UNIVERSITY OF SOUTHAMPTON

# Contraceptive Use Dynamics in Indonesia with a Special Focus on Bali: Measurements and Determinants

by
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This thesis is submitted in fulfillment of the requirement of the degree of Doctor of Philosophy

Department of Social Statistics

May 2001

*This thesis is dedicated to my parents, my beloved husband and daughters.*

UNIVERSITY OF SOUTHAMPTON


## ABSTRACT

FACULTY OF SOCIAL SCIENCES
SOCIAL STATISTICS

Doctor of Philosophy

# CONTRACEPTIVE USE DYNAMICS IN INDONESIA WITH A SPECIAL FOCUS IN BALI: MEASUREMENTS AND DETERMINANTS

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Fertility in Indonesia had been impressively declining for two decades before 1990 and some provinces such as Bali had even achieved below replacement level since early 1990s. This fast decline was mainly a result of an increase in modern contraceptive use. Bali has the highest contraceptive prevalence (about 70%) in Indonesia. However, very little is known about contraceptive use dynamics and its determinants in the country and the provinces. Since 1991 the Indonesia Demographic and Health Survey (IDHS) has used a calendar approach to collect information retrospectively on birth and contraceptive histories for five-six years before the survey. This study utilises this information to investigate contraceptive use dynamics in Indonesia in general and Bali in particular.

First, the study examines factors associated with the correlation between contraceptive prevalence and fertility rate. Second, it establishes measurements of contraceptive use dynamics (discontinuation, contraceptive failure, and switching) for the country as a whole with taking into consideration variation among provinces and its changes from 1986-91 to 1989-94. The analysis is then focused to Bali on the determinants of discontinuation and of switching behaviour after discontinuation. Because retrospective calendar data enable women to contribute more than one episode of use into the sample of analysis, episodes of use from the same woman may be correlated. Multi-stage sampling used in the DHS select individuals from the same cluster, where they are more likely to have similar attitude and behaviour in relation to contraceptive use. Therefore, multilevel discrete-time competing risks hazard models are used. Next, it analyses_current modern contraceptive choice with a focus on the effect of price of contraception. As contraceptive choice and its price are interdependent, a system of simultaneous equations exists and two-stage estimation is used to deal with this problem.

The study also shows that contraceptive prevalence was only one of the factors associated with the total fertility rate. More importantly, about 30% of contraceptive users would discontinue within a year of initiation of use, with side effects and health concerns having an important role in discontinuation. Contraceptive failure was another important factor in fertility change, although the rate was generally low. In particular, the failure rate, as well as its overall discontinuation, increased in Bali. Even after being controlled for other variables, Balinesse users were more likely to switch to another method than to abandon. Moreover, the probability of abandonment was low. The study of Bali shows that socio-economic and demographic factors were associated with discontinuation and switching behaviour. Furthermore, the change in price of contraception had a tendency to change the contraceptive mix, rather than to abandon the use of contraception. The users' behaviour in discontinuation and switching largely depended on individuals, and was unaffected by the behaviour of others in the community (cluster). Further studies should deal deeper with women's characteristics to investigate the remaining unexplained variation in contraceptive failure and other reasons for discontinuation as well as in switching to non-use while the users were at risk of an unintended pregnancy.

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# Acknowledgment

Long journey starts from one important first step. This is what I feel by the end of my Ph.D. program here in the Department of Social Statistics, University of Southampton, United Kingdom. My Ph.D. will be my first step in my hopefully long career in academic world.

I can still remember clearly the first five months, which was also the last five months of 1997, of my stay in Southampton. I left Indonesia, my country, just at the time Indonesia was going down severely in its economic, social, and political conditions. The financial support from my office (the Demographic Institute, University of Indonesia) was in *rupiah*. The financial crash had then dramatically cut the financial support of my study. It was the beginning of 1998 when a conversion between *rupiah* and poundsterling increased about 400%. It was a nightmare. I was not the only one who suffered from this sudden crisis. Almost all Indonesian students in the UK supported by Indonesian currency were affected. In such a situation, this dissertation would have not been possible without a number of helps.

My deep and sincere appreciation goes to the Demographic Institute. Despite all the financial problems faced by Indonesia in general and the Demographic Institute in particular, the Demographic Institute has been working very hard to continue its financial support to me in the first and fourth year. May I also take this opportunity to express my gratitude to Cable and Wireless plc through Dr. Amir Susanto, attaché of Education and Culture, Embassy of the Republic of Indonesia, London, and staff, who gave instant support to me and over fifty Indonesian students in the UK. I was also very fortunate and indebted to the University of Southampton who, through Far Eastern Hardship Fund, had given me an award for financing my second year of study. My gratitude also goes to the Population Council in the USA for awarding me a fellowship in my third year, which covered full living allowance and part of my tuition fee, as well as awarding me to participate in the 2000 Annual Meeting of Population Association of America, Los Angeles. Both the British Council and again Far Eastern Hardship Fund had topped up my tuition fee.

I am also indebted to the Department of Social Statistics, University of Southampton has also provided financial assistance for the last three months of my study. Other unmentioned supports for participating in various seminars/workshops inside or outside the UK are acknowledged and greatly appreciated. I would also like to thank the Indonesian Central Board of Statistics and Macro International Inc. for allowing me to use the Indonesia DHS data for this research.

Academically, I owe much to the Department of Social Statistics, University of Southampton who has provided me with an excellent opportunity to study toward my Ph.D. I would like to acknowledge the support and encouragement of Prof. Ian Diamond, as my supervisor and as the dean of the Faculty of Social Sciences, in helping me during the financial crisis, in doing my research, and in presenting the results in various seminars/workshops both within the university and outside the university, including the ones in other countries. I am very indebted to the time, guidance and detailed comments on this dissertation from Dr. John W. McDonald, also my supervisor, especially at the last stage of writing this dissertation. His encouragement and guidance in presenting my research at seminars/workshops are highly appreciated. My gratitude is delivered to Prof. Ray Chambers, head of the Department of Social Statistics, University of Southampton, who keeps paying his attention at the final stage; and also to my two examiners: Prof. Chris Skinner, Department of Social Statistics, University of Southampton, and Dr. Robert Raeside, School of Mathematics and Applied Statistics, Napier University, Edinburg. I would like to thank Dr. Peter W. F. Smith and Dr. Zoe Matthews, coordinators of Asian demography group, for involving me in the group meetings.

I also enjoyed the academic and friendly environment in the Department of Social Statistics. My sincere thanks go to all Ph.D. students and staff in the Department for making my stay so enjoyable. Among them, I have a special grateful to Dr. Farah Kausar Ahmed, who picked me up from the airport and we became a good friend and spent our time in Room 2111 in her last year.

I highly appreciate the guidance, support, and encouragement from the colleagues and management at the Demographic Institute, University of Indonesia. Let me express my special debt to the late Dr. Djuhari Wirakartakusumah, the director of the Demographic Institute, and Dr. Siti Oemijati Djajanegara, the associate director, in 1988-1995, who have provided invaluable opportunity for me to learn academic life; Dr. Haidy Pasay, the director in 1995-1998, who sent me to this Ph.D program and Dr. Sri Moertiningsih Adioetomo, the present director, who continues fully supporting my study; Prof. I Gusti Ngurah Agung, who had made me interested in studying statistics; Dr. Sri Harijati Hatmadji, who had taught me to produce "story" from quantitative analysis. I would also like to express my gratitude to Dr. Aris Ananta, currently a senior research fellow at the Institute of Southeast Asian Studies in Singapore, who had shaped my interest in demography and who had been a long-distance discussant on my research. There are still many other people from whom I have learnt a lot, but I cannot mention my special thank to them one by one here.

My recognition and gratitude are addressed to my parents and my all seven brothers and sister-in-laws who have been trying to be with me all the time despite the geographical distance. Lastly, my special gratitude to my husband and two daughters for their love, supports, encouragement, and patience throughout my study. I owe lots of days to all of those who may feel that I may have ignored them during the busy time of my study.

# Chapter 1

# INTRODUCTION

## 1.1 Family Planning in the ICPD Programme of Action

Developing countries have made significant gains for more than 30 years in providing better and more comprehensive reproductive health care, including family planning, resulting in lower birth and death rates, higher life expectancy and lower infant mortality. This progress is linked to higher levels of education and income, a narrowing 'gender gap' in health and education, increased political commitment to population policies, and changes in individual attitudes about family planning. Contraceptive use in developing countries has increased four-fold since 1965-1970, although access to family planning, contraceptive use and average family size vary widely among countries and regions.

The largest intergovernmental conference on population, entitled the International Conference on Population and Development (ICPD), took place in Cairo in September 1994 and was attended by more than 180 countries. The ICPD was the start of a new era in population and development. The ICPD Programme of Action explicitly places human beings, rather than human numbers, at the centre of all population and development activities (United Nations Population Fund/UNFP, 1995). It is the so-called people-centred development, which puts a human-being as a subject rather than an object of development. In that sense human-beings actively participate in the process and the activities are focused on investing in them generally with emphasis on improving health status, education and building equity and equality between sexes. It is seen as a firm basis for sustainable development.

In terms of childbearing, under the ICPD's contexts, all couples and individuals would be expected to decide freely and responsibly the number and spacing of their children and to have the information, education and means to do so. Then, 20-year goals are set out in three related areas (UNFP, 1995): expanded access to education; reduced mortality rates; and increased access to quality reproductive health services, including family planning, safe motherhood, and prevention and treatment of reproductive tract infections and sexually transmitted diseases. In this sense, to keep couples using contraception to achieve their fertility goal should be seen as a right for women and men and no longer as a target of population development. In addition, family planning and fertility are seen toward a comprehensive view, in which family planning is integrated into reproductive health, and reproductive health is seen as an essential part of primary health care.

Furthermore, contraceptive use might also be seen as a way for achieving better human capital for both couples and children. Couples who are using contraceptive methods must have an aim to control their number of children they want to have. Their purpose to use contraception may be to lengthen the interval between one birth to another, or to stop having more births. Longer birth intervals are likely to give an opportunity for women who just deliver a baby to recover sooner than those having short birth intervals.

Moreover, with a smaller number of children, women might have a wider opportunity for doing activities other than domestic tasks such as bringing up children. Women's labour force participation might increase and their household income will also increase. Therefore, women might be able to finance the children better than those having a larger number of children. The children will in turn probably have better human capital in term of education and health. The children are the future of the world.

If couples succeed in achieving their desired small number of children, they can have an opportunity in enhancing their quality of life. This is expected to be realised as one of the primary goals of the ICPD Programme of Action -- to provide universal access to a full range of high-quality reproductive health services, including safe, effective, affordable and acceptable methods of family planning delivered through the primary health care system by 2015 or sooner as part of a broadened approach to reproductive health and rights. The visions of reproductive health are "... every sex act should be free of coercion and infection, every pregnancy should be intended, and every birth should be healthy (Tsui, Wasserheit and Haaga (eds.) 1997)".

The questions now are 'Do all women have intercourse freely from coercion?' Do they all have intended pregnancies? Do women have rights in their reproductive behaviour? Or, do they still have to follow what government suggests to reduce population problems? Do they have the freedom to decide what they want in their reproductive behaviour? Do they have the right to be informed and to gain access to the selection of safe, effective, affordable, and acceptable contraception, including the right not to use any contraceptive?'

## 1.2 Quality of Care of Family Planning

Knowledge of family planning methods is crucial in the decision whether to use a contraceptive method and which method to use. In general, methods of contraception can be divided into hormonal contraceptives (pill, injectables, implant), surgical contraception (female sterilisation and male sterilisation), IUD, condom, spermicides, vaginal barrier methods (cervical cap, intravag), and traditional/folks methods (abstinence, withdrawal, herbs). Here is a brief description of each method of contraception, and more detailed information is in to Hatcher et al. (1989 and 1998).

Hormonal contraceptives affect ovulation, implantation, gamete transport and corpus luteum function. Pills are oral hormonal contraceptives, which have to be taken daily by women. Injectables are also hormonal contraceptives injected to the women at regular time (1, 3 or 6 months). IUDs (Intrauterine devices) are devices made of silver, copper or plastic inserted and placed in a uterus which may affect sperm, ova, fertilization, implantation or the endometrium to prevent pregnancy. Norplant is the registered trademark of Population Council for contraceptive subdermal implants consisting of six tubes. Norplant implants are usually placed under the skin on the inside of a woman's upper arm in a fan-shaped configuration.

Sterilization for women involves blocking the fallopian tubes to prevent the sperm and egg from uniting, while male sterilisation (vasectomy) blocks the vasa diferentia to prevent the passage of sperm.

The contraceptive effect of vaginal spermicides is through the mechanism of killing sperm. Spermicide can be formed as cream, gel, foam, or soluble film. Spermicide is also an essential component in the contraceptive effect of vaginal barrier methods. The vaginal barrier method can take a form of a sponge, diaphragm, or cervical cap. Condoms are a barrier method used by men. Recently, female condoms have also been available for women.

Withdrawal or coitus interruptus or 'pulling out' is considered as a contraceptive method responding to the knowledge that ejaculation into the vagina causes pregnancy. It is defined as a sexual intercourse with ejaculation occurring away from both the vagina and the external genitalia of the female partner. On the other hand, abstinence is defined as refraining from penis-in-vagina intercourse.

Couples generally decide to use one of contraceptive methods above for the simple reason: they wish to avoid having a baby soon. How long they wish to avoid it will probably be reflected by how long they will use the method. On the other hand, they would suspend the use of contraception for an equally simple reason -- they want to have a child. However, they may also stop use for other reasons that are neither planned nor anticipated at the time they start using their method. For example, women may become pregnant while they are using a method of contraception or women and their partners may be dissatisfied with the method, i.e. they may find it unpleasant to use, fear side effects of the method being used, or find it inconvenient to use. In addition, they may also abandon contraception because they have problems related to family planning services such availability of or affordability to the services. They may also abandon it because they are not in need of contraception any more in which women's exposure to the risk of pregnancy is reduced.

Therefore, choosing a contraceptive is an important decision. Who makes the choice? Ideally, the users should make the decision about the method of contraception they use, taking into consideration the feeling, thoughts and beliefs of their partners. In some societies, the decision-maker may be the woman's partner/husband or even her mother-in-law. In many health care delivery systems the family planning provider makes the decision for the patient. Patients must be advised and educated, but ultimately the decision must be theirs. They will use it and hence it is important that they make their own decisions Hatcher et al. (1989) mentions the patient's choice of a contraception depends on noncontraceptive benefits, effectiveness, safety, side effects that do not pose health hazards, and personal considerations.

Several studies have shown that side effects and health concerns have been cited as the most common reason for discontinuation. Here is a brief summary about side effects or danger signs that need users to see their clinician (Hatcher et al., 1989). For those who are using the pill, they should be cautious when they have ACHES (Abdominal pain; Chest pain, cough and shortness of breath; Headache, dizziness, weakness or numbness; Eye problems (vision loss or blurring, speech problems; and Severe leg pain (calf or thigh). Meanwhile, early IUD danger signs are PAINS (Period late, Abdominal pain, Infection exposure, Not feeling well, fever and chills, and String missing, shorter or longer). Injectable danger signals are weight gain, headaches, heavy bleeding, depression, and frequent urination. Indications of Norplant danger are arm pain, pus or bleeding at the insertion site, explusion of an implant, migraine headaches, severe lower abdominal pain, and heavy vaginal bleeding.

After sterilisation a woman should be cautious about danger signs such as fever, dizziness with fainting, abdominal pain that is persistent and increasing, and bleeding or fluid coming from the incision. Following the operation, abnormal menstruation patterns have been thought to occur. On the other hand for a man, postoperative danger signs are fever, bleeding or pus from the site of the incision, excessive pain or swelling. However, both men and women can resume normal activities two or three days after the sterilisation operation.

Success of a family planning program cannot be, therefore, adequately measured by an increase in the number of couples using contraceptive methods alone. It has become increasingly important to focus on contraceptive use dynamics, whether to continue a method or not, and if they decide to discontinue whether they want to abandon the use at all or to switch to another method and what method they choose. In other words, the focus should be shifted from one on motivating couples to adopt contraceptive use to another one on encouraging them to maintain the use (Kost, 1993). The use can be maintained by giving them counselling when problems appear, providing them with a range of contraceptive options to suit their needs (Curtis and Hammerslough, 1995; Curtis and Blanc, 1997).

Therefore, analysis of contraceptive use dynamics and its causes is an important component of family planning evaluation (Curtis and Blanc, 1997) and it is also important for program guidance (Ali and Cleland, 1995). Although willingness to continue with a method does not necessarily imply satisfaction, a high discontinuation rate is usually a sign of discontent with the method or the service (Ali and Cleland, 1995). They also mention that low use-effectiveness suggests that counseling might be inadequate. The rate at which women discontinue the use of a method due to side effects may indicate that counselling needed improvement and that information about the methods needed to be communicated more effectively. A high rate of method switching may indicate that women are exposed to an array of contraceptive options and are taking advantage of the opportunity to use different methods as their needs and preferences changes (Kost, 1993). Frequent discontinuation from one method and switch to another one has been thought to indicate some level of dissatisfaction with methods or services or responses to actual or fear from side effects (Ali and Cleland, 1995).

It is then obvious that contraceptive discontinuation and switching is a part of quality of care of the family planning as proposed by Bruce (1990). Quality of care of family planning focuses on the need and right of the women, and not merely seeing the women as a means to reduce population growth. Bruce's framework emphasises the importance of the client's perspective. It defines quality of care in terms of six fundamental elements: choice of methods, technical competence, information given to clients, interpersonal relations, mechanism to ensure the follow-up and continuity, and an appropriate constellation of services. The quality of care approach emphasises the informed choice of the women, in contrast to the "coercion" to use longer-term contraceptives. Interestingly, the quality of care approach may, in the long run, yield a lower fertility rate – and hence yield a lower population growth rate.

## 1.3 Aims of the Dissertation

This dissertation focuses on quality of care of family planning – an important element in reproductive rights. The dissertation concentrates on a narrower element of quality of care: the continuation (or discontinuation) of a contraceptive method and switching from one method to another as well as choice of contraception. Jain (1992), for example, found that when the level of quality of care was low, discontinuation tended to be relatively high. A study in East Java (Pariani, Heer and Arsdol, 1991) also showed that women who did not get the method they wanted tended to discontinue the use of this method. In addition, discontinuation became an increasingly important issue as the percentage of married women using a contraceptive method was high (Curtis and Hammerslough, 1995; Curtis and Blanc, 1997; Fathonah, 1996). Indonesia is one of the countries which has high contraceptive use prevalence. Since 1991, more than a half of Indonesian currently married women have been using traditional or modern methods of birth control.

This dissertation examines contraceptive use dynamics (choice of method, discontinuation and switching of contraceptive use) in Indonesia, using the 1991 and 1994 Demographic and Health Survey (DHS) data sets. Indonesia is a very large and heterogeneous country, with about 210 million population in 2000. The change in the government since the fall of Soeharto in May 1998 has also speeded up the need to give more attention to the regional authority and diversity. Therefore, it is important to consider regional variation. However, the complexity of the regional variation and the constraint in the computer software to manage a very large and complex data set has lead this dissertation to have a special focus on one province, although the dissertation also provides discussion about Indonesia as a whole and some other provinces.

Bali is selected as the special focus because Bali is a province with an excellent family planning programme. In Bali, the fertility rate had been below replacement levels. Also, the contraceptive prevalence had declined from 72% in 1991 to 68% in 1994, but the prevalence remained among the highest in Indonesia. At the same time, as shown by the findings in Chapter 7, the probability of discontinuation of contraceptive use after one year of initiation of use in Bali increased from 19% in 1986-91 to 25% in 1989-94. It is, therefore, important to examine the determinants of quality of care, especially the behaviours in contraceptive discontinuation and switching, as well as choice of method of contraception in this province.

The calendar data enables one to model time spent in various states and reasons for discontinuation. Time can be modelled as time of the natural logarithm time (examples of parametric models). More precisely, this dissertation uses discrete-time competing risks hazard models to examine determinants of contraceptive discontinuation and switching in Bali. This model relaxes the assumption of a constant hazard and the need for model fitting with a large number of parameters as in a piecewise constant hazard model used by Curtis and Blanc (1996) for Indonesia data as a whole.

The analysis on discontinuation and switching is preceded with a macro-analysis on fertility deficit in Indonesia and followed with analysis on the determinants of contraceptive choice in Bali. In short, it investigates the dynamics of contraceptive use and choice in Indonesia, with a special focus on Bali.

## 1.4 Outline of the Dissertation

The dissertation starts with a discussion on the condition of fertility and family planning in Indonesia and Bali. In this chapter a short description of the general population dynamics in Indonesia is also provided. Chapter 3 provides the literature review on discontinuation, switching, and impact of price on contraceptive choice. The methods of analysis are elaborated in Chapter 4, while the data construction is presented in Chapter 5. Chapter 6 presents a macro-analysis on Deficit Fertility in Indonesia by provinces. Chapters 7 and 8 deal with the life-table analysis, with Chapter 7 measuring the discontinuation rates and Chapter 8 measuring the switching rates for Indonesia as a whole and its provinces. The analyses on the determinants of discontinuation and switching, using multilevel discrete-time competing risks hazard models, are focused on Bali. Chapter 9 discusses the determinants on discontinuation; and Chapter 10, on switching. The focus on Bali is continued with the analysis on determinants of contraceptive choice, discussed in Chapter 11. Concluding Remarks and further studies are presented in Chapter 12.

# Chapter 2

# FERTILITY and FAMILY PLANNING in INDONESIA

## 2.1 Fertility Revolution

Indonesia had been experiencing fertility revolution, a very rapid decline in fertility relative to the progress in economic development. The 1950s and 1960s were the baby boom era. Marriage was nearly universal, education levels were low, and the infant mortality level was quite high. Such socioeconomic conditions are not normally considered conducive to rapid fertility decline (Freedman, Khoo and Supraptilah, 1981; Streatfield, 1985). At that time the TFR (total fertility rate) was 5.61.

By the end of the 1960s the government introduced a family planning programme and since then TFR had been declining rapidly. It dropped to 4.06 in 1980-1985 and reached 3.02 in 1989-1991 (Central Bureau of Statistics, et al., 1992). At provincial level, however, replacement level of fertility had been achieved in Bali, Jakarta, East Java, and Yogyakarta since early 1990s.

With that trend, Ananta and Adioetomo (1990) and later revised by Ananta and Anwar (1994) projected that Indonesia will achieve replacement level of fertility in the period of 2000-2005 and it will be around 1.8 by the year 2020. Further, Miranti (2000) has shown that with a relatively lower income per capita (measured with parity purchasing power) compared to Singapore, Hong Kong, and South Korea, Indonesia had achieved the level of fertility of those countries.

The 1994 Indonesia Demographic and Health Survey (IDHS) data set shows that the TFR was 2.85 in 1991-1994 and the 1997 IDHS shows it was 2.78 in 1995-1997. Both rates are higher than the projected TFR by Ananta and Anwar. The higher than expected fertility may be because provinces might not experience declining in TFR as fast as they had used to be. Another explanation is the National Family Planning Coordinating Board had been preoccupied with poverty alleviation and hence the staff and field workers had to reduce their focus on family planning.

## 2.2 Family Planning in Indonesia

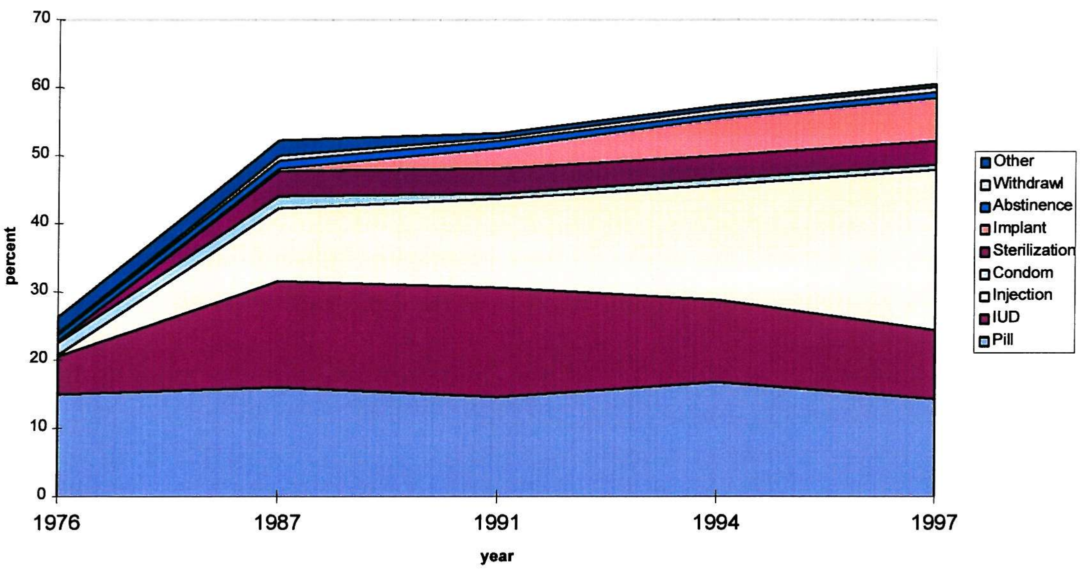
The fertility revolution in Indonesia has been partly accounted for by the success in the implementation of the government-supported family planning programme. The family planning activities were introduced in Indonesia in 1956 by a private organisation working with the support of the International Planned Parenthood Federation (IPPF). However, at that time family planning activities faced opposition from the government and some religious leaders. In 1957, the Indonesian Planned Parenthood Association (IPPA) started the family planning movement in Indonesia by providing family planning advice and services. The IPPA hoped that the economic plan would contain some reference to birth control for health reasons, since they believed family planning would never be accepted on economic grounds. In 1968, the government established the National Family Planning Institute, which two years later was reorganised as the National Family Planning Coordinating Board (NFPCB). After the NFCBD was founded, the government, with support from community leaders, demonstrated a strong commitment to strengthening the family planning program.

Many strides have been made to achieve the goals of the family planning programme. The initial goals of the programme according to Broad Guideline for State Policy were to reduce the birth rate, to establish a small family norm, and to improve the health of mothers and children. After several years the objectives of the programme were modified to include improving the quality of human resources by promoting a small, happy and prosperous family as a norm.

To achieve these goals, four strategic dimensions of the family planning programme were defined. First is the program extension, which involves activities intended to increase the need and desirability of family planning, so that the number of acceptors will increase. This is conducted through information, education and communication activities, as well as supplying and re-supplying the contraceptive methods. Then, the second dimension is programme maintenance, which involves stabilising the acceptance of family planning and improving the quality of services. The third dimension is the programme institutionalisation, which is achieved by the acceptance of the small family norm and the greater participation of government, community and private institutions in managing the programme. The last dimension is integration of the family planning programme with various other national development programmes (Central Bureau of Statistics et. al, 1995).

The family planning programme was not introduced simultaneously in all parts of the country. It was implemented over three 5-year periods in three different regions, namely Java-Bali, Outer Java-Bali I, and Outer Java-Bali II. The family planning program began in 1969 in Java-Bali region, which consists of 6 provinces, i.e. DKI Jakarta, West Java, Central Java, DI Yogyakarta, East Java, and Bali. Five years later, the programme was expanded to include the Outer Java-Bali I, which consists of 10 provinces. Finally, in 1979 the program was expanded to the remaining 11 provinces making up the Outer Java-Bali II region. Figure 2.1 presents trends in contraceptive use in Java-Bali since 1976.

**Figure 2.1 Trends in Contraceptive Methods Mix in Java_Bali, 1976-1997**




Indonesia had placed a very important place for family planning programme as a means to control population growth. International aid had poured in to help the country with this programme. However, gradually, Indonesia tried to reduce the dependency on government subsidy, especially because this subsidy had to depend on international donors.

With the fast improvement of the economy and the increasing awareness of the need of small families, the government had started to put some of the contraceptives in the private market. The government had been working toward self-sufficiency in family planning. Self-sufficiency in family planning implies that there will no longer be a subsidy for methods used. Hence, users of family planning methods will have to pay the market prices. Care, nevertheless, ought to be exercised not to reverse the increasing trend in the contraceptive prevalence rate, because of the rising price.

The family planning programme has been one of the important programmes in Indonesian development. Indeed, Indonesia has also been one of the success stories in the implementation of a family planning programme (Streatfield, 1985). Although the programme started under circumstances that suggested progress would not be easy, data show that total fertility rate (TFR) has fallen markedly, due primarily to the widespread uptake of modern, programme supported family planning (Ross and Poedjastoeti, 1983; Joesoef, Baughman and Utomo, 1988; Freedman, Khoo and Supraptilah, 1981; Hull, 1987).

Contraceptive use has increased rapidly. Poedjastuti and Hatmadji (1991) show that in 1976 estimated national percentage of married women currently using contraception was 37%. The percentage rose dramatically within 20 years of the implementation of the family planning programme. By 1991, 50% of currently married women are using contraception (Central Bureau of Statistics, 1992). In the following three years the percentage slightly increased to 54.7% and continued increasing to reach 57% in 1997(Central Bureau of Statistics, 1998)..

Among Indonesian married women who are using contraception, very few are using traditional methods. For example, in 1994, almost 3% are using traditional methods compared to 52% using modern methods (Figure 2.2). Among users who rely on modern contraceptive methods, which methods are most popular vary across time depending on availability of the existing methods and new methods being promoted. In 1991, the majority used the pill and IUD, while in 1994 the pill and injectables were predominant (Central Bureau of Statistics, 1995 and 1998). In 1997 contraceptive use is dominated by injectable and pill. Table 2.1 presents method-mix in

Indonesian in 1991 to 1997. It can be seen that other modern methods such as Norplant and sterilisation had relatively low percentages.

**Figure 2.2 Trends in Contraceptive Methods Mix in Indonesia: 1991-1997**

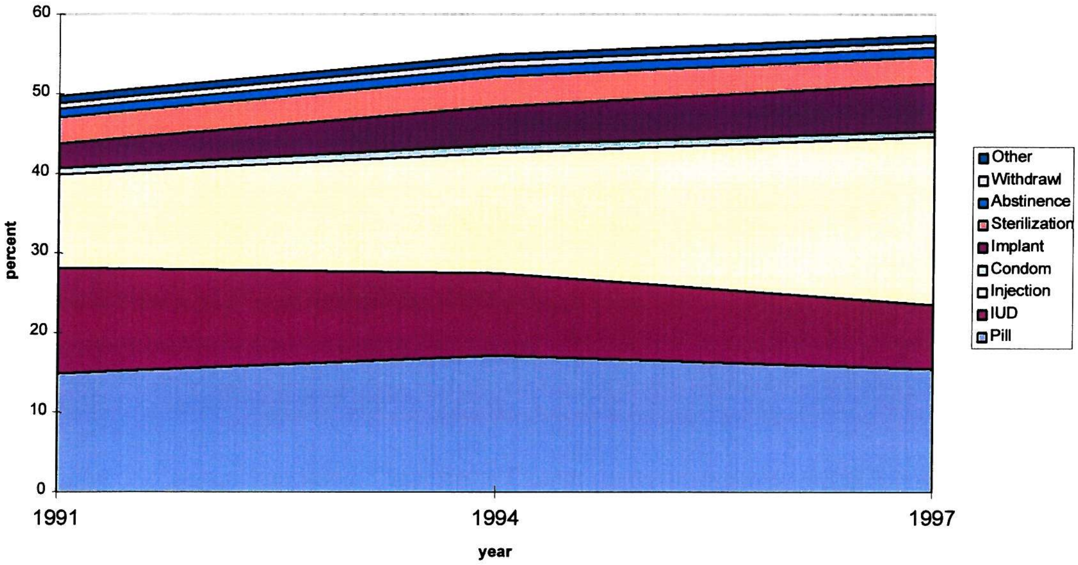



Table 2.1 Current Percentage of Contraceptive Use by Method in Indonesia: 1991, 1994 and 1997

| Method | 1991 | 1994 | 1997 |
|---|---|---|---|
| IUD | 13.3 | 10.3 | 8.1 |
| Injection | 11.7 | 15.2 | 21.1 |
| Pill | 14.8 | 17.1 | 15.4 |
| Condom | 0.8 | 0.9 | 0.7 |
| Norplant | 3.1 | 4.9 | 6.0 |
| Sterilization | 3.3 | 3.8 | 3.4 |
| Traditional methods | 2.7 | 2.7 | 2.7 |
| TOTAL | 49.7 | 54.7 | 57.4 |

Sources: Central Bureau of Statistics et al. (1992, 1995, 1998)

In addition, Norplant, a contraceptive subdermal implant, was introduced into the national family planning programme in 1987. Since that year, Norplant users have surprisingly risen, even the percentage of the users has been higher than that of sterilisation (6.0% compared to 3.4% in 1997). The Indonesia National Family Planning Co-ordinating Board has become interested in the Norplant implant system because the method is highly effective. Indonesia has the largest number of Norplant users in the world, and the number may approach four millions by 1997 (Hull, 1998; Fisher et al., 1997). However, like other clinically based methods, it has some characteristics that put a heavy burden on the service-delivery system.

Some research had been conducted even before Norplant was nationally promoted. Lubis et al. (1983) investigated the potential acceptability of the Norplant in Indonesia by recruiting up to 1,000 women aged 18-40 years old. Affandi et al. (1987) conducted clinical studies in Jakarta from 1982 to 1984 to determine whether non-physician personnel, in this case nurses and midwives, are as qualified to administer Norplant as physicians. After Norplant joined in the family planning programme in 1996, the study concerning Norplant users was conducted in 14 provinces by Fisher et Al. (1997). This study assessed Norplant removal among women who had had Norplant inserted five of more years before they were interviewed. This study was done as the result of concerns about long-term use of Norplant. After five years of the use, efficacy and effectiveness of this method may decline.

The percentage of Norplant users is lower in urban areas than in rural areas, although for all contraceptive methods altogether, the percentage of married women using contraception is higher in urban areas than that of in rural areas. (Central Bureau of Statistics et al., 1992, 1995, and 1998). Furthermore, contraceptive use correlates positively with the women's level of education. The 1994 Indonesia Demographic and Health Survey data, for example, shows that among uneducated women, 40% are using contraceptive methods; while among women having attended at least some secondary school, 60% are doing so. By looking at different methods, different patterns exist. For example, the more educated users are less likely to use Norplant, but more likely to use sterilisation, Injectables and the IUD.

## 2.3 Provincial Achievements

Indonesia is an archipelago and it is a diverse country in terms of ethnicity, culture, population sizes and also stage of development. Five larger islands (Sumatra, Java, Kalimantan, Sulawesi and Irian Jaya) could be considered a country by themselves if one considers their size of population, even a province could be considered as a country such as West Java with 43 million of population in 2000. Until 1999, Indonesia had 27 provinces as shown in Figure 2.3, and now it consists of 26 provinces as East Timor became independent. However, some of the provinces such as West Java will be split into two or more provinces. Among other provinces in Java Bali, West Java has had the highest fertility rate, though West Java has not always had the lowest percentage of contraceptive use.

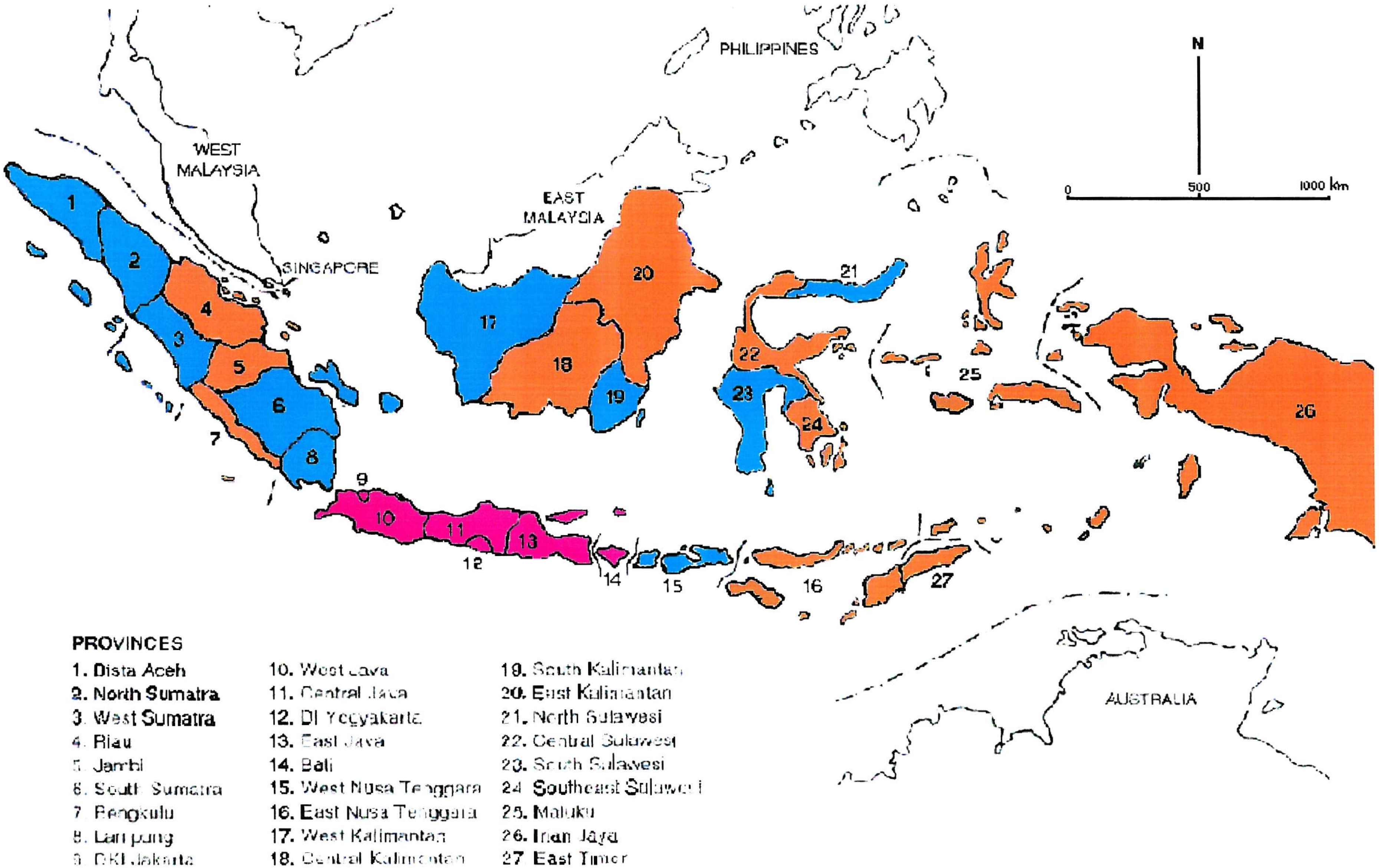
Table 2.2 Trends in Total Fertility Rate (TFR) and Contraceptive Prevalence (%) by Province: 1991 – 1997

| Province | TFR | | | Contraceptive Prevalence (%) | | |
|---|---|---|---|---|---|---|
| | 1991 | 1994 | 1997 | 1991 | 1994 | 1997 |
| Jakarta | 2.14 | 1.90 | 2.04 | 56.9 | 59.7 | 58.9 |
| West Java | 3.37 | 3.17 | 3.02 | 51.0 | 56.7 | 57.6 |
| Central Java | 2.85 | 2.77 | 2.63 | 49.7 | 61.1 | 62.4 |
| Yogyakarta | 2.04 | 1.79 | 1.85 | 71.3 | 69.5 | 72.9 |
| East Java | 2.13 | 2.22 | 2.33 | 55.4 | 55.9 | 61.1 |
| Bali | 2.22 | 2.14 | 2.12 | 71.9 | 68.4 | 68.1 |
| Aceh | 3.70 | 3.30 | 3.00 | 28.9 | 32.3 | 37.1 |
| North Sumatra | 4.18 | 3.88 | 3.72 | 37.2 | 47.0 | 46.0 |
| West Sumatra | 3.61 | 3.19 | 3.4 | 40.3 | 44.2 | 44.8 |
| South Sumatra | 3.46 | 2.87 | 2.64 | 47.1 | 52.9 | 57.9 |
| Lampung | 3.22 | 3.45 | 2.91 | 53.8 | 59.3 | 66.5 |
| West Nusa Tenggara | 3.79 | 3.64 | 2.95 | 39.0 | 49.8 | 56.5 |
| West Kalimantan | 3.94 | 3.34 | 3.35 | 44.4 | 50.6 | 58.1 |
| South Kalimantan | 2.72 | 2.33 | 2.57 | 51.9 | 54.7 | 60.2 |
| North Sulawesi | 2.27 | 2.62 | 2.60 | 68.5 | 72.5 | 71.2 |
| South Sulawesi | 2.99 | 2.92 | 2.88 | 37.1 | 42.6 | 41.5 |
| Riau | 3.70 | 3.10 | 3.42 | 39.8 | 41.0 | 48.0 |
| Jambi | 3.16 | 2.97 | 2.89 | 47.9 | 55.1 | 61.8 |
| Bengkulu | 4.28 | 3.45 | 2.97 | 58.3 | 61.6 | 66.6 |
| East Nusa Tenggara | 3.61 | 3.87 | 3.45 | 39.2 | 37.3 | 39.3 |
| East Timor | 5.55 | 4.69 | 4.43 | 25.1 | 22.6 | 26.7 |
| Central Kalimantan | 3.17 | 2.31 | 2.72 | 44.6 | 44.5 | 63.3 |
| East Kalimantan | 2.99 | 3.21 | 2.85 | 57.9 | 60.5 | 59.3 |
| Central Sulawesi | 3.81 | 3.08 | 3.04 | 50.4 | 52.5 | 51.7 |
| Southeast Sulawesi | 4.20 | 3.50 | 2.92 | 41.9 | 46.3 | 53.1 |
| Maluku | 4.26 | 3.70 | 3.31 | 43.2 | 34.9 | 40.1 |
| Irian Jaya | 3.38 | 3.15 | 3.38 | 20.6 | 41.3 | 50.4 |

Sources: Central Bureau of Statistics, et al. (1992, 1995, 1998).

Table 2.2 presents differentials in contraceptive prevalence by province and also total fertility rate. In the early 1990s contraceptive prevalence ranged from about 20% in Irian Jaya to about 72% in Bali. More than half of the provinces had reached a prevalence of more than 40%. However, in 1994 there were only four provinces with contraceptive prevalence less than 40 percent. Therefore, the increase in contraceptive prevalence over time also significantly varied.

Figure 2.3 Map of Indonesia



## 2.4 Family Planning in Bali

Bali, along with all five provinces in Java, was selected as one of the first areas for implementation of the government's family planning program. In the mid 1970's, the family planning programme in Bali had already enjoyed particularly great success, not only in the number of acceptors, but also in the effectiveness of contraceptive methods accepted (Astawa, Waloeyo and Laing, 1975). According to the 1976 Indonesia Fertility Survey data, almost 40% of couples were already using a method of contraception (Central Bureau of Statistics, et al., 1995). Since then dramatic changes have taken place in the level of contraceptive use in Bali. The percentage was almost double in 1991; in fact 72% of currently married women were using contraception.

However, between 1991 and 1994, the percentage of married woman using contraception slightly decreased by 4 percentage points. The percentage then levelled off in 1997 (Central Bureau of Statistics, et al., 1998). The users predominantly used modern methods of contraception and relied heavily on the use of the IUD with more than 40% of the users using the IUD. Other methods mostly used by the users are injections and also sterilisation (shown in Table 2.3).

Table 2.3 Current Percentage of Contraceptive Use by Method in Bali: 1991, 1994 and 1997

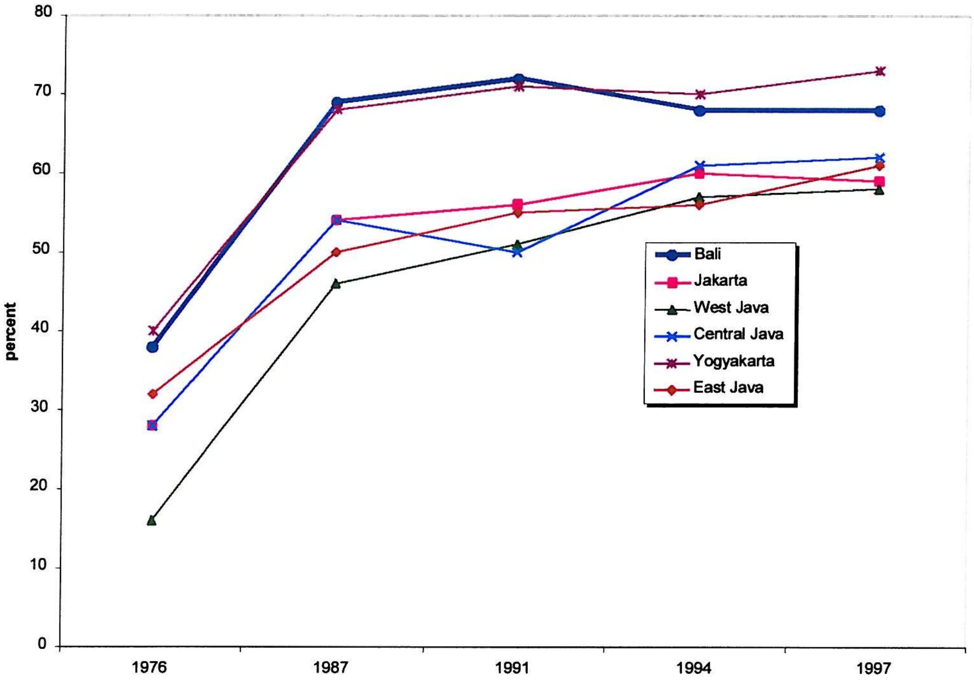
| Method | 1991 | 1994 | 1997 |
|---|---|---|---|
| IUD | 44.8 | 41.1 | 33.9 |
| Injection | 9.9 | 12.0 | 16.9 |
| Pill | 4.3 | 4.8 | 5.6 |
| Condom | 0.9 | 0.9 | 0.7 |
| Norplant | 0.7 | 0.6 | 0.6 |
| Sterilization | 9.6 | 7.1 | 8.3 |
| Traditional methods | 1.7 | 1.9 | 1.9 |
| TOTAL | 71.9 | 68.4 | 68.1 |

Sources: Central Bureau of Statistics et al. (1992, 1995, 1998)

The IUD has been popular among users since the early stage of the programme. As reported in the 1976 Indonesia Fertility Survey, about 70% of users were using the IUD, while users in other provinces, which started implementing the programme at the same time, mostly used another method.

Compared with other provinces in Java, Bali's success in encouraging couples to use contraception is like the one happening in Yogyakarta (shown in Figure 2.4).

Figure 2.4 Trends in Contraceptive Use in Bali compared to Other Provinces in Java: 1976-1997

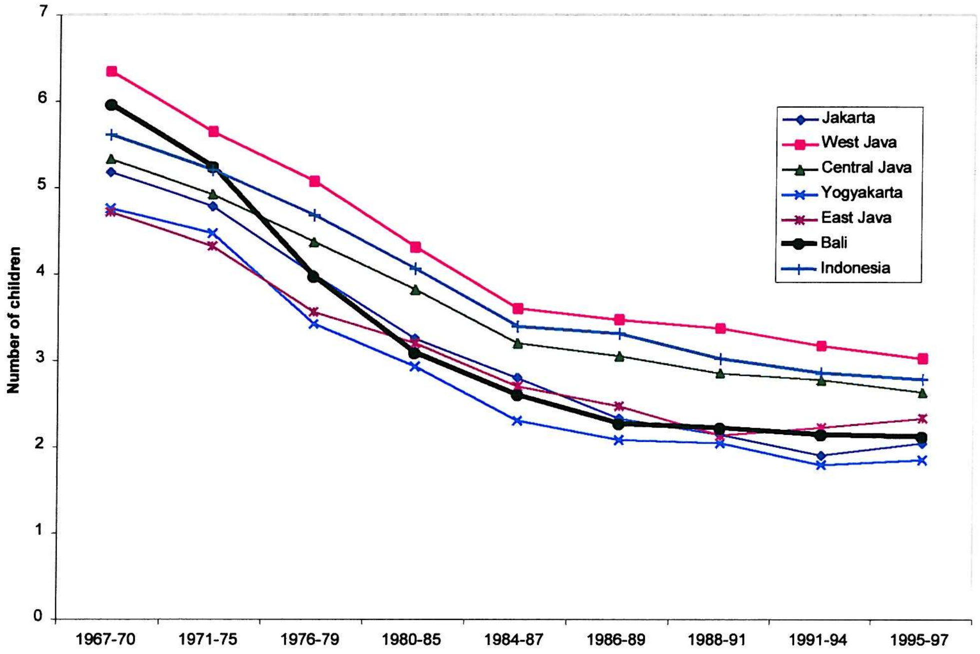



balimdlt.xls

Bali's fertility rates have declined dramatically during the past three decades (shown in Figure 2.5), especially if the decline is compared with those in other provinces in Java. As shown in Figure 2.5, in the late 1960s Bali's rate was just slightly higher than the rates of either West Java or Indonesia as a whole. In the late 1970s Bali's rate was already lower than these rates. A fast decrease had been observed for two decades until the beginning of the 1990s when fertility levelled off at a relatively low level. It has actually achieved below replacement level of fertility with TFR was about 2.22 in 1988-1991. It has then flattened at that level (Central Bureau of Statistics, et al., 1995).

Unlike in advanced countries, where birth control is largely a personal responsibility, many developing countries shoulder the major financial responsibility for the public demand for contraception. Prospects for future and sufficient growth in international donor contributors are not promising. The government of Indonesia in 1987 introduced the self-reliant family planning movement known as KB Mandiri. The KB Mandiri concept and campaign encourage family planning acceptors to accept individual responsibility for their family planning needs, including payment for services and supplies. In order to encourage the growth of self-reliance, the government implemented a new service scheme that works through private doctors, midwives, clinics and dispensaries in encouraging the community to fulfil their needs for family planning.

Figure 2.5 Trends in Total Fertility Rate in Bali Compared to Other Provinces in Java and Indonesia as a Whole: 1967-1994

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In order to evaluate the level of self-sustainability, beginning with the 1991 IDHS all users of contraception were asked where they obtained the method the last time and how much their method cost, including any cost for services. From this information, the level of self-sustainability of the community on the family planning programme, which is measured by the proportion of users of contraception who pay for the methods and services, can be examined. It can then be concluded that the level of self-sustainability of the family planning programme has been increasing. Overall, 62% of Indonesian contraceptive consumers paid for their contraceptive method in 1991 and the percentage increased to 74% in 1994. In Bali the percentage of users who pay was about 70% of the users in 1991 and increased to 80% in 1994 (Central Bureau of Statistics et al., 1992 and 1995).

Self-sustainability varies by method of contraception. Based on the 1991 IDHS nationally injection was the highest proportion of self-sustaining users, followed by female sterilisation, pill, condom, Norplant and the IUD. However, in 1994 the pill became the second highest proportion of self-sustaining users after injection, followed by condom, female sterilisation, Norplant and the IUD. In Bali, the highest level of self-sustainability is also among users of injection with almost 100% of the users paying for the method and services in 1994. For other methods, about 73% pay for having the IUD fitted and sterilization. Then about 70% of pill users pay for it.

Contraceptive users who obtain their method from a government source pay about the half of the cost of methods obtained from a private source. In 1994, for example, generally Indonesian users pay about 12,000 rupiah from a government source compared with 23,000 rupiah from a private one. On the other hand, Balinese users pay more from a government source at about 16,000 rupiah, though those who get the methods from a private source pay for more or less the same price as average price for Indonesian users. Female sterilisation is the most costly method.

## 2.5 Economic Development

The 1965 "coup" had led to a dramatic change in the economic programme in Indonesia. The so called "new economic order' started in 1967 with President Soeharto. The economic chaos preceding 1965 had then been rapidly repaired, and the economy had since that time grown vary rapidly. Inflation had been low, and investment rose quickly. The oil boom since 1973 had produced a sustained growth rate at about 8% a year. The contribution of the agricultural sector had declined significantly, while the contribution of manufacturing and modern services has risen dramatically. However, as export prices fell, growth had slowed down during 1981-1990. Yet, government policies had been able to put the economy back to booming since 1987 and this continued to the 1990s (Booth, 1998).

Therefore, in the beginning of the crisis (in the second half of 1997 and first half of 1998) worry had been mounting on the sustainability of the family planning programme in Indonesia. Ananta (1998), for example, had expressed fear that regions with a TFR higher than 3.5 may return to the high fertility norm since they might not have been too concerned with a small family norm. The suffering from the crisis might induce families to rely on children for economic reasons, returning to the old norm of large families. Yet, Ananta also maintains that among regions with TFR lower than 3.5, fertility might even decline further because couples would try to cope with the crisis by more stringent effort in limiting the births. Worries had been mounting not only related to family planning but also to the social and health impact of the economic crisis. Several studies on these topics had been conducted. However, Gardner and Amaliah (1999) mentioned that these studies reported conflicting findings due to aggregation of the data, biases resulting from the assumption that all changes were crisis-related, differences in the timing of data collection and in methodologies, as well as irrelevance or incomparability of indicators of crisis impact.

Ananta and Kosen (2000) find that many "worries" in the first year of the crisis were "overblown." Subsequent research had shown that the situation had not been as dark as often portrayed in the mass media and in the international forum. International aid increased since the beginning of the second year of the crisis. Cost of basic health care could be kept low and even it could be free of charge. Fertility and mortality may still follow the predicted paths before the crisis, except in some riot torn provinces such as in Aceh and Maluku. Pattern of migration, however, may have changed dramatically during the crisis as people try to choose to stay in the relatively better – in terms of both economic and security –place.

Those who had already started to pay for contraception, though not much, before the crisis could sometimes get free service during the crisis. This phenomenon did not happen only in the field of family planning, but also in the area of health in general and other social sectors in Indonesia. Some even worry that the Indonesian society may become spoiled with the subsidy in the "social sector", including family planning.

The evidence, however, has shown that people continue using contraceptive. They might have been motivated to use contraceptive as a means to cope with the crisis. During 1997-1999 contraceptive prevalence did not change significantly (Gardner and Amaliah 1999).

A question arises: "When the crisis is over, then international aid will stop. The price of family planning will increase. People may be frustrated and shocked. They will ask why the condition is worsening -- shown with the absence of free contraceptive -- when the crisis is over. Will the increase price really discourage the family from using contraception?"

The question is whether the implementation of the family planning programme must continue to depend on the funding from the government (and international organizations)? Will self-financed contraceptive use be harmful for the poor?

# Chapter 3

# LITERATURE REVIEW ON CONTRACEPTIVE USE DYNAMICS

## 3.1 Introduction

This chapter briefly reviews the literature on contraceptive use dynamics—including contraceptive discontinuation, failure and switching in Section 3.2. This is followed by a review of methods for the analysis of contraceptive use dynamics. Then Section 3.4 provides estimates of contraceptive use dynamics from previous studies, especially for developing countries, although some results from some developed countries are also provided. Section 3.5 presents a review on the relationship between contraceptive use and level of fertility.

## 3.2 Contraceptive Use Dynamics

Women use a contraceptive method for a simple reason: they wish to avoid being pregnant. How long they wish to avoid it probably will be reflected in how long they will use the method. On the other hand, they may suspend contraceptive use for an equally simple reason -- they want to have a child. However, women may also abandon use for other reasons neither planned nor anticipated at the time they start using their method. Therefore, as the number of women using contraceptive methods in developing countries continues to rise, it has become increasingly important to shift the focus from motivating couples to adopt contraceptive use to helping them maintain use (Kost, 1993; Curtis and Hammerslough, 1995; Curtis and Blanc, 1997), e.g. by giving them counseling when the problems appear. Maintaining use of contraception will result in a reduction in fertility. Therefore, analysis of contraceptive continuation is an important component of family planning evaluation (Laing, 1985) and program guidance (Ali and Cleland, 1995). In addition, continuation rates can be viewed as an indicator of acceptability of contraceptive methods based on actual experience (Laing, 1985). Although willingness to continue with a method does not necessarily imply satisfaction, a high discontinuation rate is usually a sign of discontent with the method or the service. Ali and Cleland, (1995) mentioned that low use-effectiveness suggested that counseling might be inadequate. The rate at which women discontinue the use of a method due to side effects may indicate that counseling needed improvement and that information about the methods needed to be communicated more effectively. It is then obvious that analysis of contraceptive continuation is a part of quality of care of family planning as proposed by Bruce (1990).

Until the late 1980s, studies on contraceptive discontinuation using population-based information were little known in developing countries. Studies were commonly carried out using clinical-trial information in which observations and coverage were limited. The main reason for this dearth of knowledge is a lack of data that would enable observations of contraceptive behaviors of a representative sample of women across time (Kost, 1993). However, since the DHS gathered information month-by-month on contraceptive use, studies on contraceptive use dynamics have been increasing. Such studies will contribute substantially to expanding our knowledge of how contraceptives are used and enable family planning providers to align their efforts with women's needs. For instance, Moreno and Goldman (1991) estimated contraceptive failure rates for 15 developing countries based on 1986-1989 Demographic and Health Survey (DHS) data. The further study by Moreno (1993) ascertained the importance of place of residence and education as correlates of contraceptive failure across populations with varying levels of fertility and contraceptive use. Another comparative study of cause-specific analysis of contraceptive discontinuation in six developing countries was done by Ali and Cleland (1995). Not only was contraceptive failure studied but also other reasons for discontinuation such as desire to get pregnant, health concern and other reasons was studied. This study also used DHS data from the same period as Moreno and Goldman did. A subsequent study investigated the determinants of contraceptive discontinuation (Ali and Cleland, 1999). In all these studies, Indonesia was chosen as one of the countries studied.

Curtis and Hammerslough (1995) published a manual to encourage further analysis of the DHS calendar data in the area of contraceptive use dynamics. Since then, their framework has been used in 10 developing countries to calculate estimates of contraceptive use dynamics (discontinuation, failure and switching). All these studies are based on single countries and examined contraceptive use dynamics based on 1991 through 1994 DHS data. The analysis for

Indonesia used the 1994 Indonesia DHS data (Fathonah, 1996). This is a more complete study of contraceptive use dynamics for Indonesia as a whole than has ever been done. Samosir (1994) examined only factors associated with contraceptive switching in Indonesia using the 1991 Indonesia DHS. An advanced comparative study on determinants of contraceptive use dynamics has been available for six developing countries (Bangladesh, Colombia, Egypt, Indonesia, Peru and Zimbabwe) that conducted DHS surveys between 1991 and 1994 (Curtis and Blanc, 1997).

The lack of historical information on contraceptive use dynamics with that national coverage is not only a matter for developing countries, but also is for developed countries. Bracher and Santow (1992) investigated levels of premature contraceptive discontinuation using life history data from the first nationally representative survey of the contraceptive experience of Australian women. These data were collected in 1986, when the DHS just initiated gathering data on episodes of contraceptive use in developing countries. Bracher and Santow examined discontinuation of contraceptive method because of accidental pregnancy (contraceptive failure), side effects or dissatisfaction.

Contraceptive failure is the most important reason for discontinuation as it has a high association with the effectiveness of the method and also it has a direct impact on fertility, especially in a region where abortion is illegal and prohibited for various reasons. These do not diminish the importance of other causes of discontinuation (Leite, 1996). Therefore, contraceptive failure it is widely known especially for family planning policy makers in developed and developing countries. Moreover, contraceptive prevalence in many developing countries has also been increasing substantially. As the level of contraceptive prevalence increases, the role played by contraceptive failure on the process of fertility decline tends to increase. Hence, understanding levels of contraceptive failure and factors associated with contraceptive failure become essential. This leads to a larger number of analyses on contraceptive failure compared to contraceptive discontinuation in general. Some studies on contraceptive failure have been mentioned above, but there are still a number of other studies such as Jones and Forrest (1992); Wang (1996); Grady, et.al. (1986); Grady, et.al. (1988); Steele, et.al (1996); Trussell and Vaughan (1999); Trussell, et.al. (1999); Ali and Cleland (1999); Fu, et.al (1999); Bairagi, et.al. (2000). Many have examined contraceptive failure in the United States, in which unintended pregnancies following contraceptive use is a major public health concern (Trussell and Vaughan, 1999; and Fu, et.al., 2000). Furthermore, Trussell and Vaughan show that half of all pregnancies in the United States are unintended.

Contraceptive switching, another important aspect of contraceptive use dynamics, has been studied by researchers since 1989. DaVanzo et.al. (1989) used Malaysian Life History data to describe contraceptive method switching over women's reproductive careers. Grady et.al. (1989) examined contraceptive switching among currently married women in the United State. Hamill et.al. (1990) examined the influence of a selected set of determinants of contraceptive switching behaviour in rural Sri Lanka.

Kost (1993) calculated rates of switching in Peru by using a multiple-decrement life-table together with other reasons for discontinuation such as, contraceptive failure, a desire to get pregnant, and abandonment of the use of a method. This approach was used by Curtis and Hammerslough (1995), although they combined failure and desire to get pregnant along with discontinuation due to becoming widowed or separated, being sub-fecund or infrequently having sex. They defined all these reasons as switching to no method while the users are not at risk of an unwanted pregnancy. There are some other researches on this issue (Samosir, 1994; Fathonah, 1996; Steele, 1996; Curtis and Blanc, 1997; Leite, 1998; Steele and Diamond, 1999; Steele, et. al, 1999).

## 3.3 Methods Used in the Analyses

There are two types of approach for estimating contraceptive continuity/discontinuity (including contraceptive failure), namely, the life-table approach and non-life table approach. An example of a non-life table approach is Laing's study (1985), which is a study of contraceptive continuation and use-effectiveness of contraceptive practice in the Philippines. This study estimated the continuation rate and failure rate using the Pearl pregnancy rate or Pearl index. The Pearl index was introduced by Raymond Pearl in 1932 and is attractive because it is easy to compute, but this index also is easy to misinterpret (Trussell and Kost, 1987).

### 3.3.1 The Life Table Approach

The use of life table approaches eliminates the problems of the Pearl index. The estimated rates calculated from the life table approach are certainly easy to interpret. There are three life table approaches that are commonly used, namely, single-decrement life table, multiple decrement life-table and associated single decrement life table. All three approaches, explained in more detail in Chapter 4, will be used in this analysis of contraceptive use dynamics.

Which life table is used depends on the purpose of the analysis. For comparisons of overall discontinuation across sub-populations, across time or across method, most researchers use the life table approach. A number of researchers employed this approach such as Ali and Cleland (1995). Moreover, since the DHS program provided researchers with guidance for further analysis of the DHS data on contraceptive use dynamics (Curtis and Hammerslough, 1995), more researchers in at least ten developing countries used this approach.

The multiple decrement life-table is also used to examine the patterns of discontinuation by reason for discontinuation. Kost (1993) used the multiple-decrement life table to derive discontinuation rates within 12-months of initiation of use by considering pregnancy-related reasons and non pregnancy-related reasons. Fathonah (1996) examined the pattern of discontinuation in Indonesia and studied whether women discontinue due to contraceptive failure, desire to get pregnant, side effects, method-related reasons and other reasons. The multiple decrement life-table is also used not only for analysis of discontinuation but also is for the analysis of contraceptive switching (Steele, 1996; Leite, 1998).

Demographers have also used the life table to measure contraceptive failure. As summarised by Trussell and Kost (1987) from studies of Tietze and Lewit (1968) and Tietze (1971), there are three types of failure, namely, actual or use failure, extended-use failure and method failure or theoretical failure. User failure is defined as pregnancies that occur while a couple considered themselves to be users of the method. This is subjective because the users must themselves determine when the method has been abandoned (before or after the pregnancy occurs). Extended-use failure includes unintended pregnancies during and subsequent to actual use, but prior to a subsequent pregnancy; and method failure includes only pregnancies directly attributable to the method, not to improper use.

There are two life-tables used for calculating contraceptive failure, the multiple-decrement and the associated single decrement life table. The estimates from the former life-table are referred as net rates while those from the latter are referred as gross rates. In the multiple decrement estimates, failure occurs within the same time as do other reasons for discontinuation, while in associated decrement estimates failure occurs in the absence of any other reasons for discontinuation. This estimate, therefore, is a hypothetical estimate but it is free from influence of other competing risks. Although in the multiple decrement life table measure, it measures the actual proportion of couples to experience a failure; however the rates can vary among methods or among subgroups of the population merely because discontinuation rates vary. If the discontinuation rate is high, the multiple-decrement failure rate will be relatively low because most women will left life table for other reasons.

Moreno and Goldman (1991) defined failure as use failure-- failures resulted from both improper use of a method and from inherent difficulties in using a method. Their estimates are calculated using a single-decrement life table. This life-table is used by Moreno (1993) to estimate failure rates across countries and across categories of residence and education. Apart from Moreno and Goldman, the single-decrement life table is more commonly used to estimate failure rates (Ali and Cleland, 1995; Mitra and Sabir, 1996; Perez and Tabije, 1996; Fathonah, 1996, Bairagi et.al, 2000; Trussell and Vaughan, 2000).

Riley et.al. (1994) employed a Cox proportional hazard model to examine determinants of first use of injectable in Rural Bangladesh. Moreno (1993) used a piecewise exponential hazard model to assess whether risks of contraceptive failure are associated with a woman's place of residence, level of education or other social or demographic characteristics.

### 3.3.2 The Use of A Multilevel Approach

In most situations, all variations in the hazard rate cannot be explained by the covariates being used in the model, as there will be risk factors that have not been observed. Difficulty in measurement is one of the causes and as such cannot be included in the model. Fecundability is one important factor that can influence contraceptive discontinuation especially in relation to contraceptive failure. It is not itself observable and is not even estimable in populations. No published study has claimed to measure it (Trussell and Kost, 1987). The user's age is usually used as a proxy measure related to fecundability, however, age can be meant something else such as experience or motivation in contraceptive use.

Women may contribute more than one segment of use in a certain period of time. In the presence of unobserved heterogeneity at the woman level and repeated segments of use for the same woman may be correlated. To take into account these matters, a two-level hazard model can be used, where level 1 is a segment of use level and level 2 is woman level. A two-level discrete-time competing-risks model is used in order to estimate cumulative probabilities of discontinuation by reason for each factor controlling for other factors in the model (Steele, et.al., 1996; Leite, 1998; Steele, et.al. 1999). This model is also used to examine users' behaviour after discontinuation, switching behaviour. A two-level model was used by Curtis and Blanc (1997) in analysing determinants of contraceptive, switching and discontinuation with segments of use as level 1 and sampling clusters as level 2.

## 3.4 Estimates from Previous Studies

### 3.4.1 Contraceptive Discontinuation

From many studies of contraceptive continuation in developing countries, there are differentials in the extent to which the couples will still continue using their current method across countries and across time. This means that variation in the quality of care of family planning programme probably exits. Ali and Cleland (1995), using the 1987-1988 Demographic and Health Survey (DHS) data from Ecuador, Egypt, Indonesia, Morroco, Thailand and Tunisa, found that discontinuation rates vary between 25 % for Indonesia and 36% for Thailand after one year adoption of contraceptive use (Table 3.1). While the 1986 Peru DHS data shows a higher probability to discontinue; in fact nearly half of all women who begin to use a method will stop using it within a year (Kost, 1993). This high discontinuation rate compared to Ali and Cleland's results is caused by a difference in contraceptive mix. Rhythm and pill are dominant methods in Peru, with 57.7% of ever-married women have used rhythm and 33.2% have used the pill. There is a high rate of discontinuation in Northeast Brazil, the poorest region of the country, with 57.6% of users discontinuing within a year of use (Leite, 1998).

It is commonly found that discontinuation rates vary by method. It is summarised from Ali and Cleland's study that the pill and the IUD are commonly used in all the six countries studied. Further, discontinuation rates of the pill vary between 26% to 40%. Compared to other methods, the IUD users are the least likely to stop using their method, with 11% to 17% of users discontinuing it after one year. Periodic abstinence was used in all six countries, but in only four countries the rates can be estimated separately. In Morocco and Indonesia, discontinuation rate of those practising abstinence is higher than is for the pill, conversely in Tunisia and Ecuador it is lower than for the pill. Different levels of discontinuation apply for rhythm and the pill in Peru. Women who practice rhythm are less likely to discontinue than are the pill users. The cumulative probability of discontinuation within 12-month of initiation of the method use is about 40% for rhythm and 50% for the pill. However, in Australia, Bracher and Santow (1992) found a very different view from all countries we have discussed in Australia that the pill was the most successfully used method. The first-year discontinuation rate is only 10%; far below the rate than are other countries. The pill discontinuation rate was calculated, however, based on women aged 20-59 years old, which is five years older than women's eligibility age in the DHS samples.

Table 3.1 Cumulative 12-month Probabilities of Discontinuation by Country, According to Reason for Discontinuation

| Country | All causes | Desire for pregnancy | Failure | Health concerns | Other |
|---|---|---|---|---|---|
| Morocco | 35.2 | 9.8 | 12.2 | 11.3 | 7.7 |
| Tunisia | 29.5 | 5.8 | 8.4 | 11.5 | 7.5 |
| Egypt | 28.0 | 5.3 | 7.1 | 12.4 | 6.7 |
| Ecuador | 34.6 | 5.9 | 11.6 | 9.8 | 12.8 |
| Indonesia | 25.1 | 7.5 | 2.8 | 8.7 | 8.7 |
| Thailand | 36.3 | 14.1 | 3.9 | 6.8 | 17.1 |

Source: Extracted from Ali and Cleland (1995)

As shown in Table 3.1 health concerns including side effects account for the most discontinuation in Indonesia, Tunisia and Egypt. Failure is the most important reason for discontinuation in Morocco and other reasons combined, which is non-pregnancy related reasons other than health concerns, account for the largest proportion of discontinuation in Ecuador and Thailand. In Peru, the highest probability of discontinuation is also for non-pregnancy-related reasons, which are reasons other than contraceptive failure and desire to get pregnant. Within 12-months, 29% of women using any contraceptive method discontinue for these reasons (Kost, 1993). Other method-related reasons account for the largest proportion of discontinuation in the Northeast Brazil, followed by side effects.

Table 3.2 Cumulative 12-month Probabilities of Discontinuation of the Pill and IUD by Country, According to Reason for Discontinuation

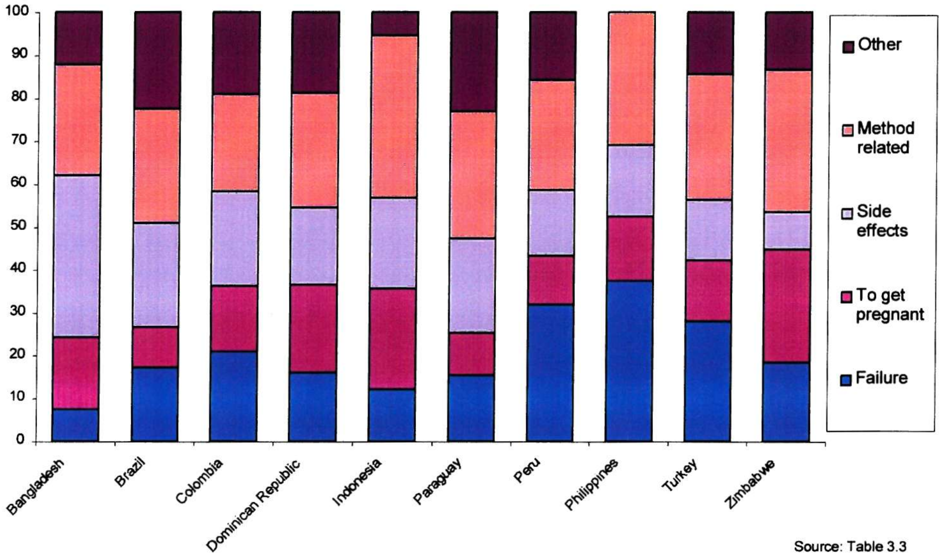
| Country | All causes | Desire for pregnancy | Failure | Health concerns | Other |
|---|---|---|---|---|---|
| **Pill** | | | | | |
| Morocco | 35.1 | 10.4 | 9.1 | 14.1 | 7.2 |
| Tunisia | 40.6 | 8.8 | 6.7 | 23.3 | 8.9 |
| Egypt | 36.5 | 7.5 | 7.9 | 19.1 | 8.0 |
| Ecuador | 37.0 | 7.8 | 6.4 | 18.9 | 9.9 |
| Indonesia | 26.2 | 9.3 | 2.2 | 10.2 | 6.3 |
| Thailand | 36.2 | 15.4 | 3.2 | 6.1 | 17.0 |
| **IUD** | | | | | |
| Morocco | 17.5 | 1.6 | 4.2 | 8.2 | 4.6 |
| Tunisia | 14.7 | 2.2 | 2.2 | 8.5 | 2.4 |
| Egypt | 10.9 | 2.3 | 2.0 | 5.0 | 1.5 |
| Ecuador | 13.6 | 1.1 | 3.8 | 3.9 | 5.6 |
| Indonesia | 12.4 | 2.1 | 2.1 | 5.8 | 3.0 |
| Thailand | 15.2 | 0.8 | 3.7 | 3.6 | 7.9 |

Source: Extracted from Ali and Cleland (1995)

The pill is a common method of contraception, in five countries it is discontinued because of health concerns, except in Thailand, where it is discontinued mostly due to other reasons (Table 3.2). The IUD is another common method and also mostly discontinued for the same reasons as the pill. In Ecuador and Thailand, health concerns are as important as are failure for discontinuation but the IUD is mostly discontinued because of other reasons. Injectables are only comparable in Indonesia and Thailand; it is mostly discontinued because of health concerns, including side effects. Mitra and Sabir (1996) separated side effects from health concerns, and they found that side effects are most important reasons for discontinuation of the pill, IUD and injectables. For traditional methods such as withdrawal and periodic abstinence, method failure is the dominant reason.

An extension of the study using the newer DHS data carried out by researchers from 10 countries examined discontinuity of contraceptive use across the countries†. From these studies, it is also found that the probabilities to discontinue using contraceptive methods after one year of initial use vary between almost 20% in Zimbabwe to almost 65% in Paraguay. Table 3.3 presents a summary of 12-month net discontinuation rates by reason, which is taken from Curtis and Blanc (1997). To be able to see which reason is most important in each country, Figure 3.1 presents percent decomposition of these discontinuation rates. It should be noted that the rate of method-related reasons in Phillipines includes other reasons. This figure shows that each country has

**Figure 3.1 Percent Decomposition of 12-month Contraceptive Discontinuation by Reason for Selected Countries, 1990-1994**




Source: Table 3.3

different dominant reasons for discontinuation. In Bangladesh, side effects account for the largest proportion of discontinuation. Meanwhile, in Peru, Philippines and Turkey, contraceptive failure is the most important reason, which account for more than 20% from all discontinuation. This will carry obvious implications for policies on induced abortion for unintended pregnancies that would happen in these countries. Method-related reasons are the most common reasons in Indonesia.

† The studies are based on data collected using virtually identical questionnaires and are analysed with the same methodology. The questionnaire differs from the one used by Ali and Cleland (1995), in which contraceptive histories were collected in a tabular format that collected information up to two episodes of use in each birth interval only (Curtis and Blanc, 1997).

It has been shown that most of the reasons for discontinuation of the pill is because of side effects and health concerns. Women make decisions to discontinue the pill without knowledge of the seriousness of their symptoms or advice from medical personnel (Janowitz et. al. 1986). The high percentage of these causes suggest the improvement in counseling and communicating side effects of the method. Janowitz et.al. (1986) carried out a study in Brazil which suggested that the relationship between client and physician and family planning programme personnel are important.

Table 3.3 Twelve-month net discontinuation rates of all reversible methods combined by reason for discontinuation and country, 1990-1994

| Country | Failure | To get pregnant | Side effects | Method related | Other | Total |
|---|---|---|---|---|---|---|
| Bangladesh 1993/94 | 3.7 | 8.3 | 18.7 | 12.7 | 6.0 | 49.4 |
| Brazil 1991 | 10.3 | 5.6 | 14.5 | 15.8 | 13.4 | 59.6 |
| Colombia 1990 | 9.5 | 6.9 | 10.0 | 10.2 | 8.6 | 45.2 |
| Dominican Republic 1991 | 10.4 | 13.3 | 11.7 | 17.4 | 12.1 | 64.9 |
| Indonesia 1994 | 3.2 | 6.2 | 5.6 | 10.0 | 1.4 | 26.5 |
| Paraguay 1990 | 9.1 | 5.9 | 13.0 | 17.5 | 13.6 | 59.1 |
| Peru 1991/92 | 15.6 | 5.6 | 7.5 | 12.5 | 7.7 | 48.9 |
| Philippines 1993 | 14.0 | 5.6 | 6.2 | ------11.5 | ------ | 37.2 |
| Turkey 1993 | 10.4 | 5.3 | 5.2 | 10.9 | 5.3 | 37.1 |
| Zimbabwe 1994 | 3.6 | 5.2 | 1.7 | 6.5 | 2.6 | 19.7 |

Source: As quoted by Curtis and Blanc (1997).

Changes in menstrual patterns after adoption of some modern methods of contraception is an important reason for discontinuation of the IUD and the pill. Zetina-Lozano (1983) suggested that women should have better information about changes in their bodies that can be caused by contraceptives in order to make better decisions about what method will be used, advantages of a method, and also cost of a method, as well as to better cope with any changes. Two types of side effects of the long-acting injectable found in Bangladesh are bleeding and non-bleeding. The degree of bleeding can be amenorrhea, spotting, or heavy, while non-bleeding side effects consists of dizziness and weakness, appetite loss and nausea, pain, discoloration of the skin and tingling in the extremities (Riley, et. al., 1994). Frequent or prolonged bleeding is more likely than infrequent bleeding to lead to method discontinuation (Hollander, 1995).

### 3.4.2 Contraceptive Failure

Information on contraceptive failure and its determinants has important implications for the women's health. Failure may result in an induced abortion, which may increase the risk of maternal morbidity and mortality (Wang, 1996). The risk is worst in countries where abortion is illegal.

Overall contraceptive failure rates, exclusive of sterilisation, in 15 developing countries vary substantially across countries. The lowest rate is 2.5% in Thailand and the second lowest is 2.9% in Indonesia, while the highest rate is 20.4% in Bolivia (Moreno and Goldman, 1991). When sterilisation is included, the biggest difference occurs in the Dominican Republic and Guatemala (Table 3.4). Meanwhile, in the six developing countries investigated by Ali and Cleland (1995), they found that failure rates vary from around 2.8% (Indonesia) to 12.2% (Morocco). All six countries are covered in the previous study.

Table 3.4 First-year Probabilities of Contraceptive Failure by Country according to Method, Calculated by Moreno and Goldman (1991), 1986-1989

| Country | Pill | IUD | Rhythm | With-drawal | Other | All methods | |
|---|---|---|---|---|---|---|---|
| | | | | | | Include Steril. | Exclude steril. |
| **Latin America** | | | | | | | |
| Bolivia 1989 | 10.5 | 3.0 | 21.2 | 34.8 | 35.4 | 19.2 | 20.4 |
| Brazil 1986 | 5.4 | 13.0 | 22.8 | 20.7 | 16.8 | 7.9 | 10.4 |
| Colombia 1986 | 7.7 | 5.3 | 24.8 | 20.1 | 23.6 | 11.7 | 13.7 |
| Dominican Republic 1986 | 11.8 | 3.6 | 19.9 | 29.2 | 23.3 | 8.7 | 14.0 |
| Ecuador 1987 | 5.8 | 4.6 | 13.9 | 27.2 | 21.1 | 8.1 | 10.0 |
| Guatemala 1987 | 9.8 | 7.7 | 24.6 | 12.0 | 16.6 | 10.9 | 14.5 |
| Mexico 1987 | 5.4 | 1.5 | 3.7 | 4.0 | 5.8 | 3.2 | 4.1 |
| Peru 1986 | 5.9 | 4.2 | 23.6 | 17.3 | 16.8 | 15.7 | 16.7 |
| Trinidad & Tobago 1987 | 5.9 | 4.2 | 13.7 | 17.6 | 15.2 | 10.3 | 11.3 |
| **Asia** | | | | | | | |
| Indonesia 1987 | 2.7 | 1.9 | 10.8 | 8.5 | 2.6 | 2.8 | 2.9 |
| Sri Lanka 1987 | 7.2 | 3.4 | 13.0 | 11.5 | 8.1 | 7.4 | 10.6 |
| Thailand 1987 | 2.8 | 2.5 | 14.8 | 7.4 | 1.0 | 1.9 | 2.5 |
| **North Africa** | | | | | | | |
| Egypt 1988 | 6.9 | 1.8 | 38.4 | 10.3 | 8.9 | 6.0 | 6.0 |
| Morocco 1987 | 8.6 | 1.1 | 30.5 | 11.5 | 22.6 | 10.9 | 11.1 |
| Tunisia 1988 | 5.4 | 2.7 | 14.2 | 12.5 | 21.2 | 7.4 | 8.0 |

If we compare the results in Table 3.1 and Table 3.4 for the same countries, we will find that the results from both studies for each country show that the latter study gave a higher failure rate, except in Indonesia both results gave approximately the same rates. The possible explanation of the difference is sample selection. Selection was terminated at a point three months prior to the date of the survey in Moreno and Goldman's study, while Ali and Cleland's study did not select a subset of cases. The differences in failure rates indicate that quite substantial failures occur in the last three months.

The failure rate of the pill exceeds that of the IUD, with the exception of Brazil. The pill failure rate within a year of use ranged between 2.7% in Indonesia and 11.8% in Dominican Republic, while the IUD failure rates are variable, from 1.1% in Morocco to 13.0% in Brazil. Users of withdrawal are more successful in avoiding unintended pregnancy than rhythm users, especially in Asia and North Africa. Even in Egypt and Morocco the failure rate for withdrawal is more than three times lower than that of rhythm. In Latin America the lower withdrawal failure rate than rhythm occurred in Brazil, Colombia, Guatemala, and Peru, while others were the opposite.

The main difference between the failure rates in developing countries and developed countries concerns the relative efficacy of the pill and the IUD. However, the failure rate in the United States did not included the IUD as this method was withdrawn from the market in the mid-1980s (Jones and Forrest, 1992). Similarly, both male and female sterilization is excluded from the calculations, as failures due to sterilization are very rare.

Among reversible method users in the Unites States, the pill users were the least likely to experience an unintended pregnancy, follow by condom users (Jones and Forrest, 1992). However, in the method mix in the 1988 National Survey of Family Growth (NSFG), there was no use of injectables and the IUD, which are commonly used in developing countries. Their results indicate that among the pill users, as many as 8 % actually became pregnant within a year of the use. Among condom users, there was almost twice this failure rate. The failure rate of periodic abstinence was higher than the Asian countries mentioned in Table 3.4. The rate was 25.6% for one year of acceptance. Compared to the results based on the 1982 survey, it indicates that contraceptive failure was not declining, even the rates for the pill and for periodic abstinence appeared to have risen (Jones and Forrest, 1992).

Table 3.5 Contraceptive failure in the First 12 Month of Use by Method in the United States, 1982, 1988 and 1995 National Survey of Family Growth

| Method | 1982[a] | 1988[a] | 1995 [b] |
|---|---|---|---|
| Pill | 6.2 | 8.3 | 7.6 |
| Condom | 14.2 | 14.8 | 13.9 |
| Diaphragm | 15.6 | 15.9 | 12.1** |
| Periodic Abstinence | 16.2 | 25.6 | 20.5 |
| Spermicides | 26.3 | 25.2 | 25.7 |
| Withdrawal | * | * | 23.6 |
| Implant | * | * | 1.8 |
| Injectable | * | * | 3.1 |

Sources: a = extracted from Jones and Forrest (1992) b = extracted from Fu, et.al.(1999)
Notes : * = Not available in the article ** = Diaphragm/cervical cap

More recent estimates of contraceptive failure in the United States calculated from the NSFG survey, which was conducted in 1995 provides more method-specific estimates, including the rate for implant and injectable. The injectable method‡ was approved in the United States in late 1992. When all reversible methods are ranked by effectiveness for one year of acceptance, the implant and injectable have the lowest failure rate, followed by the pill, and the highest is spermicides (Fu, et.al, 1999). The comparison of failure rates for each method over time is presented in Table 3.5.

### 3.4.3 Contraceptive Switching

Relatively few studies of contraceptive switching have been conducted. Before the introduction of the calendar method of data collection, only limited data were available with which to investigate changes in behaviour over time. Janowitz, et al. (1986) used survey data from southern Brazil to examine subsequent contraceptive behaviour of the pill users who reported side effects; whether they switched to another modern method, switched to traditional methods, or discontinued contraceptive use. Therefore, these data represent perceived side effects, not necessarily the actual side effects evaluated by a physician. This study had one limitation, it did not have information on duration of use of the pill. Switching behaviour was examined by comparing the percentage of women who formerly stopped using the pill because of side effects and the percentage distribution of current contraceptive status (traditional, modern methods or not using) of currently married women.

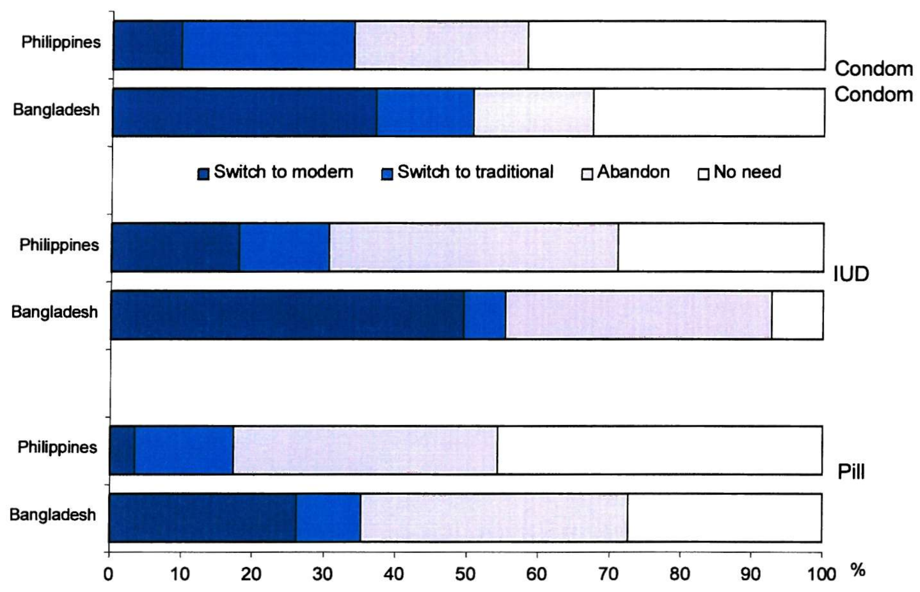
‡ DMPA (depot medroxyprogesteron acetate), or progestin-only, the hormonal injection provides protection for three months. This injectable method was introduced and used in developing countries since 1970s. For instance, it has been popular in Bangladesh since 1977 (Riley, et al. 1994).

DaVanzo et al. (1989) had information only on method changes between pregnancies, and so was unable to determine the exact duration of a use episode. Hamill et al. (1990) had data for only a three-year period and chose to analyze switching between two points in time, spaced two years apart.

Kost (1993) used a six-year calendar history to calculate life table rates of contraceptive discontinuation including contraceptive failure, method switching, and abandonment of use. Kost found that method switching in Peru accounted for about 41% of overall first year discontinuation. In addition, among pill users, they were more likely to switch to another method than to abandon use. The switching rate of the pill users accounted for almost 50 % of discontinuation.

However, in the Philippines, Perez and Tabije (1996) found a different result than in Peru, where abandonment was more likely than switching among pill users. Switching was only 17% while abandonment 37% of the total discontinuation rate. However, condom users were most likely to switch to less effective methods (traditional methods), in fact the rate of switching to less effective methods was more than twice as that of switching to modern methods. Unlike in the Philippines, in Bangladesh condom users were most likely to switch to modern methods. The switching rate to a modern method was nearly three times as that of to traditional methods (Figure 3.2).

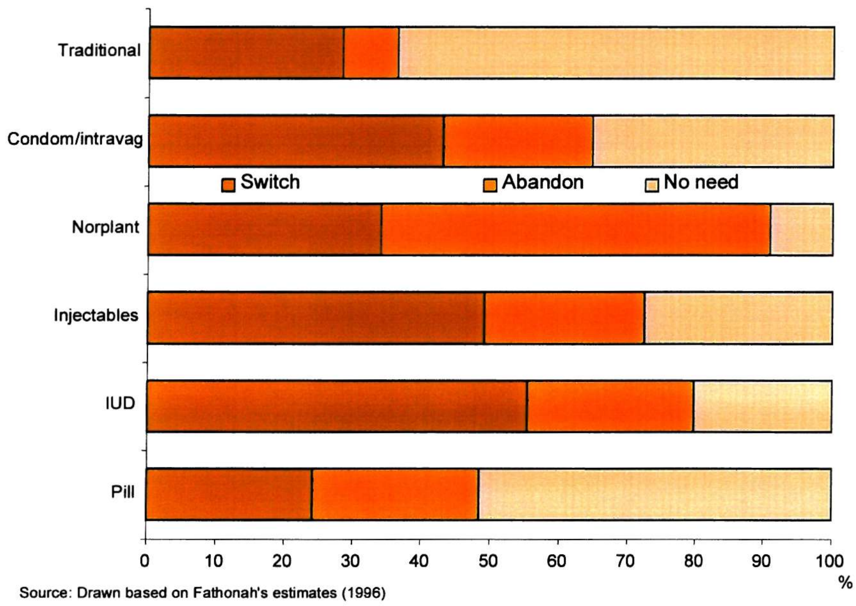
**Figure 3.2 Percent Decomposition of Contraceptive Behaviour after Discontinuation of the Pill, IUD and Condom in Bangladesh and Philippines, 1993**




Sources: Mitra and Al-Sabir (1996) and Perez and Tabije (1996)

Two studies use calendar data from the 1994 DHS to examine contraceptive dynamics in Indonesia as a whole. Fathonah (1996) estimates life-table contraceptive discontinuation and switching by using analytical framework of Curtis and Hammerslough (1995). Fathonah found that abandonment among Norplant users accounted for the highest proportion of discontinuation among other methods, while switching among the IUD and injectables accounted for the highest proportion (shown in Figure 3.3). Curtis and Blanc (1997) use event history analysis in their comparative studies of six developing countries that include Indonesia. They use multilevel techniques to allow for unexplained variation at the cluster level, but ignore unobserved factors at the individual level.

**Figure 3.3 Percent Decompisition of First Year Switching Behaviour after Discontinuation: Indonesia, 1989-94**




Source: Drawn based on Fathonah's estimates (1996)

## 3.5 Deficit Fertility

Bongaarts and Kirmeyer (1982) used a regression analysis to examine the relationship between the contraceptive prevalence rate and a number of different measures of fertility: the total fertility rate, total marital fertility rate (total fertility rate among married women) and total natural marital fertility rate (total fertility rate among married women in the absence of use of contraceptive. They used data from 22 developing countries and found a close relationship between contraceptive prevalence on one hand and each of the three measures of fertility on the other hand.

Equation 3.1 shows the regression analysis between the total fertility rate as a measure of fertility and contraceptive prevalence, producing a high coefficient of determination of 0.72, implying that 72% of the variation in the total fertility rate can be accounted by the variation in contraceptive prevalence rates. The intercept 7.30 represents the fertility rate in the absence of contraception: the expected natural fertility. The slope 0.064 gives an estimate of the decline in the total fertility rate associated with an increase of one percentage points in the contraceptive prevalence rate. That is to say an increase of 10-percentage point in prevalence will result a decline in the expected total fertility rate of 0.64 point below the expected natural fertility rate.

$$TFR = 7.30 - 0.064\ CU \tag{3.1}$$

where CU is the proportion of currently married women using contraception.

Equation 3.1 can then be used to "estimate" TFR in other countries/provinces given their contraceptive prevalence rate. This $TFR_{exp}$ ("expected" TFR) is the one in which would prevail if the country/province followed the relationship between TFR and contraceptive prevalence rate in the above 22 developing countries. Such an equation has already been widely used to identify the reasons for exceptionally high or low fertility given contraceptive prevalence. Bongaarts (1987) investigates exceptionally high total fertility rate in Yemen, Kenya, Syria, Jordan and Zimbabwe. Curtis and Diamond (1995) do similar things in Northeast Brazil. On the other hand, Gajanayake and Caldwell (1990) investigated an exceptionally low fertility rate in Sri Lanka, while Samosir (1995) did for Indonesia

The country/province is termed as experiencing deficit (excess) fertility, if their observed TFR is smaller (larger) than the expected TFR (Bongaart, 1987; Curtis and Diamond, 1995). Deficit fertility means that, given the structure in the 22 developing countries, the contraceptive prevalence rate in a particular country/ province cannot adequately explain the variation in their observed fertility. There must be some other important fertility-inhibiting factors, in addition to contraceptive use, which contribute to the relatively low observed TFR.

For example, as pointed out by Bongaarts (1984), the significant use of induced abortion in Japan and Korea and the relatively high incidence of pathological sterility in Cameroon and Zaire are probably the main reasons why these countries fall below the regression line. On the other hand, Kenya and Syria with relatively short mean durations of breastfeeding and Peru and the

Philippines with their heavy reliance on less efficient methods of contraception have fertility levels higher than expected from the regression line. They experienced surplus fertility.

Curtis and Diamond (1995) pointed out that the most common reasons proposed when deficit fertility occurred are high levels of induced abortion, high levels of natural sterility, reduced coital frequency resulting from spousal separation and unusually high fertility inhibiting effect of other proximate determinants. For Indonesia's data, Samosir (1994) points out that the factors which might account for the deficit fertility were the lag effects of changes in contraceptive use which might not yet have resulted in changes in the TFRs, whether marriage patterns were commensurate with observed contraceptive prevalence rate, whether women breastfed shorter than expected given observed CPR, and unusually high fertility-inhibiting effects of other proximate determinants.

It should be pointed out that the concept of surplus and deficit fertility discussed here is different from the ones intensively used by economists, pioneered by Easterlin (1975) and applied in Indonesia by Ananta (1983). They compared the quantity of children demanded with natural fertility. If at a given price of a child, the quantity demanded is greater than natural fertility, the individual is in deficit fertility; when the quantity of children demanded is smaller than natural fertility, the individual experiences surplus fertility. Further, their analysis is at an individual level, where the analysis in this chapter is at an aggregate level.

Samosir (1994) utilizes equation 3.1 with the 1991 IDHS data. She shows that in 1988-1991, Indonesian women in general would have been expected to have 1.1 more children than they already did given the 1991 contraceptive prevalence. In other words the observed total fertility rate, 3.02, was 1.1 births per woman below the expected total fertility rate, 4.12.

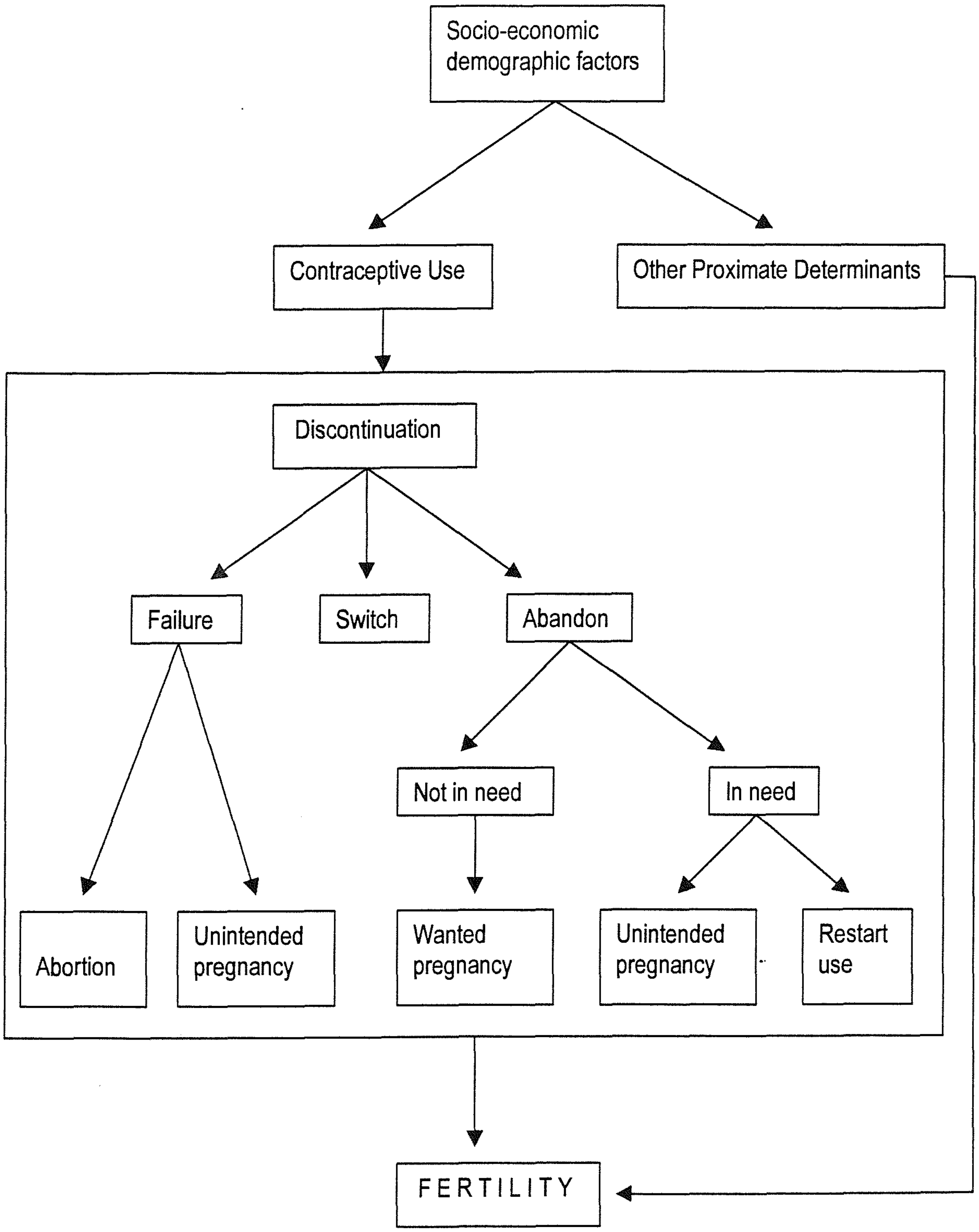
## 3.6 Summary

This review of the literature demonstrates the advances of the DHS data in providing detailed information of recent episodes of contraceptive use which have enabled researchers to assess cross-national estimates of contraceptive use dynamics in developing countries. However, the dynamics in contraceptive use are still less understood especially in Indonesia. Yet, the need for population-based studies on the various dimensions of contraceptive use dynamics exists. They even lack basic descriptive information on overall discontinuation, contraceptive failure and switching. Further, there exists only a small number of multivariate analyses on the dynamics of contraceptive use, and not simply on current contraceptive use.

Contraceptive use dynamics can be placed in a framework as shown in Figure 3.4. Contraceptive use is one of the proximate determinants of fertility, and socio-economic determinants influence fertility through the proximate determinants. However, the demographic impact of contraceptive use depends not only on its prevalence but also on duration of use and effectiveness of use. There are several statuses for those who are using contraceptive methods. Women may become pregnant while they are using the method (contraceptive failure), they may switch to another method or may abandon use. Those experiencing contraceptive failures may have induced or spontaneous abortions, or unintended pregnancies. Women may abandon use because they are not in need or they are in need for contraception. They are not in need either because they want to become pregnant, therefore, they may have a wanted pregnancy, or their exposure to the risk of pregnancy has been reduced. Those who abandon, but are in need for contraception, may be at risk of unintended pregnancies; alternatively, they may restart use.

The nature of DHS calendar data on contraceptive use is hierarchical, with episodes of use of contraception nested within the user of the contraception. Because episodes of use cannot be expected to be independent, the use of traditional multivariate analyses produces biased inference. This two-level clustering structure can be taken into account into the model. The next chapter presents methods of analysis used in this thesis and applied to the 1991 and 1994 IDHS.

Figure 3.4 Framework of Analysis of Contraceptive Use Dynamics



# Chapter 4

# METHODS OF ANALYSIS

## 4.1 Introduction

Several methods of analyses are employed in this research. The use of duration of contraceptive use as one of the important variables in the research necessitates the utilisation of event history analysis, discussed in the next section. Among many techniques in event history analysis, this research uses life table techniques to estimate the rates and patterns of discontinuation (Chapter 7) and switching (Chapter 8). Further, to examine the determinants of the behaviour in contraceptive discontinuation (Chapter 9) and contraceptive switching (Chapter 10), this research uses discrete-time competing risk hazard models. Because one individual can experience several episodes of contraceptive use, a multilevel statistical analysis is carried out. Section 4.3 elaborates this multilevel statistical analysis. Section 4.4.3 discusses the simultaneous equation model, to capture the issues of two endogenous variables, price of contraception and choice of contraception. This technique is used in Chapter 11 to examine the determinants of contraceptive choices. Finally, Section 4.4.4 elaborates the Bongaarts models, to examine deficit fertility, which is discussed in Chapter 6.

## 4.2 Event History Analysis

### 4.2.1 Concept

Social scientists often study 'whether' and 'when' specific events of interest occur in a given period of observation (Willett et al., 1998; Singer et al., 1998). An event history records whether an individual ever experiences an event of interest, if so, when. It is longitudinal data on the occurrence of events (Yamaguchi, 1992). Various kinds of events have been studied by various researchers from different backgrounds. Demographers, for example, study age at various milestones, such as age at menarche, age at first intercourse, age at first marriage, age at first birth and menopause. They are also interested in whether and when individuals give birth, or experience subsequent births. Marriage duration, contraceptive use and many more topics are also studied.

What is an event? Allison (1995) defines an event as a qualitative change --a transition from one discrete state to another-- that can be situated in time. For example, a marriage is a transition from the state of being unmarried to the state of being married. A job promotion is a transition from a job at one level to another job at a higher level (Allison, 1995). Contraceptive discontinuation is a transition from the state of being a contraceptive user to the state of being a nonuser (Curtis and Hammerslough, 1995; Steele, 1996; Leite, 1998).

An occurrence of an event is recognised as an event if there is a preceding time interval that represents its non-occurrence (Yamaguchi, 1992). In other words, a certain time period or duration of non-occurrence must exist. Some individuals will experience non-occurrence of the event, and some others will experience occurrence of the event. In this case, whether and when an event occurs for some individuals is unknown. No matter how long the data collection, some individuals will not experience the event of interest during data collection. Such observations are censored[§]. Researchers do know information about individuals with censored event times, they know their duration of non-occurrence period, but they do not know the precise time when the observed individual may experience the occurrence of the event. Censored observations create an analytic dilemma in the analysis. They cannot be excluded from the analysis, as they are often the ones least likely to experience the event (Willet, et. al, 1998) and they generate serious bias in parameter estimates if excluded (Tuma and Hannan, 1979).

Censoring is common in event history data. In essence, censoring occurs when we have some information about individual survival time, but we do not know the survival time exactly. To determine survival time or failure time precisely, there are three requirements: a time origin, a scale for measuring the passage of time and the occurrence of an event (Cox and Oakes, 1984).

[§] Maller and Zhou (1996) call immune or cured individuals to those are not subject to the event of interest, in other words they have zero risk.

Censoring can be distinguished into three forms, left censoring, right censoring and interval censoring (Allison, 1995). Right censoring occurs when an individual time origin is observed within period of observation, but the event of interest has not yet occurred when observation is terminated. Left-censoring occurs when an individual time origin is observed and the occurrence of the event is known within the period of observation, but the exact time of occurrence is unknown. Interval censoring combines both right and left censoring.

Event history analysis is also called survival analysis, duration analysis, or hazard modelling. Event history analysis models hazards as a function of time, i.e. conditional probability of moving out of a state at time *t* given that exit has not already occurred. Interests of the analysis are focused on time spent in each state, probability of transition between states, and how the hazard depends on time and covariates.

There are two types of covariates in the analysis: time-constant and time-dependent or time-varying covariates. The former is usually ascribed statuses such as sex, ethnicity and religion while the later change in value over time such as number of living children and marital status.

Event history analysis requires special methods for dealing with censored data, that is individuals that do not experience the event of interest at the time of the analysis, and time-dependent covariates. This section discusses two techniques of event history analysis used in this dissertation. They are life table analysis and discrete-time competing risks hazard model.

### 4.2.2 Life-table Techniques

Demographers have used life tables for several centuries to analyze mortality and several decades ago to look at topics such as contraceptive efficacy and employment (Goldman, Pebley and Paul 1983). The life table is a simple approach for the analysis of event history data that can handle right censored data. This approach was originally developed by Graunt to study mortality and length of life (Smith, 1992; Curtis and Hammerslough, 1995). However, it has been widely used in fertility, labor force, nuptiallity, breastfeeding, evaluation contraceptive effectiveness including contraceptive discontinuation (Halli and Rao, 1992; Curtis and Hammerslough, 1995).

The analysis of contraceptive discontinuation raises a number of statistical issues due to characteristics of the data used. For example, the unit of analysis for the study of contraceptive discontinuation is a segment of contraceptive use contributed by the users in the analysis. A segment of use is defined as an uninterrupted period of use of a particular contraceptive method. Many segments of the use come from women who are still using a method at the end of period of observation, duration of that particular segment of use is unknown and called censored segments. We simply know that it is at least the number of months observed at the end of the period of observation. These segments cannot be dropped from the analysis since they would result in bias. In fact, 67% of all selected segments used in the analysis is right-censored in the 1991 IDHS and 59% in the 1994 IDHS.

The life table is an appropriate technique to handle censored data. Segments of use are divided into monthly intervals measured from the time of beginning the segment. For each interval the number of individual at risk, the number of individual discontinued using contraceptive and the number of censored observations, i.e., individuals are still using a particular contraceptive method, are registered. These can be used to calculate rates of experiencing the event in a given interval. The construction of life tables for discontinuation rates starts with the calculation of month-by-month discontinuation rates. These rates are then linked together to obtain a cumulative discontinuation rate over a given period. Details of the construction and calculation of life tables are provided by Curtis and Hammerslough (1995) and Kost (1993).

To estimate discontinuation rates of all reversible contraceptive methods combined at different duration of use, a single decrement life table technique is used in this analysis. Differentials in discontinuation patterns by contraceptive method and area of residence are also explored by using this technique. All these rates in this paper are calculated by using both SPSS and Microsoft Excel. The most commonly used summary life-table measure of discontinuation is the 12-month discontinuation rate (Curtis and Hammerslough, 1995). This represents the proportion of users discontinuing a method within 12 months after the start of use.

Plots of the cumulative proportions of users who discontinue the contraceptive method against duration of use are also helpful in studying in discontinuation patterns. As suggested by Singer et al., (1998) graphical presentations here are presented for two years of use after initiation of contraceptive use, and 12-month and 24-month discontinuation rates also presented.

To study contraceptive discontinuation, one must consider the reason for discontinuation as users of contraception may discontinue for various reasons. The reason for discontinuation may also vary across women with different characteristics. This is the main purpose of this analysis as from a policy perspective point of view as understanding the various reasons for discontinuation can provide valuable insights into quality of care of contraceptive use. To give an overall description of discontinuation by reason stated by the users, discontinuation rates by reason are calculated using a multiple-decrement life table. It should be noted that the SPSS menu can not directly be used for this type of life table approach. It needs to follow a series of commands to calculate and Curtis and Hammerslough (1995) provides some guidance. With this guidance we can calculate multiple-decrement life table by using SPSS or any spreadsheet like Excel.

The following sections discuss several types of life tables: single decrement life tables, multiple decrement life tables, and associated life tables.

#### 4.2.2.1 Single-decrement Life Table

The single-decrement life table is applied in cases where there is only one type of event of interest, e.g. contraceptive discontinuation. To construct a life table, here duration is broken down into monthly intervals [t, t+1), t = 1, 2, 3, ... and for each interval the number of individual at risk, number of events and number of censored observation is recorded. Our notation follows event history analysis notation rather than conventional life table notation. Let

$d_t$ = number of individuals experiencing the event, e.g. discontinued using contraceptive, in this time interval [t, t+1)

$c_t$ = number of individuals censored in this time interval [t, t+1)

$n'_t$ = number of individual who are at risk during this interval [t, t+1)

$n_t$ = number of individuals at the start of the interval [t, t+1). The number of individuals at the start of the first interval, $n_1$, equals to the total number of individuals at the outset of analysis, n. Whereas, the number of individuals at the start of the other intervals, where t+1= 2, 3, ..., is determined by

$$n_{t+1} = n_t - d_t - c_t \tag{4.2.1}$$

Table 4.1 illustrates a simple example of the construction of a life table for contraceptive discontinuation. The ordered columns follow SPSS output as the SPSS program is used to perform the analysis of life table discontinuation and switching behaviour after discontinuation in Chapters 6 and 8, respectively. The four symbols above are put in columns 3 to 6.

Table 4.1 An Example of SPSS output on Single-decrement Life-table Applied to Unweighted 12-month Contraceptive Discontinuation: 1994 Indonesia DHS

| Interval | Start of Interval | Number of Individuals Entering this Interval | Number of Individuals Censored During the Interval | Number of individuals Exposed to Risk | Number of Individuals Terminating events | Proportion of Individuals Terminating | Proportion of Individuals Surviving | Cumulative Proportion of Survivors at End | Probability Density |
|---|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| $t$ | | $n_t$ | $c_t$ | $n'_t$ | $d_t$ | $\lambda_t$ | | $S_t$ | $f_t$ |
| 1 | 0 | 15210 | 282 | 15069 | 506 | 0.0336 | 0.9664 | 0.9664 | 0.0336 |
| 2 | 1 | 14422 | 290 | 14277 | 322 | 0.0226 | 0.9774 | 0.9446 | 0.0218 |
| 3 | 2 | 13810 | 268 | 13676 | 693 | 0.0507 | 0.9493 | 0.8968 | 0.0479 |
| 4 | 3 | 12849 | 259 | 12720 | 172 | 0.0135 | 0.9865 | 0.8846 | 0.0121 |
| 5 | 4 | 12418 | 272 | 12282 | 177 | 0.0144 | 0.9856 | 0.8719 | 0.0127 |
| 6 | 5 | 11969 | 254 | 11842 | 454 | 0.0383 | 0.9617 | 0.8385 | 0.0334 |
| 7 | 6 | 11261 | 223 | 11150 | 161 | 0.0144 | 0.9856 | 0.8263 | 0.0121 |
| 8 | 7 | 10877 | 214 | 10770 | 155 | 0.0144 | 0.9856 | 0.8145 | 0.0119 |
| 9 | 8 | 10508 | 268 | 10374 | 331 | 0.0319 | 0.9681 | 0.7885 | 0.0260 |
| 10 | 9 | 9909 | 270 | 9774 | 145 | 0.0148 | 0.9852 | 0.7768 | 0.0117 |
| 11 | 10 | 9494 | 222 | 9383 | 136 | 0.0145 | 0.9855 | 0.7655 | 0.0113 |
| 12 | 11 | 9136 | 204 | 9034 | 451 | 0.0499 | 0.9501 | 0.7273 | 0.0382 |

The number of individuals at risk at each duration, $n'_t$ or (Column 5), is calculated by assuming that, on average, the segment of use that are continuing at the time of observation are observed in the middle of the month, and consequently they only contribute half a month of exposure in the last month. Hence, the number of individuals at risk is calculated by taking the number individual at the start of the interval and subtracting half of the number of individual censored during the interval. In short, it is $n_t$ - $0.5c_t$.

Then we need to define the hazard rate, which is the probability of an event occuring in the interval given that an event has not already occurred. The hazard rate in Column 7, that is the probability of discontinuing use at each duration, conditional on the fact that discontinuation has not occurred at the earlier duration. It is estimated by dividing the number of discontinuing at each duration by the number at risk at that duration and it is presented as follows

$$\lambda_t = \frac{d_t}{n_t - 0.5c_t} \qquad (4.2.2)$$

The probability of continuing use at each duration, given survival to time t, in Column 8, is simply one minus the probability of discontinuing at that duration.

$$1 - \lambda_t = 1 - \frac{d_t}{n_t - 0.5c_t} \qquad (4.2.3)$$

The next stage is to calculate the cumulative probability of survivors at end of each duration, in Column 9, that a user is still using the contraceptive method at different durations. To do this the conditional probability just calculated in Column 7 has to be multiplied together. In other words, the cumulative probability of not experiencing the event before $t$ is referred to as the probability of surviving or survivor function, in this case it is the probability of continuing use of contraception, is defined as:

$S_t$ = Pr (event does not occur before t)

$S_t = \Pr(T \geq t)$

Column 9 is calculated as

$$S_t = \prod_{j=1}^{t-1} (1 - \lambda_j) \qquad (4.2.4)$$

The formulae above says that probability still using at the end of the $t^{th}$ month equals the probability still using at the end of the $(t\text{-}1)^{th}$ month times the probability still using at the end of the $t^{th}$ month given that user is still using at the end of the $(t\text{-}1)^{th}$ month.

The cumulative probability that individuals experience the event, discontinue use, by the end of the $t^{th}$ month is given by:

$$F_t = 1 - S_t \qquad (4.2.5)$$

From Column 9, the 12-month discontinuation is obtained by subtracting the proportion still using at the end of month 11 in Table 4.1 from 1. When we use SPSS, the proportion of users still using at the end of each duration in the output of the life table headed 'CUMUL PROPN SURV AT END'.

The probability density, which is the unconditional probability of event occurrence, shown in Column 10 can be defined as:

$$f_t = \lambda_t \prod_{j=1}^{t-1} (1-\lambda_j) \qquad (4.2.6)$$

or

$$f_t = \lambda_t S_t \qquad (4.2.7)$$

### 4.2.2.2 Multiple Decrement Life Table

The classification of events into different types is often somewhat arbitrary and may vary according to the specific goals of the analysis. For now, let's suppose that the events we are interested in are reasons for discontinuation of use of contraception.

The single decrement life table technique accounts for only one attrition factor or one event. The straightforward extension of the single decrement life table is the multiple decrement life table, which was originally used to construct a life table taking into account multiple events of exit. As it is usually used in studying mortality, the multiple decrement life table is used to construct a life table by causes of death is also a convenient way of analysing the risks of different types of discontinuation.

We could break down the column containing the number of discontinuations at each duration, in Column 5 in Table 4.1, into five columns, for example. Each column contains the number of discontinuations due to: (1) failure, (2) wants to get pregnant, (3) side effects and health concerns, and (4) method-related reasons and (5) other reasons. From this, the probability of discontinuing for each reason at each duration can be calculated conditional on the fact that the user is still using at the start of the interval.

Hence, the first interval (month) we have:

Probability of discontinuation due to failure =

$$\lambda_{1failure} = \frac{d_{1failure}}{n_1 - 0.5c_1} \qquad (4.2.8)$$

Probability of discontinuation due to wants to get pregnant =

$$\lambda_{1pregnant} = \frac{d_{1pregnant}}{n_1 - 0.5c_1} \tag{4.2.9}$$

Probability of discontinuation due to side effects and health concerns =

$$\lambda_{1sideeffets} = \frac{d_{1sideeffects}}{n_1 - 0.5c_1} \tag{4.2.10}$$

Probability of discontinuation due to method-related reasons =

$$\lambda_{1me\_rel} = \frac{d_{1met\_rel}}{n_1 - 0.5c_1} \tag{4.2.11}$$

Probability of discontinuation due to other reasons =

$$\lambda_{1other} = \frac{d_{1other}}{n_1 - 0.5c_1} \tag{4.2.12}$$

and repeat the same procedure for the following intervals (months).

For simplification, suppose we classify *s-1* different possible events, e.g. reasons for discontinuation. Let $r$ be a variable indicating the particular event that occurs ($r$=1,2,..., s-1) and the state $s$ represents right-censored cases for whom the event $r$ has not yet occurred. Hazard rates of an individuals experiencing an event $r$ during month [t, t+1) as

$$\lambda_{rt} = \frac{d_{rt}}{n_t - 0.5c_t} \tag{4.2.13}$$

where $d_{rt}$ = the number of individuals experiencing an event $r$ during the month [t, t+1)

The overall probability of discontinuing at each duration equals the sum of the probabilities of discontinuation for each reason. In other words, the overall hazard rate is

$$\lambda_t = \sum_{r=1}^{s-1} \lambda_{rt} \tag{4.2.14}$$

The probability that no events occur before time $t$ is

$$\lambda_{st} = 1 - \sum_{r=1}^{s-1} \lambda_{rt} \tag{4.2.15}$$

Therefore, the cumulative probability of surviving to time $t$ is

$$S_t = \prod_{j=1}^{t-1}(1-\lambda_j) \tag{4.2.16}$$

The cumulative probability that an event of kind $r$ occurs before time $t$ is expressed by:

$$F_{rt} = \sum_{j=1}^{t-1}\lambda_{rj}S_j \tag{4.2.17}$$

$F_{rt}$ is probability of discontinuation due to reason $r$ acting in the presence of all other reasons for discontinuation (Kost 1993).

### 4.2.2.3 Associated Single-decrement Life Table

The associated single-decrement probabilities are used when comparing probabilities across groups, such as the probability of contraceptive failure among young women as compared with that among older women. However, the interpretation of these rates requires an assumption that the various causes of discontinuation are independent (Kalbfleisch and Prentice, 1980).

The probabilities calculated from the multiple-decrement life tables (MDLT) are called net discontinuation probabilities because they represent the probability of discontinuing for each reason in the presence of other competing reasons for discontinuation. It is affected both by the underlying risk of discontinuing for that particular reason and the underlying risks of discontinuing for other reasons. As such, the net discontinuation rates are dependent on each other and changes in the underlying risk of discontinuing for one reason will affect the net discontinuation rates for other reasons.

A problem arises when MDLT rates are used in comparing a particular event for more than two different samples or even for subgroups within a sample, due to competition with other events. One way to overcome this problem is to construct a life table in which all the competing risks are eliminated. This kind of a life table is called an associated single-decrement life table, which treats all discontinuation for reasons other than the one of interest as censored observations. The calculation is performed by the same formula as an SDLT.

In life table analysis, the effect of one particular variable on the rate of the event occurrence is computed without controlling for the effect of other variables. It is possible to examine differentials between subgroups of population by calculating separate life tables for each sub-group. However, the life table analysis becomes infeasible when the number of subgroup increases markedly. To overcome with this problem, hazard models allow us to measure the effect of one variable on the event occurrence by controlling for the effect of the other variables. Random parameters can also be incorporated into the hazard model. The following section presents about the discrete time competing risks hazard model.

### 4.2.3 Discrete-Time Competing Risks Hazard Model

Information on the occurrence of an event can be recorded very precisely and such precise time to event data are referred to as continuous time data. More commonly, however, the occurrence of event is recorded within some finite time interval (Willett et al, 1998). We call data such as these as discrete-time data. Discrete-time models are used to analyse discrete-time data (Yamaguchi, 1992).

Suppose $T_i$ is a discrete random variable associated with survival time, which can take any non-negative value for an individual $i$, and $t$ is the actual survival time. Consider a multinomial response vector with $s$ categories, so there are $s$-1 decrements or causes of 'death', and $s$ represents right-censored cases for whom the event has not yet occurred. Let $R$ be a variable indicating the particular event, $r$, that occurs ($r$=1, 2, ..., s-1). We then define the discrete-time cause-specific hazard by

$$\lambda_{rti} = \Pr(T_i = t, R = r \mid T_i \geq t, x_{rti}),\ r = 1, 2, \ldots, s\text{-}1 \qquad (4.2.18)$$

where $\lambda_{rti}$ is the probability that individual $i$ experiences an event of type $r$ at time $t$, given survival to time $t$ and a set of covariates $x$ which may be cause-specific.

The overall hazard of an event of any type is

$$\lambda_{ti} = \sum_{r=1}^{s-1} \lambda_{rti} \qquad (4.2.19)$$

and the hazard that no event of any type, i.e. an event of type s, occurs is

$$\lambda_{sti} = 1 - \sum_{r=1}^{s-1} \lambda_{rti} \qquad (4.2.20)$$

The relationship between $\lambda_{rti}$, time and covariates can be expressed in a general form

$$\lambda_{rti} = g^{-1}(\alpha_{rt} + x'_{rti}\beta_r), \quad r = 1, 2, \ldots, s\text{-}1 \tag{4.2.21}$$

where the dependency of the hazard on time and the covariates, represented by $\alpha_{rt}$ and $\beta_r$ respectively, can vary according to the type of event and g(.) is monotonic function called the link function.

For any link function g(.), the likelihood can be shown to be

$$L = \prod_{i=1}^{n} \left[ \frac{\lambda_{rti}}{1-\lambda_{ti}} \right]^{c_i} \prod_{j=1}^{t} (1-\lambda_{ji}) \tag{4.2.22}$$

where $c_i$ is the censoring indicator. $c_i = 1$ if an event occurs at time $t$, and $c_i = 0$ otherwise.

Although other link functions can be used, the logistic function is most commonly used as it is the most tractable. Let $\lambda$ be the corresponding vector containing the probabilities of falling into any particular category. The discrete-time competing risk model for single spells assumes that for some individual in the population, the log odds of having an event of type $r$ rather than an event of type $s$ (the reference category) at discrete time point $t$ are given by

$$\log\left(\frac{\lambda_{rti}}{\lambda_{sti}}\right) = \alpha_{rt} + x'_{rti}\beta_r, \qquad r = 1, \ldots, s\text{-}1 \tag{4.2.23}$$

where $\lambda_{rti}$ is the hazard of an event of type $r$ occurring at time $t$ for an individual $i$ with covariates $X_{rit}$, $\alpha_{rt}$ is a function of the duration for individual $i$ at time $t$ for event type $r$, and $\beta_r$ is unknown parameters.

In the multinomial competing risks model, censored cases can be treated as the reference category, and the risks of each type of discontinuation relative to the risk of still using a method can be estimated simultaneously. Then the probabilities of being in a particular category $r$ at time $t$ for an individual $i$ with covariates $X_{rti}$ are given by

$$\lambda_{rti} = \frac{\exp(\alpha_{rt} + X'_{rti}\beta_r)}{1 + \sum_{k=1}^{s-1} \exp(\alpha_{kt} + X'_{kti}\beta_k)}, \quad r = 1, \ldots, s\text{-}1 \tag{4.2.24}$$

and the hazard that no event occurs is

$$\lambda_{sti} = \frac{1}{1 + \sum_{k=1}^{s-1} \exp(\alpha_{kt} + X'_{kti}\beta_k)} \tag{4.2.25}$$

The inclusion of $\alpha_{rt}$ allows duration effects to be modelled. Setting $\alpha_{rt}$ equal to $t$ or log(t) gives models analogous to continuous-time Gompertz or Weibull models respectively. Alternatively, the time axis can be split into intervals and a nonparametric piece constant hazard model can be fitted, where it is assumed that the hazard of discontinuation use is constant over a particular time interval. For such a model, $\alpha_{rt}$ will be a categorical variable, with a separate category representing each time interval. Time-dependent covariates can be incorporated easily into the analysis, though in this paper the values of the covariates do not vary over a contraceptive use interval.

The estimates $\hat{\lambda}_{sti}$ can then be used to derive estimates of the probability of survival time $t$, $\hat{S}_{ti}$, and the cumulative probability of an event type $r$, $\hat{F}_{rti}$, as

$$\hat{S}_{ti} = \prod_{j=1}^{t-1} \hat{\lambda}_{sji} \tag{4.2.26}$$

and

$$\hat{F}_{rti} = \sum_{j=1}^{t-1} \hat{\lambda}_{rji} \hat{S}_{ji} \tag{4.2.27}$$

The discrete-time competing risks hazards model can be fitted with any statistical software that performs multinomial logit regression. When using SAS, PROC CATMOD estimates the model simultaneously for all event types. The data must be restructured, however, to give a multinomial response for each month of observation and for each individual in the sample.

## 4.3 Multilevel Analysis

### 4.3.1 Hierarchical Data Structures

Data structures are often hierarchical in the following sense. We have information describing individuals, but individuals are grouped into larger units. We also have information for those larger units. Such structures occur in longitudinal studies and clustered survey samples. For example, in education in which individuals (pupils) are subject to the influences of grouping. Students learn in classes; classes are taught within schools; and schools are arranged within school district. Also, individuals are nested within a family.

Many repeated measurements are hierarchical. If we follow individuals over time, the measurements of any individual are a group, in the same way as the school class is a group. For example, in growth studies of children repeated measurements of weight are taken on a sample of individuals. This can be regarded as a 2-level hierarchy with children as the level 2 units and the set of measurement occasions for an individual constituting the level-1 units for that level-2 unit. A third level can be introduced into this structure if children are grouped into families since a family can have more than one child.

In retrospective monthly information of contraceptive use for five years preceding the survey, as in second phase DHS surveys, a woman might have more than episode of use of a particular method of contraceptive use. The woman is a level 2 unit and the episode is a level 1 unit.

The following section presents a brief overview of the multilevel model, which leads to the empirical statistical models presented in sections 4.4.1 and 4.4.2

### 4.3.2 Fundamental Principles of Multilevel Modelling

#### 4.3.2.1 The Random Intercepts Model

This section introduces the logic of hierarchical linear models. We begin with a simple linear model, a continuous response variable and one predictor. The regression equation for the data is:

$$y_i = \beta_0 + \beta_1 X_i + e_i \tag{4.3.1}$$

Consider a hierarchical data structure with two levels. For example, individuals nested into clusters. Assume that there are $J$ level 2 units, where $J$ is a large number and $n_j$ individuals in cluster $j$. $y_{ij}$ is the response for individual $i$ in cluster $j$ and $X_{ij}$ is a predictor. The simplest form of a multilevel model is a random-intercepts model, which the regression line for the relationship between the response, $y_{ij}$, and a predictor, $X_{ij}$, can have different intercepts for each cluster but each line has the same slope. The plot of the regression of $y_{ij}$ on $X_{ij}$ will be a set of parallel lines. The random intercepts model of the Equation 4.3.1 can be written as

$$y_{ij} = \beta_{0j} + \beta_1 X_{ij} + e_{ij} \text{ , } i = 1, 2, \ldots, n_j \text{ and } j = 1, 2, \ldots, J \tag{4.3.2}$$

where

$$\beta_{0j} = \beta_0 + \upsilon_{0j} \tag{4.3.3}$$

We assume that

$$e_{ij} \sim N(0, \sigma_e^2)$$

$$\upsilon_{0j} \sim N(0, \sigma_0^2)$$

$$\mathrm{cov}(e_{ij}, \upsilon_{0j}) = 0$$

Observations in the same cluster are not independent since

$$\begin{aligned} \mathrm{cov}(y_{ij}, y_{i'j'}) &= \sigma_0^2 + \sigma_e^2 \qquad && j = j',\ i = i' \\ &= \sigma_0^2 && j = j',\ i \neq i' \\ &= 0 && j \neq j'. \end{aligned}$$

The random intercept model is often referred to as a 'variance components' model since the variance of the response $y_{ij}$ can be decomposed into the sum of the level 1 and level 2 variances.

Substitution of (4.3.3) into (4.3.2) gives a single-equation formulation of the random intercepts model as

$$y_{ij} = \beta_0 + \beta_1 X_{ij} + \upsilon_{0j} + e_{ij} \tag{4.3.4}$$

$\beta_0 + \beta_1 X_{ij}$ can be thought of as the fixed part of the model, and $\upsilon_{0j} + e_{ij}$ the random part. $\beta_0$ and $\beta_1$ are known as the fixed parameters and $\sigma_0^2$ and $\sigma_e^2$ are the random part parameters.

The intra-class correlation, which is a criterion for measuring the homogeneity of units within clusters compared to between clusters, is defined as

$$\rho = corr(y_{ij}, y_{i'j}) = \frac{\mathrm{cov}(y_{ij}, y_{i'j})}{\sqrt{\mathrm{var}(y_{ij})\,\mathrm{var}(y_{i'j})}} = \frac{\sigma_0^2}{\sigma_0^2 + \sigma_e^2} \tag{4.3.5}$$

This measures the proportion of the total variation $(\sigma_0^2 + \sigma_e^2)$ which can be attributed to between-cluster variation. Hence if $\sigma_0^2 = 0$, that is, if there is no variation between the second level clusters, responses within a cluster are uncorrelated and $y_{ij} = \beta_{0j} + \beta_1 X_{ij} + e_{ij}$ reduces to a single-level model.

### 4.3.2.2 The Random Coefficients Model

The random coefficients model allows the slope parameter varies across clusters, which means that the magnitude of effect of a covariate is different in each cluster. A direct extension of the random intercepts model in (4.3.2) is to allow the slope parameter, $\beta_1$, to vary across clusters. This model can be written as

$$y_{ij} = \beta_{0j} + \beta_{1j} X_{ij} + e_{ij} \tag{4.3.6}$$

where

$$\beta_{0j} = \beta_0 + \upsilon_{0j} \tag{4.3.7a}$$

$$\beta_{1j} = \beta_1 + \upsilon_{1j} \tag{4.3.7b}$$

We assume

$$e_{ij} \sim N(0, \sigma_e^2)$$

$$\upsilon_{0j} \sim N(0, \sigma_0^2)$$

$$\upsilon_{1j} \sim N(0, \sigma_1^2)$$

$$\text{cov}(\upsilon_{0j}, \upsilon_{1j}) = \sigma_{01}$$

$$\text{cov}(e_{ij}, \upsilon_{0j}) = \text{cov}(e_{ij}, \upsilon_{1j}) = 0$$

Substituting (4.3.7a) and (4.3.7b) into (4.3.6), we have a single-equation formulation as

$$y_{ij} = \beta_0 + \beta_1 X_{ij} + \upsilon_{0j} + X_{ij}\upsilon_{1j} + e_{ij} \tag{4.3.8}$$

The fixed part of the model is $\beta_0 + \beta_1 X_{ij}$ and the random part is $\upsilon_{0j} + X_{ij}\upsilon_{1j} + e_{ij}$. The term $X_{ij}\upsilon_{1j}$ can be regarded as an interaction between $X_{ij}$ and the unobserved random effect $\upsilon_{1j}$.

### 4.3.2.3 Higher-Level Covariates

The random-coefficients regression model allows us to estimate the variability in the regression coefficients (both intercepts and slopes) across the level-2 units. To model this variability, a covariate at level 2, which takes the same value for individuals in each level 2, is included in the model. Thus, the two-level model has the two-level random slopes model with one covariat, $X_{ij}$ at level 1 and one covariate $w_j$ at level 2 can be written:

$$y_{ij} = \beta_{0j} + \beta_{1j} X_{ij} + e_{ij} \tag{4.3.9}$$

where

$$\beta_{0j} = \beta_0 + \gamma_0 w_j + \upsilon_{0j} \tag{4.3.10a}$$

$$\beta_{1j} = \beta_1 + \gamma_1 w_j + \upsilon_{1j} \tag{4.3.10b}$$

The single-equation formulation is

$$y_{ij} = \beta_0 + \beta_1 X_{ij} + \gamma_0 w_j + \gamma_1 X_{ij} w_j + \upsilon_{0j} + X_{ij} \upsilon_{1j} + e_{ij} \tag{4.3.11}$$

This model assumes that differences between clusters can be partly or completely explained by certain level 2 covariates. This model is called a 'slopes-as-outcomes' model (Bryk and Raudenbush, 1992).

#### 4.3.2.4 A Three-Level Model

A three-level model can be easily understood from cross-sectional data, which normally selects a sample using geographical strata. Individuals nested within households within geographical areas such as sampling clusters. The two-level model can be extended to a three-level model. In this model intercepts vary across both level 2 units and level 3 units. Below is a three-level model consisting of one level 1 covariate only,

$$y_{ijk} = \beta_{0jk} + \beta_1 X_{ijk} + e_{ijk} \tag{4.3.12}$$

where

$$\beta_{0jk} = \beta_0 + \upsilon_{0jk} + \nu_{0k} \tag{4.3.13}$$

$\upsilon_{0jk}$ and $\nu_{0k}$ are random effects corresponding to level 2 and level 3, respectively.

The single-equation is

$$y_{ijk} = \beta_0 + \beta_1 X_{ijk} + \upsilon_{0jk} + \nu_{0k} + e_{ijk} \tag{4.3.14}$$

We assume

$$e_{ijk} \sim N(0, \sigma_e^2)$$

$$\upsilon_{0jk} \sim N(0, \sigma_{\upsilon 0}^2)$$

$$\nu_{0k} \sim N(0, \sigma_{\nu 0}^2)$$

In this model we can also add level 2 and level 3 covariates. For example, in a case of hierarchical student data, student background characteristics, classroom characteristics, and school characteristics can be added into the model.

For a three-level model, we can calculate the intra-class correlation for level 3 units as well as for the level 2 units. For the three-level random intercepts model above, the total variation is

$$\sigma_e^2 + \sigma_{\upsilon 0}^2 + \sigma_{v 0}^2 . \tag{4.3.15}$$

Therefore, the proportion of the total variance due to variation among level 2 units is

$$\frac{\sigma_{\upsilon 0}^2 + \sigma_{v 0}^2}{\sigma_e^2 + \sigma_{\upsilon 0}^2 + \sigma_{v 0}^2} \tag{4.3.16}$$

and the proportion due to level 3 units is

$$\frac{\sigma_{v 0}^2}{\sigma_e^2 + \sigma_{\upsilon 0}^2 + \sigma_{v 0}^2} \tag{4.3.17}$$

### 4.3.2.5 Binary Response Data

So far, we have considered a continuous outcome as a response variable in the model. In this section, the outcome variable is a binary response, which takes values of zero and one. Binary response variables arise naturally in many studies. For contraceptive use, a woman can be considered as an user or not an user of contraception. Whether a woman just has had a baby or not, whether a baby is being breastfed or not, and whether a person is working or not. All are examples of a binary response, which can be associated with a number of explanatory covariates being investigated.

In order to define the multilevel logit model let $y_{ij}$ be the binary response for individual $i$ in cluster $j$. Defining $\Pr(y_{ij} = 1) = \pi_{ij}$ as the probability of 'success', the multilevel logit model can be define as

$$y_{ij} = \pi_{ij} + e_{ij} \tag{4.3.18}$$

where $$\log_e \frac{\pi_{ij}}{1-\pi_{ij}} = \eta_{ij} = X'_{ij}\beta + z'_{ij}u_j$$

The 'success' probability for individual $i$ in cluster $j$, $\pi_{ij} = \Pr(y_{ij} = 1)$, can be expressed as:

$$\pi_{ij} = \frac{e^{\eta_{ij}}}{1+e^{\eta_{ij}}} \tag{4.3.19}$$

The extension to higher level models is straightforward.

### 4.3.2.6 Polychotomous Response Data

In this section we extend the model for a single proportion as outcome to the case of a set of proportions. The response is now multivariate, which has more than two possible outcomes, and we generalize the ordinary logit model to define a multivariate logit model. For example, we may be interested in patients' outcomes such as recover, die, and no improvement; or we may be interested in the political affiliation of individuals, that is conservative, labour, or liberal democrats. We are here interested in reasons for discontinuation; contraceptive failure, desire to get pregnant, side effects and health concerns, other reasons, and still using contraception. In this section, we will consider only models for nominal response categories.

Let $y_i$ be the response variable for individual I, which has more than 2 categorical unordered response. Assuming that response variable, $y_i$, has $s$ categories, define the probability that response variable equals to r by $\Pr(y_i = r) = \pi_{ri}$, where $r$ = 1,2, ..., s, such that $\sum_{r=1}^{s} \pi_{ri} = 1$. $s$ represents the reference category. The multinomial logit model can be written as

$$y_{ri} = \pi_{ri} + e_{ri} \tag{4.3.20}$$

where $$\log_e \frac{\pi_{ri}}{\pi_{si}} = \eta_{ri} = X'_{ri}\beta \qquad r = 1,2, \ldots ,s\text{-}1$$

A set of covariates needs to be estimated for different contrast, since the effect of the covariates is likely to vary separately across the categories of the response variables. It is needed to create a number of r-1 binary variables coded as 1 or zero such that

$$y_{ri} = \begin{cases} 1 \; y_i = r, & r = 1,2,\ldots,s \\ 0 \;\; else \end{cases}$$

The probability that a response category is $r$ for an individual $i$ is calculated as

$$\pi_{ri} = \frac{e^{\eta_{ri}}}{1+\sum_{k=1}^{s-1} e^{\eta_{ki}}} \qquad (4.3.21)$$

And the probability that a response is s (the reference category) is:

$$\pi_{si} = \frac{1}{1+\sum_{k=1}^{s-1} e^{\eta_{ki}}} \qquad (4.3.22)$$

The multilevel multinomial logit model can be easily extended by including the random part in the model. This is expressed by

$$y_{rij} = \pi_{rij} + e_{rij} \qquad (4.3.23)$$

where $\log_e \frac{\pi_{rij}}{\pi_{sij}} = \eta_{rij} = X'_{rij}\beta_r + z'_{ij}u_{rj}$ $\qquad r = 1,2, \ldots ,s\text{-}1$

The probability that a response variable is $r$ for individual $i$ in cluster $j$ is calculated as

$$\pi_{rij} = \frac{e^{\eta_{rij}}}{1+\sum_{k=1}^{s-1} e^{\eta_{kij}}} \qquad (4.3.24)$$

The probability that a response is $s$ (the reference category) is

$$\pi_{sij} = \frac{1}{1+\sum_{k=1}^{s-1} e^{\eta_{kij}}} \qquad (4.3.25)$$

## 4.4 Empirical Methods of Analysis

### 4.4.1 Analysis of Contraceptive Discontinuation

In the analysis presented in Chapter 9, the reasons for discontinuation are divided into four groups: failure (become pregnant while a woman is using a contraceptive method), desire to get pregnant, side effects and health concerns, and other reasons for discontinuation. However, the multiple-decrement life table will be used for estimation of the overall rate only as it is not possible to include a number of factors simultaneously because the sample size within each group becomes too small for reliable estimation. One way of overcoming this problem is to use multinomial hazard models (or event history models) that allow for controlling for the effects of some other factors.

In event history analysis, the length of time before the occurrence of an event, in this case duration of contraceptive use, is important. The duration of use can be modelled explicitly by using either a discrete-time or a continuous-time hazard model. In analysis of contraceptive discontinuation in Bali, the use of discrete-time hazards model is considered to be the more appropriate method. There are two reasons for choosing this approach. Firstly, the duration of each interval is designed and recorded to the nearest whole month, therefore, time is not measured exactly. As stated by Yamaguchi (1991) in this case, it may be more natural to assume a model that reflects a discrete time measurement. Secondly, because durations of use are measured in months, the data are likely to contain a large number of ties. Events are tied when two or more individuals experience an event at the same time (Yamaguchi 1991). It is supported by the fact shown that many users in each month of use have the same length of duration of contraceptive use.

As we want to study on different reasons for discontinuation, a discrete-time competing risk hazards model will be used here. This model is essentially the multinomial logit model in which the contraceptive status is recorded for certain intervals of time. In this analysis, each segment of use is recorded into monthly intervals of use and five categories are considered for the multinomial response: 1) failure, 2) desire to get pregnant, 3) side effects and health concerns, 4) other reasons, and 5) still using a method. The discrete-time competing risks hazards model can be fitted with any statistical software that performs multinomial logit regression. When the software used is SAS, PROC CATMOD can estimate the model simultaneously for all event types. When MLwin is used, the commands provided by Yang et al (1999) can be followed. The MLwin is used for this analysis.

The data must be restructured, however, to give a multinomial response for each month of observation and for each individual in the sample. If, for example, a woman discontinues a method due to contraceptive failure in the seventh month of use, seven observations will be created for this segment of use, one for each month of use, and the response variable would assume the values: 5, 5, 5, 5, 5, 5 and 1. On the other hand, if a woman were still using a method at the end of observation period, the response variable would assume the values: 5, 5, 5, 5, 5, 5, and 5. The size of the data set by using this method becomes significantly increased. For Bali's data, the sizes of the data being used are 9,962 observations and 11,225 observations generated by all selected segments of use for the 1991 and 1994 data sets, respectively.

In competing risk hazards model, censored cases (still using) can be treated as the reference category, and the risks of each type of discontinuation relative to the risk of still using a method can be estimated simultaneously. The duration of use at each month is included as a covariate in the model and can be treated in one of the two ways. First, if the duration effect is specified as some continuous function of time, the model is parametric. For example, if setting duration of use equal to $t$ gives models analogous to Gompertz models or if it transformed to logarithm of $t$ is Weibull models. Alternatively, the duration of use can be split into intervals and a non-parametric model can be fitted, which is called a piece-wise constant hazard model. After a series of testing of dependency of duration of use in the model, the natural logarithm of duration of use is considered to be used for the analysis of contraceptive discontinuation in Bali.

In event history data such as a contraception history, the situation often is complicated further by the fact that an event of interest can occur more than once to an individual during a particular period of observation. This results in a hierarchical structure with repeated observation at the first level and the individual at the second level. Individual characteristics are likely to affect woman's contraceptive behaviour so the outcomes of episodes of use contributed by the same woman are likely to be correlated. In addition, women who live in the same cluster are likely to be more alike than women who live in different clusters are. Standard hazard model assumes that observations are independent, an assumption that does not hold in clustered hierarchical data such as these. The failure of the independence assumption means that estimates of standard errors obtained from standard hazard models are likely to be biased downwards, which in turn may result in effects appearing to be statistically significant when, in fact, they are not.

To address this problem, a multilevel discrete-time competing risks hazards model is used for the analysis. This model is an extension of the multinomial hazards model, where intercepts are allowed to vary randomly across clusters. The random-effects multinomial model is a special case of the non-linear multilevel model for discrete-response data proposed by Goldstein (1991). Alternatively, incorporating covariates capturing the characteristics of an individual prior to an event of interest should be added into the model to take into account of the possible dependencies between observations on the same individual. Steele, Diamond and Wang (1996) mention examples of such variables, e.g. the number of previous uses of contraception or the number of previous failures. Steele (1996) uses both variables in the analysis of contraceptive discontinuation in China. The status in the month immediately before use of contraception is considered in the model, e.g. whether an individual was using any method, just had a birth or a termination, or was not using any method, (Curtis and Blanc 1997). In this analysis, this variable is also considered to put in the model. Although one could also control for further level of clustering by including a level for sampling clustering, the present analysis is limited to two levels: segments of contraceptive use as level 1 nested within women as level 2. This is because a series of estimation found that all the random parameters at the clusters (primary sampling units) are not significant.

By including a random effect in the model, one can control both for unobserved heterogeneity and for possible correlation between duration of use for women who contribute multiple spells of use. This point is important because there are likely to be omitted or even unmeasurable factors that affect a woman's contraceptive behaviour. For instance, fecundability varies across women, and the risk of experiencing an unintended pregnancy during use of a contraceptive method (a contraceptive failure) would be expected to vary because of difference in fecundability. One may expect women who experience difficulty with use to discontinue early, contributing a series of short segments, while others who have fewer problems and, therefore, manage to continue use for longer periods often contribute only one long segments of use.

The multilevel discrete-time competing risks hazards model used for the analysis on contraceptive discontinuation in Bali is presented in equation 4.4.4.1. The four reasons for discontinuation: (1) contraceptive failure, (2) desire to get pregnant, (3) side effects and health concerns and (4) other reasons, and (5) the reference category are those who are still using contraception. The model can be expressed as the log odds of experiencing a particular reason, $r$, for discontinuation relative to continuing of the use of contraception at time $t$ for the $i^{th}$ segment for the $j^{th}$ woman with covariates $X_{rtij}$.

$$\log\left(\frac{\lambda_{rtij}}{\lambda_{5tij}}\right) = \beta_{r0} + \beta_{r1}Ln(Z_{rtij}) + \beta'_{r2}X_{rtij} + u_{rj},\ r = 1, \dots, 4 \qquad (4.4.1.1)$$

where $Ln(Z_{rtij})$ is a natural logarithm of duration of use for the $i^{th}$ segment for the $j^{th}$ woman at time $t$ for a reason of discontinuation $r$. Duration of use broken down into monthly intervals and it has values from 1 to 60. $u_{rj}$ is the random effect associated with the $j^{th}$ woman for type of discontinuation $r$. The values of $u_{rj}$ are assumed to be distributed normally with mean 0 and variance $\sigma^2_r$. Two random effects $u_{rj}$ and $u_{qj}$ can be correlated with covariance $\sigma_{rq}$. The model can be regarded as consisting of a fixed part and a random part, where $\beta_{r0}$, $\beta_{r1}$, and $\beta_{r2}$ are the parameters in the fixed part of the model and $\sigma^2_r$ and $\sigma_{rq}$ are parameters in the random part.

The following equations give the probabilities of discontinuing use of contraception due to a particular reason for discontinuation $r$ at time $t$ for a use interval $i$ with a set of background characteristics $X_{rtij}$ in the random-effects hazards model:

$$\lambda_{rtij} = \frac{\exp\left(\beta_{r0} + \beta_{r1}Ln(Z_{rtij}) + \beta'_{r2}X_{rtij} + u_{rj}\right)}{1 + \sum_{k=1}^{s-1}\exp\left(\beta_{k0} + \beta_{k1}Ln(Z_{ktij}) + \beta'_{k2}X_{ktij} + u_{rj}\right)},\ r = 1, \dots, 4 \qquad (4.4.1.2a)$$

and

$$\lambda_{5tij} = \frac{1}{1 + \sum_{k=1}^{s-1}\exp\left(\beta_{k0} + \beta_{k1}Ln(Z_{ktij}) + \beta'_{k2}X_{ktij} + u_{rj}\right)} \qquad (4.4.1.2b)$$

The cumulative probability of discontinuation due to reason $r$ is calculated using equation 4.2.28. The propensity to discontinue use of a contraceptive method is expected to depend on characteristics of the user. For example, users who do not wish to have any more children would be expected to be more highly motivated to avoid pregnancy than those who are trying to space their births; hence they would be expected to discontinue less frequently. Users in an rural area might be expected to discontinue more frequently because their access to information on how to use a particular method correctly or to a regular supply of their contraceptive method may be less than those who live in an urban area. However, analysis of discontinuation rates controlling for method or by characteristics of the users is complicated by the role of method choice. Highly motivated users are likely to choose long-term methods that are easy to maintain use of, such as IUD, whereas the choices of rural users may be more limited than urban users. Hence, differential rates by method at least partly reflect characteristics of the users of the method in addition to characteristics of the method. Conversely, differentials in the discontinuation rate by characteristics of users at least partly reflect the choice of methods of those users. Thus, we considered a number of demographic and socio-economic characteristics apart from those already mentioned like duration of use and method of contraception used in the multivariate analysis of the factors affecting contraceptive discontinuation. Due to a specific structure of the data, not so many covariates can be included in the model. These include the woman's age at the start of use, the number of the woman's living children, contraceptive intention at the start of use, the woman's experience in the month immediately before use, the woman's level of education and her husband's level of education, and also type of residence (urban or rural).

### 4.4.2 Analysis of Switching Behaviour Following Discontinuation

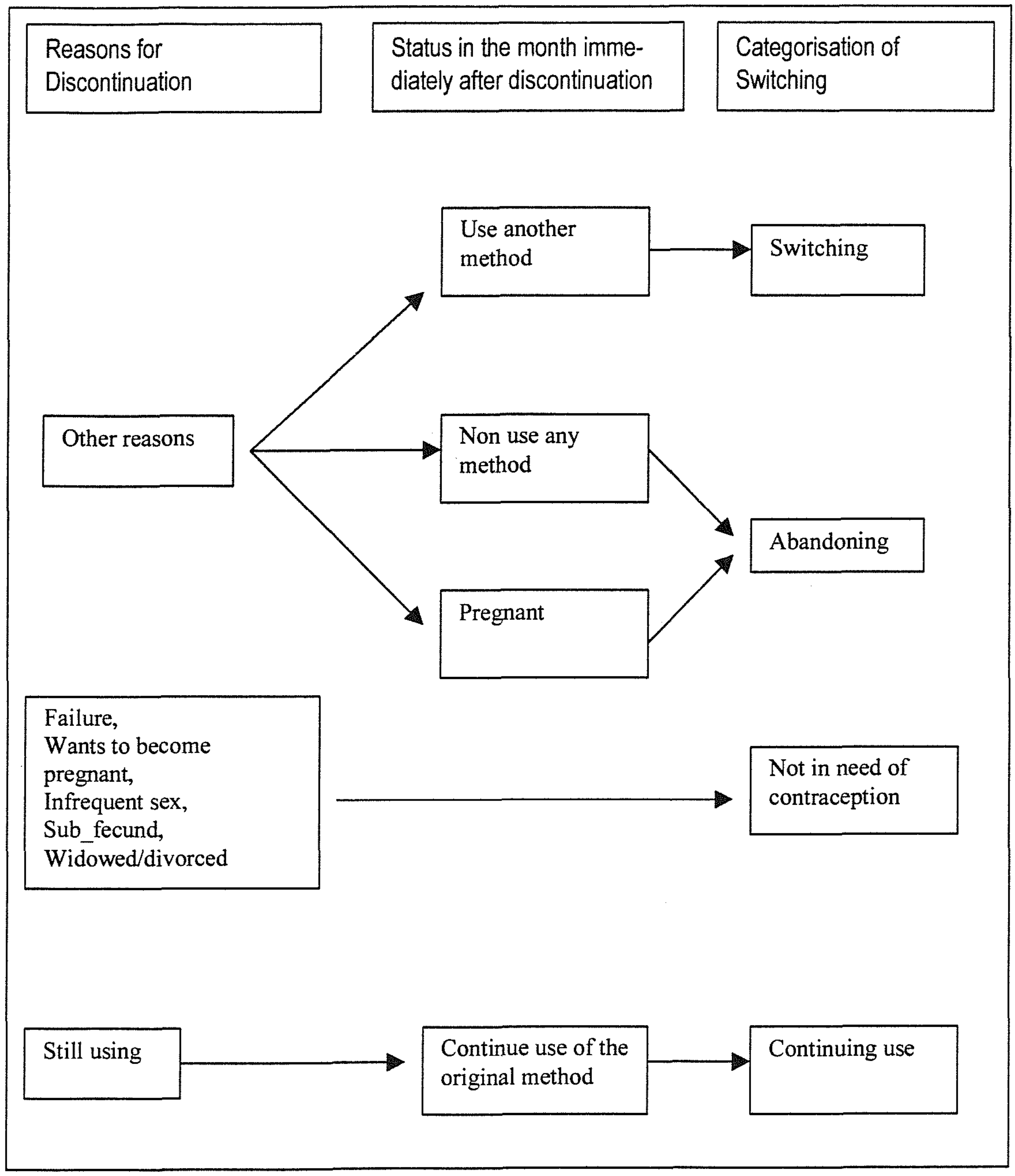
After discontinuing a contraceptive method, a woman may switch immediately to an alternative method in which case the woman may avoid the risk of unintended pregnancy. Alternatively, after she abandons the use of contraceptive, she is at risk. She may abandon use because she may not find a method that meets her needs or her efficacy. The risk of unintended pregnancy may depend on the alternative method she chooses. If she switched to an equally effective method she would have less risk than if she switched to an ineffective one.

High contraceptive switching rates have been thought as an indicator of a high level of dissatisfaction with methods or service. On the other hand, this may indicate expansive method choice and ease of access of family planning services. At the same time, very low rates of switching can be a reflection of restricted options available to the users. Contraceptive switching, therefore, is important because it can inform efforts to improve service delivery in various ways.

After discontinuation, the users contraceptive behaviours are categorised based on the framework proposed by Curtis and Hammerslough (1995). The contraceptive status of the women in the month immediately after discontinuation is classified into three categories; no longer in need of contraception, switched to another method, and switched to not using contraception. The definition of no longer in need of contraception is based on the reason given for discontinuing use. There are those who reported experiencing contraceptive failure (becoming pregnant while they are using a method of contraception), wanting to become pregnant, having infrequent sex, and separation/widowhood. Users who discontinue due to contraceptive failure are classified as no longer in need of contraception although they are a special interest in contraceptive use dynamics. They are not considered separately in this analysis as contraceptive failure will be examined separately in Chapter 9. Users who discontinue for reasons other than listed above are considered to be still in need of contraception. Those who are using another method in the month after discontinuation are classified as having switched to another method. Whereas discontinued users who are not using any method or who are pregnant in the month immediately after discontinuation are classified as having abandoned use.

Among women who become nonusers, those who are at risk of an unintended pregnancy are of primary interest because they might have discontinued due to method-related reasons and might not only indicate dissatisfaction with the current method but also the other available methods. This type of switching follows discontinuation because of method's side effects, because of health concerns, inconvenience of use, husband's disapproval, the need for a more effective method, and supply or access problems with the current method. In short, this classification is presented in Figure 4.1.

Figure 4.1 Classification of Switching Behaviour after Discontinuation



For the purpose of this analysis, each transition from any reversible method is classified into four categories, with a separate response category for each: 1) switching to another modern method; 2) switching to non-use while at risk of an unintended pregnancy; 3) switching to non-use because they are no longer in need of contraception; and (4) continuing use of the original method. Those who switch to another method are not distinguished into modern methods or traditional methods as from the descriptive analysis that no one switches to traditional methods.

To give an overall description of contraceptive behaviour after discontinuing contraceptive use, a multiple-decrement life table is presented in Chapter 8. However, it is not possible to include a number of factors simultaneously in the multiple decrement life tables because the sample size within each group becomes too small for reliable estimation.

Again, here we use the multilevel discrete-time competing risks hazards model. Competing risk models are used to distinguish between the different types of switching that may occur. The discrete-time competing risks models considered here are fitted using the multilevel software Mlwin (Yang et al, 1999). Let $r$ be a variable indicating three categories: (1) switched to another method of contraception, (2) switched to non use while they are at risk of an unintended pregnancy, and (3) switched to non use while they are no longer in need of contraception, and (4) those who are continuing using the method. The model can be expressed as follows

$$\log\left(\frac{\lambda_{rijt}}{\lambda_{4ijt}}\right) = \beta_{r0} + \beta_{r1} Z_{rijt} + \beta'_{r2} X_{rijt} + u_{rj}, \quad r = 1, \ldots, 3 \qquad (4.4.2.1)$$

The probabilities of switching to type of transition $r$ at time $t$ for a use interval $i$ with a set of background characteristics $X_{rtij}$ in the random-effects hazards model:

$$\lambda_{rtij} = \frac{\exp\left(\beta_{r0} + \beta_{r1} Z_{rtij} + \beta'_{r2} X_{rtij} + u_{rj}\right)}{1 + \sum_{k=1}^{s-1} \exp\left(\beta_{k0} + \beta_{k1} Z_{ktij} + \beta'_{k2} X_{ktij} + u_{rj}\right)} \quad , \ r = 1, \ldots, 3 \qquad (4.4.2.2a)$$

and

$$\lambda_{4tij} = \frac{1}{1 + \sum_{k=1}^{s-1} \exp\left(\beta_{k0} + \beta_{k1}(Z_{ktij}) + \beta'_{k2} X_{ktij} + u_{rj}\right)} \qquad (4.4.2.2b)$$

The cumulative probability of any type of transition is calculated using equation 4.2.28.

The set of background variables used in this analysis is now described. Each segment of use was coded according to the method used during that segment of use. The methods are grouped as follow: Pill, IUD, injectables, and less effective methods. Less effective methods consist of traditional methods such as periodical abstinence, withdrawal and herbs, some modern methods like condom and intravag. All methods are combined into one group because of small number of segments.

Socio-economic background variables included in the model are place of residence, the wife's and husband's educational level while demographic variables are age at the start of contraceptive use, and number of living children at the start of use. Place of residence (urban or rural) represents the place where the respondents lived at the time of the survey. Ideally, this should be a time-dependent variable but the necessary information to calculate it was not collected. Thus, by including this variable in the analysis we assume that there might not be much change in place of residence within five years.

Level of education was also measured at the time of the survey. With the same assumption as place of residence, women's level of education and their husband's level of education were employed in the analysis. These variables were initially grouped into no schooling, some primary, completed primary and completed some secondary education. After a series of investigations, the first two educational groups were collapsed and so were the last two groups.

As we have information on the date of the first month of each segment of use (CMCSTART) and woman's date of birth, age refers to the woman's age at the start of the segment of use. Both the date of birth and the CMCSTART are measured as century month codes. The age at the start of use was calculated as the CMCSTART minus the date of birth and it was then divided by twelve to get age in years. The age was treated as a categorical variable. The number of living children refers to the number of the woman had at the start of the segment of use. It was also treated as categorical variable.

Contraceptive intention is included in the model to estimate the effect of use for different purposes and is also expected to be a proxy for the strength of women's motivation to avoid pregnancy. This variable is based on the woman's report of the wantedness of the next birth after the segment of use, that is whether the birth was wanted at that time, wanted later, or not wanted at all. The information on the date that the segment of use began was used to identify the birth following a segment of use. If that birth was classified as wanted then or wanted later, the contraceptive intent for that segment was classified as a 'spacer'. If the birth was reported as not wanted at all, the intention for that segment of use was classified as 'limiter'. If there is no birth following the segment of use, the variable is based on the woman's current fertility preference. Women with uncertain fertility intentions were included in the category of spacers.

The first step in building our discrete-time competing risk hazards model was to test the form of the hazard with time (duration of use), i.e., whether the relationship is linear, quadratic or logarithmic. We examine these three dependencies because we broke down duration of use into months. This way reduced number of parameters in the model and also we relax the assumption of constant hazard for the interval period of time.

The next step is to test the statistical significance of each of the dependent variables other than duration of use. Each variable has a significant effect on switching behaviour. Then we examine whether there are proportional or non-proportional hazards of switching for each factor and duration of use. The interaction term between duration of use and each factor was tested. We found that in 1989-94 the two-way interaction term between duration of use and three factors was significant. The three factors are current contraceptive method, woman's educational level and contraceptive intention at the start of the use. The possibility of interaction between method and other variables also tested. However, none of the interactions was significant.

### 4.4.3 Impact of Price of Contraception on Contraceptive Choice

Here we study the determinants of the choice of contraceptive and, in particular, whether price of contraception has any effect on contraceptive choice. If price does not have a significant impact on contraceptive choice, then an increase in the price will not affect or will not reduce contraceptive use. Non-price factors must be accounted for the use and choice of contraceptive. If this is the case, the policy implication will be that the government should no longer subsidise the price of contraception; rather the government should work more on non-price factors. On the other hand, if the price has significant impact on contraceptive choice, the reduction or stopping of subsidy will have effect on the continuation and switching of contraceptive.

The main question is how price of contraception affects contraceptive choice. Ideally, we should be able to find the price information before the respondent decides on the choice of the method. However, there is no such data. The available information is only the price of the method among current users of contraception, which is explained in more details later in this section. It is impossible to know whether, for example, a woman chooses the IUD because she agrees with the price of the IUD; or she first decides on the method, IUD for example, then from the decision on the use of IUD, she knows the price. In other words, the direction of the causality of the relationship between price of contraception and choice of contraception is not known. Price of contraception may have an effect on contraceptive choice; and contraceptive choice may also affect contraceptive price. Therefore, a simultaneous equation is performed with price of contraceptive and choice of methods as the two endogenous variables.

When there are more than one endogenous variable in a system of equations, a single equation solution may result in simultaneous bias of the parameter estimates. As an illustration, suppose that there are two equations in the system, with Price of contraception (Price) and Method of contraception (Method) as endogenous variables. Suppose that $W$ is a set of exogenous variables in the first equation (with Price as the dependent variable), $X$ is a set of exogenous variables in the second equation (with Method as the dependent variables), and $Z$ is a set of exogenous variables included in both equations.

The existence of endogenous variable in the right hand side of the equation may violate the assumption of independence between explanatory variables and the error term, and hence, the bias is called as simultaneous bias. There are many methods to solve this simultaneous bias. Two-stage estimation is one of them (Maddala, 1983; Kelejian and Oates, 1974).

Here are the two equations in this analysis. The first is the price equation:

$$PRICE_{ri} = \beta_0 + \sum_{r=1}^{s-1} \beta_{ri} Method_{ri} + \beta_2 W_i + \beta_3 Z_i + e_i \qquad (4.4.3.1)$$

where $PRICE_{ri}$ is price of the current method being used by woman $i$. Price is a continuous variable and $W_i$ and $Z_i$ are exogenous variables associated with woman $i$. $\sum_{r=1}^{s-1} \beta_{ri} Method_{ri}$ is a set of dummy variables for current method of contraception, $r$, consisting of $s$ categories: (1) pill, (2) IUD, (3) injectable, (4) condom, (5) Norplant and (s) sterilisation. Sterilisation is used as the reference group.

The second equation is to examine the determinants of contraceptive choice. Method is a categorical variable, which has similar categories as mentioned above. Therefore, a multinomial model is carried out to examine the effect of the price of contraception on contraceptive choice. The model is as follows:

$$Method_r : \log\left(\frac{\pi_{ri}}{\pi_{si}}\right) = \beta_{r0} + \beta_{r1} PRICE_{ri} + \beta_{r2} X_i + \beta_{r3} Z_i \qquad r = 1, 2, \ldots, s-1 \qquad (4.4.3.2)$$

where $\pi_{ri}$ is the probability that woman $i$ chooses method $r$ and $\pi_{si}$ is the probability of choosing sterilisation (the reference category), either for male or female sterilisation. $W_i$, $X_i$ and $Z_i$ are sets of exogenous variables. $W_i$ is a set of variables, which is in the equation (4.4.3.1) but not in the equation (4.4.3.2). $X_i$ is a set of variables, which is in the equation (4.4.3.2) but not in the equation (4.4.3.1). $Z_i$ is a set of variables, which is in both equations.

The first stage is to regress each endogenous variable on all exogenous variables in the system. $PRICE_{ri}$ is regressed on $W_i$, $X_i$ and $Z_i$ . Then we get an estimated price of contraception, $PRICE_{ri}$ *hat,* as an instrumental variable for $PRICE_{ri}$, which is no longer correlated with the disturbance term. $METHOD_{ri}$ is regressed on $W_i$, $X_i$ and $Z_i$. Then we get the predicted value of contraceptive method, $METHOD_{ri}$ *hat,* which is a set of probabilities of using a particular method whereas the actual value is either 0 or 1 (Maddala, 1983). The second stage is to run equations 4.4.3.1 and 4.4.3.2 but substituting estimated price, $PRICE_{ri}$ *hat* for $PRICE_{ri}$ in the choice equation and estimated probabilities, $METHOD_{ri}$ *hat* for $METHOD_{ri}$ in the price equation.

After solving the problem of simultaneous bias, we may have another problem, i.e. the selectivity bias. The above regression is run on current users only. However, some women might not use contraception because the price was too high. Thus, if those who did not use contraception are excluded, we may have sample selectivity bias. To handle this selectivity bias, we can utilise the Heckman's two-step estimator.**

However, the finding of the research presented in Chapters 7 and 8 show that the choice among the women in Bali was no longer between using and not using contraceptive, but the choice was more on what method they wanted to use. Their fertility rate had been below replacement level. Their decision was on what method they wanted to use. Therefore, we do not have to employ Heckman's two-step estimator.

What we do is to focus on the effect of the price of contraception on the choice of contraception among current users. The information on choice of current contraception is based on question number 315 in the 1991 IDHS and question number 312 in the 1994 IDHS. In the 1991 IDHS the price of contraception is generated from question number 325B 'How much does (did) it cost you for ...'. This question is related to the current method answered in question 315. In 1994 IDHS the price is asked on question number 317, which is related to question number 312. Therefore, the price of contraception represents out of pocket money, or, the money spent for using a method of contraception.

In the 1991 IDHS, the price is recorded as one variable, which consists of price of method and also price of the service and registration fee, if any. However, in the 1994 IDHS, the price is recorded into two variables: price of method, and price of the service and registration fee, if any.

For the current research, the two prices are combined into one variable. It should be noted that an increase (or a decrease) does not necessarily mean an increase (or a decrease) in the price of a particular contraceptive; it simply implies the rising (decreasing) amount of money a woman had to pay for using contraception. Therefore, a change in price may reflect a change in the contraceptive method used. In other words, a change in price can be because of a change in the price of the method the woman used and/or because the woman changed the contraceptive method.

** Heckman's two-step estimation is essentially an attempt to transform censored dependent variable into missing relevant independent variable. This technique estimates a proxy for the missing relevant independent variable, see Heckman (1978).

We have indirect information on household income/assets, which is grouped into two categories.

1. Durable goods in the household as a set of dummy variables of the ownership of radios, bicycle, motorbike, refrigerator, and kerosene. The ownership of refrigerator is not available in the 1991 data. Source of drinking water is measured whether a household has piped water, well water or surface/rain water®[††]. The type of house is categorised whether the house has permanent/fine materials of the wall, floor and roof. If the house has brick wall, brick floor and tile roof, it takes value of 1, otherwise 0. In the 1991 data, it is available only for main material of the floor. Whether a house has an electricity of not.
2. Employment status of the respondent. This is measured by woman's occupation with three categories: white collar, blue collar and not working.

We also have information on 'taste' measured by the woman's age at the time of the survey, religion, woman's level of education, her husband's educational level, woman's childhood place of residence, years since first marriage, visited by family planning worker in the last six months, had ever heard of Blue Circle, listening to the radio, fertility goal, main reason for use of contraception, and decision makers for spending money.

The woman's age at the time of the survey is measured as the natural logarithmic scale. Religion is categorised as Hinduism and non-Hinduism® . The woman's level of education is categorised as no education/some primary and primary and above®. The husband's level of education is categorised as less than primary, and secondary and above®. The woman's childhood place of residence is categorised into countryside and town/city®. Method-related reasons and non-method related reasons® are categorised by the main reason for use. Fertility goal is measured as the difference between the number of living children and the ideal family size. This variable is categorised as whether a woman has the number of living children greater than equal the ideal number of children or a woman has the number of living children less than the ideal number of children ®. The decision-makers of spent money are categorised as the household cannot tell who the main decision-maker is, joint decision-makers and single decision-makers®.

The Blue Circle activity is a special information, education and communication campaign utilising social marketing, to promote self-reliant family planning. To evaluate the users's knowledge and

[††] ® represents the reference group for each categorical variable.

the progress of the Blue Circle campaign, the DHS surveys asked contraceptive users whether they had heard the Blue Circle campaign. This variable is chosen as one of the explanatory variable in the analysis with reference group those who had never heard about the Blue Circle.

The choice of contraceptive is regressed on each income/asset variable and also on each taste variable. The choice of contraception is grouped into six categories: 1) pill, 2) IUD, 3) injectables, 4) condom, 5) Norplant and 6) sterilisation. Sterilisation is treated as a reference group in the choice of contraceptive modelling. Traditional methods are excluded because there is no information for price. This may cause sample selectivity bias in the model. From this step, we select the significant variables. The selected variables become the exogenous variables for the choice equation.

The same procedure is employed for the price of contraception. Price is regressed on each income/assets variable and each 'taste' variable. The price is measured in 1000s rupiah. Then, we compare the list of the significant variables in the choice equation with the one in the price equation. If there is at least one independent variable in one equation, which is not available in the other equation, then we can proceed to the next stage. (This is what is called as the sufficiency condition.) Otherwise, we have to find such a variable. Once the sufficiency condition is already fulfilled, we proceed to the simultaneous equation estimation as mentioned earlier. The result is presented in Chapter 11.

### 4.4.4 Deficit Fertility

Bongaarts's framework (1978) relates the total fertility rate to level of marriage, contraceptive use, breastfeeding and induced abortion. He argued that the variations in these four proximate determinants of fertility are the main proximate determinants of fertility across populations. The other proximate determinants such as natural sterility and spontaneous intrauterine mortality tend to be fairly constant across populations and do not make any significant difference to the levels of fertility. In reality, information on induced abortion is not always available, or is unreliable. We can ignore the impact of induced abortion on the analysis, but remember that this factor might have a big impact on differentials in fertility. Indonesia, for example, does not have published information on induced abortion, thus in the three following sections the discussion will only be focussed on the three other main proximate determinants of fertility.

Bongaarts and Potter (1983) defined indices representing the fertility effect of the four most important proximate determinants, i.e. $C_m$, $C_i$, $C_c$, and $C_a$, respectively refer to the index of marriage, of postpartum infecundability, of contraception, and of induced abortion. The indices can only vary between 0 and 1. The index equals 1 if there is no fertility-inhibiting effect of a given proximate determinant; the index equals 0 if the fertility inhibition is complete. For example, if the index of marriage is equal to 1, all women of reproductive age are married and it is equal to 0 in the absence of marriage. Thus, the smaller the value of the index, the higher is the inhibiting fertility effect.

Among proximate determinants of fertility, the most important determinant is contraceptive use. A number studies show that there is strong linear relationship between contraceptive prevalence and TFR. Bongaarts and Kirmeyer (1982) estimated regression models not only for relationship between contraceptive prevalence and TFR but also between contraceptive prevalence and the total marital fertility rate and between contraceptive prevalence and the total natural marital fertility rate. With this framework, Curtis and Diamond (1995) evaluated contributions of different factors to excess fertility, i.e. when observed TFR is substantially greater than predicted TFR, in Northeast Brazil. They introduced lag effects of contraceptive use to the relationship between contraceptive prevalence and TFR as both estimates refer to different time. Samosir (1995) applied Curtis and Diamond's methodology (1995) to the 1991 Indonesian DHS. In this thesis, for consistency, the method is applied to the 1994 Indonesian DHS. Therefore, changes of the deficit in Indonesia and also the provinces over time can be analyzed. The models we use as follows:

#### 4.4.4.1 Lag-effect Contraceptive Use

Equation 3.1 in section 3.5 shows the linear relationship between the total fertility rate as a measure of fertility and contraceptive prevalence. The Indonesian TFR is usually calculated for the period of 3 years before the survey. For example, the 1994 IDHS reported the total fertility rate for the period of 1991-1994. However, the contraceptive prevalence rate is estimated at the time of the survey. So that, the contraceptive prevalence rate calculated from the 1994 IDHS data referred to the same year as the year of survey conducted. When both estimates are substituted into the equation, the effect of contraceptive prevalence rate on fertility rate is not obviously straightforward. If contraceptive use had increased or decreased to any extent immediately prior to the survey, this current-status estimate would not represent the actual prevalence rate during the period for which the total fertility rate is being estimated.

Consequently, if the prevalence had immediately increased prior to the survey, the total fertility, based on the regression equation, would be underestimated, since current use would have been higher than the level actually experienced throughout the reference period. On the other hand, if the prevalence had immediately decreased to any extent before the time of the survey was conducted, the predicted total fertility resulted would be overestimated, since current use would have been lower than the level actually experienced throughout the reference period (Curtis and Diamond, 1995).

In this case the contraceptive prevalence rate should be estimated at the midpoint of the reference period for the total fertility rate. For example, from the 1994 Indonesia DHS the total fertility rate for the period 1991-1994, it is assumed that the contraceptive prevalence rate (CPR) changes linearly, so that the prevalence for that period is the average prevalence between 1991 and 1994, which are derived from the 1991 and 1994 Indonesia DHS.

$$CPR_{91\text{-}94} = \tfrac{1}{2}\,[CPR_{91} + CPR_{94}] \qquad (4.4.4.1)$$

Substituting the value of $CPR_{91\text{-}94}$ to the equation 3.1 in section 3.5 gives a new predicted TFR, to be compared with the observed TFR to see whether the difference between the observed and (new) predicted TFR become smaller or larger.

### 4.4.4.2 Marriage Pattern

Another explanation of any remaining deficit (excess) fertility is that the fertility-inhibiting effect of other proximate determinants are higher (smaller) than anticipated, given the level of contraceptive use and the fertility-contraceptive relationship in the 22 developing countries. One of the proximate determinants of fertility is the marriage proportion. Bongaarts and Kirmeyer (1982) suggest adjusting the observed fertility with the marriage pattern in the 22 developing countries. Then, the expected fertility is compared with the adjusted fertility, to see whether the magnitude of the deficit or surplus has decreased or increased. If it increases (decreases) than the marriage pattern fails (succeeds) in explaining the variation in total fertility rates.

The observed TFR can be adjusted for marriage behaviour as follow;

$$TFR_{adj\ MP} = TFR_{obs} * [C'_m / C_m] \qquad (4.4.4.2)$$

This equation requires the estimation of both the observed $[C_m]$ and predicted index of marriage $[C'_m]$. The predicted index of marriage is based on Bongaarts and Kirmeyer's regressions using contraceptive prevalence as the independent variable, so again it is necessary to use the adjusted prevalence rate calculated in Equation 4.4.4.1. Calculating the expected total fertility rate and the expected TMFR in Equation 4.4.4.3 using the adjusted prevalence rate produces a predicted index of marriage. The ratio between both rates, as shown in Equation 4.4.4.4, is the predicted index of marriage. Based on the data from the 22 developing countries, Bongaart and Kimeyer (1982) find the following equation

$$TMFR = 9.5 - 0.048\ CU \qquad (4.4.4.3)$$

$$C'_m = TFR / TMFR \qquad (4.4.4.4)$$

or

$$C'_m = [7.30 - 0.064CU] / [9.5 - 0.048\ CU]$$

Bongaarts' index of marriage $(C_m)$ is an indicator of marriage behaviour. It is equal to zero if no woman is married and equal to one if all women are married during their entire reproductive age. This means that the higher the index of marriage, the more time spent in marriage by women of reproductive age or the earlier they marry.

The observed index of marriage is calculated directly from the Indonesian DHS data. It is the ratio of the observed TFR and the observed TMFR. Moreover, the observed TMFR is the sum of the age specific marital fertility rate (ASMFR). And then the ASMFR is derived from the age-specific fertility rate divided by the proportion of married women by age group $[ma_i]$. In other words, it is

$$TMFR_{obs} = 5 * \sum [ASFR_i / ma_i] \qquad (4.4.4.5)$$

Substituting these indices and the observed TFR in equation 4.4.4.2 produces the adjusted TFR after taking into account the marriage pattern.

Later marriage than expected would result in a higher adjusted TFR than observed TFR implying that low fertility is likely to be due to this marriage behaviour. On the other hand, earlier marriage than expected would result in a lower adjusted TFR than observed TFR implying that low fertility is not likely to be due to this marriage behaviour.

Equation 4.4.4.2 is utilized to examine how the index of marriage can explain differences between the observed and expected TFR in Equation 3.1, Section 3.5. Equation 4.4.4.2 shows that the adjusted TFR for marriage pattern is the observed TFR after taking into account the ratio between the expected index of marriage and the observed index. If the ratio is larger than 1, the observed index of marriage is smaller than the expected index: higher adjusted observed total fertility rate is larger than the unadjusted observed rate. This is the case when the marriage pattern is more likely to reduce fertility in that particular country/province compared to the experience of the 22 developing countries.

On the other hand, if the ratio is smaller than 1 but larger than 0, the observed index of marriage is larger than the expected index. Any population will never reach (an extreme value of 0 of the ratio because the lowest expected value of the index of marriage is 0.20—from equation 4.4.4.4 in the absence of contraception.) Then, this results in an adjusted total fertility rate smaller than the observed rate. Thus, a ratio smaller than 1 indicates that marriage pattern is not likely to reduce the deficit, and, hence, it is not likely to explain the relatively low fertility in the country/province relative to the experience of the 22 developing countries.

### 4.4.4.3 Breastfeeding Pattern

Here, the observed TFR is adjusted for the breastfeeding pattern, using the following equation.

$$TFR_{adj\ BP} = TFR_{obs} * [C'_i / C_i] \qquad (4.4.4.6)$$

However, the adjustment can also be carried out by taking into consideration the adjustment for the marriage pattern, applying the following equation.

$$TFR_{adj\ BP} = TFR_{obs} * [C'_m / C_m] * [C'_i / C_i] \qquad (4.4.4.7)$$

$C_i$ is the observed index of breastfeeding patterns obtained from the Bongaarts and Potter (1983) and the calculation of this index requires the duration of lactational postpartum infecundability.

$$C_i = 20 / [18.5 + i] \qquad (4.4.4.8)$$

where i is the mean or median duration of postpartum infecundability. However, since the median or mean duration of amenorrhea is longer than postpartum abstinence, the value of i is set to be equal to the mean duration of amenorrhea. The 1994 Indonesian DHS report provides information on both the median duration of amenorrhea and the median duration of postpartum abstinence. The former is longer than the latter, and, therefore, the median duration of amenorrhea, rather than the median duration of postpartum abstinence, is put into Equation 4.4.4.8.

Without breastfeeding, $C_i$ equals one. The duration of postpartum infecundability is assumed to be equal to 1.5 months. Bongaarts and Potter (1983) point out that breastfeeding is the principal determinant of amenorrhea where increasing duration of breastfeeding will increase the duration of amenorrhea, although not at the same rate. Consequently, as breastfeeding increases, the observed index of breastfeeding pattern ($C_i$) declines. Ci ranges from 0 to 1.

$C'_i$, the expected index of breastfeeding pattern, is the ratio of the expected total marital fertility rate and total natural marital fertility rate.

$$C'_i = TMFR / TNFR \qquad (4.4.4.9)$$

where

$$TNFR = 15.3 - 0.137\ CU \qquad (4.4.4.10)$$

So, Equation 10 can be reexpressed as follow:

$$C'_i = [9.5 - 0.048\ CU] / [15.3 - 0.137\ CU] \qquad (4.4.4.11)$$

Equation 4.4.4.11 is limited by the value of CU. As Bongaarts and Potter (1983) stated $C_i$ is between 0 and 1. However, when the contraceptive prevalence rate is higher than 0.64, the expected index of breastfeeding become more than one. So, this equation is only valid for the value of contraceptive use less than 64% or a $C'_i$ range from 0.630 to 0.998.

For consistency, $C'_i$ is set to be 0.97 (Samosir 1995) for the provinces with high prevalence rates. In the 1994 IDHS, $C'_i$ for Yogyakarta, Bali, and North Sulawesi were set to be this value. By substituting their observed prevalence rates, which are higher than 70%, into equation 4.4.4.11, $C'_i$ is higher than one.

Substituting the median postpartum amenorrhea into Equation 4.4.4.8 gives the observed index of lactational infecundability, $C_i$, and substituting CU as the rate in the middle of the observed period into the Equation 4.4.4.11 gives the expected index of lactational infecundability, $C'_i$. Subsequently, substituting the observed and expected indices into Equation 4.4.4.5 gives the estimated TFRs after adjusting for breastfeeding behaviour.

A longer breastfeeding duration than expected would increase the adjusted TFR and, in the case of deficit fertility, reduce the deficit. Hence, the relatively low fertility is likely to be due to breastfeeding behavior. In contrast, shorter breastfeeding duration than expected would reduce the adjusted TFR and increase the deficit; and, therefore, low fertility is not likely to be due to breastfeeding behavior.

### 4.4.4.4 Adjustment for Contraceptive Effectiveness

Lastly, levels of contraceptive effectiveness are also potentially an important factor in predicting exceptionally high or low fertility for given contraceptive prevalence. Bongaarts suggests the following method to adjust the effect of contraceptive effectiveness on fertility levels after taking into account for the effect of marriage and breastfeeding pattern.

$$TFR_{adj\ CE} = TFR_{obs} * [C'_m / C_m] * [C'_i / C_i] * [C'_c / C_c] \qquad (4.4.4.12)$$

where C'c and Cc are expected and observed indexes of contraceptive use, respectively, given the observed contraceptive prevalence.

As Bongaart and Potter (1983) propose, here is the index of contraception:

$$C_c = 1 - [1.08 * CU * e] \qquad (4.4.4.13)$$

where : CU = proportion currently using contraception among married woman of reproductive age

e = average use-effectiveness of contraception

The index of contraception varies inversely with prevalence and use effectiveness of contraception practised by couples in the reproductive ages. The index of contraception ranges from 0 to 1. If contraceptive use is absent or completely inefficient, the index is equal to one. The index declines when prevalence and effectiveness increase.

The expected index of contraceptive use is calculated using the following formula:

$$C'_c = 1 - [1.08 * CU * e'] \qquad (4.4.4.14)$$

where : CU = proportion currently using contraception among married woman of reproductive age

e' = the implicit level use-effectiveness of contraception

The implicit level of contraceptive use effectiveness is assumed to be equal to 0.83 (Bongaarts and Potter 1983). Therefore, Equation 4.4.4.14 can be rewritten to

$$C'_c = 1 - [0.895 * CU] \qquad (4.4.4.15)$$

Again, contraceptive prevalence substituted into both Equations 4.4.4.13 and 4.4.4.14 is the prevalence at the middle of the fertility rate's period. This equation needs the calculations of the observed and expected indexes of contraception. The index of contraception varies inversely with prevalence and use-effectiveness of contraception practised by couples in reproductive ages (Bongaarts and Potter 1983). In the absence of contraceptive practice or completely inefficient, the index of contraception ($C_c$) equals 1. With increasing prevalence and effectiveness, the index of contraception declines below one. Thus, the lower the index, the higher is the inhibiting fertility effect.

## 4.5 Summary

In this chapter various techniques, either using individual data or aggregate data, related to the analysis in the thesis are presented. Life table and discrete-time competing hazard model are the two techniques for analysing event history data, for both single and multiple decrements. These life table techniques are used to calculate contraceptive discontinuation rates in Chapter 7 and contraceptive switching behaviour after discontinuation rates in Chapter 8. These rates are calculated to the national sample by taking into consideration its differentials by method of contraception, woman's education, husband's education, woman's age at the start of use, urban-rural residence, region (Java-Bali, Outer Java-Bali I and Outer Java-Bali II) and province. However, the life table technique has some limitations in relation to hazards models in the sense that it is infeasible to examine a particular variable which has a number of categories and to examine the effect of a particular variable by controlling for the other variables.

Discrete-time hazards models, multivariate model analogous to both single and multiple decrements life table, are then discussed. The discrete-time competing risks hazards model, which is basically the model for multiple decrement, is used for the analysis of determinants of contraceptive discontinuation, which focuses on reasons for discontinuation in Chapter 9. The reasons for discontinuation are grouped into four groups: contraceptive failure, desire to get pregnant, side effects and health concerns, and other reasons. This model is also used for the analysis of determinants of switching behaviour following discontinuation in Chapter 10. After discontinuation the users are recorded into three groups: switching to another method, switching to non-use while they are still in need for contraception (abandon), and switching to non-use while they are no longer in need (not in need).

The discrete time competing risks hazards model is basically a multinomial model. This model, therefore, can be easily fitted by any standard software for binary and polychotomous response data. Standard discrete-time models assume that all variations in individual hazard rates can be explained by the covariates included in the model. However, this assumption may be violated by hierarchical data structure. Such structures occur in longitudinal studies and clustered survey samples. The calendar data of the IDHS used in the analysis are retrospective data. Therefore, the model has been extended to incorporate random effects which account for unobserved heterogeneity using a multilevel framework. The models are estimated using MLwin (Yang et al., 1999). The application of this model results in a huge data set. However, the problem of the huge data set is still manageable because the focus of the analysis is only in one province, namely Bali, instead the whole Indonesia.

A two-stage estimation is used to examine the effect of price of contraception on choice of contraception because the direction of causality of the relationship between price of contraception and choice of can be two ways. There are two equations in the system with price of contraception as a continuous variable and choice of contraception as a categorical variable. Therefore, there are two equations with mixed endogenous variables. This method is also applied to Bali province in Chapter 11.

Bongaarts and Kirmeyer framework combined with Curtis and Diamond's framework is discussed to examine the relationship between total fertility rate (TFR) and contraceptive prevalence in Indonesia. The application of this framework to a series of calculation is carried out to the aggregate data (provincial data) is presented in Chapter 6, which from this chapter actually leads to further analyses in the following five chapters. Chapter 5 describes the data for these analyses.

# Chapter 5

# DATA CONSTRUCTION

## 5.1 Introduction

The preparation of the data for any analysis is always as important as the analysis itself. There is no exception in this dissertation. A tedious, careful, and time-consuming effort has been spent on the data construction. This chapter elaborates the process of the data construction.

It begins with source of data—the surveys used. Then it describes the type of the data, whether individuals, households or calendar data. Section 5.4 describes how to extract the calendar data to identify precisely the timing of events. Next Section 5.5 examines the quality of data from this extraction. Since not all of the data are used in the analysis, Section 5.6 discusses the sample taken for analysis. The variables used in this analysis are presented in Section 5.7. Finally, Section 5.8 presents the data structure for the multilevel discrete-time competing risks hazard models used in the analysis of determinants of contraceptive discontinuation and switching.

## 5.2 Source of Data

The data analysed in this study are taken from the 1991 and 1994 Indonesia Demographic and Health Surveys. These surveys collected information from ever married women aged 15-49 years about family planning, fertility, mortality, and maternal and child health that can be used by policy makers, programme managers, and researchers to evaluate and improve existing policies and programmes. Both surveys were conducted by the Central Bureau of Statistics in collaboration with the Ministry of Population/National Family Planning Coordinating Board (MOP/NFPCB), and the Ministry of Health (MOH) under the auspices of the Demographic and Health Surveys programme. It is a part of the world-wide Demographic and Health Surveys (DHS) programme.

The details of these surveys including organisation of the survey, sample design and implementation are provided in the main report of these surveys (Central Bureau of Statistics, et.el., 1992 and 1995). The United States Agency for International Development (USAID) provided funds for technical assistance to Macro International Inc through the DHS programme, a project developed to provide support and technical assistance in the implementation of population and health surveys in developing countries (Central Bureau of Statistics 1998).

Data collection of the 1991 IDHS began in May and was completed in July 1991, while data collection of the 1994 IDHS began in early July 1994 and was completed in November 1994 (Central Bureau of Statistics 1992; Central Bureau of Statistics 1998). The surveys cover all 27 provinces in Indonesia. The samples are nationally representative and are designed to produce estimates at the national level, the provincial level, and for the three areas of family planning development, namely Java-Bali, Outer Java-Bali I, and Outer Java-Bali II.

Selection of the IDHS sample was done using a three-stage sample procedure. At the first stage, it systematically selected enumeration areas in urban and rural domains in each province. The second stage selected a segment or group of segments from each enumeration area with probability proportional to the number of household in the segments. Finally, 25 households were systematically selected from each segment.

## 5.3 Type of Data

Four types of questionnaires were used in the 1994 IDHS, three at household level and one at the community level. The three at the household level were the household questionnaire, the individual questionnaire, and the household expenditure questionnaire. However, the 1991 IDHA did not collect information on household expenditure. The household and individual questionnaires were adapted from the DHS Model 'A' core questionnaire, which was designed for countries with high contraceptive prevalence. This model has a section, which is aimed to collect monthly information on contraceptive use history, pregnancy history and other information related to them for a five to six year period before the survey date. The information collected using this method is called calendar data.

### 5.3.1 Individual and Household Data

The individual questionnaire of the 1991 IDHS was divided into 8 sections: 1) Respondent's background, 2) Reproduction, 3) Knowledge and practice of family planning, 4) Maternal care and breastfeeding, 5) Immunization and health of children under 5 years, 6) Marriage, 7) Fertility Preferences, and 8) Husband's background and respondent's employment. The 1994 IDHS was expanded from the prior survey to include two modules in the individual questionnaire, namely maternal mortality and awareness of AIDS.

The household questionnaire was used to list all usual members of the sample household and to obtain information on each member's age, sex, educational attainment, relationship to the head of household, and marital status. In addition, questions were included on the socioeconomic characteristics of the household, such as source of water, sanitation facilities, and the availability of durable goods. The household questionnaire was used to identify respondents eligible for the individual interview—ever-married women age 15-49 who were usual residents of the household. The 1994 household questionnaire was also expanded and it included a household expenditure module, which provides a means of identifying the household's economic status. Further, the 1994 survey gathered information on the availability of family planning and health services which provides an opportunity to link women's fertility, family planning and child health care with the availability of services.

### 5.3.2 Calendar Data

The second round of DHS surveys introduced a calendar approach to collect the longitudinal data required for the analysis of contraceptive use dynamics. The calendar collects retrospective monthly contraceptive histories and pregnancy histories for the five years preceding the surveys. It is implemented routinely in DHS surveys in countries that have reached relatively high contraceptive prevalence, approximately 40%. The calendar has been used in 24 DHS surveys (Curtis, 1997). Indonesia is one of them and the 1991 survey is the first to administer the calendar questionnaire.

The calendar questionnaire consists of a matrix of rows and columns (Appendix A-1). Each row represents a particular month with the last row usually representing January of the fifth calendar year before the survey. These are January 1986 and 1989 for the surveys conducted in 1991 and 1994, respectively. The columns are used to record different types of information for each month. In the 1991 DHS survey there were six columns included in the calendar but this was reduced to four in the 1994 survey.

The first two columns are most relevant for the analysis of contraceptive use dynamics. The first column is assigned for identifying and marking the calendar months in which the respondent gave birth, she was pregnant, she had stillbirth/abortion/miscarriage, she used a contraceptive method and she did not use any method. Every box (month) of this column contains only one code – a code for pregnancy, live birth, stillbirth/miscarriage/abortion, non use and use of a particular method. Codes for use of contraception are different for different methods, and there are at least ten methods used by the users; (1) Pill, (2) IUD, (3) Injection, (4) Norplant, (5) Intravag, (6) Condom, (7) Female sterilisation, (8) Male sterilization, (9) Periodical Abstinence, (10) Withdrawal and (11) other methods (Central Bureau of Statistics et.al., 1992 and 1995).

Information was entered into the calendar at different stages of the interview. Immediately after completing the birth history, each reported live birth was entered into the month of birth in the calendar and the duration of its pregnancy into the eight preceding months or into the preceding months up to last month if the pregnancy occurred before that date. Thereafter, any non-live births that occurred in the remaining months were probed. These are then entered in the calendar along with the number of months of pregnancy preceding each non-live birth (Curtis, 1997). This column is completed in the contraceptive section of the questionnaire when interviewers probe for all periods of contraceptive use and non-use using the live and non-live births already recorded as reference points, such as name of children, dates of birth, and period of pregnancy. The use of reference points aids the respondent's recall and helps reconcile the timing of contraceptive use with reproductive events.

The second column records the reason for discontinuation of each episode of contraceptive use of each method. This information was coded in the row (month) corresponding to the last month of continuous use of each contraceptive. Based on this information, episodes of contraceptive use can be identified and linked to the reasons for discontinuation. Other columns are used to record respectively information on postpartum amenorrhea, postpartum abstinence, breastfeeding histories and marriage histories. Both postpartum amenorrhea and postpartum abstinence were not collected in the 1994 survey.

Calendar data make it possible to identify precisely the timing of events in relation to one another. This analysis is based on segments of contraceptive use (and non-use) as a unit of analysis. Based on information in the calendar, segments of contraceptive use can be extracted, then they can be identified and linked to the reason of discontinuation. The calendar data, along with background data collected in other part of the DHS questionnaire, will be used in this analysis. The background variables can be individual background variables or community ones. The following section describes the extraction of segments of use and non-use contraception and other information linked to them.

## 5.4 Calendar Data Extraction

Extraction of segments of use and non-use utilises the CAL2SPSS programme, which is one of the computer software programs called DYNPAK designed to accompany the DHS Model Further Analysis Plan: Contraceptive Use Dynamics (Curtis and Hammerslough 1995). This programme has been employed by Fathonah (1996) and Curtis and Blanc (1997) to analyse the 1994 IDHS. This programme will only process the rectangular data file supplied by the DHS. So that the name of the rectangular file inputed to the programme must be the same as the DHS named. For example, the 1994 Indonesia's rectangular data file named IDIR31RT.DAT.

This programme will produce a new data file with a name based on the name of the rectangular file. This file will be called, for instance, IDIR31CL.DAT. The output contains each record representing a segment of contraceptive use or a segment of nonuse. A segment of use is defined as an uninterrupted period of use of an individual contraceptive method, while a segment of nonuse is an uninterrupted period in which the woman is not pregnant and is not using a contraceptive method.

The information included on each record are the woman's ID information (CASEID), the woman's sample weight (WEIGHT), the method use in that segment (including no method) called METHOD, the reason for discontinuing use (not applicable for segments of nonuse) called

WHYDISC, the woman's reproductive status in the month immediately following discontinuation of the segment (NEXTMON), the duration of the segment (DUR), the woman's reproductive status in the month immediately before initiation of the segment (PREVMON), the number of births the woman had following the segment (BIRTHS1), and the date of the first month of the segment as a century month code (CMCSTART) (See Appendix A-1).

The calendar data covered a 69-month period prior to the survey. We use a 60-month period before the survey. The last three months immediately before the survey are excluded. This is conventional practice to enable women who get pregnant to recognize that they are pregnant and hence to reduce bias in estimated failure rates due to unidentified failures. Therefore, the period covered by the data on segments of use is 3-62 months before the survey date of each woman. In addition, the programme also ignores left-truncated observations, i.e., observations that start before this 60-month period and continue into it. The excluded segments might come from women who were sterilized before the observation period, women who had no contraceptive use due to their husbands being sterilised, women who were divorced/widowed before the 62$^{th}$ month prior to the survey, and truncated segments of use.

The units of analysis are the segments of contraceptive use. All segments of sterilization are excluded from the analysis given the chance of a woman discontinuing sterilization is extremely low. There is also evidence that method-specific discontinuation rates vary substantially across modern methods of contraception. It seems more plausible not to aggregate all these methods into one single category. Therefore, segments of Norplant use with a very few number of cases (seven segments in the 1991 data set and four segments in the 1994) are excluded from the sample of analysis. The final segments of use in the samples for Bali are 466 segments and 562 segments in the 1991 and 1994, respectively.

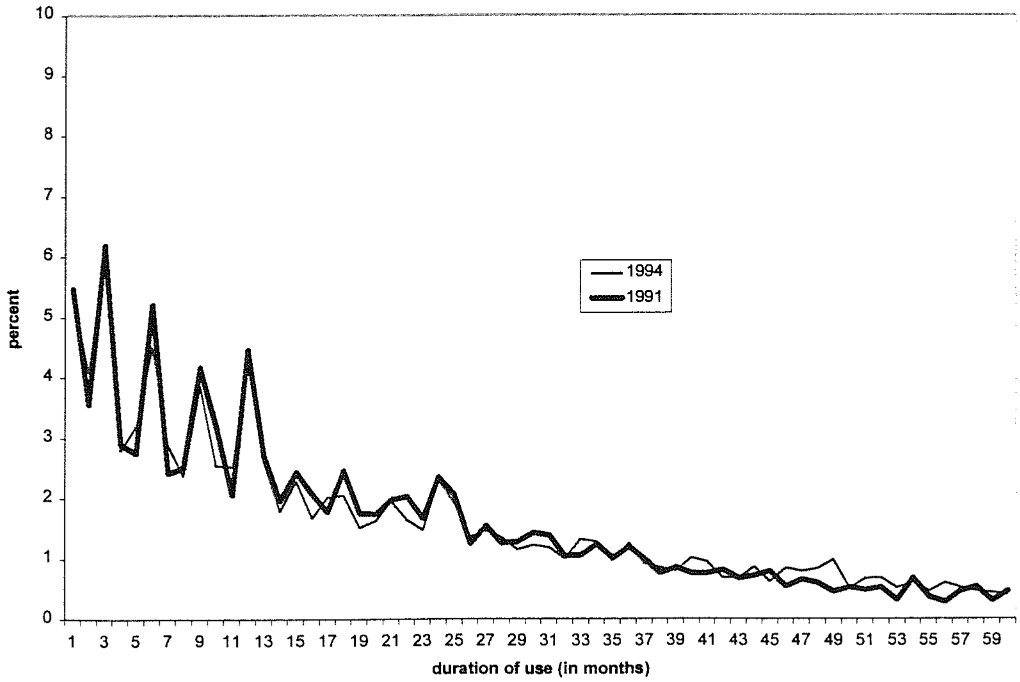
## 5.5 Data Quality

All retrospectively reported data are subject to various types of error and the DHS calendar data are no exception. Recall error due to memory lapses, duration heaping, and event omissions (both deliberate and accidental) are common problems and can bias the result. Therefore, evaluation of data quality is a crucial stage of the analysis that should not be overlooked.

Although the monthly calendar minimizes this type of recall error by forcing some consistency, it is still impossible to eliminate, especially given the long recall period. Heaping usually occurs on prominent durations, such as 6, 12, and 24 months and can be detected by graphing the reported duration of segments of use. A one or two-year failure rate might be biased if failures or exposure duration are heaped on 12 and 24 months. Heaping usually is a concern only if it is extreme, because life table summary rates are essentially smoothed.

Figure 5.1 shows the percentage distribution of durations of segments of use on popular values such as 6, 12, 18 and 24 months. The percentage tends to decrease as the duration of use increases. Though fluctuations in the percentages are there, it seems to be acceptable. The thick line presents the distribution for the 1986-91 data. It seems that no serious heaping exits for this sample although a relatively big decrease happened in the percentage of segments on the third and fourth month. The percentage decreased from 6% to about 3%, but this should not cause a problem in the life table calculation. The thin line presents the distribution for 1989-94 and again there is no serious heaping problem on values 6, 18 or 24 except on the 12th month. Since the level of heaping is modest, it is unlikely to affect the quality of the estimated contraceptive discontinuation rates to any great extent, although some underestimation of 12-month discontinuation rates is possible. In general, there is no evidence of severe heaping on reporting duration of use in the calendar in either data set.

**Figure 5.1 Distribution of Segments of Use by Duration: Indonesia, 1986-91 and 1989-94**



Recall problems may lead to accidental omission of events such as short periods of contraceptive use, but deliberate omission or misreporting of events is also a potential problem. Contraceptive failure that results in an unwanted pregnancy is a sensitive and potentially embarrassing topic for many women in many countries including Indonesia. They may perceive that they have failed at planning one of the most important elements of their lives. In some places, women conceal contraceptive failures by misreporting them as wanted pregnancies. To the extent that they do so, estimated contraceptive failure rates will be too low. Such misclassification of contraceptive failure is extremely difficult to detect, but one simple approach is to tabulate the status of the woman immediately after discontinuation by the stated reason for discontinuation. A large number of women who were pregnant in the month after discontinuation but who did not report contraceptive failure as the reason for discontinuation might suggest misreporting of contraceptive failures, particularly if they reported that they stopped using in order to become pregnant.

Table 5.1. Distribution of Discontinued Segments of Use by Reason for Discontinuation and Status in the Month Immediately After Discontinuation: Indonesia, 1991 and 1994

| Reason for Discontinuation | Status in the month immediately after discontinuation | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pregnant | | Termination | | Not using contraception | | Using another method | | Total | |
| | 1991 | 1994 | 1991 | 1994 | 1991 | 1994 | 1991 | 1994 | 1991 | 1994 |
| Failure | 662 | 806 | 0 | 21 | 0 | 0 | 0 | 1 | 662 | 828 |
| Desire to get pregnant | 162 | 196 | 0 | - | 1227 | 1499 | 0 | 0 | 1389 | 1695 |
| Other reason | 38 | 81 | 0 | 3 | 1454 | 1588 | 1887 | 2427 | 3379 | 4099 |
| Total | 862 | 1083 | 0 | 24 | 2681 | 3087 | 1887 | 2428 | 5430 | 6622 |

Table 5.1 is a cross-tabulation of discontinued segments of use by reason for discontinuation and status in the month immediately after discontinuation. This table might help to detect underreporting of contraceptive failures through retrospective rationalisation if a suspiciously large proportion of women who discontinued contraceptive use for reasons other than failure is pregnant in the month following discontinuation. It is found that in both data sets 12% of women who reported that they discontinued use in order to desire to become pregnant were recorded as pregnant in the month immediately following discontinuation. In the 1991 data 1% of women who discontinued use for other reasons and who did not immediately switch to another method were pregnant in the month after discontinuation; while it was 2% in the 1994 data. Among women who

were pregnant in the month immediately following discontinuation, 77% in 1991 and 74% in 1994 reported that they had experienced contraceptive failure. These figures, therefore, do not indicate that failures are seriously misreported as discontinuations for other reasons.

Though these data quality checks do not detect any serious data problems in the calendar data, they are not able to detect all problems. For example, the pregnancy which was terminated by an induced abortion or miscarriage may be omitted although the calendar questionnaire provides such options for recording abortion or miscarriage. Utilising studies in the U.S data, Grady et al. (1986) and Jones and Forrest (1992) suggest that abortion reporting in surveys is extremely incomplete including induced abortion caused by contraceptive failure. This incomplete reporting causes a downward bias of estimates of contraceptive failure. The extent of this bias is unavoidable for the Indonesia data and also other developing countries data. Further, such under-reporting is extremely difficult to detect (Moreno, 1993). As a result, no attempts have been made to examine this issue in this thesis. Therefore, analysts should be aware that this is a potential problem in analysing calendar data.

Missing information on variables used in the analysis is another problem related to the quality of data. However, such missing information was minor. For example, there were 0.4% or 43 segments of use with missing information on husband's level of education in the 1991 data, while in the 1994 data there was no missing information for this variable. The missing observations were excluded from the analysis. On the other hand, there was no missing for woman's level of education.

In analysing the price of contraception, the code of 999998 represents those who did not know the price while the code of 999996 represents those who did not pay for contraception. In the 1991 data there were 22 cases which did not know the price while in the 1994 it was 12 cases. These numbers were about 2.0% and 1.5% of the total cases and they were excluded from the analysis.

## 5.6 Samples for Analysis

For estimation of contraceptive discontinuation rates and switching rate and also for analyses of determinants of contraceptive discontinuation and switching, the samples used are derived from information gathered through the calendar approach. The monthly information on contraceptive use and its reason for discontinuation is broke down into episodes of each method of contraception as explained in section 5.4. Each episode becomes an unit of analysis. Thus, a woman may contribute more than one episode of use to the sample analysis. However, not all episodes are used in the analysis. Episodes of use that started before January 1986 for the 1991 IDHS and before January 1989 for the 1994 IDHS are excluded. Episodes of sterilization are also excluded, as the likelihood of the sterilised women to discontinue is extremely low. Method with a small number of episodes are excluded. We found in Bali, for example that there are only four episodes of Norplant use, and they are not used in the model.

On the other hand, for analysis of contraceptive choice, the sample is married woman age 15-49 who is using contraceptive at the time of the survey. However, as we intend to examine the effect of the price of contraceptive to the choice of the method, there is no information for those who are using traditional methods. Thus, they are excluded from the sample. We finally come up with 804 selected women and use women as the unit of the analysis.

## 5.7 Variables Used in the Analysis

There are three main dependent variables analysed in this thesis. The first is the analysis of contraceptive discontinuation. This is an analysis why a woman discontinues using a particular method. This analysis studies on the reason for discontinuation, therefore the dependent variable for this analysis represented the categorization of the reasons. The second is switching behaviour—the behaviour after a woman discontinues a particular method. The third is choice of contraception, to examine the impact of price (out of pocket money) on the choice of contraception. More details about all these dependent variables are explained in Chapter 4.

Each segment of use was coded according to the method used during that segment of use. The methods are grouped as follow: Pill, IUD, injectables, and less effective methods. Less effective methods consist of traditional methods such as periodical abstinence, withdrawal and herbs, some modern methods like condom and intravag. These methods were combined into one group because of small numbers of segments of use. Each segment of use was also assigned a code that corresponds to the woman's contraceptive status in the month immediately prior to the use. This variable was grouped into three categories; no method, birth or termination, and used any method of contraception. This variable is intended to measure the effect of previous experience with contraception on the rate of discontinuation.

Socioeconomic background variables included in the model are place of residence, the women's and husband's educational level while demographic variables are age at the start of contraceptive use, number of living children at the start of use. Place of residence represents the place where the respondents lived at the time of the survey, and represents whether they are lived in urban or rural areas. Ideally, this should be a time-dependent variable, but the necessary information to calculate it was not collected. Thus, including this variable in the analysis we assume that there might not be much change in place of residence within five years.

Again, level of education also measured at the time of the survey. With the same assumption as place of residence, women's level of education and their husband's level of education were employed in the analysis. These variables were grouped as follows: no schooling, some primary, completed primary and completed some secondary.

As we have information on the date of the first month of each segment of use (CMCSTART) and the woman's date of birth as century month codes. The age at the start of use was calculated as the CMCSTART minus the date of birth and it was then divided by twelve to calculate age in years. These ages were group into three categories, less than 25 years old, between 25 and 29, and above 30 years.

The number of living children refers to the number of the woman had at the start of the segment of use. It is grouped to be childless women and women with one child combined in one group, women who had two or three children, and the last group those with more than four children.

Contraceptive intention is included in the model to estimate the effect of use for different purposes and is also expected to be a proxy for the strength of women's motivation to avoid pregnancy. This variable is based on the woman's report of the wantedness of the next birth after the segment of use, that is, whether the birth was wanted at that time, wanted later, or not wanted at all. The information on the date that the segment of use began was used to identify the birth following a segment of use. If that birth was classified as wanted then or wanted later, the contraceptive intent for that segment was classified as a 'spacer'. If the birth was reported as not wanted at all, the intention for that segment of use was classified as 'limiter'. If there is no birth following the segment of use, the variable is based on the woman's current fertility preference. Women with uncertain fertility intentions were included in the category of spacers.

Table 5.2 presents a list of the independent variables used in the model and also the reference group for each categorical variable.

Table 5.2 List of the Independent Variables Used in the Multilevel Competing Risks Hazards Models: Bali, 1986-91 and 1989-94

| Variables | Value | Value label |
|---|---|---|
| Place of residence | 0 | Rural (reference group) |
| | 1 | Urban |
| Method of use | 1 | Pill |
| | 2 | IUD |
| | 3 | Injection |
| | 4 | Less effective methods (reference group) |
| Women's educational level | 1 | No Education |
| | 2 | Some Primary |
| | 3 | Completed Primary |
| | 4 | Completed Secondary and above (reference group) |
| Husband's educational level | | The same category as women's educational level |
| Age at the start of contraceptive use | 1 | < 25 |
| | 2 | 25 – 29 |
| | 3 | >=30 (reference group) |
| Status immediately before the use of contraceptive method | 1 | No Method |
| | 2 | Birth or Termination |
| | 3 | Using a method (reference group) |
| Number of living children | 0 | 0-1 |
| | 1 | 2-3 |
| | 2 | 4+ (reference group) |
| Contraceptive Intention | 0 | Spacers (reference group) |
| | 1 | Limiters |

## 5.8 The Data Set-up for the Analysis

In this section, the data structure required to fit multilevel multinomial discrete-time hazard models is described. The modelling was carried out using Mlwin (Goldstein et al., 1998). The dataset contains the segments of use already extracted from the women-based file must be restructured. For example, suppose the records for the first ten segments of use taken from the 1994 IDHS segment-based file are as follows (Table 5.3).

Table 5.3 Examples of Segment-based Data for the First Ten Observations Taken from the 1994 Data Set: Bali

| Caseid | Segment | Method | Duration | Reason |
|---|---|---|---|---|
| 51 1 1 6 2 | 1 | 1 | 5 | 3 |
| 51 1 1 17 2 | 2 | 1 | 29 | 0 |
| 51 1 1 28 2 | 3 | 3 | 34 | 0 |
| 51 1 1 34 2 | 4 | 1 | 22 | 0 |
| 51 1 1 45 2 | 5 | 1 | 8 | 1 |
| 51 1 1 48 2 | 6 | 1 | 18 | 0 |
| 51 1 1 66 2 | 7 | 1 | 8 | 4 |
| 51 1 1 80 2 | 8 | 4 | 42 | 0 |
| 51 1 2 5 3 | 9 | 3 | 41 | 0 |
| 51 1 2 20 2 | 10 | 1 | 1 | 0 |

Firstly, the segment-based data set must be restructured to obtain time-based data and to code a multinomial response for each time of observation and for each segment in the sample. Here, as mentioned before, time (duration of use) was broken down into months. In addition, the four reasons for discontinuation are: (1) contraceptive failure, (2) desire to get pregnant, (3) side effects and health concerns and (4) other reasons as well as (s) still using contraception (reference category).

The first observation, a woman has one segment of use, she uses the pill for five months and discontinues the method due to the third category (side effects and health concerns). Five observations will be created for this segment of use, one for each month of use, and the response variable would assume the values: 5, 5, 5, 5 and 3. The second woman is already using the pill (coded 1) for 29 months and still using it at the end of the observation period (reason=0), the response variable would assume 29 values of 5. To create this file, we need to create two new variables, called MONTH and EVENT. MONTH represents month of use that takes values from 1 to maximum 60 depending on the duration of use for each segment. EVENT represents an indicator of reason for discontinuation that takes values from 1 to 5.

The first two segments generated 34 observations. Typically, the size of the dataset prepared for the discrete-time hazard model becomes significantly expanded. The data will look like Table 5.4. For Bali' month-based file, the sizes of the dataset are 9,962 observations and 11,225 observations generated by all selected segments of use for the 1991 and 1994 data sets, respectively.

Table 5.4 Monthly-based data prepared for the Discrete-Time Competing Risks Hazards Model

| Caseid $j$ | Segment $i$ | Month $t$ | Ln(Month) $Ln(Z_{rtij})$ | Constant | Event $r$ |
|---|---|---|---|---|---|
| 51 1 1 6 2 | 1 | 1 | 0.000 | 1 | 5 |
| 51 1 1 6 2 | 1 | 2 | 0.693 | 1 | 5 |
| 51 1 1 6 2 | 1 | 3 | 1.099 | 1 | 5 |
| 51 1 1 6 2 | 1 | 4 | 1.386 | 1 | 5 |
| 51 1 1 6 2 | 1 | 5 | 1.609 | 1 | 3 |
| 51 1 1 17 2 | 2 | 1 | 0.000 | 1 | 5 |
| 51 1 1 17 2 | 2 | 2 | 0.693 | 1 | 5 |
| 51 1 1 17 2 | 2 | 3 | 1.099 | 1 | 5 |
| 51 1 1 17 2 | 2 | 4 | 1.386 | 1 | 5 |
| 51 1 1 17 2 | 2 | 5 | 1.609 | 1 | 5 |
| . | . | . | . | . | . |
| . | . | . | . | . | . |
| . | . | . | . | . | . |
| 51 1 1 17 2 | 2 | 27 | 3.296 | 1 | 5 |
| 51 1 1 17 2 | 2 | 28 | 3.332 | 1 | 5 |
| 51 1 1 17 2 | 2 | 29 | 3.367 | 1 | 5 |

Secondly, the dataset must be restructured to obtain multiple records for each month, corresponding to the elements of the multivariate binary response vector. Suppose we wish to fit a simple two-level random intercept discrete-time hazards model as shown in Equation 4.4.1.1 with one explanatory variable, duration of use. However, we have chosen to treat duration of use as the natural logarithm of the duration as shown in Equation 1. Then the model can be written as follows:

$$\log\left(\frac{\lambda_{rtij}}{\lambda_{5tij}}\right) = \beta_{r0} + \beta_{r1} Ln(Z_{rtij}) + u_{rj}, \quad r = 1, \dots, 4 \qquad (1)$$

The data presented in Table 5.4 again need to be restructured to obtain four records, or s-1 in the general case of s possible responses, for each month. In addition, one needs to define a new set of covariates for each response category in order to estimate separate intercept and regression parameters for each logit model. The monthly-based dataset will be restructured again and the data set would be structured as illustrated in Table 5.5, where $Y_1$, $Y_2$, $Y_3$ and $Y_4$ are dummy variables such that

$$Y_1 = \begin{cases} 1 & if\ r = 1 \\ 0 & else \end{cases}$$

$$Y_2 = \begin{cases} 1 & if\, r = 2 \\ 0 & else \end{cases}$$

$$Y_3 = \begin{cases} 1 & if\, r = 3 \\ 0 & else \end{cases}$$

$$Y_4 = \begin{cases} 1 & if\, r = 4 \\ 0 & else \end{cases}$$

*$Y_1$, $Y_2$, $Y_3$, $Y_4$, $Y_1$*Ln(month), $Y_2$*Ln(Month), $Y_3$*Ln(Month), $Y_4$*Ln(month)* are fitted as covariates in the model and their coefficients are $\beta_{11}$, $\beta_{12}$, $\beta_{13}$, $\beta_{14}$, $\beta_{21}$, $\beta_{22}$, $\beta_{23}$, $\beta_{24}$, etc. in equation (1) respectively. The original multinomial response has been expanded to four binary responses per observation, $\mathbf{y_{1ij}}$, $\mathbf{y_{2ij}}$, $\mathbf{y_{3ij}}$ **and** $\mathbf{y_{4ij}}$. For Bali's dataset, in fact, there are 39,848 observations for the 1986-91 data and 44,900 observations for the 1989-94.

Table 5.5 Data Structure Prepared for Multilevel Discrete-Time Competing Risks Hazards Model carried out by MLwiN: An Example of Bali's data

| Caseid $j$ | Segment $i$ | Month $t$ | Ln(month) | index | Response | Constant | $Y_1$ | $Y_2$ | $Y_3$ | $Y_4$ | $Y_1$*Ln(M) | $Y_2$*Ln(M) | $Y_3$*Ln(M) | $Y_4$*Ln(M) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 51 1 1 6 2 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 51 1 1 6 2 | 1 | 1 | 0 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 51 1 1 6 2 | 1 | 1 | 0 | 3 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 51 1 1 6 2 | 1 | 1 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 51 1 1 6 2 | 1 | 2 | 0.693 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0.693 | 0 | 0 | 0 |
| 51 1 1 6 2 | 1 | 2 | 0.693 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0.693 | 0 | 0 |
| 51 1 1 6 2 | 1 | 2 | 0.693 | 3 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0.693 | 0 |
| 51 1 1 6 2 | 1 | 2 | 0.693 | 4 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.693 |
| 51 1 1 6 2 | 1 | 3 | 1.098 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1.098 | 0 | 0 | 0 |
| 51 1 1 6 2 | 1 | 3 | 1.098 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1.098 | 0 | 0 |
| 51 1 1 6 2 | 1 | 3 | 1.098 | 3 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1.098 | 0 |
| 51 1 1 6 2 | 1 | 3 | 1.098 | 4 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1.098 |
| 51 1 1 6 2 | 1 | 4 | 1.386 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1.386 | 0 | 0 | 0 |
| 51 1 1 6 2 | 1 | 4 | 1.386 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1.386 | 0 | 0 |
| 51 1 1 6 2 | 1 | 4 | 1.386 | 3 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1.386 | 0 |
| 51 1 1 6 2 | 1 | 4 | 1.386 | 4 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1.386 |
| 51 1 1 6 2 | 1 | 5 | 1.609 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1.609 | 0 | 0 | 0 |
| 51 1 1 6 2 | 1 | 5 | 1.609 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1.609 | 0 | 0 |
| 51 1 1 6 2 | 1 | 5 | 1.609 | 3 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1.609 | 0 |
| 51 1 1 6 2 | 1 | 5 | 1.609 | 4 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1.609 |
| 51 1 1 17 2 | 2 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 51 1 1 17 2 | 2 | 1 | 0 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 51 1 1 17 2 | 2 | 1 | 0 | 3 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 51 1 1 17 2 | 2 | 1 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 51 1 1 17 2 | 2 | 2 | 0.693 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0.693 | 0 | 0 | 0 |
| 51 1 1 17 2 | 2 | 2 | 0.693 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0.693 | 0 | 0 |
| 51 1 1 17 2 | 2 | 2 | 0.693 | 3 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0.693 | 0 |
| 51 1 1 17 2 | 2 | 2 | 0.693 | 4 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.693 |
| . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| 51 1 1 17 2 | 2 | 29 | 3.367 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 3.367 | 0 | 0 | 0 |
| 51 1 1 17 2 | 2 | 29 | 3.367 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 3.367 | 0 | 0 |
| 51 1 1 17 2 | 2 | 29 | 3.367 | 3 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 3.367 | 0 |
| 51 1 1 17 2 | 2 | 29 | 3.367 | 4 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3.367 |

# Chapter 6

# DEFICIT FERTILITY IN INDONESIA

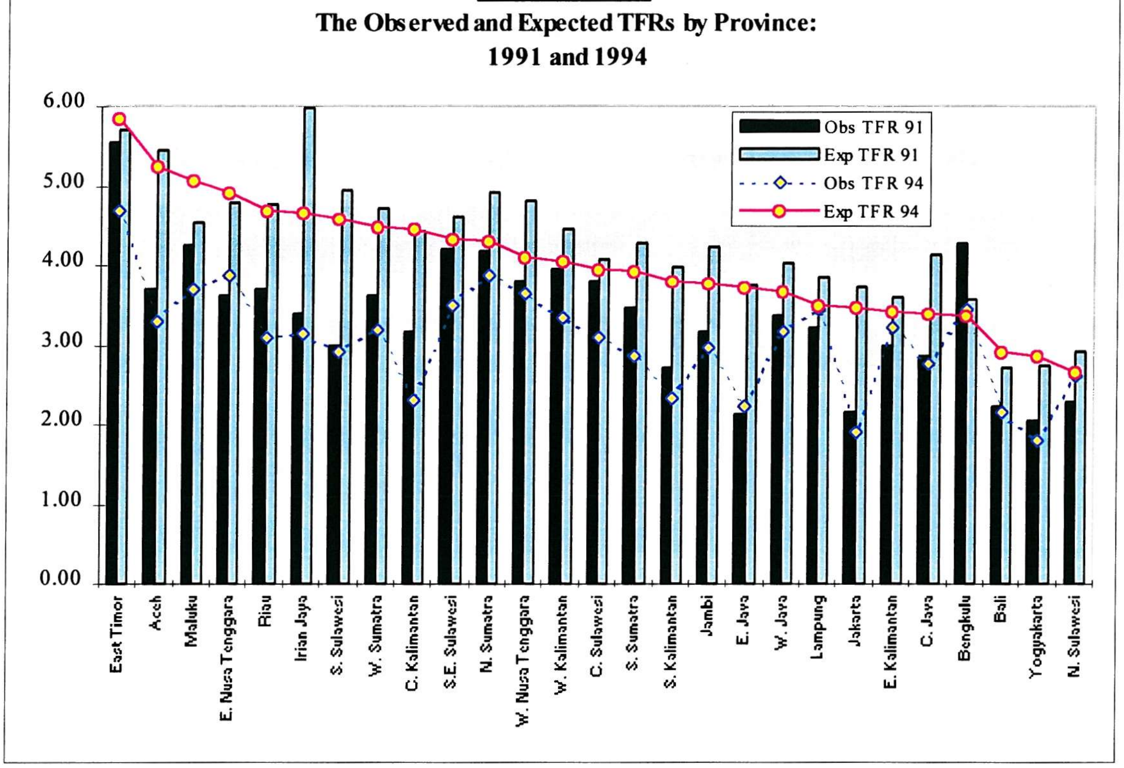
## 6.1 "Puzzle" in Total Fertility Rates and Contraceptive Prevalence Rates

Since family planning is used as a means to reduce fertility, we expect a negative correlation between family planning and fertility: the higher the contraceptive prevalence rate, the lower is the fertility rate. Sometimes, as happened in Indonesia, a rising (decreasing) fertility rate is equated with success (failure) in family planning programme. The 1994 IDHS, for example, had raised many questions on the performance of the family planning programme in the provinces of East Java, Lampung, and North Sulawesi. In these provinces, fertility rates had been increasing at the same time as increases in contraceptive prevalence rate. On the other hand, contraceptive prevalence and fertility rates had been declining together in the provinces of Yogyakarta, Bali, East Timor, and Maluku. Central Kalimantan experienced almost no change in its contraceptive prevalence rate, yet its fertility rate had been declining.

Therefore, it is clear then that contraceptive prevalence alone cannot explain the variation in fertility rate. Contraception is only one of the proximate determinants of fertility (Bongaarts, 1978). This chapter attempts to explain the variation in actual fertility rates compared to the expected fertility rates among provinces in Indonesia within two periods, 1987-1991 and 1991-1994, using the 1991 and 1994 IDHS, in terms of the proximate determinants of fertility as pioneered by Bongaarts and Potter (1983).

Based on the 1991 IDHS data, Indonesian women, in general, would have been expected to have 1.1 births more children than they already did given the 1991 contraceptive prevalence (Samosir 1995). In other words, the observed total fertility rate (3.02) was 1.1 births per woman below the expected total fertility rate (4.12). This is called deficit fertility. In this chapter for Indonesia as a whole and all provinces, trends in the difference between the observed and expected total fertility rates given contraceptive prevalence are studied. In 1994 for Indonesia as a whole, the deficit slightly decreased to 0.95 births per woman (the observed total fertility 2.85 and the expected total fertility rate (3.80).

**Figure 6.1**




The observed and expected total fertility rates given the observed contraceptive prevalence rate in 1988-1991 and 1991-1994 for Indonesia, its regions and provinces are presented in Table 6.1. Figure 6.1 presents the provincial figures only. From this table and Figure 6.1, it can be seen that during 1991 and 1994 there was a deficit fertility in Indonesia as a whole, in each region, and in all provinces except Bengkulu. Bengkulu is the only province in which there is excess fertility, in which the observed total fertility rate is higher than the expected total fertility rate, either in 1991 or 1994. The sizes of the deficit vary across regions and provinces. Clearly, the deficit fertility phenomena in all provinces, but one, in Indonesia show that contraceptive use is not the only important proximate determinant of fertility. There are several potential factors that can explain the variation in differences between actual and expected fertility rates, such as lagged effects of contraceptive use; later or earlier marriage than expected; longer or shorter durations of breastfeeding than expected duration given contraceptive prevalence; higher or lower contraceptive effectiveness. The effect of each factor will be studied in the following sections (the method of analysis was explained in Section 4.4.4).

Table 6.1 The Observed and Expected Total Fertility Rate (TFR) and Their Differences in Indonesia and Its Regions and Provinces: 1988-91 and 91-1994

| Region | TFR 1988-91* Observed | TFR 1988-91* Expected | TFR* Difference | TFR 1991-94 Observed | TFR 1991-94 Expected | TFR Difference |
|---|---|---|---|---|---|---|
| INDONESIA | 3.02 | 4.12 | -1.10 | 2.85 | 3.80 | -0.95 |
| Java-Bali | 2.68 | 3.88 | -1.20 | 2.60 | 3.56 | -0.96 |
| Outer Java-Bali I | 3.51 | 4.52 | -1.01 | 3.26 | 4.13 | -0.87 |
| Outer Java-Bali II | 3.73 | 4.56 | -0.83 | 3.33 | 4.38 | -1.05 |
| **Province:** | | | | | | |
| Jakarta | 2.14 | 3.71 | -1.57 | 1.90 | 3.48 | -1.58 |
| West Java | 3.37 | 4.03 | -0.66 | 3.17 | 3.67 | -0.50 |
| Central Java | 2.85 | 4.12 | -1.27 | 2.77 | 3.39 | -0.62 |
| Yogyakarta | 2.04 | 2.73 | -0.69 | 1.79 | 2.85 | -1.06 |
| East Java | 2.13 | 3.75 | -1.62 | 2.22 | 3.72 | -1.50 |
| Bali | 2.22 | 2.70 | -0.48 | 2.14 | 2.92 | -0.78 |
| Aceh | 3.70 | 5.45 | -1.75 | 3.30 | 5.23 | -1.93 |
| North Sumatra | 4.18 | 4.92 | -0.74 | 3.88 | 4.29 | -0.41 |
| West Sumatra | 3.61 | 4.72 | -1.11 | 3.19 | 4.47 | -1.28 |
| South Sumatra | 3.46 | 4.29 | -0.83 | 2.87 | 3.91 | -1.04 |
| Lampung | 3.22 | 3.86 | -0.64 | 3.45 | 3.50 | -0.05 |
| West Nusa Tenggara | 3.79 | 4.80 | -1.01 | 3.64 | 4.11 | -0.47 |
| West Kalimantan | 3.94 | 4.46 | -0.52 | 3.34 | 4.06 | -0.72 |
| South Kalimantan | 2.72 | 3.98 | -1.26 | 2.33 | 3.80 | -1.47 |
| North Sulawesi | 2.27 | 2.92 | -0.65 | 2.62 | 2.66 | -0.04 |
| South Sulawesi | 2.99 | 4.93 | -1.94 | 2.92 | 4.57 | -1.65 |
| Riau | 3.70 | 4.75 | -1.05 | 3.10 | 4.68 | -1.58 |
| Jambi | 3.16 | 4.24 | -1.08 | 2.97 | 3.77 | -0.80 |
| Bengkulu | 4.28 | 3.57 | 0.71 | 3.45 | 3.36 | 0.09 |
| East Nusa Tenggara | 3.61 | 4.79 | -1.18 | 3.87 | 4.91 | -1.04 |
| East Timor | 5.55 | 5.69 | -0.14 | 4.69 | 5.85 | -1.16 |
| Central Kalimantan | 3.17 | 4.44 | -1.27 | 2.31 | 4.45 | -2.14 |
| East Kalimantan | 2.99 | 3.59 | -0.60 | 3.21 | 3.43 | -0.22 |
| Cental Sulawesi | 3.81 | 4.08 | -0.27 | 3.08 | 3.94 | -0.86 |
| Southeast Sulawesi | 4.20 | 4.62 | -0.42 | 3.50 | 4.34 | -0.84 |
| Maluku | 4.26 | 4.54 | -0.28 | 3.70 | 5.07 | -1.37 |
| Irian Jaya | 3.38 | 5.98 | -2.60 | 3.15 | 4.66 | -1.51 |

Notes: * = quoted from Samosir (1994)

## 6.2 Lagged Effect of Contraceptive Use

To obtain an appropriate expected TFR the contraceptive prevalence rate at the middle of the observed period of TFR should be used. This means that contraceptive prevalence for two periods will be needed and it is assumed that the rate changes linearly during the observed periods. The contraceptive prevalence for mid of 1991-1994 is calculated using information from 1991 and 1994 Indonesian DHS. However, there is no such a data set for 1988. Therefore, to calculate the contraceptive prevalence for mid 1988-1991, Samosir (1994) utilizes the information from the 1985 Intercensal Survey for Outer Java-Bali and the 1987 IDHS for Java-Bali.

From 1988 to 1991, the proportion of currently married woman using contraception increased in almost all provinces, except in Central Java where it declined from 53.5% in 1987 to 49.7% in 1991. Whereas from 1991 to 1994, five provinces (East Timor, Maluku, East Nusa Tenggara, Yogyakarta and Bali) experienced a decrease in contraceptive prevalence, but Central Java joined other 21 provinces, experiencing an increase in contraceptive prevalence.

Adjusting the prevalence to mid period implies a new, higher, expected TFR. Then, the deficit fertility becomes larger. In other words, the adjustment of the calculation of the prevalence does not help reducing the deficit; it does not explain the relatively low observed TFR. This interpretation is made for Indonesia as a whole and for most of the provinces. The adjustment can explain the low TFR only in Central Java for the period of 1988-1991 and in East Timor, Maluku, East Nusa Tenggara, Yogyakarta, and Bali, in the period of 1991-1994.

Another exception is Bengkulu, the only province experiencing excess fertility. Here, the adjustment of the contraceptive prevalence results in a new, higher, expected TFR. Therefore, the excess becomes smaller. In other words, the adjustment can be one of the explanations for the relatively high observed-TFR in Bengkulu.

Detailed information on the changes in deficit or excess fertility because of adjustment for the lagged effect of contraceptive use can be found for 1991 in Tables 6.2, 6.4 and 6.6 and for 1994 in Tables 6.3, 6.5 and 6.7. Tables 6.2 and 6.3 contain information about the observed, expected and adjusted total fertility rate for the lagged effect of contraceptive use, marriage pattern, breastfeeding pattern and contraceptive use effectiveness. The amount of difference between observed and either expected or new expected rate, called lagged effect, is shown in Tables 6.4 and 6.5. These tables also contain the TFR differences after adjusting for marriage pattern, breastfeeding pattern and contraceptive use effectiveness. The amount of difference explained by all factors is presented in Table 6.6 for 1991 and Table 6.7 for 1994.

Table 6.2 The Observed, Expected and the Adjusted Total Fertility Rate (TFR) for Marriage Pattern, Breastfeeding Pattern and Contraceptive Effectiveness By Region and Province: Indonesia 1991

| Region and Province | Observed TFR | Expected TFR | Adjusted TFR to the lag effect | Adjusted TFR to Marriage Pattern | Adjusted TFR to Breast-feeding | Adjusted TFR to Contraceptive Effectiveness |
|---|---|---|---|---|---|---|
| INDONESIA | 3.02 | 4.12 | 4.18 | 2.80 | 3.01 | 3.50 |
| Java-Bali | 2.68 | 3.88 | 3.96 | 2.37 | 2.61 | 3.11 |
| Outer Java-Bali I | 3.51 | 4.52 | 4.57 | 3.59 | 3.68 | 4.14 |
| Outer Java-Bali II | 3.73 | 4.56 | 4.66 | 3.61 | 3.62 | 4.06 |
| Jakarta | 2.14 | 3.71 | 3.78 | 2.68 | 2.57 | 3.15 |
| West Java | 3.37 | 4.03 | 4.20 | 2.69 | 2.78 | 3.25 |
| Central Java | 2.85 | 4.12 | 4.00 | 2.66 | 3.30 | 3.88 |
| Yogyakarta | 2.04 | 2.73 | 2.84 | 2.23 | 2.89 | 4.04 |
| East Java | 2.13 | 3.75 | 3.93 | 1.90 | 2.09 | 2.49 |
| Bali | 2.22 | 2.70 | 2.81 | 2.23 | 3.02 | 4.51 |
| Aceh | 3.70 | 5.45 | 5.69 | 4.03 | 3.68 | 3.88 |
| North Sumatra | 4.18 | 4.92 | 5.11 | 4.77 | 4.48 | 4.86 |
| West Sumatra | 3.61 | 4.72 | 5.02 | 4.08 | 4.21 | 4.57 |
| South Sumatra | 3.46 | 4.29 | 4.66 | 3.15 | 3.22 | 3.61 |
| Lampung | 3.22 | 3.86 | 4.03 | 2.71 | 3.14 | 3.70 |
| West Nusa Tenggara | 3.79 | 4.80 | 5.08 | 4.03 | 4.38 | 4.81 |
| West Kalimantan | 3.94 | 4.46 | 4.74 | 3.85 | 3.83 | 4.22 |
| South Kalimantan | 2.72 | 3.98 | 4.37 | 2.67 | 2.94 | 3.41 |
| North Sulawesi | 2.27 | 2.92 | 3.05 | 2.34 | 2.89 | 4.04 |
| South Sulawesi | 2.99 | 4.93 | 5.25 | 3.86 | 3.86 | 4.18 |
| Riau | 3.70 | 4.75 | 5.25 | 4.21 | 3.85 | 4.13 |
| Jambi | 3.16 | 4.24 | 4.48 | 2.63 | 2.97 | 3.41 |
| Bengkulu | 4.28 | 3.57 | 3.96 | 3.62 | 4.19 | 4.94 |
| East Nusa Tenggara | 3.61 | 4.79 | 5.05 | 4.49 | 4.68 | 5.15 |
| East Timor | 5.55 | 5.69 | 6.13 | 6.36 | 5.92 | 6.14 |
| Central Kalimantan | 3.17 | 4.44 | 4.78 | 3.02 | 3.18 | 3.55 |
| East Kalimantan | 2.99 | 3.59 | 4.08 | 3.02 | 3.13 | 3.72 |
| Central Sulawesi | 3.81 | 4.08 | 4.52 | 3.87 | 3.84 | 4.39 |
| Southeast Sulawesi | 4.20 | 4.62 | 5.08 | 4.19 | 4.34 | 4.76 |
| Maluku | 4.26 | 4.54 | 4.99 | 4.21 | 4.14 | 4.48 |
| Irian Jaya | 3.38 | 5.98 | 6.09 | 3.20 | 3.37 | 3.50 |

Source: compiled from Samosir (1994)

Table 6.3 The Observed, Expected and the Adjusted Total Fertility Rate (TFR) for Marriage Pattern, Breastfeeding Pattern and Contraceptive Effectiveness By Region and Province: Indonesia 1994

| Region and Province | Observed TFR | Expected TFR | Adjusted TFR to the lag effect | Adjusted TFR to Marriage Pattern | Adjusted TFR to Breast-feeding | Adjusted TFR to Contraceptive Effectiveness |
|---|---|---|---|---|---|---|
| INDONESIA | 2.85 | 3.80 | 3.96 | 2.94 | 3.17 | 3.70 |
| Java-Bali | 2.60 | 3.56 | 3.72 | 2.47 | 2.85 | 3.43 |
| Outer Java-Bali I | 3.26 | 4.13 | 4.32 | 3.77 | 3.86 | 4.32 |
| Outer Java-Bali II | 3.33 | 4.38 | 4.47 | 3.74 | 3.70 | 4.11 |
| DKI Jakarta | 1.90 | 3.48 | 3.60 | 2.75 | 2.67 | 3.20 |
| West Java | 3.17 | 3.67 | 3.85 | 2.86 | 3.22 | 3.83 |
| Central Java | 2.77 | 3.39 | 3.75 | 2.61 | 3.32 | 4.01 |
| DI Yogyakarta | 1.79 | 2.85 | 2.79 | 1.98 | 2.28 | 2.98 |
| East Java | 2.22 | 3.72 | 3.74 | 2.00 | 2.26 | 2.70 |
| Bali | 2.14 | 2.92 | 2.81 | 2.63 | 3.24 | 4.70 |
| DI Aceh | 3.30 | 5.23 | 5.34 | 4.58 | 4.12 | 4.37 |
| North Sumatra | 3.88 | 4.29 | 4.61 | 4.85 | 4.59 | 4.99 |
| West Sumatra | 3.19 | 4.47 | 4.60 | 3.80 | 3.73 | 4.15 |
| South Sumatra | 2.87 | 3.91 | 4.10 | 3.17 | 3.21 | 3.68 |
| Lampung | 3.45 | 3.50 | 3.68 | 3.12 | 3.82 | 4.57 |
| West Nusa Tenggara | 3.64 | 4.11 | 4.46 | 3.99 | 4.42 | 4.95 |
| West Kalimantan | 3.34 | 4.06 | 4.26 | 3.45 | 3.47 | 3.93 |
| South Kalimantan | 2.33 | 3.80 | 3.89 | 2.70 | 2.76 | 3.15 |
| North Sulawesi | 2.62 | 2.66 | 2.79 | 2.94 | 3.18 | 4.44 |
| South Sulawesi | 2.92 | 4.57 | 4.75 | 4.04 | 4.11 | 4.40 |
| Riau | 3.10 | 4.68 | 4.71 | 3.74 | 3.53 | 3.86 |
| Jambi | 2.97 | 3.77 | 4.00 | 2.95 | 2.99 | 3.48 |
| Bengkulu | 3.45 | 3.36 | 3.46 | 3.06 | 3.19 | 3.97 |
| East Nusa Tenggara | 3.87 | 4.91 | 4.85 | 5.35 | 5.61 | 6.11 |
| East Timor | 4.69 | 5.85 | 5.77 | 6.11 | 5.48 | 5.74 |
| Central Kalimantan | 2.31 | 4.45 | 4.45 | 2.53 | 2.20 | 2.41 |
| East Kalimantan | 3.21 | 3.43 | 3.51 | 3.12 | 3.82 | 4.53 |
| Central Sulawesi | 3.08 | 3.94 | 4.01 | 3.15 | 3.08 | 3.55 |
| Southeast Sulawesi | 3.50 | 4.34 | 4.48 | 4.60 | 4.45 | 4.96 |
| Maluku | 3.70 | 5.07 | 4.80 | 4.91 | 4.71 | 5.18 |
| Irian Jaya | 3.15 | 4.66 | 5.32 | 3.33 | 3.13 | 3.23 |

Table 6.4 The Amount of TFR Difference between the Observed and Adjusted TFR by Region and Province: 1991

| Region and Province | TFR Difference between | | | | |
|---|---|---|---|---|---|
| | Observed and Expected | Observed and Adjusted to Lag Effect | Adjusted to Lag Effect and Marriage Pattern | Adjusted to Lag Effect and Breastfeeding Pattern | Adjusted to Lag Effect and Contraceptive Effectiveness |
| INDONESIA | -1.10 | -1.16 | -1.38 | -1.17 | -0.68 |
| Java-Bali | -1.20 | -1.28 | -1.59 | -1.35 | -0.85 |
| Outer Java-Bali I | -1.01 | -1.06 | -0.98 | -0.89 | -0.43 |
| Outer Java-Bali II | -0.83 | -0.93 | -1.05 | -1.04 | -0.60 |
| DKI Jakarta | -1.57 | -1.64 | -1.10 | -1.21 | -0.63 |
| West Java | -0.66 | -0.83 | -1.51 | -1.42 | -0.95 |
| Central Java | -1.27 | -1.15 | -1.34 | -0.70 | -0.12 |
| DI Yogyakarta | -0.69 | -0.80 | -0.61 | 0.05 | 1.20 |
| East Java | -1.62 | -1.80 | -2.03 | -1.84 | -1.44 |
| Bali | -0.48 | -0.59 | -0.58 | 0.21 | 1.70 |
| DI Aceh | -1.75 | -1.99 | -1.66 | -2.01 | -1.81 |
| North Sumatra | -0.74 | -0.93 | -0.34 | -0.63 | -0.25 |
| West Sumatra | -1.11 | -1.41 | -0.94 | -0.81 | -0.45 |
| South Sumatra | -0.83 | -1.20 | -1.51 | -1.44 | -1.05 |
| Lampung | -0.64 | -0.81 | -1.32 | -0.89 | -0.33 |
| West Nusa Tenggara | -1.01 | -1.29 | -1.05 | -0.70 | -0.27 |
| West Kalimantan | -0.52 | -0.80 | -0.89 | -0.91 | -0.52 |
| South Kalimantan | -1.26 | -1.65 | -1.70 | -1.43 | -0.96 |
| North Sulawesi | -0.65 | -0.78 | -0.71 | -0.16 | 0.99 |
| South Sulawesi | -1.94 | -2.26 | -1.39 | -1.39 | -1.07 |
| Riau | -1.05 | -1.55 | -1.04 | -1.40 | -1.12 |
| Jambi | -1.08 | -1.32 | -1.85 | -1.51 | -1.07 |
| Bengkulu | 0.71 | 0.32 | -0.34 | 0.23 | 0.98 |
| East Nusa Tenggara | -1.18 | -1.44 | -0.56 | -0.37 | 0.10 |
| East Timor | -0.14 | -0.58 | 0.23 | -0.21 | 0.01 |
| Central Kalimantan | -1.27 | -1.61 | -1.76 | -1.60 | -1.23 |
| East Kalimantan | -0.60 | -1.09 | -1.06 | -0.95 | -0.36 |
| Central Sulawesi | -0.27 | -0.71 | -0.65 | -0.68 | -0.13 |
| Southeast Sulawesi | -0.42 | -0.88 | -0.89 | -0.74 | -0.32 |
| Maluku | -0.28 | -0.73 | -0.78 | -0.85 | -0.51 |
| Irian Jaya | -2.60 | -2.71 | -2.89 | -2.72 | -2.59 |

Source: compiled and recalculated from Samosir (1995)

Table 6.5 The Amount of TFR Difference between the Observed and Adjusted TFR by Region and Province: 1994

| Region and Province | TFR Difference between | | | | |
|---|---|---|---|---|---|
| | Observed and Expected | Observed and Adjusted to Lag Effect | Adjusted to Lag Effect and Marriage Pattern | Adjusted to Lag Effect and Breastfeeding Pattern | Adjusted to Lag Effect and Contraceptive Effectiveness |
| INDONESIA | -0.95 | -1.11 | -1.02 | -0.79 | -0.26 |
| Java-Bali | -0.96 | -1.12 | -1.25 | -0.87 | -0.29 |
| Outer Java-Bali I | -0.87 | -1.06 | -0.56 | -0.46 | 0.00 |
| Outer Java-Bali II | -1.05 | -1.14 | -0.73 | -0.76 | -0.36 |
| DKI Jakarta | -1.58 | -1.70 | -0.84 | -0.92 | -0.39 |
| West Java | -0.50 | -0.68 | -1.00 | -0.64 | -0.02 |
| Central Java | -0.62 | -0.98 | -1.15 | -0.44 | 0.25 |
| DI Yogyakarta | -1.06 | -1.00 | -0.82 | -0.51 | 0.19 |
| East Java | -1.50 | -1.52 | -1.74 | -1.48 | -1.04 |
| Bali | -0.78 | -0.67 | -0.18 | 0.43 | 1.89 |
| DI Aceh | -1.93 | -2.04 | -0.76 | -1.22 | -0.97 |
| North Sumatra | -0.41 | -0.73 | 0.25 | -0.02 | 0.38 |
| West Sumatra | -1.28 | -1.41 | -0.80 | -0.86 | -0.44 |
| South Sumatra | -1.04 | -1.23 | -0.93 | -0.89 | -0.42 |
| Lampung | -0.05 | -0.23 | -0.56 | 0.14 | 0.89 |
| West Nusa Tenggara | -0.47 | -0.82 | -0.47 | -0.04 | 0.49 |
| West Kalimantan | -0.72 | -0.92 | -0.81 | -0.79 | -0.33 |
| South Kalimantan | -1.47 | -1.56 | -1.19 | -1.13 | -0.74 |
| North Sulawesi | -0.04 | -0.17 | 0.15 | 0.39 | 1.65 |
| South Sulawesi | -1.65 | -1.83 | -0.71 | -0.64 | -0.35 |
| Riau | -1.58 | -1.61 | -0.98 | -1.19 | -0.86 |
| Jambi | -0.80 | -1.03 | -1.06 | -1.01 | -0.53 |
| Bengkulu | 0.09 | -0.01 | -0.40 | -0.27 | 0.51 |
| East Nusa Tenggara | -1.04 | -0.98 | 0.50 | 0.76 | 1.26 |
| East Timor | -1.16 | -1.08 | 0.34 | -0.30 | -0.04 |
| Central Kalimantan | -2.14 | -2.14 | -1.92 | -2.25 | -2.04 |
| East Kalimantan | -0.22 | -0.30 | -0.39 | 0.31 | 1.02 |
| Central Sulawesi | -0.86 | -0.93 | -0.86 | -0.93 | -0.45 |
| Southeast Sulawesi | -0.84 | -0.98 | 0.12 | -0.02 | 0.48 |
| Maluku | -1.37 | -1.10 | 0.11 | -0.09 | 0.38 |
| Irian Jaya | -1.51 | -2.17 | -1.99 | -2.19 | -2.09 |

Table 6.6 The Amount of the TFR Difference Explained by Factors Influencing Fertility by Region and Province: 1991

| **Region and Province** | **TFR Difference Explained by** | | | |
|---|---|---|---|---|
| | **Lag effect** | **Marriage Pattern** | **Breastfeeding Pattern** | **Contraceptive Effectiveness** |
| INDONESIA | 0.06 | 0.22 | -0.21 | -0.49 |
| Java-Bali | 0.08 | 0.31 | -0.24 | -0.50 |
| Outer Java-Bali I | 0.05 | -0.08 | -0.09 | -0.46 |
| Outer Java-Bali II | 0.10 | 0.12 | -0.01 | -0.44 |
| DKI Jakarta | 0.07 | -0.54 | 0.11 | -0.58 |
| West Java | 0.17 | 0.68 | -0.09 | -0.47 |
| Central Java | -0.12 | 0.19 | -0.64 | -0.58 |
| DI Yogyakarta | 0.11 | -0.19 | -0.66 | -1.15 |
| East Java | 0.18 | 0.23 | -0.19 | -0.40 |
| Bali | 0.11 | -0.01 | -0.79 | -1.49 |
| DI Aceh | 0.24 | -0.33 | 0.35 | -0.20 |
| North Sumatra | 0.19 | -0.59 | 0.29 | -0.38 |
| West Sumatra | 0.30 | -0.47 | -0.13 | -0.36 |
| South Sumatra | 0.37 | 0.31 | -0.07 | -0.39 |
| Lampung | 0.17 | 0.51 | -0.43 | -0.56 |
| West Nusa Tenggara | 0.28 | -0.24 | -0.35 | -0.43 |
| West Kalimantan | 0.28 | 0.09 | 0.02 | -0.39 |
| South Kalimantan | 0.39 | 0.05 | -0.27 | -0.47 |
| North Sulawesi | 0.13 | -0.07 | -0.55 | -1.15 |
| South Sulawesi | 0.32 | -0.87 | 0.00 | -0.32 |
| Riau | 0.50 | -0.51 | 0.36 | -0.28 |
| Jambi | 0.24 | 0.53 | -0.34 | -0.44 |
| Bengkulu | 0.39 | 0.66 | -0.57 | -0.75 |
| East Nusa Tenggara | 0.26 | -0.88 | -0.19 | -0.47 |
| East Timor | 0.44 | -0.81 | 0.44 | -0.22 |
| Central Kalimantan | 0.34 | 0.15 | -0.16 | -0.37 |
| East Kalimantan | 0.49 | -0.03 | -0.11 | -0.59 |
| Central Sulawesi | 0.44 | -0.06 | 0.03 | -0.55 |
| Southeast Sulawesi | 0.46 | 0.01 | -0.15 | -0.42 |
| Maluku | 0.45 | 0.05 | 0.07 | -0.34 |
| Irian Jaya | 0.11 | 0.18 | -0.17 | -0.13 |

Source: compiled and recalculated from Samosir (1994).

Table 6.7 The Amount of the TFR Difference Explained by Factors Influencing Fertility by Region and Province: 1994

| Region and Province | TFR Difference explained by | | | |
|---|---|---|---|---|
| | Lag effect | Marriage Pattern | Breastfeeding Pattern | Contraceptive Effectiveness |
| INDONESIA | 0.16 | -0.09 | -0.23 | -0.52 |
| Java-Bali | 0.16 | 0.13 | -0.38 | -0.58 |
| Outer Java-Bali I | 0.19 | -0.51 | -0.10 | -0.46 |
| Outer Java-Bali II | 0.09 | -0.41 | 0.04 | -0.40 |
| DKI Jakarta | 0.12 | -0.85 | 0.08 | -0.53 |
| West Java | 0.18 | 0.31 | -0.36 | -0.61 |
| Central Java | 0.36 | 0.16 | -0.71 | -0.69 |
| DI Yogyakarta | -0.06 | -0.19 | -0.31 | -0.70 |
| East Java | 0.02 | 0.22 | -0.26 | -0.43 |
| Bali | -0.11 | -0.49 | -0.61 | -1.46 |
| DI Aceh | 0.11 | -1.28 | 0.46 | -0.25 |
| North Sumatra | 0.31 | -0.97 | 0.26 | -0.40 |
| West Sumatra | 0.12 | -0.61 | 0.07 | -0.42 |
| South Sumatra | 0.19 | -0.30 | -0.04 | -0.47 |
| Lampung | 0.18 | 0.33 | -0.71 | -0.74 |
| West Nusa Tenggara | 0.35 | -0.35 | -0.43 | -0.53 |
| West Kalimantan | 0.20 | -0.11 | -0.02 | -0.45 |
| South Kalimantan | 0.09 | -0.37 | -0.05 | -0.39 |
| North Sulawesi | 0.13 | -0.32 | -0.24 | -1.26 |
| South Sulawesi | 0.18 | -1.12 | -0.07 | -0.28 |
| Riau | 0.04 | -0.64 | 0.21 | -0.33 |
| Jambi | 0.23 | 0.02 | -0.04 | -0.49 |
| Bengkulu | 0.11 | 0.39 | -0.13 | -0.78 |
| East Nusa Tenggara | -0.06 | -1.48 | -0.25 | -0.50 |
| East Timor | -0.08 | -1.42 | 0.64 | -0.26 |
| Central Kalimantan | 0.00 | -0.22 | 0.33 | -0.21 |
| East Kalimantan | 0.08 | 0.09 | -0.69 | -0.71 |
| Central Sulawesi | 0.07 | -0.07 | 0.06 | -0.47 |
| Southeast Sulawesi | 0.14 | -1.10 | 0.14 | -0.50 |
| Maluku | -0.27 | -1.21 | 0.21 | -0.47 |
| Irian Jaya | 0.66 | -0.18 | 0.21 | -0.11 |

## 6.3 Adjustment for Marriage Behaviour

The 1991 Indonesia DHS results indicate that the index of marriage was 0.63 in 1988-1991 in Indonesia as a whole. This value was higher than the expected index of marriage of 0.58; and, as a result, the adjusted observed total fertility rate was 0.22 less children per woman than the observed total fertility rate (Samosir 1995). Thus, the deficit fertility was not likely to be explained by the marriage pattern in Indonesia in 1988-1991.

However, this was not the case in 1991-1994. The observed index of marriage decreased to 0.56, which means that there are more unmarried women. Further, the observed index of marriage is lower than the expected index (as shown in Table 6.8). Therefore, the adjustment of the observed TFR with the index of marriage results in a higher, new, observed TFR. Consequently, the deficit decreases from 1.11 in the case of adjustment for the lagged effect in the previous subsection to 1.02, after adjustment for the marriage pattern. Though the decline in the deficit is small, the marriage pattern helps explain the relatively low TFR in Indonesia as a whole in 1991-1994.

As in Indonesia as a whole, the marriage pattern in Outer Java-Bali II did not seem to be able to explain the deficit in 1988-1991, but provided some explanations for the deficit in 1991-1994. Women in Outer Java-Bali II tended to marry later and the index of marriage decreased from 0.64 in 1991 to 0.54 in 1994 (Table 6.8). Further, the observed indexes in 1991 and 1994 are lower than expected. In 1991-1994, the deficit declined from 1.14 with the lagged effect as the only adjustment to 0.73 when the observed TFR is adjusted for the marriage pattern. On the contrary, it rose from 0.93 to 1.05 in 1988-1991.

The marriage pattern contributes to the explanation of the relatively low fertility in Outer Java-Bali I. In both periods, the deficit had further declined because of the adjustment of the observed TFR for the marriage pattern. On contrary, the deficit had risen in both periods for Java-Bali. Thus, marriage pattern did not seem to explain the relatively low fertility in Java-Bali.

Table 6.8 The Observed ($C_m$) and Expected ($C'_m$) Index of Marriage by Region and Province : 1991 and 1994

| Region and Province | 1991 | | 1994 | |
|---|---|---|---|---|
| | Observed | Expected | Observed | Expected |
| INDONESIA | 0.63 | 0.58 | 0.56 | 0.58 |
| Java-Bali | 0.64 | 0.57 | 0.58 | 0.55 |
| Outer Java-Bali I | 0.60 | 0.61 | 0.52 | 0.59 |
| Outer Java-Bali II | 0.64 | 0.61 | 0.54 | 0.61 |
| DKI Jakarta | 0.44 | 0.55 | 0.37 | 0.54 |
| West Java | 0.74 | 0.59 | 0.62 | 0.56 |
| Central Java | 0.61 | 0.57 | 0.58 | 0.55 |
| DI Yogyakarta | 0.42 | 0.46 | 0.41 | 0.46 |
| East Java | 0.63 | 0.56 | 0.61 | 0.55 |
| Bali | 0.45 | 0.46 | 0.37 | 0.46 |
| DI Aceh | 0.63 | 0.69 | 0.48 | 0.67 |
| North Sumatra | 0.57 | 0.65 | 0.49 | 0.62 |
| West Sumatra | 0.57 | 0.64 | 0.52 | 0.62 |
| South Sumatra | 0.68 | 0.62 | 0.52 | 0.58 |
| Lampung | 0.68 | 0.57 | 0.60 | 0.54 |
| West Nusa Tenggara | 0.61 | 0.65 | 0.55 | 0.61 |
| West Kalimantan | 0.64 | 0.63 | 0.57 | 0.59 |
| South Kalimantan | 0.61 | 0.60 | 0.48 | 0.56 |
| North Sulawesi | 0.47 | 0.48 | 0.41 | 0.46 |
| South Sulawesi | 0.51 | 0.66 | 0.45 | 0.63 |
| Riau | 0.58 | 0.66 | 0.52 | 0.62 |
| Jambi | 0.73 | 0.61 | 0.57 | 0.57 |
| Bengkulu | 0.67 | 0.57 | 0.59 | 0.52 |
| East Nusa Tenggara | 0.52 | 0.65 | 0.46 | 0.63 |
| East Timor | 0.62 | 0.71 | 0.53 | 0.69 |
| Central Kalimantan | 0.66 | 0.63 | 0.55 | 0.60 |
| East Kalimantan | 0.57 | 0.58 | 0.54 | 0.53 |
| Central Sulawesi | 0.6 | 0.61 | 0.56 | 0.57 |
| Southeast Sulawesi | 0.65 | 0.65 | 0.46 | 0.61 |
| Maluku | 0.65 | 0.64 | 0.47 | 0.63 |
| Irian Jaya | 0.75 | 0.71 | 0.63 | 0.66 |

**Figure 6.2 Changes in Index of Marriage Pattern (Cm) by Province: 1988-1991 and 1991-1994**

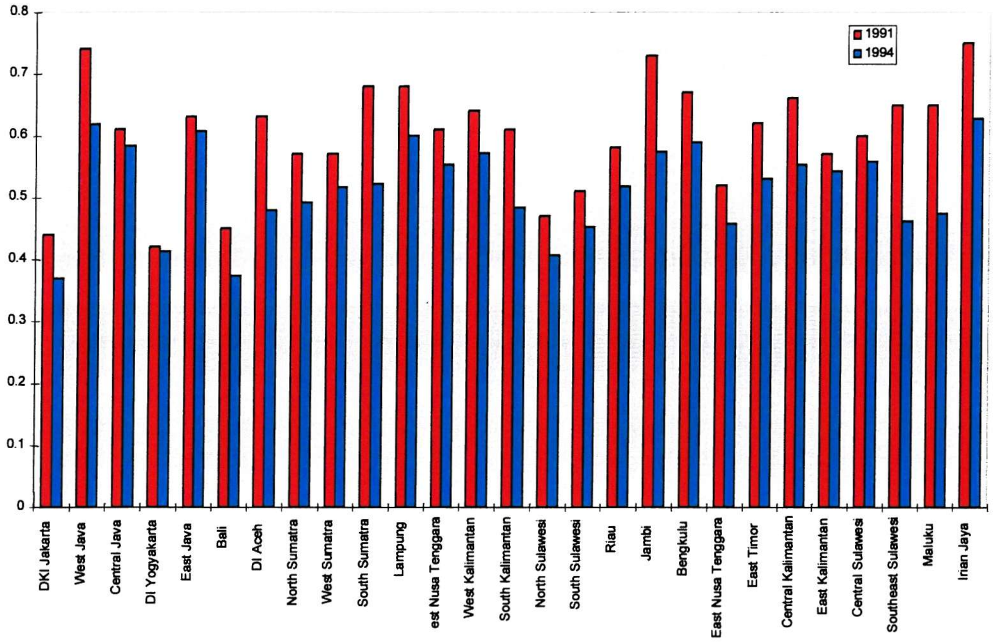



Figure 6.2 presents the index of marriage by province. Women of reproductive age in Jakarta, Yogyakarta, Bali and North Sulawesi had the lowest index of marriage, that is below 0.5 in 1988-1991. Those provinces also have a low fertility rate compared to other provinces. In contrast in West Java, Jambi and Irian Jaya it was over 0.70. Except for Jambi, West Java and Irian Jaya in 1994 still had the highest value of the index, which is around 0.62. The index in all provinces decreased from 1988-1991 to 1991-1994 indicating an increase in the percentage of unmarried women. It is interesting, apart from these four provinces mentioned above in 1991-1994 there are 7 provinces, which already had the index below 50%. They are Aceh, North Sumatra, South Kalimantan, South Sulawesi, East Nusa Tenggara, Southeast Sulawesi and Maluku. As shown in Table 11.8, the index for Aceh, South Kalimantan, Southeast Sulawesi and Maluku decreased by more than 10 points. All indices of all those provinces were lower than their expected index, thus we can expect that marriage pattern might have an effect on reducing the TFR deficit. For example, consider Jakarta, Aceh and South Sulawesi. Firstly, in Jakarta 33% of the deficit can be accounted for by the marriage pattern (from 1.64 children per woman to 1.10 children per woman). The contribution of this factor increased to 50% in 1991-1994.

Aceh and South Sulawesi experienced much bigger changes in the marriage effect on the TFR deficit. In 1988-1991 33% of Aceh's total fertility rate deficit was attributed to the marriage pattern, this increased to 63% in 1991-1994. Moreover in South Sulawesi the marriage pattern effect on the TFR deficit increased from 38% in 1988-1991 to 61% in 1991-1994, i.e., 1.12 children of 1.83 children per woman of the total deficit fertility was caused by the higher proportion of women who married later than expected.

In short, in 13 out of 26 provinces which experienced deficit fertility, the deficit could be partly explained by the marriage pattern in both periods. The only exception is East Kalimantan, where the marriage pattern could not explain the deficit in the period of 1991-1994. Further, in 8 out of the other half of the 26 provinces, marriage could partly explain the relatively low fertility in 1991-1994, but not in 1988-1991.

## 6.4 Adjustment for Breastfeeding Behaviour

As previously discussed, adjustment for the lagged effect of contraceptive use to the expected TFR and the adjustment of the marriage pattern to the observed TFR cannot explain the relatively low fertility in Indonesia as a whole in 1988-1991. However, adjustment for the breastfeeding pattern, in addition to the lag-effect and marriage pattern adjusted deficit, resulted in a smaller deficit. Thus breastfeeding behaviour can partly explain the relatively low fertility in Indonesia as whole in 1988-1999. For 1991-1994, in addition to marriage pattern, breastfeeding behaviour can also partly explain the relatively low fertility in Indonesia as whole.

Breastfeeding pattern seems partly explain the relatively low fertility in all regions: Java-Bali, Outer Java-Bali I, and Outer Java-Bali II in 1988-1991. However, it fails to explain the low fertility in Outer Java-Bali II in 1991-1994.

As shown in Figure 6.3, median duration of amenorrhea among provinces between 1991 and 1994 decreased except in West Java and East Kalimantan. Jakarta had the lowest median duration of amenorrhea. Irian Jaya in 1991 reached the highest median of the duration where women had it for more than a year, but in 1994 the value decreased sharply to around 7 months. Then the highest duration of amenorrhea was reached by Central Java of around 10 months. Central Java along with East Java, Lampung and East Nusa Tenggara was relatively stable in term of breastfeeding behaviour. A decrease in duration of amenorrhea will increase index of breastfeeding, as shown in Table 6.9.

**Figure 6.3 Trends in Median Duration of Amenorrhea (i) by Province: 1991 and 1994**

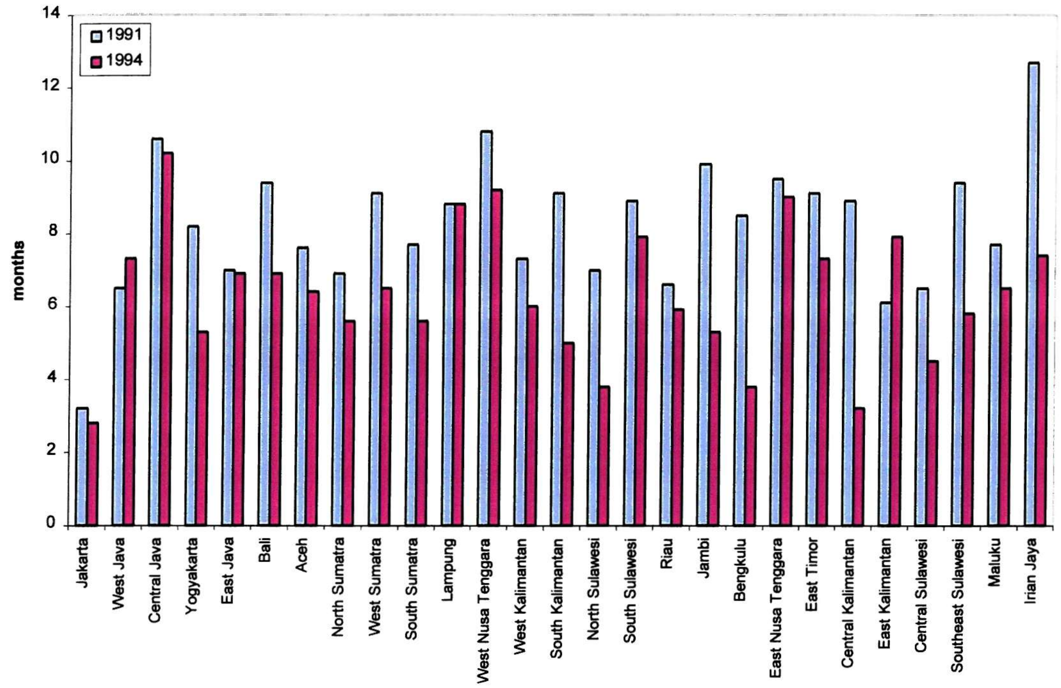



Table 6.2 shows that in 17 out of the 26 deficit fertility provinces breastfeeding adjustment can reduce the deficit in 1988-1991; that breastfeeding behaviour partly explained the relatively low fertility in those provinces in that period. However, in 1991-1994, it fails to explain in the deficit in 4 out of the 17 provinces. Yet, in the other two provinces, the breastfeeding behaviour can partly explain the relatively low fertility in 1991-1994, but not in 1988-1991.

## 6.5 Adjustment for Contraceptive Effectiveness

After adjustment to the lagged effect of contraceptive use, marriage pattern and breastfeeding, the deficit fertility in Indonesia as a whole and its provinces remain large. Since levels of contraceptive effectiveness is potentially considered as an important factor in predicting exceptionally low or high fertility given contraceptive prevalence, the impact of contraceptive effectiveness is examined in this subsection. The adjustment for effectiveness is performed to the observed fertility after being adjusted by the marriage and breastfeeding patterns.

The calculation of the index of contraception proposed by Bongaarts and Potter (1993), as presented in equation 14 in Section 4.4.4, needs information on average use-effectiveness of contraception, which is estimated as the weighted average of the method specific use-effectiveness levels with the weights equal to the proportion of women using a given method. However, they also mention that such information is often not readily available across populations, including Indonesia, but use-effectiveness of any method may not vary much across populations and overtime.

Table 6.9 The Median Duration of Amenorrhea in month (i), Observed ($C_i$) and Expected ($C'_i$) Index of Breastfeeding by Region and Province: 1991 and 1994

| Region and Province | 1991 | | | 1994 | | |
|---|---|---|---|---|---|---|
| | i | $C_i$ | $C'_i$ | i | $C_i$ | $C'_i$ |
| INDONESIA | 7.40 | 0.77 | 0.83 | 7.10 | 0.78 | 0.84 |
| Java-Bali | 7.20 | 0.78 | 0.86 | 7.40 | 0.77 | 0.89 |
| Outer Java-Bali I | 7.50 | 0.77 | 0.79 | 6.70 | 0.79 | 0.81 |
| Outer Java-Bali II | 7.20 | 0.78 | 0.78 | 6.30 | 0.81 | 0.80 |
| DKI Jakarta | 3.20 | 0.92 | 0.88 | 2.80 | 0.94 | 0.91 |
| West Java | 6.50 | 0.80 | 0.83 | 7.30 | 0.78 | 0.87 |
| Central Java | 10.60 | 0.69 | 0.85 | 10.20 | 0.70 | 0.89 |
| DI Yogyakarta | 8.20 | 0.75 | 0.97 | 5.30 | 0.84 | 0.97 |
| East Java | 7.00 | 0.78 | 0.86 | 6.90 | 0.79 | 0.89 |
| Bali | 9.40 | 0.72 | 0.97 | 6.90 | 0.79 | 0.97 |
| DI Aceh | 7.60 | 0.77 | 0.70 | 6.40 | 0.80 | 0.72 |
| North Sumatra | 6.90 | 0.79 | 0.74 | 5.60 | 0.83 | 0.78 |
| West Sumatra | 9.10 | 0.72 | 0.75 | 6.50 | 0.80 | 0.79 |
| South Sumatra | 7.70 | 0.76 | 0.78 | 5.60 | 0.83 | 0.84 |
| Lampung | 8.80 | 0.73 | 0.85 | 8.80 | 0.73 | 0.90 |
| West Nusa Tenggara | 10.80 | 0.68 | 0.74 | 9.20 | 0.72 | 0.80 |
| West Kalimantan | 7.30 | 0.78 | 0.77 | 6.00 | 0.82 | 0.82 |
| South Kalimantan | 9.10 | 0.72 | 0.81 | 5.00 | 0.85 | 0.87 |
| North Sulawesi | 7.00 | 0.78 | 0.97 | 3.80 | 0.90 | 0.97 |
| South Sulawesi | 8.90 | 0.73 | 0.73 | 7.90 | 0.76 | 0.77 |
| Riau | 6.60 | 0.80 | 0.73 | 5.90 | 0.82 | 0.77 |
| Jambi | 9.90 | 0.70 | 0.80 | 5.30 | 0.84 | 0.85 |
| Bengkulu | 8.50 | 0.74 | 0.86 | 3.80 | 0.90 | 0.93 |
| East Nusa Tenggara | 9.50 | 0.71 | 0.75 | 9.00 | 0.73 | 0.76 |
| East Timor | 9.10 | 0.72 | 0.67 | 7.30 | 0.78 | 0.69 |
| Central Kalimantan | 8.90 | 0.73 | 0.77 | 3.20 | 0.92 | 0.80 |
| East Kalimantan | 6.10 | 0.81 | 0.84 | 7.90 | 0.76 | 0.93 |
| Central Sulawesi | 6.50 | 0.80 | 0.79 | 4.50 | 0.87 | 0.85 |
| Southeast Sulawesi | 9.40 | 0.72 | 0.74 | 5.80 | 0.82 | 0.80 |
| Maluku | 7.70 | 0.76 | 0.75 | 6.50 | 0.80 | 0.77 |
| Irian Jaya | 12.70 | 0.64 | 0.68 | 7.40 | 0.77 | 0.72 |

Thus, the application of such information from other populations can be used if this information is unavailable for the population interest. Hatcher, et al. (1998) has estimated use-effectiveness in the Unites States in the 1990s though Bongaarts and Potter (1983) also provided such information for the United States in 1977 and Laing (1978) for the Philippines in 1974. The 1970s information are considered out-of-date and the implementation of the family planning programme in Indonesia for more than 25 years can be considered well developed. Thus, the information from Hatcher, et al., (1998) on use-effectiveness of different methods is applied in this chapter. We use: 0.94 for the pill, 0.992 for IUDs, 0.997 for injections, 0.860 for condoms, 0.999 for Norplants, 0.800 for abstinence, 0.700 for withdrawals and others, 1.000 for both male and female sterilisation (Hatcher, et al., 1998).

It should be noted, however, because the effectiveness of each method is assumed to be fixed, the index calculated here does not really describe changes in effectiveness; rather, it explains changes in the method mix. The index of contraception for Indonesia as a whole decreased from 0.48 in 1988-91 to 0.46 in 1991-94, implying that there had been relatively more women using more effective methods in 1994 than in 1991. The index had also been declining in all of the three regions, with Java-Bali having the smallest index, meaning that Java-Bali had the better contraceptive mix.

Table 6.10 presents the changes in the index of contraception among provinces in Indonesia from 1991 to 1994. In almost all provinces the index of contraception ($C_c$) decreased, except in Yogyakarta and Bali. A decrease in the index means more effective contraception. In this case it suggests that an increase in contraceptive prevalence experienced by almost all provinces were followed by more effective contraception. It is interesting to note that in Yogyakarta and Bali, contraceptive prevalence decreased from 1991 to 1994. Further a decrease in their prevalence was followed by lesser contraceptive use effectiveness among currently married women. Bali's contraceptive prevalence decreased from 71.9% in 1991 to 68.4% in 1994 (Central Bureau of Statistics 1992 and 1995) with relatively big decreases in IUD users and sterilised women, namely 3.7% decrease in IUD users and 2.5% decrease in sterilised women. These changes seem to confirm the increasing index of contraception in Bali. However, the changes in method mix from 1991 to 1994 did not clearly support this phenomenon in Yogyakarta. Although the overall contraceptive prevalence decrease from 71.3% in 1991 to 69.5% in 1994, but the percentage of modern contraceptive users in Yogyakarta increased from 57.0% to 59.7%, respectively.

Table 6.10 The Observed ($C_c$) and Expected ($C'_c$) Index of Contraceptive Use and Average Use-Effectiveness of Contraception by Region and Province: 1991 and 1994

| Region and Province | 1991 | | 1994 | | Average Use-effectiveness of Contraception | |
|---|---|---|---|---|---|---|
| | $C_c$ | $C'_c$ | $C_c$ | $C'_c$ | 1991 | 1994 |
| INDONESIA | 0.48 | 0.56 | 0.46 | 0.53 | 0.98 | 0.96 |
| Java-Bali | 0.45 | 0.53 | 0.42 | 0.50 | 0.98 | 0.97 |
| Outer Java-Bali I | 0.55 | 0.62 | 0.52 | 0.58 | 0.98 | 0.95 |
| Outer Java-Bali II | 0.56 | 0.63 | 0.54 | 0.60 | 0.98 | 0.95 |
| DKI Jakarta | 0.41 | 0.51 | 0.40 | 0.48 | 0.99 | 0.96 |
| West Java | 0.48 | 0.57 | 0.43 | 0.52 | 0.99 | 0.97 |
| Central Java | 0.46 | 0.54 | 0.42 | 0.50 | 0.97 | 0.97 |
| DI Yogyakarta | 0.27 | 0.38 | 0.28 | 0.37 | 0.97 | 0.94 |
| East Java | 0.44 | 0.53 | 0.42 | 0.50 | 0.98 | 0.96 |
| Bali | 0.25 | 0.37 | 0.26 | 0.37 | 0.99 | 0.98 |
| DI Aceh | 0.73 | 0.78 | 0.68 | 0.73 | 0.98 | 0.96 |
| North Sumatra | 0.64 | 0.69 | 0.57 | 0.62 | 0.97 | 0.94 |
| West Sumatra | 0.63 | 0.68 | 0.56 | 0.62 | 0.97 | 0.97 |
| South Sumatra | 0.56 | 0.63 | 0.48 | 0.55 | 0.98 | 0.96 |
| Lampung | 0.46 | 0.54 | 0.41 | 0.49 | 0.98 | 0.96 |
| West Nusa Tenggara | 0.63 | 0.69 | 0.54 | 0.60 | 0.99 | 0.97 |
| West Kalimantan | 0.58 | 0.64 | 0.51 | 0.57 | 0.97 | 0.96 |
| South Kalimantan | 0.51 | 0.59 | 0.46 | 0.52 | 0.98 | 0.94 |
| North Sulawesi | 0.29 | 0.41 | 0.26 | 0.37 | 0.99 | 0.97 |
| South Sulawesi | 0.66 | 0.71 | 0.60 | 0.64 | 0.98 | 0.93 |
| Riau | 0.67 | 0.71 | 0.58 | 0.64 | 0.97 | 0.95 |
| Jambi | 0.53 | 0.61 | 0.46 | 0.54 | 0.99 | 0.97 |
| Bengkulu | 0.45 | 0.53 | 0.37 | 0.46 | 0.97 | 0.97 |
| East Nusa Tenggara | 0.62 | 0.68 | 0.60 | 0.66 | 0.99 | 0.96 |
| East Timor | 0.81 | 0.84 | 0.75 | 0.79 | 0.98 | 0.97 |
| Central Kalimantan | 0.58 | 0.65 | 0.55 | 0.60 | 0.99 | 0.94 |
| East Kalimantan | 0.46 | 0.55 | 0.39 | 0.47 | 0.99 | 0.95 |
| Central Sulawesi | 0.53 | 0.61 | 0.47 | 0.54 | 0.99 | 0.96 |
| Southeast Sulawesi | 0.63 | 0.69 | 0.54 | 0.60 | 0.99 | 0.96 |
| Maluku | 0.62 | 0.68 | 0.59 | 0.65 | 0.96 | 0.97 |
| Irian Jaya | 0.80 | 0.83 | 0.70 | 0.72 | 0.98 | 0.90 |

Three provinces, which had decreased in prevalence from 1991 to 1994, were East Timor, East Nusa Tenggara and Maluku. However, their indexes of contraception went in the opposite direction to the expectation they should increase. The contraceptive mix between 1991 and 1994 in particular in Maluku and East Timor seemed like to confirm the more effective contraception although the prevalence in both provinces decreased. The percentage of currently married woman using any traditional method decreased from 6.6 in 1991 to 1.5 in 1994 for Maluku and from 4.7 in 1991 to 1.9 in 1994 for East Timor (Central Bureau of Statistics 1992 and 1995). This means that more currently married women used modern methods. With regard to modern methods, the percentage of currently married women taking the injections increased from 10.5% in 1991 to 14.4% in 1994 in East Timor and so did in Maluku. However, in East Nusa Tenggara it was not clear enough which methods resulted in increasing the index of contraception. Either modern or traditional methods decreased; among the modern methods injection users increased from 8.8% in 1991 to 13.8% in 1994. On the other hand, condom users also decreased from 0.2% to 0.0% in 1994 while the remaining modern methods decreased. From Table 6.10 it can be seen that provinces with a high prevalence have a low index of contraception. All provinces in Java-Bali have lower index of contraception than 0.5 and also have more than 50% of currently married women using contraception.

The adjustment for contraceptive effectiveness for the whole Indonesia results in a reduction in the deficit in both periods. This result indicates the contraceptive mix plays an important role in explaining the relatively low fertility in Indonesia as a whole. The same conclusion can be drawn for all three regions in both periods. Further, in 1991-94, the adjustment for contraceptive effectiveness had been able to completely eliminate the deficit in Outer Java-Bali I. In other words, the marriage pattern, breastfeeding behaviour, and contraceptive mix had been successful in completely explaining the deficit. Along with contraceptive prevalence, these three proximate determinants can perfectly explain the variation in TFR in Outer Java-Bali I in 1991-94.

Contraceptive effectiveness had also been able to partly explain the relatively low fertility in 21 out of the 26 provinces experiencing deficit fertility in 1988-1991. Interestingly, in the 7 out of the 21 provinces contraceptive effectiveness cannot partly explain the deficit in the period of 1991-94; but one province in which contraceptive effectiveness could not explain the deficit in 1988-1991 turned to be able to do so in 1991-94. In Bengkulu, the adjustment with the contraceptive effectiveness had increased excess fertility. Detailed description on the contribution of the adjustment for contraceptive effectiveness to the reduction in deficit or excess fertility is provided in Tables 6.2 - 6.6

## 6.6. Summary and Conclusion

Indonesia as a whole, Java-Bali, Outer Java-Bali I, Outer Java-Bali II and all provinces (except Bengkulu) experienced deficit fertility in both periods of 1988-1991 and 1991-1994. The observed TFR was lower than the expected TFR, which would have prevailed given their contraceptive prevalence rate if they had followed the TFR-contraceptive prevalence rate relationship in the 22 developing countries studied by Bongaarts and Kirmeyer (1983). The province of Bengkulu is an exception, it experienced excess fertility.

In this chapter, the proximate determinants of fertility are investigated using the method in Curtis and Diamond (1995). First, the expected TFR is adjusted for the lag-effect of contraceptive use. However, this adjustment does not help explaining the deficit in both periods for the whole of Indonesia or each of the three regions (Java-Bali, Outer Java-Bali I, and Outer Java-Bali II).

After adjusting the expected TFR, the next step is to adjust the observed TFR with the marriage pattern in the 22 developing countries. In 1991, there were more women married in Indonesia, Java-Bali, and Outside Java-Bali II compared to the 22 developing countries. Thus, by adjusting the marriage pattern, the observed TFR becomes smaller, and hence the deficit becomes larger, rather than smaller. In other words, the marriage pattern cannot help explain the deficit fertility in those regions in 1988-91. Outer Java-Bali I was the only region where marriage pattern can explain part of the deficit. A similar pattern is seen for the period of 1991-94, with Indonesia as a whole as the exception. In this period, there were relatively fewer Indonesian women married compared to the 22 developing countries. Adjusting to the experience in those developing countries, results in a higher observed TFR and hence the deficit becomes smaller. In conclusion, the marriage pattern can explain part of the fertility variation for Indonesia as whole and Outer Java-Bali I in 1991-94; but only for Outer Java-Bali I in 1988-91.

The marriage-pattern adjusted observed TFR is then further adjusted for the breastfeeding behaviour of the 22 developing countries. With this adjustment, the deficit declined in Indonesia as whole, Java-Bali, and Outer Java-Bali I for both periods. The deficit in Outer Java-Bali II increased in 1991-94 and decreased very little in 1988-91. In other words, breastfeeding behaviour can explain part of the fertility variation, except for Outer Java-Bali II

The last step is to adjust the breastfeeding and marriage adjusted observed TFR for the contraceptive effectiveness. Because use effectiveness is assumed to be constant across population and overtime, this adjustment is actually with respect to the contraceptive mix, rather than the use-effectiveness of the method. With this adjustment, the deficit declined in Indonesia as whole and in all regions in both periods. Further, the drop in the deficit was relative large compared the drop with the previous two adjustments to the observed TFR. Thus, contraceptive mix had been able to explain a relatively large part of the deficit--the relatively low fertility in Indonesia as a whole and in the three regions compared to the experience in the 22 developing countries.

Yet, it is only in Outer Java-Bali I that the three proximate determinants (marriage, breastfeeding, and contraceptive mix) can completely explain the deficit. In other regions and Indonesia as a whole there was still some deficit, which should be explained further. This residual could possibly be due to the effects of relative levels of fecundity, coital frequency, other proximate determinants of fertility and sampling and measurement errors (Bongaarts, 1984; Samosir 1995).

In all three regions, contraceptive effectiveness was the main factor causing the lower fertility rate than the expected rate. In addition to this factor, each region had another one or two other factors which can account for the deficit. In the Java-Bali region, where the family planning programme was initially implemented, longer durations of breastfeeding than expected, given contraceptive prevalence, accounted for the deficit fertility either in 1988-91 or 1991-94. Longer durations of breastfeeding and later marriage than expected were the two other factors that could explain the deficit fertility in Outer Java-Bali I in both periods. Unlike the two other regions, in Outer Java-Bali II contraceptive effectiveness was the only factor in 1988-91 while in 1991-94 apart from contraceptive effectiveness, a lower index of marriage than expected could explain the difference between the observed and expected fertility rates.

The determinants of deficit fertility varied among provinces. In some provinces at least one variable can explain deficit fertility, but in some others none variable can explain their deficit fertility such as in Lampung, East Kalimantan, North Sulawesi, and East Nusa Tenggara for period 1991-94. Longer durations of amenorrhea, latter marriage and more effective contraception than expected, altogether were more likely to account for deficit fertility in West Sumatra, West Nusa Tenggara, and East Kalimantan in 1988-91 and in South Sumatra, South Kalimantan and South Sulawesi in 1991-94. For 1988-91, only West Kalimantan and Yogyakarta had one factor, which can contribute to explaining the reducing deficit fertility, namely contraceptive effectiveness in West Kalimantan and the marriage pattern in Yogyakarta.

It is interesting to note that although marriage pattern and contraceptive effectiveness had effects on reducing the deficit fertility, the remaining deficit fertility in Irian Jaya and Aceh for the period of 1988-91 and in Irian Jaya and Central Kalimantan in 1991-94 was still very high (1.5 children per woman). Irian Jaya and Central Kalimantan had lower than 50% contraceptive prevalence (Irian Jaya had only around 20% of currently married women using contraception in 1988-91). Another of Bongaarts' proximate determinants of fertility which might have an important effect on reducing fertility is induced abortion (Bongaarts and Potter 1983). Unfortunately, published information on induced abortion was not readily available.

The deficit fertility varies across provinces either in 1988-91 or 1991-94. Irian Jaya had the largest deficit, 2.60, in 1988-91; and Central Kalimantan, 2.14, in 1991-94. The lowest deficit fertility was seen in East Timor (0.14) in 1988-1991 and North Sulawesi (0.04) in 1991-94. The small deficit in both provinces may imply that contraceptive use had played the dominant role in explaining fertility variation in both provinces, relative to the other 25 provinces in Indonesia.

Use effectiveness has been shown to be a more important variable in explaining fertility variation in Indonesia as a whole, some regions and some provinces in Indonesia. Therefore, the fertility impact of contraceptive use depends not only on its prevalence but also, and more importantly, on the use effectiveness. Nevertheless, the information on use effectiveness across provinces has not yet available from the actual data. Therefore, the following chapters focus to some aspects of contraceptive effectiveness, namely the contraceptive use dynamics, covering contraceptive discontinuation (and failure), contraceptive switching, and contraceptive choice.

# Chapter 7

# LIFE TABLE ANALYSIS OF CONTRACEPTIVE DISCONTINUATION IN INDONESIA

## 7.1 Introduction

This chapter studies contraceptive discontinuation of reversible contraceptive methods in the periods 1986-91 and 1989-94. Different methods of contraception might have different probabilities of discontinuation, and different groups of users may also have different probabilities of discontinuation. As family planning programme implementation may vary across provinces, provincial variations in levels of contraceptive discontinuation are also studied. So far, provincial levels of the discontinuation rate have not yet been studied.

The results presented in this chapter are based on single-decrement life tables. However, a multiple-decrement life table is used to estimate the probabilities of contraceptive discontinuation by reason. In order to study changes between the two periods, 1986-91 and 1989-94, an associated single-decrement life table is used.

Although East Timor has not been a province of Indonesia since 1998, estimates for East Timor are still presented because East Timor was still part of Indonesia during the data collection. Estimates for Indonesia include East Timor, but the difference between with and without East Timor was very low.*

The next section presents the overall rates and method-specific rates of contraceptive discontinuation. The discussion on socio-economic and provincial differential in the rates is carried out in Section 7.3 and reasons for discontinuation is presented in Section 7.4. Section 7.5

* East Timor contributed only 0.3% (1991, IDHS) and 0.2% (1994, IDHS) of the total sample in the analysis. Overall 12-month discontinuation rate with East Timor included was 28.61 % and 28.64% without East Timor in 1986-91. The rate for 1989-94 was 27.99% with and 28.01% without East Timor.

focuses on estimates of contraceptive failure rates as one of the reasons for dicontinuation. The analysis is carried out at both community and provincial level. Finally, to better understand the dynamics of contraceptive use in Indonesia, the remaining analyses are limited to Bali, instead of all the 27 provinces.

## 7.2 Overall Rate and Method-Specific Rates of Contraceptive Discontinuation

Besides using the conventional 12 or 24-month rates, Figure 7.1 presents changes in cumulative probabilities of discontinuation for all reversible contraceptive methods for 1986-91 and 1989-94. These probabilities were calculated using a single-decrement life table based on month-to-month information available for 60 months before the survey. Figures 7.2 and 7.3 present cumulative probabilities of discontinuation for each contraceptive method up to 24 months of use, respectively, for 1986-91 and 1989-94. Although the probability of discontinuation of contraceptive use in these figures are presented for 24 months of duration of use, the summaries, the 12-month and 24-month discontinuation rates, are also presented in Table 7.1.

Table 7.1. 12-month and 24-month Discontinuation Rate by Method of Contraception: Indonesia, 1986-91 and 1989-94

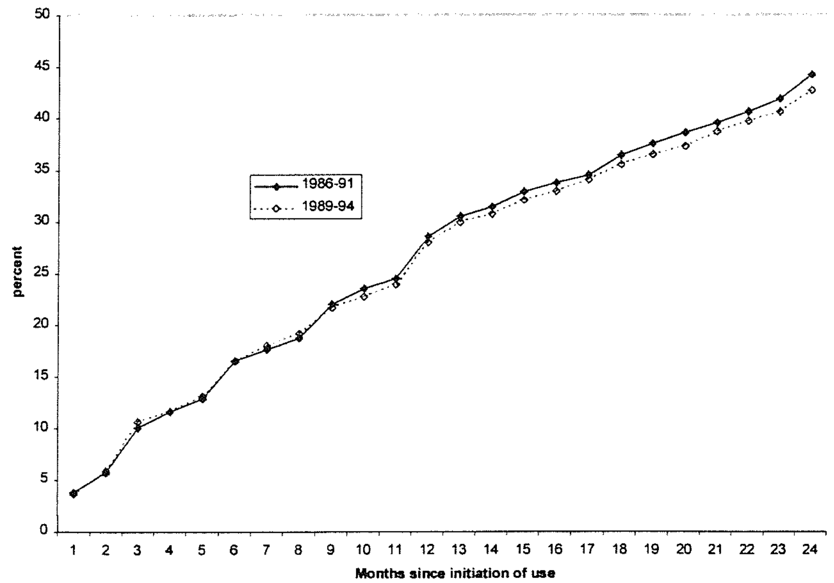
| Method | 12-month | | 24-month | |
|---|---|---|---|---|
| | 1986-91 | 1989-94 | 1986-91 | 1989-94 |
| Pill | 30.4 | 34.0 | 44.8 | 47.7 |
| IUD | 16.1 | 15.5 | 26.3 | 26.0 |
| Injectables | 33.3 | 29.3 | 54.3 | 48.2 |
| Norplant* | 3.6 | 4.5 | 8.0 | 9.0 |
| Condom | 51.8 | 52.0 | 69.5 | 62.8 |
| Abstinence | 39.2 | 33.2 | 54.7 | 54.6 |
| Withdrawal | 49.8 | 36.3 | 68.2 | 55.7 |
| Herbs | 25.7 | 39.1 | 46.6 | 59.5 |
| Other | 37.8 | 26.5 | 60.8 | 52.5 |
| | | | | |
| All reversible Methods | 28.6 | 28.0 | 44.3 | 42.8 |
| All methods | 28.0 | 27.3 | 43.3 | 41.6 |

Note: Norplant is a six-capsule nondegradable hormonal implant

Figure 7.1 shows that difficulties with contraception were more likely to occur within the first six months of adopting a reversible method of contraception, especially from the second to the third month and from the fifth to the sixth month. The efficacy of reversible methods of contraception tended to increase with duration of use because women became more experienced in employing a particular method and were also less likely to discontinue. For example, in the 1986-91 period, almost 30% of the users discontinued within the first year of initiation of use. On the other hand, about 11% of them discontinued within the second year of initiation of use.

There might be changes in the pattern of discontinuation over time as the percentage of current users increased from 49.7% in 1991 to 54.7% in 1994. On the other hand, TFR slightly decreased from 3.02 in 1988-91 to 2.85 in 1991-94. However, as shown in Figure 7.1, it is surprising that generally there is no appreciable changes in the probabilities of discontinuation between 1986-91 and 1989-94, especially for the first year of acceptance. Then, in the second year of use, the probabilities of discontinuation were likely to be slightly lower in the 1989-94 period than in the 1986-91 period.

Figure 7.1 Cumulative Probabilities of Discontinuation of All Reversible Methods: Indonesia, 1986-91 and 1989-94

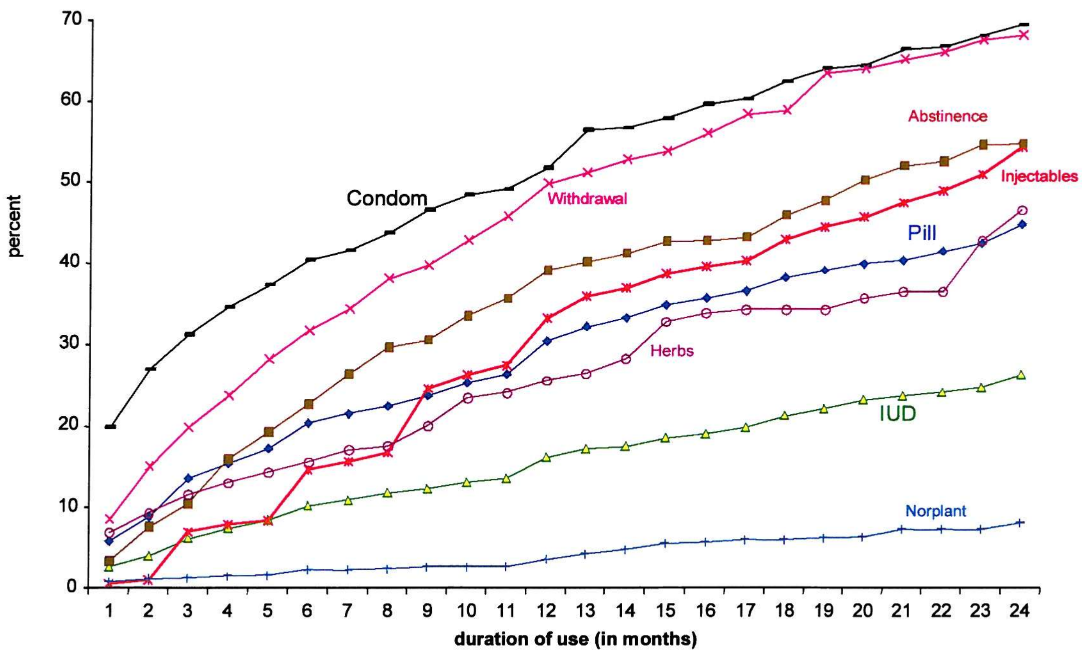



It can also be concluded from this figure that, on the average, the first year of initiation of use of the method seems to be a crucial time for giving acceptors intensive monitoring and counselling to cope with any problems which may arise. In the second year of use, they are likely to be able to maintain their use as they have adjusted to the use of the method. This supported by the fact that Figure 7.1 shows that discontinuation rate in the first year after initiation of use is almost 30% and in the second year the rate becomes 40%.

One might expect that discontinuation rates for modern methods would be lower than the rates of traditional methods (periodic abstinence, withdrawal, and herbs). The Norplant users were the most likely ones to continue use. The contrast between the continuation rate for Norplant and those for other methods was remarkable. At the 12th month from the 1986-1991 data, for instance, only 4% of the Norplant users discontinued, compared with almost 33% of injectables users, and more than 52% of condom users. The lowest discontinuation rate of the Norplant as found by Tuladar, Donaldson and Noble (1998) may be caused by a substantial proportion of users were not told that removal before five years was possible. This indicates that deficits occurred in the quality of service delivery of family planning.

Condom users had the highest discontinuation rate with just above 50% discontinuing within 12 months the rates were constant at about 50% from 1986-91 to 1989-94. Moreover, after 24 months of initiation of the use almost 70% of condom users discontinued in 1986-91 (Figure 7.2). However, fewer husbands (63%) discontinued using condom in 1989-94. Although the 12th month rates were the same, as seen in Figure 7.2 and Figure 7.3, it can be said that there was a genuine decrease in condom discontinuation rates from 1986-91 to 1989-94.

Figure 7.2 Variations in Patterns of Contraceptive Discontinuation Rates by Method: Indonesia, 1986-91

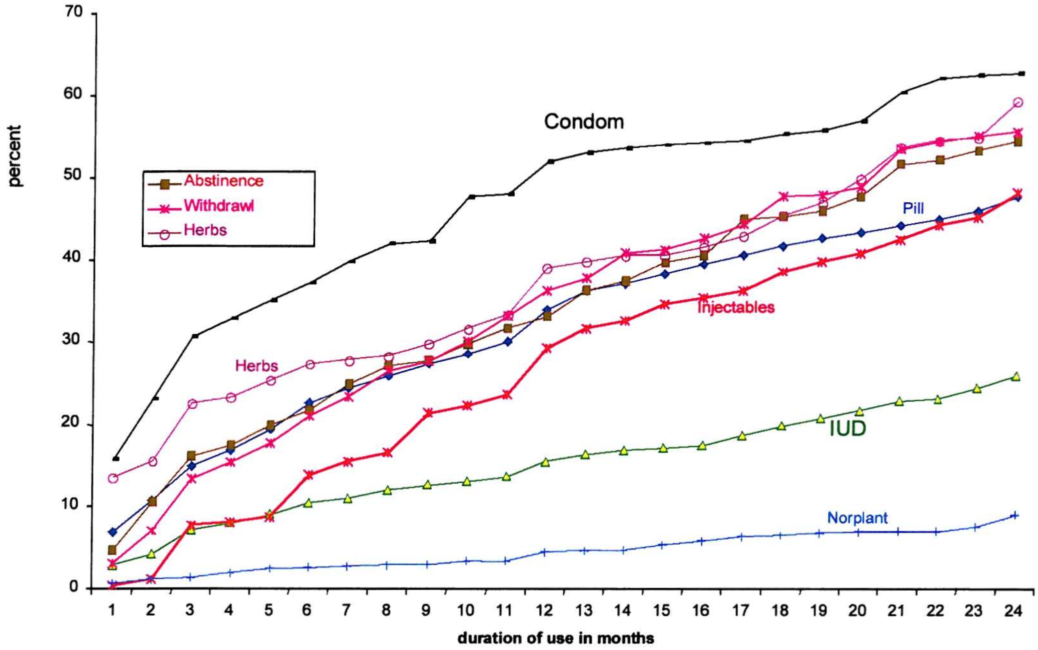


Compared with the IUD and Norplant, discontinuation rates of traditional methods were higher than those of both the IUD and Norplant, but lower than that of condoms, except for the herbs users in 1986-91. The herbs users, in particular in 1986-91, had a lower probability of discontinuation than that of pill users. In other words (as shown in Figure 7.2), traditional methods had quite similar rates of discontinuation as modern methods other than the two methods mentioned. For the two most popular contraceptive methods (pill and injectables), pill users is expected to discontinue earlier than injectables users. The pill must be daily consumed to keep its effectiveness. Thus, users must be seriously committed to choose and to use the pill.

This expectation is confirmed in that pill users were more likely to discontinue than the injectables users. In 12th month, either the pill and injectables users had relatively the same rates of discontinuation, that is around one third of the users discontinued. The changes from month to month for the injectables users were different from the changes among the pill users and even users of other contraceptive methods. Within the first six months the probability of discontinuation of injectables was much lower than the pill, but it was similar to the IUD. Furthermore, the pattern had a steep slope, which means that number of the injectables users who discontinued use increased quickly from month to month. This means that the timing to discontinue the use of injectables was behind that of the pill. This carries implications for monitoring of the two groups. Thus to reduce discontinuation of injectables depends on whether or not an early established relationship between the acceptors and providers occurred.

As women are expected to use a modern contraception, they continued using the modern, more effective method and they were less likely to switch to the traditional methods. On the contrary, those who used traditional methods were more likely to switch to the modern ones. Switching behaviour after discontinuation is presented in the Chapter 8. As can be compared from Figures 7.2 and 7.3, no changes happened to the IUD and Norplant in terms of discontinuation. The expectation was realized only by injectable and condom users, where the rates of contraceptive discontinuation were higher in 1986-91 than in 1989-94, and herbs users only had a significant increase over the same two periods. On the other hand, the level of discontinuation for the pill users slightly increased.

Figure 7.3 Variations in Patterns of Contraceptive Discontinuation Rates by Method: Indonesia, 1989-94




Withdrawal users had a remarkable decrease in discontinuation rates from 1986-91 to 1989-94. For example, within a year of initiation of use, the discontinuation rate decreased from almost 50% in 1986-91 to just above 30% in 1989-94, respectively. This means that Indonesian married women practising withdrawal as a means for controlling their fertility were likely to maintain this practice.

## 7.3 Differentials in Discontinuation Rates

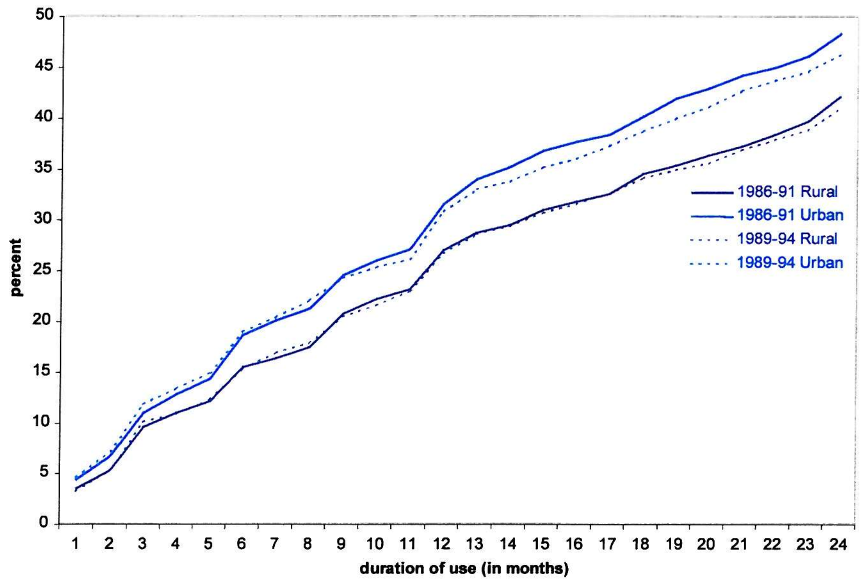
### 7.3.1 Differentials by Socio-economic Variables

Rates of contraceptive discontinuation can be expected to vary by the socio-economic characteristics of the users. A number of studies have confirmed that users characteristics such as education, place of residence, age, parity, and marital status influence the discontinuation of contraceptive use (Hammerslough, 1984; Grady, Hayward and Florey, 1988; Pariani, Heer and Arsdol, 1991; Bracher and Santow, 1992; Ali and Cleland, 1995; Steele, Diamond and Wang, 1996). This section studies contraceptive discontinuation rates among women who live in different areas (urban and rural areas) and region; among different levels of education of both the women and their husband; and among different women's age at the start of the use of contraception. These figures are presented in Figures 7.4 - 7.8.

Availability of and accessibility to family planning services are often given as the factors, which can influence use and also sustainability of the users. It is argued that users in rural areas might be expected to discontinue use of contraception more frequently because they have less access to a regular supply of their contraceptive method or to information on how to use a particular method correctly. The role of method choice complicates the differentials in contraceptive discontinuation by characteristics of the users. However, Moreno (1993) found that contraceptive practice varied considerably by place of residence among 15 developing countries, including Indonesia. In all 15 countries, the percentage of women who used a contraceptive method was higher in urban areas than in rural areas.

The result of this analysis, in Figure 7.4, shows that the contraceptive discontinuation rate of urban users for 12 months use were higher than that of the rural users. For example, in 1986-91, 27% rural users discontinued within 12 months since initiation of use, while for the urban users the rate was around 32%. A possible explanation for this phenomena is related to the fact that the urban users were more educated than rural users, (more than 40% urban users have completed secondary school and above while the rural users were just around 13% (figures not shown)). Educated women tend to marry later, and they use contraception as a means to space births.

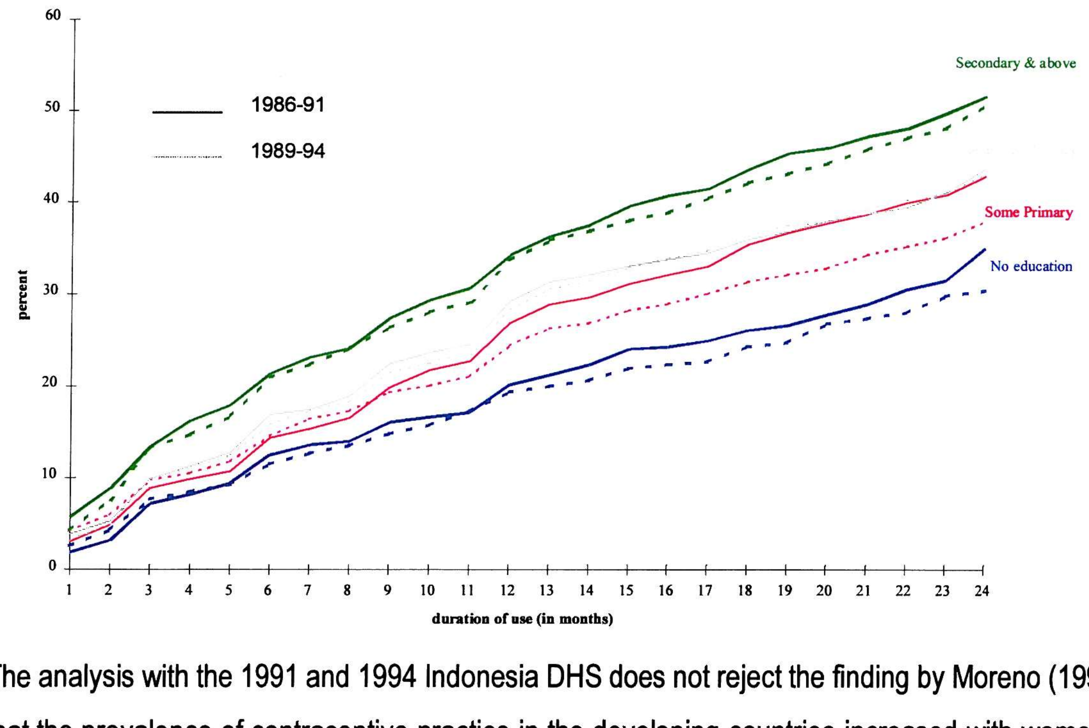
**Figure 7.4 Cumulative Probabilities of Contraceptive Discontinuation by Place of Residence: Indonesia, 1986-91 and 1989-94**



Another reason is related to implementation of the programme across areas in which in rural areas the users are more likely than those are in urban areas to be monitored intensively by the family planning workers.

Based on severity of the regional population problem and advancement of regional infrastructure, the implementation of the family planning programme was divided into three different regions. There were regional differentials in terms of the percentage of contraceptive users. Java-Bali, as expected, had the highest percentage of couples who are using contraception. Java-Bali was followed by Outer Java-Bali I and Outer Java-Bali II. However, in terms of discontinuation of contraceptive use, regional differentials did not appear in 1989-94, although it existed in the 1986-1991 period (Table 7.2). Users in Outer Java-Bali II were more likely to discontinue after a year of use. This led to the highest discontinuation rate after one year of use among the three regions. Over the two periods, discontinuation rate in Java-Bali and Outer Java-Bali II decreased. On the other hand, discontinuation rates in Outer Java-Bali I increased, for example, after one year of use about 26% of users discontinued and the rate increased to 28% in 1989-94.

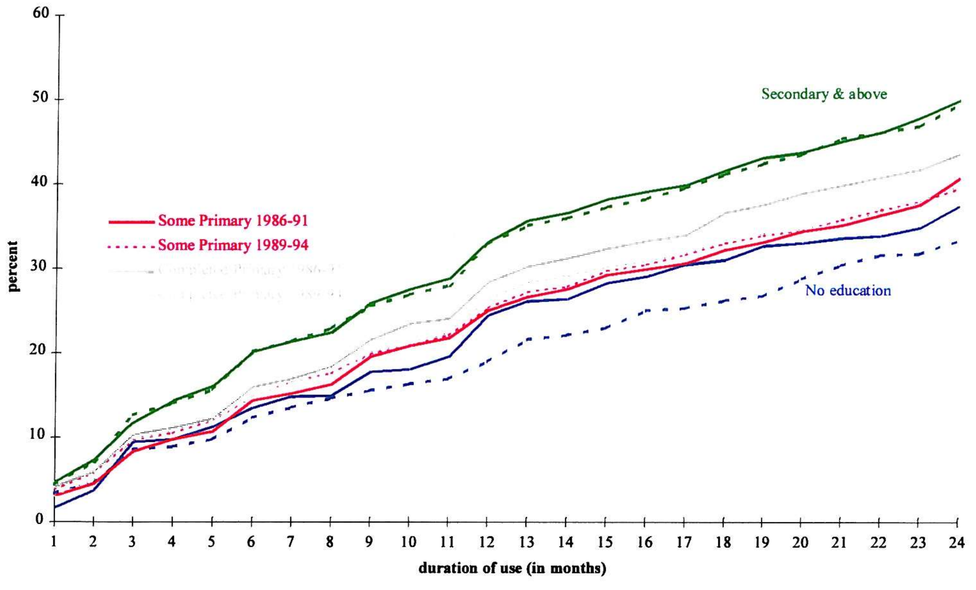
**Figure 7.5 Cumulative Probabilities of Contraceptive Discontinuation: by Woman's Education: Indonesia, 1986-91 and 1989-94**




The analysis with the 1991 and 1994 Indonesia DHS does not reject the finding by Moreno (1995) that the prevalence of contraceptive practice in the developing countries increased with women's level of education. As shown in Figure 7.5, it also shows that the higher education of the woman the higher was the probability of discontinuation. This figure also shows that since the first month initiation of use of contraception the women who had completed at least secondary school were the most likely to discontinue the method. In the following months the probability of those who discontinued rose up quickly. Therefore, after using contraception for two years, half of thewomen were still using the same method of contraception. In contrast to the highest level of education, the uneducated women were less likely to discontinue use of contraception. The gap in the probability of contraceptive discontinuation between the two extreme levels of women's education was getting wider as the duration of use increased.

For instance, in 1989-1994 after 12 months of use, probability of discontinuation was 19% for uneducated users and 34% among secondary and above users. The gap increases as the duration of contraceptive use increases. After 24 months since initiation of use, the probability was 31% among the uneducated and 53% among secondary and above. With regard to changes from 1986-91 to 1989-94, the probabilities of discontinuation decreased in each level of education, except for the group of woman who completed primary school. The greatest decline in the probability is observed among those who had not finished primary education.

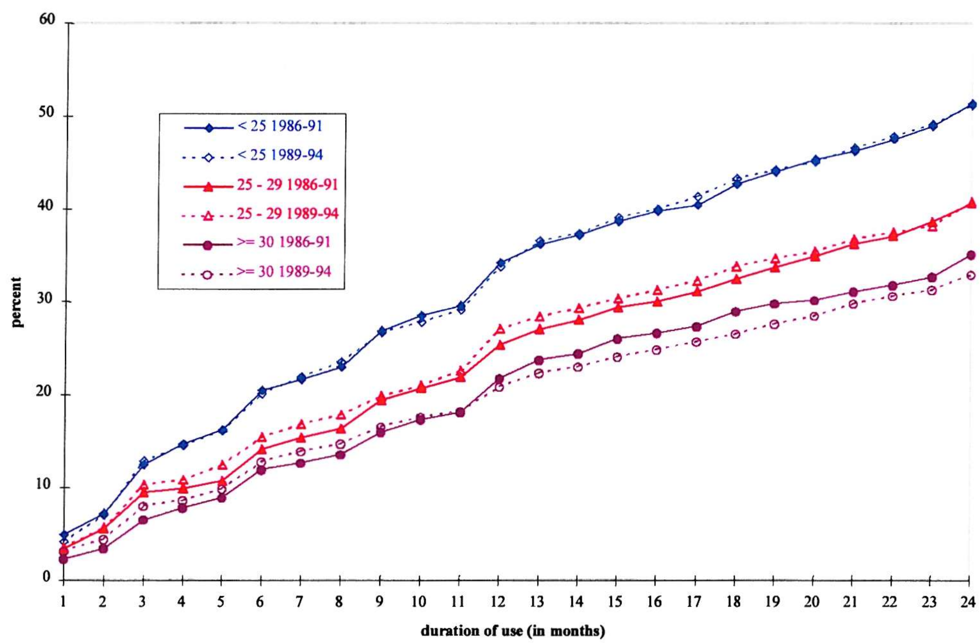
**Figure 7.6 Cumulative Probability of Contraceptive Discontinuation by Husband's Education: Indonesia, 1986-91 and 1989-94**




Contraceptive discontinuation would be expected to vary by husband's level of education. If we look at husband's level of education the same relationship appears. The women marrying a more educated husband were more likely than those marrying a lower educated husband to discontinue use. This relationship can be observed from the Figure 7.6 or from Table 7.2 that presents 12-month and 24-month cumulative probabilities of discontinuation. A quite substantial decrease in the probability of discontinuation from 1986-91 to 1989-94 appeared among women whose husband was uneducated or completed primary school. For example, the former group 24-month cumulative probability of discontinuation was 37% in 1986-91 decreased to 33% in 1989-94 while for the latter group it decreased from 44% to 40% respectively.

Women's age at the start of use of contraception might be expected to have a strong effect on the propensity to discontinue. Figure 7.7 shows a negative association between age and discontinuation rate; that is, the older the women the less likely they were to discontinue using contraceptive. This variable is used as a proxy to measure the impact of fecundity on the likelihood of contraceptive discontinuation. Fecundity is known to decline with age. Lower fecundity implies a lower probability to have a baby. Older users will be no longer in need for contraception any more. They will be more likely to discontinue use of contraception due to that reason. On the other hand, woman's age is one reason underlying a decision to limit the number of children. Thus, older women have strong motivation to maintain their use of contraception.

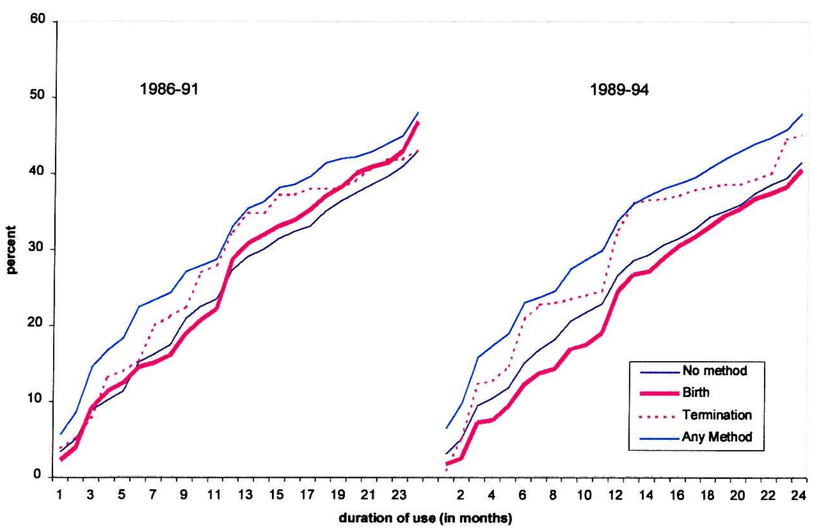
**Figure 7.7 Cumulative Probabilities of Contraceptive Discontinuation by Women's Age at Start of Use: Indonesia 1986-91 and 1989-94**



Age at the start of use is categorised into three groups, i.e. less than 25, 25 to 29, and older than 30 years old. It can be seen from Figure 7.7 that the age at the start of use was strongly and consistently negatively associated with the probability of discontinuation. For the women aged less than 25 years old, the cumulative probability to discontinue use after one year of initiation of use was around 34% in 1986-1991, then after two years, half of them already discontinued. The same rates were also observed in 1989-1994. On the other hand, among women aged 25-29 years were slightly more likely to discontinue using contraception with 25% discontinuing in 1986-1991 and 27% in 1989-1994 after one year of acceptance of the methods. Again, no genuine changes in the discontinuation rates were observed between 1986-91 and 1989-94, as the rates were the same after two years of acceptance. However, the older women age 30 years and above around 20% of them discontinued within a year and 30% did so within two years. The rates slightly decreased from 1986-91 to 1989-94.

As shown in Figure 7.8, women who had experienced using any contraceptive method were more likely to discontinue than other women. This may indicate that experience users were willing to try in using contraception. This may also indicate that they were looking for a contraceptive method that suited their needs. However, this might also indicate dissatisfaction with the method being used. Women who just delivered a baby were least likely to discontinue. This is clear from the situation in 1989-94. As expected, recent mothers might have stronger motivation to avoid another baby when they started using contraception than women. As can be seen from Table

**Figure 7.8 Cumulative Probabilities of Contraceptive Discontinuation by Previous Experience in the Month Immediately before Use of Contraception: Indonesia, 1986-92 and 1989-94**



7.2, among women who had just delivered a baby about 24.5% discontinued within a year of use. For women who had used any contraceptive method, about 33.9% discontinued.

Table 7.2. 12- month and 24-month Cumulative Percentages of Contraceptive Discontinuation by Background Variable: Indonesia, 1986-91 and 1989-94

| Characteristics | All reversible methods | | | | All methods | | | |
|---|---|---|---|---|---|---|---|---|
| | 12-month | | 24-month | | 12-month | | 24-month | |
| | 1986-91 | 1989-94 | 1986-91 | 1989-94 | 1986-91 | 1989-94 | 1986-91 | 1989-94 |
| **Place of residence** | | | | | | | | |
| Rural | 27.1 | 26.7 | 42.2 | 41.1 | 26.5 | 26.1 | 41.3 | 40.1 |
| Urban | 31.6 | 30.8 | 48.4 | 46.4 | 30.8 | 29.8 | 47.2 | 44.7 |
| **Woman's education** | | | | | | | | |
| No education | 20.1 | 19.3 | 35.0 | 31.4 | 19.4 | 18.7 | 33.8 | 29.4 |
| Some Primary | 26.8 | 24.4 | 42.8 | 40.1 | 26.3 | 23.7 | 42.0 | 36.7 |
| Completed Primary | 29.3 | 28.3 | 43.7 | 44.3 | 28.7 | 27.6 | 42.9 | 42.1 |
| Completed Secondary | 34.2 | 33.7 | 51.6 | 53.0 | 33.4 | 32.9 | 50.4 | 49.4 |
| **Husband's education** | | | | | | | | |
| No education | 24.4 | 19.0 | 37.4 | 33.3 | 24.0 | 18.3 | 36.7 | 32.1 |
| Some Primary | 25.0 | 25.3 | 40.7 | 39.5 | 24.6 | 24.8 | 39.9 | 38.6 |
| Completed Primary | 28.4 | 26.4 | 43.6 | 39.8 | 27.8 | 25.7 | 42.7 | 38.8 |
| Completed Secondary | 33.1 | 32.9 | 49.9 | 49.6 | 32.4 | 32.0 | 48.7 | 48.1 |
| **Region** | | | | | | | | |
| Java-Bali | 29.3 | 27.9 | 45.0 | 42.1 | 28.6 | 27.1 | 44.0 | 40.9 |
| Outer Java-Bali I | 25.9 | 27.9 | 41.2 | 44.6 | 25.3 | 27.3 | 40.3 | 43.6 |
| Outer Java-Bali II | 29.9 | 28.6 | 45.9 | 42.7 | 29.3 | 28.1 | 45.1 | 41.9 |
| **Age at the start of use** | | | | | | | | |
| < 25 | 34.2 | 33.8 | 51.3 | 51.2 | 33.9 | 33.7 | 51.0 | 51.0 |
| 25 – 29 | 25.4 | 27.1 | 40.6 | 40.8 | 24.9 | 26.5 | 39.8 | 39.9 |
| >= 30 | 21.8 | 20.9 | 35.2 | 32.9 | 20.8 | 19.6 | 33.5 | 30.8 |
| **Previous experience** | | | | | | | | |
| No method | 27.3 | 26. 7 | 43.0 | 41.5 | 27.0 | 26.3 | 42.5 | 40.9 |
| Birth | 28.8 | 24.5 | 46.8 | 40.5 | 25.7 | 22.5 | 41.7 | 37.3 |
| Termination | 32.3 | 32.6 | 43.0 | 45.0 | 29.7 | 28.5 | 39.9 | 39.1 |
| Any Method | 33.1 | 33.9 | 48.1 | 47.9 | 32.4 | 33.0 | 47.0 | 46.6 |

## 7.3.2 Variation in Contraceptive Discontinuation among Provinces

As in the implementation of family planning, urban-rural differential is also found on the behaviour of contraceptive discontinuation. However, the differential in discontinuation among Java-Bali and Outer Java-Bali was not as much as in the urban-rural differential. Indonesia consisted of 27 provinces before 1999. The provinces had different stages of development in general and in development of family planning in particular. The family planning program has been implemented for more than 30 years by the government. Dramatic increases in some provinces have been observed in the use of modern contraceptive methods. The nature and strength of the family planning efforts vary also from province to province although Indonesia, in general, is rated as having a very strong family planning program effort (Ross and Mauldin, 1996). It is, therefore, of interest to assess how provincial rates of contraceptive discontinuation varied and how diverse patterns of contraceptive use discontinuation may suggest program improvement.

For such a long period of implementation of the family planning programme, there had not been any representative measure of contraceptive discontinuation at provincial level. However, since the Demographic and Health Survey started collecting data for measuring contraceptive discontinuation rate. They collect information on contraceptive history retrospectively during five years before the survey. The objective of this section, therefore, is to obtain life table estimates of contraceptive discontinuation in each province, and also to examine whether the rate changed from 1986-91 to 1989-94. This section might shed light on the quality and success of family planning services.

The results are summarized in Table 7.3, which shows 12-month and 24-month discontinuation rates of all reversible methods combined for all provinces in 1986-91 and 1989-94, and also the weighted number of segments of use on which the analyses were based. The number of segments of contraceptive use included in the life table calculations ranged from 33 (East Timor) to 3,047 in (West Java) in 1986-91 and from 31 (East Timor) to 3,855 (West Java) in 1989-94. Because life-table estimates based on smaller numbers would be unreliable, it is set a lower limit of 125 segments as suggested by Curtis and Hammerslough (1995) though Ali and Cleland (1995) set a lower limit of 100 segments. When a province did not provide enough segments of use to reach this threshold, the estimation is calculated based on the unweighted number of segments. Seven out of ten provinces in Outer Java-Bali II did not reach this threshold while, all remaining provinces provided enough segments of use. Table 7.4, like Table 7.3, presents the same information but Table 7.4 included sterilised users. From both tables, most estimates based on weighted and unweighted number of segments are nearly the same, although the difference appears on the decimal digits only, except in Southeast Sulawesi and Irian Jaya in 1989-94.

Examined from the extent to which the users discontinue use of a reversible method within one year of use for the period 1986-91, as expected, discontinuation rates varied across provinces.

Table 7.3 12-month and 24-month Discontinuation Rate (Percentages) of All Reversible Methods Combined and Weighted Number of Segments of Use by Province: 1986-91 and 1989-94

| Province | 12-month | | 24-month | | Weighted Number of segments of use | |
|---|---|---|---|---|---|---|
| | 1986-91 | 1989-94 | 1986-91 | 1989-94 | 1986-91 | 1989-94 |
| Jakarta | 27.3 | 26.5 | 45.7 | 43.2 | 596 | 683 |
| West Java | 32.6 | 31.6 | 48.5 | 46.9 | 3047 | 3855 |
| Central Java | 23.7 | 23.0 | 41.2 | 36.3 | 1761 | 2458 |
| Yogyakarta | 34.2 | 28.7 | 48.9 | 43.3 | 234 | 274 |
| East Java | 29.8 | 27.8 | 43.9 | 40.4 | 2641 | 2751 |
| Bali | 19.3 | 24.9 | 31.5 | 39.1 | 149 | 198 |
| Aceh | 35.6 | 36.2 | 54.8 | 50.7 | 149 | 209 |
| North Sumatra | 29.2 | 30.6 | 42.5 | 53.0 | 421 | 775 |
| West Sumatra | 34.8 | 34.6 | 49.5 | 51.0 | 252 | 284 |
| South Sumatra | 21.0 | 19.1 | 37.3 | 33.4 | 396 | 472 |
| Lampung | 21.9 | 23.4 | 36.0 | 37.3 | 395 | 492 |
| West Nusa Tenggara | 23.1 | 23.6 | 36.8 | 39.9 | 158 | 276 |
| West Kalimantan | 29.1 | 30.9 | 43.3 | 47.6 | 217 | 329 |
| South Kalimantan | 20.5 | 26.1 | 37.8 | 42.1 | 170 | 228 |
| North Sulawesi | 24.3 | 27.9 | 44.8 | 43.6 | 157 | 258 |
| South Sulawesi | 23.7 | 31.4 | 38.7 | 46.7 | 289 | 454 |
| Riau | 37.6 | 33.8 | 53.6 | 49.4 | 272 | 281 |
| Jambi | 39.4 | 21.2 | 53.5 | 33.6 | 187 | 186 |
| Bengkulu | 33.5 | 37.5 | 47.9 | 52.7 | 100 | 150 |
| | 33.6* | | 48.0* | | 277* | |
| East Nusa Tenggara | 11.0 | 24.8 | 31.0 | 40.5 | 140 | 173 |
| East Timor | 19.4 | 19.4 | 51.4 | 37.6 | 33 | 31 |
| | 19.3* | 19.7* | 51.4* | 37.0* | 161* | 246* |
| Central Kalimantan | 20.2 | 17.4 | 34.3 | 26.6 | 87 | 95 |
| | 20.1* | 17.2* | 34.5* | 27.9* | 206* | 331* |
| East Kalimantan | 32.4 | 34.4 | 46.6 | 49.2 | 171 | 232 |
| Central Sulawesi | 24.9 | 27.5 | 38.8 | 37.5 | 104 | 122 |
| | 24.9* | 27.8* | 38.8* | 37.0* | 221* | 398* |
| Southeast Sulawesi | 32.0 | 26.8 | 43.5 | 43.9 | 72 | 93 |
| | 32.1* | 28.6* | 43.6* | 44.6* | 189* | 388* |
| Maluku | 32.2 | 27.0 | 51.5 | 40.3 | 123 | 94 |
| | 32.4* | 27.5* | 51.8* | 40.8* | 267* | 325* |
| Irian Jaya | 15.6 | 25.3 | 33.6 | 38.7 | 46 | 93 |
| | 15.7* | 26.8* | 33.8* | 41.4* | 102* | 321* |

Note : * the rates were calculated based on unweighted number of segments of use

Table 7.4 12-month and 24-month Discontinuation Rate (Percentages) of All Methods Combined and Weighted Number of Segments of Use by Province: 1986-91 and 1989-94

| Province | 12-month | | 24-month | | Weighted Number of segments of use | |
|---|---|---|---|---|---|---|
| | 1986-91 | 1989-94 | 1986-91 | 1989-94 | 1986-91 | 1989-94 |
| Jakarta | 26.5 | 26.0 | 44.3 | 42.4 | 613 | 697 |
| West Java | 32.1 | 30.9 | 47.7 | 45.8 | 3097 | 3930 |
| Central Java | 23.1 | 22.1 | 40.1 | 34.8 | 1819 | 2549 |
| Yogyakarta | 33.4 | 28.3 | 47.8 | 42.6 | 240 | 279 |
| East Java | 29.2 | 26.9 | 43.0 | 39.2 | 2699 | 2838 |
| Bali | 18.2 | 23.9 | 29.6 | 37.5 | 157 | 207 |
| Aceh | 35.2 | 35.8 | 54.1 | 50.1 | 150 | 212 |
| North Sumatra | 27.8 | 29.1 | 40.6 | 50.3 | 446 | 814 |
| West Sumatra | 34.3 | 33.8 | 48.8 | 49.9 | 256 | 290 |
| South Sumatra | 20.3 | 18.5 | 36.1 | 32.2 | 411 | 488 |
| Lampung | 21.6 | 23.2 | 35.6 | 36.9 | 401 | 502 |
| West Nusa Tenggara | 23.0 | 23.5 | 36.7 | 39.8 | 159 | 278 |
| West Kalimantan | 28.9 | 30.4 | 43.0 | 46.8 | 219 | 334 |
| South Kalimantan | 19.7 | 25.3 | 36.3 | 41.0 | 176 | 234 |
| North Sulawesi | 24.2 | 27.6 | 44.6 | 43.1 | 159 | 261 |
| South Sulawesi | 23.1 | 31.0 | 37.7 | 46.2 | 297 | 460 |
| Riau | 37.4 | 33.3 | 53.3 | 48.7 | 274 | 285 |
| Jambi | 38.9 | 21.2 | 52.9 | 33.5 | 190 | 187 |
| Bengkulu | 33.2 | 36.7 | 47.6 | 51.7 | 100 | 153 |
| | 33.3* | | 47.6* | | 279* | |
| East Nusa Tenggara | 10.3 | 23.9 | 28.7 | 39.1 | 149 | 180 |
| East Timor | 19.3 | 19.3 | 51.3 | 37.4 | 33 | 31 |
| | 19.2* | 19.6* | 51.3* | 36.8* | 162* | 247* |
| Central Kalimantan | 20.2 | 17.4 | 34.3 | 26.5 | 87 | 96 |
| | 20.1* | 17.2* | .34.5* | 27.8* | 206* | 332* |
| East Kalimantan | 31.9 | 33.7 | 45.9 | 48.1 | 173 | 238 |
| Central Sulawesi | 24.2 | 27.1 | 37.7 | 37.0 | 107 | 124 |
| | 24.2* | 27.3* | 37.8* | 36.4* | 227* | 404* |
| Southeast Sulawesi | 31.6 | 26.0 | 42.9 | 42.6 | 73 | 96 |
| | 31.6* | 28.1* | 42.9* | 43.7* | 191* | 395* |
| Maluku | 31.8 | 26.5 | 51.0 | 39.6 | 125 | 96 |
| | | 27.0* | | 40.1* | | 332* |
| Irian Jaya | 15.1 | 24.6 | 32.9 | 37.8 | 48 | 95 |
| | 15.1* | 26.1* | 33.0* | 40.4* | 106* | 330* |

Note : * Rates were calculated based on unweighted number of segments of use

As shown in Table 7.3 the discontinuation rate within a year of use ranked from 11.0% (East Nusa Tenggara) to about 39.4% (Jambi) for all reversible methods combined. By taking into account of the impact of sterilized users on discontinuation rates (Table 7.4) the rate varied from

10.3% for East Nusa Tenggara to 38.9% for Jambi. In 1989-94, first-year discontinuation rates for all reversible methods varied from about 17.2% (Central Kalimantan) to 37.5% (Bengkulu). In general, the difference between discontinuation rate with and without considering sterilised users was very low.

East Nusa Tenggara and Jambi have also different timing of discontinuation as shown in Figures 7.9 and 7.10. In East Nusa Tenggara, more users discontinued in the second year of use instead of in the first year of use for 1986-91, but it was not the case for 1989-94. On the other hand, the majority of contraceptive users in Jambi discontinued in the first year rather than in the second year in both periods.

Figure 7.9 Trends in Cumulative Probabilities of Discontinuation of All Reversible Contraceptives: East Nusa Tenggara, 1986-91 and 1989-94

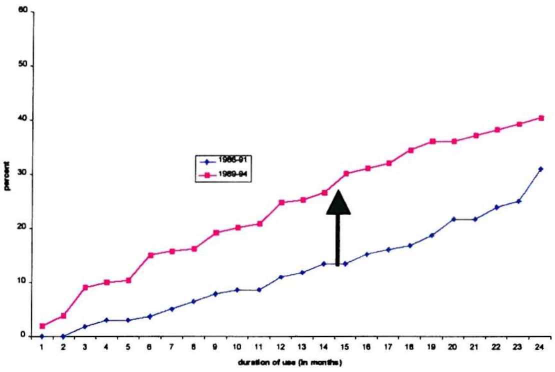
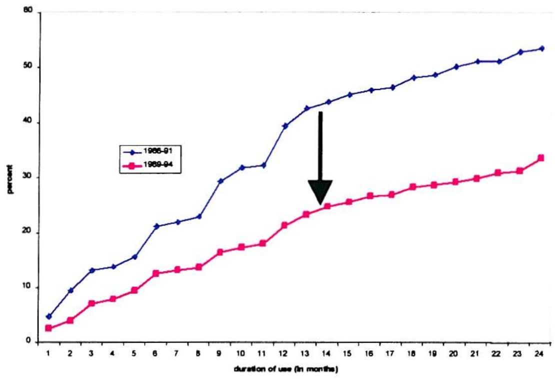



Figure 7.10 Trends in Cumulative Probabilities of Discontinuation of All Reversible Contraceptives: Jambi, 1986-91 and 1989-94




These two provinces also had the biggest change in level of discontinuation over time in which East Nusa Tenggara's level of discontinuation had an upward shift from 1986-91 to 1989-94 (shown in Figure 7.9). Discontinuation within a year increased from 11.0% to 24.8%, respectively. In contrast, Jambi's level had a downward shift. In Jambi, the discontinuation rate within a year of use dropped to 21.2% from about 39.4%.

With regard to the changes in level and pattern of contraceptive discontinuation for all reversible method combined between the two periods, provinces can be grouped into three categories. The first group is nine provinces that experienced an increase. This group is namely Bali, East Nusa Tenggara, three out of four provinces in Sulawesi (South Sulawesi, Central Sulawesi, North Sulawesi), South Kalimantan, Irian Jaya, and two provinces in Sumatra (Bengkulu and North Sumatra). The changes in six provinces (Bali, East Nusa Tenggara, South Sulawesi, South Kalimantan, Bengkulu, and Irian Jaya) had an upward shift like the one shown in Figure 7.9 while others changed in timing, but did not shift very much the pattern. For example, in Central

Sulawesi and North Sulawesi the rates of discontinuation at the 24th month were similar, but the rates increased in each month of use especially in the first year of use. All these changes in each province are presented in graphs in Appendix A-2.

The second group is seven provinces that experiencing a decrease in contraceptive discontinuation between 1986-91 and 1989-94. Namely, Yogyakarta, East Java, Riau, Jambi, South Sumatra, Central Kalimantan, and Maluku. As mentioned before the biggest decrease was Jambi followed by Maluku especially a decrease after one year of use. Yogyakarta's pattern shows that a decrease happened in each duration of use. Figures can be seen in Appendix A-3.

The third group is 11 provinces, which have unclear changes between the two periods. In general they experienced little change, and some were relatively stable in pattern. Namely, Jakarta, West Java, Central Java, Aceh, West Sumatra, Lampung, East Timor, West Nusa Tenggara, West Kalimantan, East Kalimantan, and Southeast Sulawesi. The graphs are in Appendix A-4. It should be noted that the number of provinces in each group might be different if it is based on the grouping on a particular duration of use, for instance, 12-month discontinuation rate presented in Table 7.3. Instead it is used criteria for categorization from graphical presentation.

Such a presentation has an advantage in identifying timing of discontinuation, in which month users are more or less likely to discontinue. Let we look at figures for Bali and East Nusa Tenggara in Appendix A-2. Both provinces had similar rates of discontinuation at 12th month and 24th month of initiation. These rates were about 31% and 40%, respectively, in 1986-91 and 1989-94. However, both had different timing of discontinuation. In Bali for 1986-91, users were more likely to discontinue early while in East Nusa Tenggara they were more likely to discontinue later, at least after one year of use. However, in 1989-94, East Nusa Tenggara had a different pattern. Even in the very early use of contraception more users discontinued. However, without knowing what reasons the users discontinue, the providers cannot really give them help or counselling. Therefore, in Section 7.4.3 it is presented reasons for discontinuation.

Another example is in North Sumatra compared to Bengkulu in 1989-94. After two years using contraceptive methods, both provinces had discontinuation rates of about 52%. Again they had different timing of discontinuation. In Bengkulu users discontinued in the early months of use, for instance, about 20% discontinued use of contraception by the third month. This was about twice the rate of North Sumatra for the same duration of use. Many users in North Sumatra discontinued after one year in 1989-94 than in 1986-91. What are the reasons for North Sumatran's users to discontinue later, did they discontinue because they want to have a baby? We will discuss this issue later in Section 7.4.3.

The relationship between the total fertility rate (TFR) and the contraceptive prevalence rate has been investigated by researchers (Bongaarts and Kirmeyer, 1982; Bongaarts, 1984; Mauldin and Ross, 1992). Bongaarts and Kirmeyer (1982) investigated the relationship by using data from 22 developing countries, which in fact they have different strength of programme effort and also different timing of implementation of the family planning programme. Their results reveal that there is a strong negative correlation between the total fertility rate and the contraceptive prevalence rate. This regression equation is often used for examining whether the actual total fertility rate for a particular country is higher or lower than the expected rate derived from this equation. Bongaarts and Kirmeyer's regression line has also been used by researchers to examine proximate determinants of fertility as deviations from the regression line are due to partly to variations in the other proximate determinants and party to measurement errors. For example, Curtis and Diamond (1995) used the regression line to evaluate the contribution of different factors to excess fertility in Northeast Brazil, and also Samosir (1994) examine factors of lower fertility than expected in Indonesia.

By using within country estimates on contraceptive prevalence at provincial level in Indonesia, the negative correlation is seen in Figures 7.11 and 7.12. Figure 7.11 plots the total fertility rate and the prevalence of contraceptive practice for 27 provinces derived from the 1991 Indonesia Demographic and Health Survey (DHS) while Figure 7.12 refers to the 1994 Indonesia DHS. They show provinces with a low percentage of married women of reproductive age that practice contraception might have a low total fertility rate. Therefore, the negative relationship between TFR and contraceptive prevalence exists within Indonesia. However, the demographic impact of contraceptive use depends not only on its prevalence but also on the duration and effectiveness of use (Curtis and Blanc, 1997). Therefore, we try to examine whether there is a substantial association between contraceptive use prevalence and contraceptive discontinuation rate, or between contraceptive discontinuation rate and total fertility rate (TFR). This examination was done by using the aggregate data at provincial level as presented in Table 7.4. When we plot provincial estimates of contraceptive discontinuation and contraceptive use prevalence (the plots not shown), we expect that a province with a low discontinuation rate may have a low contraceptive prevalence rate. However, we found that there is no clear relationship between them at all.

Figure 7.11. Scatterplot between Contraceptive Prevalence and Total Fertility Rate at Provincial Level: 1991 Indonesia DHS

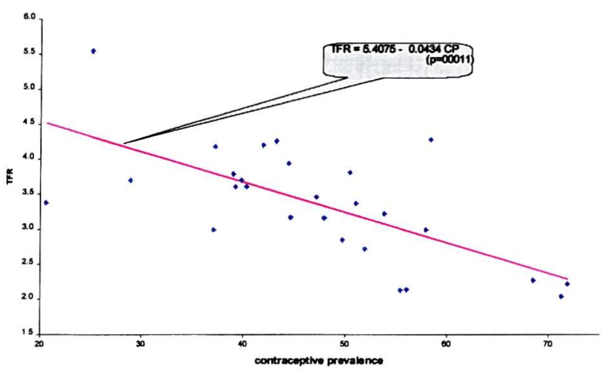
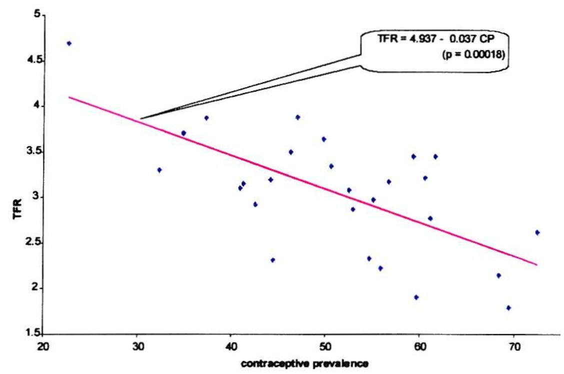


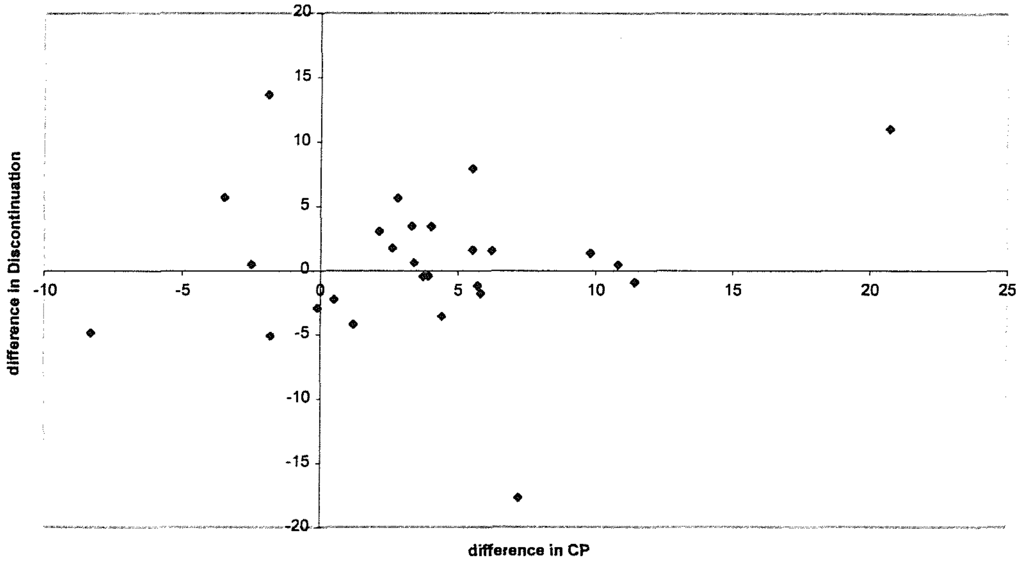

Figure 7.12 Scatterplot between Contraceptive Prevalence and Total Fertility Rate at Provincial Level: 1994 Indonesia DHS




The questions are in what ways can the negative relationship between fertility and contraceptive use be explained? Is no relationship caused by ways we define discontinuation? Here discontinuation is defined as first method discontinuation, which is defined as discontinuation if she stops a particular method regardless whether she stops at all or she switches to another method. We should probably use discontinuation for all methods consecutively used but this is not covered in this thesis.

Figure 7.13 shows another way to see the relationship between contraceptive prevalence and discontinuation. This figure plots the difference in contraceptive prevalence over two periods and the difference in 12-month discontinuation rate over the two periods from 27 provinces. If the difference is positive, this means that either contraceptive prevalence or contraceptive discontinuation increased from 1986-91 to 1989-94. On the contrary if the difference is negative, estimates decreased over the same period. The provinces are distributed into the four quadrants. More provinces fell into quadrant 1, with an increase in both contraceptive prevalence and contraceptive discontinuation. However, fewer provinces (nine) fell into the quadrant that has an increase in contraceptive prevalence but a decrease in contraceptive discontinuation. Moreover, three provinces have a decrease in contraceptive prevalence, but an increase in contraceptive discontinuation, including Bali.

**Figure 7.13 Plot between Difference in Contraceptive Prevalence against Diffence in 12-Month Discontinuation Rate at Provincial Level from 1986-91 to 1989-94**



## 7.4 Reasons for Discontinuation

### 7.4.1 Variation in Reasons for Discontinuation Among Methods

Couples who were using contraception could stop using for different reasons; women could stop using contraception because they wanted to have a baby; because they experienced contraceptive failure; because they switched to another contraceptive method; or because they could no longer afford to buy the method; or they were biologically not in need anymore. Each reason might have different implications to family planning programme policy, or to the users themselves. For example, if women experienced method failure, they would have unintended pregnancies and problems associated. Alternatively, if they terminate their pregnancies by induced abortion and they lived in a country where abortion is illegal, they might die due to illegal abortion practices. Maternal morbidity and mortality in that country would probably increase. Thus, the government should find a way to help the women by providing them safe abortion, though this alternative is still controversial, and even becoming a political commodity, in Indonesia; or providing intensive counselling to the women in order to cope with their unintended pregnancies.

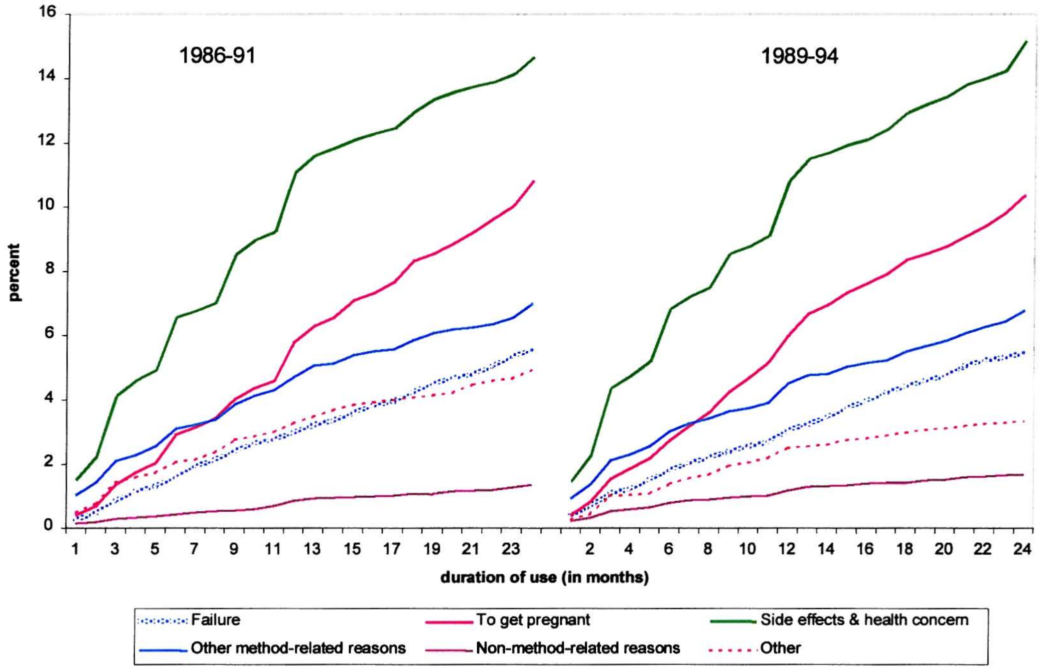
This section examines the reasons why couples discontinued using contraception for all reversible contraceptive methods combined. In addition, this section discusses the reasons for discontinuation of each method. It can provide valuable insight into the advantages and disadvantages of the different methods, which in turn can result in improved counselling and a greater understanding of contraceptive use in population. Ultimately, this will bring in improved reproductive health.

The reasons are classified into six categories; method failure, desire to get pregnant, side effect and health concern, other-method-related reason, non-method related reason and unspecified reason (other)‡. Figure 7.14 presents cumulative probability of contraceptive discontinuation for each of six reasons in 1986-1991 and 1989-1994. The most common reasons for discontinuation in Indonesia were side effects and health concerns. This finding was confirmed by previous

‡ Other-method-related reasons include partner disapproved, availability, cost, want more effective method, inconvenient to use, fatalistic, IUD expelled; while non-method related reasons include subfecund, infrequent sex, separated/widowed, cannot get pregnant; and unspecified reasons are women who stated don't know, and other categories.

findings of Ali and Cleland's (1995) study, which investigated cause-specific contraceptive discontinuation rates in six developing countries. They also found that side effects and health concerns were the main reason of discontinuation in five out six countries studied, except in Thailand where failure was the main reason to discontinue.

**Figure 7.14 Cumulative Probabilities of Reason-Specific Contraceptive Discontinuation DDiscontinuation: Indonesia, 1986-91 and 1989-94**



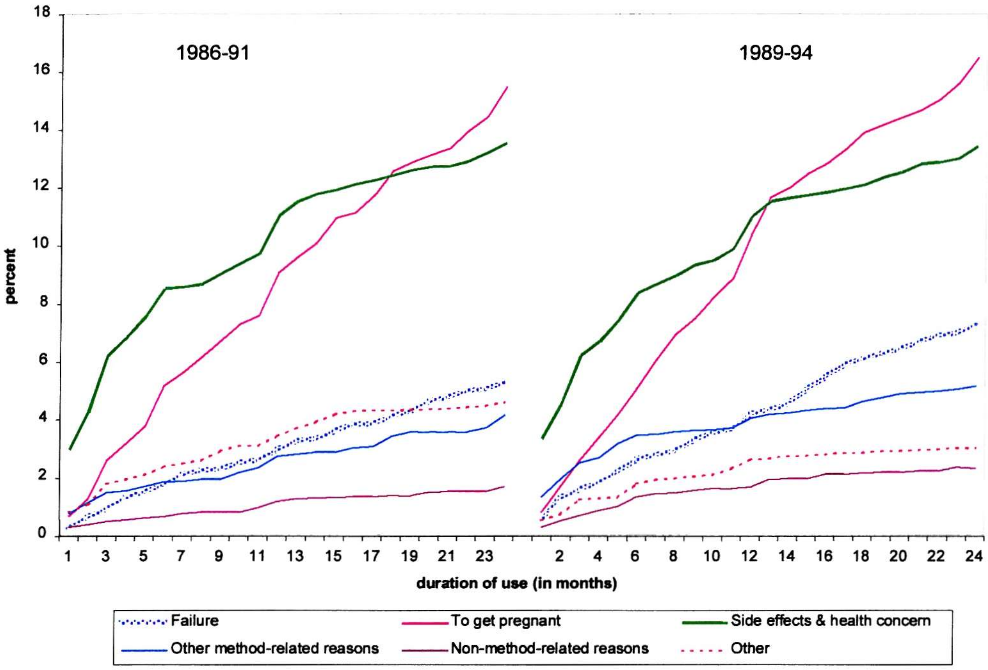

Relative to other reasons, couples who discontinue because of side effects and health concerns increased sharply from month to month. The first month of initial acceptance, almost 2.0% women discontinue their method then increased sharply and reached almost 11.0% in the 12th month after initiation of use. Ultimately, almost 15.0% of the users discontinued their methods in the 24th month after initiation.

In contrast to side effects and health concerns, there were fewer couples who discontinued their contraception because of method-related reasons-- which ranged from being expensive, unavailability of contraception, husband disapproval, inconvenient to use, desire to have more effective method, IUD expelled, or fatalistic attitude. These were less than half of those with side effects and health concern reasons. For example, around 5% of couples discontinue because of other-method-related reasons within a year compared to 11% of those due to side effects and health concerns.

Desire to become pregnant was another common reason stated by couples who discontinued their contraception. Among users, around 6% of married women stopped using contraception within a year due to wanting to have a baby. As duration of use of contraception increases, the probability of discontinuation due to this reason also increases steadily until in the 24th month the probability of discontinuation reached around 10%. This group of women will influence the fertility rate in the population. Another group of women who will have an impact on fertility was a group of women experiencing contraceptive failures. Contraceptive failures can happen because of improper use by the users themselves and/or the method itself fails. Given the data available, it was not distinguished between failures resulting from improper use of a method and failures resulting from inherent limitations of the method. Around 3% of users experience a contraceptive failure within one year after initiation of use. This percentage was half that of those who desired to get pregnant. Although other women who discontinue due to other reasons will probably be at risk of unintended pregnancy if in the month immediately after abandonment of contraception they do not use another method to prevent conception.

Each contraceptive method will be discontinued by users for various reasons depending on the characteristics of both the methods themselves and the users. It would be expected that Indonesian women would discontinue the pill because they experience side effects and health concerns. In Figure 7.15, we see that after one and half year of use in 1986-91 or after one year of the use in 1989-94, the pill users were more likely to discontinue because they wanted to have a baby. Around 10% wanted to have a baby after one year using the pill. This means that acceptors took the pill with an aim of spacing their children for at least one year. Although, before one year of initial acceptance, the pill users were most likely to discontinue due to side effects and health concerns, even in the first month 3% already stopped taking the pill. The third common reason for discontinuation of the pill was method failure. Less than 5% of married women become pregnant while using the pill. This percentage is similar to that of both Peruvian (Kost, 1993) and Brazilian women (Leite, 1998).

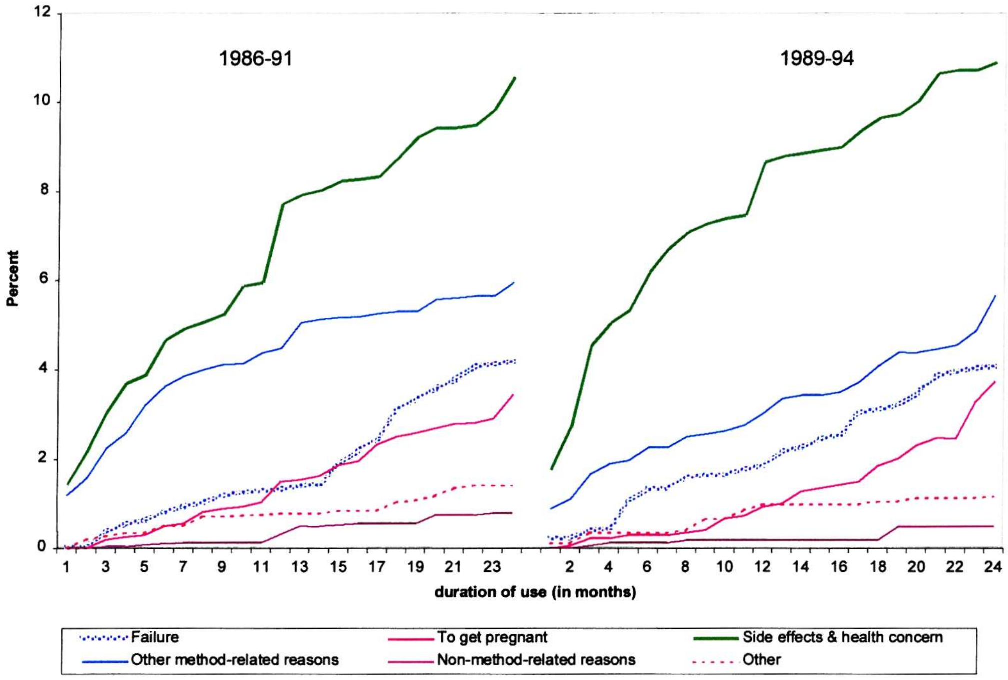
**Figure 7.15 Cumulative Probabilities of Reason-Specific Pill Discontinuation: Indonesia, 1986-91 and 1989-94**




Unlike pill users, at each duration of use, the IUD users were most likely to discontinue because of side effects and health concerns. This also occurred to women in Brazil (Leite,1998), Egypt, Morroco and Tunisia (Ali and Cleland, 1995). Compared to the pill, the probability of experiencing side effects or health concerns from the IUD was much lower, because IUD discontinuation was lower than the pill. Since the discontinuation rate varies across methods or sub-groups of a population it is sometimes difficult to compare cumulative discontinuation rates for different reasons. Therefore, examining the percentage breakdown of 12-month or 24-month discontinuation rates by reason for discontinuation may be useful. We found that among discontinued IUD-users side effects and health concerns accounted for a larger portion of discontinuation.

Another reasons stated by users discontinuing the IUD was husband disapproval, cost, availability, inconvenience to use, wants more effective method and expelled IUD (see Figure 7.16). Among these reasons expelled IUD is the most common reason mentioned by the users. However, unintended pregnancy due to method failure of the IUD was very low compared to the pill.

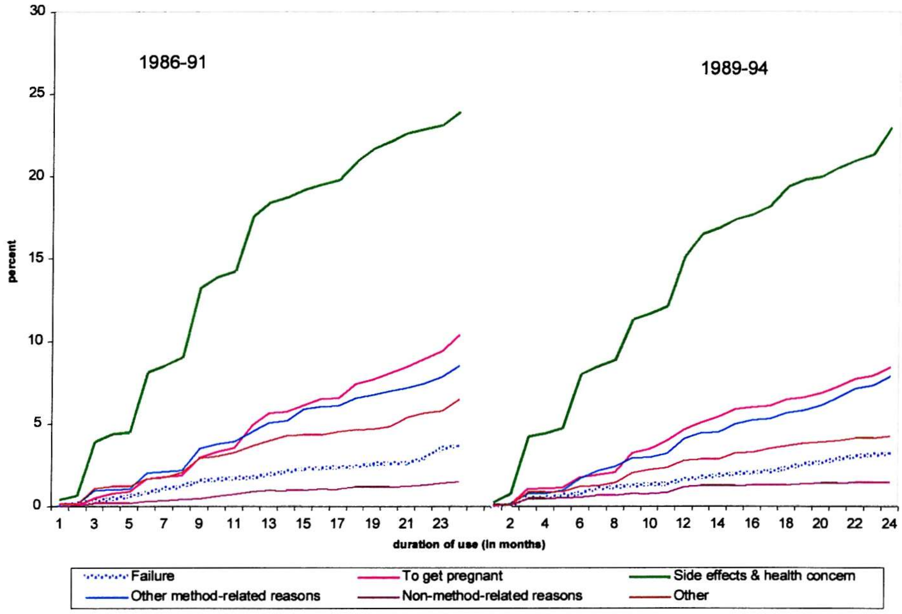
**Figure 7.16 Cumulative Probabilities of Reason-Specific IUD Discontinuation: Indonesia, 1986-91 and 1989-94**




Among IUD users in Figure 7.16, the reason for discontinuation dynamically changed over the two periods. Regarding side effects and health concerns, for example, the probability of discontinuation in the second year of the use was the same. However, within the first year of use, there has been more rapid discontinuation for side effects and health concerns. The timing of discontinuation changed with more early discontinuation in 1989-1994. In 1986-91 more users discontinued early because of wanting to become pregnant than in 1989-94. Contraceptive failure was lower in the first year compared to the second year in 1986-91. However, in the latter period although the rate of contraceptive failure was almost the same as the former period, but more users experienced early failure.

Injectables users had a similar reason for discontinuation as IUD users. They were most likely to discontinue because of side effects and health concerns. Moreover, the rates of discontinuation for injectables because of these reasons were the highest among users of modern contraceptive methods. By looking at Figure 7.17, it seemed that lowering the probability of discontinuation for those using injectables could probably be done by minimising the reasons for side effects and health concerns.

**Figure 7.17 Cumulative Probabilities of Reason-Specific Injectables Discontinuation: Indonesia, 1986-91 and 1989-94**




Among methods used by Indonesian couples, the condom had the highest probability of discontinuation because of method-related reasons. The users frequently mentioned inconvenience of use. Apart from this, they mentioned wanting to have a more effective method or partner's disapproval. The 1986-91 data shows that in the first month, for example, around 13% discontinued due to method related reasons. Then it reached 18% in the third month and 28% in the 24th month (See Figure 7.18). On common sense grounds, effectiveness of the condom is low. And in fact, condom users had the highest probability of failing among modern contraceptive methods.

It was expected that traditional methods would be discontinued due to their less effectiveness. This expectation was borne out in periodical abstinence practices, the couples who were abstaining from having sexual intercourse when the women are in the potentially fertile phase of menstrual cycle. They must know precisely when the fertile phase is, thus, this method may be suitable for women who have regular menstrual cycles. It may succeed in preventing a pregnancy for couples who can maintain a high degree of motivation to follow the abstinence rules of practice. Otherwise, as shown in Figure 7.19, periodical abstinence was most likely to be discontinued because of method failure.

**Figure 7.18 Cumulative Probabilities of Reason-Specific Condom Discontinuation: Indonesia, 1986-91 and 1989-94**

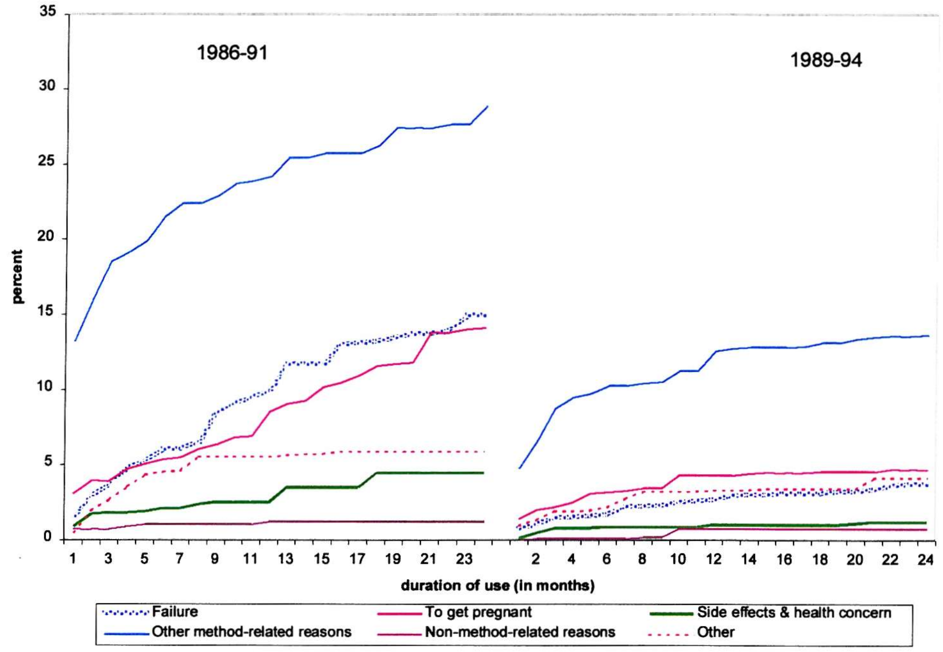
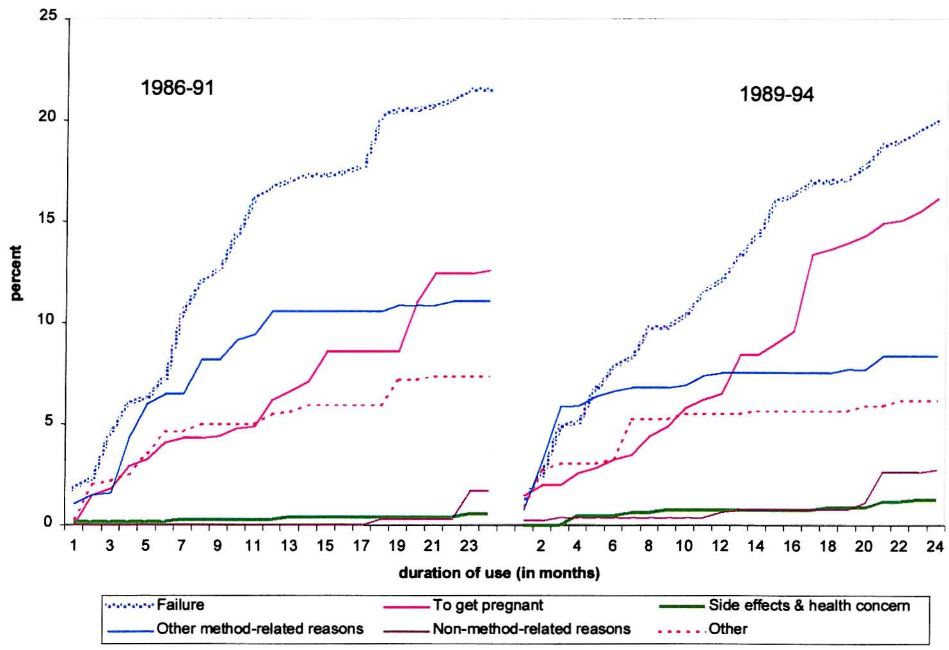



**Figure 7.19 Cumulative Probabilities of Reason-Specific Abstinence Discontinuation: Indonesia, 1986-91 and 1989-94**



Unlike periodical abstinence, as shown in Figure 7.20, accidental pregnancy is not the main reason to stop practising withdrawal. However, withdrawal users were most likely to discontinue because of method-related reasons. Inconvenience of use, husband disapproved and wants more effective method are mentioned by the users who discontinued. Almost 16% of users in 1986-91 mentioned method-related reasons as causes to discontinue within one year of adoption.

The failure rate of periodical abstinence within one year of adoption was significantly lower in 1989-94 than in the previous period. Within a year of acceptance, the failure rate decreased from around 16.7% in 1986-1991 to around 12.2% in 1989-1994. Apart from this, method-related reasons were also lower over those periods. This also happened for withdrawal users.

**Figure 7.20 Cumulative Probabilities of Reason-Specific Withdrawal Discontinuation: Indonesia, 1986-91 and 1989-94**

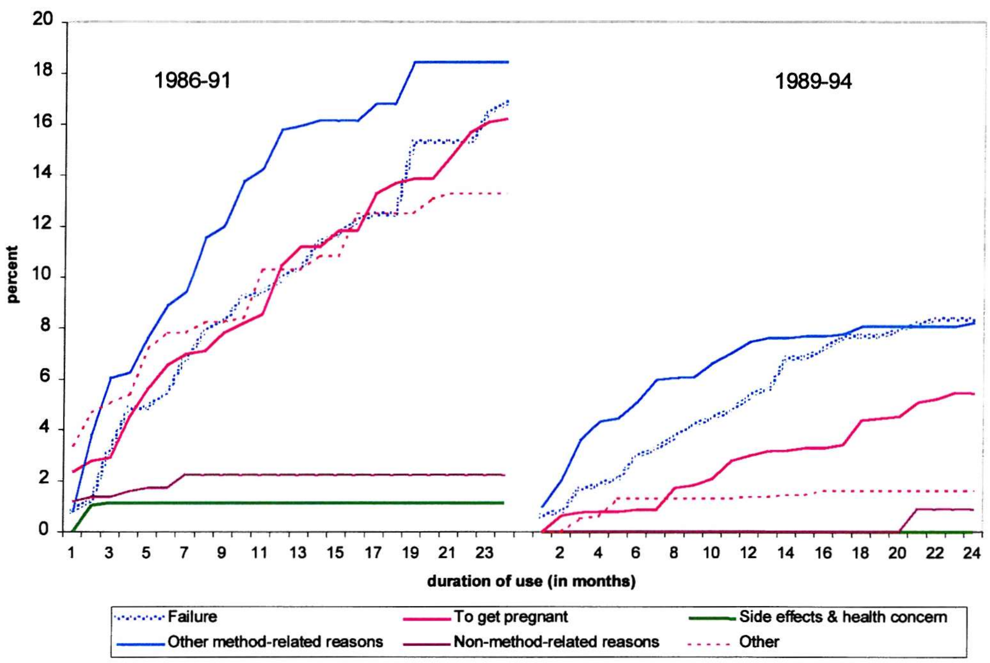


Table 7.5 12-month and 24-month Life Table for Contraceptive Discontinuation by Reason and Method: Indonesia: 1986-91 and 1989-94

| Methods of Contraception | Duration | Failure | To get pregnant | Side effects & health concern | Other method-related reasons | Non-method-related reasons | Other | Total | Number of segments of use |
|---|---|---|---|---|---|---|---|---|---|
| **1986-91** | | | | | | | | | |
| All reversible | 12-month | 3.0 | 5.8 | 11.1 | 4.7 | 0.9 | 3.3 | 28.6 | 12371 |
| Methods | 24-month | 5.6 | 10.8 | 14.7 | 7.0 | 1.4 | 4.9 | 44.3 | |
| Pill | 12-month | 3.0 | 9.1 | 11.0 | 2.8 | 1.2 | 3.4 | 30.4 | 4211 |
| | 24-month | 5.3 | 15.5 | 13.5 | 4.2 | 1.7 | 4.6 | 44.8 | |
| IUD | 12-month | 1.3 | 1.5 | 7.7 | 4.5 | 0.3 | 0.8 | 16.1 | 2186 |
| | 24-month | 4.2 | 3.4 | 10.6 | 5.9 | 0.8 | 1.4 | 26.3 | |
| Injectables | 12-month | 1.7 | 4.9 | 17.6 | 4.5 | 0.9 | 3.7 | 33.3 | 4058 |
| | 24-month | 3.7 | 10.4 | 23.9 | 8.5 | 1.5 | 6.5 | 54.3 | |
| Norplant | 12-month | 0.5 | 0.6 | 1.4 | 0.0 | 0.0 | 0.1 | 2.7 | 685 |
| | 24-month | 0.6 | 2.3 | 3.8 | 0.2 | 0.0 | 1.1 | 8.0 | |
| Condom | 12-month | 9.9 | 8.5 | 2.5 | 24.2 | 1.2 | 5.5 | 51.8 | 405 |
| | 24-month | 15.0 | 14.1 | 4.4 | 28.9 | 1.2 | 5.9 | 69.5 | |
| Abstinence | 12-month | 16.7 | 6.2 | 0.3 | 10.6 | 0.0 | 5.5 | 39.2 | 340 |
| | 24-month | 21.5 | 12.6 | 0.6 | 11.1 | 1.7 | 7.4 | 54.7 | |
| Withdrawal | 12-month | 9.9 | 10.4 | 1.1 | 15.8 | 2.2 | 10.3 | 49.8 | 268 |
| | 24-month | 16.9 | 16.2 | 1.1 | 18.4 | 2.2 | 13.3 | 68.2 | |
| Herbs | 12-month | 7.6 | 5.5 | 0.9 | 1.4 | 0.5 | 9.7 | 25.7 | 121 |
| | 24-month | 14.9 | 14.0 | 1.4 | 1.4 | 1.0 | 13.8 | 46.6 | |
| **1989-94** | | | | | | | | | |
| All reversible | 12-month | 3.1 | 6.00 | 10.79 | 4.50 | 1.2 | 2.5 | 27.99 | 15548 |
| Methods | 24-month | 5.5 | 10.36 | 15.16 | 6.77 | 1.7 | 3.3 | 42.76 | |
| Pill | 12-month | 4.2 | 10.4 | 11.0 | 4.1 | 1.7 | 2.6 | 34.0 | 5538 |
| | 24-month | 7.3 | 16.5 | 13.4 | 5.2 | 2.3 | 3.0 | 47.7 | |
| IUD | 12-month | 1.9 | 1.0 | 8.5 | 3.1 | 0.2 | 1.0 | 15.5 | 1850 |
| | 24-month | 4.1 | 3.7 | 10.9 | 5.7 | 0.5 | 1.2 | 26.0 | |
| Injectables | 12-month | 1.6 | 4.6 | 15.1 | 4.1 | 1.2 | 2.7 | 29.3 | 5829 |
| | 24-month | 3.2 | 8.4 | 23.0 | 7.9 | 1.4 | 4.2 | 48.2 | |
| Norplant | 12-month | 0.3 | 0.1 | 3.7 | 0.3 | 0.0 | 0.1 | 4.5 | 1259 |
| | 24-month | 0.4 | 0.6 | 6.9 | 0.4 | 0.4 | 0.3 | 9.0 | |
| Condom | 12-month | 2.7 | 4.3 | 1.0 | 12.5 | 0.7 | 3.3 | 24.5 | 333 |
| | 24-month | 3.7 | 4.7 | 1.2 | 13.6 | 0.7 | 4.1 | 28.0 | |
| Abstinence | 12-month | 12.2 | 6.5 | 0.8 | 7.5 | 0.6 | 5.5 | 33.2 | 376 |
| | 24-month | 20.0 | 16.1 | 1.3 | 8.4 | 2.7 | 6.2 | 54.6 | |
| Withdrawal | 12-month | 5.3 | 3.0 | 0.0 | 7.5 | 0.0 | 1.4 | 17.2 | 296 |
| | 24-month | 8.3 | 5.4 | 0.0 | 8.2 | 0.9 | 1.6 | 24.5 | |
| Herbs | 12-month | 7.3 | 7.8 | 2.6 | 5.1 | 9.8 | 6.5 | 39.1 | 159 |
| | 24-month | 14.4 | 11.7 | 10.8 | 5.1 | 9.8 | 7.6 | 59.5 | |

### 7.4.2 Reasons for Discontinuation by Background Variables

This section presents more information on discontinuation rates for different subgroups of the population as explained in Section 7.3.1. It explains observed reasons for discontinuation in 1986-91 (Table 7.6) and 1989-94 (Table 7.7).

Reasons for discontinuation among users who live in urban areas and rural areas was the same, in which users mostly discontinued use of contraception due to side effects and health concerns. The second reason was desire to become pregnant, then followed by method related reasons. Moreover, urban users were more likely than rural ones to experience contraceptive failure.

Among regions, side effects and health concerns generally were the most common reasons for discontinuation. The composition of reasons for discontinuation in Outer Java-Bali II were different from the one in either Java-Bali or Outer Java-Bali I. For the two latter regions, the three most common reasons for discontinuation were: side effects and health concerns, desire to become pregnant, and method-related reasons. On the other hand, in Outer Java-Bali II the most common reasons were side effects and health concerns, method-related reasons and desire to become pregnant. However, that was only the case in 1986-91, in the subsequent period the regions had similar composition.

Among different levels of woman's education, of husband's education and also different age groups, experience side effects and health concerns were the most common reasons for discontinuation. Educated women were more likely to discontinue due to side effects and health concerns than less educated women. Moreover, educated women were also more likely to experience contraceptive failure.

Table 7.6 Reason for Contraceptive Discontinuation by Background Characteristics: Indonesia, 1986 - 91

| Background Variable | Time | Failure | To get pregnant | Side effects & health concern | Other method-related reasons | Non-method-related reasons | Other | Total |
|---|---|---|---|---|---|---|---|---|
| **Place of residence** | | | | | | | | |
| Urban | 12-month | 3.9 | 5.7 | 12.5 | 5.2 | 0.8 | 3.6 | 31.6 |
| Rural | | 2.5 | 5.8 | 10.3 | 4.5 | 0.9 | 3.1 | 27.1 |
| Urban | 24-month | 6.6 | 11.3 | 16.6 | 6.9 | 1.4 | 5.6 | 48.4 |
| Rural | | 5.0 | 10.6 | 13.6 | 7.0 | 1.3 | 4.6 | 42.2 |
| **Region** | | | | | | | | |
| Java-Bali | 12-month | 2.7 | 6.3 | 11.5 | 4.7 | 0.9 | 3.1 | 29.3 |
| Java-Bali I | | 3.5 | 4.8 | 9.5 | 4.4 | 0.6 | 3.2 | 25.9 |
| Java-Bali II | | 3.5 | 4.4 | 11.5 | 5.2 | 0.9 | 4.4 | 29.9 |
| Java-Bali | 24-month | 5.3 | 11.1 | 15.1 | 7.2 | 1.4 | 4.9 | 45.0 |
| Java-Bali I | | 6.2 | 10.1 | 13.0 | 6.5 | 1.1 | 4.3 | 41.2 |
| Java-Bali II | | 6.0 | 10.3 | 15.3 | 6.9 | 1.4 | 6.1 | 46.0 |
| **Respondent's Education** | | | | | | | | |
| No Education | 12-month | 0.9 | 3.3 | 8.1 | 3.3 | 1.3 | 3.1 | 20.1 |
| Some Primary | | 2.2 | 5.3 | 11.4 | 3.7 | 0.9 | 3.3 | 26.8 |
| Completed Primary | | 2.7 | 6.7 | 11.5 | 4.7 | 0.6 | 3.1 | 29.3 |
| Completed Secondary + | | 5.3 | 6.3 | 11.4 | 6.8 | 0.9 | 3.6 | 34.2 |
| No Education | 24-month | 3.9 | 7.5 | 11.0 | 5.6 | 2.3 | 4.8 | 35.0 |
| Some Primary | | 5.0 | 9.9 | 15.6 | 6.3 | 1.4 | 4.6 | 42.8 |
| Completed Primary | | 5.2 | 11.0 | 14.7 | 7.1 | 1.1 | 4.6 | 43.7 |
| Completed Secondary + | | 7.7 | 13.4 | 14.9 | 8.6 | 1.3 | 5.8 | 51.6 |
| **Husband's Education** | | | | | | | | |
| No Education | 12-month | 1.1 | 4.7 | 11.8 | 2.8 | 2.0 | 2.0 | 24.4 |
| Some Primary | | 2.0 | 5.1 | 9.9 | 4.0 | 0.5 | 3.6 | 25.0 |
| Completed Primary | | 2.8 | 6.1 | 11.4 | 4.2 | 0.9 | 3.0 | 28.4 |
| Completed Secondary + | | 4.5 | 6.3 | 11.7 | 6.4 | 0.8 | 3.5 | 33.1 |
| No Education | 24-month | 4.1 | 8.2 | 14.3 | 4.6 | 3.2 | 3.0 | 37.4 |
| Some Primary | | 4.6 | 10.3 | 13.5 | 6.4 | 0.8 | 5.2 | 40.7 |
| Completed Primary | | 5.3 | 10.7 | 14.8 | 6.9 | 1.3 | 4.7 | 43.6 |
| Completed Secondary + | | 7.1 | 12.0 | 15.7 | 8.2 | 1.5 | 5.4 | 49.9 |
| **Age at the start of use** | | | | | | | | |
| < 25 | 12-month | 3.3 | 8.6 | 12.0 | 5.4 | 1.0 | 3.8 | 34.2 |
| 25 – 29 | | 2.5 | 3.5 | 11.1 | 4.7 | 0.5 | 3.1 | 25.4 |
| >= 30 | | 2.7 | 2.8 | 9.4 | 3.6 | 0.8 | 2.5 | 21.8 |
| < 25 | 24-month | 5.9 | 15.1 | 15.9 | 7.9 | 1.3 | 5.2 | 51.3 |
| 25 – 29 | | 5.5 | 8.5 | 15.0 | 6.1 | 1.0 | 4.6 | 40.6 |
| >= 30 | | 5.0 | 5.2 | 12.4 | 6.2 | 1.7 | 4.7 | 35.2 |

Table 7.7 Reason for Contraceptive Discontinuation by Background Characteristics: Indonesia, 1989 - 94

| Background Variable | Time | Failure | To get pregnant | Side effects & health concern | Other method-related reasons | Non-method-related reasons | Other | Total |
|---|---|---|---|---|---|---|---|---|
| **Place of residence** | | | | | | | | |
| Urban | 12-month | 3.9 | 5.3 | 12.0 | 5.5 | 0.8 | 3.4 | 30.8 |
| Rural | | 2.6 | 6.3 | 10.2 | 4.1 | 1.4 | 2.1 | 26.7 |
| Urban | 24-month | 6.5 | 9.2 | 16.6 | 8.2 | 1.4 | 4.5 | 46.4 |
| Rural | | 5.0 | 10.9 | 14.5 | 6.1 | 1.8 | 2.8 | 41.1 |
| **Region** | | | | | | | | |
| Java-Bali | 12-month | 3.0 | 6.3 | 10.4 | 4.3 | 1.31 | 2.6 | 27.9 |
| Java-Bali I | | 3.3 | 5.2 | 11.2 | 5.0 | 0.9 | 2.3 | 27.9 |
| Java-Bali II | | 2.8 | 5.7 | 12.1 | 4.6 | 0.7 | 2.7 | 28.6 |
| Java-Bali | 24-month | 5.3 | 10.2 | 14.9 | 6.5 | 1.9 | 3.3 | 42.1 |
| Java-Bali I | | 6.1 | 10.4 | 15.7 | 7.6 | 1.5 | 3.4 | 44.6 |
| Java-Bali II | | 4.8 | 11.4 | 15.7 | 6.3 | 0.9 | 3.5 | 42.7 |
| **Respondent's Education** | | | | | | | | |
| No Education | 12-month | 0.9 | 5.1 | 8.1 | 1.8 | 2.1 | 1.3 | 19.3 |
| Some Primary | | 2.7 | 4.1 | 10.6 | 3.9 | 1.2 | 1.9 | 24.4 |
| Completed Primary | | 3.0 | 7.0 | 10.2 | 4.6 | 1.3 | 2.2 | 28.3 |
| Completed Secondary + | | 4.1 | 6.8 | 12.5 | 5.7 | 0.7 | 3.8 | 33.7 |
| No Education | 24-month | 2.0 | 8.9 | 10.2 | 4.7 | 2.8 | 1.7 | 30.4 |
| Some Primary | | 5.0 | 8.1 | 14.5 | 6.2 | 1.8 | 2.3 | 37.9 |
| Completed Primary | | 5.4 | 10.8 | 15.1 | 6.9 | 1.8 | 3.2 | 43.2 |
| Completed Secondary + | | 6.9 | 12.5 | 17.4 | 7.7 | 1.1 | 5.0 | 50.6 |
| **Husband's Education** | | | | | | | | |
| No Education | 12-month | 1.4 | 4.72 | 7.4 | 2.1 | 0.9 | 2.4 | 19.0 |
| Some Primary | | 2.4 | 4.23 | 11.0 | 4.3 | 1.5 | 2.0 | 25.3 |
| Completed Primary | | 2.6 | 7.21 | 9.3 | 4.0 | 1.3 | 2.0 | 26.4 |
| Completed Secondary + | | 4.2 | 6.43 | 12.6 | 5.5 | 0.8 | 3.4 | 32.9 |
| No Education | 24-month | 4.5 | 9.32 | 10.3 | 4.8 | 1.6 | 2.8 | 33.3 |
| Some Primary | | 4.9 | 8.42 | 14.8 | 6.8 | 1.8 | 2.8 | 39.5 |
| Completed Primary | | 4.3 | 11.0 | 13.9 | 6.3 | 1.7 | 2.6 | 39.8 |
| Completed Secondary + | | 7.1 | 11.4 | 17.4 | 7.5 | 1.5 | 4.6 | 49.6 |
| **Age at the start of use** | | | | | | | | |
| < 25 | 12-month | 3.4 | 9.1 | 12.5 | 5.1 | 1.3 | 2.4 | 33.8 |
| 25 - 29 | | 3.6 | 5.5 | 10.0 | 4.8 | 0.9 | 2.2 | 27.1 |
| >= 30 | | 2.0 | 2.1 | 9.2 | 3.4 | 1.2 | 3.0 | 20.9 |
| < 25 | 24-month | 5.7 | 15.4 | 17.4 | 7.2 | 1.9 | 3.6 | 51.2 |
| 25 - 29 | | 6.1 | 9.4 | 14.2 | 7.1 | 1.1 | 2.8 | 40.8 |
| >= 30 | | 4.5 | 4.2 | 13.0 | 5.9 | 1.9 | 3.5 | 32.9 |

### 7.4.3 Trends in Contraceptive Discontinuation by Reason

Trends in discontinuation patterns inform policy makers about what has been happening over time in the population. Thus, analysis of trends in discontinuation rates is useful for evaluation of family planning programme implementation and of quality of care of the programme. Ultimately, it is extremely important for family planning policy in particular and in reproductive heath policy in general. Decreases in discontinuation rates indicate improvements in users' satisfaction with their method of contraception which, in turn, may indicate improved quality of family planing services. This section in particular presents the trends in discontinuation for six methods. The analyses in this section are primarily aimed at describing and understanding trends in the probability of discontinuation over the period of 1986-1991 to 1989-1994‡.

**Figure 7.21 Trends in Reasons for Discontinuation of Contraceptive Use: Indonesia, 1986-91 and 1989-94**

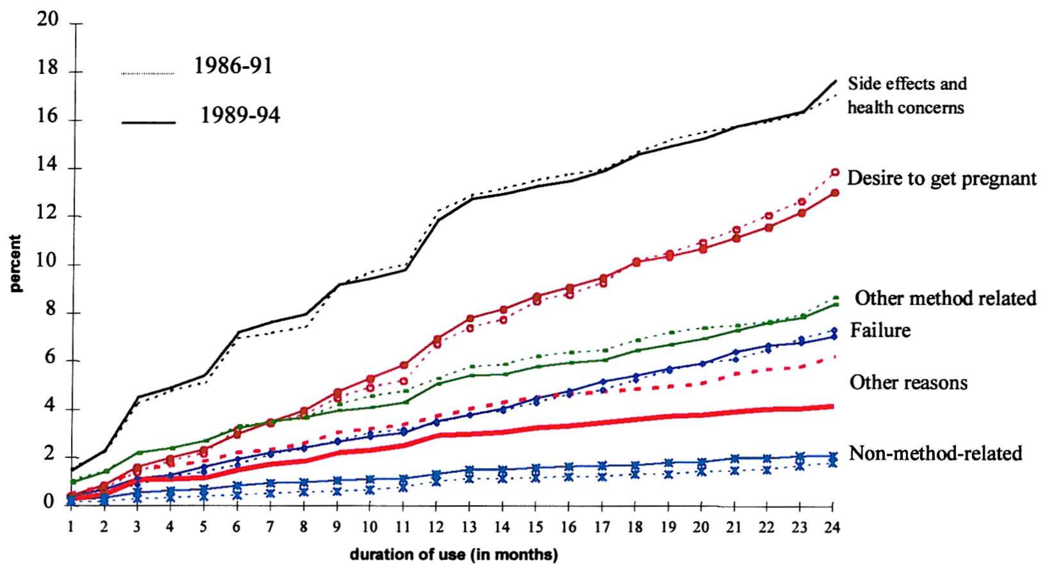
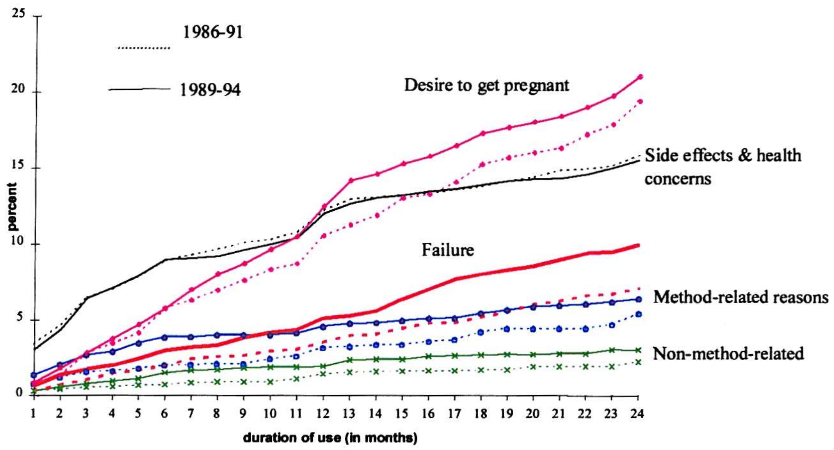



Figure 7.21 shows that there were very small changes in the reasons for discontinuation between the periods of 1986-91 and 1989-94. However, a relatively significant change occurred to the group of other reasons, where the probability of discontinuing was significantly lower in the later period than in the earlier one. Indeed, this pattern reflected a genuine decrease in the probability of discontinuing for other reasons.

‡ The sum of cumulative probabilities of discontinuation at 12th month for six categories presented in Table 7.8 and Table 7.9 do not equal the overall probability because they are calculated by using associated single-decrement life table techniques. We do not present the probabilities at 24th month, these probabilities can be estimated from the figures presented in this section.

It is more interesting to look at the changes in discontinuation rates by reason for specific method. Discussions below refer to Figures 7.22 to 7.27. The increase in discontinuation of pill users between 1986-1991 and 1989-1994 was mostly because of increases in method failure, wanting to get pregnant, other-method-related reasons and non-method-related reasons (Figure 7.22). Within the first six months of adoption the probability to discontinue because of desire to get pregnant remained the same over the two periods, afterward there were more and more the pill users who discontinued to have a baby.

**Figure 7.22 Trends in Reasons for Discontinuation of the Pill Users: Indonesia, 1986-1991 and 1989-1994**



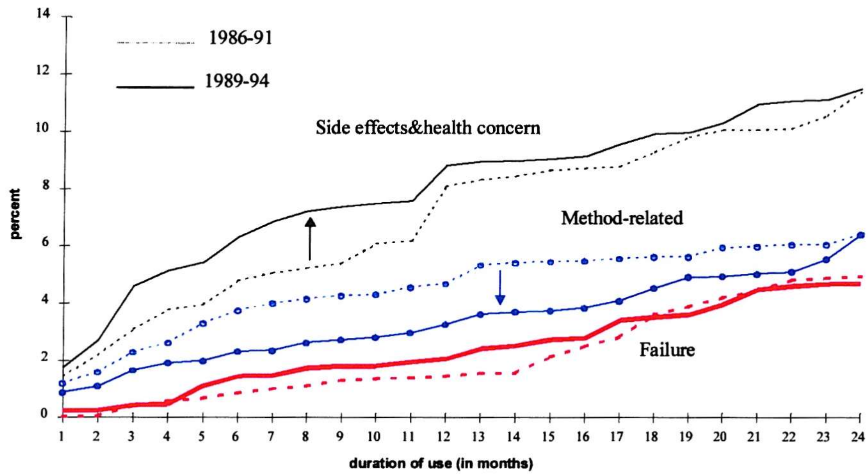

Likewise, pill failure rates were significantly higher in the later period than in the earlier period. This is interesting because both reasons of discontinuation have fertility-promoting effects. Additionally, pill users in Indonesia are predominant. Thus, an increase in the probabilities of discontinuation of the pill should focus the government and family planning programme workers' attentions to the investigating the reasons for discontinuation. These phenomena might reflect the low quality of care of the pill users.

As the pill is a hormonal contraceptive, some users may not be tolerant to its side effects. Thus, correct information about the characteristics of the pill should be known by the users and the providers should inform their clients about it. Leite (1989) study of Brazil (Leite, 1998) found side effects as the main reason for Brazilian women to discontinue the pill. In five out of six countries studied by Ali and Cleland (1995), the same phenomena occurred whereas within a year of pill acceptance, the majority users discontinued due to health concern including side effects.

However, they found that in Thailand the users discontinued the pill within a year because they wanted to have a baby.

The probability to discontinue because of other-method-related reasons by 24 months of use were the same for both periods, although before 15 months of use they were less likely to have problems related to the method itself.

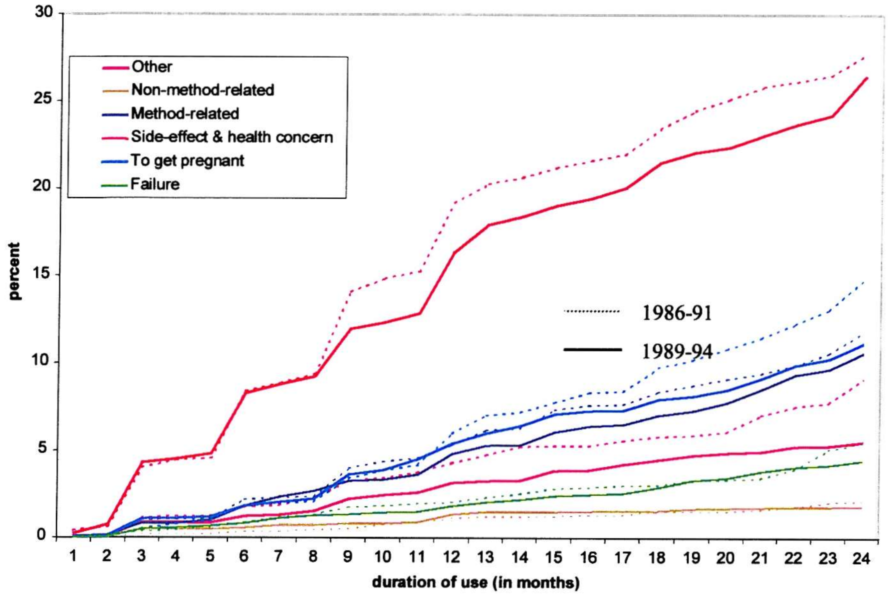
**Figure 7.23 Trends in Reasons for Discontinuation of the IUD Users: Indonesia, 1986-1991 and 1989-1994**




By 24 months of use IUD discontinuation due to side effects and health concerns, method related reasons and failure rate were similar in both periods (Figure 7.23). However, an upward shift in side effects and health concerns from 1986-91 to 1989-94 showed merely different timing of the discontinuation. This indicates that the IUD users were more likely to discontinue earlier in the 1989-94 than the previous period. On the contrary for method related reasons, the users were more likely to discontinue later.

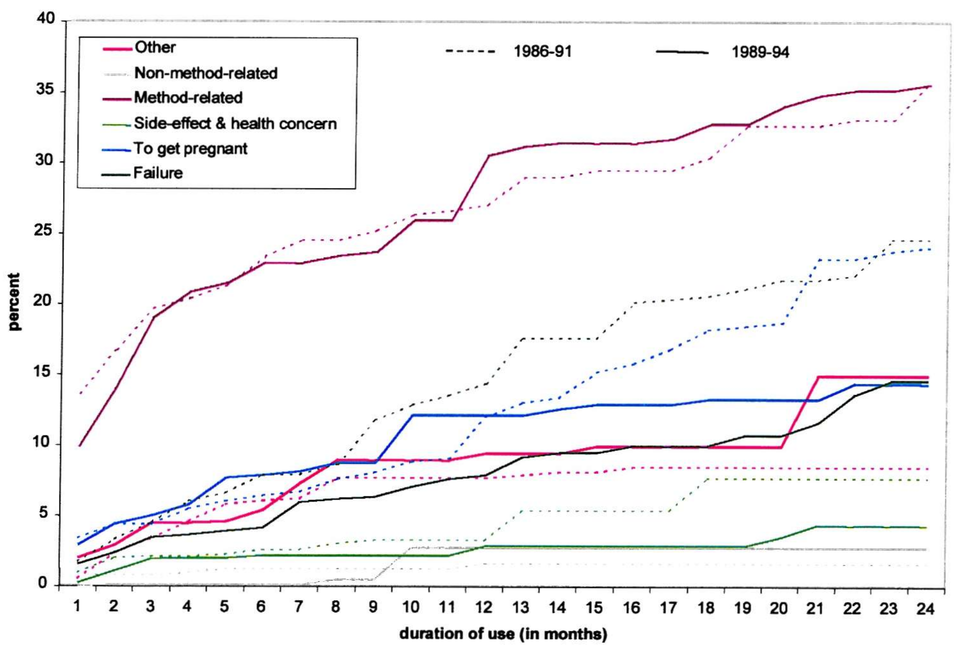
Side effects and health concerns as the main reason to discontinue among injectables users is lower in 1989-94 than in 1986-91 (Figure 7.24). This is particularly seen after six months of using the method. Other-method-related reasons, 'other reasons', and desired to get pregnant were also lower in the 1989-94. Indeed, the probability of failing was identical in the two periods and so was for non-method-related reason. The finding suggests that there were improvements on dealing with all method-related reasons.

**Figure 7.24 Trends in Reasons for Discontinuation of the Injectables Users: Indonesia, 1986-1991 and 1989-1994**




For condom users, the probability of failing was much lower in the period 1989-1994 than in 1986-91. Within one year of acceptance, it was around 5 percentage points below the rate of 1989-94, and within one and a half years around 10 percentage points lower (Figure 7.25 and Table 7.8). Discontinuing the condom because the users wanted to have a baby was lower in the latter period.

**Figure 7.25 Trends in Reasons for Discontinuation of Condom Users: Indonesia, 1986-1991 and 1989-1994**



There were few changes in each reason for discontinuation of abstinence and withdrawal (Figures 7.26 and 7.27), except abstinence discontinuation due to method related reasons decreased. Withdrawal discontinuation due to desire to get pregnant also decreased and so did discontinuation for method-related reasons. Withdrawal failure rate in 1986-91 was no different from that in 1989-94.

Figure 7.26 Trends in Reasons for Discontinuation of the Periodical Abstinence: Indonesia, 1986-1991 and 1989-1994

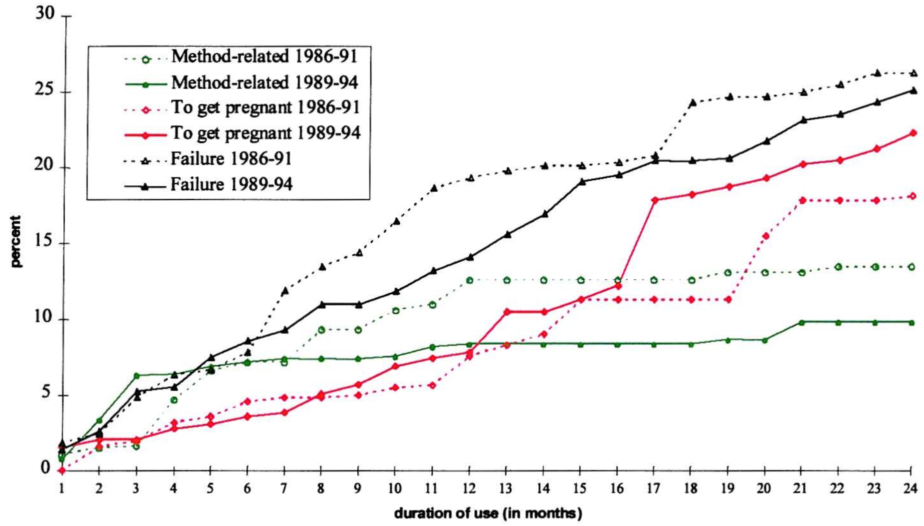



Figure 7.27 Trends in Reasons for Discontinuation of Withdrawal Users: Indonesia, 1986-1991 and 1989-1994

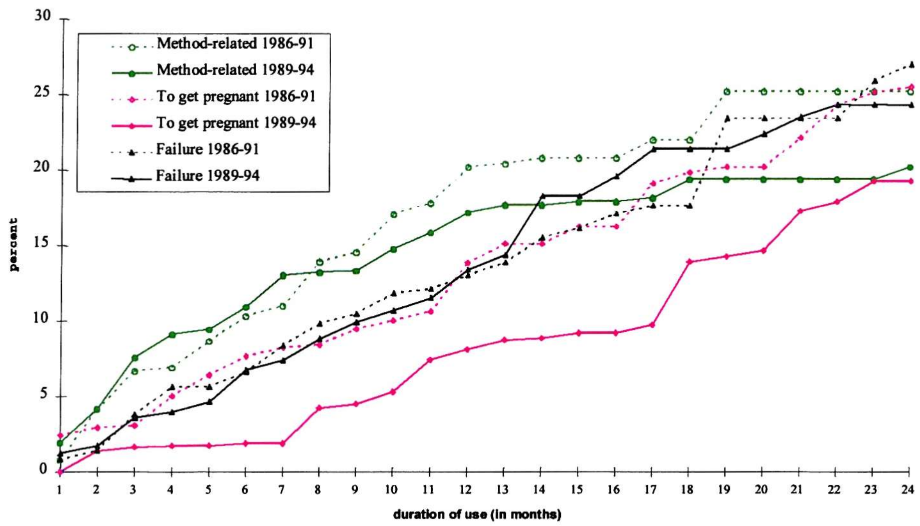


Table 7.9 presents trends in first-year reason-specific discontinuation for different background variables such as place of residence (urban/rural), woman and husband's education, and woman's age. In rural areas, an increase in the probability of discontinuation occurred for desire to become pregnant and non-method-related reasons. On the other hand, a decrease in the probability appeared due to method-related reasons and other reasons. In urban areas, a decrease in the probability of discontinuation due to desire to get pregnant (opposite direction from rural areas), due to side effects and health concerns and also other reasons, whereas an increase in probability occurred due to method-related reasons.

Changes are also seen in the regions. The probability of discontinuation due to desire to have a baby increased in both Outer Java-Bali I and II, with a larger increase in Outer Java-Bali, but no change in Java-Bali. Moreover, the probability of discontinuation due to side effects and health concerns in Outer Java-Bali also increased, with a greater increase in Outer Java-Bali I. However, the probability decreased in Java-Bali.

Among those who never attended any school, the probability of discontinuation due to desire to have a baby increased. An increase was also found among those who have attended secondary school and above. Side effects and health concerns decreased at almost all levels of woman's education, except for secondary school and above. A larger decrease in the probability of discontinuation due to method related reasons appeared for those who had no schooling and also secondary school and above. The probability of discontinuation due to desire to have a baby among users aged less than 30 years increased, but it decreased among older women.

Table 7.8 Trends in 12-Month Reason-Specific Contraceptive Discontinuation by Method of Contraception: Indonesia, 1986-91 and 1989-94

| Method | Period | Failure | Desire to get pregnant | Side effect and health concern | Method-related reasons | Non-method-related reasons | Other reasons |
|---|---|---|---|---|---|---|---|
| Pill | 1986-91 | 3.5 | 10.6 | 12.1 | 3.2 | 1.4 | 4.0 |
| | 1989-94 | 5.1 | 12.5 | 12.2 | 4.6 | 1.9 | 3.2 |
| IUD | 1986-91 | 1.4 | 1.7 | 8.1 | 4.7 | 0.3 | 0.8 |
| | 1989-94 | 2.0 | 1.1 | 8.8 | 3.3 | 0.2 | 1.1 |
| Injectables | 1986-91 | 2.0 | 6.0 | 19.2 | 5.3 | 1.1 | 4.3 |
| | 1989-94 | 1.8 | 5.4 | 16.3 | 4.8 | 1.4 | 3.2 |
| Norplant | 1986-91 | 0.6 | 1.3 | 1.5 | 0.0 | 0.0 | 0.2 |
| | 1989-94 | 0.3 | 0.1 | 3.7 | 0.3 | 0.0 | 0.1 |
| Condom | 1986-91 | 14.4 | 12.0 | 3.3 | 27.0 | 1.6 | 7.7 |
| | 1989-94 | 7.9 | 12.2 | 2.9 | 30.5 | 0.3 | 9.5 |
| Abstinence | 1986-91 | 19.3 | 7.6 | 0.3 | 12.6 | 0.0 | 6.4 |
| | 1989-94 | 14.1 | 7.8 | 0.9 | 8.4 | 0.8 | 6.3 |
| Withdrawal | 1986-91 | 13.0 | 13.8 | 1.3 | 20.2 | 2.6 | 12.7 |
| | 1989-94 | 13.4 | 8.1 | 0.0 | 17.2 | 0.0 | 3.4 |
| Herbs | 1986-91 | 8.9 | 12.3 | 1.3 | 1.7 | 1.6 | 12.7 |
| | 1989-94 | 8.8 | 10.6 | 3.3 | 6.6 | 10.0 | 8.1 |
| All reversible methods | 1986-91 | 3.4 | 6.7 | 12.2 | 5.3 | 1.0 | 3.7 |
| | 1989-94 | 3.5 | 6.9 | 11.9 | 5.1 | 1.3 | 2.9 |

Table 7.9 Trends in Reason-Specific Contraceptive Discontinuation Rates within a Year of Use: Indonesia, 1986-91 and 1989-94

| Background Variable | Time | Failure | Desire to get pregnant | Side effect and health concern | Method-related reasons | Non-method-related reasons | Other reasons |
|---|---|---|---|---|---|---|---|
| **Place of residence** | | | | | | | |
| Rural | 1986-91 | 2.9 | 6.7 | 11.3 | 5.0 | 1.0 | 3.5 |
| | 1989-94 | 3.0 | 7.3 | 11.1 | 4.5 | 1.5 | 2.4 |
| Urban | 1986-91 | 4.5 | 6.7 | 14.1 | 5.8 | 0.9 | 4.2 |
| | 1989-94 | 4.5 | 6.3 | 13.5 | 6.1 | 0.9 | 4.0 |
| **Region** | | | | | | | |
| Java-Bali | 1986-91 | 3.1 | 7.4 | 12.7 | 5.3 | 1.1 | 3.6 |
| | 1989-94 | 3.4 | 7.3 | 11.5 | 4.8 | 1.4 | 3.0 |
| Outer Java-Bali I | 1986-91 | 4.0 | 5.5 | 10.2 | 5.0 | 0.7 | 3.6 |
| | 1989-94 | 3.8 | 6.1 | 12.2 | 5.6 | 1.1 | 2.6 |
| Outer Java-Bali II | 1986-91 | 4.1 | 5.1 | 12.8 | 6.0 | 1.1 | 5.0 |
| | 1989-94 | 3.3 | 6.7 | 13.3 | 5.1 | 0.8 | 3.0 |
| **Women's education** | | | | | | | |
| No education | 1986-91 | 1.0 | 3.7 | 8.7 | 3.6 | 1.5 | 3.4 |
| | 1989-94 | 1.1 | 5.6 | 8.4 | 2.0 | 2.3 | 1.4 |
| Some Primary | 1986-91 | 2.6 | 6.2 | 12.3 | 4.2 | 1.0 | 3.7 |
| | 1989-94 | 3.0 | 4.7 | 11.4 | 4.4 | 1.4 | 2.1 |
| Completed Primary | 1986-91 | 3.2 | 7.8 | 12.6 | 5.3 | 0.7 | 3.5 |
| | 1989-94 | 3.4 | 8.0 | 11.3 | 5.2 | 1.5 | 2.6 |
| Completed Secondary | 1986-91 | 6.3 | 7.4 | 13.2 | 7.7 | 1.2 | 4.2 |
| | 1989-94 | 5.0 | 8.3 | 14.2 | 6.4 | 0.8 | 4.5 |
| **Husband's education** | | | | | | | |
| No education | 1986-91 | 1.3 | 5.4 | 12.6 | 3.1 | 2.4 | 2.2 |
| | 1989-94 | 1.7 | 5.3 | 7.7 | 2.3 | 0.9 | 2.6 |
| Some Primary | 1986-91 | 2.3 | 5.8 | 10.7 | 4.4 | 0.6 | 4.0 |
| | 1989-94 | 2.7 | 4.8 | 11.9 | 4.8 | 1.6 | 2.3 |
| Completed Primary | 1986-91 | 3.2 | 7.2 | 12.5 | 4.7 | 1.1 | 3.4 |
| | 1989-94 | 2.9 | 8.2 | 10.1 | 4.6 | 1.5 | 2.3 |
| Completed Secondary | 1986-91 | 5.3 | 7.4 | 13.4 | 7.2 | 1.1 | 4.2 |
| | 1989-94 | 5.1 | 7.7 | 14.2 | 6.1 | 1.0 | 4.0 |
| **Age at the start of use** | | | | | | | |
| < 25 | 1986-91 | 4.0 | 10.2 | 13.7 | 6.2 | 1.2 | 4.5 |
| | 1989-94 | 4.0 | 10.8 | 14.0 | 5.9 | 1.6 | 2.9 |
| 25 – 29 | 1986-91 | 2.8 | 4.1 | 12.1 | 5.1 | 0.6 | 3.4 |
| | 1989-94 | 4.2 | 6.4 | 11.1 | 5.3 | 1.0 | 2.5 |
| 30 + | 1986-91 | 3.0 | 3.2 | 10.0 | 4.0 | 0.9 | 2.7 |
| | 1989-94 | 2.3 | 2.4 | 9.8 | 3.7 | 1.3 | 3.3 |

### 7.4.4 Variation in Reasons for Contraceptive Discontinuation at Provincial Level

Section 7.3.2 presented overall contraceptive discontinuation rates among provinces, while this section presents decomposition of these rates into reasons for discontinuation in each period. The number of categories to group the reasons for discontinuation in each province is smaller than the number used at the national level, because the number of segments used in each province varies. The reasons, other than the three categories of failure, desire to get pregnant, and side effects along with health concerns, were grouped into the category 'other reasons'. Table 7.10 presents a summary of the life table estimates for 12-month and 24-month of initiation of use, while Appendices A-5 and A-6 present graphs of the life table probabilities of discontinuation by reason for each month of use within two years for each province.

Among provinces, there are variations in reason composition for discontinuation and also variation in timing of discontinuation for each reason. Even in one province, different composition over time is found. It is not easy to give simple explanations about reasons for discontinuation among provinces by the pattern of timing of discontinuation for each reason. Therefore, provinces are not grouped based on the pattern of timing of discontinuation. Instead, reason composition is utilised for categorisation. More specifically focus is on the most common reason for discontinuation.

In the majority of provinces contraceptive users discontinued a particular method mostly due to experience of side effects and health concerns. This is followed by other reasons as the second most common reason for discontinuation. Provinces which fell into this group were five provinces in the Java-Bali region except Yogyakarta, six out of eight provinces in Sumatra except Bengkulu and Lampung, three provinces in Kalimantan other than Central Kalimantan, three provinces in Sulawesi other than Central Sulawesi, East Nusa Tenggara, East Timor and Irian Jaya.

Figures 7.28 and 7.29 are examples for this group. Figure 7.28 presents reasons for discontinuation in Jakarta, while Figure 7.29 presents it for Riau. Both figures present different patterns in timing of discontinuation due to side effects and health concerns. In Riau, users were more likely to discontinue at very early durations. Two years of adoption, about 25% users discontinued due to side effects and health concerns in 1986-91. The figure for each of these provinces is in Appendix A-5.

Figure 7.28 Cumulative Probability of Contraceptive Discontinuation by Reason: Jakarta, 1986-91 and 1989-94

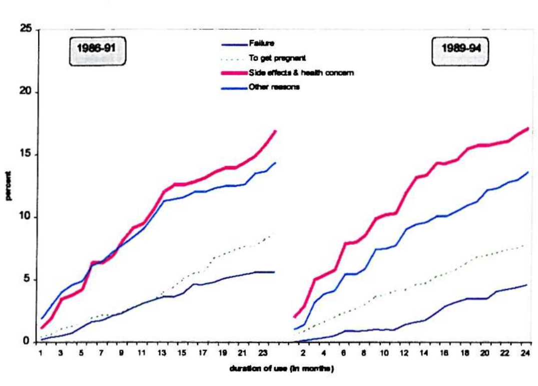
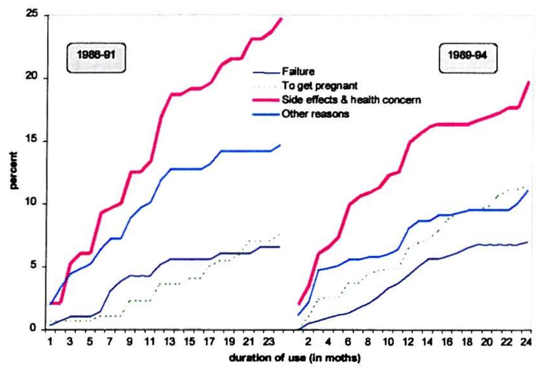



Figure 7.29 Cumulative Probability of Contraceptive Discontinuation by Reason: Riau, 1986-91 and 1989-94




The probability of discontinuation due to desire to get pregnant generally exceeded the one of discontinuation due to other reasons in the second year of use. This happened, for instance, in Central Java, Bali, Aceh, South Kalimantan, in 1986-91. Even in East Nusa Tenggara after one year of use, desire to get pregnant became the main reason for discontinuation.

In the remaining provinces such as Yogyakarta, Bengkulu, Central Sulawesi, Central Kalimantan, Lampung, Maluku and West Nusa Tenggara in 1986-91, other reasons were the main reason for discontinuation (Appendix A-6). This was followed by discontinuation for side effects and health concerns. However, in 1989-94 especially in Central Kalimantan, Maluku, and Lampung, side effects and health concerns became the main reasons for discontinuation. Figure 7.30 presents reasons for discontinuation in Maluku in 1986-91 and 1989-94. It shows a big change in reason composition over the two periods especially in relation to contraceptive failure and other reasons.

However, in Yogyakarta as shown in Figure 7.31, other reasons were the main reasons for discontinuation. The probability to discontinue due to other reasons was more than double compared to other three groups of reasons. The pattern of discontinuation due to side effects and health concerns was almost similar to the pattern for contraceptive failure, and also for the desire to become pregnant. Thus, from period to period the reason composition in Yogyakarta did not change very much.

Figure 7.30 Cumulative Probability of Contraceptive Discontinuation by Reason: Maluku, 1986-91 and 1989-94

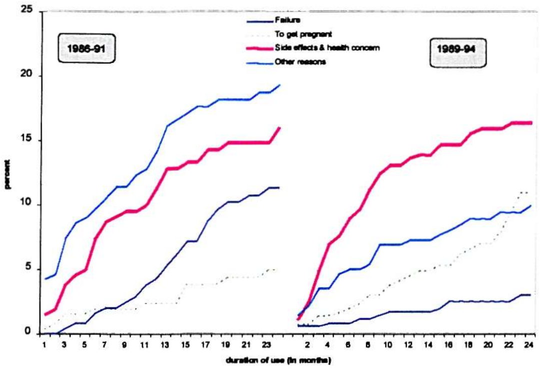
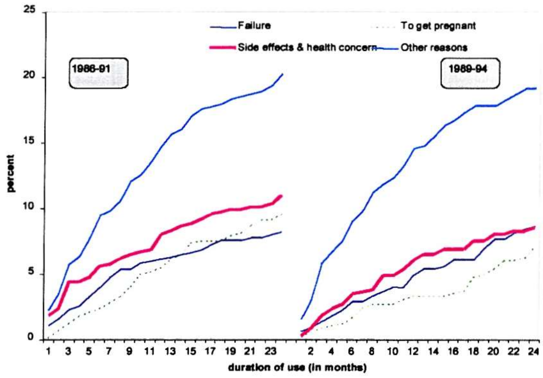



Figure 7.31 Cumulative Probability of Contraceptive Discontinuation by Reason: Yogyakarta, 1986-91 and 1989-94




In short, the main reasons for discontinuation were generally either due to experience of side effects and health concerns or other reasons. This suggests further investigation to answer the question about what users will do after discontinuation as they might be at risk of having an unwanted pregnancy. This will be studied in Chapter 8.

Table 7.10 Composition of Reason for Discontinuation by Province: 1986-91 and 1989-94

| Province | Time | 1986-91 | | | | 1989-94 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Failure | To get pregnant | Side effects & health concern | Other reasons | Failure | To get pregnant | Side effects & health concern | Other reasons |
| Jakarta | 12-M | 3.4 | 3.3 | 10.6 | 10.1 | 1.4 | 4.2 | 12.0 | 9.0 |
| | 24-M | 5.6 | 8.7 | 16.9 | 14.4 | 4.6 | 7.8 | 17.1 | 13.6 |
| West Java | 12-M | 1.6 | 9.2 | 14.0 | 7.7 | 3.1 | 6.9 | 13.0 | 8.7 |
| | 24-M | 3.7 | 14.5 | 17.8 | 12.5 | 5.1 | 10.9 | 18.9 | 12.0 |
| Central Java | 12-M | 3.4 | 5.36 | 7.8 | 7.1 | 2.1 | 5.8 | 8.0 | 7.2 |
| | 24-M | 6.5 | 11.47 | 10.6 | 12.7 | 3.7 | 10.0 | 11.6 | 11.0 |
| Yogyakarta | 12-M | 6.1 | 5.44 | 8.0 | 14.7 | 4.9 | 3.3 | 6.1 | 14.5 |
| | 24-M | 8.2 | 9.54 | 11.0 | 20.3 | 8.6 | 7.0 | 8.5 | 19.1 |
| East Java | 12-M | 3.2 | 4.45 | 11.8 | 10.4 | 3.7 | 7.1 | 9.4 | 7.6 |
| | 24-M | 6.0 | 7.91 | 15.3 | 14.7 | 6.7 | 10.4 | 12.6 | 10.7 |
| Bali | 12-M | 1.5 | 4.35 | 7.7 | 5.8 | 4.8 | 4.2 | 9.1 | 6.8 |
| | 24-M | 4.6 | 8.76 | 9.7 | 8.5 | 8.4 | 7.4 | 12.6 | 10.6 |
| Aceh | 12-M | 3.6 | 7.49 | 13.7 | 10.8 | 2.3 | 4.7 | 15.5 | 13.7 |
| | 24-M | 4.5 | 14.8 | 20.6 | 14.9 | 3.9 | 11.3 | 20.6 | 14.9 |
| North Sumatra | 12-M | 5.7 | 3.0 | 10.5 | 9.9 | 4.9 | 6.6 | 10.6 | 8.5 |
| | 24-M | 11.1 | 6.7 | 11.4 | 13.3 | 10.1 | 13.6 | 15.8 | 13.6 |
| West Sumatra | 12-M | 4.0 | 6.3 | 14.1 | 10.4 | 4.0 | 7.5 | 11.8 | 11.3 |
| | 24-M | 5.1 | 11.7 | 19.6 | 13.1 | 6.5 | 14.3 | 15.9 | 14.3 |
| South Sumatra | 12-M | 3.0 | 3.9 | 7.8 | 6.4 | 2.0 | 3.8 | 9.7 | 3.6 |
| | 24-M | 6.1 | 9.6 | 11.4 | 10.3 | 2.9 | 7.8 | 15.9 | 6.8 |
| Lampung | 12-M | 3.5 | 4.9 | 5.3 | 8.2 | 3.7 | 3.8 | 9.9 | 6.0 |
| | 24-M | 5.9 | 9.7 | 7.7 | 12.6 | 6.5 | 8.0 | 12.4 | 10.5 |
| West Nusa Tenggara | 12-M | 2.1 | 6.6 | 7.5 | 7.0 | 1.5 | 4.4 | 6.9 | 10.8 |
| | 24-M | 2.4 | 10.7 | 10.7 | 13.0 | 2.8 | 9.7 | 11.5 | 16.0 |
| West Kalimantan | 12-M | 4.0 | 4.1 | 11.2 | 9.9 | 3.2 | 5.3 | 13.4 | 9.0 |
| | 24-M | 7.8 | 7.6 | 15.0 | 12.9 | 5.9 | 10.2 | 19.2 | 12.2 |
| South Kalimantan | 12-M | 1.6 | 5.4 | 6.1 | 7.4 | 1.7 | 6.9 | 9.0 | 8.5 |
| | 24-M | 5.1 | 12.5 | 10.2 | 9.9 | 4.6 | 11.1 | 14.3 | 12.2 |

Table 7.10 Continued...

| Province | Time | 1986-91 | | | | 1989-94 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Failure | To get pregnant | Side effects & health concern | Other reasons | Failure | To get pregnant | Side effects & health concern | Other reasons |
| North Sulawesi | 12-M | 0.8 | 6.4 | 9.4 | 7.7 | 3.8 | 5.7 | 9.3 | 9.1 |
| | 24-M | 1.2 | 13.7 | 15.1 | 14.9 | 6.4 | 9.0 | 13.3 | 14.9 |
| South Sulawesi | 12-M | 3.0 | 4.3 | 11.5 | 4.9 | 3.2 | 4.2 | 16.0 | 7.9 |
| | 24-M | 5.9 | 10.6 | 15.1 | 7.0 | 5.9 | 8.4 | 18.7 | 13.7 |
| Riau | 12-M | 5.2 | 3.6 | 16.9 | 11.9 | 4.4 | 6.5 | 14.9 | 8.1 |
| | 24-M | 6.5 | 7.6 | 24.8 | 14.7 | 7.0 | 11.5 | 19.8 | 11.1 |
| Jambi | 12-M | 2.0 | 6.0 | 17.0 | 14.4 | 1.7 | 4.5 | 11.0 | 4.0 |
| | 24-M | 3.7 | 12.6 | 20.3 | 16.8 | 3.6 | 8.5 | 14.8 | 6.8 |
| Bengkulu | 12-M | 3.9 | 4.1 | 10.8 | 14.7 | 3.7 | 5.9 | 10.9 | 17.0 |
| | 24-M | 7.5 | 9.8 | 12.4 | 18.2 | 5.5 | 11.3 | 15.8 | 20.1 |
| East Nusa Tenggara | 12-M | 3.3 | 4.1 | 2.0 | 1.6 | 3.5 | 6.6 | 10.0 | 4.7 |
| | 24-M | 5.9 | 14.4 | 2.0 | 8.7 | 6.5 | 14.0 | 12.0 | 8.0 |
| East Timor | 12-M | 3.1 | 3.9 | 6.7 | 5.8 | 2.0 | 5.7 | 8.2 | 3.5 |
| | 24-M | 6.0 | 24.1 | 10.9 | 10.5 | 3.3 | 17.6 | 10.0 | 6.7 |
| Central Kalimantan | 12-M | 0.5 | 4.3 | 5.9 | 9.5 | 0.9 | 4.2 | 8.52 | 3.8 |
| | 24-M | 5.2 | 8.6 | 8.9 | 11.6 | 2.8 | 8.5 | 10.9 | 4.3 |
| East Kalimantan | 12-M | 5.2 | 6.7 | 10.9 | 9.6 | 2.3 | 6.8 | 14.4 | 11.1 |
| | 24-M | 6.1 | 11.9 | 13.3 | 15.3 | 3.0 | 13.5 | 19.1 | 13.7 |
| Central Sulawesi | 12-M | 0.6 | 6.4 | 7.3 | 10.7 | 1.8 | 6.1 | 9.4 | 10.3 |
| | 24-M | 2.3 | 12.3 | 10.3 | 13.9 | 1.8 | 13.1 | 10.9 | 11.7 |
| Southeast Sulawesi | 12-M | 4.7 | 1.4 | 17.1 | 8.9 | 1.9 | 5.3 | 13.5 | 6.0 |
| | 24-M | 4.7 | 8.6 | 19.7 | 10.6 | 7.8 | 9.9 | 17.2 | 9.0 |
| Maluku | 12-M | 4.3 | 2.4 | 11.4 | 14.2 | 1.7 | 4.5 | 13.6 | 7.2 |
| | 24-M | 11.3 | 4.9 | 16.0 | 19.3 | 3.0 | 10.9 | 16.4 | 10.0 |
| Irian Jaya | 12-M | 1.0 | 1.0 | 7.2 | 6.5 | 4.8 | 4.5 | 12.1 | 3.9 |
| | 24-M | 5.0 | 8.1 | 8.5 | 12.0 | 6.3 | 8.7 | 15.1 | 8.6 |

## 7.5 Contraceptive Failure Rates

Information on the determinants of contraceptive failure has important implications for the study of fertility as well as for women's health. Contraceptive failure becomes progressively more important determinant of fertility as fertility targets decline and as the prevalence of contraceptive use increases. Contraceptive failure rates often are of particular interest in the study of contraceptive use dynamics and fertility because they result directly in unwanted pregnancies, and, unless the pregnancies are aborted, contribute to fertility levels.

Contraceptive failure may occur either because the method itself fails or because the method is used incorrectly or inconsistently. Method, or clinical, failure rates attempt to measure failure under ideal conditions with perfect use, and are primarily useful for clinical evaluation of contraceptive methods. Use failure rates attempt to measure contraceptive failure rates in the population under the prevailing conditions of use. This latter measure is more useful from a programme perspective and is the type of failure that DHS surveys attempt to measure. All failure rates calculated in this chapter are use-failure rates.

Contraceptive failure results directly in unwanted pregnancies and contributes to fertility if the pregnancy is not aborted. High failure rates may indicate weakness in the family planning programme in providing information about correct use of methods. Examination of differentials in contraceptive failure rates helps to identify groups of users who have difficulty using particular methods effectively.

The observed failure rate is calculated from a multiple-decrement life table as presented in the previous chapter. However, the net failure rate obtained from the multiple-decrement life table depends not only on the level of the failure rate, but also on the level of discontinuation for other reasons. If discontinuation for reasons other than failure is very high, failure rates will correspondingly be reduced because few women are exposed to the risk of failure for very long. Hence, differentials in net failure rates between methods and subgroups of the populations reflect not only differential in the level of failure, but also differential in the level of discontinuation for other reasons. If the level of discontinuation for reasons other than failure vary a lot between the different subgroups of the population of interest, the comparison of failure rates will be distorted.

One way to overcome this problem is to calculate failure rates using an associated single-decrement life table. Such a life table assumes that women will only discontinue use of a method if they fail while using it. Hence, the effect of the other competing reasons for discontinuation is eliminated. The associated single-decrement life table can be constructed by treating all discontinuation for reasons other than failure as censored observations. The failure rates calculated in this way are called gross failure rates. They represent the failure rates that would be expected if failure was the only reason for discontinuing use of contraception. As such they are theoretical failure rates, and represent the underlying risk of failure in the population. Gross failure rates are higher than the corresponding net failure rates because if all other reasons for discontinuation are eliminated, more users will be at risk of failing so the failure rate will increase.

Contraceptive failure rates vary considerably by method, but they also vary across subgroups of the population because some women use contraception more effectively than others. The objectives of this section are to obtain life-table estimates of contraceptive failure for countrywide, for all provinces and for different characteristics of users, and also to compare estimates from two DHS surveys. We seek answers to questions: How varied are contraceptive failures across methods and across provinces; how different are the rates between two periods. Of course, we would expect to see large variations in overall failure rates among provinces because of differing compositions of method use.

### 7.5.1 Country Level Estimates

Table 7.8 presents the gross 12-month failure rate for each method and for all methods and all reversible methods combined. The first-year contraceptive failure rate for all reversible methods was 3.4 in 1986-91 and 3.5 in 1989-94. These two estimates were higher than the 2.8 (Moreno and Goldman, 1991) calculated from the 1987 data and the second lowest among 15 developing countries studied. There is no difference between the overall 12-month failure rate for all reversible methods and for all methods combined, because sterilization is not widely used in Indonesia and contributes only a small proportion of segments of use.

As expected, failure rates do vary significantly across methods. The failure rate of Norplant was the lowest, less than 1%, while that of abstinence was the highest. Among modern government-supplied methods, the first-year failure rate of the pill was the highest in both periods, which were

3.5% in 1986-91 and 5.1% in 1989-94. Compared to previous research by Moreno and Goldman, we could conclude that the pill failure rate increased during 1987-1994.

The higher pill failure rate compared to the IUD found in this study is consistent with Moreno and Goldman (1991). The IUD failure rate also increased from 1.4% in 1986-91 to 2.0% in 1989-94. However, the injectables failure rate for these two periods was reversed and the direction was expected. The first-year failure rate of injectables slightly decreased from 2.0% to 1.8%. Unfortunately this rate cannot be compared to the previous periods because Moreno and Goldman grouped it with other methods. Traditional methods and condoms are more likely to be used improperly, which contributes to their high failure rates, compared with other methods. The condom failure rate in 1986-91 was even higher than that of withdrawal, but it decreased by almost 50% in 1989-94.

Very few estimates exist of contraceptive failure rates across subgroups of the Indonesian population. Researchers have frequently assumed that better educated women and those living in urban areas are likely to use contraception more effectively than other women (Moreno, 1993; Wang, 1996). However, this study found that contraceptive failure was higher in urban areas than in rural areas, while Moreno's study (1993) the reverse though the differences were very small. Moreover, this study found the failure rate in rural areas was likely to increase from the period of 1986-91 to 1989-94, but this was not the case in urban areas, where the rates were unchanged.

Regarding woman's educational level, this study found no evidence that women with more education were less likely than those with less education to experience contraceptive failure. This finding was also found by Moreno, i.e. more educated women were more likely to experience contraceptive failure. The rate was 6.3 for those who completed secondary school and above in 1986-91. It decreased to 5.0 in 1989-94. On the other hand, this rate for less educated women increased during the two periods. Likewise, similar differentials in failure rates by husband's education was also found, i.e. the more educated the husband, the more likely was their wife to experience contraceptive failure.

As biological ability to conceive declines as women age, so that age of the woman at the time of birth starting the interval within which the segment of use is located was used as a proxy for fecundity (Moreno, 1993). This study measured age as age at the start of the episode of use. In 1986-91 users who were less than 25 years old were more likely to experience contraceptive failure than those who were older. In 1989-94, the direction of failure was similar but it happened to older women.

### 7.5.2 Provincial Level Estimates of Contraceptive Failure Rates

Overall failure rates, inclusive or exclusive of sterilisation, vary substantially across the 15 developing countries studied by Moreno and Goldman (1991), ranging from low values in Thailand (2%) and Indonesia (3%) to high values in Peru (16%) and Bolivia (29%). The low value of Indonesia's failure rate was also found in Ali and Cleland's study (1995) among six developing countries.

Variation in contraceptive failure rate here is also found among provinces and the rate was generally low. Table 7.11 presents 12-month and 24-month failure rates by province for all reversible methods and also for all methods. The failure rate in 1986-91 varied from the highest rate of 7.1% in Yogyakarta to the lowest one of 0.5% in Central Kalimantan. In 1989-94 the highest rate was 5.6% (Yogyakarta) and the lowest was 1.0% (Central Kalimantan). Therefore, the gap between the highest and the lowest rates was narrower. Compared to the national rate, twelve provinces fell below the national rate in 1986-91 while thirteen provinces did in 1989-94.

Between the two periods, some provinces had an increase in failure rates such as West Java, East Java, Bali, Lampung, South Kalimantan, Central Kalimantan, North Sulawesi, South Sulawesi, Central Sulawesi, East Nusa Tenggara and Irian Jaya. Though perhaps not generally failure rate becomes an important issue to provinces with low fertility levels. East Java, Bali and North Sulawesi are provinces, which have reached low total fertility rate. Moreover, Bali and North Sulawesi had the second highest increase in failure rate with more than 3 percentage points over the two periods. In Irian Jaya, the failure rate increased with more than 4 points from 1.1 in 1986-91 to 5.4 in 1989-94.

Generally, provinces with an increase in failure rates also had an increase in overall discontinuation rates. Exceptions were Bali, Lampung, South Kalimantan, North Sulawesi, South Sulawesi, East Nusa Tenggara and Irian Jaya. Failure rates, therefore, was likely to account for the increase in overall discontinuation rate over the two periods.

The remaining provinces had a decrease in failure rates from 1986-91 to 1989-94. The biggest four decreases were in East Kalimantan, Maluku, Southest Sulawesi and Jakarta.

Comparison between the 12-month and 24-month failure rate reveals that in most provinces the 24-month failure rate was almost twice or more than the 12-month rate. This means that more users experienced contraceptive failure in the second year of use than in the first year of use. Execptions were in East Kalimantan and Riau in both periods.

Table 7.11 12-month Contraceptive Failure Rates by Province: 1986-91 and 1989-94

| Province | All reversible methods | | All methods | | Difference between Two periods | |
|---|---|---|---|---|---|---|
| | 1986-91 | 1989-94 | 1981-94 | 1989-94 | Reversible | All Methods |
| **12-month Failure Rate** | | | | | | |
| Jakarta | 3.9 | 1.6 | 3.8 | 1.6 | -2.3 | -2.2 |
| West Java | 1.9 | 3.5 | 1.9 | 3.4 | 1.6 | 1.5 |
| Central Java | 3.8 | 2.2 | 3.8 | 2.1 | -1.6 | -1.7 |
| Yogyakarta | 7.1 | 5.6 | 6.9 | 5.5 | -1.5 | -1.4 |
| East Java | 3.7 | 4.4 | 3.6 | 4.2 | 0.7 | 0.6 |
| Bali | 1.7 | 5.4 | 1.6 | 5.1 | 3.7 | 3.5 |
| Aceh | 4.5 | 2.9 | 4.5 | 2.9 | -1.6 | -1.6 |
| North Sumatra | 6.6 | 5.8 | 6.2 | 5.4 | -0.8 | -0.8 |
| West Sumatra | 5.1 | 4.9 | 5.0 | 4.7 | -0.2 | -0.3 |
| South Sumatra | 3.3 | 2.2 | 3.1 | 2.1 | -1.1 | -1.1 |
| Lampung | 4.0 | 4.3 | 3.9 | 4.5 | 0.3 | 0.6 |
| West Nusa Tenggara | 2.4 | 1.8 | 2.4 | 1.8 | -0.6 | -0.6 |
| West Kalimantan | 4.8 | 3.8 | 4.8 | 3.8 | -1.0 | -1.0 |
| South Kalimantan | 1.8 | 1.9 | 1.7 | 1.8 | 0.1 | 0.1 |
| North Sulawesi | 1.0 | 4.3 | 1.0 | 4.2 | 3.3 | 3.3 |
| South Sulawesi | 3.4 | 3.9 | 3.3 | 3.8 | 0.5 | 0.5 |
| Riau | 6.3 | 5.4 | 6.3 | 5.3 | -0.9 | -0.9 |
| Jambi | 2.4 | 1.9 | 2.4 | 1.9 | -0.5 | -0.5 |
| Bengkulu | 4.9 | 4.7 | 4.8 | 4.6 | -0.2 | -0.2 |
| East Nusa Tenggara | 3.4 | 4.0 | 3.2 | 3.9 | 0.6 | 0.7 |
| East Timor | 3.4 | 2.2 | 3.3 | 2.2 | -1.1 | -1.1 |
| Central Kalimantan | 0.5 | 1.0 | 0.5 | 1.0 | 0.5 | 0.5 |
| East Kalimantan | 6.1 | 2.6 | 6.0 | 2.5 | -3.5 | -3.5 |
| Central Sulawesi | 0.7 | 2.1 | 0.7 | 2.1 | 1.4 | 1.4 |
| Southeast Sulawesi | 5.6 | 2.2 | 5.6 | 2.2 | -3.4 | -3.4 |
| Maluku | 5.4 | 2.0 | 5.3 | 1.9 | -3.4 | -3.4 |
| Irian Jaya | 1.1 | 5.4 | 1.1 | 5.3 | 4.3 | 4.2 |

Continued ...

Table 7.11 Continued...

| Province | All reversible methods | | All methods | | Difference between two periods | |
|---|---|---|---|---|---|---|
| | 1986-91 | 1989-94 | 1986-91 | 1989-94 | Reversible | All Methods |
| **24-month Failure Rate** | | | | | | |
| Jakarta | 7.2 | 6.3 | 6.9 | 6.2 | -0.8 | -0.7 |
| West Java | 5.3 | 6.6 | 5.2 | 6.4 | 1.3 | 1.2 |
| Central Java | 8.2 | 4.5 | 8.0 | 4.3 | -3.7 | -3.8 |
| Yogyakarta | 10.4 | 11.0 | 10.0 | 10.8 | 0.7 | 0.8 |
| East Java | 7.8 | 8.6 | 8.3 | 8.2 | 0.8 | -0.1 |
| Bali | 5.8 | 10.2 | 5.8 | 9.7 | 4.4 | 3.9 |
| Aceh | 6.1 | 5.6 | 6.0 | 5.5 | -0.5 | -0.5 |
| North Sumatra | 14.0 | 13.7 | 13.3 | 12.8 | -0.3 | -0.5 |
| West Sumatra | 6.8 | 8.9 | 7.3 | 8.6 | 2.0 | 1.3 |
| South Sumatra | 7.6 | 3.4 | 7.8 | 3.2 | -4.2 | -4.5 |
| Lampung | 7.2 | 7.9 | 7.1 | 8.1 | 0.7 | 1.0 |
| West Nusa Tenggara | 2.8 | 3.6 | 2.8 | 3.6 | 0.8 | 0.8 |
| West Kalimantan | 10.4 | 7.9 | 10.9 | 7.7 | -2.5 | -3.2 |
| South Kalimantan | 6.5 | 6.1 | 8.2 | 5.9 | -0.4 | -2.3 |
| North Sulawesi | 1.5 | 8.0 | 1.5 | 7.8 | 6.5 | 6.4 |
| South Sulawesi | 7.3 | 8.1 | 7.0 | 8.0 | 0.9 | 1.0 |
| Riau | 8.7 | 9.5 | 8.6 | 9.3 | 0.8 | 0.7 |
| Jambi | 5.5 | 4.4 | 5.4 | 4.3 | -1.1 | -1.0 |
| Bengkulu | 10.5 | 7.7 | 10.4 | 7.4 | -2.9 | -3.0 |
| East Nusa Tenggara | 6.4 | 8.1 | 5.9 | 7.7 | 1.7 | 1.8 |
| East Timor | 7.2 | 4.0 | 7.1 | 3.9 | -3.2 | -3.2 |
| Central Kalimantan | 6.9 | 3.4 | 6.9 | 3.4 | -3.5 | -3.5 |
| East Kalimantan | 7.4 | 3.8 | 7.3 | 3.7 | -3.6 | -3.6 |
| Central Sulawesi | 3.3 | 2.1 | 3.2 | 2.1 | -1.2 | -1.1 |
| Southeast Sulawesi | 5.6 | 10.5 | 5.6 | 10.1 | 4.8 | 4.5 |
| Maluku | 16.3 | 3.9 | 16.0 | 3.8 | -12.4 | -12.2 |
| Irian Jaya | 6.1 | 7.5 | 8.4 | 7.2 | 1.4 | -1.2 |

## 7.6 Contraceptive Discontinuation in Bali

This section studies contraceptive discontinuation in Bali to provide a background on the analysis of determinants of contraceptive discontinuation and switching after the discontinuation (in Chapter 9 and Chapter 10, respectively). The discussion starts with the result from preliminary analysis of the data. To study method choice and also overall effectiveness, it is important to look at the distribution of segments of use according to each method in the sample. As shown in Table 7.12, the IUD is the most popular method, with more than 50% of all segments included in the sample. Injectables also play an important role in the method mix, accounting for about one fourth of all segments of use in the 1986-91 dataset and one third in the 1989-94. The least used methods were less effective methods, consisting condom and traditional methods (withdrawal, abstinence, and herbs).

Table 7.12 shows changes among contraceptive users by looking at the change in the percentage of segments of use by each contraceptive method during the two periods. The percentages of segments of use of the IUD slightly decreased while the percentages of segments of use the pill and also injectables increased.

Table 7.12 Distribution of Segments of Use by Method in Bali: 1986-1991 and 1989-1994

| Method of Contraception | 1986-91 | | 1989-94 | |
|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent |
| Pill | 50 | 10.7 | 67 | 11.9 |
| IUD | 258 | 55.4 | 286 | 50.9 |
| Injectables | 118 | 25.3 | 175 | 31.1 |
| Less effective methods | 40 | 8.6 | 34 | 6.1 |
| Total | 466 | 100.0 | 562 | 100.0 |

The distribution of the number of segments of use according to the reason for discontinuation is given in Table 7.13. The table shows that very high proportions of these segments of contraceptive use were right-censored. Censored segments were 67% in 1986-1991 and 59% in 1989-1994. Some possible explanations are that Balinese women relied heavily on the IUD, known as a long-term method of contraception. In addition, Balinese women use contraception with high motivation to control their fertility as Bali had achieved a below replacement level of fertility. However, over the period of observation, there was a decline in the percentage of those who were still using contraception at the end of that observation period. In other words, there were more users likely to discontinue use of contraceptive. Approximately equal proportions of the segments were discontinued due to wanting to become pregnant, and 'side effects and health concerns'.

Table 7.13 Distribution of the number of segments of contraceptive use according to the reasons reported for discontinuation: Bali, 1986-1991 and 1989-1994

| Reasons for Discontinuation | 1986-91 | | 1989-94 | |
|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent |
| Still Using | 312 | 67.0 | 334 | 59.4 |
| Failure | 20 | 4.3 | 39 | 6.9 |
| To get pregnant | 47 | 10.1 | 66 | 11.7 |
| Side effects and health concerns | 42 | 9.0 | 73 | 13.0 |
| Other Reasons* | 45 | 9.7 | 50 | 8.9 |
| Total | 466 | 100.0 | 562 | 100.0 |

Noted: * Other reasons consist of partner disapproved, availability, want more effective method, inconvenient to use, infrequent sex, cost, separated/widowed, fatalistic, IUD expelled, don't know and other.

All selected segments of use in the 1991 analysis come from 366 ever-married women while in 1994 come from 433 ever-married women. This means that many women may contribute more than one segment in the sample. One may expect women who had experienced difficulty with use of contraception to discontinue early. It may take some time before women are fully familiar with their use. This is especially true for some modern reversible methods. If they cannot cope with this, they will therefore contribute to a series of short durations of use, while those who have fewer problems will continue use and have a long period of use and will contribute one segment of use only. Difficulty with use might happen because users may have different reactions to the side effects from a particular contraceptive method. Because fecundability also varies across women, the risk of experiencing contraceptive failure will vary as well.

Table 7.14 Distribution of the Number of Segments of Use Contributed by Each Woman: Bali, 1986-1991 and 1989-1994

| Number of segments of use | 1986-1991 | | 1989-1994 | |
|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent |
| 1 | 286 | 78.1 | 333 | 76.9 |
| 2 | 63 | 17.2 | 74 | 17.1 |
| 3 | 14 | 3.8 | 23 | 5.3 |
| 4 | 3 | 0.8 | 3 | 0.7 |
| Total | 366 | 100.0 | 433 | 100.0 |

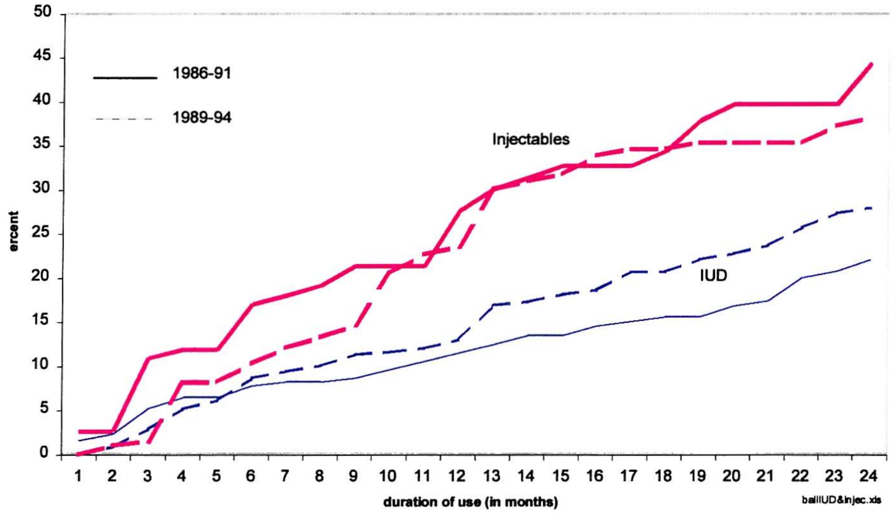
Table 7.14 shows the distribution of the number of segments of use contributed by each woman in the sample, which ranges from one to four segments of use. Those who have contributed more than one segment of use accounts for 22% in the 1991 selected sample and 23% in the

1994 sample. These suggest that the observations will not be independent if an association exists between the segments for the same woman. In such a case, a single-level multinomial model would not be appropriate. Although one could include variables relating to a woman's previous experience in contraceptive use, a single level analysis still may not capture the full extent of the association between segments of use for a woman. Therefore, for the analysis of contraceptive discontinuation and switching presented in Chapters 9 and 10 we will use a multilevel analysis approach.

In the following paragraphs we will present overall contraceptive discontinuation rate and also the rate for a particular method or population subgroups.

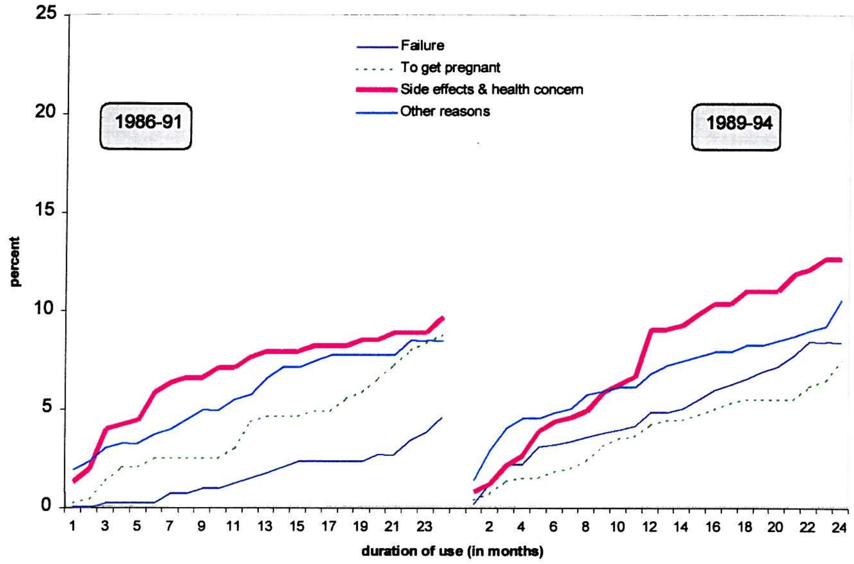
Overall cumulative probabilities discontinuation were likely to increase from 1986-91 to 1989-94. In fact, the percentage of the users discontinuing within 12 months had increased from 20% in 1986-1991 to 25% in 1989-1994. However, in the first six months of use the cumulative probabilities were unlikely to be different.

**Figure 7.32 Trends in Cumulative Probabilities for Discontinuation of the IUD and Injectables in Bali: 1986-1991 and 1989-1994**




Differentials in life table discontinuation rates among the IUD and injectables users are examined in Figure 7.32. The other reversible methods are not examined because of the absence of a large number of segments of use. As can be seen from Figure 7.32, the probability to discontinue for the users of injectables was twice as high as those of the IUD users. It was higher in the latter period and it was more pronounced in the second year of initiation of use. In other words, the probability to discontinue after two years of the start of use of the IUD was higher in 1989-94 than in 1986-91. This graph shows that the injectables users initially did well on their first nine months of adopting the method in 1989-94 but they became more likely to discontinue in the following months of the use.

**Figure 7.33 Cumulative Probability of Contraceptive Discontinuation by Reason Bali, 1986-91 and 1989-94**



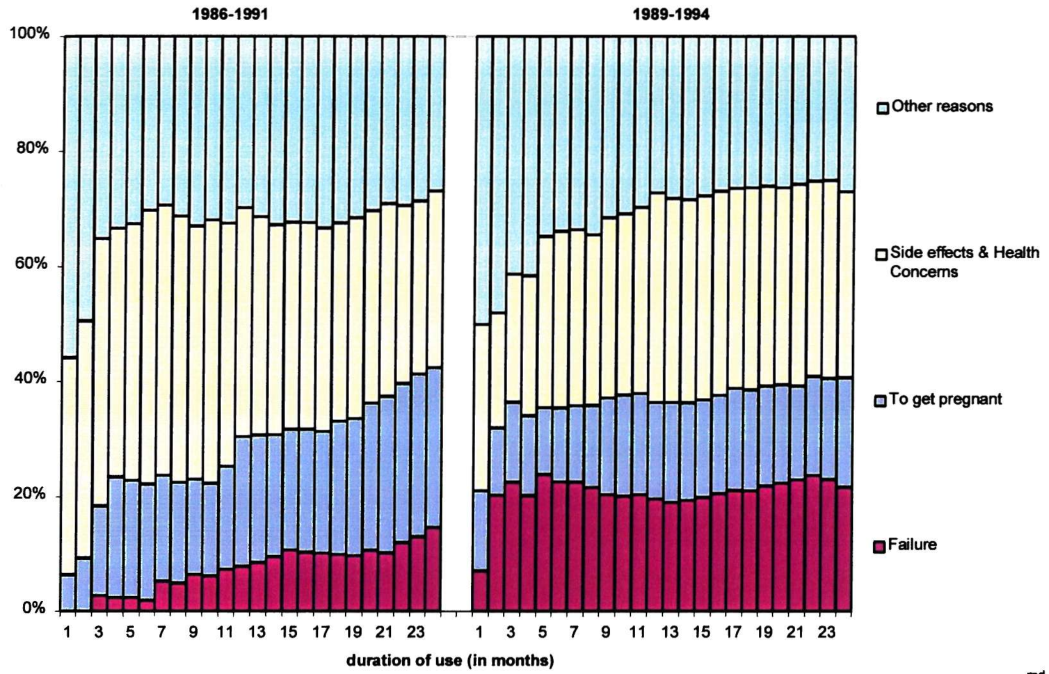

Experience of side effects and health concerns in 1986-91 was the main reason for discontinuation after three months of initiation of use (Figure 7.33); yet, before that period other reasons for discontinuation were the most common reason. Side effects and health concerns were not the main reason for discontinuation for the first year of initiation of use in 1989-1994.

Discontinuation due to desire to become pregnant was lower than that of other reasons for the first two years of initiation of use in 1986-199, but after that the likelihood of wanting to get pregnant became higher. Discontinuation due to desire to become pregnant was always lower than that of other reasons for the first two years after adopting use.

Another important result is that contraceptive failure increased over time. Only about 1.5% of users experienced contraceptive failure in the first year of contraceptive use in 1986-1991 and in the latter period it was nearly 5.0%. Although discontinuation for all other reasons increased, but the increase in contraceptive failure was the highest.

To assess the relative contribution of each different reason over time, the discontinuation rate is broken down by each reason (Figure 7.34). Side effects and health concerns together with other reasons were by far the main reason for discontinuation. These reasons accounted for more than 60% of the total discontinuation rate.

**Figure 7.34. Changes in Relative Contribution of Each Reason of Contraceptive Discontinuation for Each Month of Use: Bali, 1986-1991 and 1989-1994**

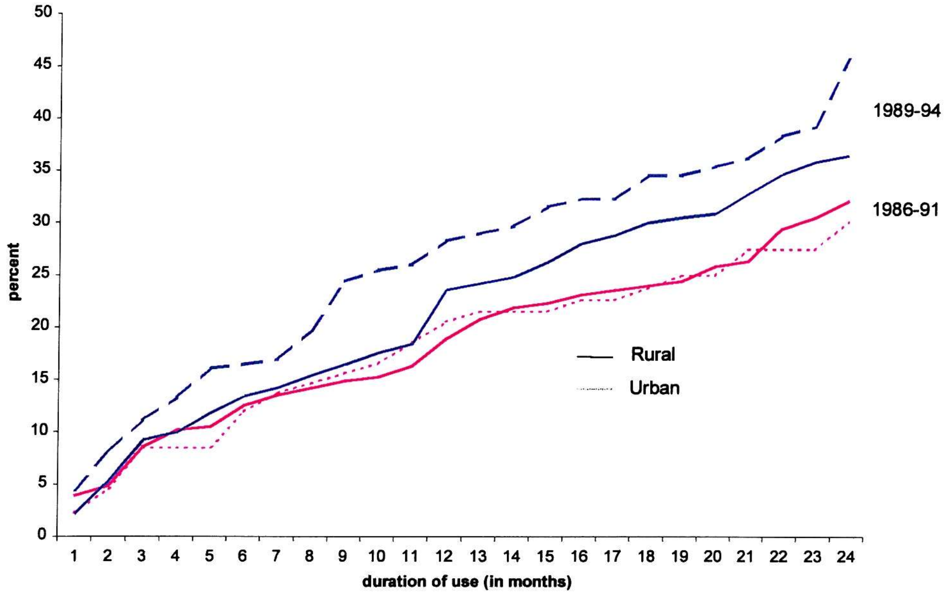



md_prov.xls

Contraceptive failure increased to almost 20% in the 1989-94. Two possible explanations for this are, first, because many users no longer used the IUD, known as a long-term and more effective method; they switched to less effective methods such as the pill and injectables (Table 7.12).

There was little difference in rates of discontinuation between two areas (urban and rural) in 1986-91, but there was a larger difference in 1989-94 (Figure 7.35). In addition, the probability of discontinuation among urban users had risen more than that of the rural ones over time. In urban areas 20% discontinued after one year of acceptance in 1986-91 and increased to nearly 30% in the latter period. It is alarming if the probability of discontinuation is rising. If true, something must be done to tackle this problem.

Figure 7.35 Changes in Cumulative Probabilities of Contraceptive Discontinuation by Place of Residence between 1986-91 and 1989-94: Bali




The service delivery of family planning needs review as we found that contraceptive discontinuation in Bali increased substantially from 1986-91 to 1989-94. The increase was much higher in urban areas compared to in rural areas. Where the IUD is the predominant method in a province, the IUD discontinuation rate increased from about 20% to 25%. Side effects and health concerns were the most common reasons for discontinuation and also other reasons were another common reason. These reasons may be perceived very early after initiation of contraceptive use and efforts dealing with these complains could make users no longer discontinue at the early stage.

## 6.7 Summary

This chapter provides some useful insight into contraceptive discontinuation. Although contraceptive prevalence in Indonesia increased from 50% in 1991 to 55% in 1994, contraceptive discontinuation rates did not seem to be different at about 30% within a year since initiation of use. Interestingly, changes in discontinuation rates varied across methods. The discontinuation rate of the pill, the most common contraceptive method used, slightly increased from 1986-91 to 1989-94. Discontinuation rates of Norplant and herbs also increased. More interestingly, pill failure rates also increased though its discontinuation because of failure was low compared to its dominant reasons for discontinuation, i.e. side effects and health concerns. On the other hand, condom discontinuation rates were the highest among all reversible methods. Condom users mostly (more than 50%) discontinued because of method-related reasons. Condom failure rates were the highest among modern methods, but its failure rate decreased substantially from 1986-91 to 1989-94.

Contrary to expectation, urban users were more likely than rural ones to discontinue contraceptive methods. The more educated women were more likely to discontinue than the less educated women were.

This study finds that users discontinued mostly (more than 50%) because of side effects and health concerns, regardless of the background variables. These reasons were mostly mentioned by the pill, injectable and IUD users. Moreover, these three groups were the main users of contraceptive methods. This finding raises a question on what they did after discontinuation. Did they switch to another method, or did they abandon use of contraception? This question is discussed in the next chapter.

Provincial variations in contraceptive discontinuation rates existed and the rates changed over time. In 1986-91 discontinuation rates ranged from 11% (East Nusa Tenggara) to 39% (Jambi), while in 1989-94 the rates ranged from 17% (Central Kalimantan) to 37% (Bengkulu). Eleven out the 27 provinces did not seem to have different discontinuation rates over the two periods, seven experienced declining discontinuation rates, and nine had increasing discontinuation rates. This finding indicates the importance of the provincial variation in contraceptive dynamics.

Interestingly, one of the nine provinces with an increasing discontinuation rate was Bali province. The decrease in contraceptive prevalence from 72% in 1991 to 68% in 1994 in Bali was accompanied by an increase in both the discontinuation rate and failure rate.

In conclusion, this chapter indicates the importance of examining the quality of contraceptive use in Indonesia with taking into consideration variations among provinces. The next chapter studies switching behaviour after discontinuation.

# Chapter 8

# LIFE TABLE ANALYSIS OF SWITCHING BEHAVIOR IN INDONESIA

## 8.1 Introduction

While Chapter 6 studies contraceptive discontinuation. This chapter studies contraceptive switching behaviour after discontinuation in order to examine the consequences of the different risks of discontinuation, i.e. to look at what happens after a woman discontinues use of contraception. If she decides not to switch to any method at all and she still needs contraception, she is more likely to have an unintended pregnancy. Or, if she switches to a less effective method, she is at higher risk of having an unintended pregnancy. These factors may increase the fertility level. On the other hand, if she does switch to more effective method, she is less likely to have an unintended pregnancy. Therefore, the impact of contraceptive discontinuation on fertility depends on the woman's decision after discontinuation. In other words, switching behaviour is another important component of contraceptive use dynamics.

Contraceptive switching behaviour after discontinuation is analysed by examining the woman's new contraceptive use status in the month immediately after discontinuation in conjunction with information on the reason for discontinuation. The new contraceptive status after discontinuation is classified into three categories: using another method of contraception (switching), not using contraception (abandoning), and no longer needs contraception. This categorisation follows the framework proposed by Curtis and Hammerslough (1995). More practical explanation of the categorisation is explained in Section 4.6.2. The analysis in this chapter focuses on the women who discontinued use of contraception but they were still in need of contraception, that is the women who experienced contraceptive switching and abandoning. Those who were not in need are discussed in Chapter 6. Unfortunately, there are no information on what they did if they became at risk of unwanted pregnancy. Therefore, this question is beyond the scope of this research.

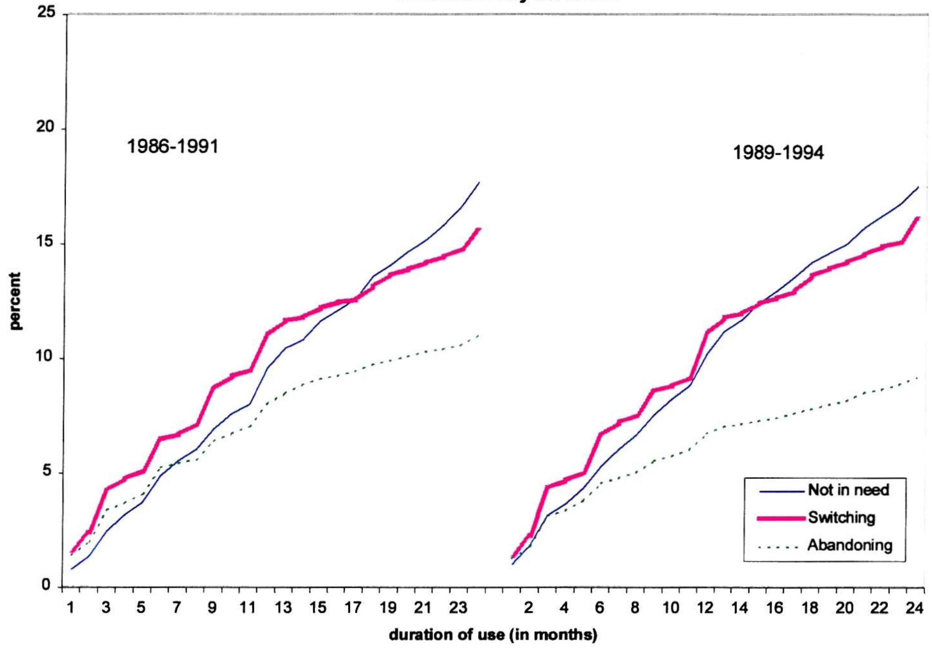
Presented in both graphs and tables, the multiple-decrement life table is here employed to estimate the rates of switching behaviour after discontinuation. The results first presented are the life table of switching behaviour calculated by the multiple decrement life table (MDLT) for Indonesia as a whole as well as differentials by place of residence, region, woman's education, husband's education, woman's age and also province in 1986-91 and 1989-94. The changes in switching and abandoning rates between the two periods are examined by comparing the rates calculated using an associated single-decrement life table. Bali's life table of switching is presented and also examined in the context of other provinces in Indonesia, because Bali is the focus of this research.

## 8.2 Overall and Method-specific Switching Behaviour in Indonesia

Firstly, cumulative probabilities of switching behaviour after discontinuation from all reversible methods of contraception as a whole are estimated for the national level in 1986-91 and 1989-94. Then similar estimates for each method of contraception are calculated. Multiple decrement life tables/ MDLT (see Section 4.2.2.2) are used to calculate the hazard of each type of switching at every month in the observation period. These hazards are then used to estimate cumulative probabilities of switching within two years of initiation of the method use. Figure 8.1 shows life table estimates of the cumulative probabilities of switching behaviour after discontinuation for all reversible methods as a whole in Indonesia in 1986-91 and 1989-94. Figures 8.2 until 8.8 show life table estimates for each method. To summarise these results, Table 8.1 presents the 12-month and 24-month cumulative probabilities of switching behaviour for all reversible methods as a whole and for each method.

As presented in Chapter 6, for all reversible methods about 28% Indonesian users in both periods discontinued within a year of initiating use. These discontinued users mainly consisted of those who were still in need of contraception, that is, those who switched to alternative methods or to non-use while they were at risk of an unwanted pregnancy. Those who switched to another method were higher than those who abandoned. The rate of switching to another method within a year of initiation of use was about 11% in both periods and the rate of abandoning use was 8% in 1986-91 and 7% in 1989-94. As seen in Figure 8.1, up to about one and half year (1986-91) after and up to 15 months (1989-94) after initiation of use switching to another method was the most common state discontinuation. This indicates that those who discontinued at early stage could find an alternative method. In 1986-1991, the rate of abandoning while still in need for

**Figure 8.1 Cumulative Probability of Contraceptive Switching Behaviour After Discontinuation:Indonesia, 1986-91 and 1989-91 Calculated by an MDLT**




contraception was slightly higher in the first six months of use in 1986-91 than the rate of those who were no longer in need. In 1989-94 both rates were similar at early duration (Figure 8.1). The rate of abandoning within 2 years after initiation in was slightly lower in 1989-94 (9%) than in 1986-91 (11%).

Behaviour after discontinuation is differentiated by the method of contraception. Figure 8.2 shows cumulative probabilities of switching behaviour after discontinuation from pill use. Among pill users who discontinue, abandonment was higher than switching in 1986-91. Regardless level of the pill discontinuation rate, the higher abandonment than switching is also found in Zimbabwe (Sambisa, 1996) and in the Philippines (Perez and Tabije, 1996). However, among pill discontinued users, abandoning and switching were similar in 1989-94.

**Figure 8.2 Cumulative Probabilities of Switching Behaviour After Discontinuation from Pill Use: Indonesia, 1986-91 and 1989-94 Calculated by an MDLT**

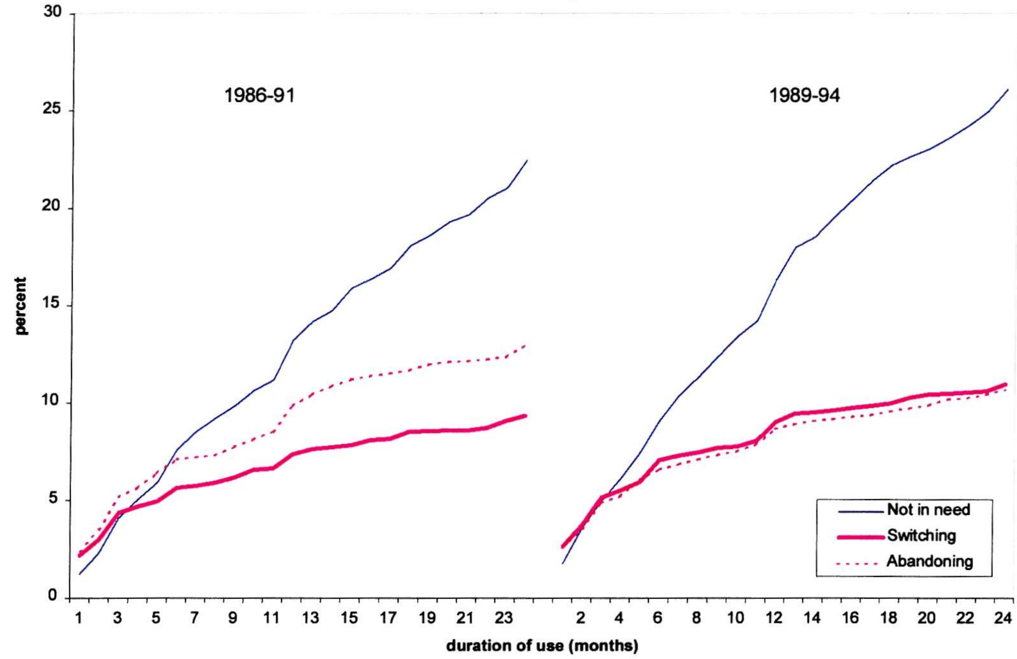
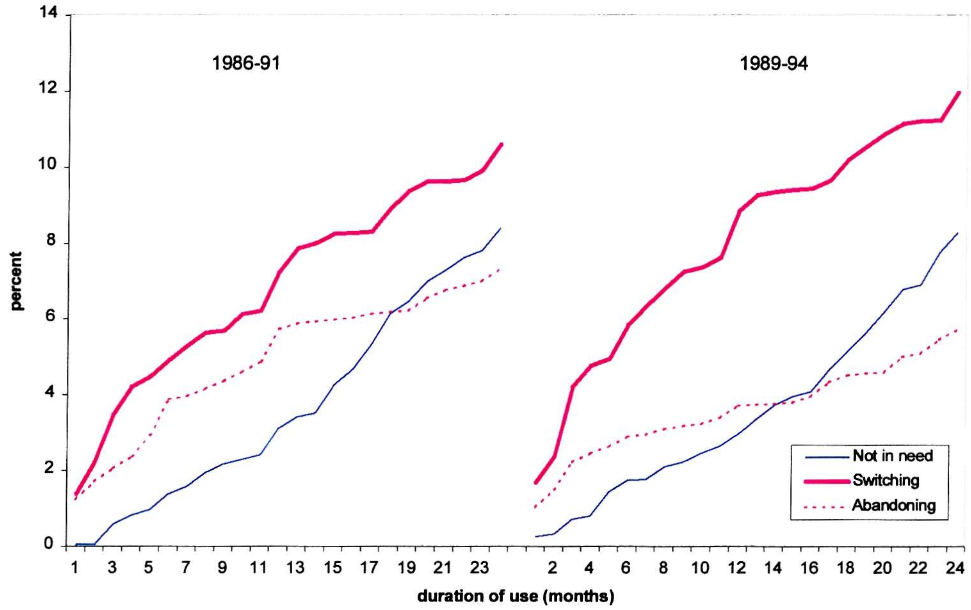



Table 8.1 12-month and 24-month Cumulative Probabilities of Switching Behaviour By Method of Contraception: Indonesia, 1986-91 and 1989-94

| | Method of Contraception | 1986-91 Switching | Abandoning | Not in needs | 1989-94 Switching | Abandoning | Not in needs |
|---|---|---|---|---|---|---|---|
| 12-month | All reversible | 11.0 | 8.0 | 9.6 | 11.1 | 8.7 | 10.2 |
| 24-month | methods | 15.6 | 11.0 | 17.7 | 16.1 | 9.2 | 17.5 |
| | | | | | | | |
| 12-month | Pill | 7.4 | 9.8 | 13.2 | 9.0 | 8.7 | 16.3 |
| | IUD | 7.2 | 5.7 | 3.1 | 8.9 | 3.7 | 3.0 |
| | Injection | 16.4 | 9.3 | 7.5 | 15.0 | 7.0 | 7.4 |
| | Norplant | 0.9 | 0.8 | 1.9 | 1.5 | 2.5 | 0.4 |
| | Condom | 25.6 | 6.5 | 19.7 | 24.3 | 11.2 | 16.5 |
| | Abstinence | 14.2 | 2.1 | 22.8 | 11.5 | 2.3 | 19.4 |
| | Withdrawal | 23.3 | 3.9 | 22.6 | 14.9 | 3.7 | 17.8 |
| | Herbs | 2.3 | 9.8 | 13.6 | 6.1 | 8.2 | 24.9 |
| | Others | 2.8 | 13.9 | 30.0 | 9.4 | 5.0 | 12.1 |
| 24-month | Pill | 9.3 | 13.0 | 22.5 | 11.0 | 10.7 | 26.1 |
| | IUD | 10.6 | 7.3 | 8.4 | 12.0 | 5.7 | 8.3 |
| | Injection | 25.3 | 13.6 | 15.5 | 24.8 | 10.3 | 13.1 |
| | Norplant | 2.5 | 2.6 | 2.9 | 2.6 | 5.1 | 1.3 |
| | Condom | 30.9 | 8.3 | 30.3 | 30.8 | 11.2 | 20.7 |
| | Abstinence | 16.1 | 2.9 | 35.8 | 12.5 | 3.2 | 38.8 |
| | Withdrawal | 28.1 | 4.8 | 35.3 | 17.2 | 3.9 | 34.6 |
| | Herbs | 15.1 | 15.0 | 7.7 | 13.3 | 10.2 | 36.0 |
| | Others | 21.5 | 16.2 | 23.1 | 13.4 | 11.4 | 27.7 |

The injectable discontinued users behaved completely different from the pill users (Figure 8.3). They immediately switched to another method when they discontinued even at the very early discontinuation. However, within a year of initiation of use the percentage of those who were abandoning was higher than that of those who were not in need. The difference between these two groups was bigger in 1986-91 than 1989-94. In 1986-91 the rate of abandoning within a year of initiation of use was 5.7% and the rate of not in need was 3.1%, and in 1989-94 the rates were about 3% (Table 8.1).

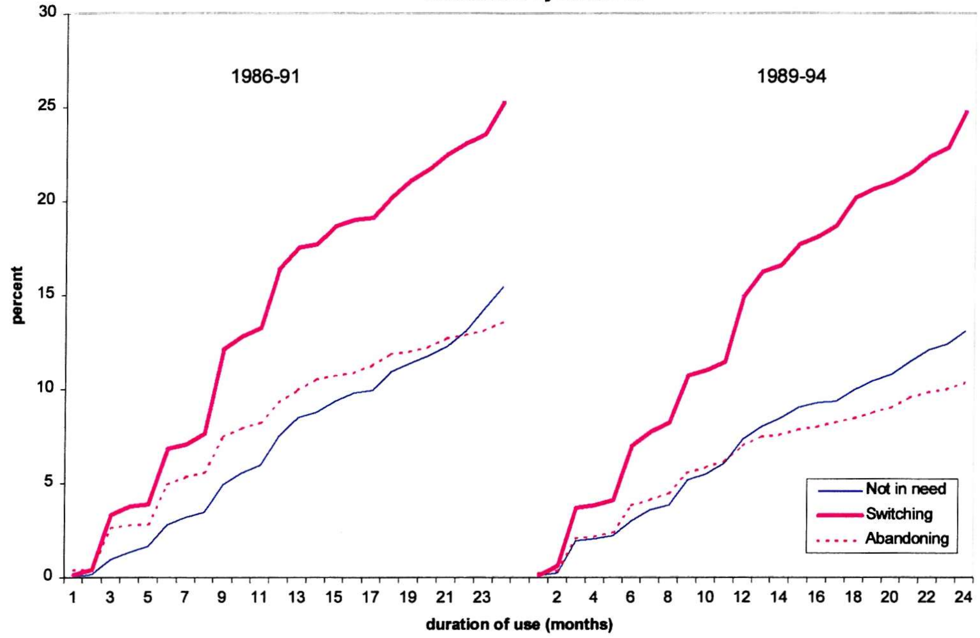
**Figure 8.3 Cumulative Probabilities of Switching Behaviour After Discontinuation from IUD Use: Indonesia, 1986-91 and 1989-94**
**Calculated by an MDLT**




Like IUD, injectables users (Figures 8.4) were much more likely to switch to alternative method than pill users. About 16% in 1986-91 and 15% in 1989-94 of injectables users switched methods in the first year of use, but 9% abandoned use in 1986-91 and 15% in 1989-94. In the second year of use about 25% of the injectables users switched to another method.

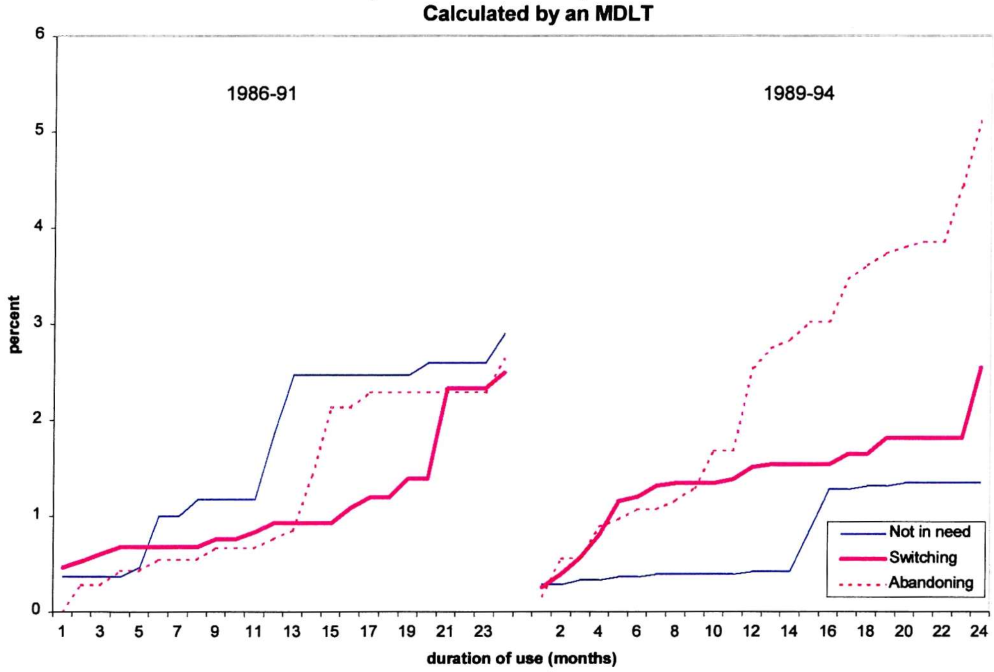
As seen in Table 8.1 almost 10% of pill and injectables users abandoned use after a year of initiating use in 1986-91. These two methods were the most common method in the country. In addition, combined with 6% of abandonment from the IUD users, another main contraceptive method in the country, and the fact that abortion was illegal could result in a big number of unintended children. In 1989-94, however, the percentages of abandonment declined to 9% from the pill, 7% from the injectables and 4% from the IUD.

**Figure 8.4 Cumulative Probabilities of Switching Behaviour After Discontinuation from Injectables Use: Indonesia, 1986-91 and 1989-94 Calculated by an MDLT**




Norplant had different patterns of switching behaviour in 1986-91 and 1989-94 (Figure 8.5). In 1986-91 the percentage of switching after a year of initiating use was similar than abandoning and in 1989-94 the percentage of switching was lower than abandoning (Table 8.1). As presented in Chapter 6, among reversible methods condom users had the highest rate of

**Figure 8.5 Cumulative Probabilities of Switching Behaviour After Discontinuation from Norplant Use: Indonesia, 1986-91 and 1989-94 Calculated by an MDLT**



discontinuation. However, condom users were found to be the most likely users to switch to another method even very early in their use (Figure 8.6). The percentage of those who switched to non-use because they were not in need was also high and the percentage of those who abandoned was low. Therefore, condom might be used as an intermediate method before they found another method.

**Figure 8.6 Cumulative Probabilities of Switching Behaviour After Discontinuation from Condom Use: Indonesia, 1986-91 and 1989-94 Calculated by an MDLT**

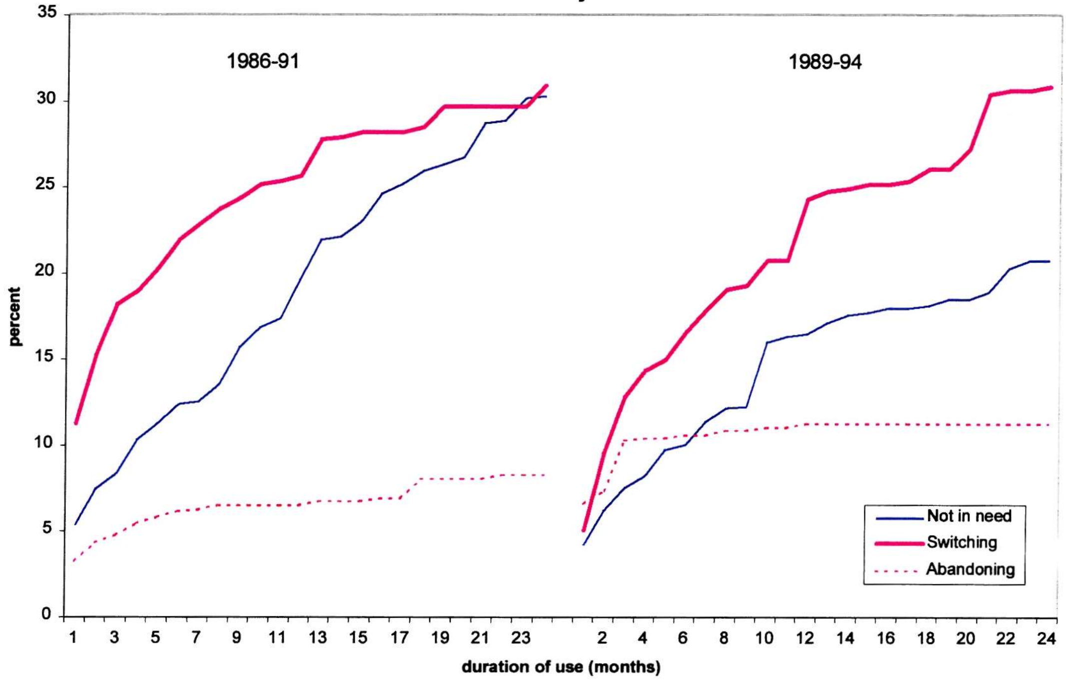



Figure 8.7 shows cumulative probabilities of switching behavior after discontinuation from abstinence; and Figure 8.8, for withdrawal. Users who discontinued from abstinence and withdrawal but still have a need for contraception were more likely to switch than to abandon. For instance, about 14% switching rate compared to 2% abandoning rate within a year of initiation of use for abstinence, while about 23% compared to 4% for withdrawal in 1986-91. For 1989-94 these rates can be seen in Table 8.1. As the percentage of current users of traditional methods in Indonesia was very low (3%), those who discontinued from traditional methods most likely to switch to another modern method.

**Figure 8.7 Cumulative Probabilities of Switching Behaviour After Discontinuation from Abstinence Use: Indonesia, 1986-91 and 1989-94 Calculated by an MDLT**

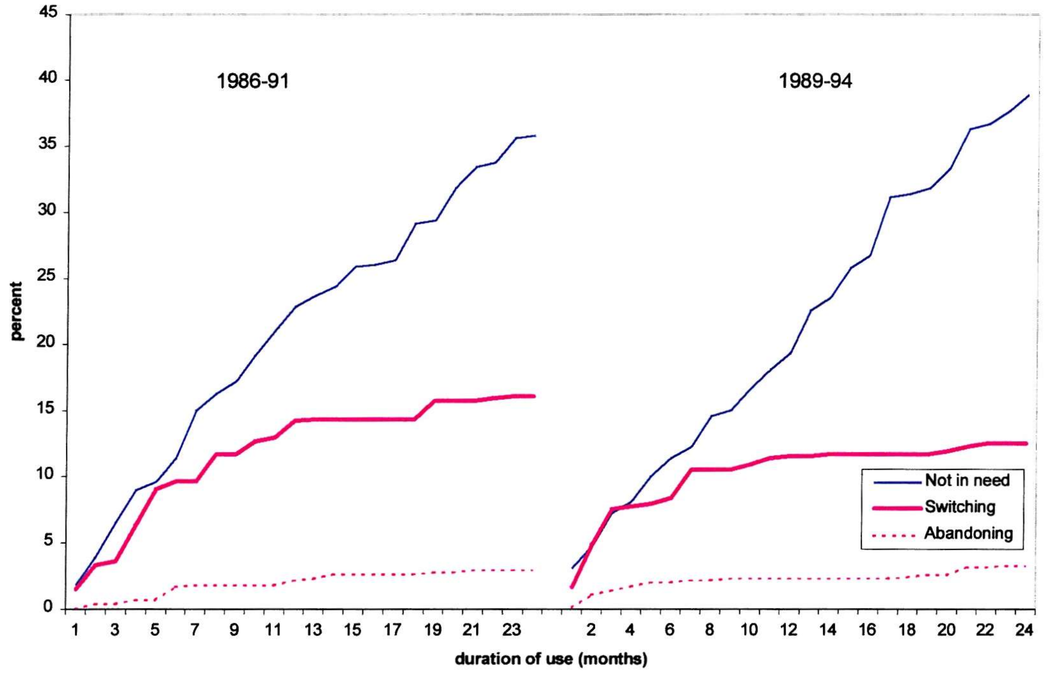
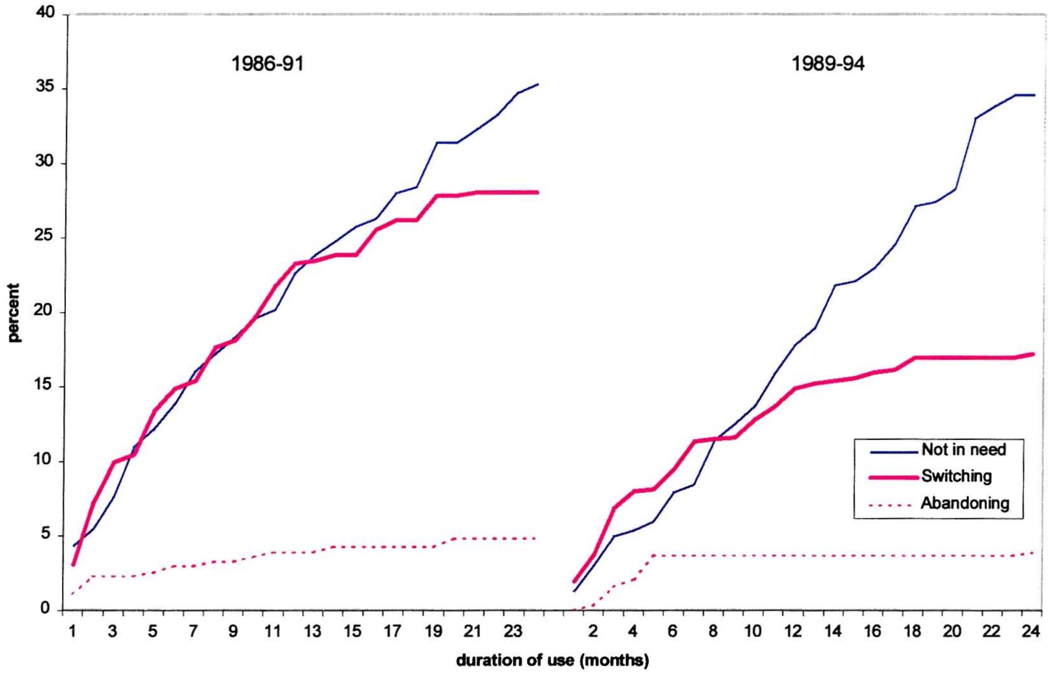



**Figure 8.8 Cumulative Probabilities of Switching Behaviour After Discontinuation from Withdrawal Use: Indonesia, 1986-91 and 1989-94 Calculated by an MDLT**



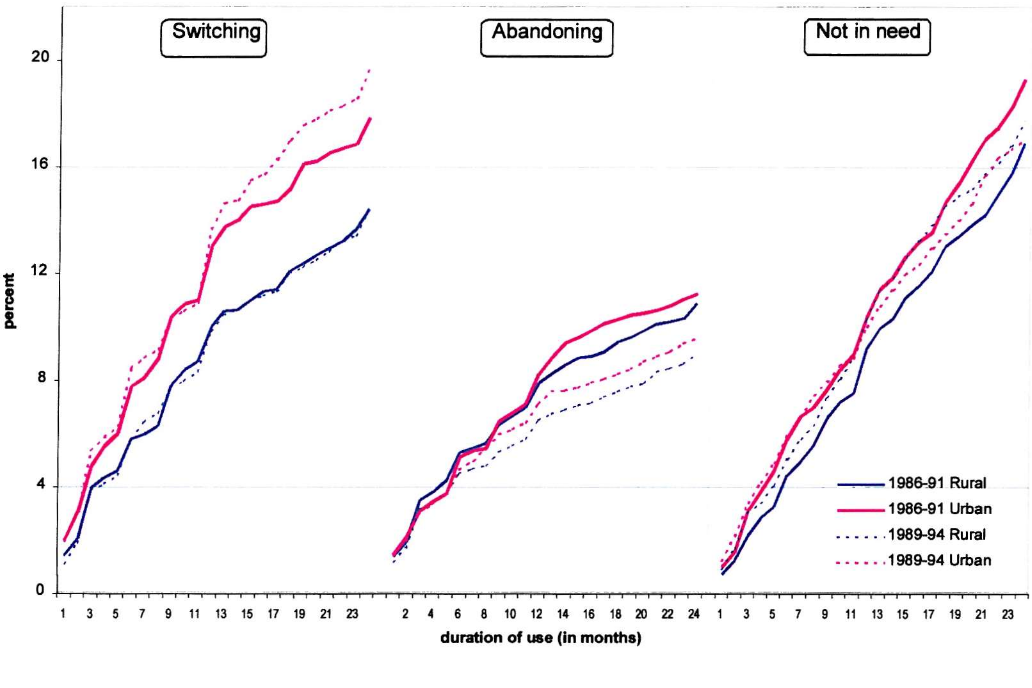
## 8.3 Non-Method Differentials in Contraceptive Switching Behaviour

The differentials by method are discussed in the previous section. This section is focused into two non-method differentials in switching behavior. Subsection 8.3.1 studies differentials by background variables (type of place of residence, region, woman's education, husband's education, and woman's age at start of use), and subsection 8.3.2 studies provincial variations. Figures 8.9 through 8.13 show cumulative probabilities of switching behaviour after discontinuation for each of background variables. Table 8.2 presents a summary of these probabilities for 12-month and 24-month after initiating use in 1986-91 and 1989-94. Table 8.3 presents the same probabilities for each province in Indonesia in 1986-91 and 1989-94, respectively. These probabilities are calculated using multiple decrement life tables

### 8.3.1 Differentials by Background Variables

Figure 8.9 presents differentials in switching behaviour after discontinuation by type of place of residence. In general, both in rural and urban areas, users immediately found alternative methods when they discontinued use. In both periods, urban users were more likely to discontinue than rural ones, but the urban users were also more likely to switch to another

**Figure 8.9 Cumulative Probabilities of Contraceptive Switching Behaviour After Discontinuation by Place of Residence: Indonesia, 1986-91 and 1989-94 Calculated by an MDLT**



method after discontinuation. In 1986-91, within a year of initiating use, for instance, about 13% of urban users and 10% of rural users switched to another method. On the other hand, the percentages of abandonment were similar between rural and urban users.

Figure 8.10 presents cumulative probabilities of contraceptive switching behaviour after discontinuation by region in 1986-91 and 1989-94. In each region in general, the probabilities of switching to another method over time were higher than the probabilities of abandonment. Regional differentials in switching behaviour did not occur in both periods except for switching to another method in 1986-91 especially between Outer Java-Bali I and II. In Outer Java-Bali I cumulative probability of switching to another method within a year of initiating use was 10% while in Outer Java-Bali II was 14%.

**Figure 8.10 Cumulative Probabilities of Contraceptive Switching Behaviour After Discontinuation by Region: Indonesia, 1986-91 and 1989-94 Calculated by an MDLT**

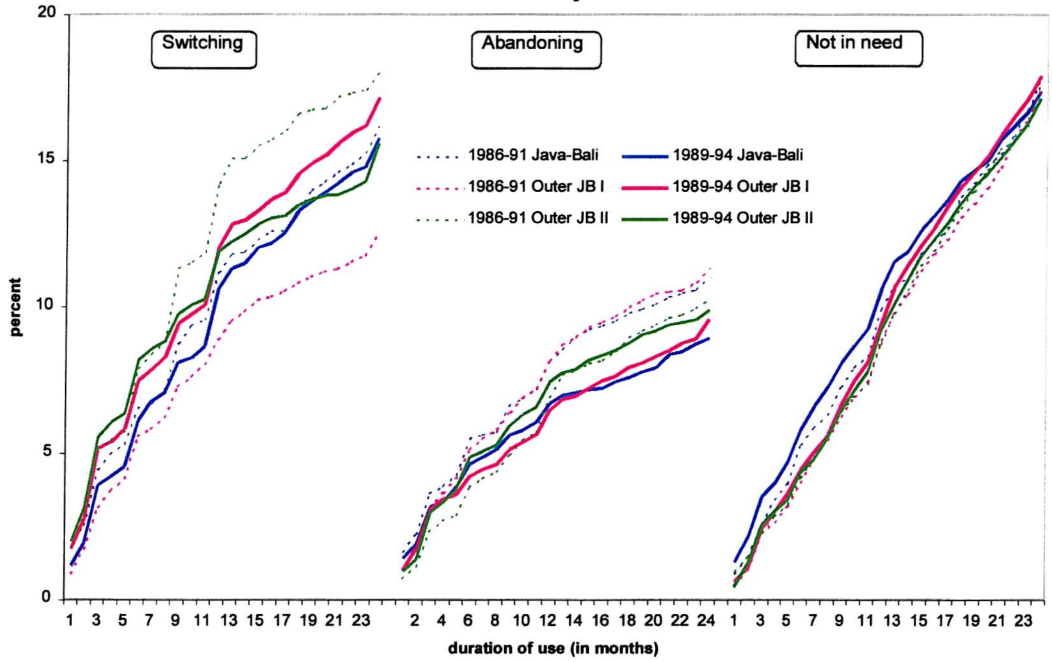


Table 8.2 12-month and 24-month Cumulative Probabilities of Switching Behaviour By Background Variable : Indonesia, 1986-91 and 1989-94

| Variable | | 1986-91 | | | 1989-94 | | |
|---|---|---|---|---|---|---|---|
| | | Switching | Abandoning | Not in need | Switching | Abandoning | Not in need |
| **Place of residence** | | | | | | | |
| 12-month | Rural | 10.0 | 7.9 | 9.2 | 9.8 | 6.5 | 10.3 |
| | Urban | 13.0 | 8.2 | 10.4 | 13.7 | 7.1 | 10.0 |
| 24-month | Rural | 14.4 | 10.9 | 16.9 | 14.4 | 9.0 | 17.7 |
| | Urban | 17.8 | 11.2 | 19.3 | 19.7 | 9.6 | 17.0 |
| **Region** | | | | | | | |
| 12-month | Java-Bali | 11.2 | 8.1 | 10.0 | 10.6 | 6.70 | 10.6 |
| | Outer JB I | 8.9 | 8.2 | 8.9 | 12.0 | 6.46 | 9.5 |
| | Outer JB II | 14.2 | 6.9 | 8.7 | 11.9 | 7.42 | 9.2 |
| 24-month | Java-Bali | 16.2 | 11.0 | 17.8 | 15.8 | 8.92 | 17.4 |
| | Outer JB I | 12.5 | 11.3 | 17.5 | 17.2 | 9.56 | 17.9 |
| | Outer JB II | 18.0 | 10.3 | 17.7 | 15.6 | 9.90 | 17.2 |
| **Woman's education** | | | | | | | |
| 12-month | No education | 5.9 | 12.6 | 5.5 | 4.5 | 10.01 | 8.1 |
| | Some Primary | 8.8 | 12.8 | 8.5 | 9.3 | 9.62 | 8.0 |
| | Primary | 10.8 | 10.9 | 10.0 | 10.3 | 8.77 | 11.2 |
| | Some Secondary+ | 16.7 | 7.8 | 12.5 | 15.6 | 9.01 | 11.7 |
| 24-month | No education | 8.8 | 8.7 | 13.6 | 6.7 | 6.76 | 13.7 |
| | Some Primary | 13.7 | 9.5 | 16.3 | 13.3 | 7.09 | 15.0 |
| | Primary | 15.5 | 8.4 | 17.3 | 16.4 | 6.67 | 18.0 |
| | Some Secondary+ | 21.5 | 4.9 | 22.3 | 21.1 | 6.38 | 20.5 |
| **Husband's education** | | | | | | | |
| 12-month | No education | 7.0 | 11.2 | 7.8 | 5.0 | 8.8 | 7.1 |
| | Some Primary | 8.4 | 11.7 | 7.6 | 9.6 | 10.4 | 8.1 |
| | Primary | 10.1 | 11.9 | 9.8 | 9.2 | 8.0 | 10.9 |
| | Some Secondary+ | 15.2 | 9.5 | 11.6 | 14.4 | 9.2 | 11.6 |
| 24-month | No education | 10.7 | 9.7 | 15.5 | 9.1 | 6.9 | 15.4 |
| | Some Primary | 13.3 | 9.1 | 15.6 | 13.9 | 7.6 | 15.1 |
| | Primary | 14.4 | 8.5 | 17.2 | 14.7 | 6.1 | 16.9 |
| | Some Secondary+ | 19.9 | 6.3 | 20.6 | 19.7 | 6.6 | 19.9 |
| **Woman's age** | | | | | | | |
| 12-month | < 25 | 12.8 | 8.5 | 12.9 | 12.4 | 7.5 | 13.9 |
| | 25 – 29 | 10.9 | 7.9 | 6.5 | 11.3 | 5.8 | 10.0 |
| | > 30 | 8.2 | 7.3 | 6.3 | 9.1 | 6.5 | 5.3 |
| 24-month | < 25 | 17.7 | 11.3 | 22.3 | 18.4 | 9.7 | 23.0 |
| | 25 – 29 | 14.4 | 11.3 | 15.0 | 15.7 | 8.4 | 16.7 |
| | > 30 | 12.9 | 10.3 | 12.0 | 13.2 | 9.2 | 10.5 |

Switching behaviour is also differentiated by woman's education (Figure 8.11). Among woman who had either no education or some primary, abandoning was the most common state after discontinuation within a year of initiation of use over time. For example, no education users consisted of 12.6% abandoning, 5.9% switching and 5.5% not in need in 1986-91. Among those who had primary school the probabilities were evenly distributed into three states after discontinuation (Table 8.2). However, those who had secondary school and above were more likely to switch to another method within a year of initiation of use. In each educational level the users generally became not in need for contraception within two years of initiation of use. Similar patterns were found by husband's education (Figure 8.12).

**Figure 8.11 Cumulative Probabilities of Contraceptive Switching Behaviour After Discontinuation by Woman's Education: Indonesia, 1986-91 and 1989-94 Calculated by an MDLT**

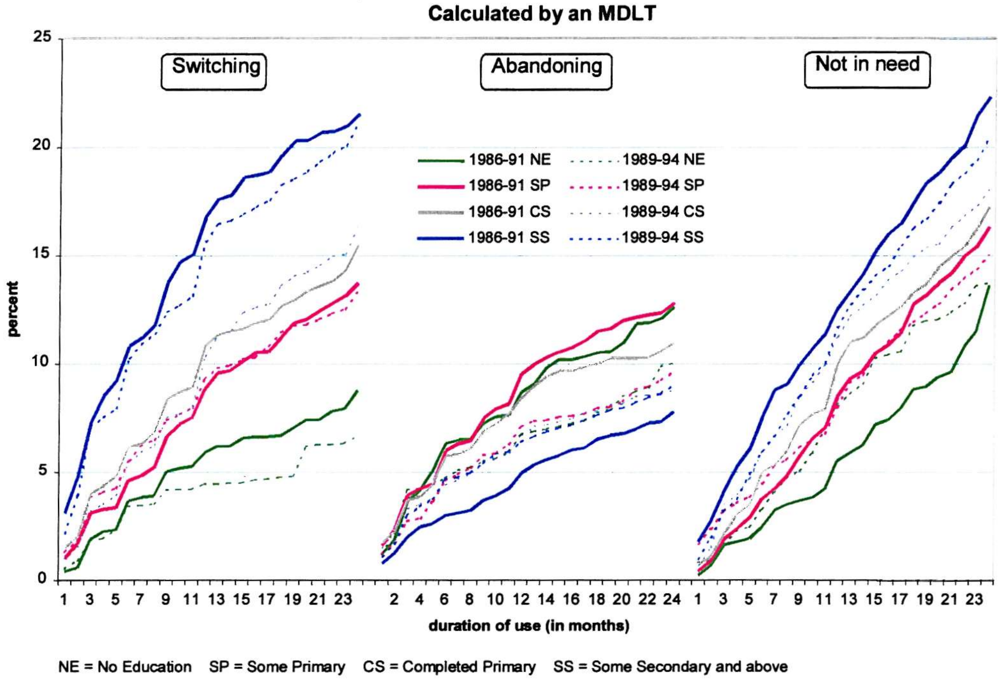



**Figure 8.12 Cumulative Probabilities of Contraceptive Switching Behaviour After Discontinuation by Husband's Education: Indonesia, 1986-91 and 1989-94 Caclculated by an MDLT**

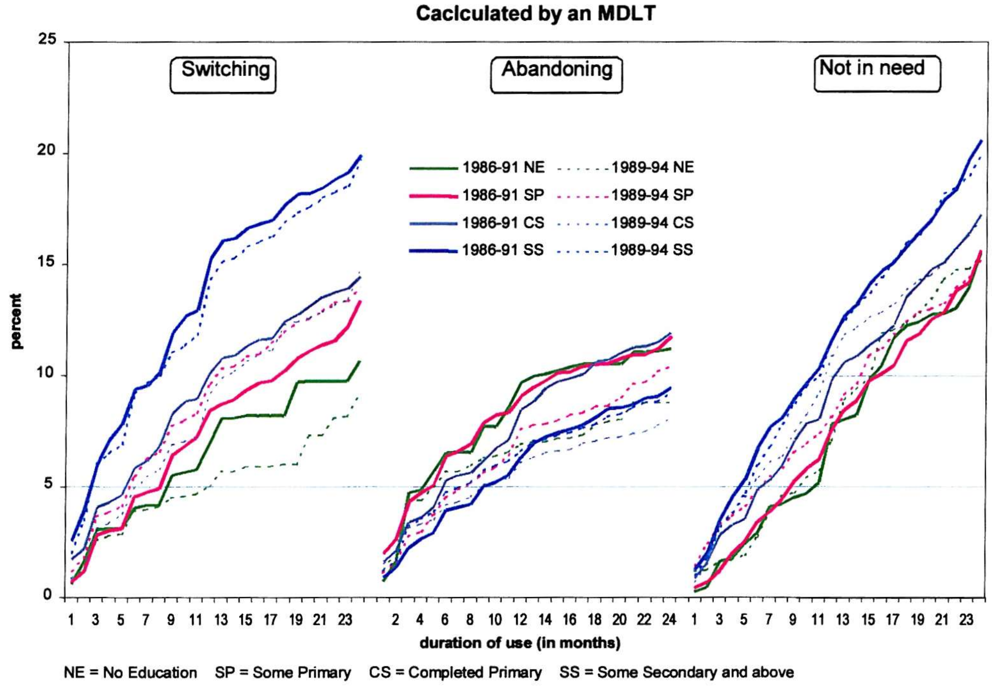
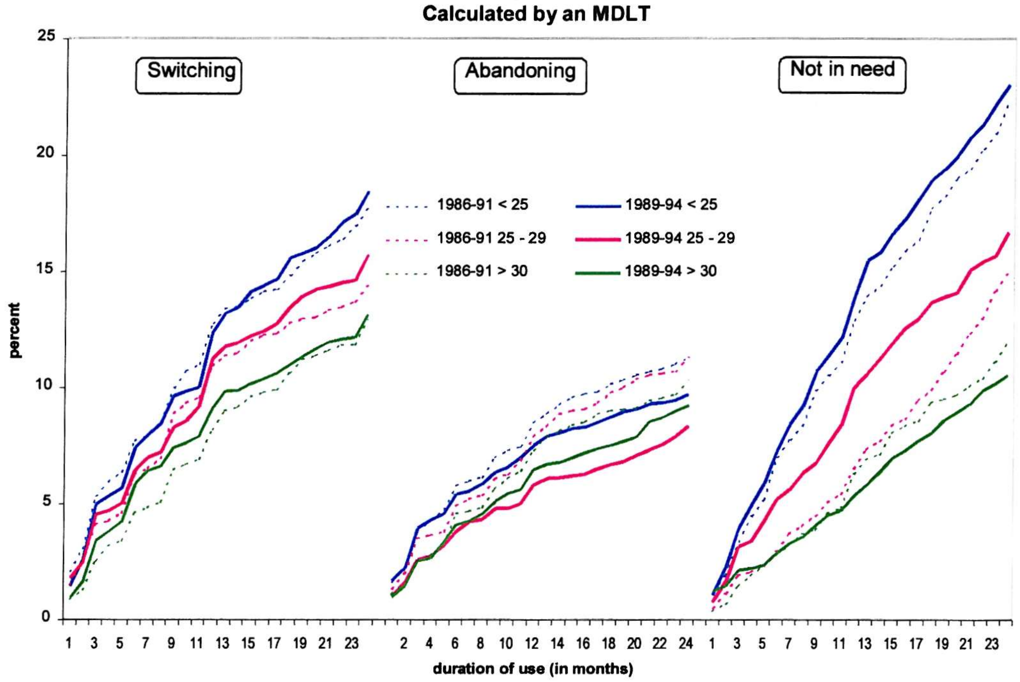


Figure 8.13 shows cumulative probabilities of contraceptive switching behaviour after discontinuation by woman's age at the start of use. Women aged less than 25 years old who discontinue within a year after adoption were most likely to be not in need, while the older women (30 and above) were most likely to switch to another method. However, in general, in each age group they were more likely to switch than to abandon use.

**Figure 8.13 Cumulative Probabilities of Contraceptive Switching Behaviour After Discontinuation by Woman's Age: Indonesia, 1986-91 and 1989-94 Calculated by an MDLT**




## 8.3.2 Provincial Variations in Switching Behaviour

Variations in switching behaviour after discontinuation existed across provinces and over time. However, for simplicity in discussions the provinces are categorized into three groups based on the largest percentage of states of switching behaviour within a year of initiating use (Table 8.3). One year of initiating use is considered as an indicator of early discontinuation in a country with high contraceptive prevalence. The first group is provinces with the highest percentage of users switched to no method while they were still in need in 1986-1991. The second group consists of provinces where the highest percentage of common users switched to another method in 1986-1991. Finally, the last group consists of provinces with the largest percentage of users was those who switched to no method because they were no longer in need for contraception in 1986-1991.

The figures presenting cumulative probabilities of switching behaviour within two years of initiation of use for each group are presented in Appendices A-7 – A-9. These probabilities also are calculated by multiple decrement life tables.

In 1986-1991, the first group consists of North Sumatra, West Nusa Tenggara, Central Sulawesi, Southeast Sulawesi and Irian Jaya (Table 8.3 and Appendix A-7). Within these groups variation in switching behaviour was still found. In Southeast Sulawesi and Irian Jaya the second highest probability was switching to another method, while in North Sumatra, West Nusa Tenggara, and Central Sulawesi, the second highest probability was not in need. However, West Nusa Tenggara had very different pattern of switching behaviour after discontinuation. In West Nusa Tenggara abandoning was dominant compared to switching to another method. Rates of abandoning were 10.5% within one year and 16.9% within two years after initiating use. On the other hand, rates of switching to another method were very low, 2.5% within one year and 3.2% within two years of initiation of use.

In 1989-94, users in these provinces were even more likely to be not in need for contraception as the most state after discontinuation. Except West Nusa Tenggara, provinces, which had abandoning as the most common state after discontinuation in 1986-1991 did not have this state any more in the following period. Switching to another method became the most common state after discontinuation (Table 8.3).

The second group consists of 16 provinces. Plots of cumulative probabilities of switching behaviour in each of these provinces are presented in Appendix A-8. Within this group, the one-year rates of switching to another method in Yogyakarta, Jambi, Riau, Bengkulu and Maluku were higher than 15% in 1986-91. This was the highest percentage and it accounted for more than 50% of the discontinued users. Bali is also in this group. As the focus of this research, Bali is discussed separately in the end of this chapter.

Within group, switching was the most common state after discontinuation in both periods, except for Maluku and East Java. Users in East Java in 1989-94 were the most likely to become no longer in need for contraception. In Maluku abandoning became an important issue in 1989-94, it seemed the users could not find an alternative method after discontinuation (Figure 8.15).

For the six provinces (West Java, Central Java, Aceh, Lampung, South Sulawesi, and East Nusa Tenggara) the most common outcome was not in need for contraception (Appendix A-9). The not in need for contraception in these provinces mainly consists of women who discontinued in order to become pregnant, although this group also contains women who experienced contraceptive failure (Table 6.10 in Chapter 6).

**Figure 8.14 Cumulative Probability of Contraceptive Switching Behaviour After Discontinuation: East Java, 1986-91 and 1989-94**

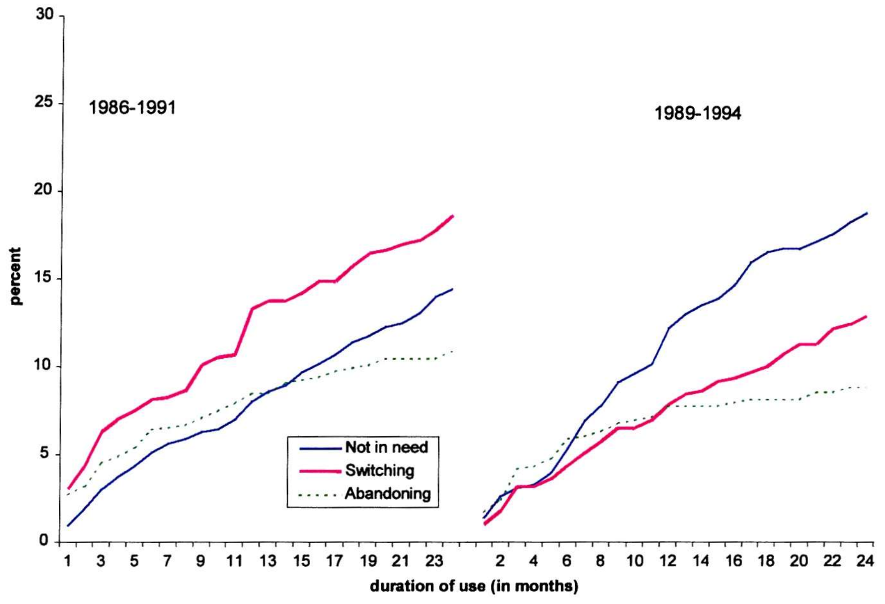



**Figure 8.15 Cumulative Probability of Contraceptive Switching Behaviour After Discontinuation: Maluku, 1986-91 and 1989-94**

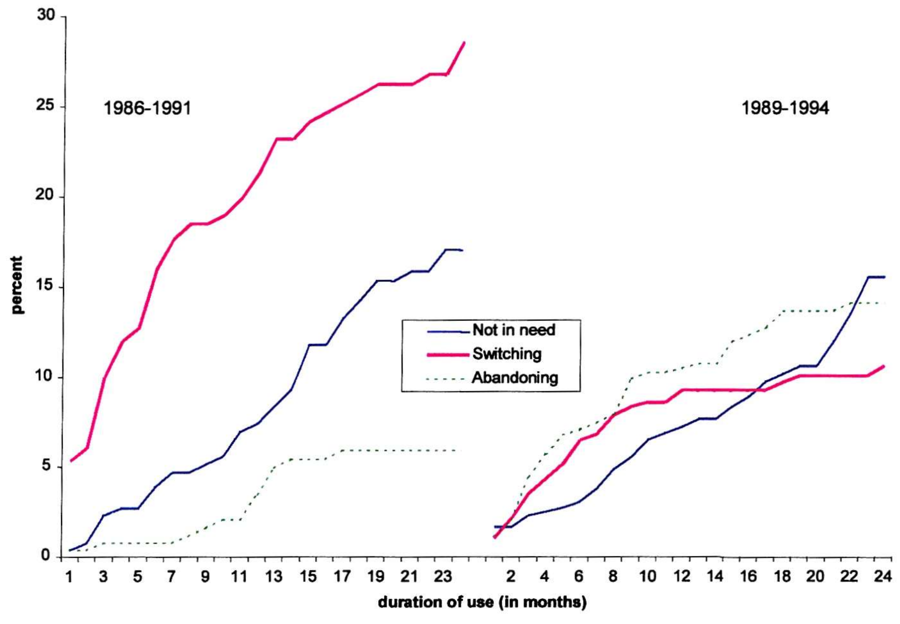


Table 8.3 Life-table 12-month and 24-month Cumulative Probabilities of Switching Behaviour By Province, 1986-91 and 1989-94

| Province | 1986-91 | | | 1989-94 | | |
|---|---|---|---|---|---|---|
| | Switching | Abandoning | Not in need | Switching | Abandoning | Not in need |
| **12-month** | | | | | | |
| Jakarta | 12.9 | 6.6 | 7.9 | 14.6 | 5.5 | 6.4 |
| West Java | 11.2 | 9.7 | 11.7 | 13.7 | 6.6 | 11.3 |
| Central Java | 6.7 | 6.4 | 10.6 | 7.5 | 6.4 | 9.1 |
| Yogyakarta | 18.1 | 3.8 | 12.3 | 16.0 | 4.0 | 8.8 |
| East Java | 13.3 | 8.5 | 8.0 | 7.8 | 7.7 | 12.2 |
| Bali | 7.9 | 5.3 | 6.1 | 9.4 | 5.9 | 9.5 |
| Aceh | 11.7 | 11.7 | 12.2 | 20.4 | 8.3 | 7.5 |
| North Sumatra | 6.9 | 13.3 | 9.0 | 12.9 | 5.3 | 12.3 |
| West Sumatra | 13.1 | 10.2 | 11.5 | 14.1 | 6.7 | 13.7 |
| South Sumatra | 7.6 | 6.1 | 7.3 | 8.4 | 4.7 | 6.0 |
| Lampung | 7.5 | 5.6 | 8.9 | 9.6 | 5.7 | 8.1 |
| West Nusa Tenggara | 2.5 | 10.5 | 10.1 | 6.7 | 7.0 | 9.8 |
| West Kalimantan | 14.7 | 5.6 | 8.8 | 14.7 | 7.6 | 8.6 |
| South Kalimantan | 9.2 | 4.2 | 7.0 | 10.6 | 5.9 | 9.5 |
| North Sulawesi | 11.9 | 4.7 | 7.8 | 13.2 | 4.5 | 10.2 |
| South Sulawesi | 7.8 | 7.9 | 8.0 | 13.1 | 10.3 | 8.0 |
| Riau | 18.3 | 9.4 | 9.9 | 13.9 | 8.1 | 11.7 |
| Jambi | 22.9 | 8.1 | 8.3 | 10.8 | 3.7 | 6.8 |
| Bengkulu | 16.8 | 7.9 | 8.9 | 22.0 | 5.6 | 9.9 |
| East Nusa Tenggara | 1.4 | 2.9 | 7.5 | 2.9 | 10.4 | 12.0 |
| East Timor | 10.1 | 2.3 | 7.0 | 2.7 | 9.0 | 7.7 |
| Central Kalimantan | 9.2 | 4.4 | 6.6 | 6.9 | 4.7 | 5.8 |
| East Kalimantan | 14.1 | 5.3 | 13.0 | 15.8 | 9.1 | 9.5 |
| Central Sulawesi | 7.3 | 9.1 | 8.6 | 13.6 | 5.4 | 8.5 |
| Southeast Sulawesi | 12.1 | 13.3 | 6.6 | 10.0 | 9.1 | 7.7 |
| Maluku | 21.3 | 3.5 | 7.4 | 9.3 | 10.5 | 7.2 |
| Irian Jaya | 5.3 | 6.3 | 4.1 | 9.5 | 6.5 | 9.3 |

Table 8.3 Continued ...

| Province | 1986-91 | | | 1989-94 | | |
|---|---|---|---|---|---|---|
| | Switching | Abandoning | Not in need | Switching | Abandoning | Not in need |
| **24-month** | | | | | | |
| Jakarta | 17.7 | 11.2 | 16.8 | 21.1 | 7.9 | 14.2 |
| West Java | 15.8 | 12.8 | 19.8 | 18.9 | 9.6 | 18.4 |
| Central Java | 11.9 | 9.2 | 20.2 | 12.4 | 8.7 | 15.2 |
| Yogyakarta | 24.8 | 5.3 | 18.8 | 21.0 | 6.0 | 16.3 |
| East Java | 18.6 | 10.9 | 14.4 | 12.9 | 8.8 | 18.8 |
| Bali | 10.1 | 7.8 | 13.6 | 12.0 | 10.1 | 16.9 |
| Aceh | 16.5 | 17.4 | 21.0 | 22.4 | 12.4 | 15.9 |
| North Sumatra | 9.5 | 14.6 | 18.4 | 20.0 | 7.92 | 25.1 |
| West Sumatra | 17.7 | 13.0 | 18.8 | 17.4 | 10.0 | 23.6 |
| South Sumatra | 11.0 | 9.8 | 16.6 | 14.1 | 8.2 | 11.2 |
| Lampung | 11.9 | 7.8 | 16.3 | 15.0 | 7.3 | 15.1 |
| West Nusa Tenggara | 3.2 | 16.8 | 16.9 | 10.1 | 11.2 | 18.5 |
| West Kalimantan | 18.9 | 8.3 | 16.2 | 21.0 | 10.3 | 16.3 |
| South Kalimantan | 11.9 | 7.9 | 18.0 | 16.3 | 8.9 | 16.8 |
| North Sulawesi | 19.3 | 9.5 | 16.1 | 20.0 | 7.3 | 16.3 |
| South Sulawesi | 10.3 | 10.9 | 17.6 | 15.7 | 15.0 | 16.0 |
| Riau | 24.2 | 13.7 | 15.8 | 20.1 | 9.9 | 19.4 |
| Jambi | 26.7 | 9.7 | 17.0 | 14.8 | 6.3 | 12.5 |
| Bengkulu | 17.8 | 11.4 | 18.7 | 27.2 | 8.3 | 17.2 |
| East Nusa Tenggara | 1.4 | 8.1 | 21.4 | 6.0 | 12.2 | 22.3 |
| East Timor | 11.4 | 7.0 | 33.1 | 3.9 | 12.8 | 20.9 |
| Central Kalimantan | 12.9 | 5.3 | 16.1 | 7.2 | 7.0 | 12.4 |
| East Kalimantan | 17.5 | 9.6 | 19.5 | 19.4 | 12.3 | 17.5 |
| Central Sulawesi | 10.6 | 11.2 | 16.9 | 14.9 | 7.0 | 15.5 |
| Southeast Sulawesi | 13.9 | 15.8 | 13.8 | 12.5 | 11.8 | 19.6 |
| Maluku | 28.6 | 5.9 | 17.1 | 10.6 | 14.1 | 15.5 |
| Irian Jaya | 6.9 | 11.6 | 15.2 | 14.7 | 9.1 | 15.0 |

## 8.4 Trends in Contraceptive Switching and Abandoning: 1986-91 and 1989-94

This section is primarily aimed to understand trends in the probability of switching to another method and the probability of abandoning over the period of 1986-91 and 1989-94 by looking at different method and background characteristics. These two probabilities are calculated by associated single decrement life tables (ASDLT). In this section the probability of no longer in need for contraception are not presented as we have presented in Chapter 6 as contraceptive failure, desire to get pregnant and non-method related reasons.

### 8.4.1 Trends in Contraceptive Switching and Abandoning by Method

Table 8.4 presents trends in 12-month and 24-month cumulative probabilities of switching and abandoning by method in 1986-91 and 1989-94. In addition, from this table we can also compare switching and abandoning rates across method. Overall rates of switching to another method from all reversible methods in 12-month and 24-month after adoption were similar over time, but abandoning rates were slightly lower in the 1989-94.

The 12-month cumulative probability of switching rate of each modern method increased from 1986-91 to 1989-94, except for injectable users. Within a year of adoption, a decline in switching occurred for injectable, abstinence, and withdrawal users. The 12-month cumulative probability of switching from withdrawal dropped from about 35% in 1986-91 to 16% 1986-94. The 12-month cumulative probability of abandoning across method generally declined between these two periods, except for the increasing rates for Norplant and Condom.

Table 8.4 Trends in 12-month and 24-month Cumulative Probabilities of Switching and Abandoning by Method: Indonesia, 1986-91 and 1989-94 (Calculated by an ASDLT)

| Time | Method | Switching | | Abandoning | |
|---|---|---|---|---|---|
| | | 1986-91 | 1989-94 | 1986-91 | 1989-94 |
| 12-month | All methods | 12.1 | 12.2 | 8.9 | 7.4 |
| 24-month | All methods | 18.3 | 18.8 | 13.0 | 10.9 |
| | | | | | |
| 12-month | Pill | 8.2 | 10.1 | 10.9 | 9.8 |
| | IUD | 7.5 | 9.2 | 6.0 | 3.9 |
| | Injectable | 18.2 | 16.3 | 10.5 | 7.8 |
| | Norplant | 0.9 | 1.5 | 0.8 | 2.6 |
| | Condom | 29.2 | 29.9 | 8.0 | 12.9 |
| | Abstinence | 16.2 | 12.7 | 2.7 | 2.6 |
| | Withdrawal | 35.3 | 16.5 | 4.9 | 4.1 |
| | Herbs | 2.6 | 8.2 | 10.1 | 9.7 |
| | Other methods | 16.8 | 10.2 | 17.0 | 5.5 |
| | | | | | |
| 24-month | Pill | 11.1 | 13.1 | 15.3 | 12.8 |
| | IUD | 11.4 | 12.7 | 7.9 | 6.3 |
| | Injectable | 30.3 | 28.8 | 16.9 | 12.7 |
| | Norplant | 2.6 | 2.6 | 2.7 | 5.3 |
| | Condom | 38.2 | 39.9 | 12.1 | 12.9 |
| | Abstinence | 19.1 | 14.3 | 4.0 | 4.4 |
| | Withdrawal | 35.3 | 20.0 | 7.0 | 4.6 |
| | Herbs | 3.3 | 21.6 | 15.3 | 13.1 |
| | Other methods | 26.7 | 16.3 | 18.8 | 14.1 |

Among modern methods, condoms users had the highest probability of switching while Norplant users had the lowest probability. Injectables users had the second highest probability of switching. Withdrawal switching probabilities were higher than abstinence switching probabilities. Pill and injectables users had the highest abandoning probabilities among modern methods in 1986-91, but in 1989-94 condom users had the highest probability of abandonment.

### 8.4.2 Trends by Background Variables

This section presents changes in switching and abandoning rates, calculated by associated single decrement life table, between 1986-91 and 1989-94. The analysis is also presented_by background variables. Table 8.5 presents the 12-month and 24-month cumulative probabilities of switching and abandoning after discontinuation by place of residence, region, woman's education, husband's education, and woman's age.

Switching rates in urban and rural areas were relatively unchanged over time. However, switching rates in urban areas were higher than in rural areas. For example, within a year of initiating use cumulative probabilities of switching to another rate were 21.1% in urban areas and 16.8% in rural areas in 1986-91. The probabilities of abandoning slightly decreased over time, but the rates were almost similar between urban and rural.

Regional changes over time were relatively minor for both switching and abandoning. Changes in switching and abandoning over time by woman's education were also relatively small. Similar changes occurred for trends in switching and abandoning by husband's education.

The more educated users were much more likely to switch methods than were less educated users (Table 8.5). Hence, educated women seem to be more willing to experiment with methods of contraception until they found methods that suited them. This may be due to greater awareness of the methods available or to greater ability to find alternative methods if they did not like the method they were using. However, a negative relationship was found between education and abandoning. After discontinuation, those who had no education were more likely to abandon than to switch. On the other hand, those who had attended secondary school and above were less likely to abandon than to switch.

Table 8.5 Trends in 12-month and 24-month Cumulative Probabilities of Switching and Abandoning after Discontinuation by Background Variable: Indonesia, 1986-91 and 1989-94 (Calculated by an ASDLT)

| Time | Background variable | Switching | | Abandoning | |
|---|---|---|---|---|---|
| | | 1986-91 | 1989-94 | 1986-91 | 1989-94 |
| **Place of Residence** | | | | | |
| 12-month | Rural | 10.9 | 10.8 | 8.7 | 7.2 |
| | Urban | 14.4 | 15.2 | 9.4 | 8.1 |
| 24-month | Rural | 16.8 | 16.8 | 12.7 | 10.6 |
| | Urban | 21.1 | 23.2 | 13.7 | 11.7 |
| **Region** | | | | | |
| 12-month | Java-Bali | 12.4 | 11.8 | 9.0 | 7.4 |
| | Outer JB I | 9.7 | 13.1 | 8.9 | 7.2 |
| | Outer JB II | 15.5 | 12.9 | 7.9 | 8.3 |
| 24-month | Java-Bali | 19.1 | 18.6 | 13.1 | 10.5 |
| | Outer JB I | 14.5 | 19.9 | 13.1 | 11.7 |
| | Outer JB II | 20.5 | 17.9 | 12.7 | 11.8 |
| **Woman's education** | | | | | |
| 12-month | No education | 6.4 | 4.8 | 9.1 | 7.1 |
| | Some Primary | 9.8 | 10.1 | 10.3 | 7.8 |
| | Completed Primary | 12.0 | 11.6 | 9.3 | 7.4 |
| | Some Secondary + | 18.4 | 17.3 | 5.9 | 7.3 |
| 24-month | No education | 10.1 | 7.6 | 13.9 | 11.1 |
| | Some Primary | 16.4 | 15.3 | 14.7 | 11.2 |
| | Completed Primary | 18.4 | 19.6 | 12.7 | 10.3 |
| | Some Secondary + | 24.9 | 24.9 | 10.5 | 11.5 |
| **Husband's education** | | | | | |
| 12-month | No education | 7.6 | 5.36 | 10.32 | 7.23 |
| | Some Primary | 9.3 | 10.55 | 9.64 | 8.37 |
| | Completed Primary | 11.1 | 10.41 | 9.41 | 6.47 |
| | Some Secondary + | 16.8 | 16.26 | 7.38 | 7.63 |
| 24-month | No education | 12.4 | 10.64 | 12.25 | 9.55 |
| | Some Primary | 15.8 | 16.09 | 13.16 | 12.24 |
| | Completed Primary | 16.9 | 17.40 | 14.15 | 9.23 |
| | Some Secondary + | 23.2 | 23.69 | 12.19 | 11.81 |
| **Age's woman** | | | | | |
| 12-month | < 25 | 14.4 | 14.1 | 9.7 | 8.5 |
| | 25 – 29 | 11.8 | 12.3 | 8.6 | 6.4 |
| | 30+ | 8.8 | 9.7 | 7.8 | 7.0 |
| 24-month | < 25 | 21.6 | 22.8 | 13.9 | 11.9 |
| | 25 – 29 | 16.2 | 18.0 | 13.1 | 10.0 |
| | 30+ | 14.7 | 14.6 | 11.6 | 10.5 |

### 8.4.3 Trends by Province

Sections 8.3.2 discussed composition of user behavior after discontinuation in the period of 1986-91 and 1989-94. It can be summarised from that section that in the latter period switching to another method became a common behaviour among discontinued users in almost all provinces. This section examines the changes in rate of contraceptive switching over the two periods and also the changes in rate of abandonment of contraception. From this section we can also examine variations in those rates among provinces. As in other sections, in this section the rates presented in Table 8.6 are also calculated using associated single decrement life tables (ASDLT). As shown Table 8.7, the cumulative probabilities of contraceptive switching after one year of initiating use varied from a very low rate of less than 1% in East Nusa Tenggara to about 26% in Jambi in 1986-91. Whereas, in 1989-94 the rate varied from 3% (East Nusa Tenggara) to 23% (Bengkulu).

Eight out of 27 provinces showed a decline in the rate of contraceptive switching. East Java and Yogyakarta were two of them. The switching rate in East Java declined sharply from about 14% in 1986-91 to about 8% in 1989-94, while the rate in Yogyakarta declined from almost 20% to 17%. These two provinces already reached low fertility rates and low desired family size. The decline in the contraceptive switching rate might indicate that after discontinuation the users could not find a suitable method that fulfilled their need.

Riau, Jambi, Central Kalimantan, Southeast Sulawesi, East Timor, and Maluku are provinces experiencing declines in the switching rate. Jambi and Maluku had 50% decline in the rate of switching, East Timor had a dramatic drop rate from about 10% to about 3%. The 19 provinces, as expected, showed increases in rate of contraceptive switching.

In terms of abandoning, the rate also varied across provinces from about 3% (East Nusa Tenggara and East Timor) to about 14% (North Sumatra and Southeast Sulawesi) in 1986-1991. In the following period the rate of abandoning slightly converged where the lowest was about 4% (Jambi) and the highest was about 11% (Maluku, East Nusa Tenggara and South Sulawesi). As expected, the abandoning rate over the time declined although 9 of 27 provinces showed an increase.

Table 8.6 Trends in 12-month and 24-month Cumulative Probabilities of Switching and Abandoning by Province, 1986-91 and 1989-94 (Calculated by an ASDLT)

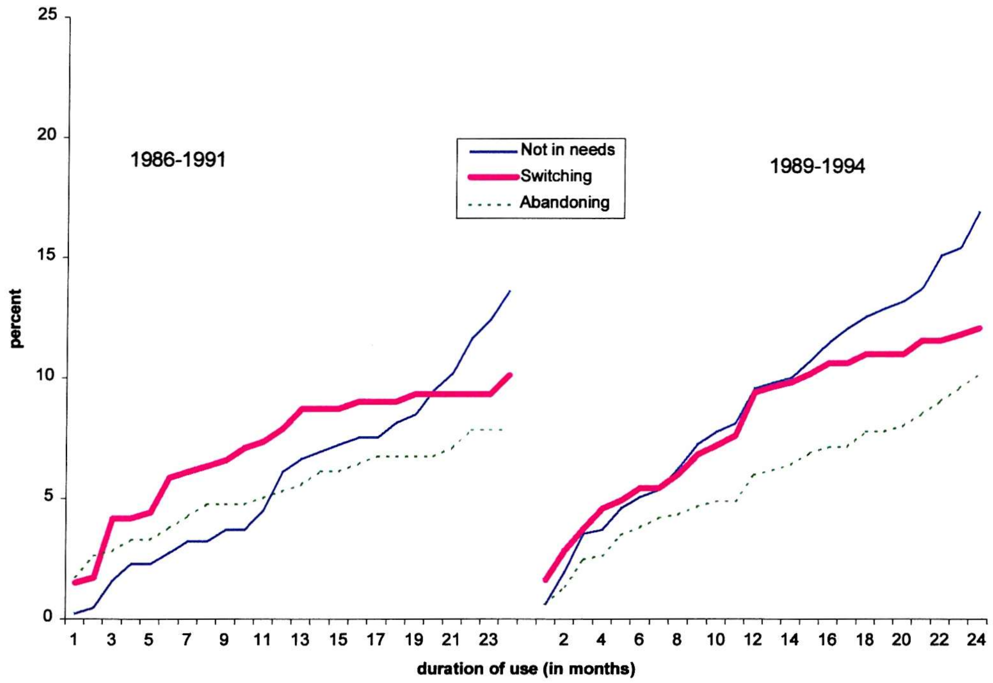
| Province | 12-month | | | | 24-month | | | |
|---|---|---|---|---|---|---|---|---|
| | Switching | | Abandoning | | Switching | | Abandoning | |
| | 1986-91 | 1989-94 | 1986-91 | 1989-94 | 1986-91 | 1989-94 | 1986-91 | 1989-94 |
| Jakarta | 13.9 | 15.7 | 7.3 | 6.1 | 20.2 | 23.7 | 14.0 | 9.5 |
| West Java | 12.6 | 15.3 | 11.0 | 7.5 | 19.3 | 22.4 | 15.5 | 11.9 |
| Central Java | 7.3 | 8.3 | 6.9 | 6.9 | 14.2 | 14.5 | 10.7 | 9.9 |
| Yogyakarta | 19.8 | 17.1 | 4.5 | 4.7 | 28.6 | 23.3 | 6.9 | 7.5 |
| East Java | 14.7 | 8.7 | 9.4 | 8.4 | 21.6 | 15.5 | 12.7 | 9.9 |
| Bali | 8.3 | 10.2 | 5.6 | 6.6 | 11.0 | 13.6 | 8.7 | 12.2 |
| Aceh | 13.4 | 22.0 | 12.9 | 9.7 | 21.0 | 24.9 | 21.3 | 16.3 |
| North Sumatra | 7.4 | 14.3 | 14.6 | 5.9 | 11.1 | 24.2 | 16.3 | 10.0 |
| West Sumatra | 14.6 | 15.9 | 11.7 | 7.7 | 21.1 | 20.5 | 15.9 | 13.0 |
| South Sumatra | 8.2 | 8.9 | 6.6 | 5.0 | 12.3 | 15.7 | 11.4 | 9.4 |
| Lampung | 8.1 | 10.3 | 6.0 | 6.2 | 13.8 | 17.0 | 8.8 | 8.3 |
| West Nusa Tenggara | 2.7 | 7.3 | 11.2 | 7.6 | 3.7 | 12.1 | 18.9 | 13.2 |
| West Kalimantan | 15.9 | 15.8 | 6.3 | 8.6 | 21.4 | 24.2 | 10.0 | 12.6 |
| South Kalimantan | 9.8 | 11.7 | 4.6 | 6.5 | 13.0 | 19.2 | 9.4 | 10.6 |
| North Sulawesi | 12.7 | 14.4 | 5.1 | 5.2 | 22.0 | 23.1 | 12.0 | 9.4 |
| South Sulawesi | 8.5 | 14.1 | 8.6 | 11.8 | 11.7 | 17.6 | 12.4 | 18.3 |
| Riau | 20.4 | 15.3 | 11.1 | 9.5 | 28.5 | 24.2 | 17.7 | 12.0 |
| Jambi | 25.8 | 11.2 | 9.5 | 4.1 | 30.8 | 16.0 | 12.5 | 7.5 |
| Bengkulu | 18.3 | 23.3 | 9.1 | 7.0 | 19.7 | 30.4 | 14.4 | 11.4 |
| East Nusa Tenggara | 0.6 | 3.3 | 3.1 | 11.1 | 1.5 | 7.9 | 9.4 | 13.5 |
| East Timor | 10.5 | 2.8 | 2.6 | 9.4 | 12.6 | 4.5 | 8.6 | 13.9 |
| Central Kalimantan | 9.8 | 7.6 | 4.9 | 5.1 | 14.2 | 7.6 | 6.1 | 7.8 |
| East Kalimantan | 15.6 | 17.6 | 6.3 | 9.4 | 20.5 | 22.6 | 12.5 | 15.2 |
| Central Sulawesi | 7.9 | 14.5 | 9.7 | 6.1 | 12.3 | 16.1 | 12.5 | 8.4 |
| Southeast Sulawesi | 13.9 | 10.8 | 14.5 | 10.1 | 16.3 | 14.3 | 17.8 | 13.9 |
| Maluku | 22.1 | 10.2 | 4.5 | 11.4 | 31.6 | 12.0 | 8.1 | 15.9 |
| Irian Jaya | 5.7 | 10.4 | 6.6 | 7.1 | 7.8 | 17.1 | 12.7 | 10.6 |

## 8.5 Life Table of Switching Behaviour in Bali

In this section a multiple decrement life table is used to estimate contraceptive switching behaviour after discontinuation within two years of initiating use in Bali in 1986-91 and 1989-94, differentiated according to method of contraception (IUD and Injectables), place of residence, woman's and husband's education, and woman's age. See Table 8.7. This subsection presents the estimation of the parameters describing the condition of contraceptive switching in Bali. Chapter 9 then focuses on the determinants of switching in Bali using discrete-time competing risks hazard models.

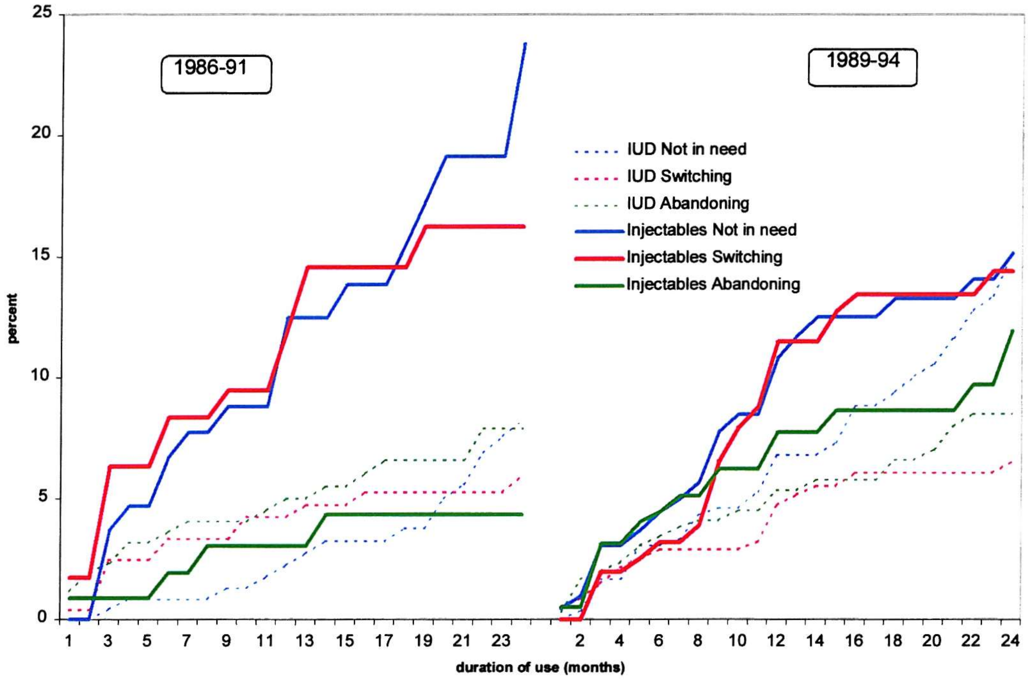
As briefly presented in section 8.3.2 and based on the rates in 1986-9, Bali is grouped into a category with switching to another method as the most common state after discontinuation within a year of initiating use. See Figure 8.16, which presents cumulative probabilities of switching behaviour after discontinuation, or Table 8.3 which summarises the 12-month and 24-month rates after adoption. Comparison between Figures 8.16 and 8.1 shows that Bali's patterns of switching behaviour after discontinuation were similar to the national patterns. As shown in other provinces in Appendix 8, Bali's patterns of switching behaviour were similar to the ones in West Sumatra, Central Kalimantan and South Kalimantan.

**Figure 8.16 Cumulative Probability of Contraceptive Switching Behaviour After Discontinuation: Bali, 1986-91 and 1989-94**




To examine either switching to another method or abandoning only, Table 8.6 presents these two rates calculated by associated single decrement life table. In this table, Bali's rates can be compared to other provinces. As shown in this table, Bali switching to another method within a year of initiation of use was 8.3% in 1986-91 and 10.2% in 1989-94. Abandoning within a year of initiation of use was 5.6% in 1986-91 and 6.6% in 1989-94. Among provinces in Java-Bali region, Bali switching to another method within a year of initiation of use was the second lowest after Central Java in both periods; the abandoning was also the lowest after Yogyakarta, 4.5% in 1986-91 and 4.7% in 1989-94. Yogyakarta had the highest switching to another method with 19.8% in 1986-91 and 17.1% in 1989-94. As in Bali, Yogyakarta was also the province with about 70% current users of contraception.

**Figure 8.17 Cumulative Probabilities of Contraceptive Switching Behaviour After Discontinuation from IUD and Injectables: Bali, 1986-91 and 1989-94 Calculated by an MDLT**



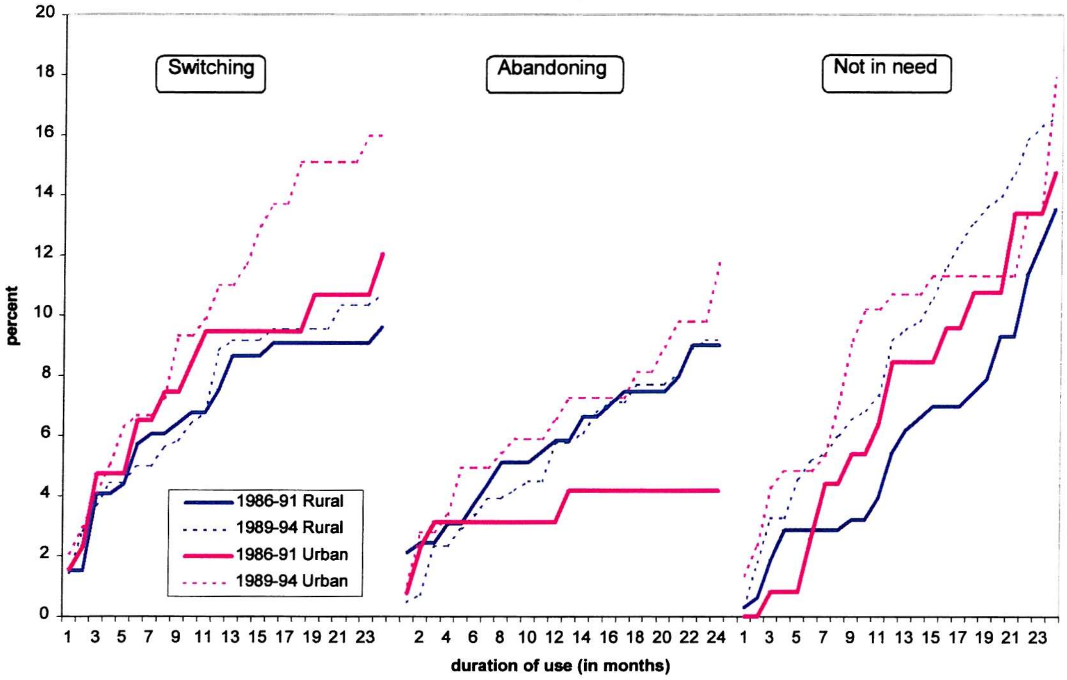

As mentioned in Chapter 4, life table technique has a drawback. This technique is infeasible when the number of observations was smaller than 100 (Ali and Cleland, 1995). Therefore, the life table switching behaviour by method is calculated for the IUD and injectables only. These two methods were the main contraception in Bali. As seen in Figure 8.17, in 1986-91 those who discontinued from the injectables were most likely to switch to another method or to switch to non-use because they were no longer in need up to 18 months after adoption. In the 1989-94, the pattern was still the same but the proportion of abandoning increased. However, IUD users had different patterns from the injectables users. IUD users also had different patterns over time. In 1986-91, abandoning was higher than switching, and not in need was the lowest. In 1989-94, however, not in need became the most common state after discontinuation from IUD. This findings draw that the same methods had different patterns of switching behaviour after discontinuation for different area (Bali and Indonesia as a whole). At the national level, we found that those who discontinued from IUD or injectable were most likely to switch to another method (Figures 8.3 and 8.4).

Table 8.7 12-month and 24-month Cumulative Probabilities of Contraceptive Switching Behaviour by Background Variables : Bali, 1986-91 and 1989-94 (Calculated by an MDLT)

| | Variable | 1986-91 | | | 1989-94 | | |
|---|---|---|---|---|---|---|---|
| | | Switching | Abandoning | Not in need | Switching | Abandoning | Not in need |
| 12-month | IUD | 4.2 | 5.0 | 2.2 | 6.8 | 4.7 | 5.3 |
| | Injectables | 12.0 | 3.0 | 12.5 | 10.8 | 11.5 | 7.8 |
| 24-month | IUD | 6.0 | 7.9 | 8.3 | 15.2 | 6.5 | 8.5 |
| | Injectables | 16.3 | 4.3 | 23.8 | 15.2 | 14.4 | 12.0 |
| 12-month | Rural | 7.5 | 5.8 | 5.4 | 8.8 | 5.8 | 9.2 |
| | Urban | 9.4 | 3.1 | 8.5 | 11.0 | 6.5 | 10.7 |
| 24-month | Rural | 9.6 | 9.0 | 13.5 | 10.7 | 9.2 | 16.6 |
| | Urban | 12.0 | 4.2 | 14.8 | 16.0 | 11.7 | 17.9 |
| 12-month | Less than Primary | 7.1 | 5.6 | 6.2 | 6.6 | 7.1 | 8.5 |
| | Secondary + | 11.9 | 3.4 | 6.1 | 14.1 | 4.1 | 11.4 |
| 24-month | Less than Primary | 8.7 | 8.3 | 12.8 | 8.8 | 12.6 | 15.3 |
| | Secondary + | 16.6 | 5.1 | 18.0 | 17.7 | 5.4 | 20.1 |
| 12-month | Less than Primary | 6.9 | 5.0 | 3.7 | 6.1 | 6.4 | 8.7 |
| | Secondary + | 9.7 | 5.5 | 10.8 | 12.4 | 5.6 | 10.4 |
| 24-month | Less than Primary | 9.2 | 7.4 | 10.9 | 7.9 | 12.4 | 16.4 |
| | Secondary + | 11.6 | 8.4 | 19.4 | 15.9 | 7.5 | 17.6 |
| 12-month | < 25 | 8.9 | 8.0 | 6.8 | 8.9 | 7.3 | 9.8 |
| | 25 - 29 | 7.9 | 4.0 | 6.9 | 8.7 | 4.8 | 12.0 |
| | 30+ | 6.5 | 0.9 | 4.3 | 11.9 | 5.3 | 5.6 |
| 24-month | < 25 | 12.3 | 10.7 | 16.6 | 11.3 | 10.0 | 20.0 |
| | 25 - 29 | 8.9 | 8.5 | 14.6 | 11.9 | 8.8 | 16.8 |
| | 30+ | 8.1 | 0.9 | 7.6 | 14.2 | 11.7 | 11.7 |

There is a marked difference in contraceptive behaviour after discontinuation between urban and rural users. Among rural users in both periods, the probability of switching to another method was the same as the probability of abandoning. On the other hand, among urban users in both periods the probabilities of switching were higher than the probabilities of abandoning (Figure 8.18). In addition, both the probabilities of switching and abandoning among urban users were higher in 1989-94 than in the previous period. The higher probability of switching among urban users in 1989-94 than in 1986-91 was also found at the national level (Figure 8.9)

**Figure 8.18 Cumulative Probabilities of Contraceptive Switching Behaviour After Discontinuation by Place of Residence: Bali, 1986-91 and 1989-94 Calculated by an MDLT**




Differentials in switching behaviour by woman's education and by husband's education can be found in Figures 8.19 and 8.20. Woman's and husband's education are categorised into two groups: less than primary, and secondary and above. Women who had educational level of less than primary had different patterns in 1986-91 and 1989-94 (Figure 8.19). In 1986-91, switching and abandoning were about the same proportion, but in 1989-94 switching were higher than abandoning within 24 month of initiating use, although switching to non-use while not in need was the most common state after discontinuation in both periods. However, among those who had secondary school and above, they were much more likely to switch than to abandon in both periods. Figure 8.11 shows that the pattern of higher switching to another method among higher educated women was also found at the national level.

Figure 8.20 shows that patterns of switching behaviour by husband's education were slightly different than that by woman's education especially among those who had secondary school and above. Within two years after adoption switching to another method in 1986-91 was higher than in 1989-94. On the other hand, among those who had husband having less than primary school, not in need in 1986-91 was much lower than in 1989-94. Similarity between Bali and the national level (Figure 8.12) was also shown by the higher probability of switching to another method among women who had better educated husbands.

**Figure 8.19 Cumulative Probabilities of Contraceptive Switching Behaviour After Discontinuation by Woman's Education: Bali, 1986-91 and 1989-94 Calculated by an MDLT**

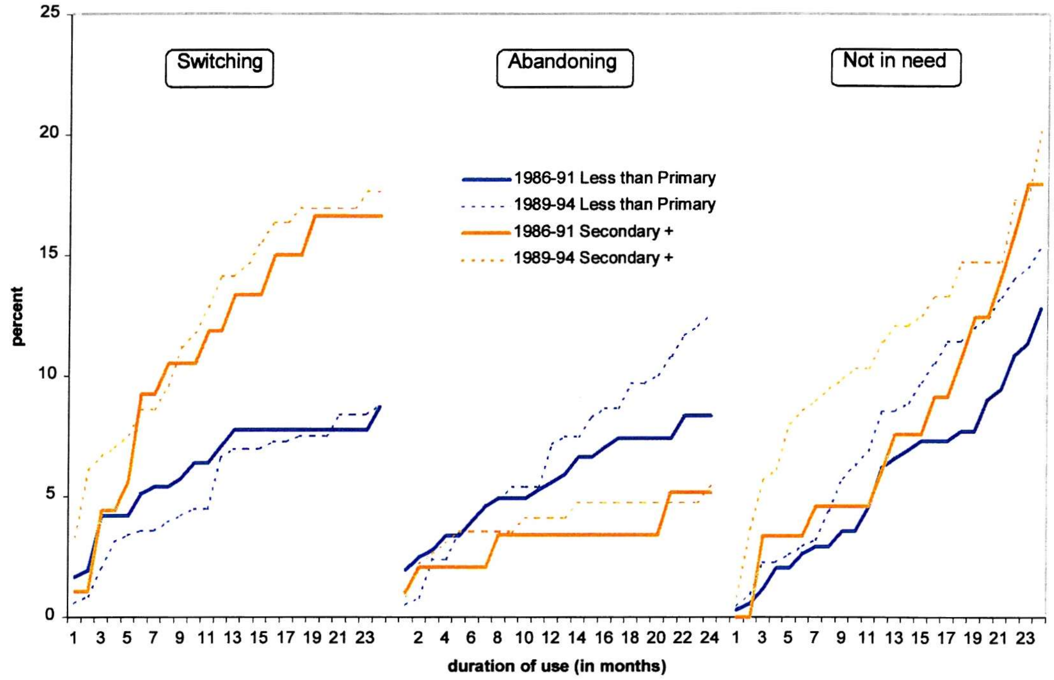
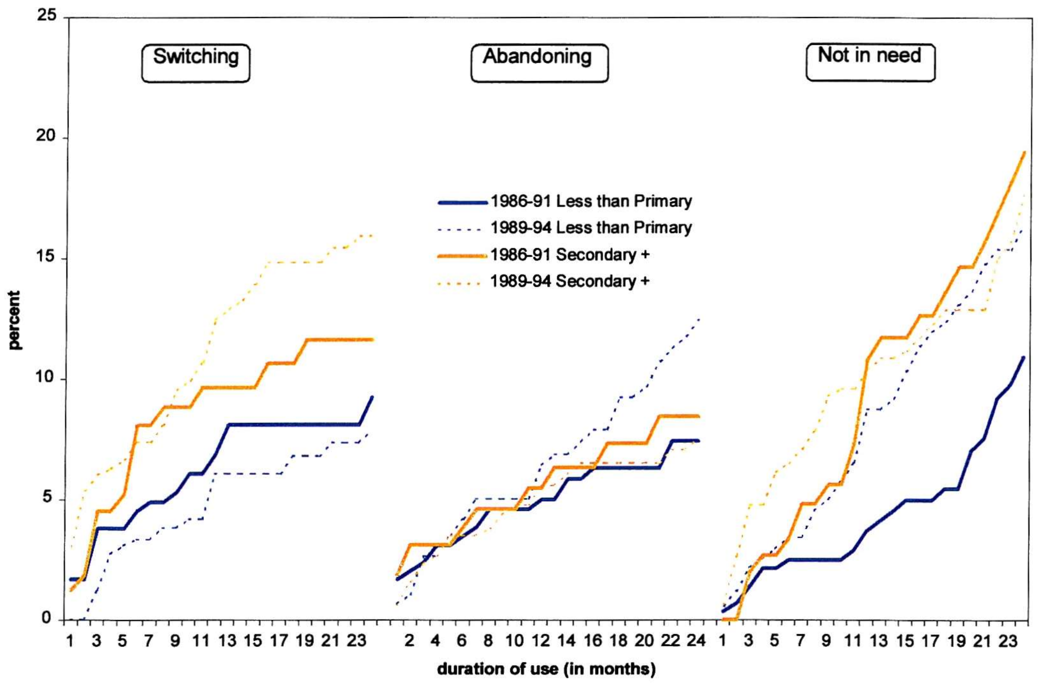
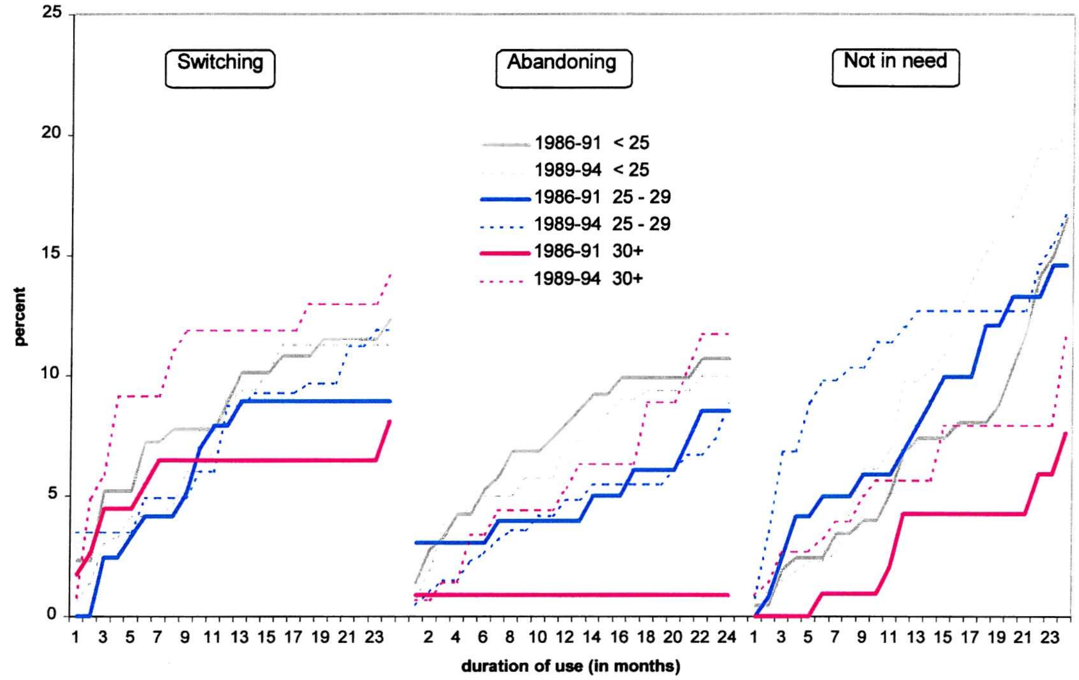



**Figure 8.20 Cumulative Probabilities of Contraceptive Switching Behaviour After Discontinuation by Husband's Education: Bali, 1986-91 and 1989-94 Calculated by an MDLT**



Finally, Figure 8.21 presents cumulative probabilities of switching behaviour by woman's age at the start of use. This figure shows that different age group has different patterns of switching behaviour after discontinuation. Young women (< 25 years old) discontinued within two years after initiating use mostly because they were no longer in need for contraception. In 1989-94 the proportion of not in need was higher than in the previous period. On the other hand, when older women (above 30 years old) discontinued, they were most likely to switch to another method. Unlike the pattern at the national level (Figure 8.13), Bali's pattern of switching behaviour after discontinuation varied across age groups and over time. However, like the national level, younger users were most likely to be not in need when they discontinued within two years of adoption.

**Figure 8.21 Cumulative Probabilities of Contraceptive Switching Behaviour After Discontinuation by Woman's Age: Bali, 1986-91 and 1989-94**
**Calculated by an MDLT**




## 8.6 Summary

This chapter presents the estimation of the parameters describing the condition of the contraceptive switching behaviour after discontinuation for each method of contraception and for different background characteristics of the users in 1986-91 and 1989-94. After discontinuation a woman may switch to another method or to non-use depending on whether or not she needs contraception. In this analysis, contraceptive switching behaviour after discontinuation is defined using Curtis and Hammerslough's framework (1995) and classified by the contraceptive status of the woman in the month immediately after discontinuation. She may switch to another method, switch to non-use while she is in need for contraception (abandon), or switch to non-use because she is no longer in need for contraception in the month immediately after discontinuation. The first two categories are defined as having a need for contraception. The last category, no longer in need for contraception, is defined according to the reasons for discontinuation. If users reported that they discontinued for one of the following reasons: contraceptive failure, want to get pregnant, infrequent sex, separation/widowed, and infecund, they fell into "no longer in need of contraception". The focus of attention in this analysis is the behaviour of users who discontinued use but still had a need for contraception because their behaviour may reflect various aspects of family planning programme such as services and method availability.

Multiple decrement life tables are used in the analysis and single decrement life tables are also to utilised to study changes over time (1986-91 and 1989-94) in switching to another method and switching to non-use while still in need for contraception. Separate life tables are calculated for each method of contraception and also for each category of background characteristics: place of residence (urban & rural), region (Java-Bali, Outer Java-Bali I and Outer Java-Bali II), woman's and husband's education (no education, some primary, primary and, secondary and above) and woman's age ( < 25, 25-29 and 30+). Contraceptive switching is also calculated for the 27 provinces in Indonesia. This analysis is therefore technically time-consuming, but it provides interesting insight into contraceptive switching behaviour in the country. This analysis produces use measurements of contraceptive switching in contrast to contraceptive prevalence rates as measurements of current contraceptive use. Hopefully, this research will be of interest to people in the field of family planning and will stimulate further analysis on this topic.

For all reversible methods, there were similar patterns of contraceptive switching behaviour after discontinuation between 1986-91 and 1989-94. Users who discontinued within a year of use after initiating use were they who still had a need for contraception, i.e. who switched to another method and who abandoned. They were more likely to switch to another method than to abandon (Table 8.1). However, there were differentials in switching behaviour by method. Users who discontinued from the pill or Norplant but still had a need for contraception were more likely to abandon than to switch to another method. On the other hand, those who discontinued from the

IUD, injectables and condoms but still have a need were more likely to switch than to abandon. Likewise these methods, traditional methods (abstinence and condom) also had the same patterns of switching behaviour.

Regardless urban or rural users, they generally switched to another method after discontinuation than abandoned (Table 8.2). Yet, urban users were more likely to switch to another method than rural users. In term of abandoning there was no different between urban and rural users. Switching behaviour by place of residence remained relatively unchanged over time (Table 8.5).

Differentials in switching behaviour existed by woman's education and husband's education. Those with no education or some primary were more likely to abandon than to switch, while those who had secondary and above were more likely to switch than to abandon (Table 8.2). A positive relationship occurred between woman's education and switching to another method in both periods and also between husband's education and switching to another method. On the other hand, a negative relationship occurred between education and abandoning for woman's and husband's education.

Among different age groups the probabilities of switching to another method were higher than the probabilities of abandoning. In terms of abandoning, the younger the women, the more likely to abandon. A negative relationship was also found for switching.

Variation over time in switching and abandoning from 1986-91 and 1989-96 by background variables was relatively small.

Regional patterns of switching behaviour did not occur in both periods. Generally, those who lived in Java-Bali, Outer Java-Bali I, and Outer Java-Bali II switched to another method after discontinuation than abandoned. Because each region consists of provinces, provincial variation was observed in each region. Provincial variations in patterns of switching behaviour after discontinuation can be categorised into three groups; provinces with the largest proportion of abandoning, with the largest proportion of switching, and with the largest proportion of not in need. West Nusa Tenggara, North Sumatra, Central Sulawesi, Southeast Sulawesi and Irian

Jaya were the provinces in 1986-91 with abandoning as the most common state after discontinuation. While in 1989-94, switching to another method became the most common state after discontinuation in Central Sulawesi, Southeast Sulawesi and Irian Jaya. Not in need for contraception was the most common state after discontinuation in West Nusa Tenggara and North Sumatra. Fifteen out of 27 provinces in 1986-91 had the largest proportion of switching and 7 provinces had the largest proportion of being not in need. In 1989-94 there were 20 provinces with switching to another method as the most common state after discontinuation.

The national patterns of switching behaviour as shown in Figure 8.1 was also found in Bali, West Sumatra, Central Kalimantan, and South Kalimantan. The last section of this chapter presents a series of multiple decrement life tables of switching behaviour after discontinuation in Bali by method, place of residence, woman's and husband's education, and woman's age at the start of use. There were differentials in switching behaviour after discontinuation in the province by those variables. Urban users were more likely to switch to another method, but urban users were as likely to switch to another method as to abandon. Women with less than primary schoool were more likely to abandon than to switch to another method. On the other hand, women with secondary and above were more likely to switch to another method than to abandon. This pattern was also found for differentials by husband's education. Young women were most likely to discontinue because they were no longer in need. Interestingly, unlike at the national level, users who discontinued from IUD were more likely to abandon than to switch to another method. Injectable users were more likely to switch to another method than to abandon, but the probability of switching to another method was the same as the probability to be not in need of contraception. Chapter 10 investigates the effects of method of contraception on the risks of switching behaviour in Bali by controlling with other variables using multilevel discrete-time competing risks hazard models.

# Chapter 9

# DETERMINANTS OF CONTRACEPTIVE DISCONTINUATION IN BALI

## 9.1 Introduction

This chapter studies determinants of contraceptive discontinuation in Bali in 1986-91 and 1989-94 as an extension of the research in Section 7.6. As presented in that section, the probability of discontinuation within one year of initiation of use increased from 19% in 1986-91 to 25% in 1989-94. The discontinuation rate varied across methods. However, because there were not enough segments of use from the available data, the life table techniques allowed for estimation of the IUD and injectable discontinuation rates only (Figure 7.32). This chapter uses multilevel discrete time competing risks hazard models to examine the effect of method chosen on discontinuation controlling for other variables. However, as users may have different reasons for discontinuation, the analysis also focused on the reason for discontinuation. The reasons for discontinuation in this analysis are similar to the ones in Section 7.6, where the reasons are divided into four groups: (1) contraceptive failure, (2) desire to get pregnant, (3) side effects and health concerns, and (4) other reasons for discontinuation. 'How long do the users use a particular method?' is an important question to answer. Therefore, duration of use is considered as a strong determinant of stopping use of any contraceptive and is examined in this chapter. This chapter firstly compares the ordinary model with the multilevel discrete time competing risks hazard model. It is followed by a discussion of the impact of duration of use and method of contraception in Section 9.3. Section 9.4 presents the impact of socio-economic and demographic variables on reason for discontinuation. The summary of the findings ends this chapter.

## 9.2 Model Comparison and Random Effects

Tables 9.1, 9.2 and 9.3 present parameter estimates and standard errors for two discrete time competing risks hazard models, hereafter referred to model A and model B. Model A represents a standard discrete-time competing risks hazard model, which ignores a woman-level effect. Model B is the multilevel discrete-time competing risks hazards model, which incorporates a woman-level effect. A test of a zero woman level variance tests the independence assumption across episodes of use. This approach of comparison between models A and B was inspired by Curtis, Diamond and McDonald's study (1993) in analysing the effects of the preceding birth interval on post-neonatal in Brazil, controlling for the correlation of survival outcome between siblings.

Table 9.1 Parameter Estimates and Standard Errors for Contraceptive Discontinuation from Discrete-Time Competing Risks Hazard Models without Controlling for Other Covariates: Bali, 1986-91 and 1989-94

| Type of Discontinuation | PARAMETER | Model A | | | | Model B | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1986-91 | | 1989-94 | | 1986-91 | | 1989-94 | |
| | | ESTIMATE | S. E | ESTIMATE | S. E | ESTIMATE | S. E | ESTIMATE | S. E |
| Failure | Intercept | -7.250 | 0.778 | -5.453 | 0.399 | -7.421 | 0.807 | -5.573 | 0.423 |
| | Log(duration) | 0.398* | 0.265 | -0.0798 | 0.157 | 0.480* | 0.272 | 0.011 | 0.161 |
| | *Random effect* | - | - | - | - | 2.303** | 1.251 | 4.423**** | 0.967 |
| To get pregnant | Intercept | -5.833 | 0.445 | -6.190 | 0.423 | -5.835 | 0.445 | -6.192 | 0.423 |
| | Log(duration) | 0.192 | 0.158 | 0.414*** | 0.147 | 0.193 | 0.159 | 0.415*** | 0.147 |
| | Random effect | - | - | - | - | 0.000 | 0.000 | 0.000 | 0.000 |
| Side Effects and Health Concerns | Intercept | -4.125 | 0.281 | -4.683 | 0.281 | -4.208 | 0.297 | -4.711 | 0.286 |
| | Log(duration) | -0.626**** | 0.135 | -0.142 | 0.113 | -0.587**** | 0.138 | -0.132 | 0.114 |
| | Random effect | - | - | - | - | 1.330** | 0.7195 | 0.492 | 0.397 |
| Other Reasons | Intercept | -4.605 | 0.324 | -4.514 | 0.289 | -4.606 | 0.324 | -4.594 | 0.303 |
| | Log(duration) | -0.362*** | 0.138 | -0.401*** | 0.128 | -0.362*** | 0.138 | -0.368*** | 0.131 |
| | Random effect | - | - | - | - | 0.000 | 0.000 | 1.162** | 0.633 |

Note : **** p<0.001 *** p<0.01 ** p<0.05 * P<0.1

The standard errors of the parameter estimates in Model B are generally higher than in model A, though the increase is small. However, the changes in parameter estimates and standard errors are sufficiently large to alter the significance of the parameter estimates. For example, Table 9.2

presents that the level of significance of injectable on failure in 1989-94 changed from $p < 0.05$ in model A to $p < 0.10$ in model B.

Table 9.2 Parameter Estimate and Standard Error (SE) for Contraceptive Discontinuation from Discrete-Time Competing Risks Hazard Models with Controlling for Method of Contraceptive: Bali, 1986-91 and 1989-94

| Type of Discontinuation | PARAMETER | Model A | | | | Model B | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1986-91 | | 1989-94 | | 1986-91 | | 1989-94 | |
| | | ESTIMATE | S.E | ESTIMATE | S.E | ESTIMATE | S.E | ESTIMATE | S.E |
| Failure | Intercept | -7.471 | 1.226 | -4.431 | 0.574 | -7.542 | 1.240 | -4.172 | 0.650 |
| | Log(duration) | 0.433* | 0.270 | -0.076 | 0.157 | 0.497* | 0.276 | 0.043 | 0.156 |
| | Contraceptive Method (base=other methods) | | | | | | | | |
| | Pill | 0.420 | 1.127 | -0.365 | 0.572 | 0.439 | 1.142 | -0.487 | 0.680 |
| | IUD | -0.222 | 1.058 | -1.258*** | 0.508 | -0.323 | 1.065 | -1.807*** | 0.619 |
| | Injection | 0.743 | 1.082 | -1.304** | 0.572 | 0.699 | 1.095 | -1.769*** | 0.670 |
| | Random Effect | - | - | - | - | 1.773 | 1.161 | 3.690**** | 0.875 |
| To get pregnant | Intercept | -4.902 | 0.535 | -5.720 | 0.607 | -4.903 | 0.535 | -5.702 | 0.607 |
| | Log(duration) | 0.289 | 0.166 | 0.430*** | 0.148 | 0.289 | 0.166 | 0.430*** | 0.148 |
| | Contraceptive Method (base=other methods) | | | | | | | | |
| | Pill | -1.306** | 0.535 | -0.248 | 0.562 | -1.306** | 0.535 | -0.264 | 0.561 |
| | IUD | -1.749**** | 0.417 | -0.693 | 0.483 | -1.749**** | 0.417 | -0.713 | 0.483 |
| | Injection | -0.543 | 0.425 | -0.381 | 0.506 | -0.543 | 0.425 | -0.400 | 0.506 |
| | Random Effect | - | - | - | - | 0.000 | 0.000 | 0.000 | 0.000 |
| Side Effects and Health Concerns | Intercept | -4.532 | 0.738 | -5.952 | 1.028 | -4.688 | 0.803 | -6.051 | 1.103 |
| | Log(duration) | -0.603**** | 0.137 | -0.113 | 0.114 | -0.568**** | 0.140 | -0.119 | 0.115 |
| | Contraceptive Method (base=other methods) | | | | | | | | |
| | Pill | 0.385 | 0.836 | 1.800* | 1.031 | 0.392 | 0.917 | 1.845* | 1.111 |
| | IUD | 0.175 | 0.739 | 0.829 | 1.013 | 0.284 | 0.803 | 0.947 | 1.090 |
| | Injection | 0.830 | 0.755 | 1.586 | 1.013 | 0.904 | 0.824 | 1.690 | 1.090 |
| | Random Effect | - | - | - | - | 1.204** | 0.6996 | 0.346 | 0.369 |
| Other Reasons | Intercept | -3.476 | 0.428 | -3.178 | 0.415 | -3.477 | 0.428 | -2.851 | 0.447 |
| | Log(duration) | -0.353*** | 0.139 | -0.391*** | 0.128 | -0.352*** | 0.139 | -0.318*** | 0.128 |
| | Contraceptive Method (base=other methods) | | | | | | | | |
| | Pill | -0.619 | 0.478 | -1.417** | 0.559 | -0.619 | 0.478 | -1.900*** | 0.615 |
| | IUD | -1.531**** | 0.412 | -1.564**** | 0.396 | -1.530**** | 0.412 | -2.039**** | 0.444 |
| | Injection | -1.340*** | 0.507 | -1.432**** | 0.436 | -1.340*** | 0.507 | -1.982**** | 0.487 |
| | Random Effect | - | - | - | - | 0.000 | 0.000 | 1.577*** | 0.6074 |

Note : **** p<0.001 *** p<0.01 ** p<0.05 * p<0.1

After controlling for other covariates (Table 9.3) the level of significance of the impact of injectable on failure was $p < 0.01$ in Model A and $p < 0.05$ in model B for the 1989-94 period. The changes in level of significance between models A and B generally occurred in 1989-94 model, particularly in discontinuation due to contraceptive failure for parameters of pill, and women with no schooling. For side effects and health concerns the changes in level of significance of parameters occurred for husband with no schooling. For discontinuation due to other reasons, the significance of parameter of those who just had a baby/termination before use of contraception changed from $p < 0.05$ in model A to $p < 0.10$ in model B, but the significance of pill, IUD and injectable became more significant in model B.

In order to test significance of the random effect in model B, the random parameter significance test has to be modified because $\sigma = 0$ is on the boundary of parameter space. Rather than as a chi-square random variable with one degree of freedom, Maller and Zou (1996) have suggested that, in large sample, the test statistic is approximately distributed as a random variable with an equal probability (50-50) mixture of a chi-square and a point mass at zero. The 95th percentile of the distribution of such a random variable is given by

$$\frac{1}{2}+\frac{1}{2}p\left(X_1^2 \le c_{0.95}\right)=0.95$$

or

$$p\left(X_1^2 \le c_{0.95}\right)=0.90$$

This critical value for the 0.05 significance level now becomes 2.71 rather 3.84 as in the standard case. This critical value is used in the present study to calculate significance levels of the random parameters.

As shown in Table 9.1, the parameter estimate of random effect of contraceptive failure was significant at the 0.05 level of significance in 1986-91 and at the 0.001 in 1989-94. The significant parameter estimate of random effect was also revealed in discontinuation due to side effects and health concerns in the 1986-1991 and due to other reasons in 1989-1994. The parameter estimates of random effect for discontinuation due to desire to become pregnant in the two periods of observation were zero.

The magnitude of parameter of random effect changes when method of use is included in the model (compare random effect in Tables 9.1 and 9.2). The inclusion of method of use in the model reduces the extra variation in the risk of discontinuation due to side effects and health concerns, and also contraceptive failure in both periods. The parameter estimate of 3.69 was high for contraceptive failure. However, the inclusion of the method of use in the model increases the extravariation in the risk of other reasons from 1.162 to 1.577. The level of significance of the random effect of other reasons increases from 0.05 to 0.01 in 1989-94.

Table 9.3 Parameter Estimates and Standard Errors (SE) from the Multilevel Discrete-Time Competing Risks Hazard Models for Contraceptive Discontinuation Controlling for Other Variables: Bali, 1986-1991 and 1989-1994

| Type of Discontinuation | PARAMETER | Model A | | | | Model B | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1986-91 | | 1989-94 | | 1986-91 | | 1989-94 | |
| | | ESTIMATE | S. E | ESTIMATE | S. E | ESTIMATE | S. E | ESTIMATE | S. E |
| Failure/Still using | Intercept | -6.788 | 1.746 | -4.798 | 1.107 | -6.028 | 1.658 | -4.506 | 1.302 |
| | Log(duration) | 0.516* | 0.285 | -0.010 | 0.161 | 0.525* | 0.285 | 0.131 | 0.165 |
| | Method of use (base=other methods) | | | | | | | | |
| | *Pill* | 0.524 | 1.216 | -0.257 | 0.657 | 0.424 | 1.182 | -0.073 | 0.740 |
| | *IUD* | -0.144 | 1.100 | -1.961**** | 0.569 | -0.312 | 1.078 | -2.156*** | 0.681 |
| | *Injectable* | 0.745 | 1.149 | -1.724*** | 0.628 | 0.581 | 1.123 | -1.808** | 0.726 |
| | Place of Residence (base= Rural) | | | | | | | | |
| | *Urban* | 0.008 | 0.543 | -1.278*** | 0.490 | -0.128 | 0.569 | -1.388*** | 0.537 |
| | Wife's educational (base=secondary plus) | | | | | | | | |
| | *No schooling* | 0.467 | 0.927 | -1.099 | 0.702 | 0.403 | 0.979 | -1.481* | 0.785 |
| | *Some Primary* | 0.279 | 0.858 | -1.318** | 0.578 | 0.315 | 0.891 | -1.618** | 0.643 |
| | *Primary* | 0.140 | 0.739 | -0.436 | 0.444 | 0.111 | 0.767 | *-0.709* | *0.516* |
| | Husband's education (base=secondary plus) | | | | | | | | |
| | *No schooling* | -0.795 | 1.217 | -0.069 | 0.877 | -0.778 | 1.196 | 0.024 | 1.016 |
| | *Some Primary* | -0.372 | 0.684 | 0.658 | 0.605 | -0.473 | 0.719 | 1.066* | 0.661 |
| | *Primary* | -0.959 | 0.722 | 0.646 | 0.450 | -0.987 | 0.745 | 0.832* | 0.522 |
| | Status in the month immediately before use (base= any method) | | | | | | | | |
| | *No method* | 0.165 | 0.816 | 1.034* | 0.597 | -0.483 | 0.691 | 1.045* | 0.604 |
| | *Birth* | 0.458 | 1.100 | 1.130* | 0.668 | -0.285 | 1.071 | *0.984* | *0.713* |
| | Age the start of use (base=>30) | | | | | | | | |
| | *< 25* | 0.677 | 0.775 | -0.215 | 0.552 | 0.701 | 0.813 | -0.295 | 0.596 |
| | *25 – 29* | 0.075 | 0.778 | -0.329 | 0.531 | 0.066 | 0.812 | -0.513 | 0.565 |
| | Contraceptive intention at the start of use (base=spacers) | | | | | | | | |
| | *Limiters* | -1.499** | 0.586 | -0.412 | 0.515 | -1.478** | 0.604 | -0.402 | 0.553 |
| | Number of living children at the start of use (base=>4) | | | | | | | | |
| | 0-1 | *-1.084* | *1.053* | 0.383 | 0.916 | *-1.100* | *1.092* | 0.536 | 0.997 |
| | 2-3 | -0.594 | 0.851 | 0.191 | 0.743 | -0.542 | 0.892 | 0.384 | 0.806 |
| | Random effect | - | - | - | - | 0.911 | 0.931 | 2.082*** | 0.703 |

Note: **** p< 0.001 *** p< 0.01 ** p< 0.05 * p < 0.1

Table 9.3 Continued...

| Type of Discontinuation | PARAMETER | Model A | | | | Model B | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1986-91 | | 1989-94 | | 1986-91 | | 1989-94 | |
| | | ESTIMATE | S. E | ESTIMATE | S. E | ESTIMATE | S. E | ESTIMATE | S. E |
| Desire to get pregnant / Still using | Intercept | -4.529 | 1.005 | -7.074 | 1.089 | -4.529 | 1.005 | -6.062 | 1.155 |
| | Log(duration) | 0.480*** | 0.182 | 0.496**** | 0.152 | 0.481*** | 0.182 | 0.498**** | 0.152 |
| | Method of use (base=other methods) | | | | | | | | |
| | *Pill* | -1.281** | 0.622 | -0.316 | 0.641 | -1.280** | 0.622 | -0.324 | 0.641 |
| | *IUD* | -1.586**** | 0.471 | -1.203** | 0.530 | -1.586**** | 0.471 | -1.216** | 0.530 |
| | *Injectable* | -0.372 | 0.482 | -0.965* | 0.550 | -0.372 | 0.482 | -0.976* | 0.550 |
| | Place of Residence (base= Rural) | | | | | | | | |
| | *Urban* | 0.374 | 0.357 | 0.011 | 0.304 | *0.373* | *0.357* | 0.011 | 0.304 |
| | Wife's educational (base=secondary plus) | | | | | | | | |
| | *No schooling* | -0.159 | 0.611 | 0.163 | 0.459 | -0.158 | 0.611 | 0.161 | 0.459 |
| | *Some Primary* | -0.487 | 0.567 | -0.518 | 0.431 | -0.488 | 0.567 | -0.520 | 0.431 |
| | *Primary* | -0.173 | 0.440 | -0.257 | 0.347 | -0.172 | 0.440 | -0.259 | 0.347 |
| | Husband's education (base=secondary plus) | | | | | | | | |
| | *No schooling* | 0.438 | 0.787 | 0.497 | 0.553 | 0.437 | 0.787 | 0.498 | 0.553 |
| | *Some Primary* | -0.005 | 0.552 | 0.123 | 0.486 | -0.005 | 0.552 | 0.126 | 0.486 |
| | *Primary* | 0.345 | 0.446 | -0.043 | 0.380 | 0.345 | 0.446 | -0.042 | 0.380 |
| | Status in the month immediately before use (base=any method) | | | | | | | | |
| | *No method* | -1.089*** | 0.399 | 0.322 | 0.391 | -1.091*** | 0.399 | 0.324 | 0.391 |
| | *Birth* | -0.981* | 0.613 | 0.252 | 0.472 | -0.983* | 0.613 | 0.252 | 0.472 |
| | Age the start of use (base=>30) | | | | | | | | |
| | *< 25* | 0.702 | 0.623 | 0.062 | 0.570 | 0.702 | 0.623 | 0.061 | 0.570 |
| | *25 - 29* | 0.768 | 0.606 | 0.222 | 0.560 | 0.769 | 0.607 | 0.220 | 0.560 |
| | Contraceptive intention at the start of use (base=spacers) | | | | | | | | |
| | *Limiters* | -1.706**** | 0.463 | -1.004** | 0.472 | -1.706**** | 0.463 | -1.006** | 0.472 |
| | Number of living children at the start of use (base=>4) | | | | | | | | |
| | 0-1 | 0.077 | 0.826 | 1.205 | 0.931 | 0.078 | 0.826 | 1.205 | 0.932 |
| | 2-3 | -0.387 | 0.746 | 0.019 | 0.837 | -0.386 | 0.746 | 0.022 | 0.837 |
| | Random effect | - | - | - | - | 0.000 | 0.000 | 0.000 | 0.000 |

Note: **** p< 0.001 *** p< 0.01 ** p< 0.05 * p < 0.1

Table 9.3 Continued...

| Type of Discontinuation | PARAMETER | Model A | | | | Model B | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1986-91 | | 1989-94 | | 1986-91 | | 1989-94 | |
| | | ESTIMATE | S. E | ESTIMATE | S. E | ESTIMATE | S. E | ESTIMATE | S. E |
| Side effects | Intercept | -3.269 | 1.033 | -5.618 | 1.181 | -3.439 | 1.060 | -5.015 | 1.218 |
| and health | Log(duration) | -0.572**** | 0.141 | -0.112 | 0.115 | -0.588**** | 0.141 | -0.111 | 0.115 |
| concerns / still | Method of use (base=other methods) | | | | | | | | |
| using | *Pill* | 0.260 | 0.902 | 1.806* | 1.050 | 0.214 | 0.913 | 1.796* | 1.049 |
| | *IUD* | 0.217 | 0.781 | 1.011 | 1.035 | 0.200 | 0.782 | 0.998 | 1.034 |
| | *Injectable* | 0.761 | 0.797 | 1.527 | 1.034 | 0.712 | 0.801 | 1.514 | 1.033 |
| | Place of Residence (base= Rural) | | | | | | | | |
| | *Urban* | -0.218 | 0.400 | 0.252 | 0.265 | -0.155 | 0.405 | 0.251 | 0.265 |
| | Wife's educational (base=secondary plus) | | | | | | | | |
| | *No schooling* | -0.258 | 0.619 | 0.615 | 0.445 | -0.063 | 0.631 | 0.614 | 0.445 |
| | *Some Primary* | -0.562 | 0.588 | 0.543 | 0.360 | -0.525 | 0.607 | 0.543 | 0.360 |
| | *Primary* | -0.448 | 0.508 | 0.186 | 0.343 | -0.406 | 0.523 | 0.186 | 0.343 |
| | Husband's education (base=secondary plus) | | | | | | | | |
| | *No schooling* | 0.341 | 0.732 | -1.948** | 1.077 | 0.239 | 0.755 | -1.949* | 1.077 |
| | *Some Primary* | 0.631 | 0.493 | -0.456 | 0.396 | 0.609 | 0.507 | -0.454 | 0.396 |
| | *Primary* | -1.030* | 0.635 | -0.397 | 0.331 | -1.071* | 0.647 | -0.397 | 0.331 |
| | Status in the month immediately before use (base=any method) | | | | | | | | |
| | *No method* | -0.471 | 0.455 | -0.212 | 0.312 | -0.362 | 0.479 | -0.209 | 0.312 |
| | *Birth* | 0.189 | 0.632 | -1.303** | 0.579 | 0.381 | 0.646 | -1.302** | 0.579 |
| | Age the start of use (base=>30) | | | | | | | | |
| | *< 25* | 0.892* | 0.565 | 0.065 | 0.407 | 0.953* | 0.579 | 0.065 | 0.407 |
| | *25 - 29* | 0.468 | 0.533 | -0.038 | 0.357 | 0.564 | 0.544 | -0.039 | 0.357 |
| | Contraceptive intention at the start of use (base=spacers) | | | | | | | | |
| | *Limiters* | -0.864** | 0.393 | -0.595* | 0.344 | -0.863** | 0.401 | -0.594* | 0.344 |
| | Number of living children at the start of use (base=>4) | | | | | | | | |
| | 0-1 | -1.250* | 0.653 | -0.830 | 0.591 | -1.240* | 0.667 | -0.828 | 0.592 |
| | 2-3 | -0.824 | 0.531 | -0.455 | 0.442 | -0.840 | 0.538 | -0.453 | 0.442 |
| | Random effect | - | - | - | - | 0.243 | 0.464 | 0.000 | 0.000 |

Note: **** $p< 0.001$ *** $p< 0.01$ ** $p< 0.05$ * $p < 0.1$

Table 9.3 Continued...

| Type of Discontinuation | PARAMETER | Model A | | | | Model B | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1986-91 | | 1989-94 | | 1986-91 | | 1989-94 | |
| | | ESTIMATE | S. E | ESTIMATE | S. E | ESTIMATE | S. E | ESTIMATE | S. E |
| Other reasons / | Intercept | -3.918 | 0.879 | -3.697 | 0.885 | -3.916 | 0.879 | -2.720 | 1.053 |
| Still using | Log(duration) | -0.310** | 0.143 | -0.358*** | 0.130 | -0.310** | 0.143 | -0.285** | 0.131 |
| | Method of use (base=other methods) | | | | | | | | |
| | *Pill* | -0.792 | 0.545 | -1.518** | 0.596 | -0.792 | 0.545 | -1.847*** | 0.641 |
| | *IUD* | -1.885**** | 0.462 | -1.434*** | 0.450 | -1.885**** | 0.462 | -1.877**** | 0.489 |
| | *Injectable* | -1.682*** | 0.537 | -1.423*** | 0.478 | -1.683*** | 0.537 | -1.853**** | 0.515 |
| | Place of Residence (base= Rural) | | | | | | | | |
| | *Urban* | 0.096 | 0.364 | 0.305 | 0.342 | 0.096 | 0.364 | 0.367 | 0.374 |
| | Wife's educational (base=secondary plus) | | | | | | | | |
| | *No schooling* | 0.203 | 0.659 | 0.327 | 0.560 | 0.204 | 0.658 | 0.377 | 0.630 |
| | *Some Primary* | 0.635 | 0.562 | -0.260 | 0.476 | *0.635* | *0.562* | -0.138 | 0.514 |
| | *Primary* | 0.254 | 0.534 | -0.413 | 0.421 | 0.254 | 0.534 | -0.369 | 0.460 |
| | Husband's education (base=secondary plus) | | | | | | | | |
| | *No schooling* | -0.020 | 0.753 | 0.386 | 0.766 | -0.022 | 0.753 | 0.464 | 0.816 |
| | *Some Primary* | -0.073 | 0.516 | -0.074 | 0.569 | -0.073 | 0.516 | -0.166 | 0.619 |
| | *Primary* | 0.130 | 0.464 | 0.435 | 0.396 | 0.129 | 0.464 | 0.395 | 0.433 |
| | Status in the month immediately before use (base=any method) | | | | | | | | |
| | *No method* | 0.155 | 0.462 | -0.067 | 0.390 | 0.153 | 0.462 | 0.194 | 0.442 |
| | *Birth* | -1.384 | 1.101 | -1.498** | 0.670 | -1.385 | 1.101 | -1.295* | 0.704 |
| | Age the start of use (base=>30) | | | | | | | | |
| | *< 25* | 1.101* | 0.600 | -0.881* | 0.495 | 1.102* | 0.600 | -0.849* | 0.542 |
| | *25 – 29* | 1.188** | 0.541 | -0.801* | 0.435 | 1.188** | 0.541 | -0.822* | 0.475 |
| | Contraceptive intention at the start of use (base=spacers) | | | | | | | | |
| | *Limiters* | -0.476 | 0.408 | 1.099** | -0.435 | -0.475 | 0.408 | -1.079** | 0.472 |
| | Number of living children at the start of use (base=>4) | | | | | | | | |
| | 0-1 | -0.285 | 0.660 | 0.599 | 0.835 | -0.286 | 0.660 | 0.723 | 0.897 |
| | 2-3 | -0.869* | 0.522 | 0.508 | 0.693 | -0.869* | 0.522 | 0.617 | 0.738 |
| | Random effect | - | - | - | - | 0.000 | 0.000 | 1.069** | 0.530 |

Note: **** p< 0.001 *** p< 0.01 ** p< 0.05 * p < 0.1

In spite of the large number of variables included in the model the random effects of discontinuation due to contraceptive failure and other reasons is still significant at the 0.05 level of significance in 1989-1994 (Table 9.3). However, the significant random effect for side effects and health concerns is no longer observed in both periods. Previous contraceptive experience explained the changes in significance of the random effects of side effects and health concerns discontinuation. This variable explained the correlation among episodes of use of contraceptive within woman.

The significance of the random effect of contraceptive failure and other reasons suggests that there remain some unobserved variables that increased or decreased a woman's susceptibility to the risk of discontinuing use of contraception related to those reasons. To examine the extent to which the variation across women affects the rates of discontinuation due to contraceptive failure, and other reasons, the 12-month and 24-month duration for each one of these two reasons are calculated for different values of random effect at woman level. The value of random effect considered by Curtis et al. (1993) are $-2\sigma$, $-\sigma$, 0, $+\sigma$, and $+2\sigma$ which correspond to the mean value of $u_{rj}$ (0) and to one and two standard deviations on either side of the mean. Hence the probability that a use episode with a certain set of characteristics for type of discontinuation $r$ lie between the probabilities corresponding to $u_{rj} = -\sigma$ and $u_{rj} = +\sigma$ for 68% of women, and between the probabilities corresponding to $u_{rj} = -2\sigma$ and $u_{rj} = +2\sigma$ for 95% of women. Negative values of random effect ($-2\sigma$ and $-\sigma$) would correspond to women who had below-average risk of discontinuation due to type of reasons $r$ on the unobserved factors; positive values ($2\sigma$ and $\sigma$) would correspond to women with above-average risk.

Table 9.4 presents estimated probabilities of discontinuation due to contraceptive failure and other reasons within one-year and two-year after initiation of use for episode with average characteristics in 1989-94, for different values of the random effect $u_{rj}$. These probabilities are calculated by fixing all variables in the model at their mean values and setting the random effects associated with the other two types of discontinuation at 0 because they are not significant.

Table 9.4 Estimated 12-month and 24-month Cumulative Probabilities of Contraceptive Failure And Other Reasons for Discontinuation for Different Values of the Woman-level Random Effect: Bali, 1989-94

| Reason for Discontinuation | Duration | Woman-level Random Effect ($u_r$) | | | | |
|---|---|---|---|---|---|---|
| | | $-2\sigma_r$ | $-1\sigma_r$ | 0 | $+\sigma_r$ | $+2\sigma_r$ |
| Failure | 12-month | 0.002 | 0.006 | 0.026 | 0.101 | 0.311 |
| | 24-month | 0.003 | 0.013 | 0.052 | 0.185 | 0.455 |
| Other Reasons | 12-month | 0.006 | 0.016 | 0.044 | 0.115 | 0.247 |
| | 24-month | 0.009 | 0.026 | 0.070 | 0.170 | 0.311 |

As can be seen from Table 9.4, the probability of contraceptive failure within one year of initiation of use at the mean value was low, but these probabilities varied greatly from 0.002 at two standard deviations below the mean to 0.311 at two standard deviations above the mean because of the unobserved variables that affect the experience of contraceptive failure. The probability of failure within two years of initiating use ranged from 0.003 to 0.455. These two ranges are overlap. Therefore, although the probability of failure within one year was lower than that observed within two years, users associated with one standard deviation above the mean would experience higher rate of failure (0.101) than users associated with the mean of random effect (0.052). In other words, though in general women who had used contraceptive within one year tended to have a lower probability of failure than a women who had use contraceptive within two years, a woman of one-year duration but of higher risk (e.g, at one standard deviation above the mean) had a higher probability of failure than a woman of two-year duration but with lower risk (e.g at one standard deviation below the mean.)

Similarly the random effect at woman level had a strong effect on the cumulative probabilities of discontinuing due to other reasons. Women associated with one standard deviation above the mean may have their risk of discontinuation due to other reason increased by 158 percent in relation to those women associated with an average random effect in the case of discontinuation within one year of initiating use. The increase of 143 percent was observed for discontinuation due to other reasons within two years after adoption.

The significant extra variation on contraceptive failure was also found in China (Steele, 1996). She mentions that unobserved biological factors might be a possible explanation. Some women may have an inherently higher chance of conceiving and, therefore, have a higher risk of failure, regardless of which method they are using. Another possible factor that may explain at least part of the unobserved heterogeneity is the frequency of coitus. The opinion of the husbands in relation to male dependent methods could also explain part of the unobserved variation for discontinuation due to other reasons. Further possibilities are variables relating to the availability and quality of family planning services.

Wang and Diamond (1995) suggest that much of the IUD failure rate can be attributed to the low quality of IUDs used in China. It is possible that Bali, where the predominant users were the IUD users, might have a similar case to China. IUD quality and poor insertion techniques might have led to an increase in failure, side effects and health concerns, and expulsion risk.

DHS surveys are carried out based on a three-stage sampling design. The interest is the selection of households but the first stage sampling unit is often a well defined geographical unit, generally known as a cluster. A cluster in IDHS surveys is a primary sampling unit or an enumeration area. Therefore, the population is divided into clusters that are randomly selected. In the following stage, households are randomly selected within each cluster and all women of reproductive age are interviewed. This clustered structure is expected to be related to the individual behaviour in that people living close together are likely to share similar norms and values. After considering the woman level, the next model is to extend the model to a three level model where clusters are considered as a higher level than woman level. When cluster effect is tested in the model, all random effects of the cluster levels were not statistically significant in both 1991 and 1994 surveys. Therefore, the cluster level is excluded from the analysis. In analysing contraceptive discontinuation in Brazil, Leite (1998) also finds that all random effects at cluster level are not significant.

As discussed, the multilevel discrete time competing risks hazard model (Model B) shows the significant random effect at woman level. This suggests a violation of the independence assumption across episodes of use within a woman. The discussion in this chapter is based on the results of the multilevel discrete time competing risks hazard model with woman level as the highest level. The multilevel discrete time competing risks hazard model is more appropriate in examining factors associated with contraceptive discontinuation.

To aid interpretation, estimates of the hazard functions by duration are calculated from the multilevel model (model B). At this stage, the random effects at the woman level are held at their mean value of zero.

## 9.3 Duration of Use and Method of Contraception

Hazard functions for each reason for discontinuation are specified as function of the logarithm of duration and derived from multilevel discrete time competing risks hazard model (Model B). Estimated hazard functions without controlling for other characteristics are shown in Figure 9.1 and the resulting parameter estimates and standard errors are presented in Table 9.1. Figure 9.2 presents estimated hazard functions with controlling for other covariates as the parameter estimates presented in Table 9.3. Duration of use had a significant effect on discontinuation although the effect was not seen in each type of discontinuation and neither in each period.

Figures 9.1 and 9.2 show estimated hazard functions for each reason for discontinuation. They reveal that the risk of discontinuation use of contraception due to side effects and health concerns decreased as the duration increased. Log(duration) for these reasons was significant at $p < 0.001$ level in 1986-1991. The risk of discontinuation due to experiencing side effects and health concerns sharply decreased from a relatively high risk. This would suggest that the longer a woman managed to use a method of contraception successfully, the more experienced she became and the less likely she was to discontinue due to side effects and health concerns. On the other hand, in 1989-1994 the negative effect of duration of use to discontinuation due to these reasons was not significant. Significantly negative effect of duration of use was also observed in the risk of discontinuation due to other reasons. In the two time periods, the risk of discontinuation due to these reasons was very similar.

Risk of failure is expected to decline over time for two reasons. First, women with poor knowledge of use of the method are expected to fail early. Second, couples' use of a method may improve over time so that the risk of failure might decline as duration of use increases. However, the results from the 1986-1991 data are not consistent with this. The risk of failure increased as the duration of use increased although the effect was only significant at the 0.10 level (see Table 9.1 and 9.3). The positive effect of duration on the risk of failure was probably related to the fact that there was a relatively high level of overlap between contraceptive use and postpartum amenorrhea. Hence, it is possible that this pattern reflects a reduced risk of failure at early durations associated with redundant use (Curtis, 1996). On the other hand, the risk of failure was basically constant with duration of use for 1989-1994. The positive effect of duration of use on the discontinuation due to desire to become pregnant is as expected but only significant in 1989-94.

**Figure 9.1 Estimated Hazard Functions for Each Type of Discontinuation without Controlling for Other Covariates: Bali, 1986-1991 and 1989-1994**

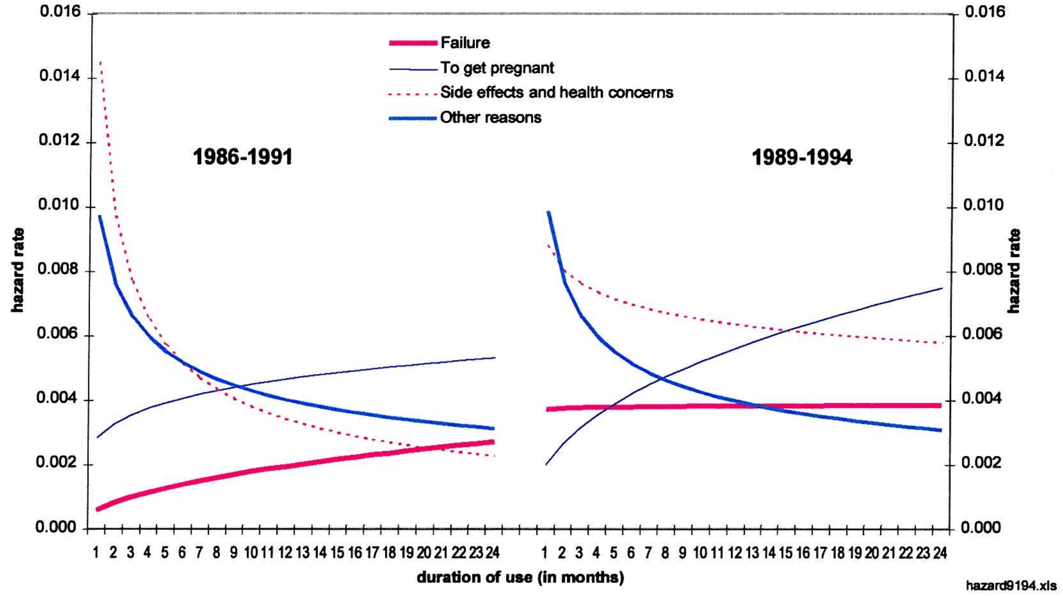
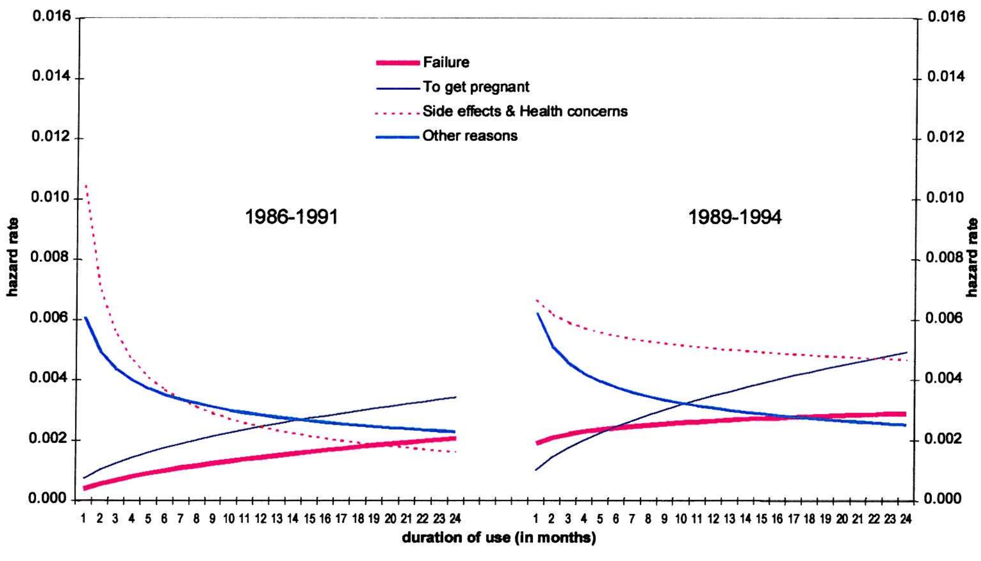



Figure 9.2 Estimated Hazard Functions for Each Type of Discontinuation Controlling for Other Covariates: Bali, 1986-1991 and 1989-1994




Methods of contraception vary in their convenience, effectiveness and availability and in the side effects they can cause. Consequently, discontinuation rates for a particular reason vary across methods. Without (Table 9.2) or with controlling for other covariates (Table 9.3), the method of contraception was significant for some, but not all reasons for discontinuation. Method was not significantly associated with both contraceptive failure and experiencing side effects and health concerns in 1986-1991. However, in 1989-1994, method was significantly associated with contraceptive failure and discontinuation due to side effects and health concerns. Relative to less effective methods, users of the IUD and of injectables experienced significantly lower risk of failure. The risk of failure of the pill was not significantly different from that of less effective methods.

The risk of experiencing side effects and health concerns was significantly higher at the 0.10 level of significance for the pill users relative to users of less effective methods while the injectables users and the IUD ones were not significantly different from the less effective users.

Discontinuation because of desire to become pregnant was significantly associated with method of contraception in both periods. In both periods IUD users were the least likely to discontinue use because of desire to become pregnant (see Table 9.5). The IUD was regarded as a long-term method, an alternative to sterilization, whereas other methods were more likely to be used as temporary contraception among couples who planned to have another child. Pill discontinuation due to desire to become pregnant was significantly ($p < 0.05$) lower than less effective methods in 1986-91. However, the risk of discontinuation due to desire to get pregnant for the injectables users was not significantly different from those of the less effective methods in 1986-1991 while those of the pill users was not significantly different from the less effective methods in 1989-1994.

Method of contraception was associated with discontinuation due to other reasons. IUD and injectable were significantly ($p < 0.001$) lower than less effective methods to discontinue due to these reasons in both periods. The pill was also lower than less effective methods to discontinue due to other reasons in 1989-94.

## 9.4 Socio-economic and Demographic Variables

The socio-economic and demographic factors are now included in the model to study determinants of contraceptive discontinuation. The covariates are woman's age, number of living children, contraceptive intention, and past contraceptive use experience, which all represent situation at the start of episode of use of contraception. Woman and husband's education and place of residence are other covariates in the model. The results are presented in Table 9.3. Estimated cumulative probabilities of discontinuation within 24 months use after acceptance by background variable are presented in Table 9.5. In this section we interpret the multilevel discrete time competing risks hazard model (model B).

### 9.4.1 Age at the start of use

There was no evidence of a significant effect of woman's age at the start of use on contraceptive failure and on discontinuation due to desire to get pregnant. However, woman's age at the start of use was significantly ($p < 0.1$) affecting the risk of discontinuation due to side effects and health concerns in 1986-1991 and discontinuation due to other reasons. However, there is no clear pattern and the signs reversed from negative to positive over time for other reasons (Table 9.5).

### 9.4.2 Past Experience

To examine the impact of past experience on the risk of any type of discontinuation, we use the status in the month immediately before episode of use of contraception. We categorise whether a woman just had a baby or a termination, had no method of contraception or had used any method of contraception. In this case, this variable was significant; implying that the preceding experience was important in explaining the risk of discontinuation. Except for the risk of discontinuation due to desire to get pregnant, the preceding status of the users did not affect other risks of contraceptive discontinuation in 1986-1991. As expected, relative to users who previously experienced with contraception, those who used the method immediately after having a baby or pregnancy termination were less likely to discontinue the use due to desire to have another baby. Whereas, those who were not previously using any method were significantly less likely to discontinue than those who switched to another method.

Table 9.5 Estimated Cumulative Probabilities (Percentage) of Women Discontinuing Contraceptive Use within 24 months of Initiating Use: Bali, 1986-91 and 1989-94

| Variable | 1986-91 | | | | | 1989-94 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Reasons for Discontinuation of Contraceptive Use | | | | | | | | | |
| | Failure | To get pregnant | Side effects & Health concerns | Other reasons | Still using | Failure | To get pregnant | Side effects & Health concerns | Other reasons | Still using |
| **Method of use** | | | | | | | | | | |
| Pill | 4.11 | 3.95 | 6.05 | 13.87 | 72.02 | 21.25 | 10.11 | 16.41 | 5.44 | 46.79 |
| IUD | 2.16 | 3.19 | 6.31 | 4.97 | 83.38 | 3.34 | 5.41 | 9.07 | 6.36 | 75.82 |
| Injection | 4.76 | 9.71 | 9.91 | 5.67 | 69.96 | 4.48 | 6.47 | 14.49 | 6.23 | 68.34 |
| Less effective methods | 2.27 | 12.02 | 4.42 | 27.17 | 54.12 | 11.94 | 12.72 | 2.52 | 32.06 | 40.77 |
| **Place of residence** | | | | | | | | | | |
| Urban | 2.63 | 6.44 | 6.17 | 7.20 | 77.55 | 2.01 | 6.68 | 12.58 | 8.92 | 69.82 |
| Rural | 3.01 | 4.46 | 7.23 | 6.57 | 78.74 | 8.05 | 6.61 | 9.81 | 6.19 | 69.34 |
| **Wife's educational level** | | | | | | | | | | |
| No schooling | 3.47 | 5.20 | 8.49 | 6.08 | 76.76 | 2.48 | 8.84 | 14.40 | 10.59 | 63.69 |
| Some Primary | 3.21 | 3.78 | 5.39 | 9.44 | 78.17 | 2.30 | 4.80 | 14.18 | 6.65 | 72.07 |
| Primary | 2.59 | 5.13 | 6.04 | 9.37 | 76.87 | 5.76 | 6.29 | 10.01 | 5.33 | 72.62 |
| Some Secondary | 2.32 | 6.10 | 9.06 | 5.35 | 77.17 | 11.14 | 7.71 | 7.96 | 7.41 | 65.79 |
| **Husband's educational level** | | | | | | | | | | |
| No schooling | 2.10 | 8.51 | 10.00 | 6.33 | 75.07 | 3.66 | 10.88 | 2.08 | 10.22 | 73.16 |
| Some Primary | 2.77 | 4.08 | 14.21 | 5.89 | 73.05 | 10.03 | 7.21 | 8.98 | 5.30 | 68.48 |
| Primary | 1.80 | 6.29 | 2.81 | 7.70 | 81.41 | 7.84 | 6.02 | 9.40 | 9.17 | 67.56 |
| Some Secondary | 4.63 | 4.27 | 7.96 | 6.55 | 76.59 | 3.47 | 6.39 | 14.19 | 6.26 | 69.70 |
| **Previous experience** | | | | | | | | | | |
| No method | 2.68 | 4.25 | 6.22 | 7.80 | 79.05 | 6.08 | 6.87 | 12.10 | 9.13 | 65.82 |
| Birth or termination | 3.22 | 4.66 | 12.91 | 1.65 | 77.55 | 6.37 | 7.20 | 4.47 | 2.25 | 79.70 |
| Any method | 4.05 | 11.79 | 8.58 | 6.37 | 69.22 | 2.20 | 5.12 | 15.28 | 7.68 | 69.72 |
| **Age at the start of use** | | | | | | | | | | |
| < 25 | 3.93 | 5.50 | 9.46 | 8.31 | 72.80 | 5.28 | 6.48 | 11.30 | 5.66 | 71.28 |
| 25 – 29 | 2.14 | 6.04 | 6.53 | 9.25 | 76.04 | 4.27 | 7.66 | 10.24 | 5.85 | 71.99 |
| > 30 | 2.20 | 3.07 | 3.94 | 3.02 | 87.77 | 6.71 | 5.74 | 10.07 | 12.65 | 64.84 |
| **Contraceptive intention** | | | | | | | | | | |
| Limiters | 1.65 | 2.57 | 4.99 | 5.74 | 85.05 | 4.59 | 4.49 | 8.53 | 4.46 | 77.93 |
| Spacers | 6.09 | 11.92 | 10.67 | 8.17 | 63.15 | 5.92 | 10.38 | 13.55 | 11.63 | 58.52 |
| **Living Children** | | | | | | | | | | |
| 0-1 | 1.76 | 6.46 | 4.46 | 8.77 | 78.56 | 5.78 | 13.39 | 7.88 | 7.74 | 65.21 |
| 2-3 | 3.13 | 4.13 | 6.72 | 4.95 | 81.07 | 5.16 | 4.28 | 11.83 | 7.16 | 71.58 |
| 4+ | 4.67 | 5.28 | 14.19 | 10.60 | 65.26 | 3.47 | 4.14 | 18.44 | 3.83 | 70.13 |
| Overall | 2.90 | 4.95 | 6.92 | 6.74 | 78.49 | 5.23 | 6.69 | 10.67 | 6.99 | 70.43 |

Conversely in 1989-94, the past experience did not significantly affect the risk of discontinuation due to desire to become pregnant but it affected the three other risks of contraceptive discontinuation, namely contraceptive failure ($p < 0.1$), experiencing side effects and health concerns ($p < 0.05$), and other reasons ($p < 0.1$). Users who did not use any method of contraception in the month immediately of the episode of use were more likely to experience a contraceptive failure than those who were previously using a method of contraception.

Relative to those who previously used another method, users who had just delivered a baby or experienced pregnancy termination in the month immediately before the use were less likely to discontinue due to experiencing side effects and health concerns, and also due to other reasons.

### 9.4.3 Contraceptive Intention

Contraceptive intention was associated with the risk of contraceptive failure in 1986-1991 but was not in 1989-1994. Women who were using contraception to limit future births were less likely to experience contraceptive failure. This probably reflects the role of motivation to avoid pregnancy on the quality of contraceptive use. Contraceptive intention was also strongly negatively associated with other risks of discontinuation. The risk of experiencing side effects and health concerns was also lower for those who were using contraception for limiting future births than those who were using contraception for spacing with $p < 0.05$ in 1986-91 and $p < 0.1$ in 1986-94. Discontinuation due to desire to become pregnant as well as due to other reasons was lower for limiters than spacers with $p < 0.05$.

### 9.4.4 Number of Living Children

The number of living children was only significantly associated at $p < 0.1$ with the risk of experiencing side effects and health concerns, and other reasons. This case was only observed in 1986-1991. Women with no children or with a child were less likely to experience side effects and health concerns than other women were. Women with more than 4 children were more likely to discontinue due to other reasons.

### 9.4.5 Education

Wife's educational level was not significantly associated to any type of discontinuation in 1986-1991. However, it was only significant on the risk of contraceptive failure in 1984-1994. Women who had no schooling and those who had had some primary school had significantly lower risk of contraceptive failure from those who had had secondary school. Those with some primary schooling had the lowest risk of contraceptive failure followed by women with no schooling. The higher risk of failure among educated women might be because the more educated women were more fecund.

Husband's educational level was not associated with contraceptive failure, but it was significant at $p< 0.1$ on experiencing side effects and health concerns over the two periods. However, in 1986-91 there was no clear pattern of discontinuation due to side effects and health concerns regarding to husband's education. In 1989-94 there was a positive association which the more educated the husband, the higher the risk of experiencing side effects and health concerns.

### 9.4.6 Place of Residence

Place of residence was not statistically significant for all types of discontinuation in the 1986-1991 data set. However, place of residence was statistically significant at $p < 0.001$ for discontinuation due to failure in the 1989-1994 only. It was one of the few variables, which had impact on contraceptive failure. Women who lived in urban areas were less likely to experience contraceptive failure than those who lived in rural areas. This means that urban women were doing better in using contraception than rural women, because urban women might have better access to the information on how each method works or how to use the method correctly.

## 9.5 Summary

In this chapter, a multilevel discrete time competing risks hazard model was used to study factors associated with contraceptive discontinuation in Bali in 1986-91 and 1989-94. A discrete time hazard model allows to model duration of use since acceptance as a discrete interval, which is rounded to the nearest month. Whereas, a competing risks approach allows one to distinguish between the risk factors associated with each reason for discontinuation, i.e. contraceptive failure, desire to become pregnant, side effects and health concerns, and other reasons. A multilevel model allows omitted covariates at the woman level and also correlation between episodes of use for the same woman.

Duration of use and contraceptive method chosen were strongly associated with the risk of discontinuation although not always in each reason for discontinuation in both data sets. Duration of use was positively associated with discontinuation because of desire to become pregnant, but negatively associated with discontinuation because of other reasons in both periods. Duration of use was negatively associated with side effects and health concerns in 1986-91 only. Users of modern methods had consistently lower rates of discontinuation than users of less effective methods. Overall, these results suggest that method choice and methods characteristics played an important role in contraceptive discontinuation behaviour.

A series of socio-economic and demographic factors were associated with reasons for discontinuation. However, contraceptive intention, as do more proximate characteristics of contraceptive users, tends to have strong relationship with each reason for discontinuation. Over time women who used contraception for limiting future births were more likely to discontinue contraceptive use due to desire to become pregnant or due to experience side effects and heath concerns than those who used contraception for spacing. Spacers in 1986-91 were more likely to experience a contraceptive failure than limiters. Spacers were more likely to discontinue due to other reasons than limiters in 1989-94.

The effects of socio-economic variables were important, however, in the case of contraceptive failure and side effects and health concerns although not for all periods. The risk of contraceptive failure for those who lived in urban areas in 1989-1994 was lower than that of rural areas. The risk of contraceptive failure was also higher in the latter period in rural areas. This may indicate the importance of how to improve users' knowledge about using a contraceptive method correctly.

After controlling for other factors, contraceptive discontinuation rose over time although it decreased for some groups of women. The risk of discontinuation from those who had immediately had a birth or a termination was more likely to decrease than that of other groups. Similarly, this was also observed among those who had had more than four living children. In addition, those who were using injectables had lower risk of discontinuation.

Even after controlling for a range of covariates, substantial unobserved heterogeneity remained for contraceptive failure in 1989-1994. This could be a result of the absence of variables indicating fecundability. In conjunction with an increase in contraceptive failure for two periods of observation, the risk of contraceptive failure was higher for the more educated users; and it increased over time. As in Bongaarts and Potter (1983), health and nutritional status are some of the proximate determinants of fertility. The more educated users can have better health and nutritional status. Therefore, they can be more fecund and they, in turn, can have a larger risk of contraceptive failure.

The random effect at woman level has also a strong effect on the risk of discontinuation due to other reasons. A possible factor that may explain at least part of the unobserved heterogeneity was the frequency of coitus along with fecundability. The opinion of the husbands in relation to male dependent methods could also explain part of the unobserved variation for discontinuation due to other reasons.

# Chapter 10

# DETERMINANTS OF SWITCHING BEHAVIOUR IN BALI

## 10.1 Introduction

This chapter studies switching behaviour of contraceptive users after discontinuation, how users change from one method to another and also how users change from one method to not using any contraception. In the 1994 data there are no users who switched from a modern method to a traditional method or sterilisation. Further there are only a few women who switched to traditional methods in the 1991 data set†. Therefore, the research is limited to switching among modern methods, switching from traditional method to modern methods, and switching to not using any contraceptives. As in Chapter 8, states after discontinuation of contraceptive use are grouped into three categories. Section 8.6 presented a life table analysis of switching behaviour after discontinuation in Bali as a descriptive analysis which leads to this chapter's research.

The data and methods used in this chapter are similar to the data and methods used in the analysis of determinants of contraceptive discontinuation (Chapter 7). The origin method of contraception is included as a covariate and the fitted multilevel discrete time competing risk hazards model is used to estimate cumulative probabilities of switching behaviour after discontinuation within two years of use. Therefore, the results present switching from a particular method‡ to another method. The emphasis in this chapter is on those who have a need for contraception: i.e., those who switched to another method (switching) and those who switched to not using contraception while in need (abandoning). These women behaviour may indicate whether or not family planning services successfully provide users with a range of contraceptive option and meet the women needs.

† Two women switched from injectable to periodical abstinence and one woman switched from condom to herbs.

‡ Origin methods of contraception are grouped into pill, IUD, injectable and less effective methods. Less effective methods consist of condom and traditional methods.

## 10.2 Impacts of Duration of Use and Method of Contraception on Switching and Abandoning

In the discrete-time competing risks hazards model used, three functions of duration are considered: (1) a linear function of duration ($\alpha_{rt} = \alpha_{r0} + \alpha_{r1}$ t), (2) a quadratic function of duration ( $\alpha_{rt} = \alpha_{r0} + \alpha_{r1}$ t + $\alpha_{r2}$ $t^2$), and (3) the natural logarithm of duration ($\alpha_{rt} = \alpha_{r0} + \alpha_{r1}$ ln (t)). At this stage, only duration of contraceptive use is included in the model. The model was fitted using SAS.

From the three functions of duration only linear and quadratic models are nested, so that standard tests such as the likelihood ratio test can only be used to select between nested model. However, the natural logarithm of duration is also considered. A criterion for model selection that allows comparison among non nested models is the Akaike's Information Criterion / AIC (Maddala, 1988; Collett, 1994). For each model, the following statistic was calculated:

AIC = -2 (maximised log-likelihood of the fitted model) + 2 q

where q is the number of parameters fitted in the model. The model which minimizes the AIC statistic is selected.

Table 10.1 presents the values of the –2 log-likelihood, q and the AIC statistic for each of the three duration functions of each data set. From this table, the natural logarithm of duration is decided to be the better model for the 1991 data; and the linear function of duration is the better model for the 1994 data.

Table 10.1 Modelling the Dependency of Switching Risk on Duration of Use

| Time function | -2Log-Likelihood | Number of parameters (q) | AIC |
|---|---|---|---|
| **1991** | | | |
| Linear ($\alpha_{rt} = \alpha_{r0} + \alpha_{r1}$ t) | 1871.9941 | 6 | 1883.9941 |
| Quadratic ($\alpha_{rt} = \alpha_{r0} + \alpha_{r1}$ t + $\alpha_{r2}$ $t^2$) | 1858.9924 | 9 | 1876.9924 |
| Logarithmic ($\alpha_{rt} = \alpha_{r0} + \alpha_{r1}$ ln (t) | 1860.2682 | 6 | 1872.2682 |
| **1994** | | | |
| Linear ($\alpha_{rt} = \alpha_{r0} + \alpha_{r1}$ t) | 2685.516 | 6 | 2697.516 |
| Quadratic ($\alpha_{rt} = \alpha_{r0} + \alpha_{r1}$ t + $\alpha_{r2}$ $t^2$) | 2682.353 | 9 | 2700.353 |
| Logarithmic ($\alpha_{rt} = \alpha_{r0} + \alpha_{r1}$ ln (t) | 2688.788 | 6 | 2700.788 |

After specifying the duration dependency on the hazard of switching, a model selection is performed to determine which variables have a significant effect on the risk of one type of switching behaviour.

The following discussion is on how duration of use affects each of types of transitions after discontinuation. Table 10.2 presents the parameter estimates of the model with a duration term in it. The duration of use term is significant for each type of transitions after discontinuation for 1986-91 and for 1989-94, except for abandoning use. To aid interpretation of the impact of duration of use on each state, hazard functions are calculated and the results presented in Figure 10.1. This figure shows that as the duration of use increases the hazard of switching to another method decreases. As shown in 1986-91, in the early months the hazard of switching to another method decreased sharply especially in the first three months. In the second three months a decrease in the hazard of switching to another method was still high, although it was not as high as in the first three months. This finding is confirmed by what was found in Figure 8.16, in which the cumulative probability of switching in the first six months increased sharply. On the other hand in 1989-94, the hazard of switching had a negative linear relationship with duration of use. A negative relationship is also found in the relationship between duration of use and the hazard of abandoning. On the other hand, as duration of use increases the hazard of switching to non-use increases for those not in need for contraception.

Table 10.2 Parameter Estimates of Duration of Use on the Hazard of Switching, Abandoning and Not in Need for Contraception: Bali, 1986-91 and 1989-94

| Type of transition | Parameter | 1986-91 | | 1989-94 | |
|---|---|---|---|---|---|
| | | Estimate | S.E | Estimate | S.E |
| Switching/Continuing | Intercept | -4.0680**** | 0.2754 | -4.7550 | 0.2011 |
| | Duration [a] | -0.6450**** | 0.1337 | -0.0285** | 0.0121 |
| | Random effect | 0.0792 | 0.3208 | 0.5483 | 0.4644 |
| Abandoning/Continuing | Intercept | -4.5530**** | 0.3257 | -5.036 | 0.2248 |
| | Duration [a] | -0.4349**** | 0.1430 | -0.0163 | 0.0121 |
| | Random effect | 0 | 0 | 1.675*** | 0.606 |
| Not in need/Continuing | Intercept | -5.7570**** | 0.3945 | -4.9780 | 0.1682 |
| | Duration [a] | 0.3147*** | 0.1368 | 0.0211*** | 0.0069 |
| | Random effect | 0.0092 | 0.6344 | 0 | 0 |

Note: a = Natural logarithm of duration model is applied to 1986-91, Linear duration model is applied to 1989-94

Before controlling for other factors, a model which only the effects of origin method and duration of use is fitted. The origin methods of contraception is grouped into four: pill, IUD, injectable and less effective methods (condom and traditional methods). The group of less effective methods is the reference group. An examination on whether the hazards of switching behaviour after discontinuation are different from one method to another is also performed by testing interaction terms between method of contraception and duration of use. For the 1991 data these interaction terms were not significant, but were significant in the 1994 data. Parameter estimates and its standard errors, are presented in Table 10.3. Figures 10.2a - 10.3b present estimated cumulative probabilities of each type of switching transition according to method of contraception used before discontinuation by month of use.

**Figure 10.1 Estimated Hazard Function for Each Type of Switching Behaviour after Discontinuation (without Controlled for Other Variables) : Bali, 1986-91 and 1989-94**

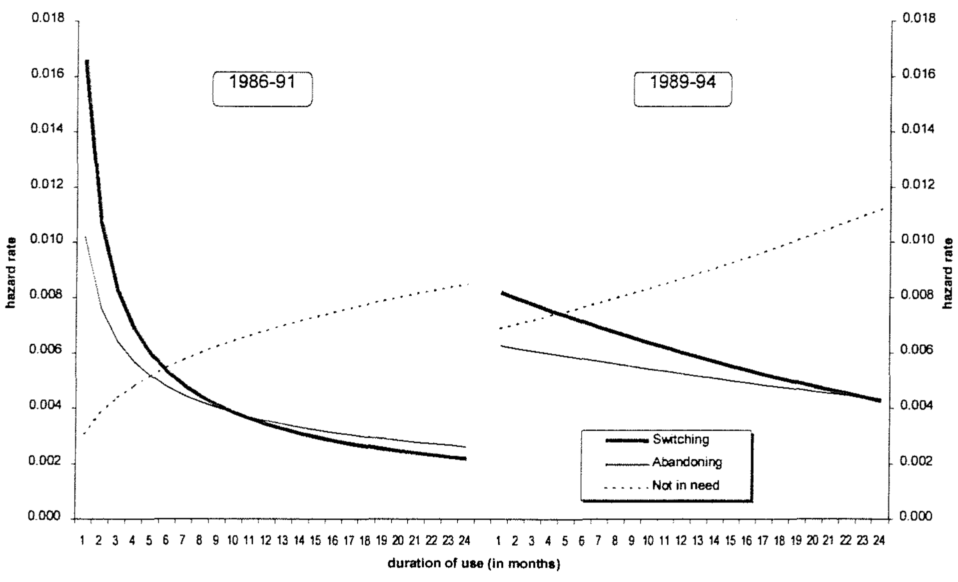



Table 10.3 shows the evidence of the strong relationship between duration of use and method of contraception in relation to switching behaviour after discontinuation. The evidence is particularly obvious for switching to another modern method and for switching to not using any contraception while users were not in need for contraception. Figures 10.2b and 10.3b clearly present variations in switching, abandoning and not in need for contraception rates as duration of use increases. The difference is clear between users of less effective methods and the injectable users. In particular, as duration of use increases in the first year of use, switching rate from less

effective methods to any modern method increases sharply with an increasing rate of switching. On the other hand, as duration of use increases cumulative the probability of switching from injectable to another modern method linearly increases.

Table 10.3 Parameter Estimates and Its Standard Errors of Model of Duration of Use and Method of Contraception in Relation to Switching Behaviour after Discontinuation without Controlling for other factors: Bali, 1986-91 and 1989-94

| Type of transition | Parameter | 1986-91 | | 1989-94 | |
|---|---|---|---|---|---|
| | | Estimate | S.E | Estimate | S.E |
| Switching/ Continuing | Intercept | -3.282**** | 0.4392 | -2.7610**** | 0.5152 |
| | Duration a | -0.6007**** | 0.1362 | -0.1361** | 0.0625 |
| | Pill | -0.6876 | 0.5606 | -1.1430 | 0.7055 |
| | IUD | -1.4130**** | 0.4610 | -2.4880**** | 0.616 |
| | Injection | -0.3514 | 0.4607 | -2.1850*** | 0.6177 |
| | Duration*Pill | | | 0.0635 | 0.0748 |
| | Duration*IUD | | | 0.1083 | 0.0655 |
| | Duration*Injectable | | | 0.1450** | 0.0649 |
| | Random | 0 | 0 | 0.1624 | 0.3823 |
| Abandoning/ Continuing | Intercept | -4.095**** | 0.5654 | -6.5690*** | 1.8440 |
| | Duration a | -0.4499**** | 0.1431 | 0.0113 | 0.0813 |
| | Pill | -0.0236 | 0.6343 | 2.4910 | 1.9080 |
| | IUD | -0.4625 | 0.5474 | 1.1940 | 1.8730 |
| | Injection | -0.8865 | 0.6761 | 1.8380 | 1.8830 |
| | Duration*Pill | | | -0.0565 | 0.0879 |
| | Duration*IUD | | | -0.0148 | 0.0828 |
| | Duration*Injectable | | | -0.0478 | 0.0859 |
| | Random | 0 | 0 | 1.9670*** | 0.6242 |
| Not in need/ Continuing | Intercept | -5.032**** | 0.4847 | -3.4300**** | 0.4627 |
| | Duration a | 0.3838*** | 0.1416 | -0.0203 | 0.0263 |
| | Pill | -0.8554* | 0.4445 | -0.4756 | 0.6018 |
| | IUD | -1.4220**** | 0.3742 | -2.1680**** | 0.5361 |
| | Injection | -0.2686 | 0.3843 | -1.6390*** | 0.5678 |
| | Duration*Pill | | | -0.0032 | 0.0347 |
| | Duration*IUD | | | 0.0602** | 0.0279 |
| | Duration*Injectable | | | 0.0471 | 0.0302 |
| | Random | 0.0931 | 0.6184 | 0.1265 | 0.2172 |

Note: **** $p < 0.001$ *** $p < 0.01$, ** $p < 0.05$
a = Natural logarithm of duration model is applied to 1986-91, Linear duration model is applied to 1989-94

Figures 10.2a to 10.3b show that the cumulative probability of switching to another modern method from any modern method is lower than the probability of switching from traditional method to any modern method. Among users of modern methods, the injectable users were the most likely to switch to another method and the IUD users were the least likely to switch to another method during 1986-91. During 1989-94, the pill users were the most likely to switch to another modern method and the IUD users were the least likely to do so. As in the analysis using multiple decrement life tables (shown in Figure 8.17) injectable users were more likely to switch to another modern method than IUD users in both periods. The probability of switching from less effective methods to any modern method is much higher at the beginning of their use.

When we look at abandonment in Figure 10.2a to 10.3b, again as in the analysis of multiple decrement life tables in Figure 8.17, abandoning the IUD was higher than injectables in 1986-91 but in 1989-94 abandoning the IUD was lower than injectables. Those having used traditional method or condoms were most likely to have the lowest rate of abandoning. This means that the availability of alternative modern methods may play an important role in achievement of self-sustainability of contraceptive use in 1989-94. However, in 1986-91 abandoning rate of the less effective users were still the highest though the rate was much lower than the switching rate.

Figure 10.3b shows that probability of abandoning using any method is highest among the pill users and lowest among those who use less effective. However, the users seem to be committed to use of contraception. The probability of abandoning using any contraceptive is found to be lower than switching to another method, especially to a modern method.

After controlling for other factors, switching behaviour are still found to vary significantly according to the method used. A strong evidence is also found on the relationship between duration of use and method of contraception (see Table 10.4). Figures 10.3a and 10.3b present cumulative probabilities of switching, abandoning and not in need for contraception after being controlled with other variables. These probabilities are calculated by holding other variables at their mean values and the random parameters are set at zero. Comparison between Figures 10.2a and 10.3a or Figures 10.2b and 10.3b shows that after controlling for other factors the patterns are still the same, but the rates are lower than the ones without controlling for other factors. In particular this occurs for switching and abandoning. For example, in the 1989-94 estimated cumulative probability of switching to another modern method among less effective method users was lower by almost 10 percentage points after two years. Cumulative probability of abandoning among pill users was also declining from about 15% to 10%. This indicates an important role of other factors in terms of switching to another method or abandoning contraceptive use. The following section will investigate other factors associated with switching behaviour after discontinuation.

**Figure 10.2a Estimated Cumulative Probabilities of Switching, Abandoning, and Not in Need for Contraception by Method and Duration of Use: Bali, 1986-91 without Controlling for Other Variables**

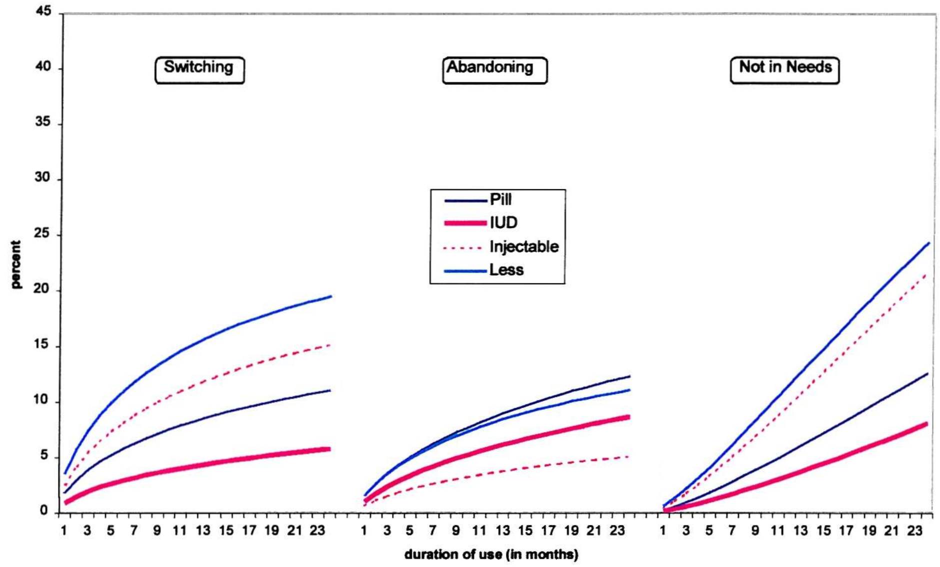



**Figure 10.2b Estimated Cumulative Probabilities of Switching, Abandoning and Not in Need for Contraception by Method and Duration of Use: Bali, 1989-94 without Controlling for Other Variables**

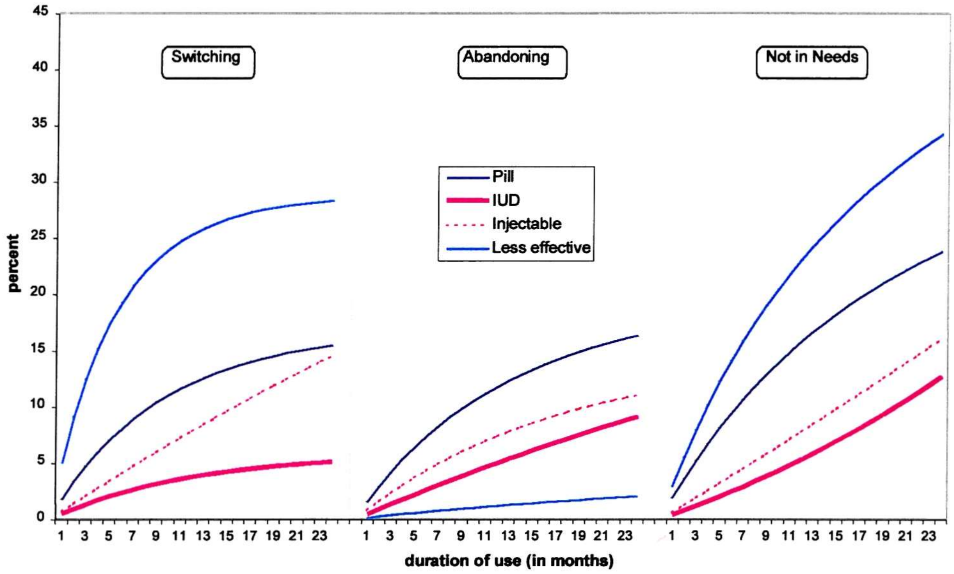


**Figure 10.3a. Estimated Cumulative Probabilities of Switching, Abandoning, and Not in Need for Contraception by Method and Duration of Use: Bali, 1986-91 Controlling for Other Variables**

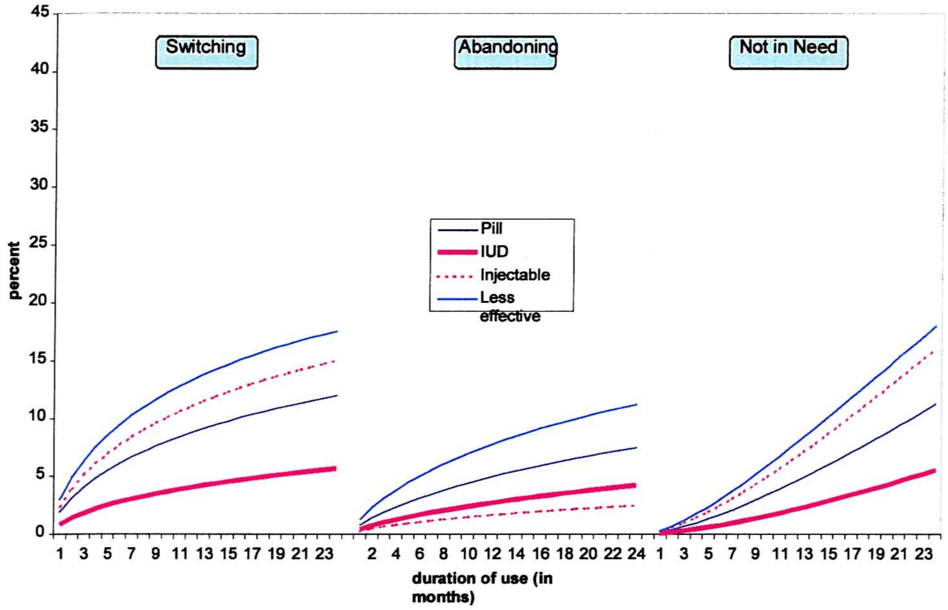



**Figure 10.3b Estimated Cumulative Probabilities of Switching, Abandoning, and Not in Need for Contraception by Method and Duration of Use: Bali, 1989-94 Controlling for Other Variables**

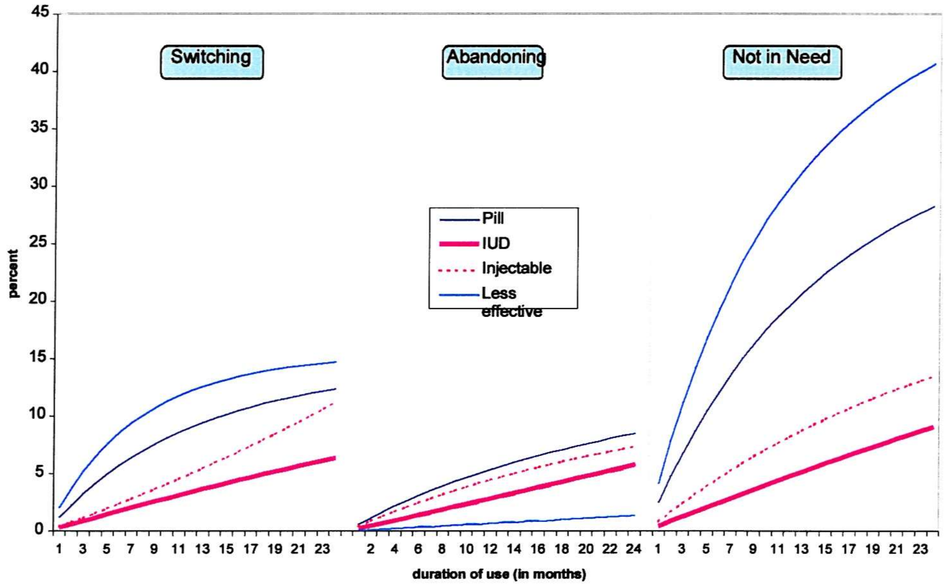


Table 10.4 Parameter Estimates and Their Standard Errors for Switching Behaviour After Discontinuation: Bali, 1986-91 and 1989-94

| Type of Transition | Parameter | 1986-91 | | 1989-94 | |
|---|---|---|---|---|---|
| | | Estimate | S.E | Estimate | S.E |
| Switching/ Continuing | Intercept | -3.5610**** | 0.6038 | **-4.4230******** | 0.8353 |
| | **Duration in Month** | -0.5900**** | 0.1377 | -0.0971 | 0.0676 |
| | **Method (base=less effective)** | | | | |
| | Pill | -0.4779 | 0.6112 | -0.5918 | 0.7038 |
| | IUD | -1.3050*** | 0.4964 | -2.0750**** | 0.6252 |
| | Injectable | -0.2466 | 0.4955 | -1.8600*** | 0.6307 |
| | ***Interaction*** | | | | |
| | Duration & Pill | ni | ni | 0.0413 | 0.0758 |
| | Duration & IUD | ni | ni | 0.0972 | 0.0678 |
| | Duration & Injectables | ni | ni | 0.1309* | 0.0676 |
| | **Number of living children (base= > 4)** | | | | |
| | 0 – 1 | -0.6119 | 0.6439 | 1.0460 | 0.7758 |
| | 2 – 3 | -0.4000 | 0.4937 | 0.6261 | 0.6333 |
| | **Woman's Age (base= > 30)** | | | | |
| | **< 25** | 0.6675 | 0.5018 | -0.2468 | 0.4271 |
| | **25 – 29** | 0.3607 | 0.4589 | -0.2454 | 0.3689 |
| | **Contraceptive intention (base = limiter)** | | | | |
| | Spacer | 0.1187 | 0.3805 | -0.1050 | 0.5106 |
| | Duration & Spacer | ni | ni | -0.0109 | 0.0236 |
| | **Woman's education (base= lower than Primary)** | | | | |
| | Secondary & above | 0.6786 | 0.4350 | 0.8064 | 0.4317 |
| | Duration & w_educ | ni | ni | -0.0677** | 0.0278 |
| | **Husband's education (base= lower than Primary)** | | | | |
| | Secondary & above | -0.2166 | 0.4158 | 0.5802 | 0.3351 |
| | **Place of residence (base=Rural)** | | | | |
| | Urban | 0.0431 | 0.3561 | 0.3447 | 0.2727 |
| | Woman-level Random effect ($\sigma^2$) | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

Note: **** $p < 0.001$ *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 10.4 Continued ...

| Type of Transition | Parameter | 1986-91 Estimate | S.E | 1989-94 Estimate | S.E |
|---|---|---|---|---|---|
| Abandoning/ Continuing | Intercept | -5.0870**** | 0.9205 | -6.4500*** | 2.0080 |
| | **Duration in Month** | -0.3720*** | 0.1495 | 0.0384 | 0.0880 |
| | **Method (base=less effective)** | | | | |
| | Pill | -0.5142 | 0.6775 | 2.3530 | 2.0140 |
| | IUD | -1.1750** | 0.5871 | 1.3540 | 1.9770 |
| | Injectable | -1.6120** | 0.7005 | 2.0520 | 1.9860 |
| | ***Interaction*** | | | | |
| | Duration & Pill | Ni | ni | -0.0561 | 0.0945 |
| | Duration & IUD | Ni | ni | -0.0260 | 0.0883 |
| | Duration & Injectables | Ni | ni | -0.0588 | 0.0913 |
| | **Number of living children (base= > 4)** | | | | |
| | 0 – 1 | -1.2870** | 0.6436 | -1.9160*** | 0.6809 |
| | 2 – 3 | -1.5610*** | 0.5682 | -0.8658 | 0.5307 |
| | **Woman's Age (base= > 30)** | | | | |
| | **< 25** | 2.4440*** | 0.8326 | -0.7801 | 0.5228 |
| | **25 – 29** | 2.1780*** | 0.7906 | -0.3626 | 0.4714 |
| | **Contraceptive intention (base = limiter)** | | | | |
| | Spacer | 1.3970*** | 0.4572 | 2.3380**** | 0.5749 |
| | Duration & Spacer | Ni | ni | -0.0042 | 0.0261 |
| | **Woman's education (base= lower than Primary)** | | | | |
| | Secondary & above | -1.1920* | 0.6199 | -0.1913 | 0.6501 |
| | Duration & w_educ | Ni | ni | -0.0544 | 0.0413 |
| | **Husband's education (base= lower than Primary)** | | | | |
| | Secondary & above | 0.1670 | 0.4389 | -0.1403 | 0.4045 |
| | **Place of residence (base=Rural)** | | | | |
| | Urban | -0.2789 | 0.4231 | -0.0074 | 0.3799 |
| | Woman-level Random effect ($\sigma^2$) | 0.0000 | 0.0000 | 1.4710*** | 0.5572 |

Note: **** $p < 0.001$ *** $p < 0.01$, ** $p< 0.05$, * $p < 0.1$

Table 10.4 Continued ...

| Type of Transition | Parameter | 1986-91 | | 1989-94 | |
|---|---|---|---|---|---|
| | | Estimate | S.E | Estimate | S.E |
| Not in need / Continuing | Intercept | -6.5340**** | 0.6736 | **-3.4430** | 0.7037 |
| | **Duration in Month** | 0.5290**** | 0.1508 | -0.0527 | 0.0321 |
| | **Method (base=less effective)** | | | | |
| | Pill | -0.6291 | 0.4817 | -0.5587 | 0.6203 |
| | IUD | -1.4650**** | 0.4088 | -2.4130**** | 0.5484 |
| | Injectable | -0.2563 | 0.4264 | -1.6820**** | 0.5696 |
| | ***Interaction*** | | | | |
| | Duration & Pill | Ni | ni | 0.0102 | 0.0352 |
| | Duration & IUD | Ni | ni | 0.0541*** | 0.0266 |
| | Duration & Injectables | Ni | ni | 0.0310 | 0.0290 |
| | **Number of living children (base= > 4)** | | | | |
| | 0 – 1 | -0.2762 | 0.5418 | -0.2514 | 0.6248 |
| | 2 – 3 | -0.6796 | 0.4728 | -0.3333 | 0.5540 |
| | **Woman's Age (base= > 30)** | | | | |
| | **< 25** | 0.4468 | 0.4251 | -0.1995 | 0.3868 |
| | **25 – 29** | 0.6632 | 0.3989 | -0.1772 | 0.3770 |
| | **Contraceptive intention (base = limiter)** | | | | |
| | Spacer | 1.5860**** | 0.3423 | 0.9744** | 0.4875 |
| | Duration & Spacer | ni | ni | 0.0562** | 0.0220 |
| | **Woman's education (base= lower than Primary)** | | | | |
| | Secondary & above | -0.0299 | 0.3583 | 0.4846 | 0.3988 |
| | Duration & w_educ | ni | ni | -0.0019 | 0.0150 |
| | **Husband's education (base= lower than Primary)** | | | | |
| | Secondary & above | 0.1965 | 0.3245 | -0.2560 | 0.2679 |
| | **Place of residence (base=Rural)** | | | | |
| | Urban | 0.2703 | 0.2818 | -0.3816 | 0.2559 |
| | Woman-level Random effect ($\sigma^2$) | 0.0308 | 0.2434 | 0.2091 | 0.1917 |

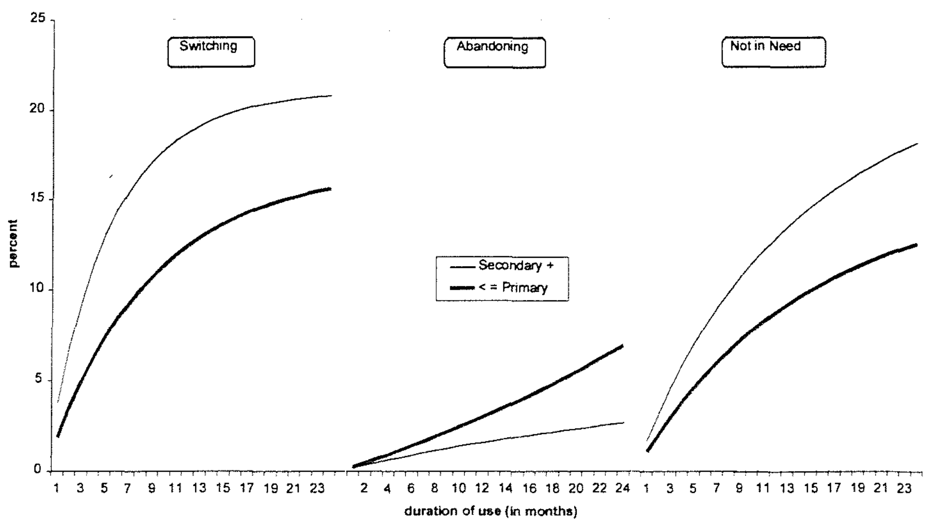
Note: **** p < 0.001 *** p < 0.01, ** p< 0.05, * p < 0.1

## 10.3 Impact of Background Variables

The parameter estimates and their standard errors for selected models of switching behaviour after discontinuation are presented in Table 10.4. However, for the 1989-94 data set, the significant interactions between duration and origin method, women's education, and contraceptive intention make the interpretation of Table 10.4 cumbersome. Therefore, the results are presented in a set of graphs. Each graph shows the effects of a single variable on the hazard of each type of switching given that other variables are set to their mean values and the random effects are held at their mean values of zero. The results are also presented in Figures 10.4 and 10.5 as estimated cumulative probabilities within 24 months of use. Tables 10.5 and 10.6 present estimated one-year cumulative probability of switching behaviour by background variables presented in Table 10.3 and 10.4 for 1986-91 and 1989-94, respectively. Again, the effects of each variable are considered separately, whereas all other variables in the model are fixed at mean value. At this stage, random effect for woman levels are held at their mean values of zero.

Women's level of education (less than primary and secondary plus), influences the likelihood of switching and abandoning. In 1986-91, the women's level of education significantly differentiated the likelihood of abandoning. As in the life table analysis shown in Figure 8.19, women with completed primary school or lower were more likely to abandon than women with secondary and above education. In 1989-94, the effect of duration of use on the probability of switching from one method to another varied by women's educational level. Figure 10.4 plots how the probabilities of each type of transition varied by woman's educational level as duration of use increased. More educated women were more likely to switch to another method after discontinuation. Especially in the first year of use, the cumulative probability of switching from one method to another increased faster among more educated women than among less educated women.

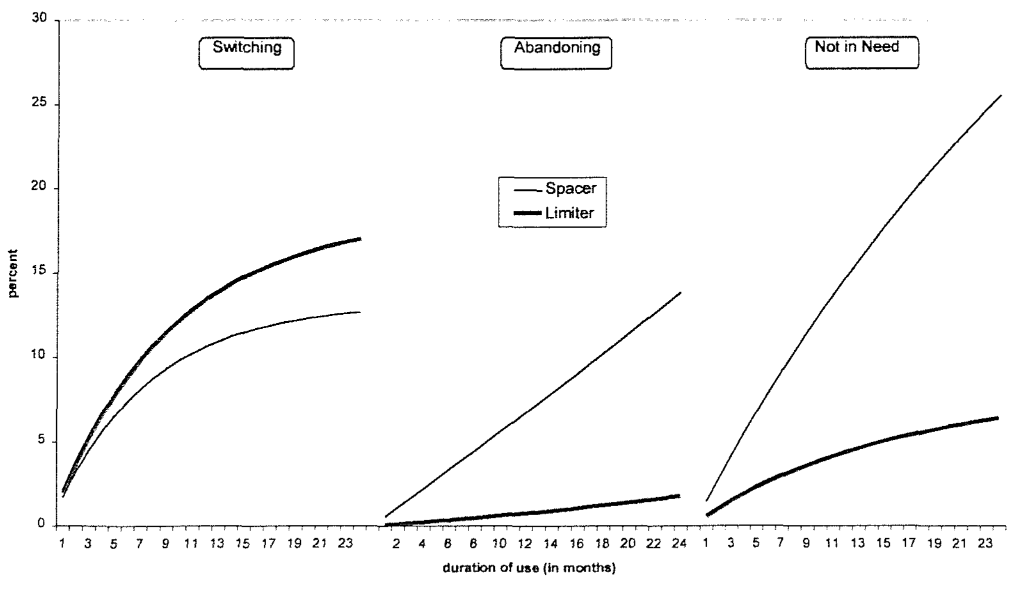
**Figure 10.4 Estimated Cumulative Probabilities of Switching, Abandoning and Not in Need for Contraception by Woman's Education and Duration of Use: Bali, 1989-94 Controlling for Other Variables**



Likewise in 1986-91, users with lower education (less or equal to primary school) were more likely than those with higher education to abandon using any contraceptive. Education differentials also indicate that educated women were more likely to switch to non-use while no longer in need for contraception. Differentials in switching behaviour after discontinuation by husband's education and by place of residence are shown in Figures 8.18 and 8.20. In this chapter it is found that the husband's level of education did not have a significant effect on switching behaviour. Type of residence neither affected switching behaviour significantly for any of the three statuses after discontinuation.

Contraceptive intention, which differentiates users as limiters or spacers, is also analyzed and it has significant relationship with states of switching behaviour after discontinuation. Figure 10.5 shows relationship between contraceptive intention at the start of use and the switching behaviour. As duration of use increased, the probabilities of switching, abandoning while in need, and abandoning while not in need, also increased, but the increase was faster among limiters than spacers. The biggest difference between the probabilities among spacers and limiters is found among those who abandoned the use of contraception while not in need. The second highest difference is among those who abandoned use of contraception while in need. As expected, the differentials in contraceptive intention indicate that women who were spacers were more likely to abandon and to be not in need for contraception than the limiters were.

**Figure 10.5 Estimated Cumulative Probabilities of Switching, Abandoning and Not in Need for Contraception by Contraceptive Intention and Duration of Use: Bali, 1989-94 Controlling for Other Variables**



Two other variables which have significant effect are the number of living children and age at the start of use (Table 10.4). Number of living children is used to represent family composition. In both data sets, the number of living children has a significant relationship with abandoning. From Table 10.5 and 10.6, it can be seen that the larger the number of living children the more likely were the women to abandon, implying that they were at risk of having unwanted pregnancies. This is unexpected because women with larger numbers of living children (more than 4 children) are assumed to include more stoppers. This result might indicate that women with more living children could not immediately find suitable methods after they discontinued. Further, this result implies that there was a need for contraception that was not satisfied, especially for those who wanted to limit the number of living children.

Table 10.5 Estimated Probability (Percentage) of Switching Behaviour After Discontinuation Within One Year of Initiation of Use by Background Variables: Bali, 1986-91

| Background Variable | Type of Transition | | | | |
|---|---|---|---|---|---|
| | Switching | Abandoning | Not in need | Continuing | Total |
| **Method of Contraception** | | | | | |
| Pill | 8.78 | 4.96 | 4.41 | 81.85 | 100 |
| IUD | 4.04 | 2.71 | 2.06 | 91.20 | 100 |
| Injectables | 11.04 | 1.65 | 6.37 | 80.95 | 100 |
| Less effective methods | 13.33 | 7.76 | 7.56 | 71.36 | 100 |
| **Number of Living Children** | | | | | |
| 0 – 1 | 4.69 | 2.66 | 3.65 | 89.00 | 100 |
| 2 – 3 | 5.80 | 2.03 | 2.44 | 89.72 | 100 |
| 4+ | 8.14 | 9.02 | 4.41 | 78.44 | 100 |
| **Woman's Age** | | | | | |
| < 25 | 7.68 | 6.15 | 3.07 | 83.10 | 100 |
| 25 - 29 | 5.75 | 4.80 | 3.90 | 85.56 | 100 |
| 30+ | 4.17 | 0.57 | 2.13 | 93.14 | 100 |
| **Contraceptive Intention** | | | | | |
| Spacer | 6.04 | 6.31 | 7.35 | 80.30 | 100 |
| Limiter | 5.64 | 1.65 | 1.63 | 91.09 | 100 |
| **Woman's education** | | | | | |
| Less than Primary | 5.18 | 3.58 | 3.08 | 88.15 | 100 |
| Secondary | 5.25 | 1.10 | 3.05 | 90.60 | 100 |
| **Husband's education** | | | | | |
| Less than Primary | 6.23 | 2.75 | 2.89 | 88.13 | 100 |
| Secondary | 5.03 | 3.26 | 3.53 | 88.19 | 100 |
| **Place of residence** | | | | | |
| Urban | 6.02 | 2.37 | 3.72 | 87.89 | 100 |
| Rural | 5.77 | 3.13 | 2.84 | 88.25 | 100 |
| **Overall** | 5.84 | 2.89 | 3.07 | 88.19 | 100 |

The 1986-1991 data shows that age at the start of use had a significant impact on switching behaviour after discontinuation. Here we found that the women's age of the start of use is significant for switching to non-use while in need in 1986-91. The probability is lower among older women: women aged 30 or more (Table 10.5). Many of these women were likely to have strong motivation to avoid another conception. However, its significance in 1989-94 was considerably reduced after controlling for the number of living children. The change in significance of the impact of age at the start of use is also found by Steele (1996) in analysing contraceptive switching in Bangladesh.

Table 10.6 Estimated Probability (Percentage) of Switching Behaviour After Discontinuation Within One Year of Initiation of Use by Background Variables: Bali, 1989-94

| Background Variable | Type of transition | | | | |
|---|---|---|---|---|---|
| | Switching | Abandoning | Not in need | Continuing | Total |
| **Method of contraception** | | | | | |
| IUD | 3.38 | 2.84 | 4.77 | 89.01 | 100.00 |
| Pill | 9.07 | 5.38 | 19.75 | 65.80 | 100.00 |
| Injectables | 5.00 | 4.45 | 8.22 | 82.33 | 100.00 |
| Less effective methods | 12.24 | 0.66 | 30.07 | 57.03 | 100.00 |
| **Number of living children** | | | | | |
| 0 – 1 | 15.39 | 1.00 | 10.17 | 73.44 | 100.00 |
| 2 – 3 | 10.40 | 2.94 | 9.65 | 77.01 | 100.00 |
| 4+ | 5.50 | 6.88 | 13.31 | 74.31 | 100.00 |
| **Woman's age** | | | | | |
| < 25 | 10.92 | 1.58 | 9.83 | 77.67 | 100.00 |
| 25 - 29 | 10.88 | 2.39 | 10.00 | 76.74 | 100.00 |
| 30 + | 13.46 | 3.29 | 11.52 | 71.73 | 100.00 |
| **Contraceptive Intention** | | | | | |
| Spacer | 10.63 | 6.74 | 14.75 | 67.88 | 100.00 |
| Limiter | 13.39 | 0.74 | 4.34 | 81.54 | 100.00 |
| **Woman's education** | | | | | |
| Second | 18.80 | 1.62 | 12.92 | 66.66 | 100.00 |
| Less than | 12.49 | 3.03 | 8.77 | 75.71 | 100.00 |
| **Husband's education** | | | | | |
| Second | 15.07 | 1.95 | 8.83 | 74.15 | 100.00 |
| Less than | 8.64 | 2.31 | 11.70 | 77.35 | 100.00 |
| **Place of residence** | | | | | |
| Urban | 14.41 | 2.11 | 7.79 | 75.69 | 100.00 |
| Rural | 10.26 | 2.14 | 11.47 | 76.13 | 100.00 |
| Overall | 11.39 | 2.14 | 10.23 | 76.25 | 100.00 |

## 10.4 Impact of Unobserved Heterogeneity

Inclusion of the random effect in the model presented in Table 10.4 can control both unobserved heterogeneity and possible correlation between episodes of use for women who contribute more than one episode. This random effect also controls unobserved heterogeneity between women. Controlling for the random effect is important because of the possibility of omitted and/or unmeasured variables that affect women's behavior in switching after discontinuation, especially in the nature of the DHS calendar data which enable the use of a limited number of variables in the analysis. Initially, primary sampling unit/PSU-level or cluster level is included into the models, but no evidence of the random effect at cluster-level is found. The lack of variation at the cluster level suggests that users' behaviour after discontinuation largely depended on individuals and was relatively affected by the behaviour of others in the community.

Table 10.4 shows that even after controlling for socio-economic and demographic variables, the parameter of random effect is still highly significant ($p < 0.001$) in 1989-94 especially for the probability of abandoning. A great deal of unexplained variation in abandoning remained with parameter estimate of the random effect of 1.471. However, for the 1986-91 data, there is no strong evidence of the variation at the woman level.

One way of examining the implication of the variability across women is to use an approach adopted by Curtis, Diamond, and McDonald (1993), which has been subsequently applied to the multilevel approach on the analysis of contraceptive use dynamics in China and Brazil. (Steele, Diamond and Wang, 1996; Leite, 1998). This approach involves estimating probabilities of being in type of switching behaviour after discontinuation $r$ (see equation 4.4.2.2) for different values of $u_{rj}$, where $u_{rj}$ is the random effect associated with woman $j$ for type of switching $r$ for episodes of use with a specific combination of characteristics. The values of $u_{rj}$ utilised in Curtis et al. (1993) are $-2\sigma$, $-\sigma$, 0, $+\sigma$, and $+2\sigma$ which correspond to the mean value of $u_{rj}$ (0) and to one and two standard deviations on either side of the mean. Hence the probability that a use episode with a certain set of characteristics for type of switching $r$ lie between the probabilities corresponding to $u_{rj} = -\sigma$ and $u_{rj} = +\sigma$ for 68% of women, and between the probabilities corresponding to $u_{rj} = -2\sigma$ and $u_{rj} = +2\sigma$ for 95% of women. Negative values of random effect ($-2\sigma$ and $-\sigma$) would correspond to women who had below-average risk of switching to type $r$ on the unobserved factors; positive values ($2\sigma$ and $\sigma$ ) would correspond to women with above-average risk.

To examine the extent to which variation across women affects switching behaviour after discontinuation, especially for abandoning in 1989-94, Table 10.7 presents estimated probabilities of abandoning within one-year and two-year after initiation of use for different values of the random effect $u_{rj}$. The probabilities of abandoning are calculated by fixing all variables in the model at their mean values and setting the random effects associated with the other two types of switching behaviour at 0 because they are not significant.

Table 10.7 12-month and 24-month Cumulative Probabilities of Abandoning for Episode with Average Characteristics, for Different Values of the Woman-level Random Effect: Bali, 1989-94

| | $-2\sigma$ | $-\sigma$ | 0 | $+\sigma$ | $2\sigma$ |
|---|---|---|---|---|---|
| 12-month | 0.001 | 0.005 | 0.021 | 0.089 | 0.325 |
| 24-month | 0.003 | 0.012 | 0.049 | 0.194 | 0.568 |

The large amount of unexplained variation at the woman level had an important effect on abandoning behaviour in Bali 1989-94. The probability of abandoning within one year of initiating use ranges from 0.001 if the random effect at the woman level is two standard deviations below the mean to 0.325 for similar woman with the random effect is two standard deviations above the mean. Within two years since initiating use the probability ranges from 0.003 to 0568. These two ranges overlap considerably.

For these two groups of women, the probability of abandoning is low at the random value of 0, but these probabilities vary greatly because of unobserved variables that affect women to abandon use of contraception. Table 10.7 shows that although women generally are more likely to abandon within 24-month after initiation of use than within 12-month after initiation, it is possible that a high-risk woman who has successfully continued use for one year has a higher chance of abandoning than a woman with similar characteristics who has been using a method for 2 years, but who is in the low-risk category. For example, if a woman who abandoned within one year after initiation of use had a random value of $\sigma$, she would have a higher chance of abandoning (0.089) than 0.049 for a woman who abandoned at longer duration but had a random effect of 0.

Steele and Diamond (1999) also found a considerable amount of unexplained variation in switching and abandoning in Bangladesh. Unobserved woman-level factors that can potentially influence switching behaviour as stated by Steele and Diamond (1999) are the level of a woman's commitment and motivation to practice family planning as well as her experience with her current and previous methods.

## 10.5 Summary

The aim of the analysis in this chapter is to investigate changes in status of contraceptive use after discontinuation. A series of multilevel discrete time competing risks hazards models are used to study variables affecting women's risk of switching from any particular method to another method and abandonment of contraception. Of most interest to family planning workers and policy makers is switching from an effective method to a less effective one or abandonment while the women were at risk of an unintended pregnancy, because these types of transition are likely to affect the level of fertility. However, switching from any modern method to less effective methods and switching from any reversible method to sterilization was uncommon. Therefore, switching was among reversible methods. The rate of abandonment was generally lower than switching from any method to another method. Age at the start of use, number of living children, woman's level of education, and contraceptive intention all affect switching behaviour and abandonment after discontinuation. Among women with more than four living children there was an indication of unsatisfied need for contraception.

The 1986-91 data shows that there was no evidence for unobserved heterogeneity, but the 1989-94 data reveals significant unobserved heterogeneity in particular for switching to non-use while users were at risk of an unintended pregnancy. The probability of abandoning was low, but a large number of unexplained variations at woman level had an important effect on abandoning. Woman's commitment and motivation to practise family planning as well as access to a range of available methods may have been the variables that potentially affect abandoning.

# Chapter 11

# DETERMINANTS OF CHOICE OF CONTRACEPTIVE USE IN BALI

## 11.1 Selectivity Bias

Chapter 9 shows that the highest probability of "other reasons" for discontinuation is found among those who use traditional methods. Among the "other reasons", cost is only mentioned by 1% of users as the reason for discontinuation. Chapter 10 finds that overall probability of abandoning was very low (about 3% in both periods, Tables 10.5 and 10.6). The switching is more from traditional methods to modern methods, or among modern methods, and none substitute modern methods to traditional methods or sterilisation. In other words, the users in Bali seem committed to use contraception. As mentioned in Anwar and Ananta (2000), qualitative observation in several villages in Yogyakarta (also in Indonesia, with a similar level of fertility as in Bali) finds that during the recent economic crisis, the women have been more committed to family planning, as a means to cope with the crisis. With this finding, the Heckman two-step estimation is not needed to manage the possibility of the selectivity bias.

## 11.2 Modelling Strategy

Although the concern of this section is on the determinants of choice of contraceptive and price is one of the determinants, the choice of method may have an impact on the price. Therefore, a test of endogeneity is first performed. The endogeneity test is seen from the significance of the coefficients of the estimated probability of each method on price during the second stage of the simultaneous equation model.

The modelling strategy is first to test the significance of each variable mentioned in Section 4.4.3 on each endogenous variable. Some variables are not used in one of the analysis because they have zero cells for one of contraceptive methods. However, such variables are still represented by other variables in the model. For example, among variables measuring income/assets of households (ownership of durable goods), no condom user has a bicycle and no condom has piped water in 1991 data set. Therefore, these variables are not utilised, but there are still other variables such as ownership of a radio, television, motorbike or stove, which measure income/assets.

Next, the variables that are highly statistically insignificant are excluded and significant variables in each equation are retained. Therefore, Table 11.1 shows the selected exogenous variables in the price equation and choice of method equation. From this list of variable it can be shown that both equations are already identified and hence there is no need to find more exogenous variables. The identification of the equations is the necessary condition to be able to perform two-stage estimation (Kelejian and Oates, 1974). The next stage is to calculate the estimated price and the estimated probability of each method. This is the first stage of the two-stage estimation.

There are two equations. One is the price equation, where price is the response variable; and the other is the choice of method equation, where choice of method is the response variable. To get the estimated price and the estimated probability of each method, both price and choice of method are regressed on all significant exogenous variables in the system as listed in Table 11.1. The estimated price is to be the instrumental variable for price of contraception in the choice of method equation; and the estimated probabilities of each method are used as the instrumental variables for choice of method in the price equation. In the second stage price and choice of method equations are re-run with the instrumental variables.

It is found that there is no endogeneity bias in estimating the impact of price on choice of contraceptive method in 1994 (see Appendix A-10). A single equation model to analyse the impact of price on choice of contraceptive method will not suffer from simultaneity bias. Because a single-equation model tends to be more efficient than the simultaneous-equation model, the absence of endogeneity implies that the estimates from the single-equation model are preferred.

The choice equation is then run without the instrumental variables for price of contraception. It is found that price has a significant impact on choice of method. Its impact on choice of method may be associated with some other variables in the model. Thus, two-way interactions between the price and other variables are tested. The results show that the impact of price of contraception on the choice of method depends on both ownership of a motorbike and contraceptive intention. Therefore, the discussion for the 1994 data is based on the result from the single equation estimation involving these two interactions as shown in Table 11.4.

Table 11.1 Exogenous Variables in the Equations (Price and Method Equations): Bali, 1991 and 1994

| Variabel | 1991 | | 1994 | |
|---|---|---|---|---|
| | Endogenous variable | | | |
| | Method | Cost | Method | Cost |
| **a. Variables which measure income/assets** | | | | |
| **a.1 Ownership of durable goods** | | | | |
| Own a tv | Ns | Significant | Ns | Ns |
| Own Radio | Ns | Significant | Ns | Ns |
| Own motorbyke | Ns | Ns | Significant | Ns |
| Own fridge | Na | Na | Ns | Significant |
| Own kerosene/stove | Significant | Significant | Significant | Ns |
| **a.2 Housing condition** | | | | |
| Source of drinking water | Ns | Ns | Significant | Significant |
| Type of house* | Ns | Ns | Significant | Significant |
| Having electricity | Ns | Significant | Ns | Ns |
| **b. Taste** | | | | |
| **b.1 Employment** | | | | |
| Respondent's occupation | Ns | Ns | Significant | Ns |
| Decision makers on spending money | Ns | Ns | Significant | Significant |
| | | | | |
| **b.2 Information** | | | | |
| Visited by FP worker | Significant | Ns | Significant | Ns |
| Watching TV every week | Ns | Significant | Ni | Ni |
| | | | | |
| **b.3 Related to method use** | | | | |
| Fertility goals | Ni | Ni | Significant | Ns |
| Main reason of use | Significant | Ns | Significant | Significant |
| Ever heard/seen of Blue Circle | Significant | Ns | Ns | Ns |
| | | | | |
| **b.4 Demographic variables** | | | | |
| Natural logarithmic of age | Significant | Ns | Significant | Ns |
| Number of living children | Significant | Ns | Significant | Ns |
| Years since first marriage | Significant | Ns | Significant | Ns |
| | | | | |
| **b.5 Other** | | | | |
| Respondent's education | Significant | Significant | Significant | Significant |
| Husband's education | Ns | Significant | Significant | Significant |
| Childhood place of residence | Ns | Ns | Ns | Significant |
| Religion | Significant | Significant | Significant | Ns |

Note : Ns = Not significant Na = Not available Ni = Not included
* = for the 1991 data it is available only for main material of the floor

Unlike in the 1994 data set, the 1991 data set finds the existence of endogeneity (Appendix A-10). Therefore, the discussion on the 1991 data is based on the result of the two-stage estimation as shown in Table 11.3. To assist interpretation in the multinomial logistic model, an MCA (multiple classification analysis) table is performed to estimate the probabilities of choosing each method (Retherford and Choe, 1993). Therefore, probabilities are calculated for a particular variable from the selected model holding the other variables constant at their means. However, to examine the changes in price of contraception on the choice of contraception, the estimated probabilities of choosing each alternative contraceptive method at different level of price of contraception are calculated by holding other variables at their mean values.

## 11.3 Impact of Price on Choice of Contraceptive Method

Implementation of the Indonesian family planning movement involves active participation by the community and private sector. One indicator of community participation is self-sustainability, which can be measured by the proportion of users who pay for having a method of contraception and services. Therefore, in the 1991 and 1994 DHS data sets information on 'how much the method cost' was asked to current contraceptive users. The money spent for using a method of contraception (out of pocket money), as mentioned in Chapter 4, is referred as price of contraception in the present analysis. As presented in the DHS report, in general, about 70% of users in Bali paid for obtaining a method of contraception in 1991; and about 80% in 1994. About 42% of users who paid either in 1991 or 1994 obtained the method from government sources.

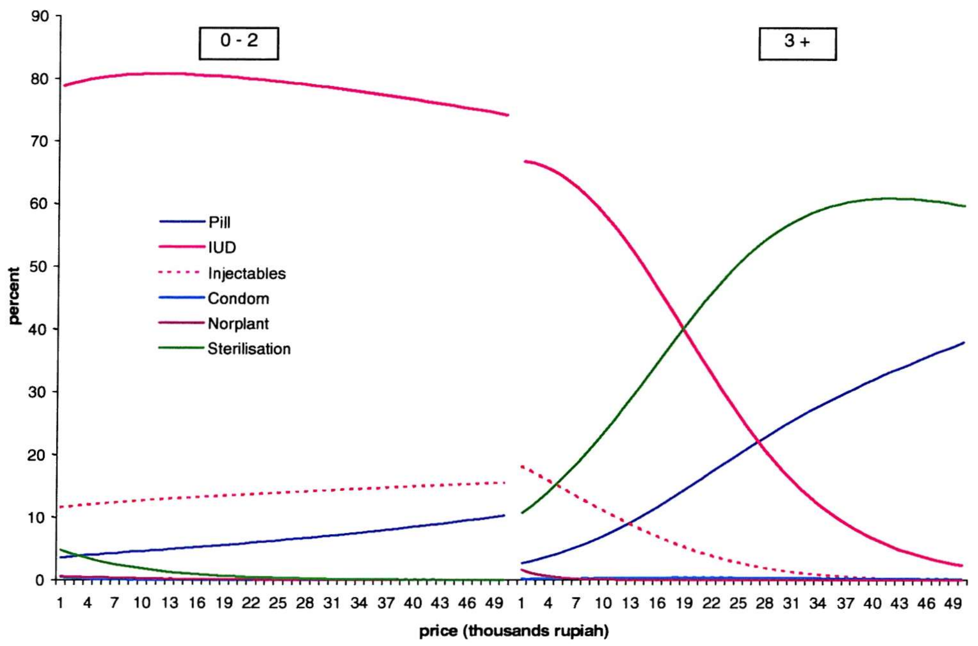
As a complement to the DHS report, which does not present the percentages of paying users for each method of contraception, Table 11.2 presents the percentage distribution of current users of contraception who paid for a particular method of contraception in 1991 and 1994. The percentages of current users who paid are different across methods. Almost 100% of injectable users and more than 60% of users of other methods paid in 1991 and 1994. Among those who paid, users paid the highest for sterilization and the lowest for the pill.

Table 11.2 Percentage Distribution of Current Users of Modern Contraception Who Pay or Method is free and Mean, Minimum and Maximum Price by Method: Bali: 1991 and 1994

| Method | Free | | Pay | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|
| | % | N | % | N | Mean (in thousands rupiah) | Min | Max | N | % |
| **1991** | | | | | | | | | |
| Total | 29.74 | 193 | 70.26 | 456 | 7.263 | 0.02 | 400.00 | 649 | 100 |
| Pill | 41.46 | 17 | 58.54 | 24 | 0.325 | 0.05 | 1.00 | 41 | 100 |
| IUD | 32.46 | 136 | 67.54 | 283 | 5.252 | 0.02 | 60.00 | 419 | 100 |
| Injectable | 2.11 | 2 | 97.89 | 93 | 3.169 | 0.10 | 15.00 | 95 | 100 |
| Condom | 71.43 | 5 | 28.57 | 2 | 4.250 | 3.50 | 5.00 | 7 | 100 |
| Norplant | 33.33 | 2 | 66.67 | 4 | 4.950 | 0.30 | 15.50 | 6 | 100 |
| Sterilization | 38.27 | 31 | 61.73 | 50 | 29.896 | 0.15 | 400.00 | 81 | 100 |
| **1994** | | | | | | | | | |
| Total | 20.40 | 164 | 79.60 | 640 | 18.420 | 0.01 | 1300.00 | 804 | 100 |
| Pill | 26.98 | 17 | 73.02 | 46 | 0.958 | 0.10 | 5.00 | 63 | 100 |
| IUD | 24.64 | 120 | 75.36 | 367 | 8.850 | 0.01 | 250.00 | 487 | 100 |
| Injectable | 1.39 | 2 | 98.61 | 142 | 4.752 | 0.20 | 63.50 | 144 | 100 |
| Condom | 9.09 | 1 | 90.91 | 10 | 1.650 | 0.50 | 3.60 | 11 | 100 |
| Norplant | 37.50 | 3 | 62.50 | 5 | 4.280 | 1.30 | 7.50 | 8 | 100 |
| Sterilization | 23.08 | 21 | 76.92 | 70 | 115.217 | 0.10 | 1300.00 | 91 | 100 |

As shown in Table 11.3, in 1991 the impact of price of contraception on the choice of method depends on the number of living children. Figure 11.1 shows the probability of choosing a particular method at the same price of contraception, controlled by the number of living children they had. In other words, at the same level of out of pocket money a woman spent on contraception, what is the probability of use among the six different methods of contraception? The relationship between price and probability of choosing a particular method is markedly different between those who had at least three children and those who had less than three children. Those who had less than three children were most likely to choose IUD at any level of price of contraception. Apart from IUD, they were likely to choose injectables, or the pill. On the other hand, when women with at least three children had to spend more money for contraception, the probability of choosing a method of contraception is different between when the price is lower or higher than 20,000 rupiah. When_they had to pay less than 20,000 rupiah, they were most likely to choose IUD, but when they had to pay more than 20,000 rupiah they were most likely to choose sterilisation.

**Figure 11.1 Estimated Probability of Choosing a Method of Contraception given Price of Contraception by the Number of Living Children: Bali, 1991**




To faciliate a better examination of the different behaviours in choosing a particular method of contraception between women who had less than three children and those who had at least three children at the same level of price of contraception, Figure 11.1 is broken down into Figures 11.2 to 11.7. The probability of using sterilisation is always higher for those who had at least three children (Figure 11.5). For women with at least three children, the probability of choosing sterilization is higher when they had to pay a higher price for contraception. However, for those who had less than three children, the probability of choosing sterilisation is lower when they had to pay a higher price. On the other hand, the probability of choosing IUD is always higher for those who had less than three children. Although the change in the probability of using the IUD as the price of contraception increased was not much, it was significant at the 5% level. An increase in price of contraceptive was accompanied with a decline in the probabilities of using the IUD, with a much bigger impact among those with at least three children. (Figure 11.3). For the remaining methods, the figures indicate crossing patterns. The use of injectables is an example (Figure 11.4). When the price is less than 9,000 rupiah, the probability of using injectables is higher among those who had at least three children. Yet, when the price is higher than 9,000 rupiah, the probability is smaller among those who had at least three children.

Among those who had at least three children (Figures 11.1) as the price increased the probability of using the pill, sterilization, and condom (Figure 11.6) increased. In contrast, the probability of using IUD, injectable and Norplant (Figure 11.7) decreased as the price increased. The positive relationship with the use of condom is only found for price under 21,000 rupiah (see Figure 11.6). This result may indicate that for those who might have wanted to stop their fertility (those with at least three children) an increase in price of contraceptive had persuaded them to use the pill and sterilization. When the price level was still relatively low (under 21,000), the increase in the price was also accompanied by a higher probability to use condoms.

For those who had less than three children, and an increase in price of contraception was accompanied by a small reduction in the probability of using long-term methods such as IUD (Figure 11.2), Sterilisation (Figure 11.5) and Norplant (Figure 11.7). This finding may reveal that an increase in price of contraceptive might have fertility promoting effect among those who had less than three children in Bali 1991. They might still want to have more children, and hence an increase in price of contraception induced them not to use more effective contraception.

**Figure 11.2 Estimated Probability of Using Pill at Different Level of Price of Contraception by Number of Living Children: Bali, 1991**

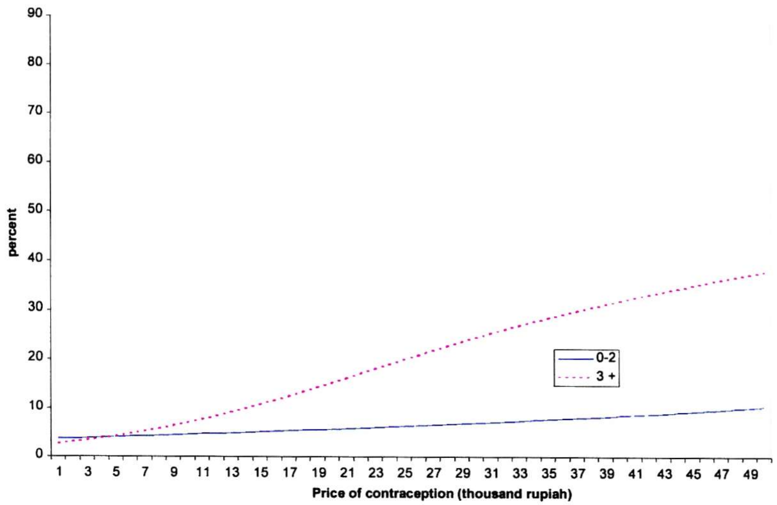



**Figure 11.3 Estimated Probability of Using IUD at Different Level of Price of Contraception by Number of Living Children: Bali, 1991**

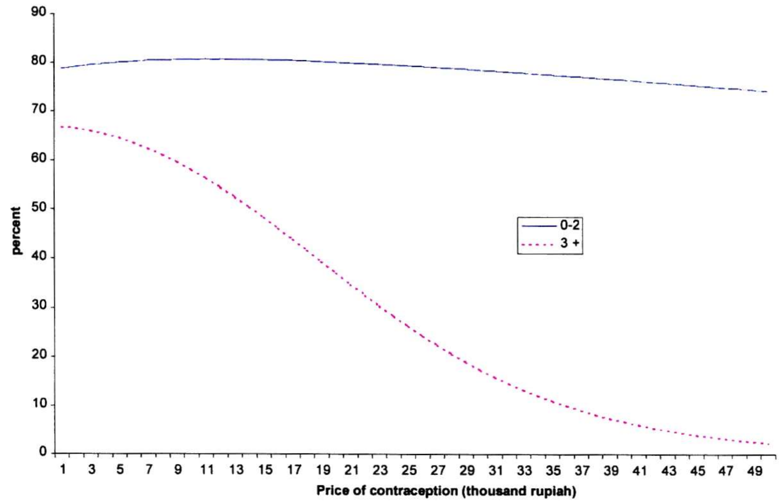



**Figure 11.4 Estimated Probability of Using Injectable at Different Level of Price of Contraception by Number of Living Children: Bali, 1991**

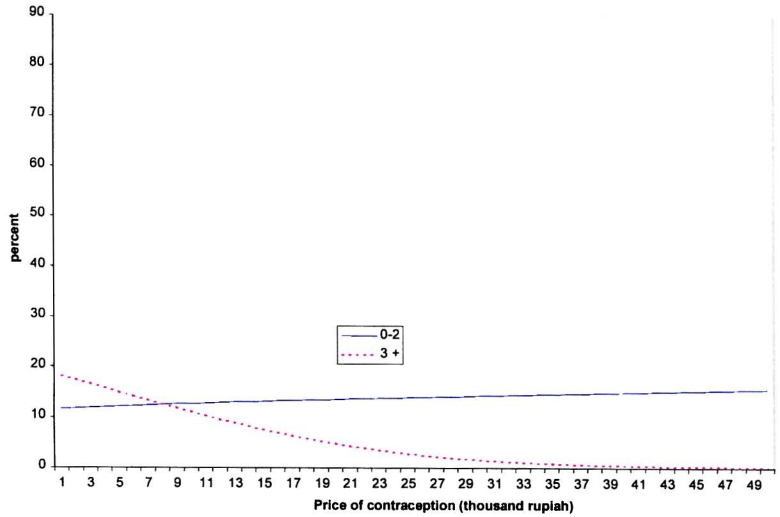



**Figure 11.5 Estimated Probability of Using Sterilization at Different Level of Contraception by Number of Living Children: Bali, 1991**

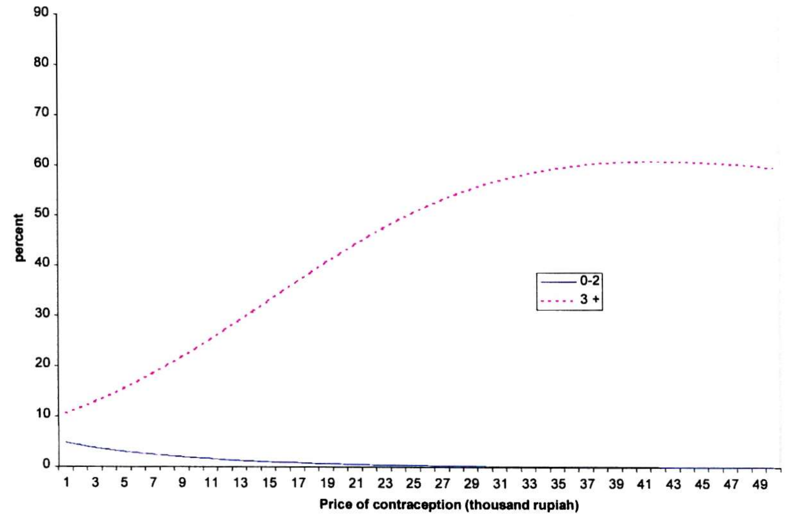


**Figure 11.6 Estimated Probability of Using Condom at Different Level of Price of Contraception by Number of Living Children: Bali, 1991**

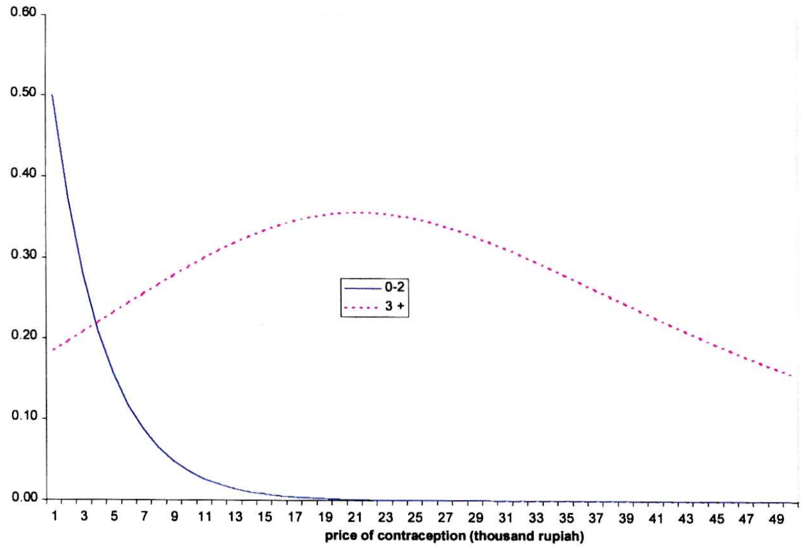



**Figure 11.7 Estimated Probability of Using Norplant at Different Level of Price of Contraception by Number of Living Children: Bali, 1991**

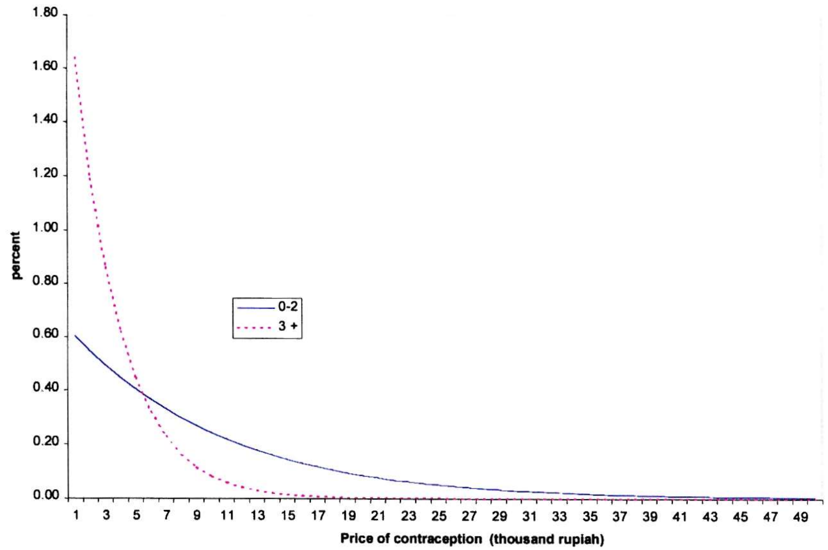


Table11.3 Parameter Estimates in the Choice of Method Equation: Bali 1991

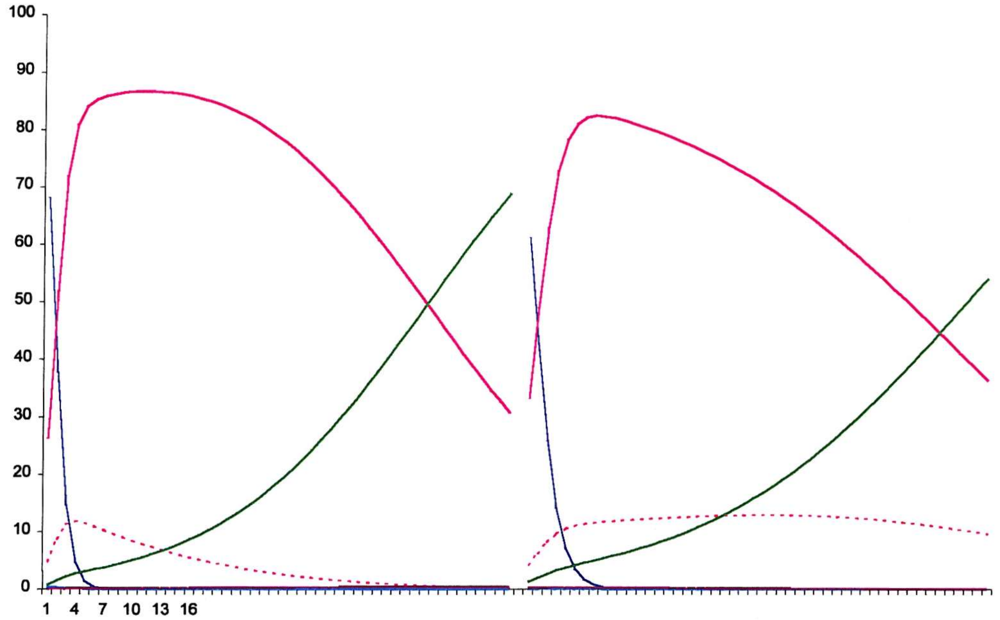
| Parameter | Pill | | IUD | | Injectable | | Condom | | Norplant | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Estimate | S.E | Estimate | S.E | Estimate | S.E | Estimate | S.E | Estimate | S.E |
| Intercept | 10.1855** | 4.5577 | 7.2127** | 3.1130 | 17.1072**** | 3.8292 | 11.8449 | 10.2972 | 11.6212 | 8.5577 |
| **Estimated Price** | 0.0189 | 0.1047 | -0.1038 | 0.0685 | -0.1430 | 0.0895 | -0.0385 | 0.2401 | -0.4218 | 0.2846 |
| **Number of living children** (base= > 3) | | | | | | | | | | |
| 0-2 | 0.9894 | 0.6757 | 0.7459 | 0.4734 | 0.0899 | 0.6009 | 1.9363 | 2.1578 | -0.6372 | 1.4123 |
| **Interaction between price and living children** | | | | | | | | | | |
| | 0.1157 | 0.1075 | 0.2160** | 0.0924 | 0.2623** | 0.1023 | -0.1450 | 0.2473 | 0.4304* | 0.2357 |
| Natural logarithm of age | -2.8203** | 1.1374 | -1.7936** | 0.7752 | -4.6937**** | 0.9553 | -4.4621* | 2.4612 | -2.9430 | 2.2005 |
| **Woman's education** (base= < some primary) | | | | | | | | | | |
| Primary & above | -0.2256 | 0.5338 | 0.6686** | 0.3359 | 0.6922* | 0.4115 | 2.5275** | 1.2412 | 1.0850 | 1.0918 |
| **Religion** (base=non Hindu) | | | | | | | | | | |
| Hindu | -0.9199 | 1.4070 | 0.6067 | 1.0727 | -0.5268 | 1.3118 | -2.3540 | 3.1155 | -4.3318 | 3.2132 |
| **Has a stove** (base=No) | | | | | | | | | | |
| Yes | -0.2507 | 0.6718 | 0.3629 | 0.4296 | 0.8262 | 0.5425 | 2.5528 | 1.8163 | 1.3953 | 1.5423 |
| **Main reason for use** (base=method related) | | | | | | | | | | |
| Recommended by others | -0.3935 | 0.4563 | 0.0352 | 0.2805 | -0.7826** | 0.3988 | -1.0782 | 1.2351 | 0.1539 | 0.9767 |
| **Visited by FP workers** (base= not visited) | | | | | | | | | | |
| Visited | 1.0568 | 0.7659 | 0.7869 | 0.5714 | 0.9646 | 0.6480 | 2.6826** | 1.1354 | 2.9015** | 1.2049 |
| **Heard of Blue Circle** (base= never heard) | | | | | | | | | | |
| Heard Blue Circle | -2.2513*** | 0.8325 | -0.3817 | 0.3508 | -0.2096 | 0.4339 | -0.4848 | 1.0370 | -0.3587 | 1.2283 |

Note: the results are based on the two-stage estimation.
**** $p < 0.001$ *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Unlike in 1991, the 1994 impact of price of contraceptive on choice of method depends on contraceptive intention (spacing or limiting) and ownership of motorbike, rather than on number of living children (see Table 11.4).

Figure 11.8 presents estimated probabilities of choosing a method of contraception as price of contraception increases for spacers in the left panel and for the limiters in the right panel. Both groups of women had similar patterns of choosing a method of contraception except for injectables. When the price was low (less than 3,000 rupiah) either spacers or limiters were most likely to choose the pill, followed by the IUD. The probability of using the pill moved in a different direction from the probability of using the IUD in response to an increase in the price of contraception. The probability of using the pill decreased, but the probability of using the IUD increased as price of contraception increased. An increase in the price was also followed by an increase in the probability of using sterilisation and injectables. However, an increase in the probability of choosing the IUD started to decrease when users had to pay more than 9,000 rupiah. Interestingly, the probability of choosing sterilisation monotonically increased as the price of contraception increased both for spacers and limiters.

**Figure 11.8 Estimated Probability of Choosing a Method of Contraception given Price of Contraception by Contraceptive Intention: Bali, 1994**



To examine how different the probability of choosing a particular method was between spacers and limiters, Figure 11.8 is broken down into Figures 11.9 to 11.14. These figures show some extreme results. First is related to the decision on the use of sterilization (Figure 11.12). Regardless of the contraceptive intention, the likelihood of using sterilization increased as they had to pay a higher price. Interestingly, the probability was higher among those who intended to space than to limit. Second, the probability of using the pill declined with the increase in price regardless the intention of the contraceptive use (Figure 11.9). Here, the probability was higher among the limiters than the spacers. The third case is the contrasting pattern when the decision was related to the use of Norplant (Figure 11.14). In general, an increase in price tended to be accompanied by an increase in probability of using Norplant among spacers but by a decrease in the probability among limiters.

When the price was still low, the probability of use of some methods was still rising. The threshold of low was 5,000 for IUD, 3,000 for injection, 5,000 for condom and Norplant (only among limiters). Above 5,000 rupiah, the probability of choosing the IUD decreased with spacers having a lower probability than limiters (Figure 11.10). Meanwhile, for injectables, when the price was above 3,000 rupiah the probability of choosing it for limiters was lower than the probability for spacers (Figure 11.11).

In summary, the results show that an increase in price of contraception was followed by a shift in contraceptive mix with more sterilization users (regardless of the intention of use of contraceptive).

Table11.4 Parameter Estimates in the Choice of Method Equation: Bali 1994

| Variable | Pill | | IUD | | Injectable | | Condom | | Norplant | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Estimate | S.E | Estimate | S.E | Estimate | S.E | Estimate | S.E | Estimate | S.E |
| Intercept | 21.0496**** | 4.3802 | 10.7622*** | 3.3696 | 25.0887**** | 3.8411 | 12.9777* | 7.6967 | 10.4725 | 8.4242 |
| **Price** | -0.8293**** | 0.2321 | -0.0762**** | 0.0163 | -0.0612*** | 0.0196 | -0.1438 | 0.2030 | -0.1250 | 0.1105 |
| **Has a motorbike** (base=No) | | | | | | | | | | |
| Yes | -1.0558** | 0.4839 | -1.0326*** | 0.3213 | -0.3772 | 0.3979 | 1.0240 | 0.8885 | -0.6291 | 0.9679 |
| Interaction between | | | | | | | | | | |
| Price and Motorbike | 0.4258* | 0.2497 | 0.0620**** | 0.0169 | -0.0430 | 0.0341 | -0.2258 | 0.3035 | -0.1354 | 0.2429 |
| **Source of drinking water** (base=surface) | | | | | | | | | | |
| Piped | 1.1781** | 0.5041 | 0.8575** | 0.3651 | 1.2501*** | 0.4375 | 2.6408** | 1.1613 | -0.4902 | 1.2189 |
| Well | 0.7784 | 0.4983 | 0.4390 | 0.3394 | 1.0008** | 0.4046 | 1.4954 | 1.2527 | 0.0564 | 0.9122 |
| **Contraceptive Intention** (base=limiter) | | | | | | | | | | |
| Spacer | 1.2171 | 0.8357 | 0.3521 | 0.7401 | 0.7869 | 0.7903 | 3.0134** | 1.1871 | -1.2667 | 1.7092 |
| Interaction between | | | | | | | | | | |
| Price and Spacer | -0.5387* | 0.2795 | -0.0153 | 0.0332 | -0.0992* | 0.0526 | -0.6447 | 0.4376 | 0.0811 | 0.1645 |
| **Main reason of use** (base=method-related) | | | | | | | | | | |
| Recommended | 0.5117 | 0.5230 | 1.1108*** | 0.4004 | 0.3032 | 0.4731 | 0.6066 | 0.9165 | 1.4618* | 0.8543 |
| **Number of living children** (base=> 3) | | | | | | | | | | |
| 0 – 2 | 1.2937** | 0.5040 | 1.4618**** | 0.3738 | 0.7510* | 0.4383 | -0.0764 | 0.9716 | 1.8433** | 0.9290 |
| **Woman's education** (base= Some Primary) | | | | | | | | | | |
| Primary & above | 0.8800** | 0.4353 | 0.7269** | 0.3185 | 0.8539** | 0.3707 | 2.0882** | 0.8875 | 1.7817** | 0.8474 |
| **Natural logarithm of age** | -5.1937**** | 1.1824 | -2.7128*** | 0.8976 | -6.6879**** | 1.0352 | -4.4558** | 2.0738 | -3.1106 | 2.3000 |
| **Religion** (base=non Hindu) | | | | | | | | | | |
| Hindu | -3.0212**** | 0.7031 | 0.3159 | 0.6282 | -1.6270** | 0.6369 | -2.1035* | 1.0957 | -2.5203** | 1.1131 |

Note: the results are based on the single equation estimation.
**** $p < 0.001$ *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

**Figure 11.9 Estimated Probability of Using Pill at Different Level of Price of Contraception by Contraceptive Intention: Bali, 1994**

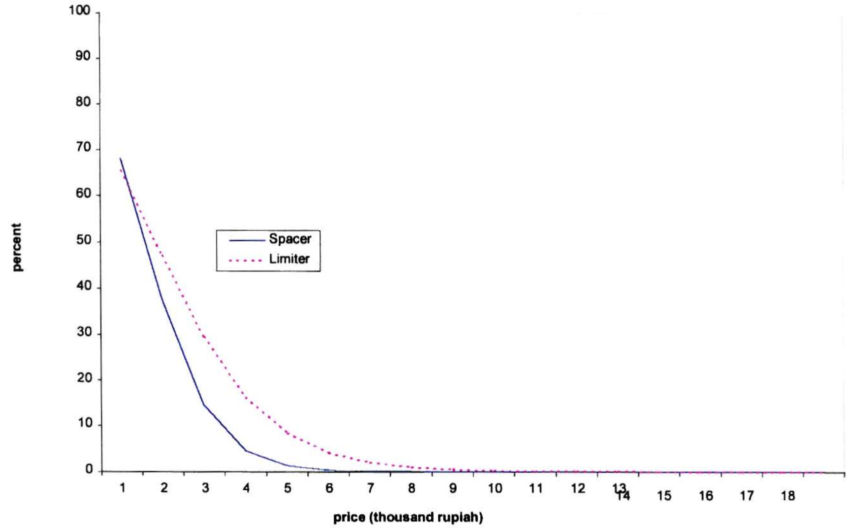



**Figure 11.10 Estimated Probability of Using IUD at Different Level of Price of Contraception by Contraceptive Intention: Bali, 1994**

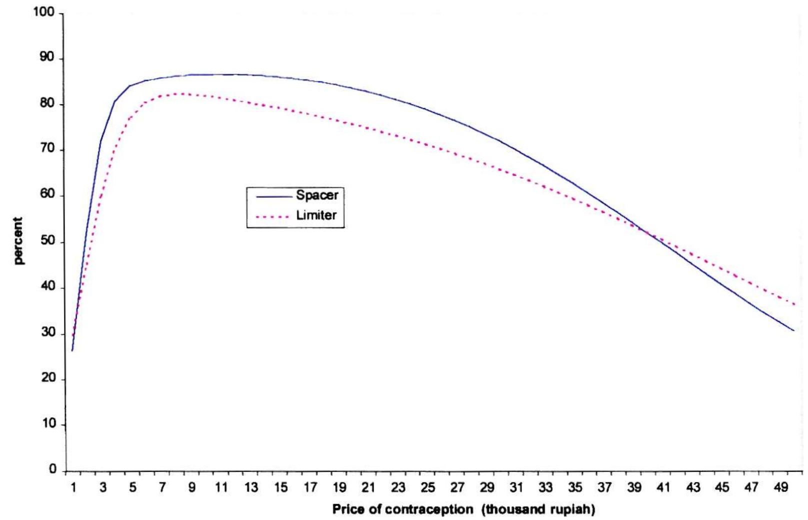



**Figure 11.11 Estimated Probability of Using Injection at Different Level of Price of Contraception by Contraceptive Intention: Bali, 1994**

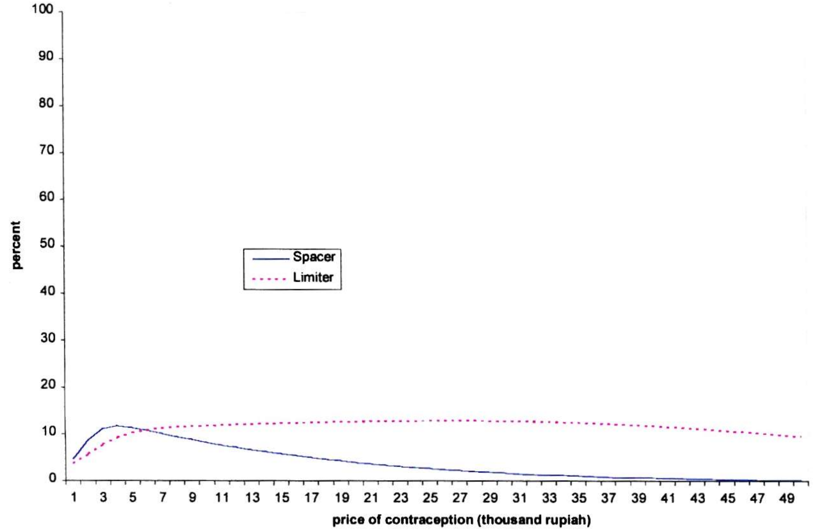



**Figure 11.12 Estimated Probability of Using Sterilization at Different Level of Price of Contraception by Contraceptive Intention: Bali, 1994**

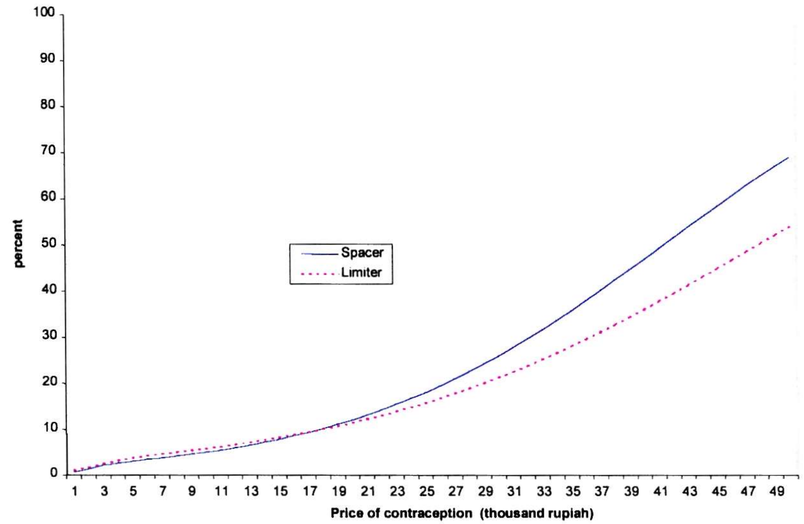


Figure 11.13 Estimated Probability of Using Condom at Different Level of Price of Contraception by Contraceptive Intention: Bali, 1994

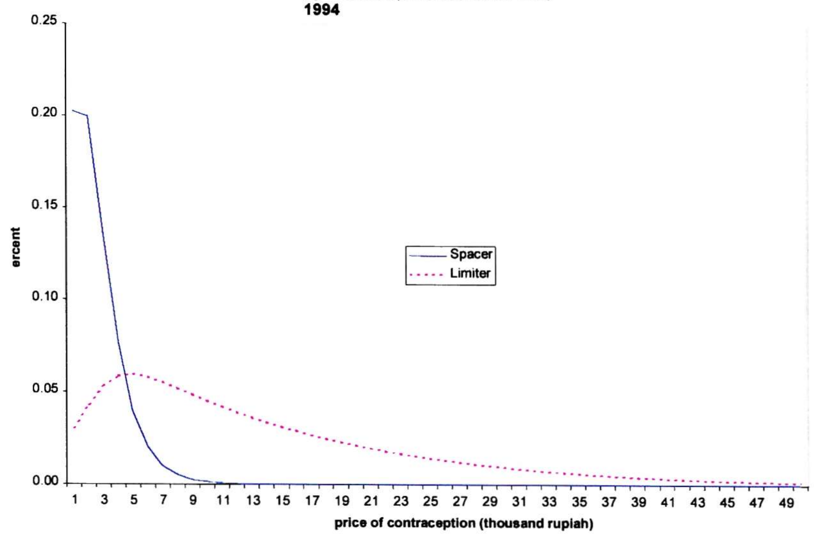
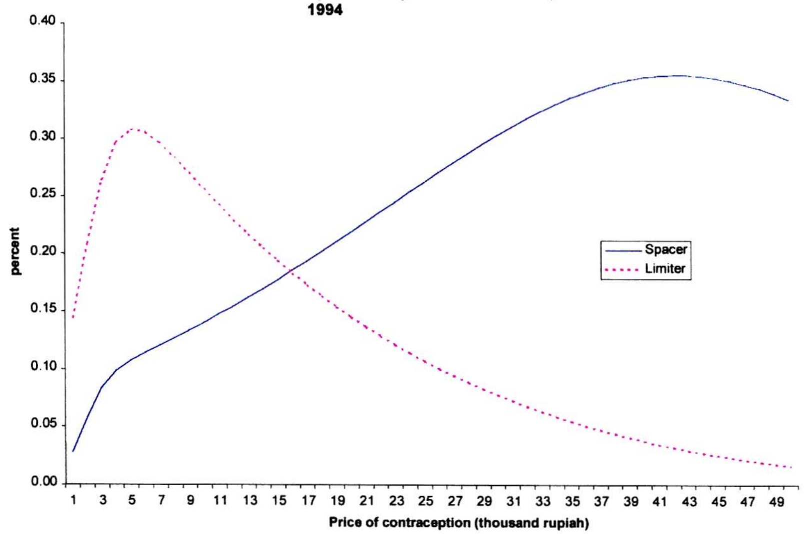
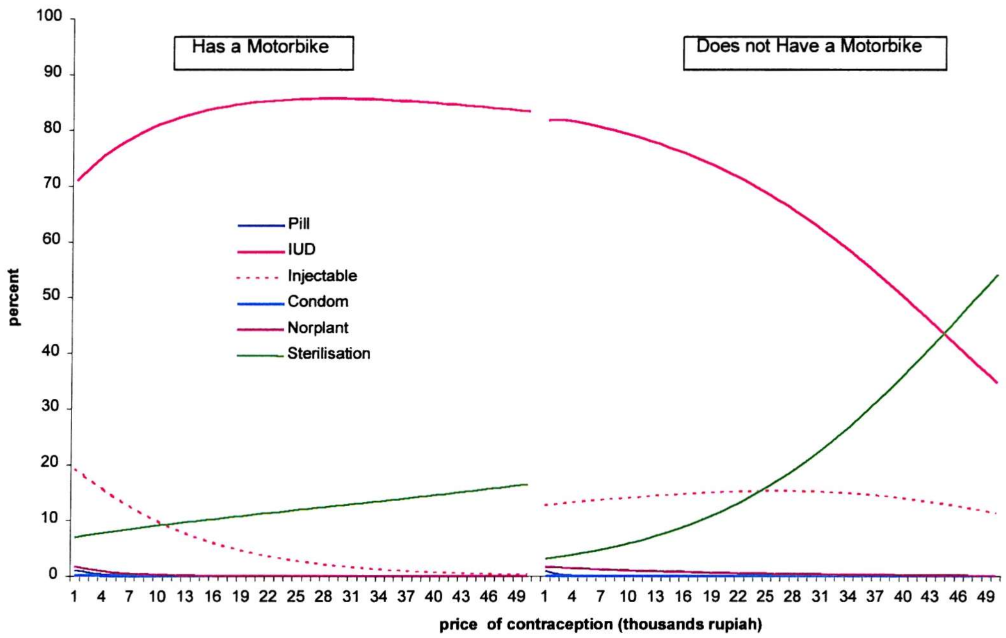



Figure 11.14 Estimated Probability of Using Norplant at Different Level of Price of Contraception by Contraceptive Intention: Bali, 1994



The impact of the price of contraception on choice of contraception was different between a household which owns a motorbike and one which does not own one. This ownership indicates household assets. Figure 11.15 shows different patterns of estimated probabilities of choosing a method of contraception at different levels of price of contraception between households having a motorbike in the left panel and households not having a motorbike in the right panel. It can be seen from this figure that at every price of contraception those who had a motorbike were most likely to choose the IUD. The highest probability of choosing the IUD also appeared among users who did not have a motorbike, but when they had to pay much more money they were most likely to choose sterilisation.

**Figure 11.15 Estimated Probability of Choosing a Method of Contraception given Price of Contraception by Ownership of a Motorbike: Bali, 1994**




Figures 11.16-11.21 are derived from Figure 11.15. They present the different patterns of estimated probability of each method for different levels of price of contraception by ownership of motorbike. The probability of using the pill was lower for women who did not have a motorbike than those who had a motorbike (Figure 11.16). When the price was lower than 8,000 rupiah, the probability of choosing the IUD was higher for women who had a motorbike than those who did not have a motorbike, and then the pattern reversed for prices higher than 8,000 rupiah (Figure 11.17).

In general, the likelihood of using a method declined with the increase in the price of contraceptive, regardless of whether she had a motor bike or not. An exception is seen for the decision regarding the use of sterilization (Figure 11.16). Among those who did not have any motorbike, an increase in the price of contraceptive was accompanied by an increase in the probability of using sterilization. At price higher than 19,000 rupiah the probability of using sterilization was even larger among those who did not have any motorbike. The gap increased as the price rose.

If ownership of a motorbike can represent wealth, then the relatively less wealthy tended to shift to sterilization more than those who were wealthier. This result may reveal that the relatively poorer had to struggle more with financial matters and that they could not afford to have more children. Therefore, it was better for them to spend a larger amount of money for sterilisation at one time, and then there would be no more spending for contraception; rather than pay a lower price repeatedly in the future.

Figure 10.16 Estimated Probability of Using Pill at Different Level of Price of Contraception by Ownership of a Motorbike: Bali, 1994

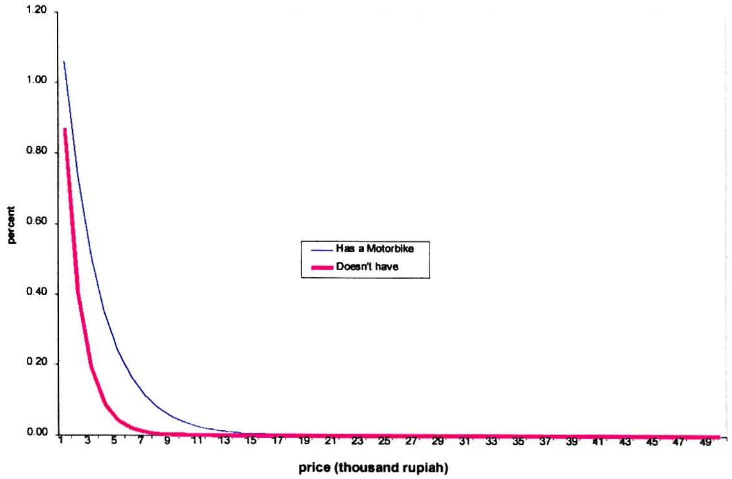



Figure 10.17 Estimated Probability of Using IUD at Different Level of Price of Contraception by Ownership of a Motorbike: Bali, 1994

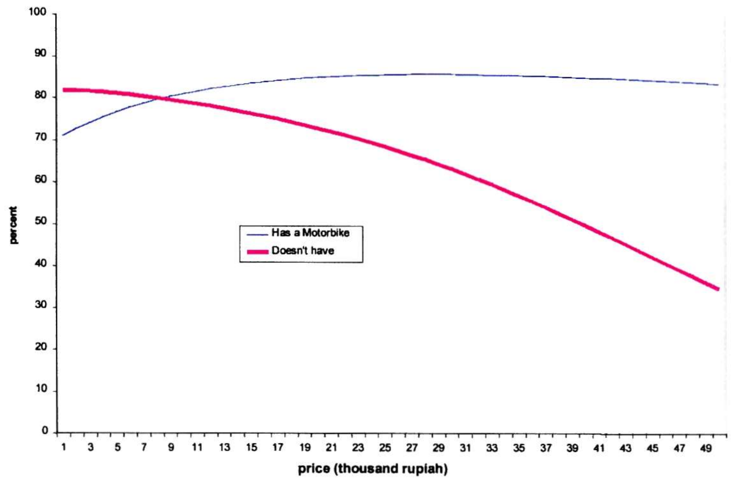



Figure 10.18 Estimated Probability of Using Injection at Different Level of Price of Contraception by Ownership of a Motorbike: Bali, 1994

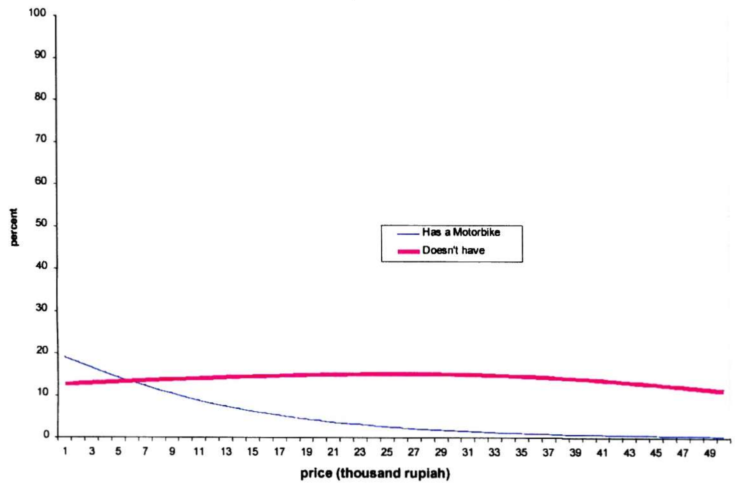



Figure 10.19 Estimated Probability of Using Sterilisation at Different Price of Contraception by Ownership of a Motorbike: Bali, 1994

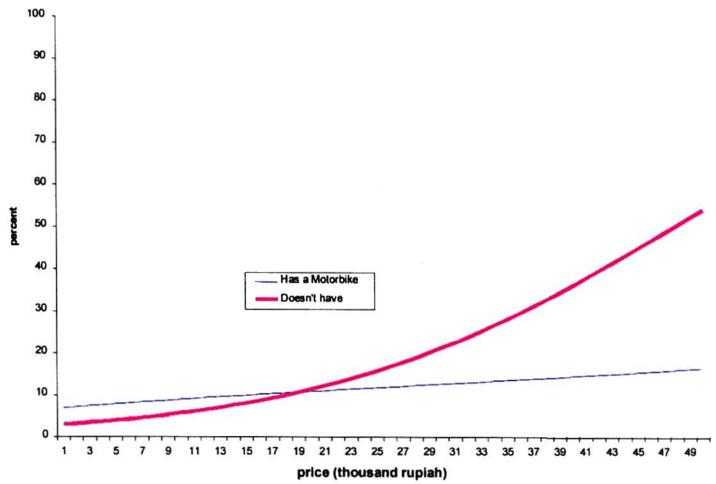


Figure 11.20 Estimated Probability of Using Condom at Different Level of Price of Contraception by Ownership of a Motorbike: Bali, 1994

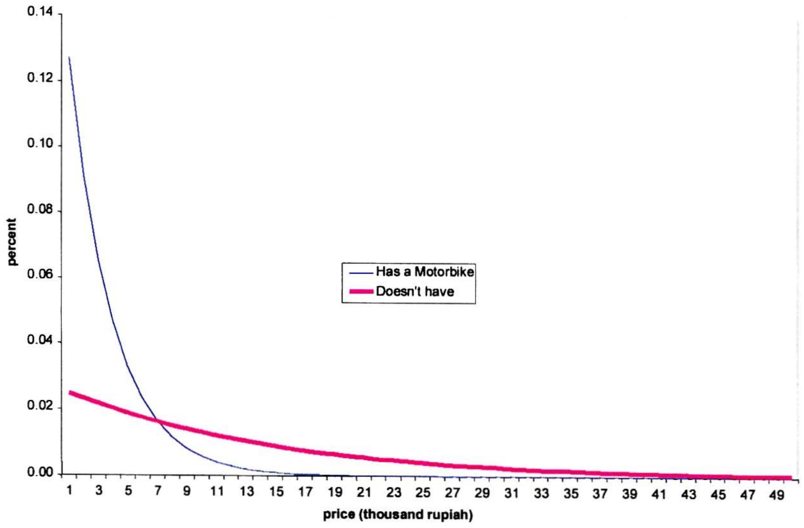
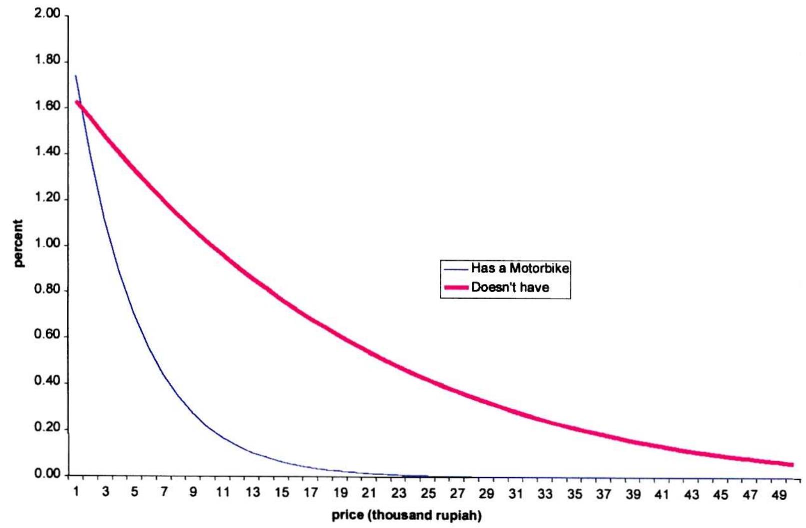



Figure 11.21 Estimated Probability of Using Norplant at Different Level of Price of Contraception by Ownership of a Motorbike: Bali, 1994



## 11.4 Impact of Non-Price Variables on Choice of Contraception

As shown in Tables 11.3 and 11.4, the choice of contraception was associated with other variables such as the presence of durable goods in the household, as an indicator of the household's socio-economic status. Table 11.5 indicates that in 1991 women in households equipped with stoves were less likely to choose sterilisation; but Table 11.4 shows that in 1994 other socio-economic indicators, such as source of drinking water, had a significant effect (p<5%) on the choice of contraception. It is found that the better off households, which used piped water as the source of drinking, were less likely to choose sterilisation compared to those having water from the surface or rainwater. Further, the less educated women (some primary or no schooling) were more likely to use sterilization. This might indicate that sterilisation through the government programme was given to the poor people as they might already have larger family sizes. The use of the IUD was higher among more educated women and so was the use of injectables. Use of condoms was also higher among educated women.

Table 11.5 Estimated Probability of Choosing a Particular Method of Contraception By Background Variables: Bali, 1991

| | Pill | IUD | Injectable | Condom | Norplant | Sterilization | Total |
|---|---|---|---|---|---|---|---|
| **Has a stove** | | | | | | | |
| Yes | 3.03 | 72.13 | 17.33 | 0.83 | 0.69 | 6.00 | 100 |
| No | 5.73 | 73.92 | 11.17 | 0.09 | 0.25 | 8.84 | 100 |
| **Main reason for use** | | | | | | | |
| Method-related | 4.86 | 70.80 | 16.29 | 0.30 | 0.35 | 7.40 | 100 |
| Recommended | 3.56 | 79.73 | 8.10 | 0.11 | 0.45 | 8.04 | 100 |
| **Woman's education** | | | | | | | |
| Some Primary* | 6.24 | 70.90 | 12.77 | 0.10 | 0.31 | 9.68 | 100 |
| Primary & above | 2.76 | 76.57 | 14.12 | 0.70 | 0.50 | 5.36 | 100 |
| **Visited by FP worker** | | | | | | | |
| Visited | 5.53 | 71.91 | 15.28 | 1.17 | 2.38 | 3.73 | 100 |
| Not visited | 4.32 | 73.69 | 13.11 | 0.18 | 0.29 | 8.40 | 100 |
| **Heard of Blue Circle Campaign** | | | | | | | |
| Ever heard | 1.22 | 73.30 | 15.01 | 0.21 | 0.39 | 9.87 | 100 |
| Never heard | 7.82 | 72.43 | 12.49 | 0.23 | 0.37 | 6.66 | 100 |
| **Religion** | | | | | | | |
| Hindu | 4.19 | 74.99 | 12.83 | 0.20 | 0.30 | 7.51 | 100 |
| Non Hindu | 9.98 | 38.83 | 20.63 | 1.97 | 21.46 | 7.13 | 100 |

Note : * this group include women with no schooling
Calculated using MCA based on Table 10.3

The reason women choose their current methods are also important for the family planning programme. The reasons are grouped into two: whether the women used the method as recommended by family workers, friends or relatives or because their husbands preferred to the methods; whether the women used the method because method-related reasons such as wanted more effective method, wanted permanent method, side effect of other method, convenience, accessibility and availability. The IUD and Norplant were chosen more because of recommendation by other people than because of the method itself. However, the choice of injectable was more likely because of method-related reasons.

The choice of contraception is not only affected by its price but also strongly determined by users' taste. For instance, Hindus had different preferences compared to non-Hindus. Tables 11.5 and 11.6 show that the Hindus relied heavily on the choice of the IUD, but the non-Hindus chose more variety of methods.

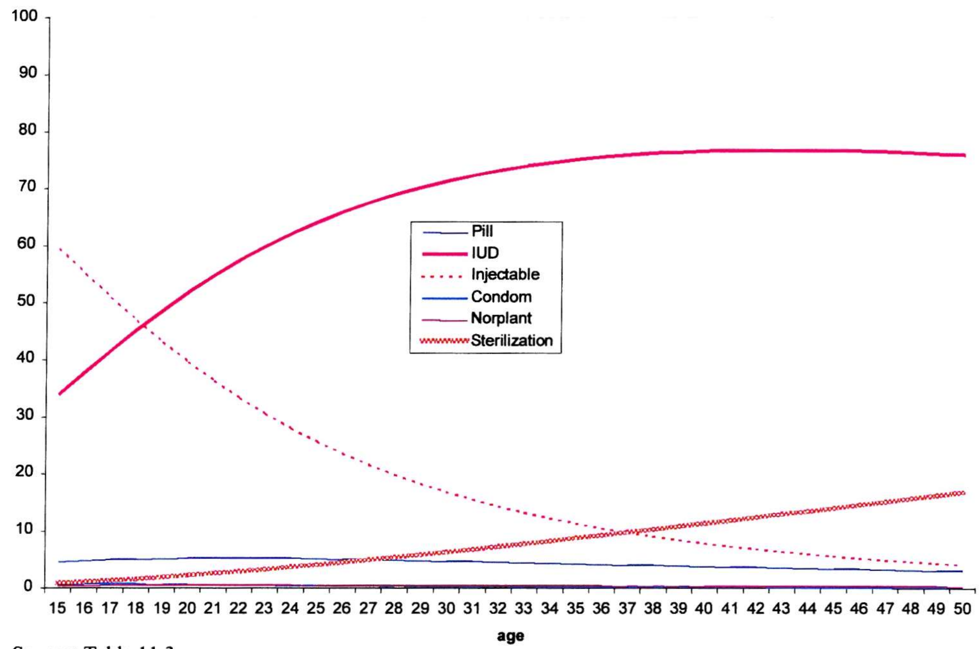
Table 11.6 Estimated Probability of Choosing a Particular Method of Contraception By Background Variables: Bali, 1994

| | Pill | IUD | Injectable | Condom | Norplant | Sterilisation | Total |
|---|---|---|---|---|---|---|---|
| **Source of drinking water** | | | | | | | |
| Piped | 0.00 | 84.34 | 10.33 | 0.01 | 0.10 | 5.22 | 100 |
| Well | 0.00 | 80.49 | 11.67 | 0.00 | 0.26 | 7.58 | 100 |
| Surface | 0.00 | 81.08 | 6.70 | 0.00 | 0.38 | 11.84 | 100 |
| **Main reason for use** | | | | | | | |
| Method-related | 0.00 | 79.18 | 10.65 | 0.00 | 0.20 | 9.96 | 100 |
| Recommended | 0.00 | 90.49 | 5.43 | 0.00 | 0.33 | 3.75 | 100 |
| **Number of living children** | | | | | | | |
| 0-2 | 0.00 | 88.06 | 7.17 | 0.00 | 0.29 | 4.48 | 100 |
| 3+ | 0.00 | 72.07 | 11.95 | 0.01 | 0.16 | 15.81 | 100 |
| **Woman's education** | | | | | | | |
| Some Primary* | 0.00 | 80.26 | 8.44 | 0.00 | 0.13 | 11.16 | 100 |
| Primary + | 0.00 | 83.92 | 10.03 | 0.01 | 0.40 | 5.64 | 100 |
| **Religion** | | | | | | | |
| Hindu | 0.00 | 84.12 | 7.74 | 0.00 | 0.18 | 7.96 | 100 |
| Non Hindu | 0.01 | 55.31 | 35.52 | 0.02 | 1.97 | 7.18 | 100 |

Note : * this group include women with no schooling
Calculated using MCA based on Table 10.4

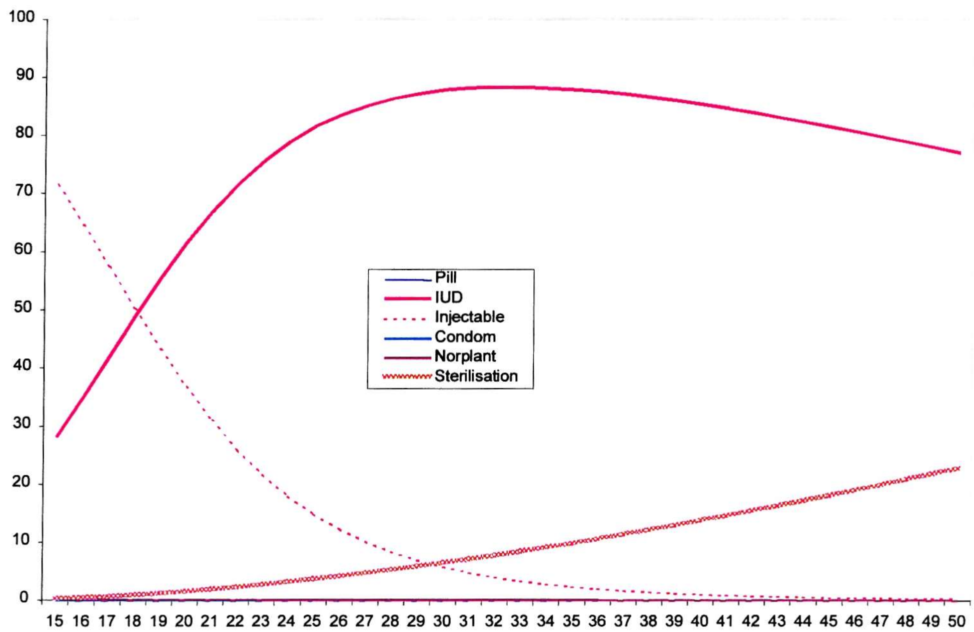
Woman's age had a significant effect on the choice of contraceptive method. Figures 11.22 and 11.23 present the estimated probability of choosing a particular method for each single age of reproductive between 15 to 50 years old. As shown from these figures, the younger the women the more likely did they choose injectables than other methods. The older the age of the users, the more likely they choose the IUD and sterilisation.

**Figure 11.22 Impact of Woman's Age on Choice of Contraceptive Method: Bali, 1991**




Source: Table 11.3

**Figure 11.23 Impact of Woman's Age on Choice of Contraceptive Method: Bali, 1994**




Source: Table 11.4

The Information, Education and Communication (IEC) activities, which aim to disseminate information about family planning and to institutionalise the 'small, happy, and prosperous family' norm, are operated by family planning workers at the grassroots level. These workers play a very important role in the IEC component of the family planning programme. The present research finds that the visit made by family planning workers in the preceding six months had a significant effect on the choice of contraception. There are variations in the probability of choosing contraception among users who were visited by the family planning worker. Table 11.5 shows that the use of the pill, condom, injectable and Norplant were higher among those who were visited by the family worker. Those who were not visited by the family worker relied more on the IUD and they were also more likely to choose sterilisation.

Blue Circle campaign is an IEC (Information, Education and Communication) for a self-reliant family planning movement (KB Mandiri) activity. The concept and campaign encourages users to take their responsibility for their own family planning needs, including payment for methods and services. This approach is based on the belief that users seek family planning services because of some fundamental motivation for a better life of their family. It is found that the knowledge of the Blue Circle is significantly associated with choice of contraception. As shown in Table 11.5, those who had heard about the Blue Circle were more likely to use the IUD, injectables, Norplant and sterilisation than those who had never heard of it. On the other hand, those who had never heard about the Blue Circle were more likely to use the pill than those who had heard.

The choice of method of contraception was also associated with the number of living children. As expected, the probability of choosing sterilisation was higher for those who had already more than three children than those who had fewer living children. However, injectables is also preferred by those who had more than three living children.

## 11.5 Summary

This chapter basically studies variables associated with current contraceptive choice in Bali using the 1991 and 1994 IDHS. One of the variables being studied is price of contraception, because price of contraception and choice of contraceptive use may have a two-way causal relationship. Therefore, a test for endogeneity is first performed using a two-stage estimation.

Endogeneity is found in the 1991 data set, but there is no endogeneity in the 1994 data set. Hence, the interpretation of the effect of changes in price of contraception on choice of contraception controlled for other variables is based on the two-stage estimation for the 1991 data set and based on a single-equation model for the 1994 data set.

It is found that price of contraception has a significant effect on choice of contraception in 1991 and 1994. However, the effect of price on choice of contraception is also complicated by other variables such as number of living children in 1991; contraceptive intention and ownership of a motorbike in 1994.

Among those who had three or more children, an increase in price of contraception was followed by a shift from IUD to sterilisation. On the other hand, among those with less than three children, as the price increased the probability of using any contraception did not change very much, with IUD as the most likely chosen contraceptive. Regardless of the intention of use, an increase in price was more likely to be followed by a shift to sterilisation.

Whether users have or do not have motor bikes, the probability of choosing a method declined with the increase in the price of contraception in 1994. An exception is found for choosing sterilisation. Among those who did not have any motor bike the probability of choosing sterilisation increased as the price increased and the probability became higher than those who had a motor bike.

Woman's education, woman's age, and number of living children were other variables associated with choice of contraception in 1991 and 1994. Visited by family workers and also having heard about Blue circle were associated with choice of contraception in 1991. Other variables significantly associated with choice in 1994 are source of drinking water, contraceptive intention and religion.

# Chapter 12

# CLOSING REMARKS

## 12.1 Contraceptive Use Dynamics

Fertility in Indonesia had been impressively declining for two decades before 1990 and some provinces such as Bali had even achieved below replacement level since early 1990s. This fast decline was mainly a result of an increase in modern contraceptive use. However, very little is known about measurements of contraceptive use dynamics and its determinants in the country and particularly in the provinces. As contraceptive use increased and had reached a high prevalence, contraceptive continuity/discontinuity had been becoming an increasingly important issue. Further, when couples already desire to have their ideal small number of children, the issue is no longer on whether to use or not to use contraception, but more on when and why to discontinue and what method to switch to.

This research aims at contributing better understanding on the dynamics of contraceptive use, in particular as related to discontinuation, switching, and choice of contraceptive. It utilizes the opportunity from the availability of the calendar approach, which has been utilised in the Indonesia Demographic and health Survey (IDHS) since 1991, to collect information on birth and contraceptive histories for five-six years before the survey. This information is used to investigate contraceptive behaviour in discontinuation and switching.

## 12.2 Deficit Fertility

This analysis on contraceptive use dynamics is preceded with a macro analysis on deficit fertility in Indonesia. The Bongaarts and Kirmeyer's approach (1982) and Curtis and Diamond's approach (1995) are used to examine deficit fertility in Indonesia and its provinces. Findings from Samosir's study (1994) are used to compare with the 1991-94 data. Deficit fertility is defined as a lower observed total fertility rate (TFR) than the expected TFR, given the contraceptive prevalence. The data show that deficit fertility in Indonesia was high, about 1.1 children in 1988-91 and 0.95 in 1991-94.

The macro-analysis on deficit fertility in Indonesia and its provinces are conducted to enhance knowledge on relationship between fertility and contraceptive use. It also provides a better background for the analysis on the contraceptive use dynamics. Using aggregate level data (province) the analysis examines fertility determinants other than contraceptive prevalence. It analyses the lagged effects of changes in contraceptive use which might not yet have resulted in changes in TFRs, whether marriage patterns are commensurate with observed contraceptive prevalence, whether women breastfed longer than expected given observed contraceptive prevalence, and whether contraceptive effectiveness is higher than expected. This study finds that marriage, breastfeeding, and use effectiveness could completely explain the deficit fertility in Outer Java-Bali I. In the other two regions (Java-Bali and Outer Java-Bali II) and Indonesia as a whole there were still some deficit, which could possibly be due to the effects of relative levels of fecundity, coital frequency, other proximate determinants of fertility as well as sampling and measurement errors.

In all regions (Java-Bali, Outer Java-Bali I, and Outer Java-Bali II) use effectiveness was the main determinant in explaining their deficit fertility. In addition to this factor, in the Java-Bali region, where the family programme was initially implemented, a longer mean duration of breastfeeding helped explaining the deficit fertility. Longer mean duration of breastfeeding and later marriage were the two other factors which explained the deficit fertility in Outer Java-Bali I. Unlike the two other regions, in Outer Java-Bali II, contraceptive effectiveness was the only factor explaining deficit fertility in 1988-1991, while in 1991-1994 contraceptive effectiveness and marriage pattern contributed in explaining the deficit fertility.

The deficit fertility varies across provinces both in 1988-91 and 1991-94. Irian Jaya had the largest deficit, 2.60, in 1988-91; and Central Kalimantan, 2.14, in 1991-94. The lowest deficit fertility was seen in East Timor (0.14) in 1988-1991 and North Sulawesi (0.04) in 1991-94. The small deficit in both provinces may imply that contraceptive prevalence had played the dominant role in explaining fertility variation in both provinces, relative to the other 25 provinces in Indonesia. In these 25 provinces at least one of four determinants other than contraceptive prevalence could explain the deficit fertility.

Therefore, there were various factors affecting deficit fertility in Indonesia and its provinces. In addition to contraceptive prevalence, use effectiveness has been shown to be a more important variable in explaining fertility variation. Therefore, the fertility impact of contraceptive use depends not only on its prevalence but also, and more importantly, on the use effectiveness. Nevertheless, the information on use effectiveness has not yet available from the actual data, especially for provinces. Hence, the following analyses focus to some aspects of contraceptive effectiveness, namely the contraceptive use dynamics, covering contraceptive discontinuation (and failure), contraceptive switching, and contraceptive choice.

## 12.3 Methods of Analyses

A number of approaches were used throughout the analysis of contraceptive use dynamics in this thesis. Single-decrement, multiple-decrement and associated single-decrement life table approaches are firstly utilised to estimate measurements of contraceptive use dynamics in Indonesia as a whole by incorporating provinces and some background variables. However, these approaches become infeasible when the effects of a large number of variables are examined simultaneously. A hazard model is therefore used to examine variables associated with contraceptive discontinuation and switching behaviour after discontinuation. A discrete time hazard model is considered because of a number of reasons: duration of use of contraception is measured in discrete-time, i.e. it is recorded to the nearest month, and the large number of ties, i.e. there were many individuals experiencing discontinuation or switching at the same duration of use. By modelling duration to be discrete, the models can be fitted using any computer software dealing with categorical response data. In the analysis of discontinuation, each episode of use is categorised into 5: failure, desire to get pregnant, side effects and health concerns, other reasons, and still using. Whereas in the analysis of switching behaviour after discontinuation, each episode of use is recorded into 4: switching to another method, abandoning, being not in need for contraception, and continuing original method. Discrete time competing risks hazard models is used in both analyses.

This model, however, assumes that all variation in the hazard rate can be explained by the variables in the model. In most situation, such an assumption is untenable as there may be omitted variables that have not been observed or are unobservable. Further, a woman may contribute more than one episode of use and the episodes may be associated with each other. Apart from these, the sample of IDHS was selected in three stages. The first stage of sampling unit is enumeration area, generally known as a cluster. Therefore, the population is divided into clusters that are randomly selected. Moreover, individuals who are selected from the same cluster are expected to share similar attitudes and values. In other words, individuals from different cluster (community) may have different behaviour. To take into account these extravariation between women and clusters, a series of multilevel models are performed to the analyses of contraceptive discontinuation and switching behaviour after discontinuation.

A simultaneous equation model is carried out in the analysis of contraceptive choice. This analysis basically studies variables associated with current contraceptive choice. However, one of the variables being studied is price of contraception. Price of contraception and choice of contraceptive use may have a two-way causal relationship. Therefore, a test for endogeneity is first performed using a two-stage estimation. There are two equations in the system which are price equation and method equation. Price of contraception is treated as a continuous variable, while method of contraception as a categorical variable.

in the first stage of the studies of contraceptive discontinuation and switching behaviour, information from the calendar data is extracted to produce episodes of various events, such as episodes of use of contraception, episodes of not using contraception, and episodes of pregnancy. However, units of analysis for studies on discontinuation and switching are episodes of use only. To study the changes in transition from one state to another state, the episodes are linked with previous and subsequent episode status. After linking with the episode status, the episodes (segments) of use are then linked with background variables. Almost all the answers of questions in the DHS questionnaire are referred to the time of the survey, while information from the calendar data are referred back to 5-6 years before the survey. Therefore, the variables used in the analysis are limited: method of use, woman's age at the start of episode of use, number of living children at the start of episode of use, contraceptive intention at the start of episode of use, previous experience of contraception in the month immediately before the episode of use, place of residence, woman's and husband's education, region, and province. The measurements of contraceptive use dynamics are then estimated using a life table approach. However, challenges remain to using the multilevel discrete time competing risks hazard model with large data sets for the analysis on determinants of discontinuation and switching in Indonesia. By focussing the analysis on Bali province the data sets for the model fitted become manageable.

Bali is also the focus for the analysis of contraceptive choice. Unlike information used for analyses of discontinuation and switching behaviour, the information used for this analysis is based on information at the time of the survey from current users of modern methods of contraception. Examining the effect of price of contraception on choice of contraception is of interest for this analysis. Because there is no information on price for using traditional methods, users of traditional methods are not considered in the analysis. The information on choice of current contraception is based on question number 315 in the 1991 IDHS and question number 312 in the 1994 IDHS. In the 1991 IDHS the price of contraception is generated from question number 325B 'How much does (did) it cost you for ...'. This question is related to the current method answered in question 315. In 1994 IDHS the price is asked on question number 317, which is related to question number 312. In the 1991 IDHS, the price is recorded as one variable, which consists of price of method and also price of the service and registration fee, if any. However, in the 1994 IDHS, the price is recorded into two variables: price of method, and price of the service and registration fee, if any. For consistency, the two prices are combined into one variable.

## 12.4 Empirical Results

First, the results for measurements of contraceptive discontinuation reveal that overall one-year cumulative probabilities of discontinuation for Indonesia as a whole remained unchanged from 1986-91 to 1989-94 (about 30%). As expected, among methods, condom had the highest probability to discontinue and Norplant had the lowest. While pill discontinuation rate for one-year after initiation of use slightly increased from 30.4% in 1986-91 to 34.0% in 1989-94, and so did herbs (from 25.7% to 39.1%); but rates for Injectable, abstinence and withdrawal decreased. IUD, Norplant and condom were unchanged.

Discontinuation also varied among provinces. In 1986-91 discontinuation rate ranged from 11% (East Nusa Tenggara) to 39% (Jambi), while in 1989-94 the rate ranged from 17% (Central Kalimantan) to 37% (Bengkulu). Eleven out the 27 provinces did not seem to have different one-year discontinuation rates over the two periods, seven (Yogyakarta, East Java, Riau, Jambi, South Sumatra, Central Kalimantan, and Maluku) experienced declining discontinuation rates, and nine (Bali, East Nusa Tenggara, Bengkulu, North Sumatra, South Sulawesi, North Sulawesi, Central Sulawesi, South Kalimantan, and Irian Jaya) had increasing discontinuation rates. Among provinces in Java-Bali region, Bali's discontinuation rates were the lowest and the rates increased from 20% in 1986-1991 to 25% in 1989-1994 for one year after initiation of use. However, the rates for other provinces in this region decreased.

Discontinuation rates also varied across subgroups of the population. More educated women were more likely to discontinue than less educated women. However, more educated women were more likely to switch to another method. This might indicate that women with higher education were more likely to choose less effective methods. It was found that more educated women were more likely to use condom and traditional methods while lower educated women, especially women with no education, were more likely to use Norplant and sterilisation. However, lower educated women with lower effective methods were more likely to abandon use than higher educated women.

Women with higher education also tended to be concentrated in urban areas. This study finds that urban users were more likely than rural ones to discontinue contraceptive methods. This may also indicate that urban users might have more choice of methods of contraception, or that the family planning programme implementation in Indonesia was more focused to introduce more effective methods for rural users. It is found that rural users were more likely to use Norplant than urban users, while urban users were more likely to use condoms and traditional methods. Rural users were more likely to be monitored by the family planning workers. The findings from analysis of contraceptive switching after discontinuation in Chapter 8 confirmed the higher probability of switching to another method in urban areas than in rural areas.

The older the woman the less likely she was to discontinue. Apart from this, the older the woman the less likely she was to switch to another method. One explanation for this is the probable increase in the woman's motivation either for spacing or limiting fertility as age increases. The results show that discontinuation due to desire to get pregnant declined as age increased. The older women were more likely to use more effective methods such as IUD, Norplant and sterilisation.

The most common reasons for discontinuation within one year of initiation of use in Indonesia were side effects and health concerns (11%) followed by desire to get pregnant (6%). Except for condom users, other modern method users mostly discontinued because of side effects and health concerns. Regardless of background characteristics of the users, side effects and health concerns were the most common reasons for discontinuation over time. Educated women were more likely to discontinue due to side effects and health concerns than less educated women.

Contraceptive failure may result directly in unwanted pregnancies and contribute to fertility if the pregnancy is not aborted. High failure rates may indicate weakness in the family planning programme in providing information about correct use of methods. Examination of differentials in contraceptive failure rates helps to identify groups of users who have difficulty using particular methods effectively. In this study, contraceptive failure is defined as use-failure (method failure and improper use). The failure rate of all reversible methods in Indonesia as a whole did not seem to be different from 1986-91 to 1989-94 at about 3.5%. The highest rate was for condoms, and the highest failure rate among hormonal methods was the pill. The injectable failure rate was quite similar to the IUD. Norplant had the lowest failure rate. The pill failure rate increased from 3.5% in 1986-91 to 5.0% in 1989-94. A big decrease (from 14.4% to 7.9%) was seen in the condom failure rate.

Higher failure rates were found among educated women, urban women and also young women. Higher failure rates among young women may be related to their fecundity. Higher failure rates among educated women and urban women, as mentioned before, were related to the contraceptive method they chose and that they chose less effective methods.

Failure rates were generally low among provinces. The failure rate within one year of initiation of use in 1986-91 varied from 7.1% in Yogyakarta to 0.5% in Central Kalimantan. In 1989-94 the highest rate was 5.6% (Yogyakarta) and the lowest was 1.0% (Central Kalimantan). Between the two periods, failure rates in West Java, East Java, Bali, Lampung, South Kalimantan, Central Kalimantan, North Sulawesi, South Sulawesi, Central Sulawesi, East Nusa Tenggara and Irian Jaya increased. Moreover, Bali, along with North Sulawesi, had the second highest increase in failure rate with about 3 percentage points over the two periods. Irian Jaya had the highest increase with more than 4 points from 1.1 in 1986-91.

Indonesian discontinued users mainly consisted of those who were still in need of contraception, that is, those who switched to alternative methods or to non-use while they were at risk of an unwanted pregnancy. The rate of switching to another method within a year of initiation of use was about 11% in both periods and the rate of abandoning use was 8% in 1986-91 and 7% in 1989-94. Users who discontinued from the pill or Norplant but still had a need for contraception were more likely to abandon than to switch to another method. On the other hand, those who discontinued from the IUD, injectables and condoms, as well as abstinence and condom, but still had a need were more likely to switch than to abandon.

The findings from multilevel discrete time competing risks hazard model for discontinuation in Bali found that duration of use and contraceptive method chosen were strongly associated with the risk of discontinuation although not always in each reason for discontinuation in both 1991 and 1994 sets. Duration of use was positively associated with discontinuation because of desire to become_pregnant, but negatively associated with discontinuation because of other reasons in both periods. Duration of use was negatively associated with side effects and health concerns in 1986-91 only. Users of modern methods had consistently lower rates of discontinuation than users of less effective methods. Overall, these results suggest that method choice and methods characteristics played an important role in contraceptive discontinuation behaviour.

A series of socio-economic and demographic factors were associated with reasons for discontinuation. However, contraceptive intention, as do more proximate characteristics of contraceptive users, tends to have strong relationship with each reason for discontinuation. Over time women who used contraception for limiting future births were more likely to discontinue contraceptive use due to desire to become pregnant or due to experience side effects and heath concerns than those who used contraception for spacing. Spacers in 1986-91 were more likely to experience a contraceptive failure than limiters. Spacers were more likely to discontinue due to other reasons than limiters in 1989-94.

The probability of discontinuation due to side effects and health concerns was associated with contraceptive intention. Husband's education and previous experience with contraceptive use were other variables associated with the probability of discontinuation due to side effects and health concerns in 1989-94. Age at the start of use was negatively associated with these reasons for discontinuation in 1986-1991. Contraceptive intention was associated with contraceptive failure in 1986-91 and also with desire to become pregnant in both periods. Spacers were more likely than limiters to experience contraceptive failure. Spacers were more likely than limiters to discontinue due to desire to become pregnant. Either wife's education or husband's education and also place of residence had an association with contraceptive failure in 1989-94.

After controlling for other factors, contraceptive discontinuation rose over time although it decreased for some groups of women. The risk of discontinuation from those who had immediately had a birth or a termination was more likely to decrease than that of other groups. Similarly, the finding was also observed among those who had had more than four living children. In addition, those who were using injectables had lower risk of discontinuation.

Even after controlling for a range of covariates, substantial unobserved heterogeneity remained for contraceptive failure in 1989-1994. This could be a result of the absence of variables indicating fecundability. The random effect at woman level has also a strong effect on the risk of discontinuation due to other reasons. A possible factor that may explain at least part of the unobserved heterogeneity was the frequency of coitus along with fecundability. The opinion of the husbands in relation to male dependent methods could also explain part of the unobserved variation for discontinuation due to other reasons.

The aim of the analysis of switching behaviour to investigate changes in status of contraceptive use after discontinuation. Of most interest to family planning workers and policy makers is switching to another method or abandonment while the women were at risk of an unintended pregnancy, because these types of transition are likely to affect the level of fertility. However, switching from any modern method to less effective methods and switching from any reversible method to sterilization was uncommon in Bali. Therefore, switching after discontinuation a method was only found among reversible methods. The rate of abandonment was generally lower than switching from any method to another method. Age at the start of use, number of living children, woman's level of education, and contraceptive intention all affect switching behaviour and abandonment after discontinuation. Among women with more than four living children there was an indication of unsatisfied need for contraception.

The 1986-91 data shows that there was no evidence for unobserved heterogeneity, but the 1989-94 data reveals significant unobserved heterogeneity in particular for switching to non-use while users were at risk of an unintended pregnancy. The probability of abandoning was low, but a large number of unexplained variations at woman level had an important effect on abandoning. The 1986-91 data shows that there was no evidence for unobserved heterogeneity, but the 1989-94 data reveals significant unobserved heterogeneity in particular for switching to non-use while users are in need. The probability of abandoning within one year of initiating use ranges from 0.001 if the random effect at the woman level is two standard deviations below the mean to 0.325 for similar woman with the random effect is two standard deviations above the mean. Within two years since initiating use the probability ranges from 0.003 to 0568. These two ranges overlap considerably. It is possible that a high-risk woman who had successfully continued use for one year had a higher chance of abandoning than a woman with similar characteristics who had been using a method for 2 years, but who was in the low-risk category. Woman's commitment and motivation to practise family planning as well as access to a range of available methods may have been the variables that potentially affect abandoning.

From the analyses of contraceptive discontinuation and switching using multilevel discrete time competing risks hazard models reveal that there was no strong evidence on the existence of the random effects at cluster level. The decision to discontinue contraceptive methods and the decision after discontinuation to switch largely depended on individuals and relatively unaffected by the behaviour of others in the community

From the descriptive analysis, cost is only mentioned by 1% of users as the reason for discontinuation in Bali. Meanwhile, in the analysis of determinants of discontinuation, cost is included in the category of 'other reasons'. The result shows that the highest probability of "other reasons" for discontinuation is found among those who use traditional methods. Therefore, cost was not the reason for discontinuation from modern methods. On the other hand, the analysis on determinants of switching finds that overall probability of abandoning while in need was very low (about 3% in both periods). In other words, the users in Bali seem committed to use contraception. Lastly, the final study analyses the determinants of modern contraceptive choice with a focus on the effect of price of contraception. As contraceptive choice and its price are interdependent, a system of simultaneous equations exists and a two-stage estimation is therefore used. However, endogeniety is found in the 1994 data set only, and not in the 1991 data set. In the 1991 data set contraceptive choice did not affect price of contraception and hence the estimation of the determinant of contraceptive choice uses a single equation, rather than a simultaneous equation, model. For the 1994 data set, a simultaneous equation model is performed to find the determinants of contraceptive choice.

The result shows that price of contraception had a significant effect on choice of modern contraception in 1991 and 1994. Furthermore, the effect of price of contraception depended on the number of living children in 1991, while in 1994 depended on contraceptive intention and ownership of a motorbike. In 1991 among women with less than 3 children the increase in price of contraception remained relatively unchanged in the probability of choice of contraception. On the other hand, among those who had at least three children, an increase in price of contraception tended to be followed with a shift toward the use of pill, sterilisation, and condom (only if the price of condom was less than 21,000 rupiah).

For those who had less than three children, and an increase in the price of contraception was accompanied by a reduction in the probability of using any method. This finding may reveal that an increase in price of contraception might have a fertility promoting effect among those who had less than three children in Bali 1991. They might still want to have more children, and hence an increase in the price of contraception induced them not to use contraception.

In 1994, on the other hand, an increase in the price of contraception tended to be followed with a shift toward the use of sterilisation and Norplant (among spacers only). When the price was still low (less than 5,000 rupiah), an increase in price of contraception shifted use to injection and, for limiters only, to condoms and IUD. Coupled with the results from the discontinuation and switching analyses, the question from the users was not whether they wanted to use contraception or not, but what method. Even if they did not want to use any method, only very few wanted to do so because of the cost of contraception. Further, those who mentioned the cost as a reason not to use any method were those who used traditional methods. Therefore, in 1994, raising the cost of contraception may not reduce the use of contraception in Bali; it may only change the mix of contraceptive use.

Woman's education, woman's age, and number of living children were other variables associated with choice of contraception in 1991 and 1994. Less educated women (some primary or no schooling) were more likely to use sterilization. The younger the women the more likely did they choose injectables than other methods. The older the age of the users, the more likely did they choose the IUD and sterilisation. Visited by family workers and also having heard about Blue circle were associated with choice of contraception in 1991. Visit made by family planning workers in the last six months had a significant effect on the choice of contraception by the family worker relied more on the IUD and they were also more likely to choose sterilisation. There are variations in the probability of choosing contraception among users who were visited by the family planning worker. The probabilities of choosing the pill, condom, injectable and Norplant were higher among those who were visited by the family worker. Those who were not visited by the family worker relied more on the IUD and they were also more likely to choose sterilisation. Other variables significantly associated with choice in 1994 are source of drinking water, contraceptive intention and religion.

## 12.5 Policy Implications

A number of policy implications for Indonesia's family planning programme can be derived from the findings shown in this thesis. This study confirms the importance of contraceptive use dynamics apart from the importance of contraceptive prevalence in examining the success of family planning programme implementation. However, the implementation of the family planning programme in Indonesia has still emphasized use of modern methods of contraception only and has not focused on the dynamics of contraceptive use. This study find that regardless of women's background characteristics, side effects and health concerns played an important role in users' decision to discontinue modern methods of contraception. This implies a need for communicating clear information about the advantages and disadvantages of each method of contraception and how to handle the disadvantages.

Levels of education, either woman's or husband's, have important socio-economics differentials in contraceptive use dynamics in Indonesia as a whole. As more people reach higher levels of education, they will be more likely to have better access to better information on contraception. In addition, more educated people tend to be younger and more fecund. Therefore, there is a rising need for better information related to failure of contraception. On the other hand, the need for better choice of contraception for low educated women will help them from abandoning contraception after discontinuation of a particular method.

The family planning programme also needs to pay more attention into variations between provinces as contraceptive discontinuation and switching behaviour varied across provinces, especially to those provinces with increasing discontinuation and decreasing switching. These phenomena may indicate dissatisfaction of users of contraception to the methods and services of family planning. Because contraceptive use failure also varied across provinces, more attention should be given to provinces such as Bali, East Java and North Sulawesi, with low fertility rates, but with an increase in one year failure rates from 1986-91 to 1989-94. West Java is the most populous province with a quite high fertility rate which had an increase in the failure rate over time. Further, Irian Jaya's fertility rates were as high as West Java, and the failure rate increased. This indicates the choice of more effective modern methods and safe abortion should be made more available. Further, this also indicates the need to educate users on how to use contraception correctly if failure was not caused by the method itself.

Apart from those policy implications mentioned above, changes in price of contraception in Bali will not affect use of contraception but will affect the choice of contraception. Therefore, subsidy of methods of contraception should be shifted to other things related to family planning such as efforts to reduce side effects and health concerns, increase quality and quantity of the supply of contraception, and increase quality and quantity of family planning workers.

This study also confirms an increase in need of sterilisation in Bali for those who had high motivation to use contraception when they had to pay more money to have contraception. On the other hand, an indication of unmet need also existed especially among those who had more than 4 children as abandoning was higher than switching.

## 12.6 Further research

Side effects and health concerns were the most common reasons for discontinuation of use of modern methods in Indonesia and the majority of the provinces. This finding should be followed by further research to study the types of side effects and health concerns experienced by the users. The highest probability of having side effects and health concerns was injectables, followed by the pill.

This analysis of switching behaviour after discontinuation limits the analysis to those who contribute segments of use of contraception and did not capture those who switched from not using a method to any method of contraception. Analysis of episodes of non-use is beyond the scope of this thesis. Analysing these segments may explain other aspects of contraceptive use.

# APPENDICES

## Appendix A-1. Calendar Questionnaires of the 1991 and 1994 IDHS and Calendar Data Layout

CALENDAR

ONLY ONE CODE SHOULD APPEAR IN ANY BOX.

IN COLUMNS 1 AND 6, ALL BOXES SHOULD BE FILLED IN.

INFORMATION TO BE CODED FOR EACH COLUMN.

COL 1: Births, Pregnancies, Contraceptive Use

- L BIRTHS
- H PREGNANCIES
- E STILLBIRTHS/MISCARRIAGES/ABORTIONS

- 0 NO METHOD
- 1 PILL
- 2 IUD
- 3 INJECTION
- 4 INTRAVAG
- 5 CONDOM
- 6 NORPLANT
- 7 FEMALE STERILIZATION
- 8 MALE STERILIZATION
- 9 PERIODIC ABSTINENCE/CALENDAR
- S WITHDRAWAL
- W OTHER ______________ (SPECIFY)

COL. 2: Discontinuation of Contraceptive Use

- 1 BECAME PREGNANT WHILE USING
- 2 WANTED TO BECOME PREGNANT
- 3 HUSBAND DISAPPROVED
- 4 SIDE EFFECTS
- 5 HEALTH CONCERNS
- 6 ACCESS/AVAILABILITY
- 7 WANTED MORE EFFECTIVE METHOD
- 8 INCONVENIENT TO USE
- 9 INFREQUENT SEX/ HUSBAND AWAY
- B COST
- F FATALISTIC
- M MENOPAUSAL
- C DIVORCED/SEPARATED/WIDOWED
- X IUD EXPELLED
- W OTHER ______________ (SPECIFY)
- T DON'T KNOW

COL. 3: Post-partum Amenorrhea

- X PERIOD DID NOT RETURN
- 0 LESS THAN 1 MONTH

COL. 4: Post-partum Abstinence

- X NO SEXUAL RELATIONS
- 0 LESS THAN 1 MONTH

COL. 5: Breastfeeding

- X BREASTFEEDING
- 0 LESS THAN 1 MONTH
- N NEVER BREASTFED

COL. 6: Marriage/Union

- X IN UNION (MARRIED OR LIVING TOGETHER)
- 0 NOT IN UNION

| | | | 1 | 2 | 3 | 4 | 5 | 6 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | SEP | 01 | | | | | | | 01 | SEP | |
| | AUG | 02 | | | | | | | 02 | AUG | |
| 1 | JUL | 03 | | | | | | | 03 | JUL | 1 |
| 9 | JUN | 04 | | | | | | | 04 | JUN | 9 |
| 9 | MAY | 05 | | | | | | | 05 | MAY | 9 |
| 1 | APR | 06 | | | | | | | 06 | APR | 1 |
| | MAR | 07 | | | | | | | 07 | MAR | |
| | FEB | 08 | | | | | | | 08 | FEB | |
| | JAN | 09 | | | | | | | 09 | JAN | |
| | DEC | 10 | | | | | | | 10 | DEC | |
| | NOV | 11 | | | | | | | 11 | NOV | |
| | OCT | 12 | | | | | | | 12 | OCT | |
| | SEP | 13 | | | | | | | 13 | SEP | |
| 1 | AUG | 14 | | | | | | | 14 | AUG | 1 |
| 9 | JUL | 15 | | | | | | | 15 | JUL | 9 |
| 9 | JUN | 16 | | | | | | | 16 | JUN | 9 |
| 0 | MAY | 17 | | | | | | | 17 | MAY | 0 |
| | APR | 18 | | | | | | | 18 | APR | |
| | MAR | 19 | | | | | | | 19 | MAR | |
| | FEB | 20 | | | | | | | 20 | FEB | |
| | JAN | 21 | | | | | | | 21 | JAN | |
| | DEC | 22 | | | | | | | 22 | DEC | |
| | NOV | 23 | | | | | | | 23 | NOV | |
| | OCT | 24 | | | | | | | 24 | OCT | |
| | SEP | 25 | | | | | | | 25 | SEP | |
| 1 | AUG | 26 | | | | | | | 26 | AUG | 1 |
| 9 | JUL | 27 | | | | | | | 27 | JUL | 9 |
| 8 | JUN | 28 | | | | | | | 28 | JUN | 8 |
| 9 | MAY | 29 | | | | | | | 29 | MAY | 9 |
| | APR | 30 | | | | | | | 30 | APR | |
| | MAR | 31 | | | | | | | 31 | MAR | |
| | FEB | 32 | | | | | | | 32 | FEB | |
| | JAN | 33 | | | | | | | 33 | JAN | |
| | DEC | 34 | | | | | | | 34 | DEC | |
| | NOV | 35 | | | | | | | 35 | NOV | |
| | OCT | 36 | | | | | | | 36 | OCT | |
| | SEP | 37 | | | | | | | 37 | SEP | |
| 1 | AUG | 38 | | | | | | | 38 | AUG | 1 |
| 9 | JUL | 39 | | | | | | | 39 | JUL | 9 |
| 8 | JUN | 40 | | | | | | | 40 | JUN | 8 |
| 8 | MAY | 41 | | | | | | | 41 | MAY | 8 |
| | APR | 42 | | | | | | | 42 | APR | |
| | MAR | 43 | | | | | | | 43 | MAR | |
| | FEB | 44 | | | | | | | 44 | FEB | |
| | JAN | 45 | | | | | | | 45 | JAN | |
| | DEC | 46 | | | | | | | 46 | DEC | |
| | NOV | 47 | | | | | | | 47 | NOV | |
| | OCT | 48 | | | | | | | 48 | OCT | |
| | SEP | 49 | | | | | | | 49 | SEP | |
| 1 | AUG | 50 | | | | | | | 50 | AUG | 1 |
| 9 | JUL | 51 | | | | | | | 51 | JUL | 9 |
| 8 | JUN | 52 | | | | | | | 52 | JUN | 8 |
| 7 | MAY | 53 | | | | | | | 53 | MAY | 7 |
| | APR | 54 | | | | | | | 54 | APR | |
| | MAR | 55 | | | | | | | 55 | MAR | |
| | FEB | 56 | | | | | | | 56 | FEB | |
| | JAN | 57 | | | | | | | 57 | JAN | |
| | DEC | 58 | | | | | | | 58 | DEC | |
| | NOV | 59 | | | | | | | 59 | NOV | |
| | OCT | 60 | | | | | | | 60 | OCT | |
| | SEP | 61 | | | | | | | 61 | SEP | |
| 1 | AUG | 62 | | | | | | | 62 | AUG | 1 |
| 9 | JUL | 63 | | | | | | | 63 | JUL | 9 |
| 8 | JUN | 64 | | | | | | | 64 | JUN | 8 |
| 6 | MAY | 65 | | | | | | | 65 | MAY | 6 |
| | APR | 66 | | | | | | | 66 | APR | |
| | MAR | 67 | | | | | | | 67 | MAR | |
| | FEB | 68 | | | | | | | 68 | FEB | |
| | JAN | 69 | | | | | | | 69 | JAN | |

LAST CHILD BORN PRIOR TO JANUARY 1986

NAME: ______________ MONTH.. ☐☐ YEAR... ☐☐

## CALENDAR

ONLY ONE CODE SHOULD APPEAR IN ANY BOX.

IN COLUMN 1 AND 3 ALL BOXES SHOULD BE FILLED IN.

INFORMATION TO BE CODED FOR EACH COLUMN.

COLUMN 1: Births, pregnancies, contraceptive use

- L LIVE BIRTH
- H PREGNANCY
- K STILLBIRTH/MISCARRIAGE/ABORTION
- 0 NO METHOD
- 1 PILL
- 2 IUD
- 3 INJECTION
- 4 IMPLANT/NORPLANT
- 5 INTRAVAG/DIAPHRAGM/FOAM/JELLY
- 6 CONDOM
- 7 FEMALE STERILIZATION/TUBECTOMY
- 8 MALE STERILIZATION/VASECTOMY
- 9 PERIODIC ABSTINENCE
- T WITHDRAWAL
- M OTHER ______________ (SPECIFY)

COLUMN 2 : Discontinuation of Contraceptive Use

- 0 INFREQUENT SEX/HUSBAND AWAY
- 1 BECAME PREGNANT WHILE USING
- 2 WANTED TO BECOME PREGNANT
- 3 HUSBAND DISAPPROVED
- 4 WANTED MORE EFFECTIVE METHOD
- 5 HEALTH CONCERNS
- 6 SIDE EFFECTS
- 7 ACCESS/AVAILABILITY
- 8 COST TOO MUCH
- 9 INCONVENIENT TO USE
- F FATALISTIC
- M MENOPAUSAL
- C DIVORCED/WIDOWED
- N IUD EXPELLED
- K OTHER ______________ (SPECIFY)
- T DON'T KNOW

COLUMN 3 : Marriage

- X MARRIED
- 0 UNMARRIED

COLUMN 4 : Breastfeeding

- X BREASTFEEDING
- 0 BREASTFEEDING LESS THAN 1 MONTH
- N NO BREASTFEEDING

| | | | 1 | 2 | 3 | 4 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | SEP | 01 | | | | | 01 | SEP | |
| | AGT | 02 | | | | | 02 | AGT | |
| 1 | JUL | 03 | | | | | 03 | JUL | 1 |
| 9 | JUN | 04 | | | | | 04 | JUN | 9 |
| 9 | MAY | 05 | | | | | 05 | MAY | 9 |
| 4 | APR | 06 | | | | | 06 | APR | 4 |
| | MAR | 07 | | | | | 07 | MAR | |
| | FEB | 08 | | | | | 08 | FEB | |
| | JAN | 09 | | | | | 09 | JAN | |
| | DEC | 10 | | | | | 10 | DEC | |
| | NOV | 11 | | | | | 11 | NOV | |
| | OCT | 12 | | | | | 12 | OCT | |
| | SEP | 13 | | | | | 13 | SEP | |
| 1 | AGT | 14 | | | | | 14 | AGT | 1 |
| 9 | JUL | 15 | | | | | 15 | JUL | 9 |
| 9 | JUN | 16 | | | | | 16 | JUN | 9 |
| 3 | MAY | 17 | | | | | 17 | MAY | 3 |
| | APR | 18 | | | | | 18 | APR | |
| | MAR | 19 | | | | | 19 | MAR | |
| | FEB | 20 | | | | | 20 | FEB | |
| | JAN | 21 | | | | | 21 | JAN | |
| | DEC | 22 | | | | | 22 | DEC | |
| | NOV | 23 | | | | | 23 | NOV | |
| | OCT | 24 | | | | | 24 | OCT | |
| | SEP | 25 | | | | | 25 | SEP | |
| 1 | AGT | 26 | | | | | 26 | AGT | 1 |
| 9 | JUL | 27 | | | | | 27 | JUL | 9 |
| 9 | JUN | 28 | | | | | 28 | JUN | 9 |
| 2 | MAY | 29 | | | | | 29 | MAY | 2 |
| | APR | 30 | | | | | 30 | APR | |
| | MAR | 31 | | | | | 31 | MAR | |
| | FEB | 32 | | | | | 32 | FEB | |
| | JAN | 33 | | | | | 33 | JAN | |
| | DEC | 34 | | | | | 34 | DEC | |
| | NOV | 35 | | | | | 35 | NOV | |
| | OCT | 36 | | | | | 36 | OCT | |
| | SEP | 37 | | | | | 37 | SEP | |
| 1 | AGT | 38 | | | | | 38 | AGT | 1 |
| 9 | JUL | 39 | | | | | 39 | JUL | 9 |
| 9 | JUN | 40 | | | | | 40 | JUN | 9 |
| 1 | MAY | 41 | | | | | 41 | MAY | 1 |
| | APR | 42 | | | | | 42 | APR | |
| | MAR | 43 | | | | | 43 | MAR | |
| | FEB | 44 | | | | | 44 | FEB | |
| | JAN | 45 | | | | | 45 | JAN | |
| | DEC | 46 | | | | | 46 | DEC | |
| | NOV | 47 | | | | | 47 | NOV | |
| | OCT | 48 | | | | | 48 | OCT | |
| | SEP | 49 | | | | | 49 | SEP | |
| 1 | AGT | 50 | | | | | 50 | AGT | 1 |
| 9 | JUL | 51 | | | | | 51 | JUL | 9 |
| 9 | JUN | 52 | | | | | 52 | JUN | 9 |
| 0 | MAY | 53 | | | | | 53 | MAY | 0 |
| | APR | 54 | | | | | 54 | APR | |
| | MAR | 55 | | | | | 55 | MAR | |
| | FEB | 56 | | | | | 56 | FEB | |
| | JAN | 57 | | | | | 57 | JAN | |
| | DEC | 58 | | | | | 58 | DEC | |
| | NOV | 59 | | | | | 59 | NOV | |
| | OCT | 60 | | | | | 60 | OCT | |
| | SEP | 61 | | | | | 61 | SEP | |
| 1 | AGT | 62 | | | | | 62 | AGT | 1 |
| 9 | JUL | 63 | | | | | 63 | JUL | 9 |
| 8 | JUN | 64 | | | | | 64 | JUN | 8 |
| 9 | MAY | 65 | | | | | 65 | MAY | 9 |
| | APR | 66 | | | | | 66 | APR | |
| | MAR | 67 | | | | | 67 | MAR | |
| | FEB | 68 | | | | | 68 | FEB | |
| | JAN | 69 | | | | | 69 | JAN | |

LAST CHILD BORN PRIOR TO JANUARY 1989

NAME: ______________ MONTH.... YEAR....

# DHS Calendar data layout

S
T
A
R
T

1=Pill

3 = Injectable

| CASEID | | | | | VCOL_1 | VCAL_1 |
|---|---|---|---|---|---|---|
| 51 | 1 | 1 | 6 | 2 | 1 | 0000001111103333333333333333333333333333333333333333333333333333333 |
| 51 | 1 | 1 | 10 | 2 | 1 | 8888888888888888888888888888888888888888888888888888888888888888888 |
| 51 | 1 | 1 | 17 | 2 | 1 | 1111111111111111111111111111111100000BPPPPPPPP011111111111111111111 |
| 51 | 1 | 1 | 24 | 2 | 1 | 0000BPPPPPPPP000002222222222222222222222222222222222222222222222222 |
| 51 | 1 | 1 | 28 | 2 | 1 | 33333333333333333333333333333333333330000000000BPPPPPPPP0000000BPPP |
| 51 | 1 | 1 | 34 | 2 | 1 | 1111111111111111111111111000000000BPPPPPPPP000000000000000000000000 |
| 51 | 1 | 1 | 45 | 2 | 1 | 00BPPPPPPPP11111111000000000000BPPPPPPPP0000000000000TP000000000000 |

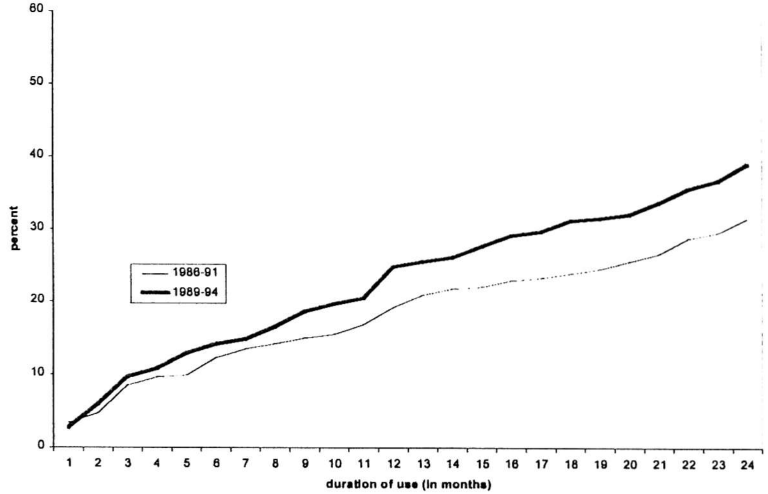
| OBS | VCOL_2 | | | VCAL_2 | |
|---|---|---|---|---|---|
| 1 | 2 | 4 | 8 | | |
| 2 | 2 | | | | |
| 3 | 2 | | | | 2 |
| 4 | 2 | | | 2 | |
| 5 | 2 | | | | |
| 6 | 2 | | | | |
| 7 | 2 | 1 | | | |

# Extracted calendar data

| CASEID | METHOD | DUR | WHYDISC | NEXTMON | PREVMON | BIRTHS1 | CMCSTART |
|---|---|---|---|---|---|---|---|
| 51 1 1 6 2 | 1 | 4 | 4 | 0 | 0 | 0 | 1125 |
| 51 1 1 6 2 | 0 | 0 | | 1 | 3 | 0 | 1124 |
| 51 1 1 17 2 | 1 | 28 | 0 | Z | 0 | 0 | 1104 |
| 51 1 1 17 2 | 0 | 4 | | 1 | B | 0 | 1099 |
| 51 1 1 17 2 | 0 | 0 | | P | 1 | 1 | 1089 |
| 51 1 1 24 2 | 0 | 0 | 0 | Z | B | 0 | 1132 |
| 51 1 1 24 2 | 0 | 4 | | P | 2 | 1 | 1118 |
| 51 1 1 28 2 | 3 | 33 | 0 | Z | 0 | 0 | 1099 |
| 51 1 1 28 2 | 0 | 9 | | 3 | B | 0 | 1089 |
| 51 1 1 28 2 | 0 | 6 | | P | B | 1 | 1073 |
| 51 1 1 34 2 | 1 | 21 | 0 | Z | 0 | 0 | 1111 |
| 51 1 1 34 2 | 0 | 8 | | 1 | B | 0 | 1102 |
| 51 1 1 45 2 | 1 | 7 | 1 | P | 0 | 1 | 1117 |
| 51 1 1 45 2 | 0 | 11 | | 1 | B | 1 | 1105 |
| 51 1 1 45 2 | 0 | 12 | | P | T | 2 | 1083 |

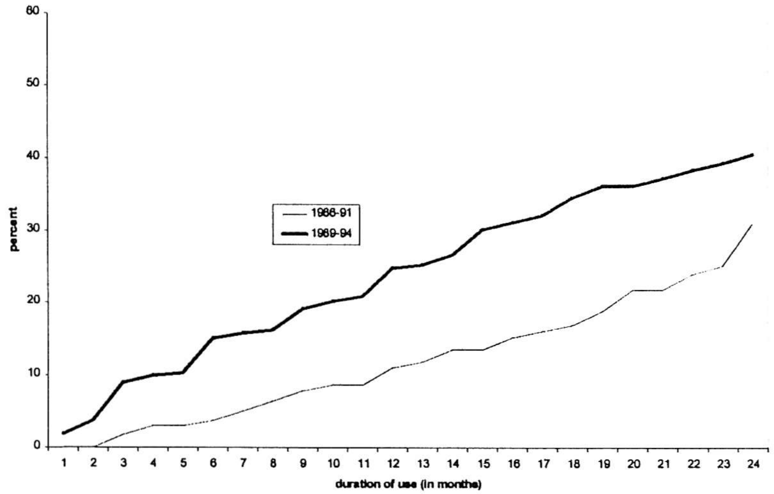
Appendix A-2. Provinces which Experienced an Increase in Contraceptive Discontinuation between 1986-91 and 1989-94

Trends in Cumulative Probabilities of Contraceptive Discontinuation in Bali between 1986-1991 and 1989-1994

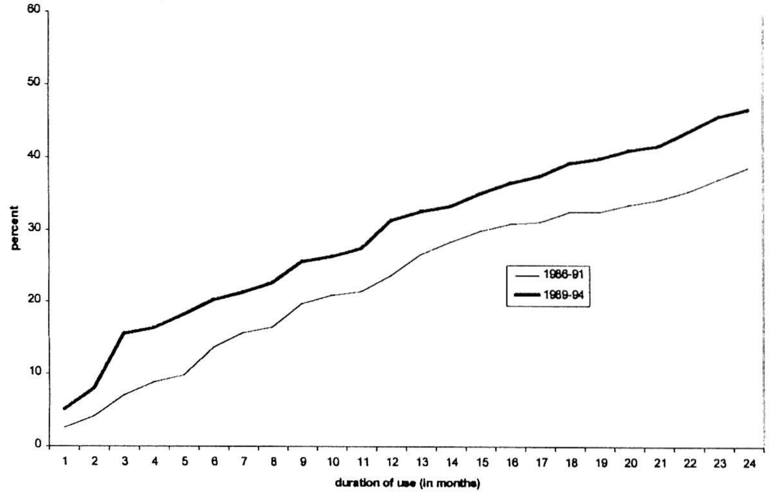



prov9194rev xls

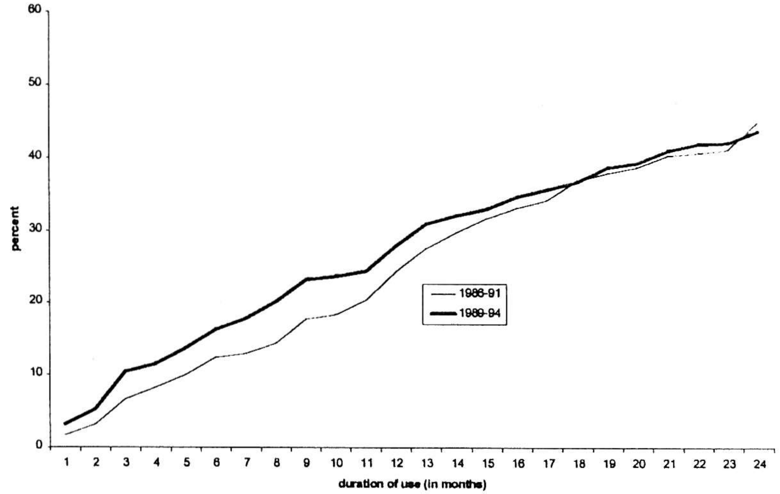
Trends in Cumulative Probabilities of Discontinuation of All Reversible Contraceptives: East Nusa Tenggara, 1986-91 and 1989-94



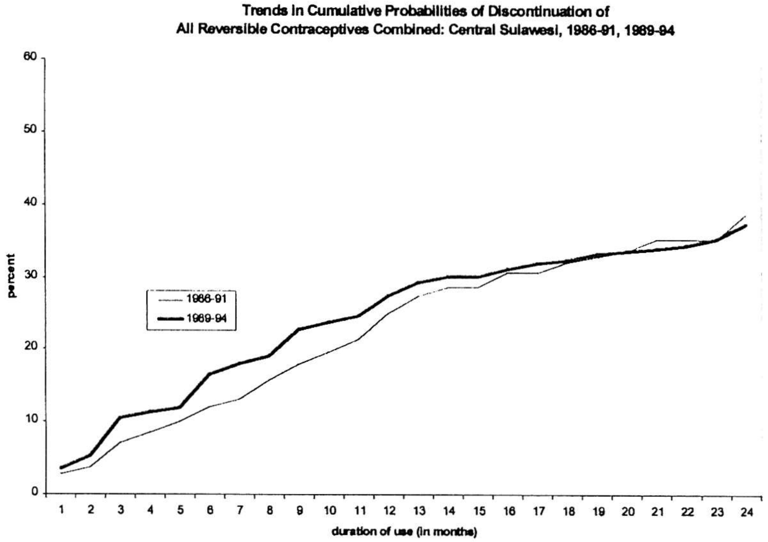

Trends in Cumulative Probabilities of Discontinuation of All Reversible Contraceptives Combined: South Sulawesi, 1986-91, 1989-94

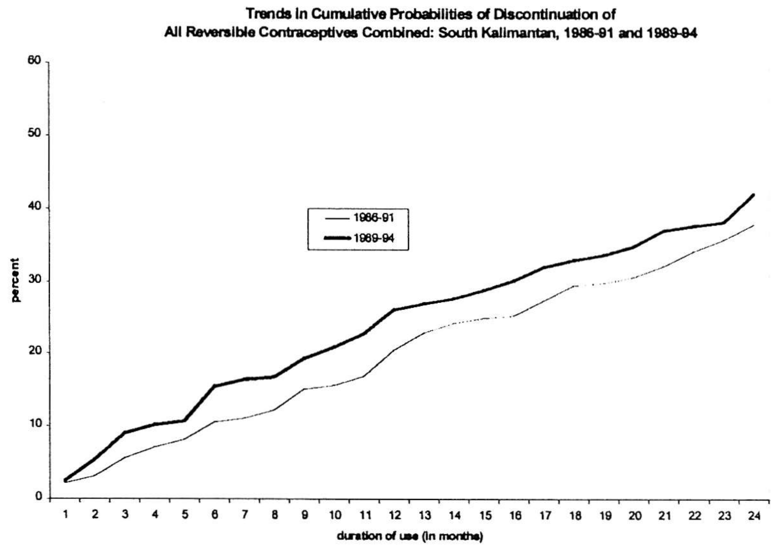


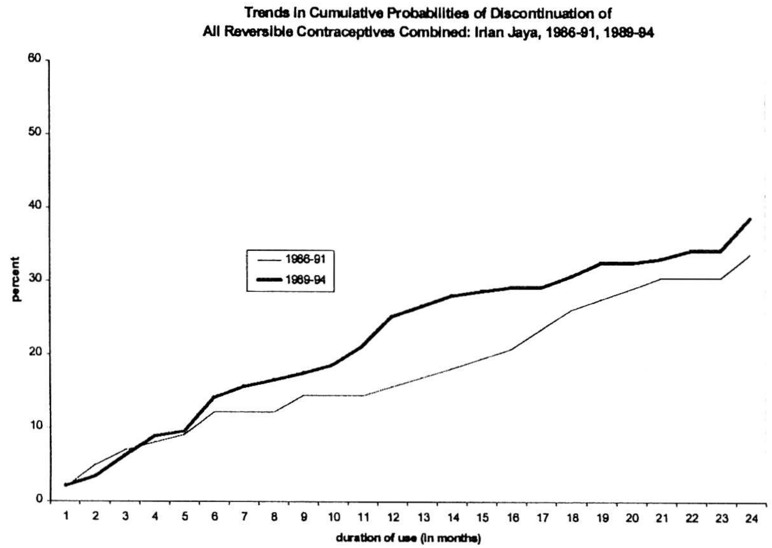

Trends in Cumulative Probabilities of Discontinuation of All Reversible Contraceptives Combined: North Sulawesi, 1986-91 and 1989-94



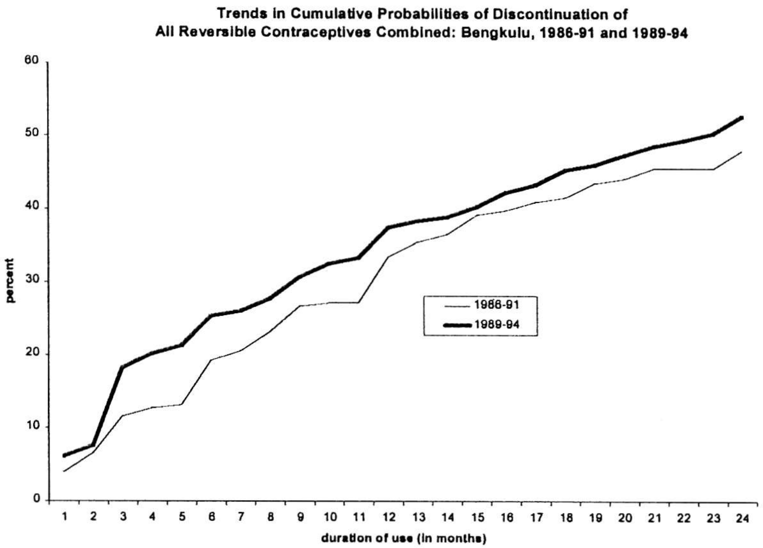
Appendix A-2. Continued...

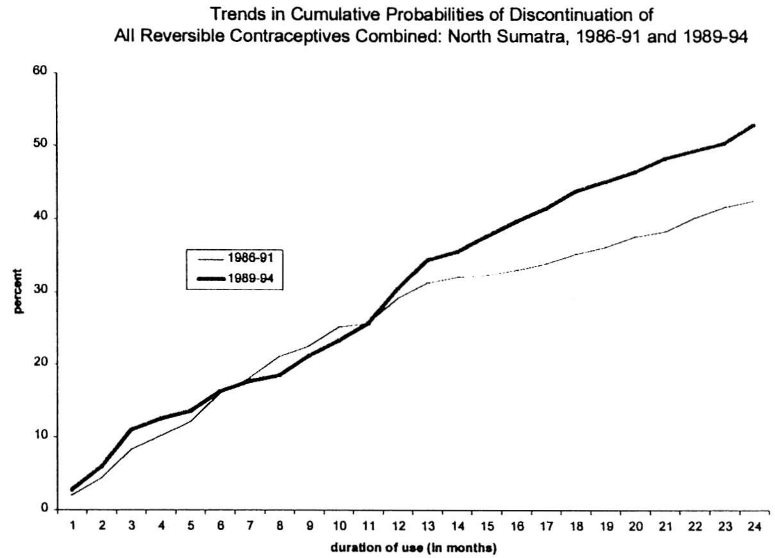


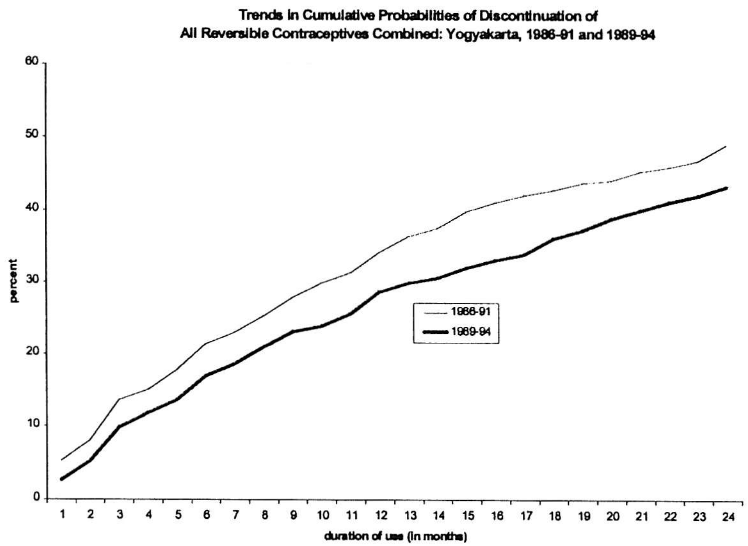



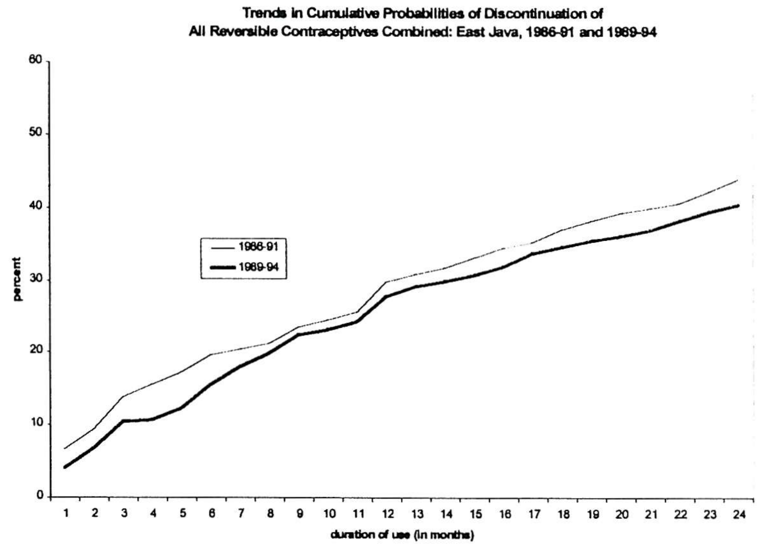
Appendix A-2. Continued...

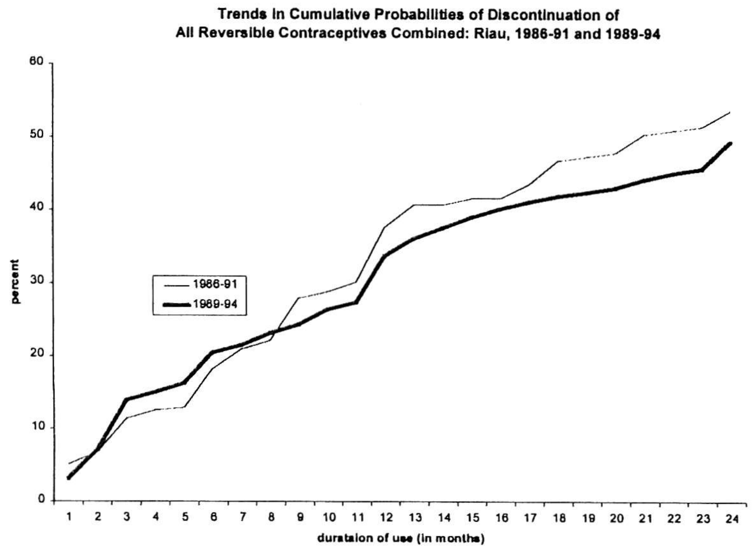


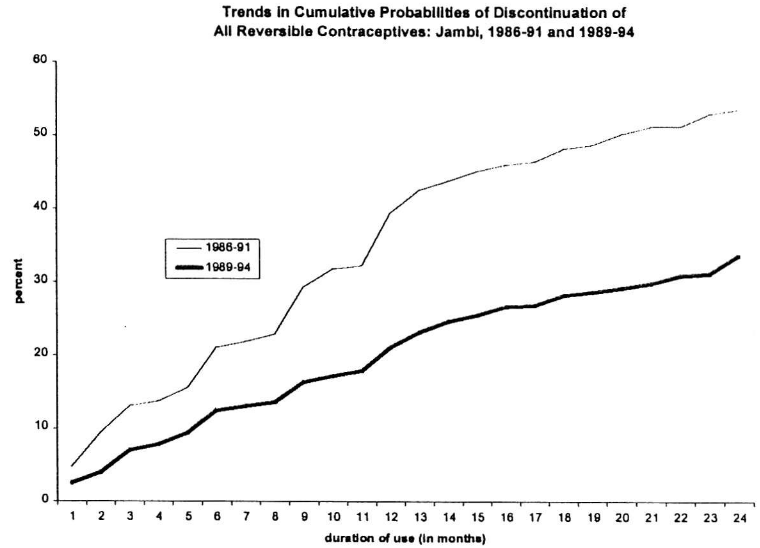



Appendix A-3. Provinces which Experienced a Decrease in Contraceptive Discontinuation between 1986-91 and 1989-94



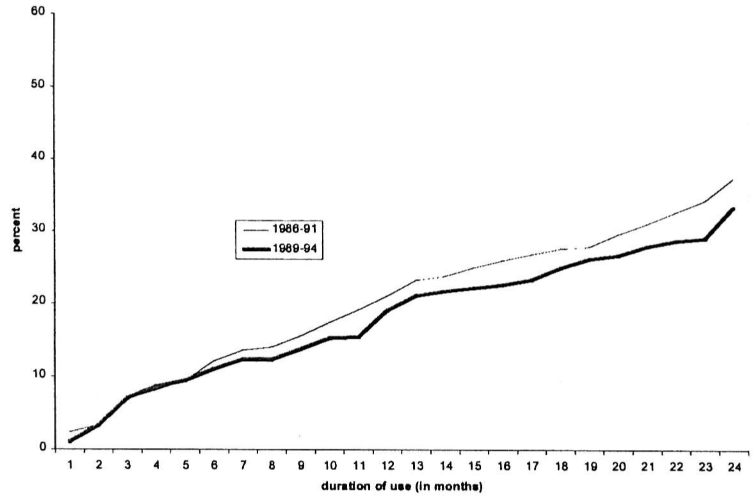



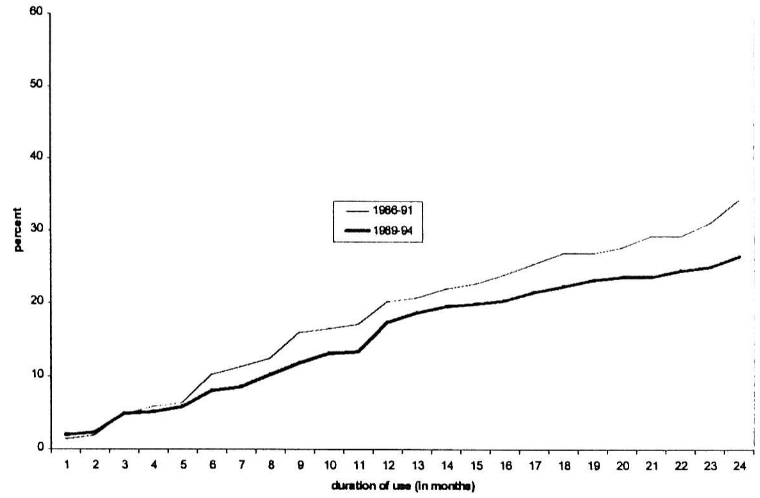



Appendix A-3. Continued...

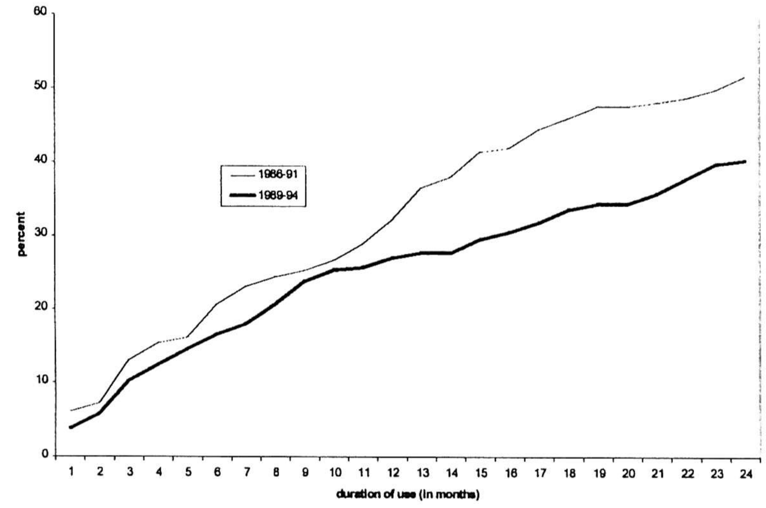
Trends in Cumulative Probabilities of Discontinuation of
All Reversible Contraceptives Combined: South Sumatra, 1986-91 and 1989-94




Trends in Cumulative Probabilities of Discontinuation of
All Reversible Contraceptives Combined: Central Kalimantan, 1986-91 and 1989-94

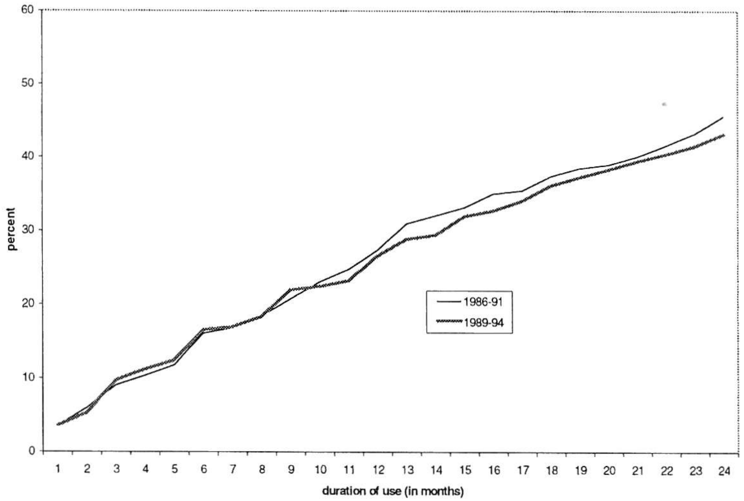



Trends in Cumulative Probabilities of Discontinuation of
All Reversible Contraceptives Combined: Maluku, 1986-91, 1989-94

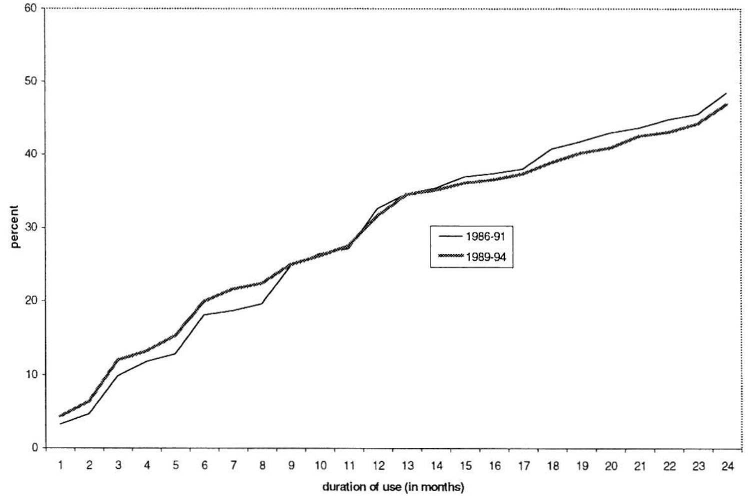


Appendix A-4. Provinces which Experienced a Little or Unclear Changes in Contraceptive Discontinuation between 1986-91 and 1989-94

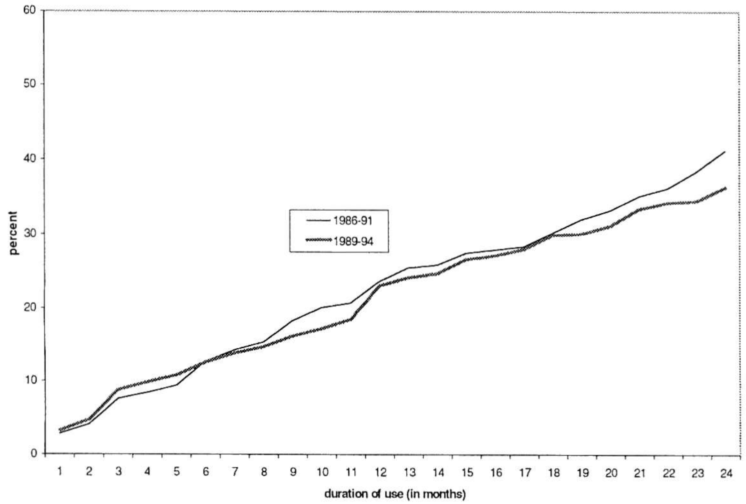
Trends in Cumulative Probabilities of Discontinuation of
All Reversible Contraceptives Combined: Jakarta, 1986-91, 1989-94



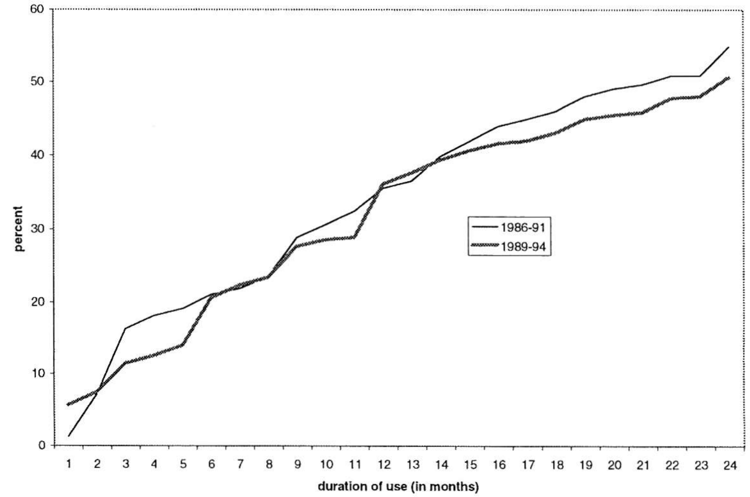

Trends in Cumulative Probabilities of Discontinuation of
All Reversible Contraceptives Combined: West Java, 1986-91 and 1989-94



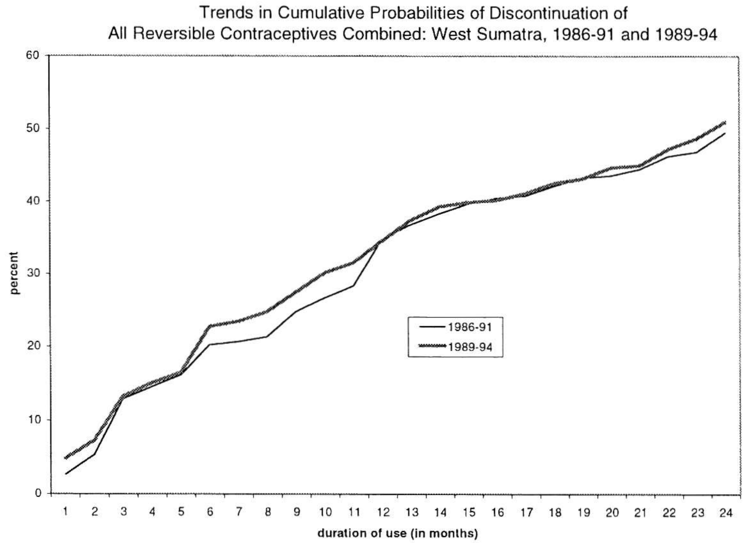

Trends in Cumulative Probabilities of Discontinuation of
All Reversible Contraceptives Combined: Central Java, 1986-91 and 1989-94

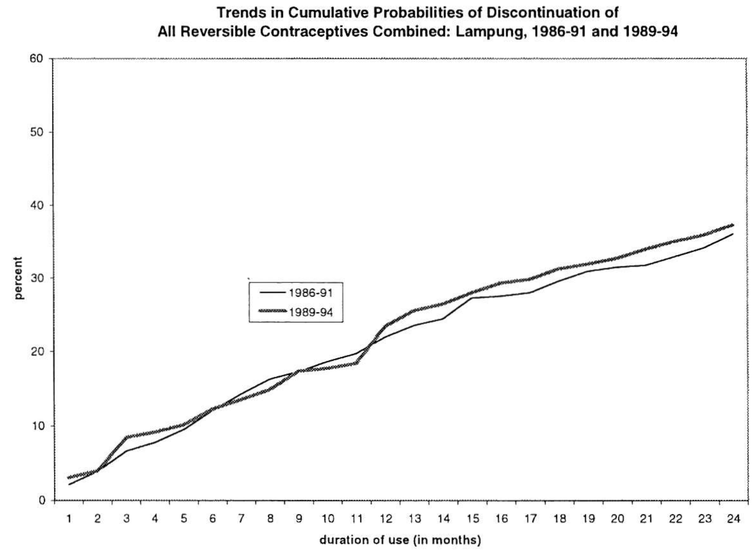


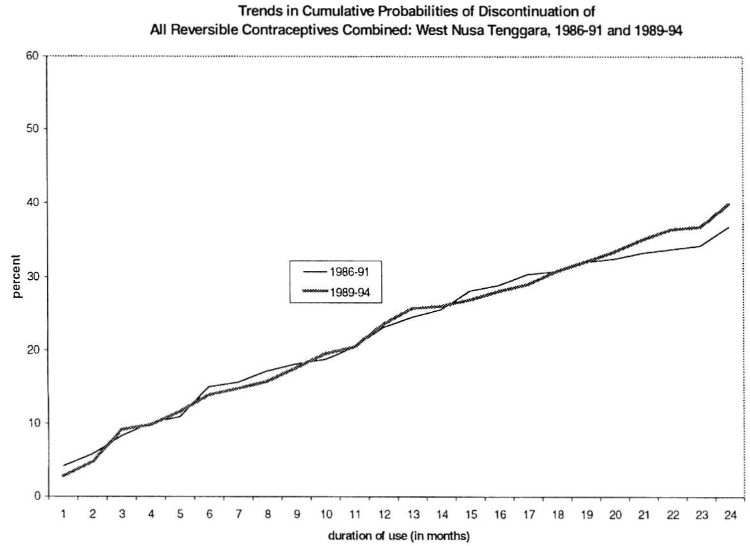

Trends in Cumulative Probabilities of Discontinuation of
All Reversible Contraceptives Combined: Aceh, 1986-91 and 1989-94

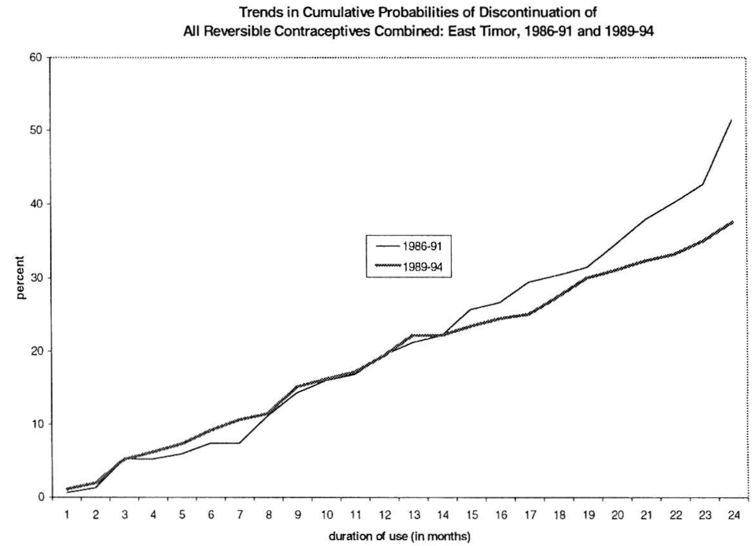


Appendix A-4. Continued...

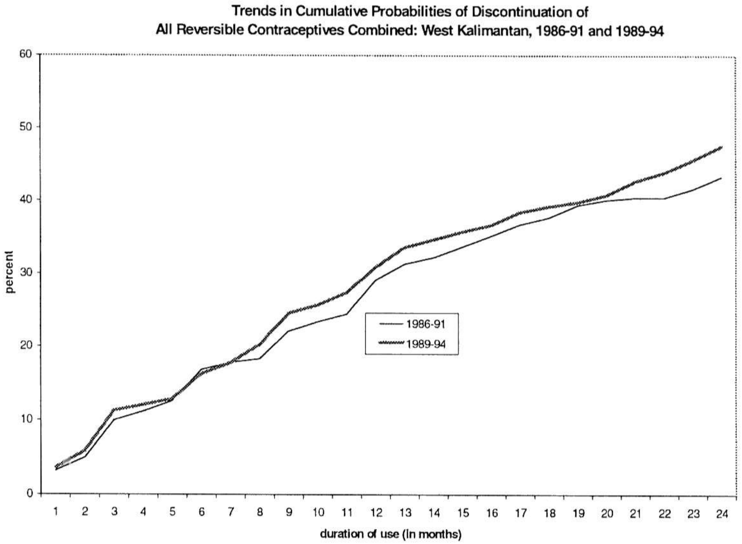


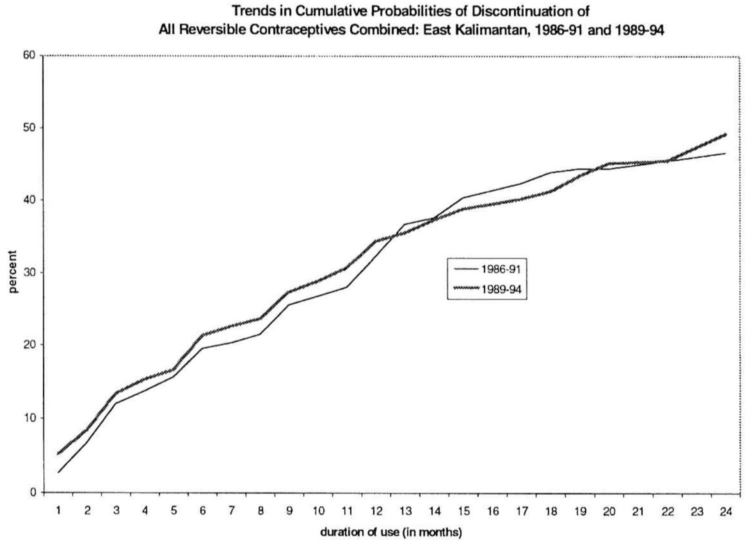



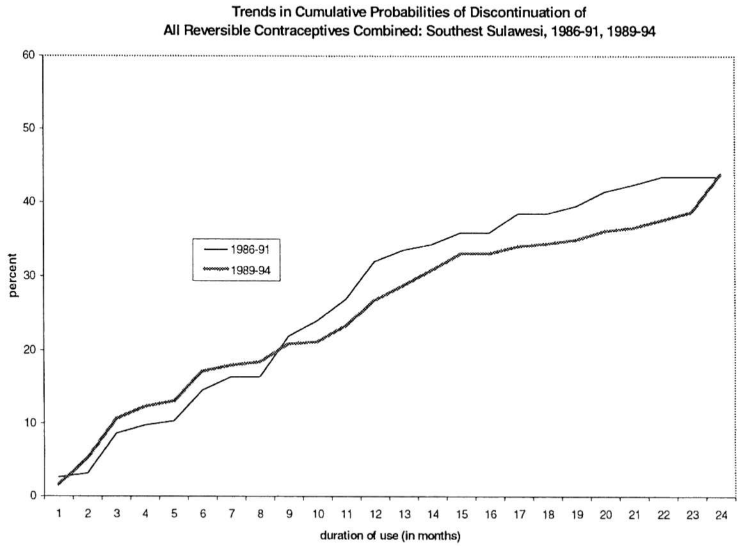



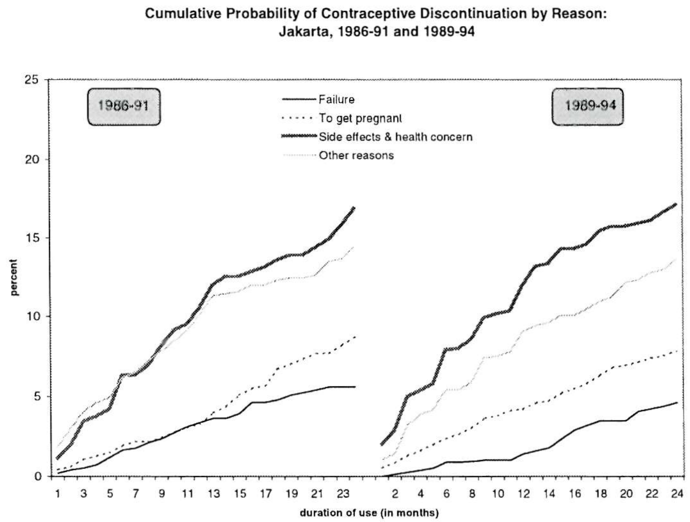
Appendix A-4. Continued...

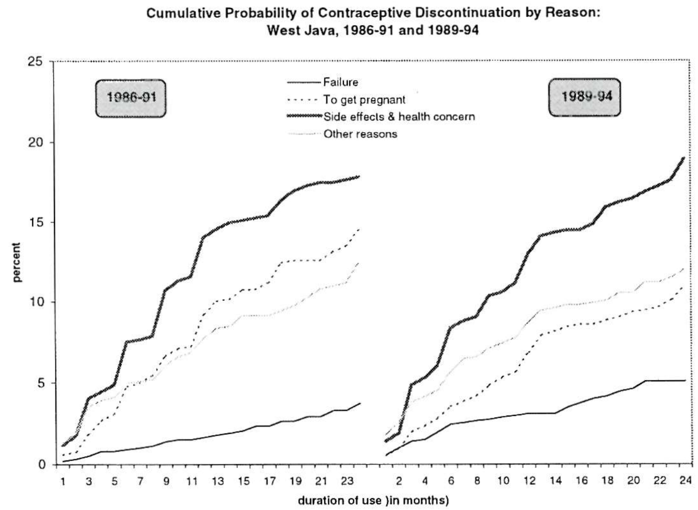


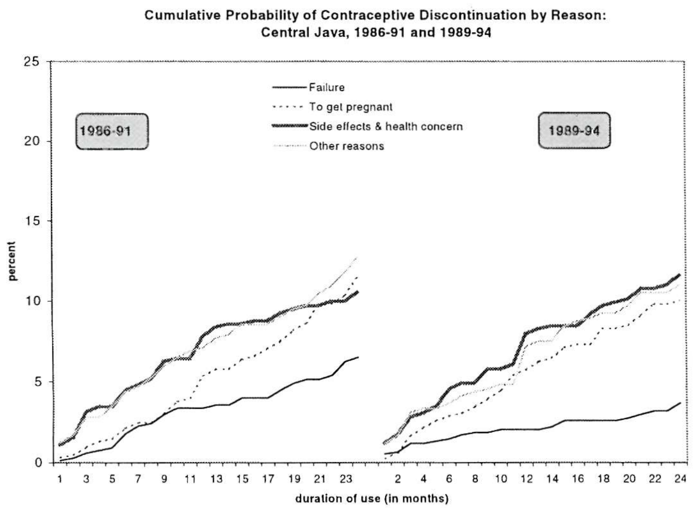



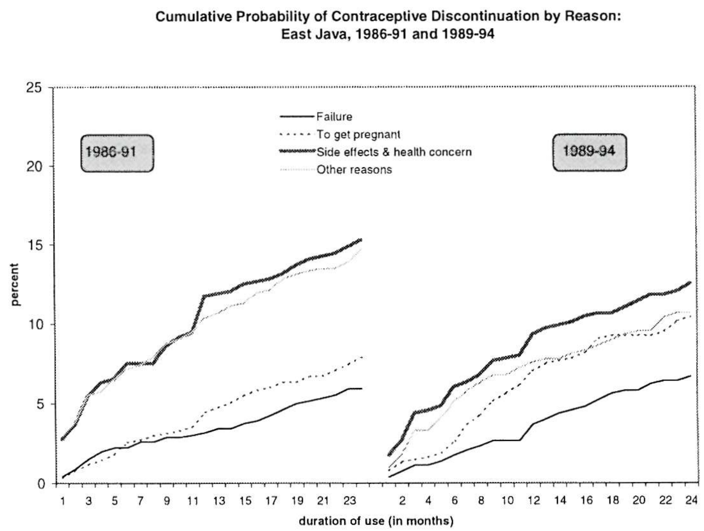



## Appendix A-5. Provinces which Have Side Effects and Health Concerns as the Main Reasons for Discontinuation Calculated Using an MDLT



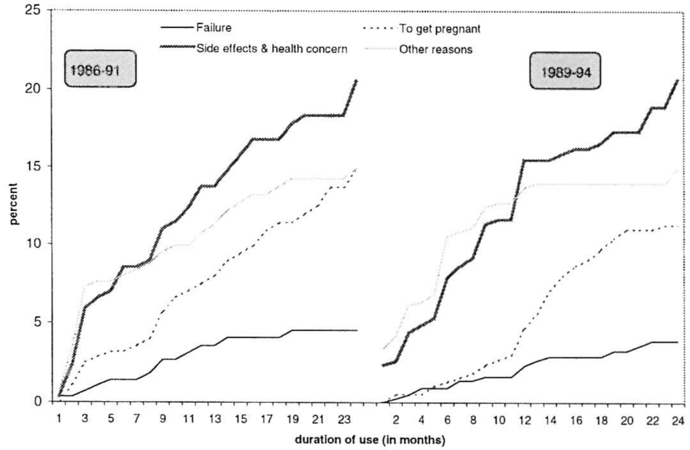



## Appendix A-5. Continued ...

**Cumulative Probability of Contraceptive Discontinuation by Reason: Aceh, 1986-91 and 1989-94**

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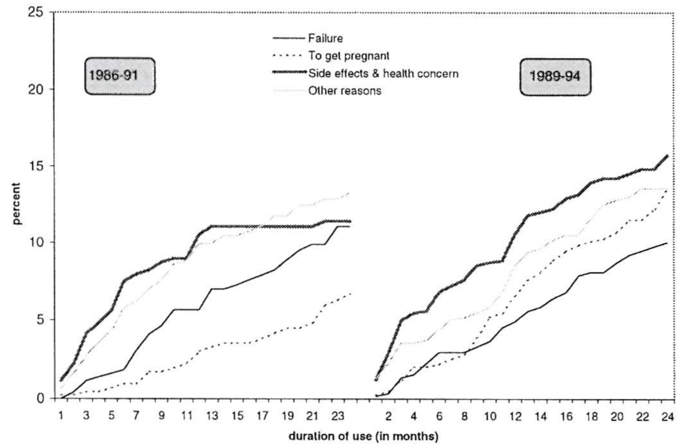
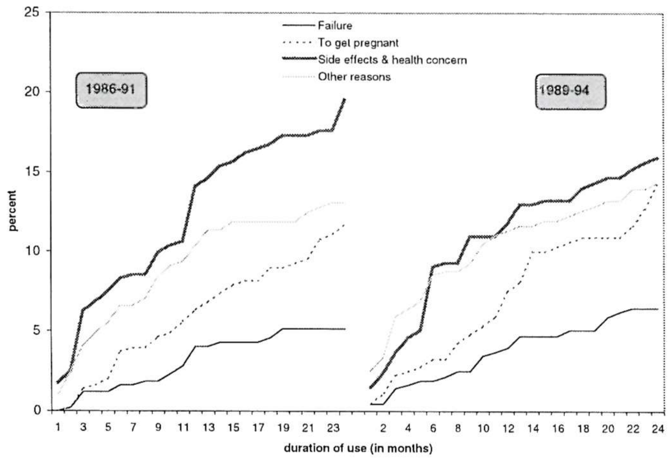



**Cumulative Probability of Contraceptive Discontinuation by Reason: West Sumatra, 1986-91 and 1989-94**



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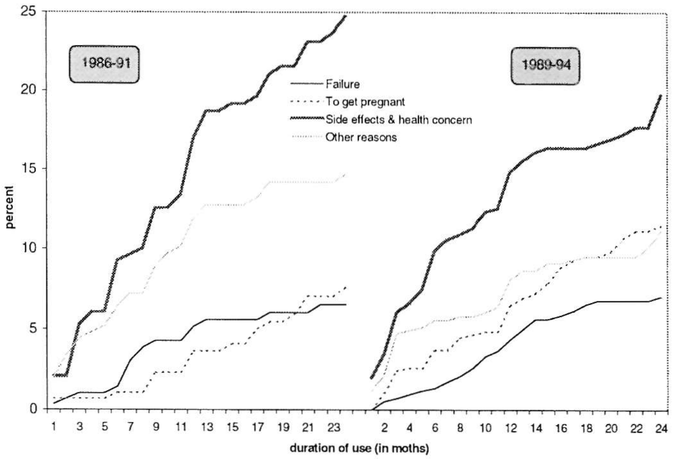
Cumulative Probability of Contraceptive Discontinuation by Reason: Riau, 1986-91 and 1989-94

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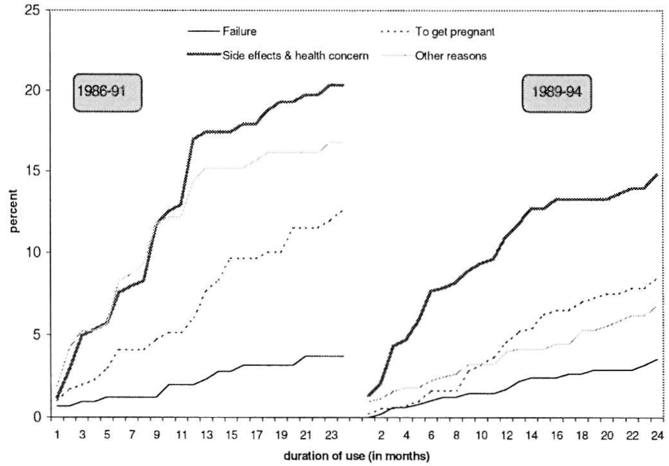
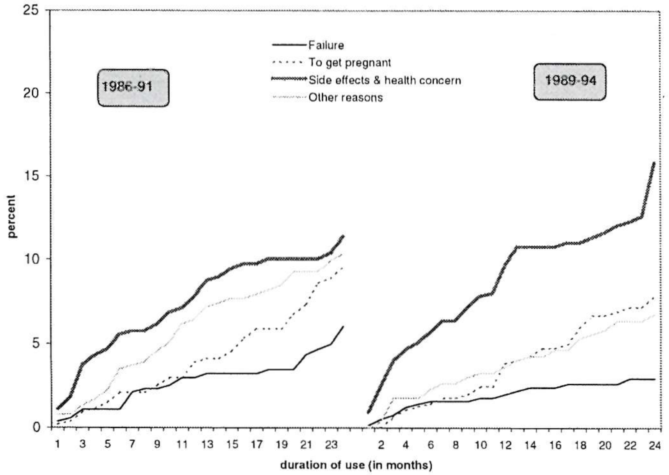



Cumulative Probability of Contraceptive Discontinuation by Reason: South Sumatra, 1986-91 and 1989-94



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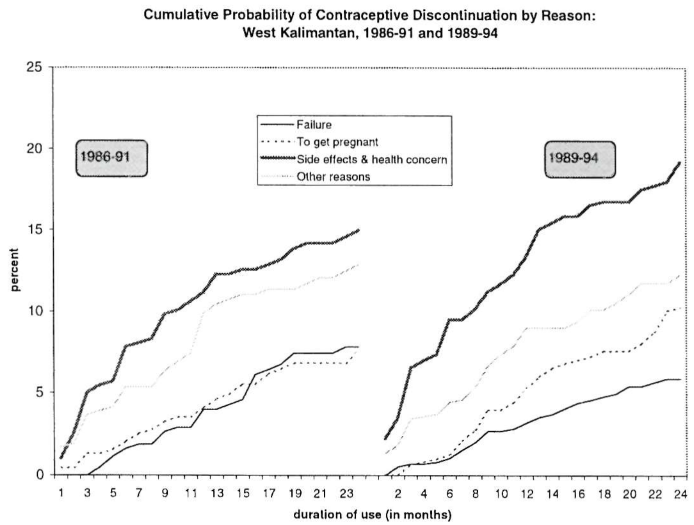
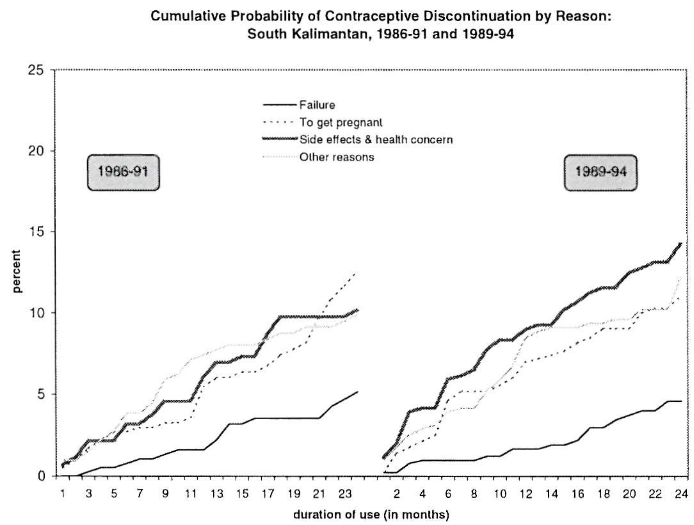
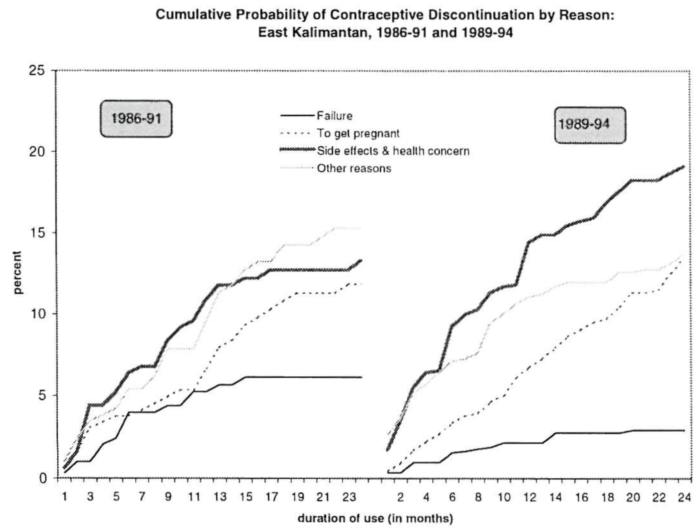
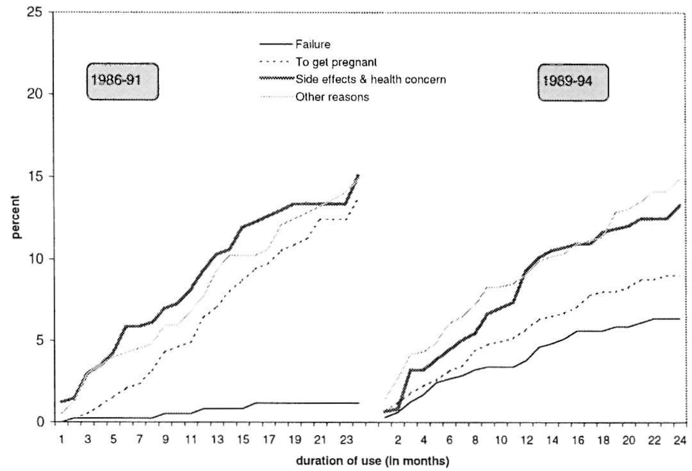


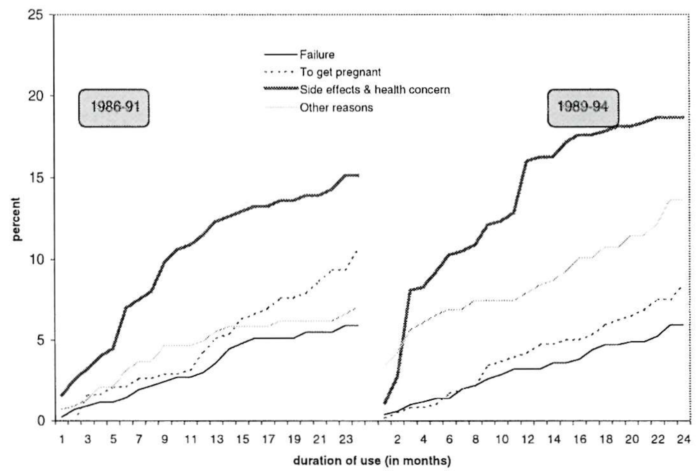



Appendix A-5. Continued ...

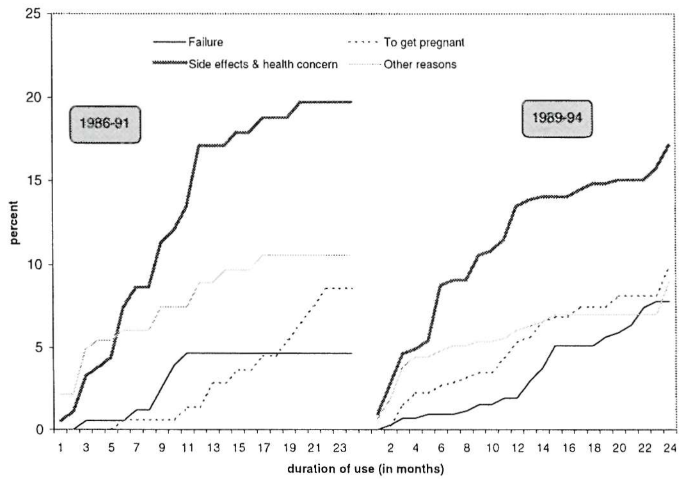
Cumulative Probability of Contraceptive Discontinuation by Reason:
North Sulawesi, 1986-91 and 1989-94




Cumulative Probability of Contraceptive Discontinuation by Reason:
South Sulawesi, 1986-91 and 1989-94




Cumulative Probability of Contraceptive Discontinuation by Reason:
Southeast Sulawesi, 1986-91 and 1989-94



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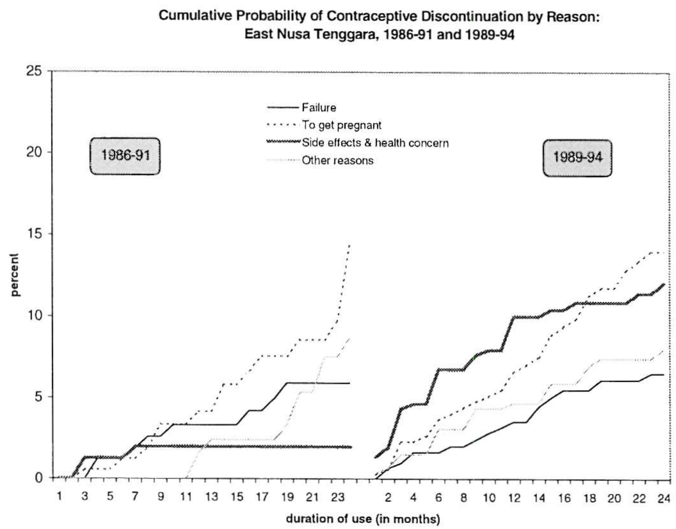
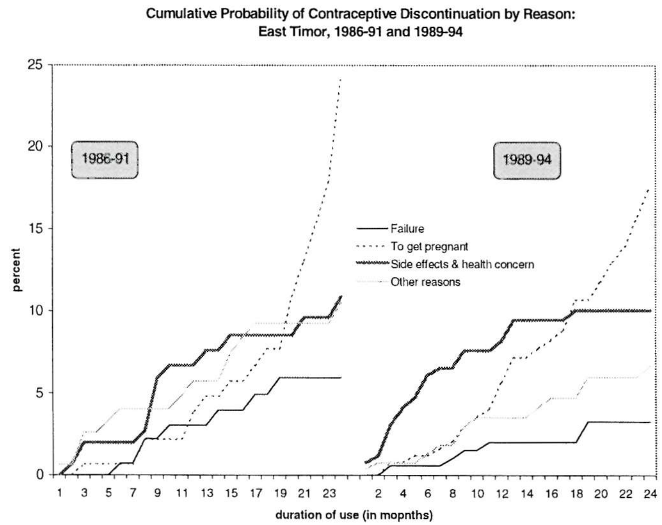
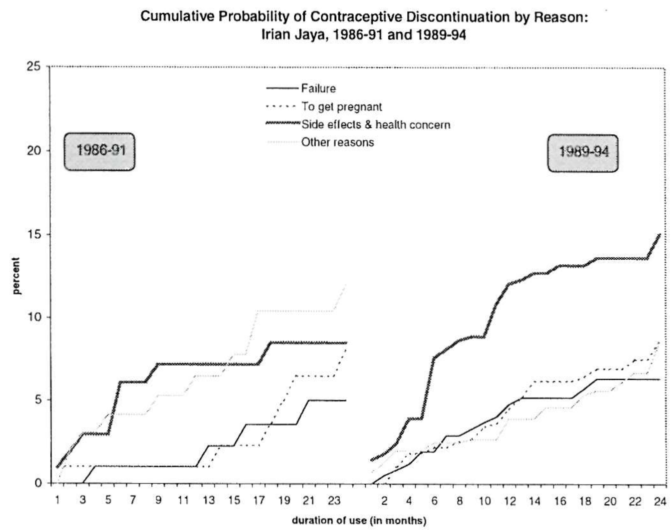
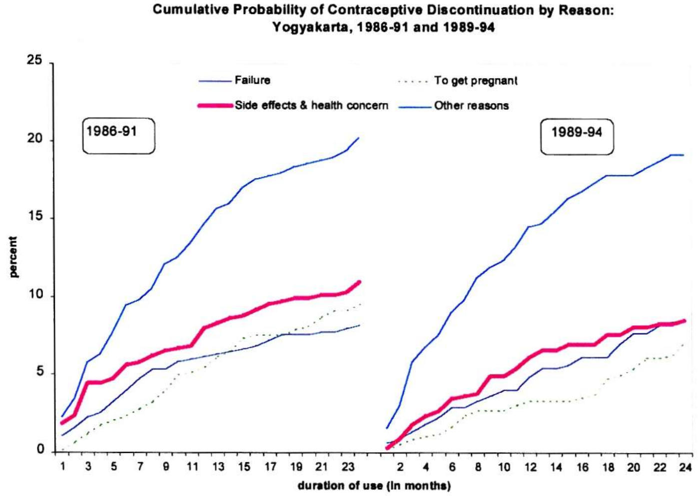
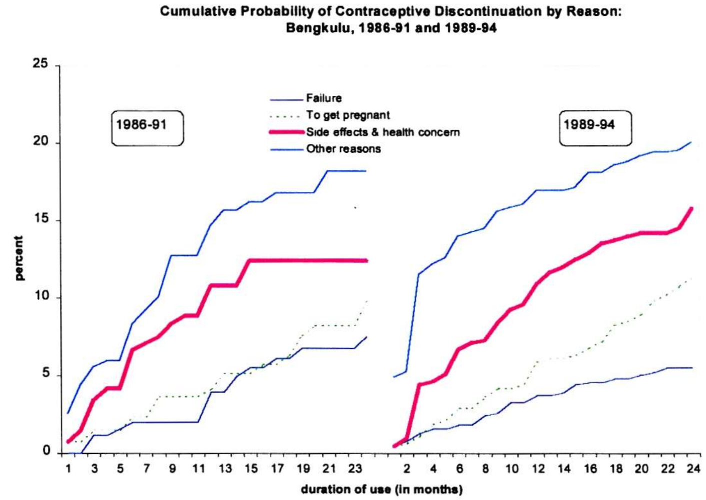


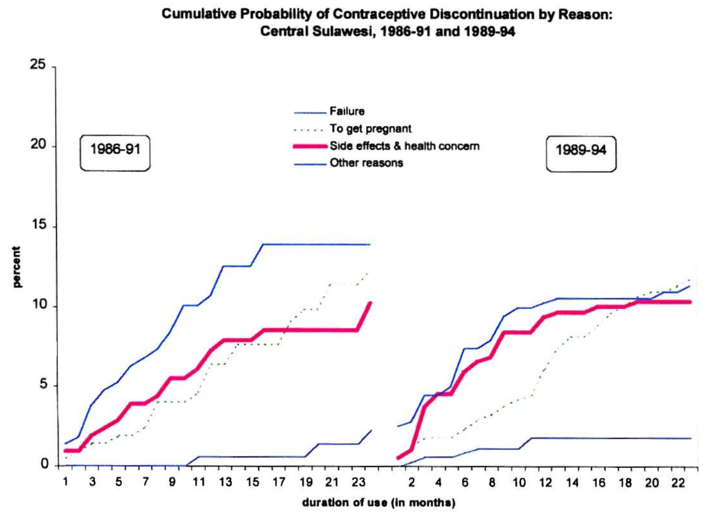



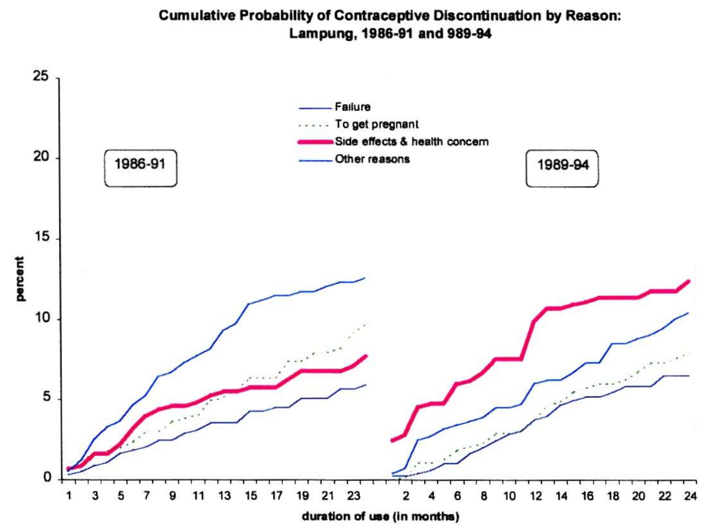



## Appendix A-6. Provinces which Have Other Reasons as the Main Reasons for Discontinuation Calculated Using an MDLT



## Appendix A-6. Continued ...

**Cumulative Probability of Contraceptive Discontinuation by Reason: Central Kalimantan, 1986-91 and 1989-94**

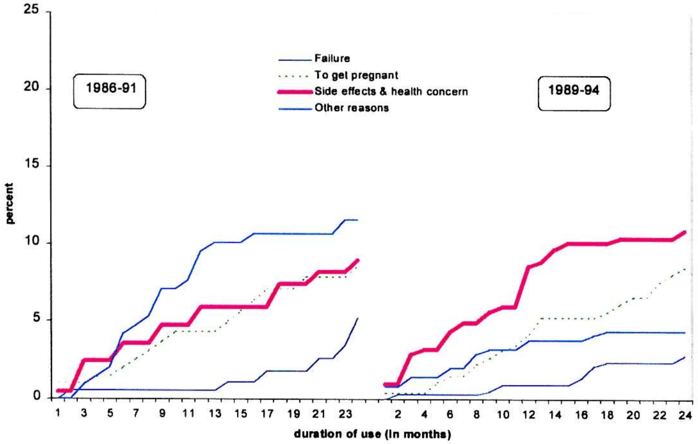
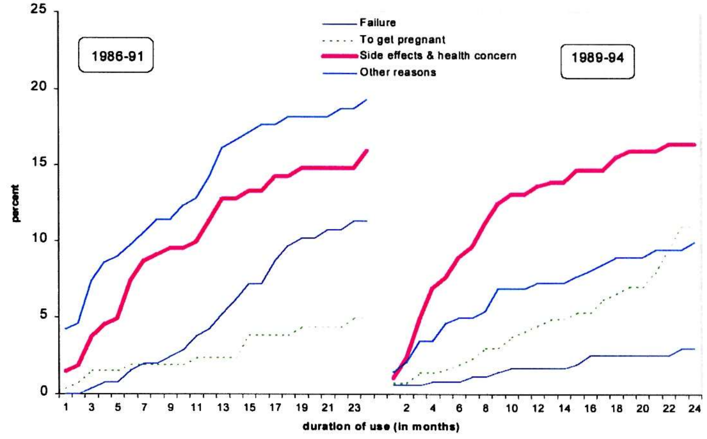
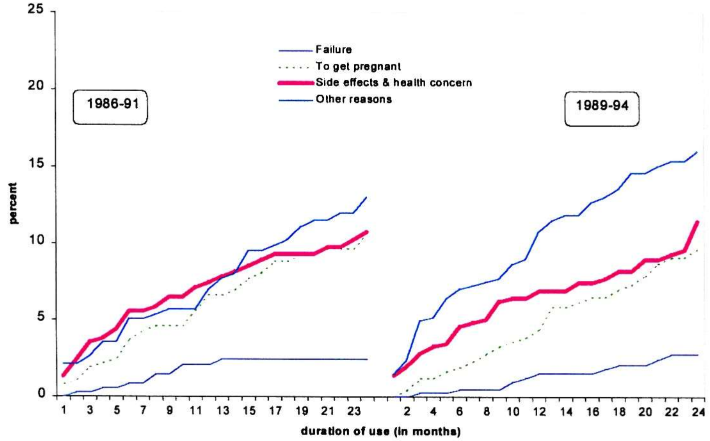


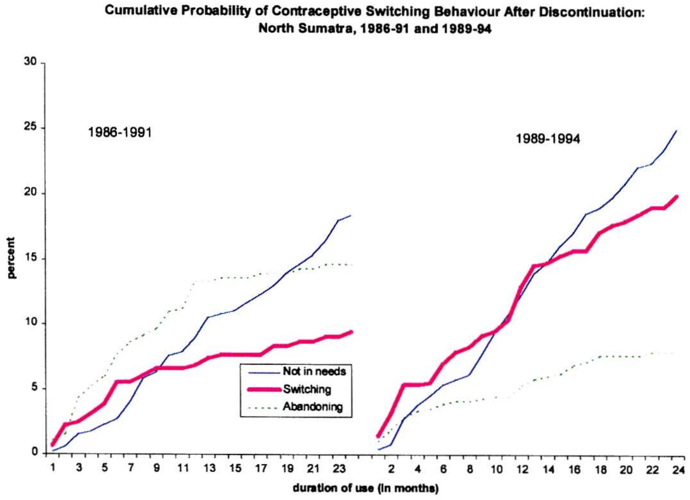

**Figure 6.30 Cumulative Probability of Contraceptive Discontinuation by Reason: Maluku, 1986-91 and 1989-94**

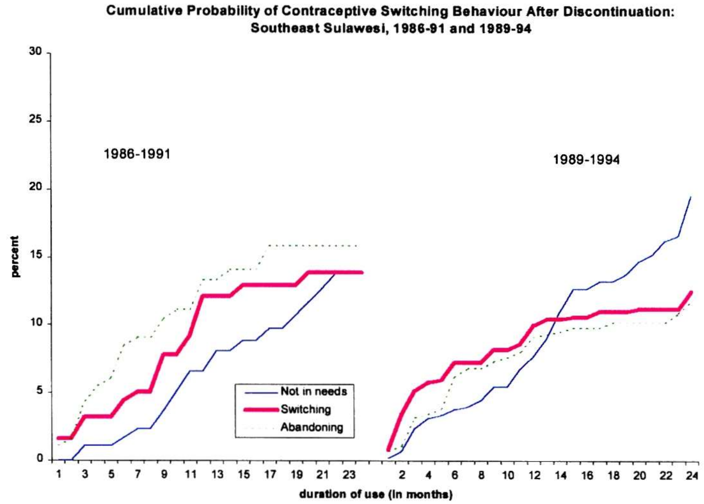


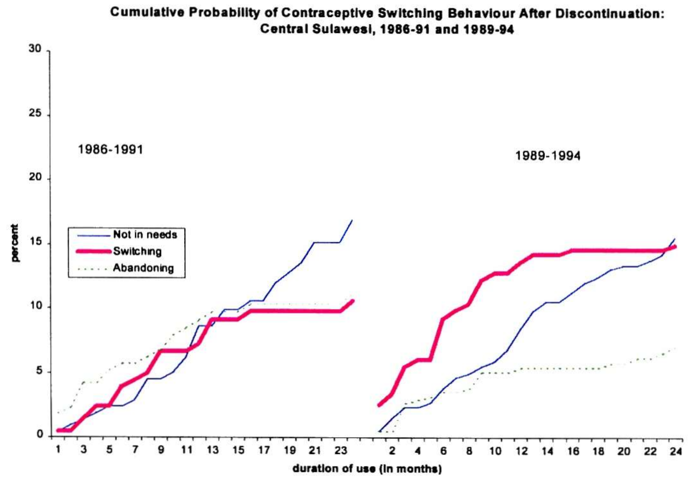

**Cumulative Probability of Contraceptive Discontinuation by Reason: West Nusa Tenggara, 1986-91 and 1989-94**



# Appendix A-7. Provinces Which Have Abandoning as the Main State after Discontinuation Calculated Using an MDLT



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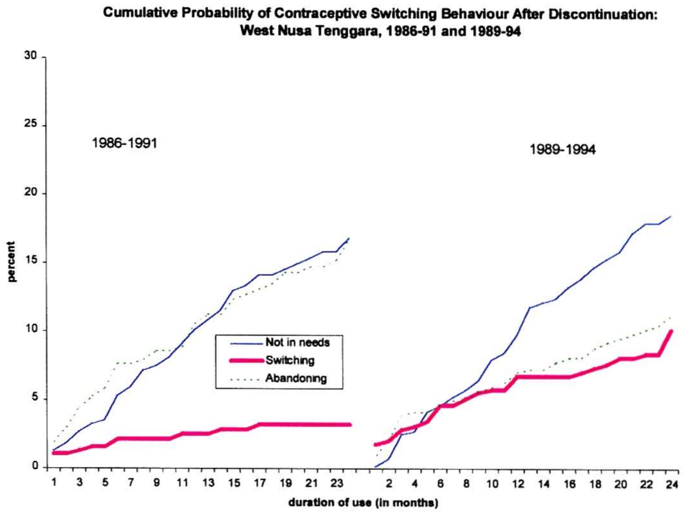
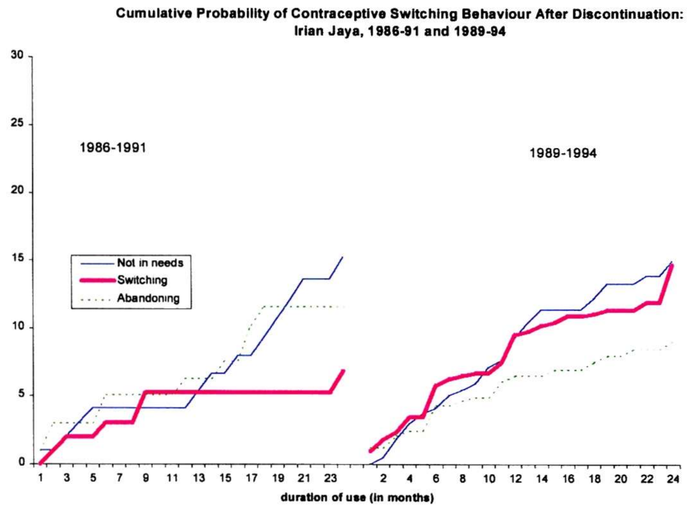
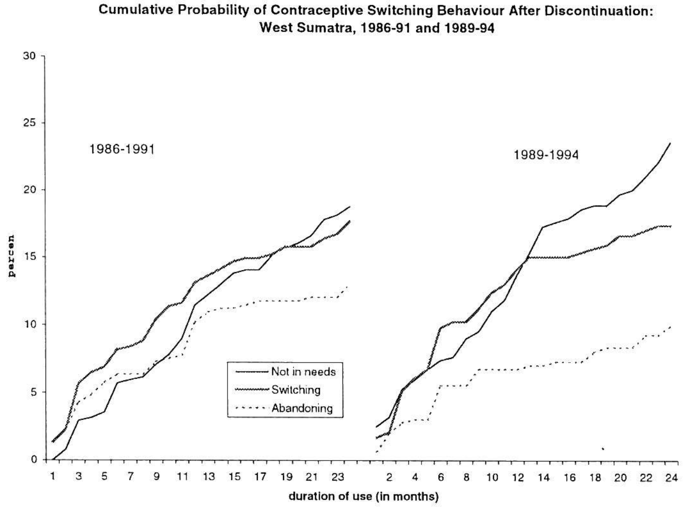
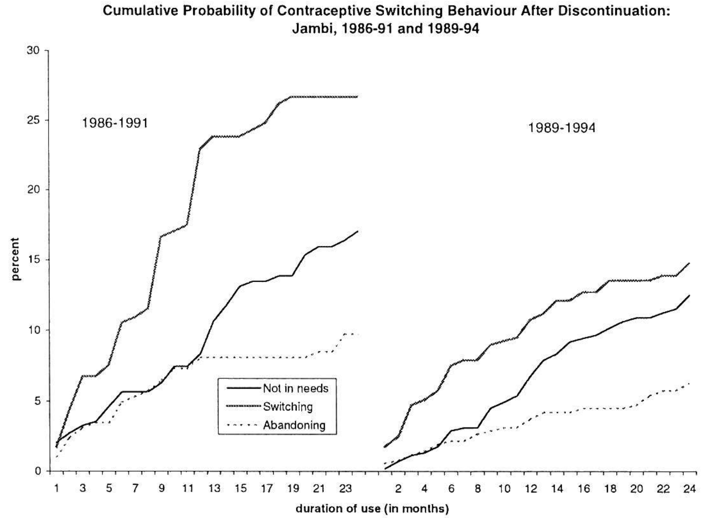
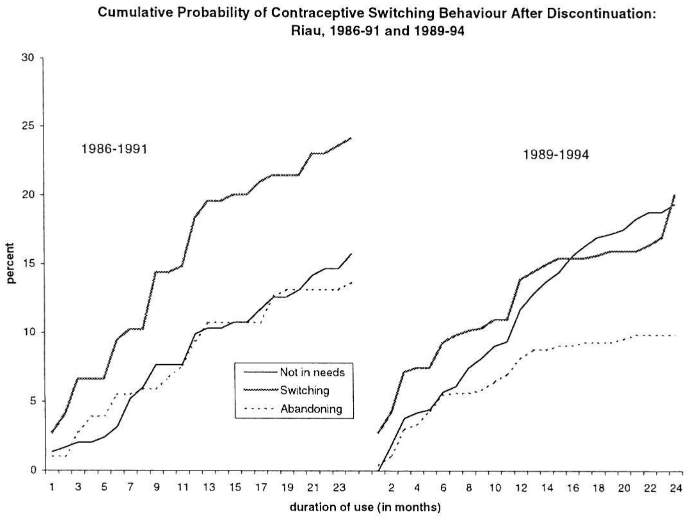


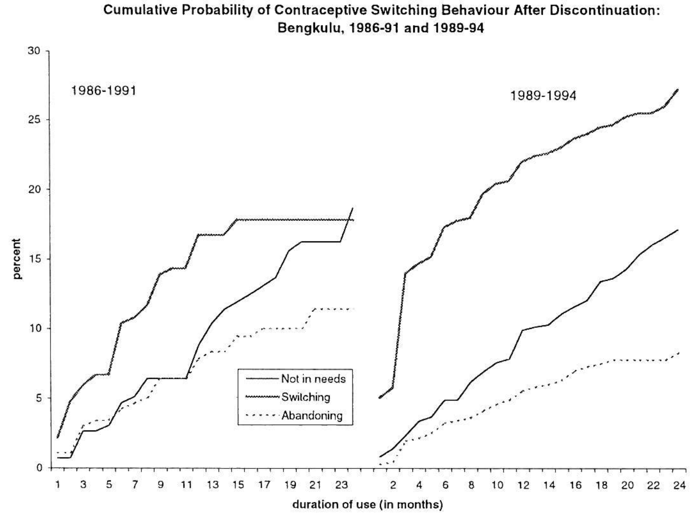



## Appendix A-8. Provinces Which Have Switching as the Main State after Discontinuation Calculated Using an MDLT

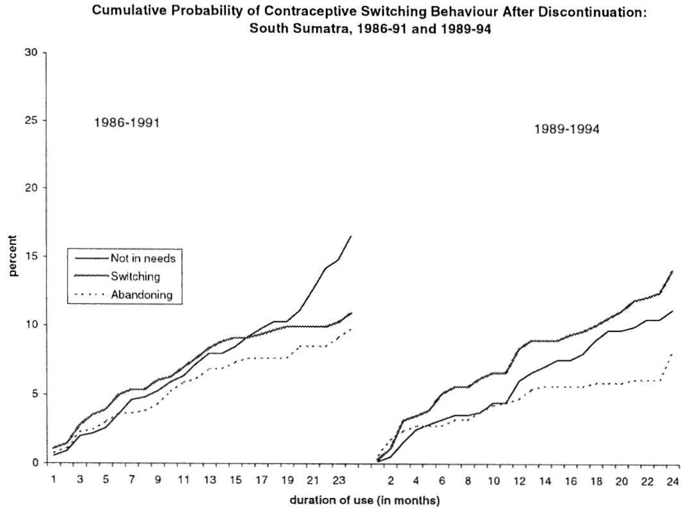


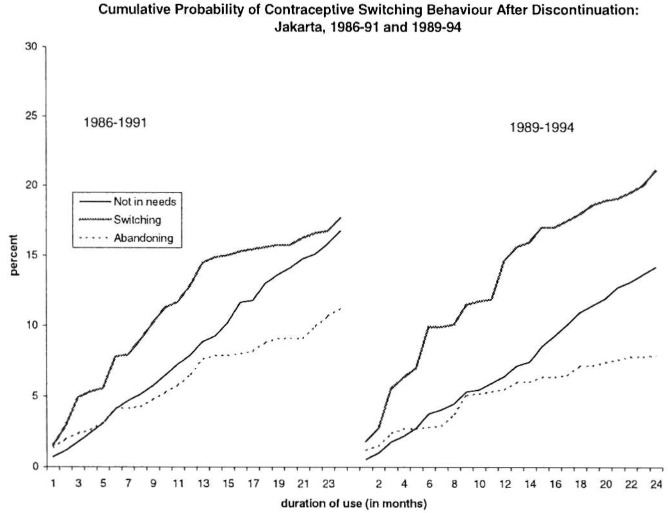



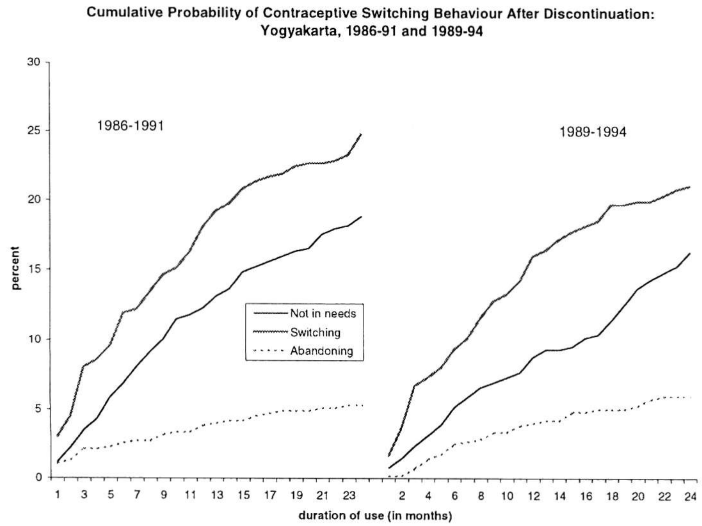



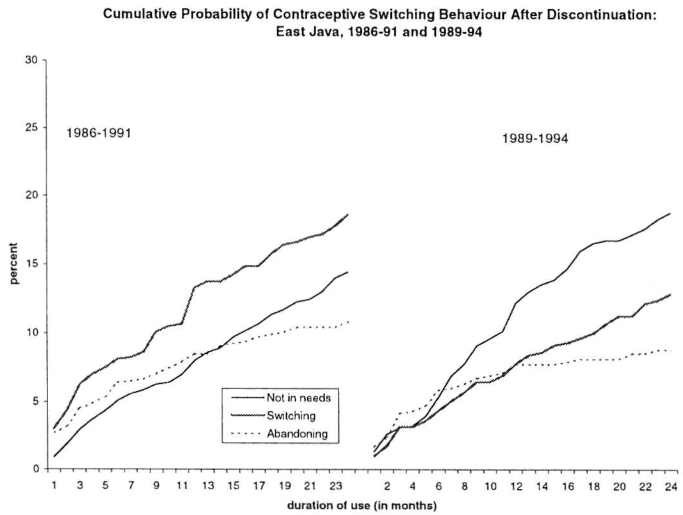



Appendix A-8. Continued ...

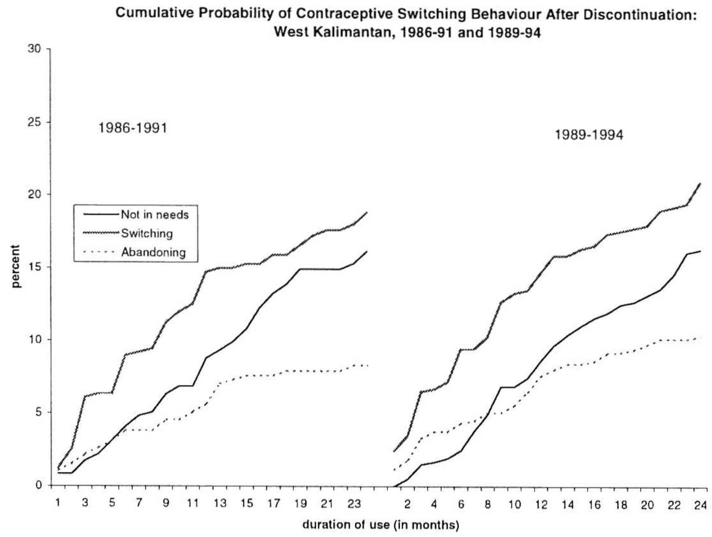


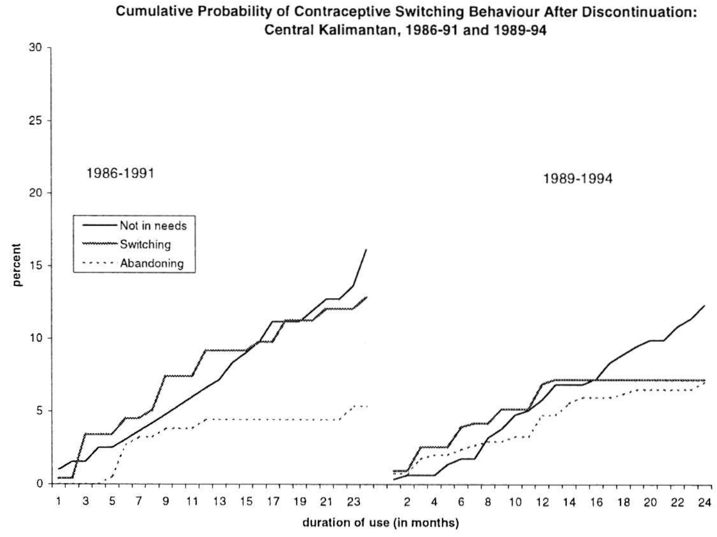



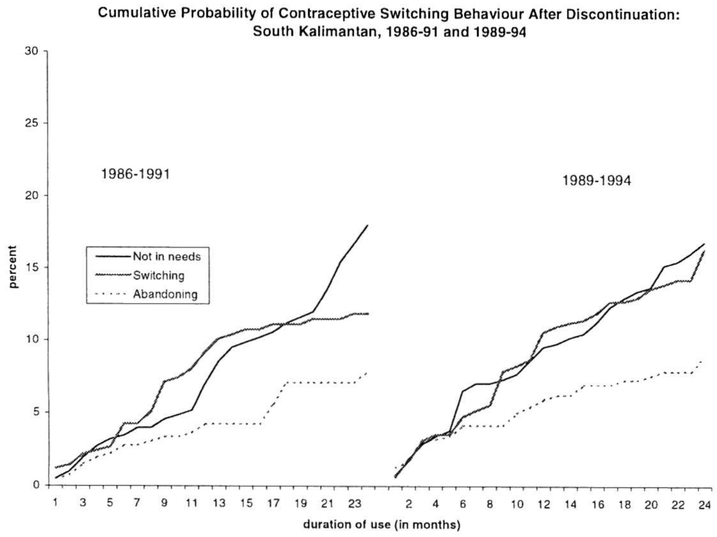



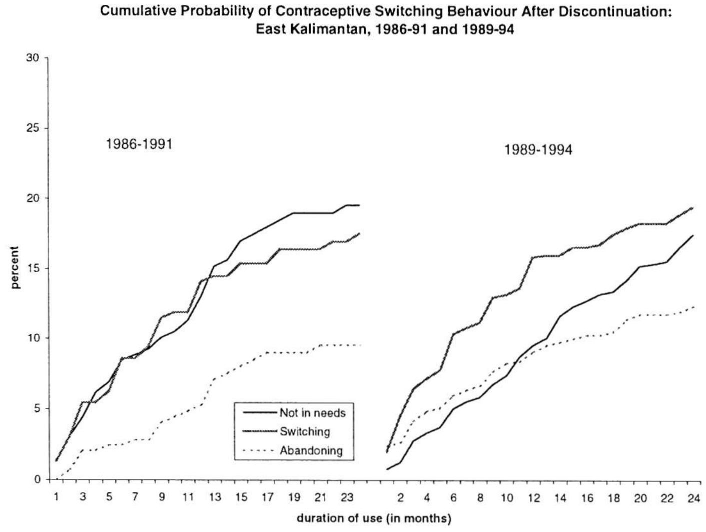



## Appendix A-8. Continued ...



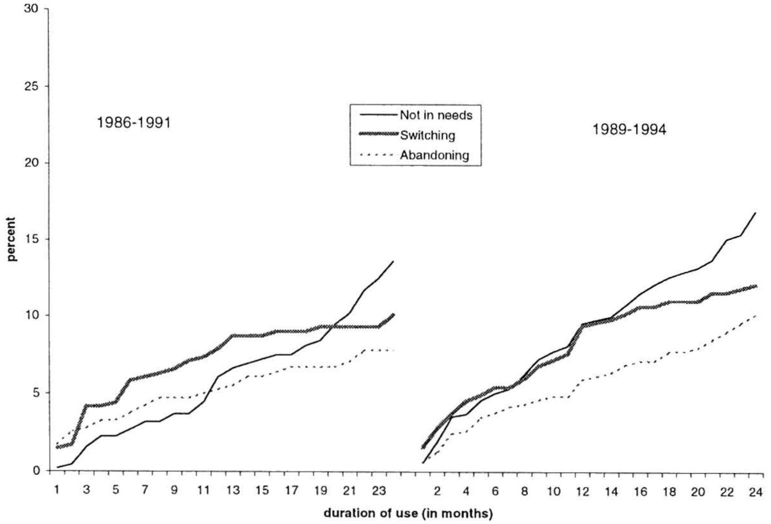



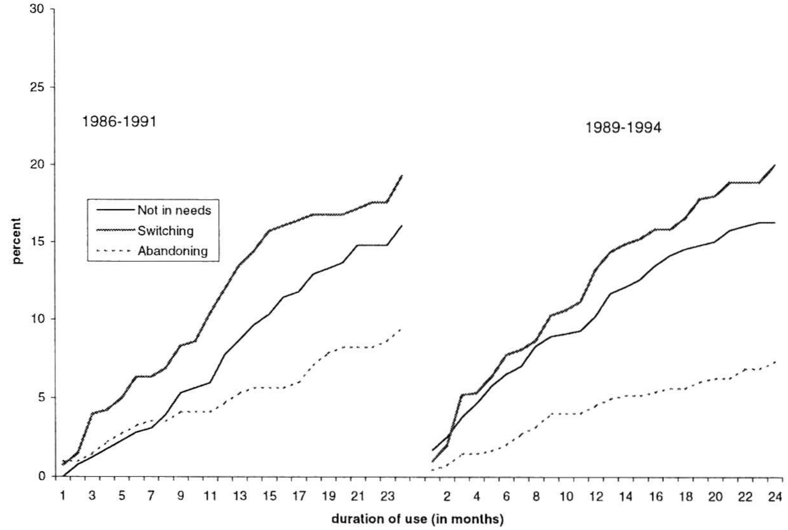



Appendix A-8. Continued ...

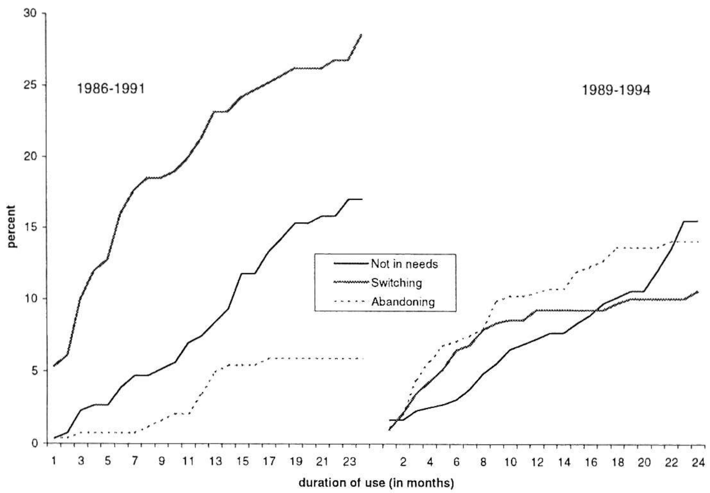
**Figure 8.9 Cumulative Probability of Contraceptive Switching Behaviour After Discontinuation: Bali, 1986-91 and 1989-94**



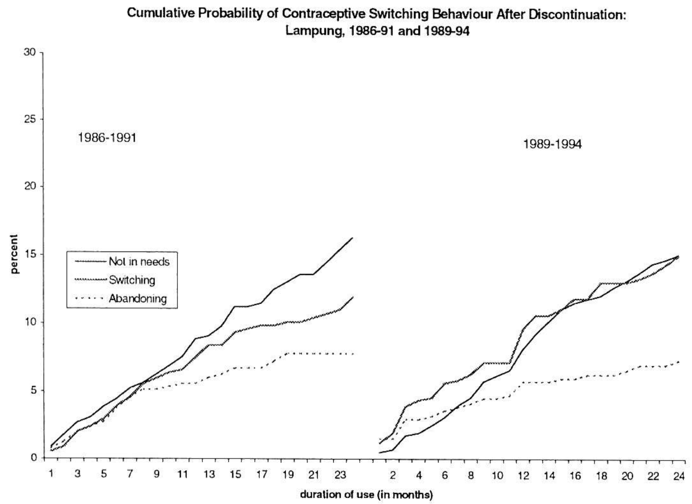

**Cumulative Probability of Contraceptive Switching Behaviour After Discontinuation: North Sulawesi, 1986-91 and 1989-94**

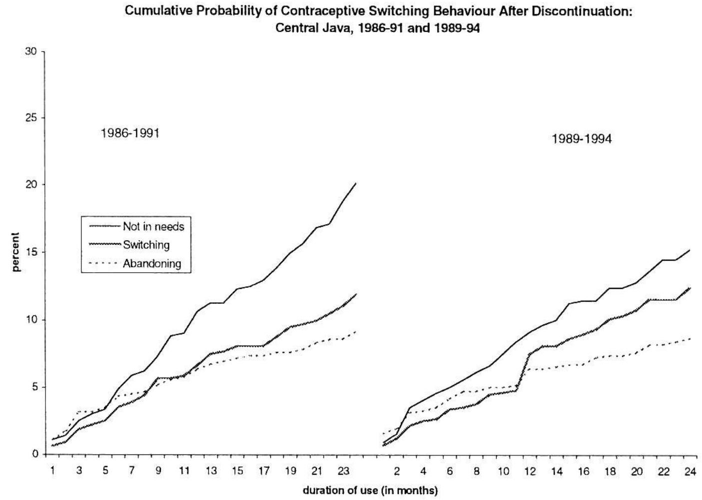


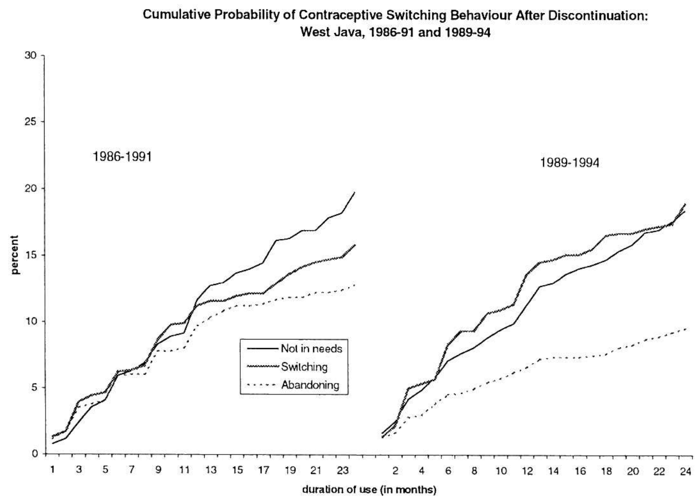

**Cumulative Probability of Contraceptive Switching Behaviour After Discontinuation: Maluku, 1986-91 and 1989-94**



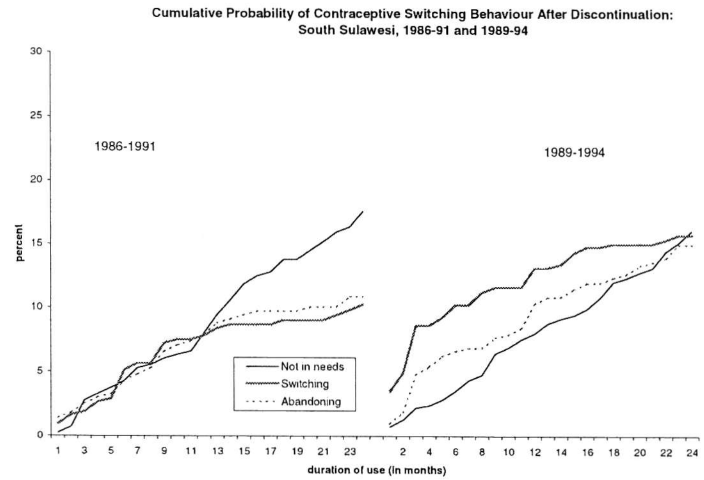
## Appendix A-9. Provinces Which Have Not in Needs for Contraception as the Main State after Discontinuation Calculated Using an MDLT

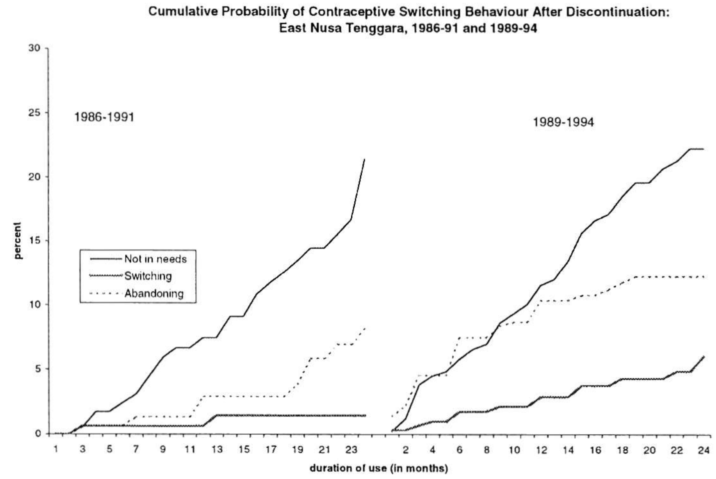


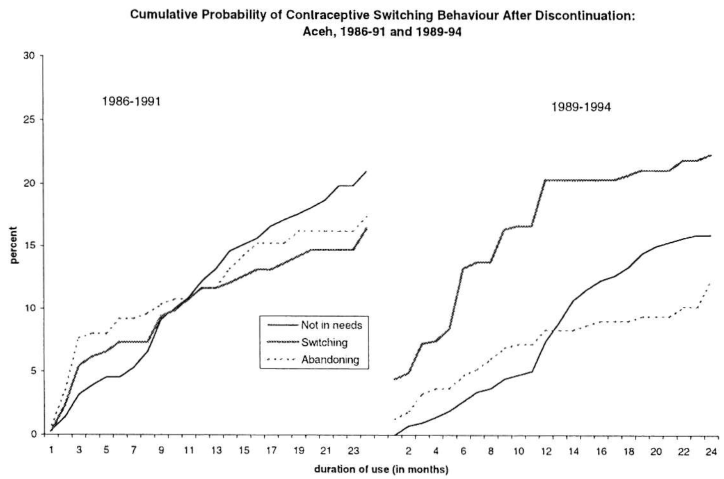



Appendix A-9. Continued ...



## Appendix 10. An F-test for Restricted and Unrestricted Models of the Price Equation

An F-test is utilized to compare the sum of squared errors of the restricted model (without the estimated probabilities) and the sum of squared errors of the unrestricted model (with the estimated probabilities) of the price equation. See Tables A-10.1 and A-10.2. The F-test utilizes the following formulae:

$$F = \{(RSS^* - RSS)/m\} / \{RSS/(n - p)\} \quad \text{with } m, (n - p) \text{ degrees of freedom}$$

Where RSS – Residual Sum of Squared under unrestricted model

RSS* - Residual Sum of Squared under restricted model

m – number of restrictions

n – number of observations

p - number of parameters to be estimated in the unrestricted model

The F-statistic is significant and the coefficients of the estimated probabilities of choosing a particular method in the price equation are significant in 1991(Table A-10.1). However, the 1994 data set shows that each t-statistic of the estimated probability of each method is not significant (Table A-10.2). The F-statistic is not significant at 5%. In other words, the probabilities of the method as a group do not explain the variation of the price of method of contraception. Therefore, there is no endogeneity bias in 1994.

Table A-10.1. Comparison between Restricted and Unrestricted Models of the Price Equation For Testing of Endogeneity: Bali, 1991

| Parameter | Unrestricted model | | Restricted model | |
|---|---|---|---|---|
| | Estimate | S.E | Estimate | S.E |
| Intercept | 8.4188 | 9.2936 | 12.8684 | 3.9066 |
| **Estimated Probability of using:** | | | | |
| Pill[a] | 45.9614** | 20.3290 | | |
| IUD[a] | -2.7910 | 9.0911 | | |
| Injectable[a] | -4.7958 | 9.2750 | | |
| Condom[a] | -37.9052 | 32.8461 | | |
| Norplant[a] | -52.4147 | 37.3599 | | |
| **Has a stove** (base=No) | | | | |
| Yes | -0.2507 | 0.6718 | 3.7035** | 1.8489 |
| **Woman's education** (base= < some primary) | | | | |
| Primary & above | -0.2256 | 0.5338 | 0.2464 | 1.7526 |
| **Religion** (base=non Hindu) | | | | |
| Hindu | -0.9199 | 5.7020 | -13.2587**** | 3.5457 |
| **Husband's education** (base= < primary) | | | | |
| Secondary & above | 1.9028 | 2.3830 | 1.4823 | 2.3551 |
| **Has a TV** (base=No) | | | | |
| Yes | -0.2507 | 2.3219 | 3.0470 | 2.2739 |
| **Has a radio** (base=No) | | | | |
| Yes | -0.2507 | 1.9682 | 1.6091 | 1.8436 |
| **Has Electricity** (base=No) | | | | |
| Yes | -0.2507 | 2.2637 | -0.0903 | 2.1886 |
| **Watch TV** (base=No) | | | | |
| Yes | 1.3752 | 2.4313 | 0.6630 | 2.3721 |
| RSS (Residual Sum of squared) | 248268.5 | | 253055.5 | |
| N (number of observation) | 649 | | 649 | |
| P (number of parameters) | 14 | | 9 | |

Note : a = the instrumental variables for the method
***** $p < 0.001$ *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

$F = \{(253055.5 - 248268.5) / 5\} / \{248268.5/(649-14)\}$ with 5 and 635 degrees of freedom

Table A-10.2. Comparison between Restricted and Unrestricted Models of the Price Equation for Testing of Endogeneity: Bali, 1994

| Parameter | Unrestricted model | | Restricted model | |
|---|---|---|---|---|
| | Estimate | S.E | Estimate | S.E |
| Intercept | 8.5026 | 349.2461 | 2.1106 | 10.1364 |
| **Estimated Probability of using:** | | | | |
| Pill[a] | -1.4561 | 346.9536 | - | - |
| IUD[a] | -31.4527 | 356.1117 | - | - |
| Injectable[a] | -16.2385 | 350.3320 | - | - |
| Condom[a] | -4.2462 | 349.7898 | - | - |
| Norplant[a] | 86.6678 | 349.0505 | - | - |
| **Has a TV** (base=No) | | | | |
| Yes | -0.8635 | 7.4612 | 2.6103 | 7.1887 |
| **Has a Fridge** (base=No) | | | | |
| Yes | 12.2612 | 12.6243 | 10.3633 | 12.5662 |
| **Source of drinking water** (base=surface) | | | | |
| Piped | -5.7735 | 8.9560 | 4.6488 | 7.3708 |
| Well | -8.0312 | 7.5190 | -6.9081 | 7.1063 |
| **House materials** (base=mixed) | | | | |
| Brick, Tile and Concrete roof | 1.3871 | 7.0428 | 6.8681 | 6.4492 |
| **Watches TV** (base=No) | | | | |
| Yes | 8.5657 | 9.2119 | 7.3345 | 9.2124 |
| **Reads a newspaper** (base=No) | | | | |
| Yes | 5.8597 | 8.3881 | 5.7854 | 8.3698 |
| **Source of method** (base=private) | | | | |
| Government | -5.9674 | 6.1532 | -5.0124 | 6.0898 |
| **Main reason for use** (base=method-related) | | | | |
| Recommended | -5.4509 | 7.8756 | -10.1189 | 6.8515 |
| **Decision makers (DM) on spending money** (base=single DM) | | | | |
| Cannot tell the DM | 10.9633 | 8.4558 | 6.5563 | 7.7253 |
| Joined DM | 4.7085 | 7.1952 | 2.2340 | 6.4608 |
| **Woman's education** (base= < some primary) | | | | |
| Primary & above | -0.2256 | 7.2971 | 4.4287 | 6.6420 |
| **Husband's education** (base= < primary) | | | | |
| Secondary & above | 1.9028 | 8.9644 | -0.8721 | 8.1977 |
| **Childhood place of residence** (base=countryside) | | | | |
| Town/city | 20.8639* | 10.9138 | 11.0921 | 10.2189 |
| RSS (Residual Sum of squared) | 4888400 | | 4951144 | |
| N (number of observation) | 804 | | 804 | |
| P (number of parameters) | 20 | | 15 | |

Note : a = the instrumental variables for the method

***** $p < 0.001$ *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

$F = \{(4951144 - 4888400) / 5\} / \{4888400 / (804-20)\}$ with 5 and 786 degrees of freedom

# References

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