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ESSAYS ON TRANSITIONAL ECONOMIES

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ABSTRACT

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In this thesis we investigate the effect of imperfections in credit and financial markets during the transition process that is characterizing Eastern European countries. The analysis is conducted on three levels: the first level is microeconomic and investigate the effects of credit market imperfections on firms' restructuring choices. We show how the need to sort out firms' features in a credit relationship may trigger the incentive for the firms to signal their type to the banks through initial restructuring choices and through lay offs. The analysis helps to understand the unexpected high dynamism in restructuring choices made by state owned firms and is strongly supported by empirical evidence.

The second level is macroeconomic and looks at the long run development of the economy and the evolution of the distribution of wealth. The analysis helps to explain how financial market imperfections affect occupational choices and the long run evolution of income. We show that those imperfections do matter for the long run accumulation of capital but also that they can explain only part of the observed cross country variability of income.
We consider also the interactions between financial market imperfections and soft budget constraints in a model of occupational choice. We show that soft budget constraints, while negative per se, can reduce the degree of imperfections present in the economy resulting, under some conditions, in a higher level of output.

The third level is empirical and tries to quantify precisely the relevance of such imperfections using a panel data of 1600 Hungarian firms over a period of 5 years. We analyse their borrowing decisions and investigate whether or not there exists an optimal capital structure for them and whether there are constraints to the achievements of this optimal capital structure.

The introductory chapter provides a survey of the relevant literature and a framework for a clear identification of the arguments defined in the subsequent chapters.

To Elisa and Tommaso

To all my masters who have been friends
and to all my friends who have been masters

Contents

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Chapter 1

Financial Market Imperfections

1.1 Introduction

This thesis is composed of three essays on the process of transition that is characterizing Eastern Europe. Although the essays examine different aspects of transition, there is a common underlying theme that emphasizes the role played by imperfections in credit and financial markets during the transition process.
The emphasis put on financial market imperfections is justified by three basic reasons: firstly this topic has received in the last years increasing attention by both the theoretical (micro and macro) and empirical literature. Secondly, as explained in section 1.4 there are peculiar aspects that make those imperfections particularly relevant for Eastern European countries. Finally, the role of credit and financial markets during the process of transition has been somewhat neglected by the literature, partly because of available data and partly because initially other issues (i.e. labour market dynamics) seemed more urgent to be addressed.

The topic of financial market imperfections is by itself sufficiently big to call for an extremely extensive survey. However, as this thesis touches only some aspects of the topic, this chapter focuses only on the parts of the literature that are related to the subsequent chapters. In particular the contributions undertake a microeconomic, a macroeconomic and an empirical analysis, and therefore this survey is structured so to mirror this division.
The remainder of the chapter is organized as follows: section 1.2 looks at the the-

oretical literature; it shows what is the importance of informational failures on the microeconomic behavior of the credit market (section 1.2.2), and subsequently it analyses what are the macroeconomic effects of such failures looking at both short run fluctuations (section 1.2.3) and long run growth (section 1.2.4). Section 1.3 looks at the empirical evidence that supports the theoretical analysis.
The chapter continues explaining why all those issues are particularly relevant for the transition process that is affecting Eastern European countries (section 1.4). Finally section 1.5 links the surveyed literature with the following parts of the thesis.

1.2 Theoretical background

1.2.1 MM irrelevance theorem

The idea that imperfections in credit and financial markets can play a decisive role in both the short and long run development of an economy is very old and, as magistrally surveyed by Gertler (1988), dates back to Irving Fisher (1933), and Joseph Schumpeter (1934) . Nevertheless from Fisher to Gurley and Shaw (1955) the early theory of financial structure did not succeed in providing a rigorous and coherent framework within which to describe the effects of financial intermediation on the real economic activity.

Under this point of view the paper by Modigliani and Miller (1958) [henceforth MM] constituted a real breakthrough because it provided a unified rigorous framework with which it was possible to analyse firms' investment decisions jointly with financing decisions. But, MM's paper was going in a completely different direction with respect to previous works, as it drastically undermined the relevance of financial market imperfections in the determination of real variables. In a typical Arrow-Debreu world where markets are complete Modigliani and Miller showed that the only thing that matters for firms' investment decisions is their total value, given by the present discounted value of their cash flows (profits net of investment expenditures). On this value firms can issue claims in form of equity or debt, but the total value itself is invariant to the way cash flows are distributed between these different claims: there is therefore no difference between internal and external finance and the capital structure becomes irrelevant.

As the Arrow-Debreu competitive equilibrium framework progressively become the workhorse of macroeconomic analysis, MM's irrelevance theorem become one of the most widely applied results in economic theory. The reason for such attractiveness lies precisely in the fact that it allowed to ignore the financial side when considering firms' investment behaviour, drastically simplifying the analysis.

1.2.2 The importance of informational failures

The effectiveness of MM's theorem is totally based on the assumption of symmetric information. Lenders and borrowers share the same information and this allows them to agree on a unique price for each possible contingency. In practice, however, this is not the case: firms are generally much better informed about the profitability and riskiness of their investment projects that lenders and shareholders are. In other words there are information asymmetries in credit relationships.
The introduction of asymmetric information has two consequences. The first is a widening of the role of financial intermediation: banks and financial intermediaries are considered not only as a channel of transmission of money and financial variables but also (and more importantly) as processors of information and monitors of borrowers' behaviour.
The second consequence is that when information is asymmetric, processing information becomes crucial: idiosyncratic risk cannot be completely diversified away and the real service provided by the banking sector becomes that one of differentiating good from bad borrowers. In this way it is introduced an additional component of the determination of investments: the informational efficiency of the financial system.

In a seminal paper, Stiglitz and Weiss (1981) showed the effects of informational failures on the credit market. As in the "market for lemons" of Akerlof (1970) information is asymmetrically distributed between buyers (firms) and sellers (banks) of loans and the outcome may be an inefficient level of loans offered in the market. In particular it is assumed that the profitability of investment projects is private information to the borrowers[1]; banks can use the interest rate as a screening device

[1]Stiglitz and Weiss's paper is based on the following crucial assumptions: all investment projects have the same expected return but differ in terms of risk. This assumption is known as *mean*

in order to sort out good borrowers from bad ones, but doing so they trigger a twofold effect:

- *Adverse Selection* effect: as the interest rate rises good borrowers may drop out of the market increasing the average riskiness of the loans; this is because under reasonable assumptions good borrowers are on average less willing to pay high interest rates than bad borrowers who already perceive a high probability of not repaying the loan.

- *Moral Hazard* effect: when the borrowers have the possibility to undertake different types of projects, changes in the interest rate can affect their behaviour. An increase in the interest rate reduces the effective return on successful projects and this may induce borrowers to choose riskier projects[2].

Due to both these effects the relationship between interest rate and expected return to the bank is not monotonically increasing but there is a "Laffer Curve" characterized by an optimal rate at which the expected return is maximized. At higher rates of interest both the adverse selection and the moral hazard effects are so relevant to completely overcome the positive effect determined by the increased interest rate. At this "optimal" rate, however, there may be an excess of demand for loans where credit is rationed.

For credit rationing to have an effective bite on the economic system it has to be accompanied also by some inefficiencies in the equity market, otherwise firms would just substitute credit with equity[3]. Greenwald, Stiglitz, and Weiss (1984) and Myers and Majluf (1984) show that similar informational failures could trigger adverse selection effects also in the equity market.

- With equity finance most of the profit can be disposed of by managers with extreme discretion, while debt financing reduces the flexibility of managers actions. Moreover with debt financing there is always the discipline power of

preserving spread.

[2]This moral hazard argument was first put forward by Jensen and Meckling (1976).

[3]Indeed De Meza and Webb (1987) show that in the Stiglitz-Weiss model the equilibrium method of finance is an equity contract, and if all entrepreneurs choose equity finance the social optimum is achieved.

the threat by lenders of withdrawing their funds. For both these reasons debt, compared to equity, reduces informational problems.

- There may be *signalling effects* that restrict firm's ability to issue equity. Since managers are assumed to have superior information about firm's profitability, a greater debt burden would be a signal of a healthy firm. If good firms rely primarily on debt, then equity is issued mainly by bad firms. Hence, issuing equity, a firm may convey a negative signal and its market value may be consequently reduced.

As a consequence informational failures can be responsible for the existence of rationing in both the credit and equity market.

Perhaps the greatest shortcoming of the approach presented above is the fact that the contractual form between lenders and borrowers is always assumed and never derived. This is troublesome for two simple reasons: on one hand, because the contract is not "optimal", small variation in the relevant conditions and constraints can lead to completely different outcomes. On the other hand it is natural to think about financial institutions as endogenous outcomes of the informational structure of the economic system.

The *costly state verification* approach pioneered by the work by Townsend (1979)[4] overcomes this problem. It is assumed that lenders cannot observe the outcome of the project undertaken by borrowers without incurring in a fixed cost. As borrowers have limited liability there is an optimal auditing frequency which trades off between the cost of auditing and the incentive by the borrowers to misreport the outcome when not audited. The optimal contract has to specify three elements: a payment (function of the outcome of the project) from the borrower to the lender, an auditing frequency and a penalty that the borrower has to pay when audited and found misreporting the true state.

Townsend shows that the incentive compatible debt contract takes the following form: if the payoff of the project exceeds a certain threshold (say P), the borrower pays the amount P and the lender does not verify. If the payoff is less than P the lender pays the verification cost and takes all the output. This contract is therefore

[4]See also Gale and Hellwig (1985).

a fixed debt contract where for an investment I a borrower with wealth W borrows $I - W$ and promises to pay back P. If the return is greater than P the borrower pays what agreed and keeps what is left, otherwise he is left with nothing.
Williamson (1986, 1987) shows that also in this framework equilibrium credit rationing can arise.

By the mid eighties therefore the relevance of asymmetric information in credit and financial market was well established. Nevertheless, even if informational failures mined the fundamental assumptions on which it was based, the Modigliani-Miller's theorem experienced only a marginal reduction in its use. As previously mentioned the reason had to do with the fact that this theorem was extremely important for macroeconomic models for both long run (equilibrium growth theory) and short run (real business cycle theory) analysis.
If the MM's theorem was to be challenged it had to be on that ground, and the task was really difficult because one thing is to use asymmetric information to build microeconomic models aimed at partial equilibrium analysis, quite another is to use them within a general equilibrium framework, where the distinction between lenders and borrowers makes the representative-agent paradigm inappropriate.

1.2.3 Financial Markets and cycles

Both the costly state verification approach and the approach à la Stiglitz have been incorporated in a dynamic general equilibrium setting to analyse the impact of financial market imperfections on business cycles.
The rationing arguments made by Stiglitz and Weiss (1981) have been extended by Greenwald and Stiglitz (1993): because of a one period lag between the purchase of the inputs and the sale of the output, firms suffering from a decline in cash flows have to rely on external finance to cover input costs. If there are constraints to the use of external finance, firms would reduce employment and production. Moreover because financial market imperfections prevent firms from diversifying the risk that they face, they induce them to act in a risk averse manner. Risk aversion in turn acts as an amplification mechanism for shocks that hit the economy[5].

[5]Similar arguments are developed in Greenwald and Stiglitz (1988a, 1988b, 1990a, 1990b)

But it has been the costly state verification approach that proved to be more suitable for a general equilibrium analysis. In a path-breaking article Bernanke and Gertler (1989)[6] embed financial market imperfections in a standard real business cycle framework challenging the MM's theorem on the ground in which it was more fertile.

In an overlapping generation all economic agents receive, when young, a wage that has to be invested to provide income for retirement (second period); some agents (entrepreneurs) have the possibility of starting up an investment project as they have access to external finance. Because of a costly state verification problem, debt contract are imperfect, generating agency costs[7] and preventing some profitable projects from being implemented. Moreover, as implemented contracts provide employment for the next generation, there is a clear transmission mechanism linked to financial markets imperfections. A negative shock in fact has three effects:

- It reduces the wealth of existing entrepreneurs and, for any given financing cost, decreases the fraction of those who can undertake an investment project. As a consequence labour demand decreases.
- It increases agency costs inducing what is called a *flight to quality*: lenders reduce the amount of credit extended to projects that require monitoring and increase the share allocated to safe assets.
- It reduces next generation's wage introducing persistence into the mechanism.

Bernanke and Gertler show that financial market imperfections not only create an amplification mechanism for shocks that hit the economy, but also can generate cycles by themselves; moreover the obtained dynamics are non-linear in the sense that the adverse effects of those imperfections worsen the deeper is the recession that hits the economy[8].

[6] See also Boyd and Prescott (1986), Bernanke and Gertler (1990) and Bacchetta and Caminal (1995)

[7] Agency costs can be defined as the deadweight loss that is consequence of asymmetric information. They can be approximated by the difference between the cost of internal and external finance.

[8] In Bernanke and Gertler's model financial markets effects last only one period; Gertler (1992) extend the model to a multiperiod framework, obtaining similar results and capturing the idea that liquidity constraint that affect the firm for one period may induce it to cut investment for

The "agency cost" approach outlined above is embedded by Kiyotaki and Moore (1997a) in a richer setting in which firms are credit constrained (because of the usual agency problems) and have to use their productive assets as collateral. In addition to effects similar to the ones obtained by Bernanke and Gertler, here an additional mechanism is at work: when the economy is hit by a negative shock the decrease in the *price* of the productive assets will also have a negative effect on firms' investment as the amount borrowed is proportional to the value of collateral (i.e. to the value of the productive assets). In another interesting contribution Kiyotaki and Moore (1997b) stress that when some goods are "customized", their value is related to the particular buyer for which the good itself is produced (in other words the market value of the good is much lower than the value to the buyer). If in a downturn the buyer defaults, it induces the seller to sell the customized good on the market realizing a capital loss. Both the fact that some productive assets are used as collateral and the peculiar buyer-seller relationship can constitute an amplification mechanism for failures in the credit market.

1.2.4 Financial markets and growth

So far we have stressed the importance of financial market imperfections for short run fluctuations. In doing so we have underlined that their play a double role: they constitute an amplification mechanism for the cyclical movement of macroeconomic variables and they are able to generate cycles by themselves.

The subsequent natural step is to investigate whether or not those imperfections can exercise an impact also on the long run development of the economy, that is if they can affect growth.

The link between financial markets and economic development was already established by Schumpeter (1934), however it has been again only at the beginning of this decade that the field has been enriched by some decisive contributions. Generally speaking we can distinguish between those contributions who emphasize the direct effect of financial market imperfections on growth and those who stress the indirect effect exercised through the distribution of income.

several periods afterwards in order to build up adequate levels of cash. Bernanke, Gertler, and Gilchrist (1999) extend all those results in a full real business cycle model and assess the relevance of financial market imperfections via numerical methods.

King and Levine (1993a, 1993b) stress that agency costs created by financial market imperfections increase intermediation costs and thus decrease investment in risky but profitable activities (like R&D); this in turn slows down growth. King and Levine provide also empirical evidence that the degree of financial development (measured by the ratio of liquid liabilities to GDP and by the ratio of commercial bank paper to central bank credit) is positively related with GDP growth. The King and Levine argument is mainly based on monitoring costs and therefore it can be viewed as an "extension" to the long run of the short run analysis conducted by Bernanke and Gertler and the "agency cost" approach. The emphasis put on risk diversification by Greenwald and Stiglitz is on the other hand resumed by the analysis of Acemoglu and Zillibotti (1997). Their argument is that financial market imperfections reduce diversification opportunities and this induces lenders to invest in safe low return activities that slow down the growth process.
In both cases there is a two sided interaction between financial markets and growth: on one hand more developed financial markets reduce monitoring costs, increase diversification and enhance growth. On the other hand higher growth allows more resources to be available for both monitoring and diversification and therefore improves the development of the financial system[9].

One of the most important consequences of asymmetric information, as stressed in the initial paragraphs, is that the representative agent paradigm is not longer applicable and one has to deal with the complications arising from the heterogeneity between agents. As a consequence changes in the distribution of wealth will have non trivial effects on the economy. A strand of the literature has therefore investigated the effects of financial markets imperfections on the distribution of wealth and indirectly on growth[10]; in addition it has also been possible to derive theoretical foundations for what is called the Kuznets hypothesis (Kuznets (1955)), that is early stages of development should be associated with a widening of the income distribution while later stages of development should be associated with a narrowing

[9]Similar analysis to the ones presented here are conducted by Bencivenga and Smith (1991, 1993) , Boyd and Smith (1992), De Gregorio (1996).

[10]There are contributions that investigate the effects of wealth distribution on growth in absence of financial market imperfections. The mechanism through which this happens is usually via voting mechanisms over policy issues; see Alesina and Rodrik (1994), Bertola (1993), Persson and Tabellini (1994). Bénabou (1996) provides an excellent survey of this literature and the one mentioned below.

of the distribution.

Whether the wealth distribution of the economy is exogenously or endogenously determined the introduction of financial market imperfections gives to it an extremely important role.

The general idea is that whenever there is a minimum project size for investment purposes[11], financial market imperfections generates a threshold level of wealth that distinguishes agents in two groups: those above the threshold will undertake the investment and those below will not.

The presence of the non convexity (minimum project size) gives to the agents who are above the threshold an extra return with respect to the ones who are below. In order to maximize total output (and growth) it is necessary to maximize the number of agents belonging to the entrepreneurial class. Through the determination of the threshold, financial market imperfections determine also the distribution and total output of the economy.

Moreover when one considers the *endogenous* determination of wealth distribution, there is also a feedback effect *from* the distribution *to* financial market imperfections, that comes into place. An increase in inequality in fact worsen the credit constraint that agents face and thus reduces the possibility for poor agents to pass the threshold of wealth needed to become entrepreneurs.

This negative feedback of the distribution operates through different channels: in Piketty (1997) and Aghion and Bolton (1997) it operates through the capital market. In their model the threshold distinguishes "good" from "bad" entrepreneurs: the former run high-return projects; the latter low-return projects. A more unequal distribution of wealth means that more people are below the threshold and have to operate the low return technology. This depresses capital accumulation (and therefore capital supply) and requires a high interest rate to clear the market. High interest rate makes borrowing more difficult and worsen the condition of those poor agents that are below the threshold.

In Banerjee and Newman (1993, 1994, 1998) the mechanism operates through the labour market: the threshold in this case distinguishes between entrepreneurs that are sufficiently rich to set up a firm and workers who have to be employed by en-

[11] The investment can also be in terms of human capital as in Galor and Zeira (1993) and Owen and Weil (1998).

trepreneurs. A more unequal distribution of wealth implies that there are more agents below the threshold who will have to work as employees. This in turn depresses the wage, makes them poorer and the employers richer widening further the distribution.

The feedback effect deriving from the endogeneity of wealth distribution together with the existence of non convexities often implies the existence of multiple equilibrium long run distributions that makes the stochastic evolution of the economy history dependent. The non convexity generates also an evolution similar to the Kuznetz-curve: maximizing total output in fact requires, in the initial stages of development, to concentrate wealth on few agents who can undertake the investment projects. When aggregate growth increases, more people will be able to get out from the "development trap" and eventually inequality will decrease [Aghion and Bolton (1997)].

1.3 Empirical Evidence

So far we have analysed theories that stress the relevance of financial market imperfections for the equilibrium in the credit market, for business cycle analysis and for long run growth.

But *how* relevant are those imperfections? Only empirical analysis can give an answer on this issue. We have previously mentioned the evidence brought forward by King and Levine (1993a, 1993b) on the relationship between financial development and growth.

The standard approach for testing for the presence of financial market imperfections has been to assess whether there are significant departures from the basic assumptions on which the Modigliani and Miller's theorem is based. This can be done in two ways: on one hand one can investigate whether firms' *investment behaviour* is correctly described by models based the assumption of perfect credit markets.

On the other side one can investigate whether firms' *capital structure* is correctly described by the complete market assumptions. Both approaches are clearly two sides of the same coin.

The first approach is based on the following argument: in a Modigliani Miller economy, with complete markets, the only thing that really matters for firms' investment

is the value of Tobin's Q. Any deviation from the Q theory of investment would be a signal of market incompleteness. Financial market imperfections on the other hand insert a wedge between internal and external cost of financing; for any given level of interest rate, high profit firms will tend to invest more than low profit firms. Starting from these considerations one could augment a traditional investment equation to incorporate some measure of cash flows[12]. Evidence of a positive correlation between investment and cash flows would lead to the rejection of the complete market assumption.

This procedure entails however a problem: simply regressing investment on cash flows, one very easily finds a strong positive relationship even in absence of imperfections; the reason is that cash flows may simply be a proxy for profitability: when a firm's liquidity is high is likely that the firm is doing well and it should have good investment opportunities, the estimated effect of cash flows on investment thus results biased.

To overcome this problem Fazzari, Hubbard, and Petersen (1988) compare the investment behaviour of different groups of firms. They divide a large panel of manufacturing firms in three classes according to their dividend/income ratio: class 1 represented firms with the lowest D/I ratio and class 3 the highest. The basic idea is that a firm that has a high D/I ratio, can finance investment simply reducing D/I, while a firm with a low D/I ratio must rely on external finance and is more likely to be liquidity constrained.

Fazzari, Hubbard and Petersen use the following basic regression:

$$I_{it}/K_{it} = aQ_{it} + b(CashFlow/K)_{it} + u_t$$

where I = investment, K = capital and Q = value of q at the beginning of the period.

They are mainly interested in the *differences* between estimated coefficients of different classes, in fact as long as the bias is the same for the three groups of firms the difference of the estimated coefficients should be an unbiased estimate of the true difference.

[12]Schiantarelli (1997) provides an excellent survey of the empirical literature that test the presence of financial constraints to investment.

If financial market imperfections are present, the relationship between cash flows and investment should be stronger for firms that have a higher cost of raising funds. Their conclusions are that adding the variable cash flows to the regression improves significantly the goodness of fit of the overall equation and more importantly that the estimates of b are positive and statistically significant. In particular the estimated coefficients are 0.230 for class 3, 0.363 for class 2 and 0.461 for class 1 suggesting the importance of financial market imperfections mainly for low dividend firms.

Hoshi, Kashyap, and Sharftein (1991) use a variation of the above approach: they focus on a panel data set of Japanese firms that allows them to distinguish between a group of firm that has a close relationship with banks and a group that has weak banking ties.

The former group should not be subject to asymmetric information while the latter on the contrary should find greater difficulty in raising capital because of informational problems.

Their results fully confirm the ones obtained by Fazzari Hubbard and Petersen.

Gertler and Gilchrist (1994) adopt a different approach: they divide firms on a priori ground as well but this time accordingly to their dimension: their hypothesis is that small firms should encounter larger barriers to external finance (and thus higher liquidity constraints) than large firms, because of fixed costs associated with issuing publicly traded bonds.

They compare the behaviour of small and big firms after a tightening of the monetary policy and find that small firms account for an extremely high share of the decline in sales, inventories and short term debt suggesting the presence of liquidity constraints.

An extension of the previous work is provided by Bernanke, Gertler, and Gilchrist (1996) that split the sample by some proxy for credit market access other than firm's size. In particular they divide firms by "bank dependency"[13] and find that bank dependent firms have a stronger procyclical behaviour of inventories and short term debt than non dependent firms suggesting the influence of liquidity constraint for the first group of firms.

An approach equivalent to estimating investment equations has been to estimate

[13]They define "a bank dependent firm to be one that has no commercial paper outstanding and has at least 50% of its short term liabilities in the form of bank loans".

Euler equations for the capital stock[14]. The Euler equation approach has the advantage of not requiring the calculation of the market value of the firm (this can be difficult especially in developing countries where stock markets are inefficient); this measure is on the other hand required by any model based on the Q theory. Examples of the Euler equation approach are the works by Bond and Meghir (1994), Bond, Elston, Mairesse, and Mulkay (1997), Hubbard, Kashyap, and Whited (1995) and Whited (1992) for developed economies and Harris, Schiantarelli, and Siregar (1994) and Jaramillo, Schiantarelli, and Weiss (1996) for developing countries. All those works confirm the findings that proxies for the availability of internal funds are a significant determinant of investment, underlining the presence of financial market imperfections.

The alternative approach to investment and/or Euler equations has been to estimate directly firms' capital structure. Under the MM's assumptions a firm's capital structure is completely irrelevant that is internal and external finance should be perfect substitutes. Moreover external forms of finance should not be systematically related to measures of size, collateral, investment opportunity etc. If we observe a systematic substitution of debt with other internal forms of finance, it could be evidence that firms actually *prefer* one form of finance over the other. This means that there exist an "optimal" capital structure that firms want to achieve and, following Myers and Majluf (1984), a "pecking order" of financing methods.
Titman and Wessels (1988) and Rajan and Zingales (1995) investigated this issue regressing leverage on measures of tangibility, profitability, investment opportunities, size and internal finance. They found that leverage tend to be positively related with size, collateral and investment opportunities. The sign of profitability in principle could be either positive or negative. If we are considering the supply side of the credit market banks should be more keen to lend to more profitable firms and we should observe debt to be positively related with profitability. Demand side considerations point however in the opposite direction: if there is a "pecking" order of financing methods firms should prefer internal to external finance and the relationship between debt and profits (that are a major component of cash flows) should be negative. The

[14]Formally the two approaches are perfectly equivalent as the Euler equation is derived from the first order conditions of a Q model of investment.

sign therefore depends on whether the demand effect overcomes the supply effects. Rajan and Zingales (1995) and Titman and Wessels (1988) found a negative relation between debt and profits (or cash flows) and conclude the this is evidence of the existence of a "pecking" order of financing methods[15].

1.4 Financial market imperfections in Eastern Europe

The analysis developed so far and the literature quoted refers almost exclusively to developed economies. The same arguments can be applied *a fortiori* to the case of developing countries. Informational failure that are at the base of financial market imperfections are in fact generally more pronounced in developing rather than developed economies.

Under many points of view transitional economies can be considered as any other developing economies, nevertheless there are some factors that are peculiar to Eastern Europe that made the initial conditions of Eastern European credit and financial markets quite unique.

First we need to consider how economic relations were organized during the socialist system and what kind of challenge financial institution faced with transition.

During the old planned system the financial sector was fictitious; firms had virtually no budget constraint; if any of them found itself in credit or liquidity shortage some commercial bank would have been ordered to accord to the firm an additional loan. The solvency of the whole system was provided by the central bank itself (that had always the possibility of printing money without generating inflation since prices were fixed).

Moreover, as the problem of solvency was non-existent, there was no difference between borrowing from banks or from other firms; therefore at the beginning of reforms firms credit was composed in large part by *interenterprise credit.*

Because banks in their lending behaviour were merely executing what was stated in the plan, they never exercised any monitoring or risk assessment activity and at the beginning of transition even if they had an ongoing long term relationship with

[15] Other contributions to this literature are nicely surveyed by Harris and Raviv (1991).

some firms, this relationship was effectively totally uninformative[16].

With the beginning of transition the central bank stopped to exercise a passive role, hard budget constraints started to be imposed and banks had to provide in a very short period of time quite sophisticated services without the ability to do it. Moreover the needs that they were facing were not comparable to the needs of a developing country rather to those of a quite developed economy. Under this point of view, the condition of banks in Eastern Europe was worse than that one of banks in other (even poorer) developing countries, because they did not have the time to adequate themselves to a growing economy.

All the rules and regulations of financial intermediation had to be designed (starting from adequate bankruptcy procedures) but more importantly banks had to develop monitoring skills: they had to build up information on their costumers, learn how to assess risk and to implement all those actions that reduce informational failures in the borrower-lender relationship.

Finally the early stages of transition were characterized by a high level of economic instability; in presence of an unstable economic system current performance are a very poor indicator for future performances. Therefore not only borrowers did not have any reputation deriving from the past, but they also had relevant difficulties in building one *ex novo*.

The picture depicted so far contains all the ingredients for a severe credit crunch due to forms of rationing to be experienced during the early stages of the transition process (see Calvo and Coricelli (1993), Calvo and Frenkel (1991)). After the initial credit crunch both the level and the quality of financial intermediation improved, but very slowly putting a severe constraint on the development of those economies. Imperfections in the credit financial markets affect heavily three aspects of the process of transition that in turn have a profound impact on the macroeconomic performances.

- The restructuring process of State-Owned firms. State-Owned firms constituted the backbone of the planned economy. The possibility of restructuring those firms relies also on the efficiency of the financial markets that can provide capital for those types of investments.

[16]A detailed description of how the credit system was designed under the planned economy is provided by the joint study by the IMF, World Bank, OECD and EBRD (1992).

- The growth of the new private firms. With the beginning of transition there have been an impressive rate of birth of new firms. An inefficient financial market cannot provide adequate financing at reasonable "prices" for new (and risky) entrepreneurial projects. In this way there is a serious risk of hampering the development of the new private sector and ultimately the growth prospects of the economy.

- The privatization process: the success of the privatization process ultimately depends on the efficiency of the financial markets in pricing correctly the firms, and in providing alternative financing methods that enable firms to achieve the desired capital structure.

There are few contributions by the theoretical literature who emphasize the above mentioned arguments: Coricelli (1996) considers a framework similar to the one developed by Calvo and Coricelli (1992b) to analyse the role played by financial market inefficiencies and how they interact with trade credit in affecting the long run growth of the economy. He shows that even if financial markets are underdeveloped, their efficiency could still induce trade credit to allow the economy to achieve the first best. The relationship between private sector development and financial markets is analysed by Brixiova and Kiyotaki (1997) in a model of liquidity constraints similar in spirit to Kiyotaki and Moore (1997b)

It has been difficult to estimate the relevance of the above mentioned effects, the reason being that there was lack of reliable microeconomic data with which to test the relevant hypothesis.

Recently however firm level case studies reported by Belka, Estrin, Schaffer, and Singh (1995), Bonin and Schaffer (1995), Carlin and Landesmann (1997) Estrin, Brada, Gelb, and Singh (1995) stress that firms in Eastern Europe face severe financing constraints. For example Belka, Estrin, Schaffer, and Singh (1995) survey 200 Polish firms in 1993; when asked which was the most important obstacle that was constraining their investment behaviour firms ranked first high interest rate, second their poor financial situation and third the unwillingness of banks to lend. All those factors are in one way or another strongly linked to the presence of financial market imperfections. More recently Bratkowski, Grosfeld, and Rostowski (2000), using survey data, analyse the investment behaviour and the financing methods of

de novo private firms in Hungary, Poland and the Czech Republic. They find evidence of imperfections in financial markets but also that there do not appear to be severe forms of credit rationing for *de novo* firms and those imperfections do not seem to inhibit the growth of those firms. Similar conclusions are reached by Johnson, McMillan, and Woodruff (1999a, 1999b).
Other econometric studies have been conducted by Cornelli, Portes, and Schaffer (1998) for Hungary and Poland, Carare and Perotti (1997) for Romania, Budina, Garretsen, and de Jong (1999) for Bulgaria, Lensink and Sterken (1998) for Estonia and by Lízal and Svejnar (1998, 99) for the Czech Republic; all those studies provide evidence of imperfections in financial markets that are constraining firms in the achievement of their optimal capital structure or in their investment behaviour.

The theoretical and empirical evidence stressed in this paragraph emphasize that understanding the problems that are afflicting credit and financial markets in Eastern Europe is crucial for a correct analysis of the transition process. In the next paragraph we will explain how those issues will be addressed in this thesis.

1.5 The aim of this work

So far we have underlined what are the theoretical and empirical issue related to financial market imperfections. Subsequently we have stressed that those issues are particularly relevant for Eastern European countries that are experiencing the transition from a planned to a market economy.
It is now time to explain how those issues will be treated in this work.
We will proceed following the general lines given in the introductory sections, where we have stressed three aspects: the effects of financial market imperfections on the microeconomic structure of the credit market (section 1.2.2), on the macroeconomic phenomena (section 1.2.3 and 1.2.4) and the empirical evidence that quantifies those effects (section 1.3).
Chapter 2 has a microeconomic approach: it analyzes the effects of asymmetric information on the relationships between firms and banks during the transition process and investigates how informational failures in the credit relationships affect firms' restructuring choices. This is done in a simple game theoretical framework where it

is argued that the massive amount of lay-offs created by state-owned firms during the initial phase of the transition can be interpreted as a signal directed to the banking sector to overcome those informational problems and to obtain more favourable financing conditions for the subsequent process of restructuring. The model explains the (unexpected) strong dynamism showed by state owned firms during the initial stages of transition. The conclusions are strongly supported by Polish firm level empirical evidence where contracts between banks and firms to finance restructuring plans take exactly the form envisaged in the model. The model does not contain any intrinsic dynamics, but provides explanations for the amplification mechanism of short run dynamic evolution of employment following the beginning of transition.

The effects of financial market imperfections on the macroeconomy are analysed in chapter 3 which focuses on long run growth and development. We analyse a model of wealth distribution that extends some of the models presented in section 1.2.4. In particular we provide the endogenous determination of wealth distribution together with the wage level and we assess quantitatively the relationship between growth, distribution and financial markets.

In our model agents can choose between two different activities: they can either become *workers* earning a competitive wage, or they can become *entrepreneurs*, hiring capital and labor on competitive markets and getting an income determined by the difference between the revenues from selling the output and the input costs. Agents are assumed to be heterogeneous in two respects: they have different wealth levels (initial or inherited from their parents) and they differ in terms of productivity. The distribution of wealth is determined endogenously in the model while the distribution of productivity is exogenously given. The more agents (both workers and entrepreneurs) are productive, ceteris paribus, the higher their earnings are. However the presence of financial market imperfections prevents some individuals to borrow the amount that is necessary in order to become an entrepreneur. Since more productive individuals typically wish to borrow more as entrepreneurs, imperfections on the financial markets are more likely to prevent the more productive individuals to become entrepreneurs. Therefore if financial markets are imperfect there are less entrepreneurs and more workers in equilibrium than otherwise, resulting in a lower level of output.

We analyse the development of such an economy and we analyse quantitatively the impact of financial market imperfections on the long run level of income. We find that those imperfections, alone, do matter but also that they can explain only part of the cross country differences in income levels. What seems to be relatively more important is the distribution of agents' productivity (or opportunities), and mostly the *interaction* between the degree of mobility within the distribution of abilities and the level of financial market imperfections, that in the presence of low mobility and high level of imperfections, can generate a development trap.
This would suggest that, albeit financial market reforms are important, the crucial determinant for the long term development of transitional economies are institutional reforms that can modify the distribution of opportunities that agents face.

Chapter 4 analyzes the interaction between financial market imperfections and soft budget constraints in a model similar in spirit to the one used in chapter 3.
Also in this case agents may become entrepreneurs by implementing a project. The likelihood of success of the project can be increased by spending effort on it. Depending on their wealth agents may need to borrow in order to become entrepreneur. Individuals' limited liability generates an agency problem in the borrower-lender relationship that in turn increase the cost of borrowing. In this framework we introduce soft budget constraints in form of a subsidy to entrepreneurs in case of failure of the project.
We look at the general equilibrium effect of soft budget constraints assuming that they are financed with a proportional tax on income. We show the existence of an optimal "level" of soft budget constraints that is strictly positive. This level is related to the degree financial market imperfections and of institutional failures present in the economy.
The intuition for this result is the following: on one hand soft budget constraints distort agents' incentives inducing them to provide less effort, on the other hand they reduce the agency problem diminishing the interest charged by financial intermediaries. The "optimal level" of soft budget constraint is the one that trades off between those two effects.

Finally chapter 5 provides a quantitative evaluation of the relevance of financial market imperfections in Eastern Europe. To do this we use comprehensive (and quite

unique for Eastern European standards) firm level data for Hungary that allow us to build a panel of 1100 firms over a time horizon of five years. We investigate what is the capital structure of Hungarian firms and whether there are constraints to the achievement of what those firms consider to be an "optimal" capital structure. The approach is therefore similar to the one outlined in the second part of paragraph 1.3; to our knowledge this is the first study that investigate those issues using a large panel of Eastern European firms. We find evidence of relevant forms of financial market imperfections (and of the existence of a "pecking order" of financing methods), but also that banks are positively and actively involved in resolving the informational problems that are afflicting the credit market. At least for the case of Hungary, therefore there seems to be positive signs of attempts to reduce financial market imperfections.

As it emerges clearly from the previous paragraphs, this work will touch different aspects of the role played by financial markets in Eastern Europe, using different frameworks. For this reason, in order to provide to the reader all the necessary tools for the grasp of the topic, each chapter has been written to be, as far as possible, self contained. Therefore each chapter contains its own motivation, links to the relevant literature and relation to empirical evidence in Eastern Europe.

Chapter 2

Restructuring and Signalling

2.1 Introduction

One of the most striking aspects of the first years of the transition process is the massive increase in unemployment that accompanied economic reforms.
The majority of the literature explains this increase in unemployment within models of "sectoral flows" in which a transitional economy is viewed as composed of a strongly inefficient contracting state sector characterized by low productivity of labour and an efficient growing, high productivity private sector. The labour force follows an allocation process from the first to the second sector and unemployment arises because the outflow from the state sector is greater than the absorbing capacity of the private sector. Examples of these models are works by Aghion and Blanchard (1994), Atkeson and Kehoe (1996), Blanchard (1997), Castanheira and Roland (1996), Chadha and Coricelli (1996), Gavin (1997), and Rodrik (1995).
Recent empirical estimates by Konings, Lehmann, and Schaffer (1996)[1] are consistent with the flow approach stressing that flows into unemployment come essentially from the state sector while flows out of unemployment are driven by the growth of the private sector.
Nevertheless when one turns from the macroeconomic level to the microeconomic level to analyze the roots of this phenomenon, most studies warn that the resulting "speed of transition" is likely to be very low. The reason is that in transitional economies workers have a high decision making power in state owned firms and it is

[1] See also Svejnar (1996) for a survey.

"optimal" for them to slow down the speed of transition and wait for private sector growth in order to have better chances to find a match there[2].
At a theoretical level it is therefore difficult to explain a high dynamism of the state sector, and these arguments have been reflected in suggestions by analysts and policy advisors which from the beginning stressed the urgency of fast privatization of state-owned firms in order to force them to change. In fact privatizations have been all but fast with the most important "waves" being implemented in the Czech Republic and in Poland only in 1994 and 1995 respectively.
Despite all these considerations, recent firm level empirical evidence [see in particular Belka, Estrin, Schaffer, and Singh (1995), Carlin, Van Reenen, and Wolfe (1995), Konings, Lehmann, and Schaffer (1996), Pinto, Belka, and Krajewski (1993) and Pinto and Van Wijnbergen (1995)] stress that, unexpectedly, state owned firms implemented from the beginning heavy and costly restructuring measures. These were mostly in terms of reductions of the labour force.
A second aspect stressed by empirical evidence is that there have been substantial differences in restructuring behaviour of firms that were operating within the same sector and therefore in principle subject to analogous shocks in terms of demand, terms of trade etc. The macroeconomic models previously mentioned fail to account for these behavioral differences.

In this chapter we provide a simple theoretical framework to explain those aspects: why firms restructured more than expected and why observationally similar firms adopted different restructuring choices.

Firstly we define precisely what are the actions and measures implied by the restructuring process. Following Grosfeld and Roland (1995) we distinguish between *defensive* and *strategic* restructuring; the former identifies all those measures implemented in order to guarantee the immediate survival of the firm (reduction of costs and of production scale through lay-offs, closing of non-productive plants and the reorganization of the existing production line). The latter refers to a more radical and deep form of restructuring addressed to the firm's long run development and

[2]In this general framework Aghion and Blanchard (1994) stress the role of unemployment benefits, Atkeson and Kehoe (1996) analyse the effects of social insurance, while Rodrik (1995) emphasizes the role of government policy and of consensus to reforms.

growth through the introduction of new technologies, new production processes and new investments.
Firms in our model are heterogeneous and the heterogeneity derives from differences in managers' quality; those differences in turn result in different choices during the restructuring phase. In particular we show that firms managed by "good" managers face lower adjustment costs during the defensive restructuring phase and choose less risky strategic restructuring projects with respect to firms managed by "bad" managers.

The two types of restructuring cannot be considered as separated: when deciding about defensive restructuring measures, managers most likely will also consider what has to be done in the subsequent strategic restructuring phase, while on the other hand the outcome of the strategic restructuring measures will depend to some extent on the previous defensive restructuring choices.
We therefore subsequently analyse jointly the two forms of restructuring by introducing into the picture another player: the banking sector.
The strategic restructuring choice can in fact be seen as an investment decision that involves the relationship with financial institutions and that entails the usual problems of asymmetric information and market failure. In this case what banks cannot observe is the managers' quality. The relationship between banks and firms is modelled as a standard signalling game where firms can use their initial defensive restructuring choices to signal their quality to the banking sector in order to obtain a more favourable contract for the subsequent strategic restructuring phase.
It is found that in a separating equilibrium some firms may signal their type with an excess of short term restructuring; that is, laying off too many workers at the beginning of the adjustment process.
The predictions of the model are confronted with firm level evidence from Poland and are strongly supported by the recently implemented Enterprise Restructuring Programme where it appears that contracts between state-owned firms and banks take exactly the form envisaged in the model.

The remainder of the chapter is organized as follows: section 2.2 presents the relevant aspects of defensive and strategic restructuring; section 2.3 spells out the formal model; section 2.4 compares the predictions of the model with the empirical evidence;

section 2.5 discusses the role of the private sector; section 2.7 concludes. All proofs and technical aspects are confined to the Appendix.

2.2 Defensive and strategic restructuring

As stressed in the introduction a puzzling aspect of many transitional economies has been that observationally similar firms (i.e. belonging to the same sector, and in principle subject to similar terms of trade and demand shocks) showed different economic performance during the initial stages of transition. This different behaviour may not seem surprising if observed in western-type economies, nevertheless it is less obvious in transitional economies where the same productive model was applied quite rigorously over entire economies and where within the same sector there were virtually no technological differences between firms. If there are unobservable differences between firms, then those have to be related in some way to the human capital employed, that is in differences between managers, workers, or a combination of the two (i.e. how the decision making process is allocated within the firm).

In this work we will assume that differences in firms' performance reflect differences in managers' qualities, i.e. how different managers implement different phases of firms' restructuring process. The results are however quite general and our story can be easily turned into a story in which different firms' performances are due to different degrees of workers' influence over the decision making process; those modifications will be analyzed in section 2.6.

2.2.1 Defensive restructuring

It is common knowledge that pre-transition firms employed an excess of workers in the production process. Therefore it was widely expected an transition would have brought an increase in the number of lay-offs as firms adjusted to the new market conditions.

On the other hand any casual observation of labour market adjustment during the early phase of transition, would emphasize the difficulties encountered by firms in achieving their optimal level of employment. In particular even after the initial restructuring decisions, firms seem still to be characterized by an "overemployment

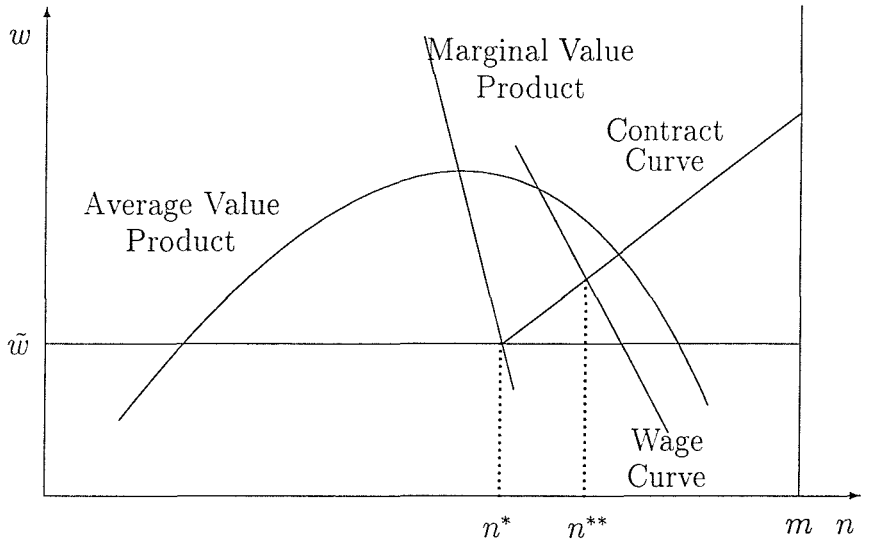


Figure 2.1: The "overemployment bias"

bias". We argue that this bias is due to the institutional form of the firm and in particular to how the decision making power is allocated between workers and managers.

The institutional form of a transitional firm can be represented by a situation in which decisions are the outcome of a bargaining process between a workers' union and the management. As a consequence the restructuring decision, being the outcome of this bargaining process, is affected by the relative bargaining powers.

This argument can be illustrated with the aid of figure 2.1; a formal version of this model is presented in Appendix A.

We assume that workers are organized in a union whose objective is the maximization of the total utility of its members. We take the initial membership fixed at m, assume that each worker is an expecetd utility maximizer, and that fired workers are selected randomly from the union.

If bargaining is on wage and employment the outcome will belong to the contract curve that represent the locus of tangency points between the manager iso-profit curves and the union indifference curves[3].

In the figure it is represented the competitive wage $\tilde{w}$. If the firm were solely profit

[3]The model in Appendix A establishes the properties of the contract curve and in particular the fact that it is upward sloping.

maximizing, the wage would be set to $\tilde{w}$ and the employment level would be n^* therefore the firm would lay off $l^* = m - n^*$ workers. But this is only one of the many points which belong to the contract curve. To determine which particular point on the contract curve will be chosen one can derive from the first order conditions a fair shares curve (i.e. wage equation) and look at the intersection between the fair shares curve and the contract curve. It can be shown that if the average value product is greater than the marginal value product the fair shares curve lies above the marginal value curve. Therefore the employment will be set at $n^{**} > n^*$ and consequently the firm will lay off only l^{**} workers. That is an "overemployment bias" will persist. The size of the bias (i.e. the position of the fair shares curve) clearly depends on the institutional structure of the firm.

A simple and intuitive way to analyse the employment bias is to interpret the bargaining powers of the manager and the the union as their respective threat points. An improvement in the manager's threat point, raising his income in the event of disagreement, increases his bargaining power and shifts the fair shares curve to the left reducing the employment bias. The opposite will occur in case of an increase of of the union's threat point.

It is quite natural to think about firms' differences in terms of differences in their human capital which in turn affects the threat points: a "good" manager will most likely have a higher threat point than a "bad" manager. This is because a good manager can earn, compared with a bad manager, a higher income outside the firm in case of disagreement with the union, or even within the firm but without the cooperation of the union. Alternatively one can think about the bargaining process as a process that involves effort in which case a good manager has lower effort cost that a bad manager.

Therefore firms characterized by differences in the management quality will display different restructuring outcomes.

With those considerations in the background we turn to the proper analysis of this chapter.

We approximate defensive restructuring with lay-offs. This is a strongly simplifying assumption. We do not claim that restructuring can be identified only with the creation of unemployment, nevertheless firm level empirical evidence shows that

among the short run defensive responses, lay-offs have been the most frequently used. Moreover the level of lay-offs created by each firm, being easily identifiable and measurable constitutes an ideal signal to be used as a proxy for restructuring. In order to keep the analysis simple and to be able to integrate the defensive with the strategic restructuring decision we start by considering the lay-off decision of a firm as the result of the maximization of the profit function in presence of adjustment costs; the presence of these costs capture the bargaining considerations done above.

$$\Pi_\theta = \zeta - \alpha_\theta l - \frac{1}{2}\gamma(l^* - l)^2 \tag{2.1}$$

Differences in manager's qualities are reflected by the term α_θ which denotes the type of the firm (manager) and ζ, α, γ are constants[4]. The index subscript for α illustrates the effect of differences in manager's quality: firms of type g managed by "good" managers will face lower adjustment costs than firms of type b; therefore $\alpha_g < \alpha_b$

The efficient level of lay-offs for each firm is derived maximizing (2.1) with respect to l, which gives the first order conditions:

$$\hat{l}_\theta = l^* - \frac{\alpha_\theta}{\gamma},$$

where it can be easily checked that $\hat{l}_g > \hat{l}_b$, that is, firms run by more efficient managers will lay off more workers than firms run by less efficient managers. Even if very stylized this set up yields the same insights of the bargaining example outlined above.

2.2.2 Strategic Restructuring

The initial lay-off decision have mainly to do with the defensive restructuring phase but this is only a part of the complex transformation that State-Owned firms have to face during the initial stages of transition. In the long run if those firms want to be economically viable they need to implement some more profound forms of strategic restructuring.

[4] l is interpreted as being normalized by the initial level of sales, to avoid capturing effects generated simply by the dimension of the firms.

Differences in managers' qualities, other than affecting the cost of defensive restructuring, can considerably affect the outcome of the strategic restructuring phase; in particular they can play a decisive role in the choice of the type of the investment project by the firm.

Let us suppose that the strategic investment project is chosen by a manager who cares about two aspects: the expected return of the project (he is rewarded with a share of its return) and the cost of bankruptcy. The latter term can be thought of as the loss in reputation following bankruptcy; managers in fact can use their performance in the implementation of the strategic restructuring project to build a reputation for themselves for a possible future job in the private sector[5].
Managers with different abilities effectively face different bankruptcy costs because they most likely attribute different weights to the "outside options" created by the private sector. In particular bad managers that are more involved with the old bureaucracy will attribute less importance to future possibilities of finding a job in the private sector resulting in effectively lower perceived bankruptcy costs.
Differences in bankruptcy costs can result in turn in differences in the choice of the type of project.
For simplicity we assume that the strategic restructuring project requires an investment I, it is entirely financed by a loan[6] on which a (gross) interest rate r has to be paid, and yields a random return R, distributed over the support $[0, \bar{R}]$ according with a distribution function $F(R)$.
Managers are characterized by a standard utility function twice differentiable $U(W)$, with $U'(W) > 0$ and $U''(W) < 0$, where W = wealth.
Wealth depends on their compensation and on the event of bankruptcy that yields a (monetary) fixed bankruptcy cost c_b. The term c_b can be thought as the cost in monetary terms that derives from the loss of reputation associated with bankruptcy.
Finally managers' compensations are in form of performance-related pay constituted by a fixed wage ω plus a fraction α of the firm's profits (that is the project return).
The expected utility of the manager following the strategic investment project is the following:

[5]Pinto and Van Wijnbergen (1995) and Pinto, Belka, and Krajewski (1993) provide ample evidence of these reputational effects.
[6]We will specify in the next section where precisely this loan comes from.

$$EU = \int_{\tilde{R}}^{\bar{R}} U_1(\omega + \alpha(R - Ir))dF(R) + \int_{0}^{\tilde{R}} U_2(\omega - c_b)dF(R) \qquad (2.2)$$

Where $\tilde{R}$ is the realization of R such that $U_1(\omega + \alpha(R - Ir)) = U_2(\omega - c_b)$.

Proposition 2.1 *Managers that face lower bankruptcy costs choose riskier projects with respect to managers that face higher bankruptcy costs.*

Proof: see the Appendix

2.3 The game

In the previous sections we have shown that differences in managers' qualities result in different choices of defensive and strategic restructuring.
But the two types of restructuring cannot be considered as separated: when deciding about defensive restructuring measures, managers most likely will also consider what has to be done in the subsequent strategic restructuring phase; on the other hand the outcome of the strategic restructuring measures will depend to some extent on the previous defensive restructuring choices.

In this section we combine the analysis of the two forms of restructuring by introducing into the picture another player: the banking sector; strategic restructuring can in fact be seen as a form of investment that, in order to be financed, involves necessarily a relationship with banks.

Banks would like to screen between firms and offer to different firms different types of contract. Nevertheless they are not able to observe the managers' type. What banks can observe is the outcome of the defensive restructuring phase, that is the level of lay-offs generated by each firm. This in turn gives to the firms an incentive to use their initial restructuring choices as a signal to resolve the informational problem.
The game used here is a standard signalling game with the following structure:

- There is a single period divided in two stages
- Prior to players' moves nature determines the firms' types (θ) assigning a probability λ to each type. In our simple example, as there are only two types it will be assumed that $\lambda = prob(\theta = \theta_g)$ and $(1 - \lambda) = prob(\theta = \theta_b)$.

- At the beginning of the period firms choose the amount of defensive restructuring that they want to implement and then ask for a loan from the bank.
- Banks observe the restructuring choice by firms and simultaneously make an offer of a loan B.
- Firms decide whether or not to accept the offer.
- If the offer is accepted, firms use the loan to implement an investment oriented to strategic restructuring.
- At the end of the period firms get a return from the investment and repay the loan.

2.3.1 A general setting

In section 2.2.2 we showed that bad managers will choose riskier projects than good ones; this allow us to express the return from strategic restructuring as depending on:

a) the amount of restructuring previously undertaken
b) the type θ of the manager
c) some stochastic factor ϵ

We can therefore write the return R as $\tilde{R} = R(l, \theta, \tilde{\epsilon})$. In particular it will be convenient to make the following assumptions:

Assumption 2.1 *The return to strategic restructuring takes the form:*

$$R(l, \theta, \tilde{\epsilon}) = \tilde{R}_\theta \left[\kappa - \frac{1}{2} (l^* - l)^2 \right] \tag{2.3}$$

with $\kappa > 1$, where $\tilde{R}_\theta$ is distributed on the support $\left[0, \bar{R}\right]$ with a distribution $F(R, \theta)$ and a density $f(R, \theta)$. Following Rothschild and Stiglitz (1970) we model risk in terms of mean preserving spreads (see the Appendix) and we make the following assumption.

Assumption 2.2 *Given two distributions $F_b(R)$ and $F_g(R)$, they are characterized by the following two properties:*

a) $F_b(R)$ *is a mean preserving spread of* $F_g(R)$

b) $F_b(R)$ *and* $F_g(R)$ *exhibit the single crossing property.*

The requirements of Assumption 2.2 on the distribution $F(R,\theta)$ are precisely stated in the Appendix.

Assumptions 2.1 and 2.2 state that the return from strategic restructuring differs among firms in two aspects:

1) *Risk* with bad firms having a more risky distribution of returns than good firms.

2) *Deviations from efficiency*: the closer the firm has gone during the defensive restructuring phase to the efficient level of lay-offs, the higher will be the return from strategic restructuring.

From Assumption 2.2 one can show

Lemma 2.1 *If* $F_b(R)$ *is a mean preserving spread of* $F_g(R)$ *and the two distributions have the single crossing property then*

$$E\left[R \mid z \leq R \leq \bar{R} \mid F_b(\cdot)\right] \geq E\left[R \mid z \leq R \leq \bar{R} \mid F_g(\cdot)\right] \qquad \forall \;\; 0 \leq z \leq \bar{R}.$$

Proof: see the Appendix.

Assuming that each strategic restructuring process needs a fixed investment I that has to be entirely financed by debt, with limited liability the firms' return from investment is given by

$$E\Pi_\theta = E\max\left\{R_\theta\left[\kappa - \frac{1}{2}\left(l^* - l\right)^2\right] - rB, 0\right\} \tag{2.4}$$

Where $B = I$ is the amount of loan given by the bank to the firm and r is the (gross) contractual interest rate. Making use of (2.4) the overall payoff function of the firm deriving from the defensive and the strategic restructuring decision is the following:

$$\Phi_\theta = \zeta - \alpha_\theta l - \frac{1}{2}\gamma(l^* - l)^2 + \int_{R^*}^{\bar{R}} R_\theta\left[\kappa - \frac{1}{2}\left(l^* - l\right)^2\right] dF_\theta(R) - rB[1 - F_\theta(R^*)] \tag{2.5}$$

where R^* satisfies

$$R^* = \frac{rB}{\left[\kappa - \frac{1}{2}(l^* - l)^2\right]} \tag{2.6}$$

Equation (2.5) defines a set of iso-profit curves for the firm. In the (r, l) space the iso-profit curves are concave l.

Assumption 2.3 *The two distributions and parameter values are such that*

a) $\frac{\psi_b+\gamma}{[1-F_b(R^*)]} > \frac{\psi_g+\gamma}{[1-F_g(R^*)]}$

b) $\frac{\gamma-\mu}{1-F_b(R^*)} > \frac{\gamma-\mu}{1-F_g(R^*)}$

where μ is defined in the appendix and

$$\psi_\theta = \int_{R^*}^{\bar{R}} R_\theta dF_\theta(R) \tag{2.7}$$

Part a) of assumption 2.3 is particularly important: it guarantees that the iso-profit curves for the good type of firm are more open parabolae than those of the bad type of firm; in other words the "single crossing property" holds, ensuring the existence of a perfect (bayesian) Nash equilibrium of the game.

We now turn to the banking sector: banks are assumed to operate in an oligopolistic market where Bertrand competition drives profits to 0. Let ρ be the (gross) deposit interest rate. The bank's zero profit condition can be expressed as

$$E\Pi_\theta^B = Br[1 - F_\theta(R^*)] + \int_0^{R^*} R\left[\kappa - \frac{1}{2}(l^* - l)^2\right] dF_\theta(R) - \rho B = 0 \tag{2.8}$$

Also the banks' iso-profit curves are parabolae, but they are convex in l with a minimum at $l = l^*$.

To check the parabola's slope we have to refer to the marginal rate of substitution between r and l.

$$\left.\frac{\partial r}{\partial l}\right|_{\pi_\theta^B=0} = \frac{-\left(\int_0^{R^*} RdF_\theta(R)\right)(l^* - l)}{B[1 - F_\theta(R^*)]} = \delta_\theta \tag{2.9}$$

Proposition 2.2 *If assumption 2.3 holds, then:*

i) the bank zero profit lines are steeper for the good type of firm than for the bad type.

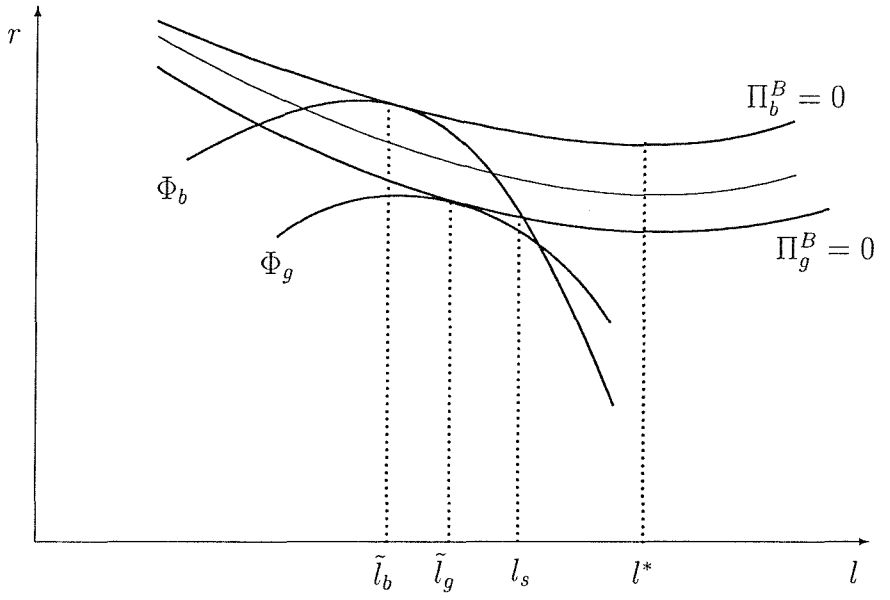


Figure 2.2: Separating Equilibrium

ii) at $l = l^*$ the zero profit line for the bad type lies above the zero profit line for the good type.

Proof: see the Appendix.

Banks are therefore rewarding firms for getting close to l^* during the defensive restructuring phase by charging a lower interest rate. Moreover the reduction in interest rate banks are willing to accept for any given increase in l is higher for the good type of firm than for the bad type.

Consider first, as a benchmark, the *symmetric information case*: the bank is perfectly able to discriminate between firms' types. There is no incentive problem and the equilibrium level of lay-off (denoted by $\tilde{l}_\theta$) is identified with the tangency point between banks' and firms' iso-profit lines.

Proposition 2.3 *The equilibrium level of lay-off $\tilde{l}_\theta$ is greater for the good type than for the bad type and lies between the level l that maximizes* (2.5) *($\bar{l}_\theta$) and l^*.*

Proof: see the Appendix.

Figure (2.2) gives a graphical representation. Note that the levels of firms' iso-profit lines are decreasing in r.

In the following we are implicitly assuming that banks are willing to lend at different interest rates to both types of firm; it could be argued that this is not necessarily the case and that banks may not be willing to lend at all to the bad type of firm. The current formulation is justified by the fact that the main point here is to stress the use of defensive restructuring for signalling purposes; from the literature on signalling games we know that types should not be too different in order to have effective mimicking and separating incentives[7]. Moreover this allows us to explain different behaviour of firms operating within the same sector and therefore theoretically very similar[8].

In case of *asymmetric information*, however the pair of contract $(\tilde{l}_b, \tilde{l}_g)$ is no longer sustainable as the bad type of firm would increase profits by mimicking the good type and choosing $l = \tilde{l}_g$; moreover at $\tilde{l}_g$, if both types apply for the loan, the bank would make a loss as $\tilde{l}_g$ lies below the dotted line of the zero profit condition for the bank in case of pooling.

With asymmetric information $\tilde{l}_g$ cannot therefore be an equilibrium; however, as well known in the literature on signalling games, banks' beliefs about firms' types may allow several different equilibria, both separating and pooling, to be sustained. A separating equilibrium must satisfy the pair of incentive compatibility constraints

$$\Phi_g(l_s, r_g(l_s)) \geq \Phi_g(\tilde{l}_g, r_b(\tilde{l}_g)) \tag{2.10}$$

$$\Phi_b(\tilde{l}_b, r_b(\tilde{l}_b)) \geq \Phi_b(l_s, r_g(l_s)) \tag{2.11}$$

That is the good type does not have an incentive to choose $l = \tilde{l}_g$ and being believed to be bad and the bad type does not have an incentive to mimic the good one choosing $l = l_s$.

Proposition 2.4 (Separating Equilibrium) *If Assumptions 1 through 3 hold, there exist a set of contracts that constitutes a separating (bayesian) equilibrium.*

[7] See Fudenberg and Tirole (1991, Ch.8, and 11).

[8] The case in which the bad type do not receive any money at all from the banking sector can always be seen as a particular case of this more general framework.

The set of contracts is characterized by the following properties:

i *The good type chooses a lay-off level between* $\tilde{l}_g$ *and* l_s.

ii *The bad type chooses the complete information level of lay-off* $\tilde{l}_b$.

iii *The bank breaks even on each contract.*

If moreover we apply refinements based on equilibrium dominance, there is a unique separating equilibrium in which the incentive compatibility constraint (2.11) holds with equality. Such contract is identified by l_s *in figure (2.2).*

Note that there is an "outperformance" effect in l_s : in order to separate from the bad type, the good firm has to create lay-offs in excess to the efficient level $\tilde{l}_g$.
The intuition behind this result is the following: from equation (2.1) we know that without the investment project the good type of firm would lay-off $\hat{l}_g > \hat{l}_b$ workers; however the efficiency cost (the term represented by γ) for the firm to exceed $\hat{l}_g$ is the same for both firms. The possibility of investing in strategic restructuring introduces an additional element that affects the squared term: the more l exceeds $\hat{l}_\theta$ by getting closer to l^* the lower are the advantages of investing in a project with a riskier return and therefore ceteris paribus the bad type of firm would require a higher reduction of r to match a given increase in l. If this second effect is sufficiently high (this is guaranteed by Assumption 2.3) the good type of firm has the incentive to "overshoot" the full information outcome in order to separate from the bad type.

There are also several pooling equilibria in which both types choose the same level of l and are being offered the same interest rate by the bank. One of these equilibria is depicted in figure (2.3) and is represented by l_p. In figure (2.3) there is also depicted the area (indicated by the arrow) that represents the set of possible deviations from l_p by the good type that meet the requirements of the intuitive criterion (see Cho and Kreps (1987) and Kreps and Sobel (1994)), and that therefore can be used to eliminate an equilibrium like l_p.

As a technical note we comment the possibility of extending the analysis done so far to more than two types of senders of the signal: although possible in principle, such an extension would not allow to obtain a unique prediction in the definition of the

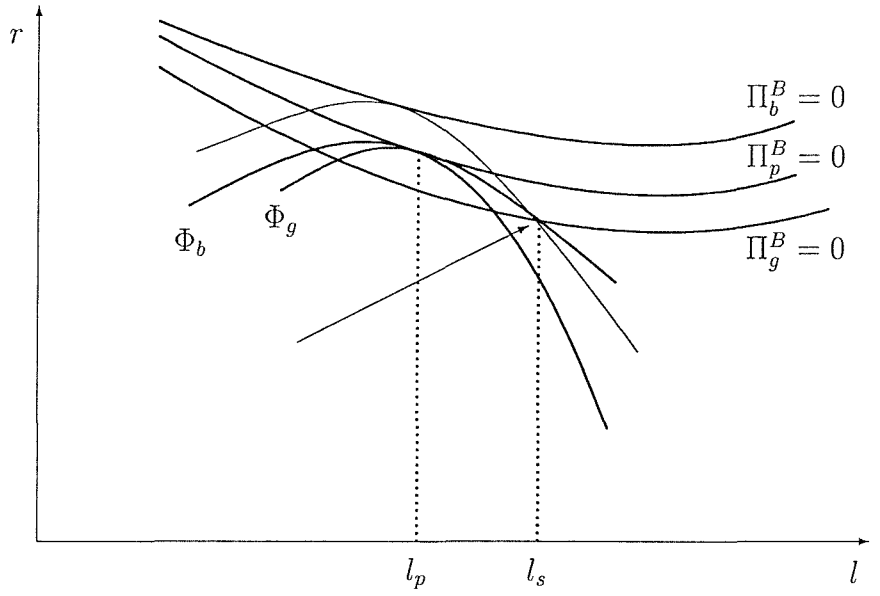


Figure 2.3: Pooling Equilibrium

equilibrium as it is known that the intuitive criterion looses much of its power when challenged by three or more types. Broadly speaking we can single out three ways through which it is possible, from this type of game, to select the best separating equilibrium as the unique equilibrium in presence with more than two types.

a) Use stronger equilibrium refinements as the "universal divinity" (see Cho and Sobel (1990) for a discussion).

b) Structure the game as a take-it-or-leave-it game in which the firm makes a complete offer (that specifies both l and r) to the bank and then the bank can either accept it or refuse it. Kreps and Sobel (1994), show that structuring a standard signalling game with a take-it-or-leave-it form, gives the intuitive criterion enough power to generate always full separation.

c) Formulate the game with the uninformed part (banks in this case) as taking the lead proposing to the informed part (firms) a set of contracts among which to choose; in this way it is possible to avoid the problems linked to the formation of beliefs and of their consistency in equilibrium (see Stiglitz and Weiss (1990) for a discussion). Engers and Fernandez (1987) show that this class of games has always a unique separating (reactive) equilibrium.

We do not feel however that it is worth to endorse these changes for reasons of analytical simplicity (part a) and of consistency of the game structure with the particular situation that we aimed to model (part b and c).

2.4 Empirical Evidence

There are two types of empirical evidence that support the predictions of the model.

2.4.1 Direct Evidence

In its simplest form the model lead to the following prediction: we should observe credit contracts to be contingent upon the level of lay-offs. The recently implemented Polish Enterprise Restructuring Program (ERP) [9] provides full support to this claim. Implemented over a three year horizon between 1993 and 1996 the ERP was aimed at restructuring banks' portfolios and at the resolution of the bad debt problem inherited by State-Owned enterprises from the pre-transition period. In contrast to other programs adopted in Poland and other countries, the ERP was based on strict economic criteria. The aims of the ERP were twofold: on one side it established the condition for the implementation of successful long term restructuring programs, and on the other it helped banks to learn risk assessment and to develop monitoring techniques. Within this program State Owned enterprises could initiate conciliatory procedures with banks in order to have a rescheduling of the existing debt or an extension of new credit. These measures were subject on the presentation of a restructuring program by the firm that had to be approved by the bank. The restructuring programs were typical examples of defensive restructuring with much emphasis on the reduction of the labour force. The contracts written between banks and firms were therefore contingent upon the level of defensive restructuring that had to be implemented. The fact that we observe such contracts is *per se* evidence of an underlying problem of asymmetric information between banks and firms, that the contract tries to resolve. Of course such empirical evidence cannot show whether it is the informed (firms in our case) or the uninformed part (banks) to move first, in

[9] Belka and Krajewska (1997) provide an assessment of the ERP based on a survey conducted on firms that adopted it.

which case our signalling model would be turned into a screening model. Since the basic results would be the same in either case we preferred to focus on the signalling case to stress the importance of firms' active rather than passive response to the changing economic environment.

2.4.2 Indirect Evidence

Although the model does not say much about firms' profitability, if good firms are laying off workers in excess of their optimal level, in the initial stages of the transition they should be characterized by lower output and lower profitability than bad firms. We should then observe initially a negative correlation between banks' credit and firms' profitability, while this relationship should turn positive. This is exactly what found by Pinto and Van Wijnbergen (1995) in Poland. One could argue that this is nothing more than evidence of hardening of budget constraints (i.e. budget constraint were initially soft and then progressively became hard), however Grosfeld and Nivet (1997) show that firms that experienced highest fall in output and employment during the initial stages of transition and that were characterized by initial negative profitability, subsequently experienced a sustained growth of output, labour productivity and profit margins. On the other side those firms that had a low fall in output and employment and were characterized by positive initial profitability experienced a steady decline in profit margin and a much lower output and labour productivity growth.

Finally it has to be stressed that this work has important implications for empirical work, in relation to studies of wages and employment; in particular it suggests that estimated elasticities of labour demand in transition economies may be low because "good" firms are shedding labour faster than they would for signalling purposes. Further empirical work on this matter is certainly needed.

2.5 The Private Sector

Despite being focused on the state sector, the model could be extended to the private sector where signalling effects play an important role when we consider the

relationship between banks and private firms in the decision on how to finance a given investment project.

It is well known from the literature of financial market imperfection that when there are multi-dimensional contracts that specify, other than the interest rate, some other variable such as the level of collateral [Bester (1985)] or the dimension of the loan [Milde and Riley (1988)], it is always possible to determine the conditions for which there can be a separating non rationed equilibrium in contrast with the pooling rationed one.

The work by Milde and Riley in particular provides a "natural" extension to our framework: in their paper it is shown that in presence of mean preserving spreads in the distribution of project returns, it is possible to obtain a separating equilibrium in which good firms signal their type by underinvesting [10].

Under very similar assumptions about project returns we can therefore think about a general framework in which state owned firms create "excess" lay-offs and private firms create very few new jobs in order to signal their types. The results of this general framework are perfectly compatible with the "macroeconomic" flow approach discussed in the introduction, and, although it does not exhibit full dynamics, it is able to account for the inflow and the outflow in unemployment in the early stages of transition.

2.6 An Alternative Set-Up

2.6.1 Unionized labour force

As stressed in the introduction the analysis done in this chapter is quite general and the story told so far can be easily turned into a story that takes as the major factor affecting firms' choices not differences in managers' types but differences in workers' types. In particular the degree of firms' unionization can considerably influence the decision making process within the firm and therefore its restructuring choices. In this alternative set up we can consider again defensive and strategic restructuring decisions.

[10] In the Milde and Riley case underinvesting means choosing smaller loan contracts.

Defensive Restructuring

In the bargaining example that we have provided in section 2.2.1 it is straightforward to show that different degrees of workers' influence affect differently the employment bias. The effects can operate through the manager's or the union's threat points. If the manager threat point includes the income that he can earn within the firm but without the cooperation of the union, different degrees of union's power will affect differently the manager's threat point affecting consequently the employment bias. Alternatively differences in union's strength will determine different union's threat points (a stronger and more organized union will most likely offer to its member a higher premium over the outside income i.e. a higher value of σ)

Strategic Restructuring

Workers' decision making power can also affect the choice of the type of the investment project by the firm.
Let us keep the same assumptions adopted in section 2.2.2 (i.e. the strategic investment project is chosen by a manager who cares about the expected return of the project and the cost of bankruptcy). We can assume that in the event of a bad outcome the manager will always blame workers for it, turning the evidence in his favor; nevertheless even if *ex-ante* the internal organization of the firm (i.e. how much the manager is in control of the firm versus how much workers are) is unobservable to outsiders, *ex-post* with time some information will be revealed and the private sector will have a reasonable idea of the division of powers within the firm[11]. This will effectively create an inverse relationship between bankruptcy costs ((c_b) and workers' bargaining power $\frac{\partial c}{\partial \sigma} < 0$ inducing managers of firms in which workers have a higher bargaining power to choose riskier projects.

2.7 Conclusions

Despite being stylized and very simple the analysis conducted in this chapter gives an explanation of the high dynamism and success of state-owned firms in reducing

[11]The time and the amount of information revealed is however still uncertain, i.e. it is not possible to write contracts contingent upon this information.

employment in the first phases of the transition process and of the different behaviour of observationally similar firms.

We have identified the conditions for which state owned firms may use defensive restructuring as a signal to obtain more favourable credit deals with banks during the subsequent strategic restructuring phase. It turns out that the same conditions would create an incentive for private firms to use short term defensive investment as a signal for their quality.

Both these signalling effects would lead to excessive dynamism of the state sector in laying off workers and excessive prudence by the private sector in implementing decisive (and labour creating) investment projects. The joint effect of these two forces can provide a good explanation of the impressive rise of unemployment during the earlier phases of transition.

Evidence from Enterprises Restructuring Program recently implemented in Poland show that the type of contract envisaged in the model was widely adopted.

Appendix A

A formal model of bargaining and lay-offs

The model follows the one by Commander and McHale (1995).

Let us suppose that the defensive restructuring decision by a transition firm is the outcome of a bargaining process between the management and the workers.

Workers are organized in a union whose objective is the maximization of the total utility of its members. We assume that each worker maximizes his expected utility and that, in case of lay-offs, fired workers are selected randomly from the union. This means that, taking initial membership as fixed, from the union's point of view maximizing total utility is equivalent to maximizing average utility[12].

Total utility of the union is therefore defined as

$$U = Nu(w) + (M - N)u(\tilde{w}) \tag{A.1}$$

where N is the employment level, M is the initial size of the union, w is the contracted wage and $\tilde{w}$ is the wage that the workers gan get in case of lay-off[13]; $u(\cdot)$ has the usual properties ($u'(\cdot) > 0$, $u''(\cdot) < 0$)

On the other hand the manager's objective is the maximization of the firm's profit π.

The outcome of the bargaining process is the result of the maximization of the Nash maximand

$$\Omega = (\pi - \pi^*)(U - U^*) \tag{A.2}$$

where π^* and U^* are respectively the payoff that the manager and the union can earn if no agreement is reached, i.e. their outside options. We assume that the union's disagreement point is given by $U^* = Mu(\tilde{w}) + \sigma$ where σ is the premium workers can get over the unemployment benefit[14].

Noting that firm's profits can be defined as $\pi = F(N) - wN$ we can write the Nash maximand as[15]

[12] We are therefore using the paradigm of the utilitarian union.

[13] It can be approximated by the unemployment benefit b.

[14] The inclusion of the parameter σ is only for simplifying matters. In this way we have a shifting parameter in the union's outside option.

[15] $F'(\cdot) > 0$, $F''(\cdot) < 0$.

$$\Omega = \{F(N) - wN - \pi^*\}\{N[u(w) - u(\tilde{w})] - \sigma\} \tag{A.3}$$

The first order conditions are obtained by maximizing equation (A.3) with respect to N and w.

$$\frac{\partial \Omega}{\partial w} = [F(N) - wN - \pi^*][Nu'(w)] - N\{N[u(w) - u(\tilde{w})] - \sigma\} = 0 \tag{A.4}$$

$$\frac{\partial \Omega}{\partial N} = [F'(N) - w]\{N[u(w) - u(\tilde{w})] - \sigma\} + [F(N) - wN - \pi^*][u(w) - u(\tilde{w})] = 0 \tag{A.5}$$

Dividing equation (A.5) by (A.4) we obtain the equation for the contract curve

$$\frac{F'(N) - w}{N} + \frac{u(w) - u(\tilde{w})}{Nu'(w)} = 0 \tag{A.6}$$

Equation (A.6) defines the set of pairs (w, N) that can be the outcome of the bargaining process between the union and the manager[16].

In order to determine which particular point on the contract curve will be chosen we can find the intersection between the contract curve and the wage equation given by equation (A.5)

Equation (A.5), making use of (A.6) can be rewritten as

$$w = \frac{1}{2}\left\{\frac{F(N)}{N} + F'(N) + \frac{1}{N}\left[\frac{\sigma}{u'(w)} - \pi^*\right]\right\} \tag{A.7}$$

It is easy to show that while the contract curve is upward sloping the wage curve is downward sloping. In particular for the contract curve

$$\frac{\partial w}{\partial N} = \frac{F''(N)}{\frac{[u(w)-u(\tilde{w})]u''(w)}{(u'(w))^2}} > 0 \tag{A.8}$$

while for the wage curve

$$\frac{\partial w}{\partial N} = \frac{F''(N)\{N[u(w) - u(\tilde{w})] - \sigma\}}{2N(u(w) - u(\tilde{w}))} - \frac{w - F'(N)}{N} < 0 \tag{A.9}$$

[16]The first term of equation (A.6) defines the slope of the union indifference curves while the second term defines the slope of the firm's iso-profit curves.

In order for the curve (A.9) to lie above the marginal value product curve we have to assume that the average value product is greater than the marginal value and in particular that $\frac{F(N)}{N} + \frac{1}{n}\left[\frac{\sigma}{u'(w)} - \pi^*\right] > F'(N)$.
The two curves look then like the ones represented in figure 2.1
Since the contract curve is upward sloping the resulting employment level is higher than the one there would be in a competitive firm. Therefore there is an employment bias in this model. It can be shown quite easily that the employment bias is sensitive to the bargaining powers of the union and of the manager. A change in the bargaining powers can be captured in this simple set up by shifts in the outside options of the two parties.

Proposition 2.5 *An increase in the manager's threat point lowers employment by shifting the wage curve to the left. An increase in the union's threat point increase employment by shifting the wage curve to the right.*

Proof.
Differentiating equation (A.7) we get

$$\frac{dw}{d\pi^*} = -\frac{1}{2N} < 0$$

$$\frac{dw}{d\sigma} = \frac{1}{2Nu'(w)} > 0$$

□

Therefore firms in which managers have higher bargaining power (or lower union's bargaining power) will display higher levels of lay-offs.

Appendix B

Proof of Proposition 2.1

Consider a manager that is just indifferent between two projects, a and b. The two projects yield therefore the same expected utility. Differentiating the managers' expected utility 2.2 with respect to c_b we obtain

$$\frac{\partial EU_i}{\partial c_b} = -F_i(\tilde{R})U_2' \tag{B.1}$$

That is a reduction in bankruptcy costs increases the expected return from the project with the higher probability of default more than it does for the other project. Facing a reduction in bankruptcy costs the manager will choose the riskier project, i.e. the one characterized by the higher probability of default. □

Proof of Lemma 2.1

In line with Rothschild and Stiglitz (1970) we adopt the following definition:

Definition 2.1 *Given two distributions $F_b(R)$ and $F_g(R)$ defined over the same support $[0, \bar{R}]$, $F_b(R)$ is a mean preserving spread of $F_g(R)$ if the following two properties hold:*

i They have the same mean,:

$$\int_0^{\bar{R}} R dF_b(R) = \int_0^{\bar{R}} R dF_g(R)$$

ii For any $z \in [0, \bar{R}]$ then

$$\int_0^z F_b(R)dR \geq \int_0^z F_g(R)dR$$

or, alternatively

$$\int_z^{\bar{R}} [1 - F_b(R)]dR \geq \int_z^{\bar{R}} [1 - F_g(R)]dR$$

Definition 2.2 *If two distributions $F_b(R)$ and $F_g(R)$ exhibit the single crossing property, there is a $0 \leq \hat{R} \leq \bar{R}$ such that*

$$F_b(R) \geq F_g(R) \qquad \text{for } R \leq \hat{R}$$

and

$$F_b(R) \leq F_g(R) \qquad \text{for } R \geq \hat{R}$$

From Lemma 2.1, if $F_b(R)$ is a mean preserving spread of $F_g(R)$ and the two distributions have the single crossing property, then for any $z \in [0, \bar{R}]$

$$\frac{\int_z^{\bar{R}} R dF_b(R)}{1 - F_b(z)} \geq \frac{\int_z^{\bar{R}} R dF(R)}{1 - F_g(z)} \tag{B.2}$$

Proof:

Consider initially the case in which $0 \leq z \leq \hat{R}$, then using the formula of integration by parts we have

$$\int_z^{\bar{R}} R dF_b(R) = \bar{R} - zF_b(z) - \int_z^{\bar{R}} F_b(R) dR = z[1 - F_b(z)] + \int_z^{\bar{R}} [1 - F_b(R)] dR$$

Analogously for $F_g(R)$ we have

$$\int_z^{\bar{R}} R dF_g(R) = \bar{R} - zF_g(z) - \int_z^{\bar{R}} F_g(R) dR = z[1 - F_g(z)] + \int_z^{\bar{R}} [1 - F(R)] dR$$

From the definition of mean preserving spread and noting that for $0 \leq z \leq \hat{R}$, $[1 - F_b(R)] \leq [1 - F_g(R)]$ equation (B.2) follows.
For $\hat{R} \leq z \leq \bar{R}$, however $[1 - F_b(R)] \geq [1 - F_g(R)]$ and equation (B.2) not necessarily holds; to prove Lemma 2.1 completely note that given the definition of mean preserving spread and the assumption of a single crossing point, if equation (B.2) holds, then

$$\frac{\int_0^z R dF_b(R)}{F_b(z)} \leq \frac{\int_0^z R dF_g(R)}{F_g(z)} \tag{B.3}$$

with the first inequality implying necessarily the second and vice versa.
We can then apply to the interval $[\hat{R}, \bar{R}]$ the same procedure followed previously. Integrating by parts in equation (B.3),

$$\int_0^z RdF_b(R) = zF_b(z) - \int_0^z F_b(R)dR$$

and

$$\int_0^z RdF_g(R) = zF_g(z) - \int_0^z F_g(R)dR$$

From the definition of mean preserving spread and from the fact that for $\hat{R} \leq z \leq \bar{R}$, $F_b(R) \leq F_g(R)$ then equation (B.3) follows and the proof is complete. □

Proof of Proposition 2.2

Part i): if $|\delta_b| < |\delta_g|$ it must be the case that

$$\frac{\int_0^{R^*} RdF_b(R)}{[1 - F_b(R^*)]} < \frac{\int_0^{R^*} RdF_g(R)}{[1 - F_g(R^*)]} \tag{B.4}$$

Using the fact that

$$\int_0^{R^*} RdF_\theta(R) = \mu - \int_{R^*}^{\bar{R}} RdF_\theta(R) \tag{B.5}$$

where, by definition of mean preserving spread

$$\mu = \int_0^{\bar{R}} RdF_b(R) = \int_0^{\bar{R}} RdF_g(R)$$

Inequality (B.4) can therefore be rewritten as

$$\frac{\int_{R^*}^{\bar{R}} RdF_b(R) - \mu}{[1 - F_b(R^*)]} > \frac{\int_{R^*}^{\bar{R}} RdF_g(R) - \mu}{[1 - F_g(R^*)]} \tag{B.6}$$

It is easy to check that holds whenever assumption 2.3 is satisfied.

Part ii): at $l = l^*$

$$r = \frac{\rho B - \kappa \int_0^{R^*} RdF_\theta(R)}{B[1 - F_\theta(R^*)]}$$

Our claim is that

$$\frac{\rho B - \kappa \int_0^{R^*} R dF_b(R)}{B[1 - F_b(R^*)]} > \frac{\rho B - \kappa \int_0^{R^*} R dF_g(R)}{B[1 - F_g(R^*)]}$$

that making use of equation (B.5) can be rewritten as:

$$\frac{\kappa}{B} \frac{\left(\frac{\rho B}{\kappa} - \mu\right) + \int_{R^*}^{\bar{R}} R dF_b(R)}{[1 - F_b(R^*)]} > \frac{\kappa}{B} \frac{\left(\frac{\rho B}{\kappa} - \mu\right) + \int_{R^*}^{\bar{R}} R dF_g(R)}{[1 - F_g(R^*)]} \tag{B.7}$$

As $\rho B \leq \kappa\mu$ equation (B.7) holds whenever assumption 2.3 is satisfied. □

Proof of Proposition 2.3

The efficient level of l is defined by the tangency point between the banks' and the firms' iso-profit curves. Differentiating the firms' iso-profit curves, by the implicit function theorem we get

$$\left.\frac{\partial r}{\partial l}\right|_{\Phi_\theta = \text{constant}} = \frac{-\alpha_\theta + \left(\gamma + \int_{R^*}^{\bar{R}} R dF_\theta(R)\right)(l^* - l)}{B[1 - F_\theta(R^*)]}$$

and we know that for the banks

$$\left.\frac{\partial r}{\partial l}\right|_{\pi_\theta^B = 0} = \frac{-\left(\int_0^{R^*} R dF_\theta(R)\right)(l^* - l)}{B[1 - F_\theta(R^*)]}$$

The efficient level of l is such that

$$\left.\frac{\partial r}{\partial l}\right|_{\Phi_\theta = \text{constant}} = \left.\frac{\partial r}{\partial l}\right|_{\pi_\theta^B = 0}$$

making use of equation (B.5) the efficient level of lay-off

$$\tilde{l}_\theta = l^* - \frac{\alpha_\theta}{\gamma + \mu} \tag{B.8}$$

is such that $\tilde{l}_g > \tilde{l}_b$ as $\alpha_b > \alpha_g$.

Moreover denoting by $\hat{l}$ the level of l that maximizes (2.5); $\hat{l}$ is such that

$$\bar{l}_\theta + \frac{\alpha_\theta}{\gamma + \psi_\theta} - l^* = 0$$

Noting that, by definition

$$\psi_\theta = \int_{R^*}^{\bar{R}} R dF_\theta(R) \leq \mu$$

It follows that $\tilde{l}_\theta > \bar{l}_\theta$ for any type.□

Chapter 3

Occupational Choice, Financial Market Imperfections and Development

3.1 Introduction

When looking at long run development of transitional economies one has to tackle some general issues already applied to other developing countries. This chapter takes this approach considering the relationship between financial market imperfections and development in a very general framework.

Explaining economic growth has been in the forefront of economic research for a long time. In particular, growth theory experienced a revival since the early 1980s when better data became available leading to the refinement of old theories and inducing new ones. The old theories on physical and human capital accumulation have been witnessed new developments, and new theories of R&D based on monopolistic competition have emerged (Lucas (1988), Romer (1986) as the frontrunners). Several models investigated how financial market imperfections influence economic development [see Bencivenga and Smith (1991), Boyd and Smith (1992) and Greenwood and Jovanovic (1990) among others]. Moreover, the empirical evidence also supports the view that financial markets matter for growth [see King and Levine (1993a)]. However, little effort has been made to quantify the effects of financial market imperfections on the level of income. This question can only be answered

if one calibrates a general equilibrium model in order to asses the effect of financial market imperfections on development. The aim of present work is to do this in the context of the interaction between wealth distribution and financial market imperfections. There are several papers which analyze qualitatively the relationship between growth, distribution and financial markets [see Aghion and Bolton (1997), Banerjee and Newman (1993, 94), Galor and Zeira (1993), Loury (1981), and Piketty (1997)]. This work follows a line similar to theirs, but we focus the quantitative instead of the qualitative implications.

In our model agents can engage in two different activities: they can either become *workers* earning a competitive wage, or they can become *entrepreneurs*, hiring capital and labour on competitive markets and getting an income determined by the difference between the revenues from selling the output and the cost of production factors. Moreover, agents are assumed to be heterogeneous in two respects: they have different wealth levels (initial or inherited from their parents) and they differ in terms of productivity. The distribution of wealth is determined endogenously in the model while the distribution of productivity is exogenously given, and invariant over time. Productivity matters for earnings of both workers and entrepreneurs. *Ceteris paribus* the more productive agents are, the higher their earnings will be. In the absence of financial market imperfections there is a threshold productivity level such that all individuals below that threshold find it optimal to become a worker while above that level they find it optimal to become an entrepreneur. However, in the presence of financial market imperfections some individuals may not be able to borrow the amount necessary to become entrepreneurs. Since more productive individuals typically wish to borrow more as entrepreneurs, imperfections on the financial markets are more likely to prevent the more productive individuals to become entrepreneurs. Therefore if financial markets are imperfect there are less entrepreneurs and more workers in equilibrium than otherwise, determining lower equilibrium output. The work also assess this effect quantitatively. We find that imperfections, alone, do matter but also that they can explain only part of the cross country differences in income levels. What seems to be relatively more important is the distribution of agents' productivity (or opportunities), and mostly the *interaction* between the degree of mobility within the distribution of abilities and the

level of financial market imperfections. In particular we find that in the presence of low mobility increasing the level of imperfcetions can push the economy into a development trap.

From the theoretical point of view the paper contains some interesting results as well. We provide a characterization of the equilibrium in presence of financial market imperfections, wealth distribution and technological convexities. The paper is in a way an evolution of Lucas (1978) who provides a static analysis in absence of financial market imperfections and also of Evans and Jovanovic (1989) who introduce financial market imperfections in a similar framework but who have some technological non convexities (the wage rate is fixed and not derived endogenously) and who limit themselves to a static analysis.

The remainder of the chapter is organized as follows. Section 2 describes the model economy. Section 3 characterizes the equilibrium while section 4 describes the equilibrium dynamics, and presents the numerical results. Finally, Section 5 concludes.

3.2 Economic Environment

Time is discrete, we consider a small open economy with perfect capital mobility which is populated by a continuum of agents of measure one. The interest rate on the world capital market is r. There is one good which can be used for investment and consumption. Each agent lives for one period in which she chooses an occupation, invests and works. At the end of the period she decides how much to consume of her income, and how much to leave as bequest to her off-spring. The population is stationary, that is each agent has one child to take care of.

3.2.1 Preferences

Agents are assumed to be risk neutral and to have preferences over consumption and bequest.

$$U(c_t, b_{t+1}) = c_t^{1-s} b_{t+1}^{s}, \tag{3.1}$$

where c_t and b_{t+1} denote consumption and bequest, respectively. At the beginning of each period individuals receive bequest, invest their wealth, and choose an occupation. At the end of the period they receive labour income and interest earnings on

their investments, and choose consumption and bequest so as to maximize utility. Write ω_t for the total revenues of an individual at the end of the period. Given this simple utility function, optimal consumption and bequest are a constant fraction of total revenues, thus,

$$b_{t+1} = s\omega_t \tag{3.2a}$$

$$c_t = (1-s)\omega_t. \tag{3.2b}$$

The indirect utility function now is given by $U(\omega_t) = s^s(1-s)^{1-s}\omega_t$. It follows that rational individuals maximize their total income otherwise they would not maximize consumption.

3.2.2 Technology

Agents are endowed with a level of ability which determines their productivity when they undertake any economic activity. We assume that in each period the ability level a_t is determined by two factors. The first factor (a_{t-1}) refers to the parental level of ability as intends to capture the importance (documented by Becker and Tomes (1986) and Coleman (1966)) of the parental effect in the transmission of skills. The second factor (g) is idiosyncratic and is randomly drawn from a distribution D for each generation.

Assumption 3.1 *$D(\cdot) : [0, \bar{g}] \to [0,1]$ is exogenously given, time invariant, has finite mean and a continuous positive density function $d(\cdot)$.*

We assume similar properties for the initial parental distribution

Assumption 3.2 *$H_0(\cdot) : [0, \bar{h}] \to [0,1]$ is exogenously given, has finite mean and a continuous positive density function $h(\cdot)$.*

Let $F(\cdot)$ be the joint distribution of D and H. To keep the analysis simple we assume that in each period the ability level of each individual is a simple weighted average of the two factors explained above.

$$a_t = \theta a_{t-1} + (1-\theta)g_t \tag{3.3}$$

The specification of the ability distribution expressed by (3.3) deserves a more profound explanation. Firstly, as stressed above, it allows to capture two different and realistically important channels of transmission of abilities and skills. The terms a_{t-1} and g in fact capture two different effects: the former identifies a local (home) effect while the latter identifies what can be called an *institutional* effect. The term "institutional" may not seem completely adequate, but it is so if we interpret the distribution of a_t as the *set of opportunities* that individuals face. Under this point of view there are some opportunities that derive from the local (home) environment while others depend on the institutional structure of the economy.
Secondly the two components, a_{t-1} and g exert two different effect on the dynamical evolution of a_t: the local component a_{t-1} gives *persistence* to the initial ability distribution while the "institutional" component g redistributes abilities between periods. Moreover since, as we shall see, our model does not have a stochastic production function[1], the redistribution of abilities between periods is the only channel of mobility between classes.
Therefore varying the parameter θ in equation (3.3) one can change the degree of mobility within the model. Since it does not affect the results of the analytical part, without loss of generality we will initially assume $\theta = 0$, i.e. each member of the new generation receives an ability draw independent of the previous generation. The effect of a change in θ will be addressed in section 3.4.1.

Agents can engage in two different activities. An individual can choose to become a *worker*. In this case an individual with ability level a_t supplies a_t efficiency unit of labour, and earns a competitive wage w_t per efficiency units. Alternatively, she may choose to become an *entrepreneur*. In this case she hires capital and labour on competitive markets, and her income is determined by the difference between the revenues from selling the output and the costs from renting production factors.[2] We assume that if an entrepreneur manages k_t units of homogeneous capital, and l_t efficiency units of labour, her firm produces y_t units of output where

$$y_t = a k_t^{\alpha} l_t^{\beta} \qquad \alpha + \beta < 1. \tag{3.4}$$

[1]Under this point of view the model differs from Aghion and Bolton (1997), Banerjee and Newman (1993) and Piketty (1997).

[2]The model is a variant of that of Lucas (1978).

Entrepreneurs and workers are treated as complementary factors in this setup because firms do not produce without workers, and in turn firms are not set up without entrepreneurs. Therefore, we must observe both entrepreneurs and workers in any equilibrium with positive production.
Assuming perfect competition between entrepreneurs the marginal products of capital and labour equal the factor prices

$$r = \alpha a k_t^{\alpha-1} l_t^{\beta} \tag{3.5a}$$

$$w_t = \beta a k_t^{\alpha} l_t^{\beta-1}, \tag{3.5b}$$

implying the standard demand function for the production factors

$$k_t = k(w_t, a) = \left[\left(\frac{\alpha}{r}\right)^{1-\beta} \left(\frac{\beta}{w_t}\right)^{\beta} a \right]^{\frac{1}{1-\alpha-\beta}} \tag{3.6a}$$

$$l_t = l(w_t, a) = \left[\left(\frac{\alpha}{r}\right)^{\alpha} \left(\frac{\beta}{w_t}\right)^{1-\alpha} a \right]^{\frac{1}{1-\alpha-\beta}} \tag{3.6b}$$

It is important to note that factor demands also depend on individuals' type. In particular, individuals with higher productivity will run larger firms.

3.2.3 The structure of the credit market

Each individual born at time t inherits an amount b_t from her parent. We assume that b is distributed by a distribution function $G_t(\cdot)$ at time t. Write $g_t(\cdot)$ for the corresponding density function. Our assumptions later will ensure that $G_t(\cdot)$ has finite mean and support $[0, \bar{b}]$ for all t.[3]
To bring financial markets into the model, we assume that individuals deposit their inherited wealth at competitive banks, and the banks lend the deposits to entrepreneurs. Assuming costless intermediation and perfect competition in the banking sector, both the lending and the borrowing rate must equal the marginal product of capital.

[3]Our assumption about the dynamics will ensure that the level of wealth is bounded.

However, we do not rule out the possibility of credit market imperfections. There may be entrepreneurs who wish to borrow at the prevailing interest rate, but banks are not willing to lend to them. We generate imperfection in a very simple way by assuming that a borrower may run away with the output of the project before repaying the loan to the bank. Nevertheless, the bank is always able to seize a fraction π of the output. The borrower repays its debt if the benefit from repaying the debt exceeds the benefit from defaulting on it, thus, if[4]

$$ak_t^\alpha l_t^\beta - w_t l_t - r_t(k_t - b_t) \geq (1-\pi)ak_t^\alpha l_t^\beta \tag{3.7}$$

If an individual is not credit constrained, she is going to make an optimal investment and employment decision by equating the marginal product of capital and labour to their respective rental price. In this case we can use equations (3.5a) and (3.5b) for the factor prices, and we obtain that an individual has no incentive to renege on the contract given her optimal investment and employment plan if

$$k_t \leq \frac{\alpha}{\alpha+\beta-\pi} b_t \equiv \lambda b_t, \tag{3.8}$$

that is, the investment plan cannot exceed an amount proportional the individual's wealth. Moreover, it is also easy to see that if the optimal level of investment exceeds λb_t, then the incentive compatibility constraint holds for $k_t = \lambda b_t$. Note also that nobody can invest in a firm more than her wealth if $\pi \in [0, \beta]$ and nobody is credit constrained if $\pi \in [\beta + \alpha, 1]$.

3.2.4 Occupational choice

Individuals choose their occupation optimally. Since individual's utility is monotonically increasing in income, an individual chooses to become an entrepreneur if and

[4]We assume that each individual can always recover the deposit at the bank. This assumption implies that in each period total savings are equal to the capital stock. Alternatively one could assume that there is a 100% depreciation in which case in equation (3.7) r equals one plus the interest rate. Minor modifications would be needed to accomodate for this change. Finally an even simpler representation of the credit market could assume that credit market imperfections allow each agent to borrow up to an amount that is proportional to her wealth, the factor of proportionality being $\pi - 1$. This assumption would yield the same conclusions as equation (3.8) with the factor of proportionality being πb instead of λb.

only if the return on being an entrepreneur exceeds the return on being a worker. The entrepreneurial income Π depends on whether the individual is credit constrained or not. If she is not credit constrained, then she chooses both investment and employment optimally by equating the marginal products of their respective rental price. The Cobb-Douglas technology ensures that the entrepreneurial income for an unconstrained individual is $(1-\alpha-\beta)y_t$. In contrast, if an individual is credit constrained, she invests the maximum amount she can λb_t and hires workers optimally by equating the marginal product of labour to its rental price. Since the marginal product of capital is higher than its marginal product due to the credit constraint, the entrepreneurial income for a credit constrained individual becomes $(1-\beta)y_t - r\lambda b_t$. In summary, the entrepreneurial income is given by

$$\Pi = \begin{cases} (1-\alpha-\beta)ak_t^{\alpha}l_t^{\beta} & \text{if an individual is not credit constrained} \\ (1-\beta)a(\lambda b_t)^{\alpha}l_t^{\beta} - r\lambda b_t & \text{if an individual is credit constrained.} \end{cases} \tag{3.9}$$

The occupational choice of an individual depends on whether Π exceeds the the market wage w_t or not.

3.3 Competitive Equilibrium

Since we are considering a small open economy, the only concern is the labour market equilibrium. The supply and demand of labour depend on how many individual choose to become an entrepreneur and how much labour they do demand. We proceed by deriving the demand for capital and labour of each type of individuals as a function of a cut-off ability level A_t where no individual with $a < A_t$ chooses the become an entrepreneur. The level of investment and employment together with the credit constraint determine who chooses to become an entrepreneur among those individuals with $a \geq A_t$. This allows us to define the competitive equilibrium in term of A_t.

Our first statement concerns the existence of the threshold ability level A_t.

Lemma 3.1 *If*

$$\lambda \bar{b} > \left[\frac{\beta}{1-\alpha-\beta}\right]^{\frac{\beta}{1-\alpha}} \left(\frac{\alpha}{r}\right)^{\frac{1}{1-\alpha}} \bar{a}^{\frac{(1+\beta)}{1-\alpha}} \tag{3.10}$$

then there is a unique A_t such that some individuals of type A_t are not credit constrained, and those individuals are indifferent between becoming a worker and entrepreneur.

Proof. Suppose that an individual of type A_t is unconstrained. It follows from (3.9) that such an individual is indifferent between becoming a worker or an entrepreneur if and only if

$$(1-\alpha-\beta)A_t k_t^{\alpha} l_t^{\beta} = A_t \beta A_t k_t^{\alpha} l_t^{\beta-1}$$

where we used the fact the the market wage equals the marginal product of labour in efficiency units. Using the labour demand of an unconstrained entrepreneur from equation (3.6b), this can be rewritten as

$$\left[\left(\frac{\alpha}{r}\right)^{\alpha}\left(\frac{\beta}{w_t}\right)^{1-\alpha}\right]^{\frac{1}{1-\alpha-\beta}} A_t^{\frac{\alpha+\beta}{1-\alpha-\beta}} = \frac{\beta}{1-\alpha-\beta} \tag{3.11}$$

which has a unique solution in A_t.

It remains to be proved whether there is an unconstrained individual with ability level A_t. Combining condition (3.11) with equation (3.6a), we obtain that the optimal unconstrained investment level of an individual of type A_t is

$$k_t = \left[\frac{\beta}{1-\alpha-\beta}\right]^{\frac{\beta}{1-\alpha}} \left(\frac{\alpha}{r}\right)^{\frac{1}{1-\alpha}} A_t^{\frac{(1+\beta)}{1-\alpha}}.$$

Condition (3.10) ensures that one can find unconstrained individuals even among the most productive entrepreneurs implying the existence of unconstrained individuals for any $A_t \leq \bar{a}$. □

No individuals with ability $a < A_t$ choose to become an entrepreneur by construction. However, an individual with $a \geq A_t$ may or may not find it profitable to become an entrepreneur depending on whether she is credit constrained or not. Equation (3.9) shows that the entrepreneurial income is increasing in the firm size. Therefore,

an individual may be so poor, and consequently, her investment would be so low, that her entrepreneurial income falls short of the market wage.

Next we make this intuition more precise. Note that entrepreneurial income depends on firm size. We start by deriving the demand for capital and labour, and the entrepreneurial income both for the credit constrained and unconstrained individuals. Equation (3.11) can be solved for the real wage w_t per efficiency unit of labour,

$$w_t = w(A_t) = \beta \left[\left(\frac{1-\alpha-\beta}{\beta} \right)^{1-\alpha-\beta} \left(\frac{\alpha}{r} \right)^{\alpha} \right]^{\frac{1}{1-\alpha}} A_t^{\frac{\alpha+\beta}{1-\alpha}}. \tag{3.12}$$

This equation tells us that the more an individual find it attractive to become a worker, i.e. the higher is A_t, the higher is the real wage. This condition allows us to write the demand of each class of individuals as a function of A_t.

We first derive the factor demand functions of a *credit constrained* entrepreneur. A credit constrained individual will borrow the maximum amount she possible can

$$k_c(b_t) = \lambda b_t, \tag{3.13a}$$

which we obtain from equation (3.8). The demand for labour is determined by the marginal condition (3.5b)

$$l_c(a, A_t, b_t) = \left(\frac{\beta a (k_c(b_t))^{\alpha}}{w(A_t)} \right)^{\frac{1}{1-\beta}}. \tag{3.13b}$$

Using the demand functions, we can derive the income of a credit constrained entrepreneur

$$\Pi_c(a, A_t, b_t) = (1-\beta) a [k_c(b_t)]^{\alpha} [l_c(A_t, b_t, a)]^{\beta} - r k_c(b_t). \tag{3.13c}$$

We then derive the factor demand functions in terms of A_t for an *unconstrained* entrepreneur. Again, substituting equation (3.12) into the factor demand functions

(3.6a) and (3.6b) leads to

$$k_u(a, A_t) = \left(\frac{\beta}{1-\alpha-\beta}\right)^{\frac{\beta}{1-\alpha}} \left(\frac{\alpha}{r}\right)^{\frac{1}{1-\alpha}} a^{\frac{1}{1-\alpha-\beta}} A_t^{-\frac{\beta}{1-\alpha}\frac{\alpha+\beta}{1-\alpha-\beta}} \tag{3.14a}$$

$$l_u(a, A_t) = \frac{\beta}{1-\alpha-\beta} a^{\frac{1}{1-\alpha-\beta}} A_t^{-\frac{\alpha+\beta}{1-\alpha-\beta}}. \tag{3.14b}$$

Using equation (3.9), the demand for capital and labour (3.14a) and (3.14b), we obtain the entrepreneurial income for an unconstrained entrepreneur

$$\Pi_u(a, A_t) = (1-\alpha-\beta)a[k_u(a, A_t)]^{\alpha}[l_u(a, A_t)]^{\beta} \tag{3.14c}$$

It is easy to check that $\Pi_u(a, A_t) \geq \Pi_c(a, A_t, b_t)$.
Once we have the factor demand functions for each type of entrepreneurs, we can derive the threshold level of wealth which determine the occupational choice for individuals with $a > A_t$.

Lemma 3.2 *There are unique $\underline{B}(a, A_t) \leq \bar{B}(a, A_t)$ such that an individual with ability a and*

(a) with wealth $b \in [0, \underline{B}(a, A_t))$ chooses to become a worker,

(b) with wealth $b \in \left[\underline{B}(a, A_t), \bar{B}(a, A_t)\right)$ chooses to become an entrepreneur, and she is credit constrained, and

(c) with wealth $b \in \left[\bar{B}(a, A_t), \bar{b}\right]$ chooses to become an entrepreneur, and she is not credit constrained.

Moreover, the derivatives of $\underline{B}(a, A_t)$ and $\bar{B}(a, A_t)$ with respect to A_t satisfy

$$\frac{\partial \underline{B}(a, A_t)}{\partial A_t} > 0 \qquad \frac{\partial \underline{B}(a, A_t)}{\partial a} < 0 \tag{3.15a}$$

$$\frac{\partial \bar{B}(a, A_t)}{\partial A_t} < 0 \qquad \frac{\partial \bar{B}(a, A_t)}{\partial a} > 0 \tag{3.15b}$$

Proof. First, we show the existence of $\underline{B}(a, A_t)$. A credit constrained individual is indifferent between becoming a worker or an entrepreneur if the entrepreneurial

income equals wage earnings, that is, if

$$\Pi_c(a, A_t, b_t) = aw(A_t).$$

Inspecting equations (3.13c) and (3.12) reveals that the entrepreneurial income is increasing in b_t while the wage is independent of it, therefore the previous equation has a unique solution in terms of the wealth $\underline{B}(a, A_t)$. It follows that the market wage exceeds the entrepreneurial income for an individual with $b_t < \underline{B}(a, A_t)$ implying that no such an individual chooses to become an entrepreneur.
Moreover, $\Pi_c(a, A_t, b_t)$ is decreasing while $w(A_t)$ increasing in A_t implying that a higher A_t is associated with a higher b_t for which the above equation holds with equality. Furthermore, inspecting (3.14c) reveals that $\Pi_c(a, A_t, b_t)/a$ is increasing in a. It follows that a higher ability level a is associated with a lower b_t satisfying the above equation with equality. This proves our claims about the partial derivatives given in (3.15a).
Next, we show the existence of $\bar{B}(a, A_t)$. Any unconstrained individual with $a > A_t$ finds it optimal to engage in entrepreneurial activity by definition. The optimal level of investment of such an individual is given in equation (3.14a). Hence, an individual with wealth b_t and with $a > A_t$ is unconstrained if and only if

$$\lambda b_t \geq \left(\frac{\beta}{1-\alpha-\beta}\right)^{\frac{\beta}{1-\alpha}} \left(\frac{\alpha}{r}\right)^{\frac{1}{1-\alpha}} a^{\frac{1}{1-\alpha-\beta}} A_t^{-\frac{\beta(\alpha+\beta)}{1-\alpha}\frac{1}{1-\alpha-\beta}}.$$

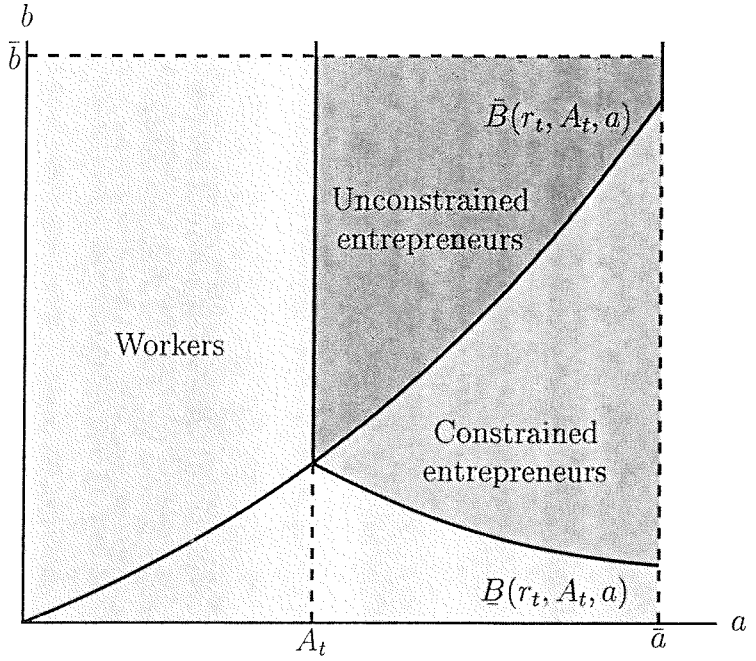
Clearly, there is a unique wealth level $\bar{B}(a, A_t)$ for which the equation holds with equality, i.e. all entrepreneurs with $b_t \geq \bar{B}(a, A_t)$ are not credit constrained. It is also easy to see that the partial derivatives of $\bar{B}(a, A_t)$ satisfy (3.15b). □

The results are displayed on Figure 3.1. The population of individuals sorted by ability and wealth (a, b) is selected into three groups in each period: worker, unconstrained and constrained entrepreneurs.
It is now possible to define the equilibrium for this economy.

Definition 3.1 *A competitive equilibrium in period t is a cut-off ability level A_t such that*

(a) firms maximize profit,

Figure 3.1: Selection of individuals into occupation



(b) the occupation choice is optimal,

(c) the labour market clears

$$\int_0^{A_t} a dF(a) + \int_{A_t}^{\bar{a}} \int_0^{\underline{B}(a,A_t)} a dG_t(b) dF(a) =$$

$$\int_{A_t}^{\bar{a}} \int_{\underline{B}(a,A_t)}^{\bar{B}(a,A_t)} l_c(a, A_t, b) dG_t(b) dF(a) + \int_{A_t}^{\bar{a}} \int_{\bar{B}(a,A_t)}^{\bar{b}} l_u(a, A_t) dG_t(b) dF(a) \tag{3.16}$$

Proposition 3.1 *There is an A_t such that firms maximize profits, the occupational choice of each individual is optimal, and labour market clears.*

Proof. Let $Z(A_t)$ be the excess demand for labour given by the difference between the right and the left hand side of equation (3.16). First, observe that $A_t = 0$ implies nobody wishes to work as a worker implying that there is an excess demand for labour, thus, $Z(0) > 0$. Second, if $A_t = \bar{a}$, then $F(A_t) = 1$, i.e. nobody wants to become an entrepreneur implying an excess supply of labour, thus, $Z(\bar{a}) < 0$. Since

the excess demand function is continuous, there is an A_t^* such that $Z(A_t^*) = 0$. □

3.4 The equilibrium dynamics

The equilibrium dynamics of the economy is given by the following transition functions

$$b_{t+1} = \begin{cases} s[(1+r)b_t + \Pi_u(a, A_t)] & \text{if } a \geq A_t \text{ and } b_t \geq \bar{B}(a, A_t) \\ s[(1+r)b_t + \Pi_c(a, A_t, b_t)] & \text{if } a \geq A_t \text{ and } b_t \in \left[\underline{B}(a, A_t), \bar{B}(a, A_t)\right) \\ s[(1+r)b_t + aw(A_t)] & \text{otherwise} \end{cases} \quad (3.17)$$

The transition function describes the change in the wealth of a family with wealth b_t between period t and $t+1$. An individual receives interest earnings regardless of her occupation, and enjoys entrepreneurial or worker income depending on her occupation, and on her ability.
The next assumption ensures that the wealth is bounded.

Assumption 3.3 $1 > s(1+r)$

One can easily see that both an unconstrained, and a constrained entrepreneurs', and a workers' wealth has an upper bound, namely,

$$b_t \leq \frac{s\Pi_u(a, A_t)}{1 - s(1+r)} \qquad b_t \leq \frac{s\Pi_c(a, A_t)}{1 - s(1+r)} \qquad b_t \leq \frac{saw(A_t)}{1 - s(1+r)}$$

The transition functions are monotone in b_t. Moreover, since each member of a new generation receives an ability draw independent of the previous generation, there is always positive probability that an individual will face different opportunities than her parent, i.e. there is mobility in the model. This ensures the existence of a unique stationary distribution, [see Futia (1982) and Hopenhayn and Prescott (1992)][5]. Since it is impossible to analyse the dynamic equilibrium of the model analytically, we rely on numerical analysis in the remaining part of the chapter.

[5]For a detailed analysis on the conditions that ensures the existence of a unique stationary distribution see the appendix of chapter 4

3.4.1 Numerical Results

The numerical analysis allows us to establish the properties of the steady state and also to conduct some comparative dynamics exercises; in particular in what follows we will analyse the effects on the steady state aggregate income levels of the degree of financial market imperfections and of features of the distribution of abilities a. This will be done in three steps: firstly we will analyse the effect changes in the degree of financial market imperfections on the level of equilibrium level of income. Secondly we will analyse the effects of changes in the distribution of a; finally we will investigate the effect of the interaction between financial market imperfections and the degree of mobility within the distribution of a.

The model was simulated as follows: first we started with an initial distribution of agents in terms of wealth and ability. The initial distribution gives an initial A_0. We then derived the demand functions for the two classes of entrepreneurs which in turn allows us to determine the wage rate and A_t. The process is then repeated until convergence.

We set the technological parameters in the following values: $\alpha = 0.3$ and $\beta = 0.5$. This allows for a 0.2 entrepreneurial share in output. We set $s = 0.6$ and $r = 0.066$ which are similar to those used by Owen and Weil (1998). We have chosen for the distribution of abilities, the normal distribution $N(5, 1)$ trunctated at zero; the wealth distribution has been taken as lognormal as the majority of the studies do. To asses the quantitative effect of financial market imperfections on the level of aggregate output, we varied the parameter π. Setting it to 0.75 would correspond to a rather mild imperfection on the financial markets where potential borrowers may carry out an investment project which requires six times more capital than their own wealth. Similarly, if financial market imperfections are severe, i.e. $\pi = 0.55$, implies that an entrepreneur can invest an amount which is only 20% higher that her own wealth.

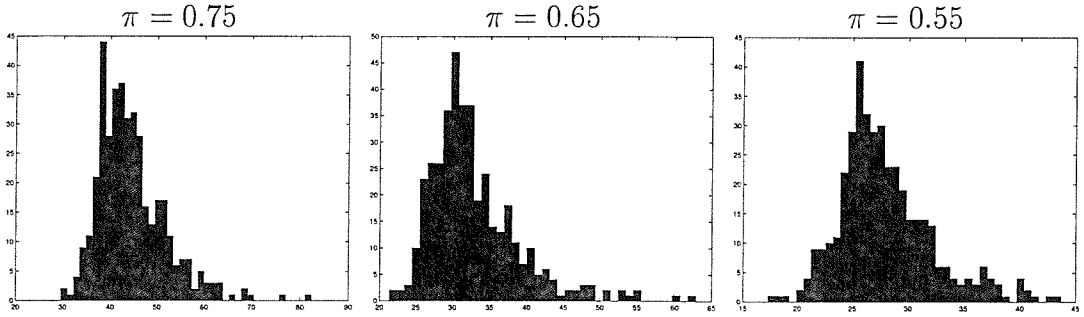
Proposition 3.2 *The numerical analysis suggests that financial market imperfections can induce differences in relative income level up to a factor of 2.*

Table 3.1 presents the results. With an induced twofold difference in relative income level financial market imperfections do matter for the long run development of an

Table 3.1: Financial market imperfection and the level of income

π	Relative output level
0.75	1.864
0.65	1.252
0.55	1.000

Figure 3.2: The distribution of wealth



economy. However, this difference is at least a magnitude lower than the income difference between developed and less developed countries. This result indicates that even if financial market imperfections play a role in generating differences in income across countries, they play only a minor role in explaining cross country differences in per capita income.

One might wonder how sensitive are those results to the specific functional forms adopted and in particular to the production function which displays decreasing returns to scale, giving rents to entrepreneurs. As table 3.2 shows the results are indeed sensitive to the degree of returns to scale: as $\alpha+\beta$ approach 1, entrepreneurial rents decrease and so do the effects of financial market imperfections on the level of income. However the basic message remains unchanged i.e. financial market imperfections, alone, can explain only a limited fraction of differences in income levels.

We next compare the effect of financial market imperfections with the other important element of our paper: the distribution of abilities.

As we shall see there are many ways in which the distribution of a can affect the level of income; here we investigate the most direct link i.e. a change in the *mean* of

Table 3.2: Effect of financial market imperfections on the level of income for different degrees of returns to scale

	$\alpha+\beta=0.8$	$\alpha+\beta=0.85$	$\alpha+\beta=0.9$	$\alpha+\beta=0.95$
$\pi=0.55$	100.00	100.00	100.00	100.00
$\pi=0.65$	124.22	119.28	117.21	117.1
$\pi=0.75$	183.52	157.55	146.16	142.6

Table 3.3: Effect of the distribution of abilities on the level of income. The mean of the distribution has been normalized to 100

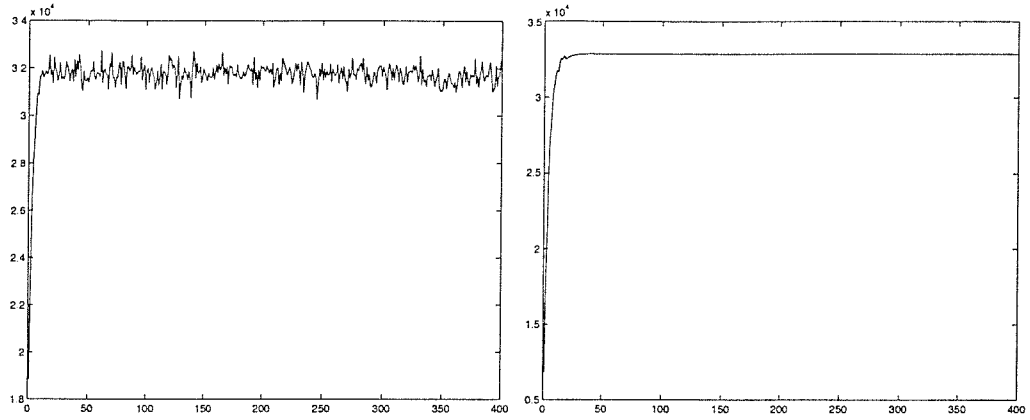
	Mean of a		
	100	118.2	136.36
$\pi=0.55$	100	138.84	187.21
$\pi=0.65$	100	139.42	186.41
$\pi=0.75$	100	140.02	186.74

the distribution. In order to compare the effect on the level of income of a change in the distribution with a change in the degree of financial market imperfections we increase the mean of the distribution of a by the same proportion as the change in the parameter π; note that doing this we are overestimating the effect of financial market imperfections as π has a multiplicative effect on the level of credit constraints λ (a 18.2% increase in π from 0.55 to 0.65 determines in fact an increase in credit constraints of 66.67% - from 1.2 to 2-).

Table 3.3 shows that compared to the degree of financial market imperfections, changes in the distribution of abilities have a stronger impact on relative income levels.

However, what proves to be really important is the *interaction* between the distribution of a and the degree of financial market imperfections. To be more precise *within* the distribution of a a crucial role is played by the parameter θ that gives the weight between the parental effect and the institutional effect in the transmission of abilities. θ plays a crucial role because regulates the degree of *mobility* between classes. As we have already stressed, in our model the only way in which there can be mobility between classes is through the redistribution of abilities from one period to another.

Figure 3.3: Income dynamics: a) $\theta = 0$, b) $\theta = 1$



(a) (b)

Figure 3.3 explains the point clearly: there we have represented the dynamic behaviour of total output with $\theta = 0$ (maximum mobility) and with $\theta = 1$ (no mobility). With $\theta = 1$ the evolution of aggregate output does not display fluctuations, since the absence of movements within the distribution replicates over time the same ability distribution and the same structure of occupational choices.

The effect on relative output levels exercised by changes in the degree of mobility is explained by table 3.4 and by figure 3.4.

Two effects emerge clearly from the observation of the table and the figure: firstly, ceteris paribus, a reduction in the degree of mobility reduces total output. This is true independently of the level of financial market imperfections. In fact, even with very mild imperfections ($\pi = 0.75$) the aggregate output level with very little mobility ($\theta = 0.9$) is 10% lower than aggregate output with maximum mobility ($\theta = 0$), see figure 3.4. There is a simple intuitive explanation for this result: a typical outcome of this class of models that analyse the interaction between financial market imperfections and distributional effects, is that redistributive policies are always welfare improving. The reason is that total output is maximized when the number of entrepreneurs is maximized. In this model we can achieve this goal in two ways: either by redistributing wealth from entrepreneurs to workers, or by redistributing abilities (opportunities) from entrepreneurs to workers. Both policies would achieve the same result that is to allow more people to pass the double thresh-

Table 3.4: Effects of financial market imperfections under different mobility regimes

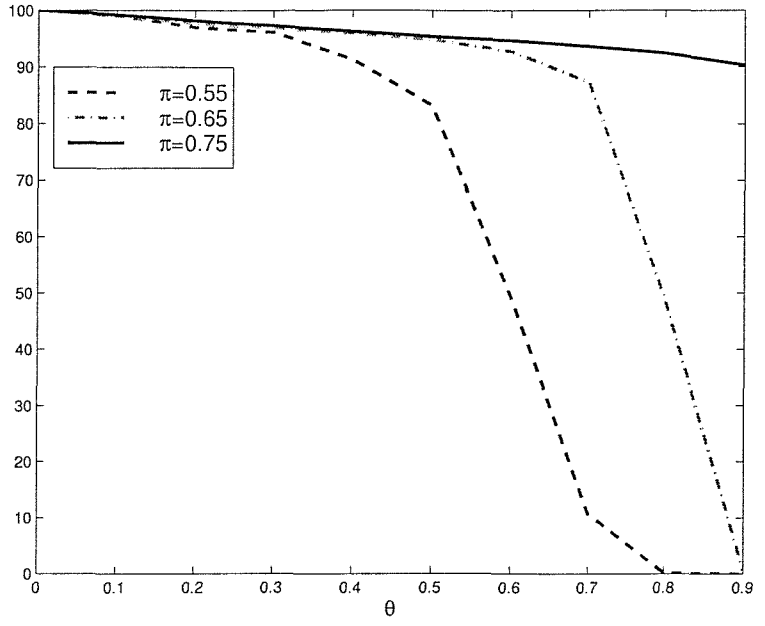
	$\pi = 0.55$	$\pi = 0.65$	$\pi = 0.75$
$\theta = 0$	100.00	124.22	183.52
$\theta = 0.1$	100.00	124.51	183.85
$\theta = 0.2$	100.00	125.06	185.74
$\theta = 0.3$	100.00	125.80	185.77
$\theta = 0.4$	100.00	130.49	193.54
$\theta = 0.5$	100.00	141.59	210.39
$\theta = 0.6$	100.00	233.49	352.19
$\theta = 0.7$	100.00	$100.74e^1$	$159.64e^1$
$\theta = 0.8$	100.00	$470.40e^2$	$131.04e^4$
$\theta = 0.9$	100.00	$144.63e^4$	$287.17e^6$

old (ability and wealth level) that discriminates between workers and entrepreneurs. As θ increases, the probability of a change in the distribution of a from one period to the next, becomes less and less likely and therefore this channel of redistribution is progressively shut down.

Secondly, the simultaneous presence of low mobility and financial market imperfections can bring the economy in a development trap in which too few individuals can start an entrepreneurial activity. This result is showed by figure 3.4 in which with very low mobility $\theta = 0.8$ for high values of credit constraints ($\pi = 0.55$) no one is able to become entrepreneur and equilibrium aggregate output falls to zero. Reducing the amount of credit constraints ($\pi = 0.65$) only few (88 out of 1000 agents) constrained entrepreneur can operate in the economy, while with mild imperfections ($\pi = 0.75$) the economy is able to get out of the development trap. The intuition for this results is again provided by the fact that in our model there is a double threshold both in terms of ability and in terms of wealth that has to be passed in order to become entrepreneur. Severe forms of financial market imperfections increase the threshold level of wealth necessary to become entrepreneur; a low redistribution of abilities makes this effect more and more persistent leading the economy into a development trap.

It seems therefore that the real challenge that Eastern European countries face now is to accompany the removal of imperfections in their financial markets with the appropriate institutional reforms. Those reforms reforms need to address not only

Figure 3.4: Relative output levels under different mobility regimes



the improvement of the set of opportunities that individuals face (i.e. changes in the mean of the distribution of a) but also and more decisively, the issue of (upward) mobility between classes. Albeit a discussion on those aspects is beyond the scope of this chapter we can mention not only the use of redistributive (tax) policies but also other reforms related to the educational system, the labour market and the level of infrastructure, which should be aimed at the reducing the weight of the family or social background in the determination of the opportunities that each agent faces favouring in this way more mobility between classes.

3.5 Conclusions

We studied a simple model of occupational choice under financial market imperfections. The aim of the chapter was to analyze the quantitative effect of these imperfections on the level of income. We have found that although their effect is relatively large, financial market imperfections, alone, are not able to explain the observed cross country difference in terms of income. However when analysed jointly with the issue of mobility, those imperfections become much more relevant to the point of pushing the economy into a development trap. We therefore conclude that

the removal of financial market imperfections has to be accompanied by appropriate institutional reforms that can increase the level of (upward) mobility both in terms of wealth and in terms of opportunities that each agent face.

Chapter 4

Soft Budget Constraints and Financial Market Imperfections

4.1 Introduction

During the last twenty years since Janos Kornai (1979) first introduced the concept of soft budget constraints, the formulation and definition of this phenomenon has changed substantially even though its economic implications remained the same. Kornai's original definition, later formalized by Kornai and Weibull (1983) saw a paternalistic state rescuing loss making firms because unwilling to accept the economic and social consequences of their failure. This view has been challenged by some recent contributions that widened the definition and application of the notion of soft budget constraints. In a path breaking article Dewatripont and Maskin (1995) identify soft budget constraints with a dynamic commitment problem. Their key insight is that when the implementation of a project requires a sunk initial investment, *ex post* the financial intermediary can find optimal to bail out the entrepreneur even if *ex-ante* such action would not have been undertaken. The reason is that since prior funds invested are sunk, the continuation value of the firm may be higher than its liquidation value. In other words soft budget constraints arise following an inability of the financial intermediary to commit to a specified financing scheme.

This approach has stimulated a series of important contributions that go from the analysis of banking reforms (Berglöf and Roland (1997, 1998)), to the analysis of

financial crises (Huang and Xu (1999b))[1] to the issue of federalism (Qian and Roland (1998))[2].

An interesting application of this stream of literature is the one provided by Huang and Xu (1998, 1999)[3]: they embed the Dewatripont-Maskin argument in a standard model of endogenous growth à la Aghion-Howitt showing that soft budget constraints (SBC) induce a lower investment in technological advances and R&D than hard budget constraints (HBC), with the result that SBC economies display a lower growth rate than HBC economies. They also show that when technological progress is driven by imitation rather than by innovation a SBC economy will catch up with a HBC economy. Therefore there are conditions in which soft budget constraints are not necessarily deleterious to economic development.

In general, even if there is much debate in the theory on the *origins* of soft budget constraints (paternalism, dynamic commitment problem etc.), there is a widespread consensus on their *consequences*: soft budget constraints distort agents' incentives determining a loss of efficiency. Moreover, in addition to the distortion of incentives, soft budget constraints often imply additional costs: they are in fact generally associated with widespread institutional failures like unclear definition of property rights, inefficient bankruptcy procedures etc. Those institutional failures create costs on the economy as a whole and generate rents that can be extracted by some classes of agents.

In this paper we challenge the general view that soft budget constraints have necessarily a negative impact on the economy. Our argument is based on the observation that in several economies soft budget constraints are accompanied by other forms of market and institutional failures.

Most transitional economies, for instance, are plagued by severe imperfections in their financial markets. The effects of those imperfections are forms of credit rationing and/or high cost of external borrowing. Soft budget constraints can be viewed as a relaxation of these credit constraints and in some cases they can exert

[1] Mitchell (2000) provides a good survey on the theories of soft budget constraint applied to banking and financial crises.

[2] Several other applications of the theory of soft budget constraint are provided by Maskin and Xu (1999).

[3] See also Qian and Xu (1998).

an overall positive effect.
Our argument is therefore a simple application of the "theory of second best": subsidies and SBC, alone, are a cost for the economy, but if they are introduced in an environment where other distortions are already in place, under some conditions they can mitigate them.
We explore those aspects in a simple model of development derived from Aghion and Bolton (1997); in this respect our approach complements the one by Huang and Xu (1998, 1999) in that we emphasize a different channel through which SBC can affect the long run development of an economy.
In our model agents may become entrepreneurs by implementing a project. The likelihood of success of the project can be increased by spending effort on it. Depending on their wealth agents may need to borrow in order to become entrepreneurs. Individuals' limited liability generates an agency problem in the borrower-lender relationship that in turn increase the cost of borrowing. In this framework we introduce soft budget constraints in form of a subsidy to entrepreneurs in case of failure of the project. The effect of soft budget constraint is twofold: on one hand it distort agents' incentives inducing them to provide less effort, on the other hand it reduces the agency problem diminishing the interest charged by financial intermediaries.
We look at the general equilibrium effect of soft budget constraints assuming that they are financed with a proportional tax on income. We show the existence of an optimal "level" of soft budget constraints that is strictly positive. This level is related to two crucial features of the economic environment: the degree financial market imperfections and of institutional failures present in the economy.
During the chapter we put the emphasis on the issue of soft budget constraints; the implications and applications of the argument made here are however wider and have profound implication on the normative side (reforms design). Those aspects are stressed in section 4.7.

The remainder of the chapter is organized as follows: section 4.2 sets up the modelling framework, section 4.3 characterizes its equilibrium, section 4.4 introduces the issue of soft budget constraints and analyzes their implications; section 4.5 presents the numerical results. Section 4.6 provides some possible extensions of the modelling framework. Section 4.7 discusses the policy implication of the analysis. Section 4.8

finally concludes.

4.2 Modelling framework

The modelling framework relies on a simplified version of the model by Aghion and Bolton (1997).

Consider a *small open economy* populated by a continuum of individuals who live for one period. In this period each agent works, consumes and invests; the remaining is left as bequest to her off springs. The population is stationary, that is each agent has one child to take care of.

4.2.1 Preferences

Agents are assumed to be risk neutral and to have preferences over consumption and bequest.

$$U(c_t, b_{t+1}) = c_t^{1-s} b_{t+1}^s, \tag{4.1}$$

where c_t and b_{t+1} denote consumption and bequest, respectively. At the beginning of the period individuals receive bequest, invest their wealth, and choose an occupation. We assume that b is distributed with a distribution function $G_t(\cdot)$ over the support $[0, \bar{b}]$. At the end of the period they receive labour income and interest earnings on their investments, and choose consumption and bequest so as to maximize utility. Write ω_t for the total revenues of an individual at the end of the period. Given this simple utility function, the optimal consumption and bequest are a constant fraction of total revenues, thus,

$$b_{t+1} = s\omega_t \tag{4.2a}$$

$$c_t = (1-s)\omega_t. \tag{4.2b}$$

It follows that rational individuals maximize their total income otherwise they would not maximize consumption[4].

[4]The indirect utility function is given by $U(\omega_t) = s^s(1-s)^{1-s}\omega_t - C(\cdot)$ where $C(\cdot)$ denotes the

4.2.2 Technology

Agents have an "occupational choice": they can either choose to work in a backyard activity that yields a fixed wage n or they can invest in an entrepreneurial activity that requires a sunk initial investment of h and yields a return R.[5] The return R is not certain but is stochastic, that is

$$R = \begin{cases} R \text{ with probability } p \\ 0 \text{ with probability } (1-p) \end{cases} \tag{4.3}$$

Agents who want to implement a project can spend effort in it, improving the likelihood of success. Effort has a cost that we are assuming to be convex. Like Aghion and Bolton (1997) we take the cost function to be quadratic.

$$c(p) = \frac{Rp^2}{2a} \tag{4.4}$$

Not all potential entrepreneurs have the resources to finance the investment project. Those with wealth $b > h$ can rely on internal finance, the others have to borrow the difference $(h-b)$. Denoting by i the interest rate that have to be paid on loans the entrepreneurial expected return (net of effort costs) is given by

$$E\Pi = pR - p(h-b)(1+i) - c(p) \tag{4.5}$$

Because of the non observability of effort and of the limited liability of each entrepreneur (each individual cannot repay to the lender more that her available wealth), there is a moral hazard problem that generates an imperfection in the credit market.

The moral hazard problem arises in the effort choice which is done optimally by each entrepreneur, that is p is such that

$$p = \arg\max\{pR - p(h-b)(1+i) - c(p)\} \tag{4.6}$$

cost of effort to be defined below.

[5] Alternatively one could assume that there are two sectors: a sector for which output is produced with a constant return to scale technology that uses unskilled labour and capital as inputs and another sector for which output is produced from entrepreneurial activity. For the first sector factors are paid their marginal product and as the economy is small and open the world interest rate also fixes the wage rate.

Note that each entrepreneur takes the interest rate i (that will be determined below) as given.

The solution to the equation (4.6) is given by

$$p = a\left\{1 - \frac{h-b}{R}(1+i)\right\} \tag{4.7}$$

Effort increases with the return from the investment, decreases with the interest rate and decreases in borrowed wealth[6]. In other words the more one borrows the lower is the effort provided due to the fact that the share of the return that she can keep is reduced. Those who do not need to borrow provide the first best level of effort, a.

4.2.3 Financial intermediation

Banks act as financial intermediaries and are assumed to behave competitively, therefore for any amount $(h-b)$ borrowed the interest rate i charged on the loan has to satisfy the zero profit condition:

$$(h-b)(1+i)p = (1+r)(h-b) \tag{4.8}$$

Where r denotes the riskless world interest rate. From equation (4.8) follows that there is a spread between the lending and the deposit interest rate to keep into account the moral hazard problem (the spread is in fact inversely related to p).

The equilibrium effort choice is determined by inserting equation (4.8) into (4.7). The equilibrium level of p is thus the solution to the following equation

$$p^* = a\left\{1 - \frac{h-b}{R}\frac{(1+r)}{p^*}\right\} \tag{4.9}$$

It can be shown that p^* increases with b, that is also in a general equilibrium perspective optimal effort increases with wealth.

Potential entrepreneurs have also a participation constraint to respect, that is the income they receive from being entrepreneurs has to be greater than the revenues they would get simply lending their wealth at the market rate and enjoying the outcome of the backyard activity.

[6]This is a standard result of this literature, see Sappington (1983)

$$\left[pR - (1+r)(h-b) - \frac{p^2 R}{2a}\right] \geq (1+r)b + n \tag{4.10}$$

This last equation determines a threshold level of wealth ($\hat{b}$) such that all agents with $b \geq \hat{b}$ choose to be entrepreneurs, while the others work at the backyard activity.

The economy is therefore characterized by three classes of agents:

(a) Agents who do not reach the threshold $\hat{b}$. Those agents are too poor to become entrepreneurs and work at the backyard activity.

(b) Agents whose wealth is greater than $\hat{b}$ but lower than h. Those agents are entrepreneurs that have to borrow in order to finance the investment project; for this reason they do not exercise first best effort.

(c) Agents whose wealth is greater than h. They are entrepreneurs as well, but they are sufficiently rich to finance the investment project with internal funds. They provide first best effort.

4.3 Dynamic equilibrium

The dynamic equilibrium of the economy is characterized by the evolution of the transition functions of the three classes of agents described above. The transition functions are as follows: for the poor agents who cannot become entrepreneurs

$$b_{t+1} = s[(1+r)b_t + n] \tag{4.11}$$

For the entrepreneurs whose wealth does not exceed h

$$b_{t+1} = \begin{cases} s\left[R - (1+i)(h-b)\right] & \text{with probability } p \\ 0 & \text{with probability } (1-p) \end{cases} \tag{4.12}$$

Finally for the rich entrepreneurs whose wealth exceeds h

$$b_{t+1} = \begin{cases} s\left[R + (1+r)(b-h)\right] & \text{with probability } a \\ s(1+r)(b-h) & \text{with probability } (1-a) \end{cases} \tag{4.13}$$

Typically the dynamic evolution of an economy like the one described above is complex, since the state variable is the wealth distribution itself. For this particular model it is easy to show that the transition functions described above have certain properties that allow us to use some recent results obtained by Hopenhayn and Prescott (1992) and state the following proposition:

Proposition 4.1 *For any given world interest rate there exists a unique limiting wealth distribution to which the economy converges.*

Proof. In the appendix we show that the transition functions like (4.11), (4.12) and (4.13) are monotone, bounded and satisfy the mixing condition. We can therefore apply theorem 2 by Hopenhayn and Prescott (1992) and show the existence of a unique invariant wealth distribution. □

The proposition ensures that the economy converges to a stochastic equilibrium in which the stationary distribution of wealth replicates over time.

4.4 The effect of soft budget constraints

We now introduce soft budget constraints. In doing so we will limit ourselves to a comparative static analysis between steady states. In the modelling framework used here this means that starting from an equilibrium wealth distribution we will analyze the effects of soft budget constraints on individual choices and output taking the distribution as given. In section 4.6 we will analyze possible extensions of the present framework to a full dynamic analysis.

Let us suppose that, for any amount borrowed $(h - b)$ the state bails out a fraction x of it in case of failure of the project. This subsidy is given to the firm that in turn is required by the lending contract to turn it to the bank that provided the loan. However the entrepreneur can "hide" a fraction ϕ of the subsidy and keep it for herself. Considering the whole economy ϕ is a known parameter, but it is not possible to monitor the behavior of each entrepreneur[7].

[7] One can imagine that the relationship between the entrepreneur and the government is not observable, in which case the entrepreneur can claim to have received less that what she actually had.

This specification is simple but allows to capture two effects of soft budget constraints:

(a) The fact that soft budget constraints modify the effective return of an investment project in case of the bad state of the world. This is the major channel through which soft budget constraints distort incentives that agents face[8].

(b) The fact that soft budget constraints are often accompanied by other institutional deficiency (not clear definition of property rights, ineffective bankruptcy laws etc.). Typically institutional deficiencies allow agents to exercise rent seeking activities[9]. The parameter ϕ captures the extent to which such rents are extracted by entrepreneurs.

This second aspect is not crucial for the analysis that will be carried over but it is nevertheless very important. Soft budget constraints are in fact a problem that ultimately derive from the inability or unwillingness to fully apply the concept of (financial) accountability of an investment project. It may happen that financial authorities are unable to do that simply because there are institutional failures that prevent the determination of financial responsibilities and punishments. This is the case when there is an unclear definition of property rights, when bankruptcy procedures are ineffective, etc. In this case soft budget constraints are a natural consequence of such institutional failures[10]. It is worth to analyse the link between soft budget constraints and institutional failures for two reasons: first because this is a common situation in many transitional economies (for example Russia and the other ex-Soviet Republics), and second because institutional failures modify the channel through which the effects of soft budget constraints affect the economy.

As the reader will promptly notice the definition of soft budget constraints used here is somewhat closer to the original definition of Kornai rather than to the one used

[8]This channel has been emphasized recently as the major factor affecting the Asian financial crisis; see Huang and Xu (1999a) for an application of SBC to the Asian crisis.

[9]Boycko, Shleifer, and Vishny (1996), Shleifer and Vishny (1993, 94)

[10]Pistor, Raiser, and Gelfer (2000) provide an assessment of the extensiveness and effectiveness of legal and market institutions in Eastern Europe; Johnson, McMillan, and Woodruff (1999a, 1999b) analyse the impact of the lack of institutional development on private sector growth using survey data in Poland, Romania, Slovak Republic, Russia and Ukraine.

by the recent literature. We are in fact mainly interested to the macroeconomic implications of soft budget constraints rather to their microeconomic foundations.

To close the model, since we are addressing this issue from a general equilibrium perspective, we have to consider the provision of resources that pay for the cost of soft budget constraints. To keep matters simple we assume that they are financed by a proportional tax on income τ.

The modelling framework is therefore modified as follows.
Soft budget constraints increase the return of each entrepreneur in case of default for the portion she can "hide". The expected return for the entrepreneur becomes now

$$E\Pi = (1-\tau)\left[pR - p(1+i)(h-b)\right] - c(p) + (1-p)x(h-b)\phi \tag{4.14}$$

That is in the case of the good state the entrepreneur earns the return from the investment net of effort costs, interest payments and taxes, in case of the bad state she gets the fraction ϕ of the subsidy.
The optimal effort that maximizes (4.14) becomes

$$p^* = a(1-\tau)\left\{1 - \frac{(h-b)}{R}\left[(1+i) + \frac{x\phi}{(1-\tau)}\right]\right\} \tag{4.15}$$

Now there is an additional term that affects the choice of p: soft budget constraints distort incentives, inducing the agents to reduce the amount of effort. This happens for two reasons: on the one hand they directly increase the return in the bad state, on the other hand they indirectly (through taxes) reduce the return in the good state; both these effects reduce the incentives to provide effort. The effect of taxation affects also the optimal level of effort that falls from a to $a(1-\tau)$. Therefore also rich entrepreneurs who do not benefit from soft budget constraints (because they do not have to borrow) have their effort distorted by the fact that they have to pay for it.
This is however only part of the story because we have to consider the effect of soft budget constraints on banks' behavior; banks in fact receive the part of the subsidy that is not hidden by entrepreneurs, and this changes their zero profit condition. Equation (4.8) now becomes

$$(h-b)p(1+i(b))+x(1-p)(h-b)(1-\phi)=(h-b)(1+r) \tag{4.16}$$

From (4.16) follows that the interest rate on loans is given by

$$(1+i)=\frac{(1+r)-(1-p)x(1-\phi)}{p} \tag{4.17}$$

As clearly shown by equation (4.17), soft budget constraints, increasing banks' return in the bad state, reduce the interest rate charged on loans. Putting together equation (4.15) and (4.17) we obtain the optimal level of effort as a function of the parameters of the model and of the level of wealth. The optimal level of effort is the solution to the following equation

$$p^*=a(1-\tau)\left\{1-\frac{(h-b)}{R}\left[\frac{(1+r)-(1-p^*)x(1-\phi)}{p^*}+\frac{x\phi}{(1-\tau)}\right]\right\} \tag{4.18}$$

Equation (4.18) shows clearly that considered from a general equilibrium perspective, the impact of soft budget constraints on optimal effort is mixed.
On one hand soft budget constraints distort incentives both directly and indirectly (through taxes) -see equation (4.15)- reducing effort. On the other hand, through banks' zero profit condition (equation (4.17)), an increase in x reduces the relevant interest charged to entrepreneurs which in turn raises the expected return of the project inducing an increase in effort. The net effect will depend on the strength of these two opposite forces.

Also the participation constraint is modified; equation (4.10) is now changed into:

$$\begin{aligned}&(1-\tau)\left[pR-\left[(1+r)-(1-p)x(1-\phi)\right](h-b)\right]-\frac{p^2R}{2a}\\&+(1-p)x\phi(h-b)\geq(1+r)b+n\end{aligned} \tag{4.19}$$

This last equation determines a threshold level of wealth ($\hat{b}$) such that all agents with $b\geq\hat{b}$ choose to be entrepreneurs, while the others work at the backyard activity.

Soft budget constraints are financed levying a proportional tax on income. Therefore

x and the tax rate τ have to satisfy the government budget constraint

$$\begin{aligned}
&\tau \int_{\underline{b}}^{\hat{b}} ((1+r)b+n)dG(b) \\
&+\tau \int_{\hat{b}}^{h} \left[pR - \left[(1+r) - (1-p)x(1-\phi)\right](h-b)\right] dG(b) \\
&+\tau \int_{h}^{\bar{b}} \left[aR + (b-h)(1+r)\right] dG(b) \\
&= x \int_{\hat{b}}^{h} (1-p)(h-b)dG(b)
\end{aligned} \tag{4.20}$$

Here we have assumed that the tax is levied on all incomes (also those of the poorest agents). None of the results is affected if the tax is levied only on the entrepreneurial class.

We are now in the position of assessing the effect of soft budget constraints on total output of the economy. To do that is sufficient to characterize total output as a function of x and look at its behavior when x changes.

Total output is defined as

$$\begin{aligned}
Y = &\int_{\underline{b}}^{\hat{b}} \left[(1-\tau)((1+r)b+n)\right] dG(b) \\
&+ \int_{\hat{b}}^{h} \left\{ (1-\tau)\left[pR - \left[(1+r) - (1-p)x(1-\phi)\right](h-b)\right] - \frac{p^2 R}{2a} \right\} dG(b) \\
&+ \int_{h}^{\bar{b}} \left\{ (1-\tau)\left[aR + (b-h)(1+r)\right] - \frac{aR(1-\tau)^2}{2} \right\} dG(b) \\
&+ \int_{\hat{b}}^{h} ((1-p)x\phi(h-b))dG(b)
\end{aligned} \tag{4.21}$$

4.5 Numerical Results

Despite the simplicity of the model, it is not possible to assess the impact of soft budget constraints analytically. We therefore have to conduct a numerical analysis.

The model was simulated as follows: given the initial distribution and the initial number of agents total wealth is determined. The latter, given the project size h determines in turn how many project can be financed; sorting the agents by wealth this in turn determines the threshold $\hat{b}$. For each level of x one can then compute effort (p) and project returns all as a function of the tax rate τ. The government budget constraint (equation (4.20)) is then used to calculate the tax rate.
The simulations assumed agents distributed according a gamma distribution[11] which is displayed in figure 4.1.
Moreover h was set at 130; $a = 0.6$, $r = 0.1$, R was set in order to ensure an average rate of return of 30%, finally ϕ was set to 0.15.

Proposition 4.2 *Numerical results show that there exists a positive level of x (call it x^*) that maximizes total output; moreover*

i *Ceteris paribus an increase in a shifts x^* to the left*

ii *Ceteris paribus an increase in ϕ shifts x^* to the left*

The "optimal" level x^* trades off between a positive and a negative effect of soft budget constraints. To better understand the mechanics of the model note that the three classes of agents that characterize the economy can also be classified into two groups: net borrowers and net lenders. Agents belonging to the first and to the third class are in fact net lenders while agents belonging to the second class are net borrowers. This distinction is crucial because as will be explained in the next section the effect of soft budget constraint operates on two levels: an *efficiency level* as it affects the effort level p, a *distribution level* that operates through taxation. In both cases it affect differently borrowers and lenders.

The *positive effect* of soft budget constraints comes from the reduction in the interest premium charged by financial intermediaries. Under this point of view they reduce imperfections in the financial market (theory of the second best).

The *negative effect* comes from taxation and the distribution of income. Soft budget constraints operate a redistribution of income from net lenders to net borrowers. Net

[11] In particular the distribution is $Gamma(b; 10, 1/9)$ so that $E(B) = 90$.

lenders (both very rich and very poor agents) do not benefit at all from soft budget constraints, but they are taxed in order to pay for it.

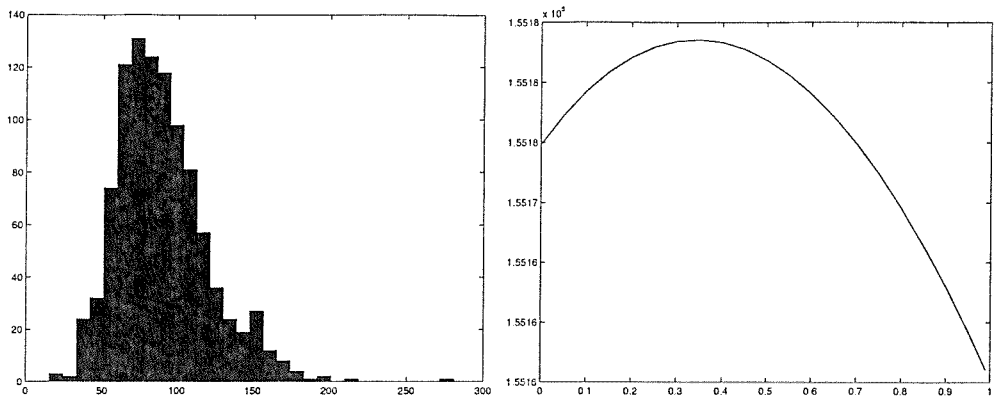
At a certain point the benefits to the borrowers deriving from a reduction in the interest rate are outweighed by the costs to the lenders deriving from an increase of taxes.

There is a *mixed effect* on effort of net borrowers. On one hand soft budget constraints tend to reduce effort, on the other (through the reduction of the interest rate) they tend to increase it. It turns out that, due to the specific functional forms adopted, this effect is always of second order with respect to the previous two. That is there is not a great difference whether effort increases or decreases. In general, and this is again due to the functional forms adopted, for high values of a and of R the effect of soft budget constraints on effort is negative, while for low values of these variables the effect is positive. This can be explained as follows: if a or R are high the return in the good state is very high, and the reduction in interest rate has such a high income effect that it more than outweighs the substitution effect reducing in this way effort.
Effort of net lenders (rich entrepreneurs) unambiguously decreases.

The remaining part of proposition 4.2 refers to a comparative static analysis that looks at the effect of some key parameters on the optimal level of x (call it x^*)
Ceteris paribus an increase in a shifts x^* to the left: this is due to the fact that a provides an upper bound to the level of effort, and that soft budget constraints affect the interest rate only in the bad states of the world. Therefore the higher is a the less effective are soft budget constraints in reducing the interest rate and the earlier the negative effects outweigh the positive ones.

Ceteris paribus An increase in ϕ shifts x^* to the left: this is due to the fact that the higher is the share of the subsidy that is hidden by entrepreneurs, the less effective are soft budget constraints in reducing the interest rate.

Apart from comparative statics exercises, the parameters a and ϕ have also some interesting economic interpretation.



(a) (b)

Figure 4.1: The effect of soft budget constraints on total output

a can be interpreted as defining the degree of imperfections of financial markets (a moral hazard parameter): the higher is a the more efficient are financial markets (in fact the higher is a the higher is effort the lower is the interest rate spread)[12]. ϕ on the other hand can denote the degree of "institutional failure". When institutions are not functioning properly (lack of property rights, bribes etc.) it is easier to hide resources and to extract rents from soft budget constraints.

This suggests that soft budget constraints are deleterious in developed economies where financial markets are functioning well (a is high), but also in countries like Russia, where, despite financial markets are highly imperfect, the lack of institutional development makes ϕ very high and this reduces the effectiveness of soft budget constraints in reducing financial market imperfections.

4.6 Extensions

4.6.1 Different bailing out practices

The modelling framework used here assumes that the state bails out a fixed percentage of borrowed wealth $(h - b)$ in case of failure.

[12]More precisely a is an *indirect* measure of moral hazard. Since agents are risk neutral, what is crucial for moral hazard to have a bite on the borrower-lender relationship, is borrowers' limited liability which in turn is triggered by the realization of the bad state of the world. A higher a makes the bad outcome a less likely event and therefore reduces the limited liability problem.

An alternative set up would see the state bail out a fixed fraction of the investment needed - h - in case of failure. This would slightly modify the effect of soft budget constraints on incentives. To see it let us consider again equation (4.14); in this case the equation is changed as follows

$$E\Pi = (1-\tau)\left[pR - p(1+i)(h-b)\right] - c(p) + (1-p)xh\phi \tag{4.22}$$

which determines the following effort choice

$$p^*(b) = a(1-\tau)\left\{1 - \frac{(h-b)}{R}(1+i) - \frac{x\phi}{(1-\tau)}\frac{h}{R}\right\} \tag{4.23}$$

In this case the distortion effect of soft budget constraints on effort is higher simply because in case of failure agents receive a higher payoff. The analysis would then carry on as before yielding similar results.

4.6.2 A dynamic framework

As previously stressed the paper performs a comparative statics exercise, that is taking the limiting wealth distribution as given. An interesting extension of the current set up would consider the effects of soft budget constraints on the dynamic evolution of the economy and therefore on wealth distribution. The analysis is by no means trivial because there is a two sided interaction between wealth distribution and soft budget constraints. On one hand we have seen that soft budget constraints redistribute resources from net lenders to net borrowers, on the other hand changes in the distribution of wealth modify the effect of soft budget constraints on total output.

Generally speaking the dynamic interaction between soft budget constraints would be characterized by the following features:

a *A static effect*: this is the effect that we have analyzed in the previous paragraphs. Because soft budget constraints make net lenders worse off those agents would bequeath less to their children. This would increase downward mobility between the class of "rich" entrepreneurs (those who do not need to borrow) towards the class of "poor" entrepreneurs (who do need to borrow). At the

same time it would reduce upward mobility from the very poor agents who work in the backyard activity into the middle class of "poor" entrepreneurs.

b *A dynamic effect*: as we have seen the introduction of soft budget constraints reduces the relevant interest rate that entrepreneurs have to pay on borrowed wealth. A reduction in the interest rate in turn reduces the threshold level of wealth $\hat{b}$ that enables one to become entrepreneur, that is a lower interest rate make it easier to become entrepreneur, increasing upward mobility from the lower class to the middle class.

The net effect of those two factors implies that soft budget constraints should be associated with a more equal distribution of wealth.

4.7 Policy implications

The conclusions reached by the model seem somewhat surprising and provocative: soft budget constraints may actually help the economy instead of increasing the level of inefficiencies. The implications of the paper are in fact wider; in this section we examine them more closely.

Firstly, as clearly appears from the model, soft budget constraints, *alone* (i.e. *without* others imperfections) have a negative impact on the economy: in the absence of imperfections in fact everybody would provide first best effort and there would be no scope for redistributive policies.

Secondly SBC are an example of a possible welfare improving policy instrument, but others can be considered as well. The effect of SBC in the model is twofold: on one hand it eases financial constraints reducing the spread between i and r, on the other it redistributes resources in favour of (constrained) entrepreneurs. Under this point of view *any* redistribution policy would improve efficiency[13]. For instance an insurance scheme for entrepreneurs would accomplish this task ; in fact SBC can be considered an implicit insurance scheme in which $x(h-b)$ is the amount insured and τy is the insurance premium.

[13]This is a standard result in those models of occupational choice and income distribution, see Aghion and Bolton (1997).

It can be argued that, since they are one of many possible policy instruments that can be implemented in the model and that can increase efficiency, the emphasis put in this chapter on soft budget constraints is excessive.

There are two reasons that justify our choice: firstly SBC were already in place at the beginning of transition and are still widespread among transitional economies; dealing with them implies understanding all their implications, even the ones that do not appear obvious.

Secondly, as the model suggests, the effect of soft budget constraints is linked also to the level of institutional deficiencies present in the economy. In other words, in order to exert a positive effect, SBC require not only severe imperfections in financial market but also a low level of institutional failures.

The link between soft budget constraints and institutional failures has profound implication for the design and sequencing of economic and institutional reforms. The chapter suggests that institutional reforms constitutes prerequisite for other reforms. This is confirmed by both macroeconomic and microeconomic evidence. On the macroeconomic side it is now well established that countries that implemented earlier and more effectively institutional reforms are now experiencing higher and sustainable growth (see the 1999 EBRD Transition Report for a documentation on the progress and measurability of institutional developments). On the microeconomic side Johnson, McMillan, and Woodruff (1999a, 1999b), using survey data, show that in the absence of a clear definition of property rights and of an appropriate legislative framework, financial liberalization and the easing of credit constraints has no impact on the entrepreneurial development. They show in fact that in countries such as Russia and Ukraine which are mostly behind in term of regulatory framework and institutional development, the relaxation of financing constraints had a limited impact on firms' growth. By the same token in countries where institutional developments are more advanced easing credit constraints, even through forms of subsidies, can have a positive economic effect.

A further extension of the argument of this chapter is referred to the application of bankruptcy procedures. Instead of soft budget constraints one can interpret the subsidy $x(h-b)$ as a refinancing scheme to firms that otherwise would go bankrupt and then compare the two situation with and without SBC as two different degrees

of toughness of bankruptcy procedures. The message of the chapter in this case would be that in the presence of financial market imperfections and in the absence of severe institutional failures a bankruptcy law too severe can be deleterious for the economy.

This argument is supported by the experience of Hungary. Hungary is one of earliest reformers and it is now one of the countries in Eastern Europe where institutions are more developed. In September 1992 the Hungarian parliament passed the Bankruptcy Act that became effective on 1st January 1992. This bankruptcy law was very tough as it contained an automatic trigger that required firms helding overdue debts of any size to any creditor to initiate liquidation proceedings[14]. By many observers[15] the Hungarian bankruptcy reform was too severe, and coupled with the existence of financial market imperfections, was one of the determinant of the severe credit crunch that affected the Hungarian economy until 1996[16].

4.8 Conclusions

In this chapter we have analysed the interaction between soft budget constraints and financial market imperfections in a simple model of occupational choice. Despite being very simple, the analysis conveys a basic message: when evaluating the effects of soft budget constraints on the macroeconomy one has to consider the possible contemporaneous presence of other distortions with which soft budget constraints may interact.

In particular in environments where there are severe forms of financial market imperfections, soft budget constraints can ease those imperfections and reduce credit rationing problems. Under this point of view soft budget constraints can be welfare improving.

[14]For a detailed description of the Hungarian bankruptcy law see Mitchell (1998)

[15]See Bonin and Schaffer (1995, 1999) and Mitchell (1998)

[16]Also the Hungarian authorities were aware of this, in fact they amended the bankruptcy law in a softer direction only one year later its implementation.

Appendix

In the proof of proposition 4.1 we relied on some results obtained by Hopenhayn and Prescott (1992) and in particular on corollary 4 and theorem 2. In this Appendix we briefly state those results and we show that the transition functions (4.11), (4.12) and (4.13) do have the properties required.
In what follows we take the state space to be a Borel set of an Euclidean space, $B \subseteq \mathbf{R}^l$ with Borel subset $\mathcal{B}$.

Let B be a compact metric space and let P be a transition function as defined above. P induces a mapping $T^* : \mathcal{P} \times (B) \to \mathcal{P} \times (B)$ defined by

$$(T^*\mu)(A) = \int P(b, A)\mu(db)$$

T^* is called the *adjoint* of the Markov operator T, μ is a probability measure and A is a Borel subset of B.
The interpretation is that if $\mu(A)$ is the probability that the current period the state b is in the set A, then $(T^*\mu)(A)$ is the probability that b lies in A next period.

Corollary 4, HP pp.1392: If B is a compact metric space with a minimum element and $P : B \times \mathcal{B} \to [0, 1]$ is an increasing monotone function, then the Markov process corresponding to P has a stationary distribution; i.e., there exists a fixed point for the mapping T^* induced by the process.

Theorem 2, HP pp.1397:
Suppose P is increasing , B contains a lower bound l and an upper bound u and the following condition is satisfied:
Monotone Mixing Condition[17]: there exists a point $b^* \in B$ and an integer m such that $P^m(u, [l, b^*]) > 0$ and $P^m(l, [b^*, u]) > 0$[18].
Then there is a unique stationary distribution λ^* for the process P and for any initial measure μ, $T^{*n}\mu = \int P^n(b, \cdot)\mu(db)$ converges to λ^*.

We first show the monotonicity property.

[17] See Stokey, Lucas, Jr., and Prescott (1989), pp.381.
[18] Where $P^m(l, [b^*, u])$ denotes the probability of reaching the set $[b^*, u]$ starting from l after m iterations of the Markov Process

Let $P : B \times \mathcal{B} \to [0,1]$ be the transition function that corresponds to the Markov process followed by wealth. The interpretation is that $P(a, A) = \Pr\{b_{t+1} \in A \mid b_t = a\}$, that is the number $P(a, A)$ is the probability that the random variable b next period lies in the set A given that the current value is a.
P is monotone if it is increasing in its first arguments in the stochastic order sense: $b, b' \in B$ and $b \geq b'$ implies $P(b, \cdot) \geq P(b', \cdot)$. This property can be established immediately observing the individual transition functions and noting that b_{t+1} is an increasing function of b_t.

Next we establish that the transition functions a) operate on a bounded set, and b) satisfy the Monotone Mixing Condition.

Part a) The set is bounded between 0 and $\max\{\bar{b}, \check{b}\}$ where $\check{b}$ is the largest endowment (inheritance) any individual starts up with at $t = 0$.

Part b) The mixing condition is indeed satisfied whenever there is both upward and downward mobility between classes. Note that in the model the mixing condition is guaranteed by the stochastic process followed by the project return. There is always the chance for any poor individual to get a sequence of good draws that allow to become a rich entrepreneur and in each moment anyone has a positive probability of defaulting.

We can therefore apply Theorem 2 by HP and establish the existence of a unique invariant distribution.

Chapter 5

The Capital Structure of Hungarian Firms

5.1 Introduction

Somewhat paradoxically, the theory of capital structure has been made famous by a contribution that showed its irrelevance to the value of the firm (Modigliani and Miller (1958)). In the presence of perfect information, in fact, there is no difference between internal and external finance, and therefore firm's capital structure, i.e., how it allocates its financial position between debt, equity and other forms of finance, becomes completely irrelevant.

Forty years after Modigliani and Miller's seminal paper, economic theory has shown that while the frictionless neoclassical world is a useful theoretical benchmark, in reality there are financial market imperfections, mainly due to informational failures, that introduce a wedge between internal and external finance, creating on one hand a "pecking order" of financing methods (Myers and Majluf (1984)) and on the other hand a precise link between investment and financing decisions. The relationship between financial structure and investment has in turn led in recent years to the development of a considerable literature that underlines its macroeconomic effects (Bernanke and Gertler (1989), Greenwald and Stiglitz (1993) and the references quoted in section 1.2.3).

In this work we will investigate the factors that affect decisions about the capital structure (and in particular about bank debt) of a sample of Hungarian firms. This

investigation should reveal the existence of constraints on firms' choice allowing us to infer some considerations on the degree of imperfections that characterize credit and financial markets in Hungary.
It is important to stress that our procedure, unlike the studies that estimate investment equations (see all the references quoted in section 1.3), *is not* a test for the presence of financial market imperfections; it is only an empirical investigation of firms' capital structure that *indirectly* can reveal the presence of such imperfections.

There is a conspicuous literature that analyze those issues in industrialized countries (see for example Titman and Wessels (1988) and Rajan and Zingales (1995)), but also in the case of Eastern Europe there are several contributions: Cornelli, Portes, and Schaffer (1998) for Hungary and Poland, Revoltella (1998) for the Czech Republic and Carare and Perotti (1997) for Romania.
However while in all the above mentioned works the analysis is conducted at a cross sectional level, we conduct both a cross-section and a panel data analysis. We believe that the additional information and efficiency that can be extracted from a panel can considerably improve our understanding of the relevance of financial market imperfections in Eastern European economies and allows us to have a better grasp of the determinants of firms' capital structure in those countries.
The second qualifying aspect of the present work is constituted by the data set: the panel analysis is in fact allowed by a data set that is unique for Eastern European standards, as it gives detailed information on balance sheet and market structure for some 1100 Hungarian firms from 1992 to 1996, allowing to test precisely the relevant hypothesis.
The remainder of the chapter is organized as follows: section (5.2) introduces the theoretical framework, section (5.3) describes the data set and some descriptive statistics, section (5.4) explains the methodology used, section (5.5) presents the empirical findings, section (5.6) concludes.

5.2 The Theory

As stressed in the introduction the analysis of the capital structure of firms assumes relevance mainly in the presence of financial market imperfections; it is due to such

imperfections that different financing methods become imperfect substitutes and determine the presence of an "optimal capital structure". There are two very good reasons for which those imperfections are likely to be particularly severe in Eastern Europe.

The first is that during the planned-type economy banks did not exercise any monitoring or risk assessment activity: they were lending to firms simply because this was what the plan stated, but they were not concerned about the solvency of the borrower (the solvency of the whole system was guaranteed by the state itself). Therefore, even if there existed a relationship between borrowers and lenders, this relationship was completely uninformative. With the beginning of transition, lenders had to be concerned about the creditworthiness of borrowers, but on one hand the former did not have any experience in monitoring activity, on the other hand the latter did not have any reputation or credit history to show.

The second reason is the economic instability that characterized the early stages of transition: in the presence of an unstable economic system, current performances are a very poor indicator for future performances. Therefore, not only borrowers do not have any reputation deriving from the past, but also they have relevant difficulties in building one *ex novo*.

In this situation the informational problems that are likely to emerge may cause severe forms of credit rationing and may in general constrain firms in their capital structure decisions.

In what follows we will analyze from the theoretical point of view the factors that most likely affect the capital structure of firms in our sample. In doing so we will not consider theories based on tax consideration that give rise to what are called static tradeoff models[1]. We rather focus on the theories that stress the relevance of informational failures, known also as "pecking order" theories (see Harris and Raviv (1991)). The reason for such a choice is twofold: firstly as recently shown by Shyam-Sunder and Myers (1999) the pecking order theory describes extremely well corporate structure decisions, moreover tests on the static tradeoff theories do not have sufficient statistical power.

[1]Those models define an optimal capital structure that arise from trading off the tax advantages of borrowing money and the bankruptcy costs caused by an excessive level of debt, see Bradley, Jarrell, and Kim (1984).

The second and more important reason is due to the fact that our data set has a limited time horizon and the measure of debt used is short term debt (see section 5.4). It is well known that tax rates are virtually flat over short time periods and that they are more likely to affect long term debt decisions rather than short term ones. We thus do not have the proper instruments to measure the effects of tax considerations on our sample.

Nevertheless also "pecking order" theories have to be amended in order to apply them to the context of Eastern Europe. In particular the limited size of equity markets in transitional economies has so far excluded an important element in the choice about the capital structure; on the other hand the widespread use, inherited from the planned system, of trade credit has introduced an additional element that affect firms' decisions. Finally ownership characteristics may also constitute an important variable to be considered.
In principle it is important to distinguish between demand and supply side factors determining the capital structure; this distinction can be made at theoretical level but, as it will be stressed later, it is very difficult to be made at empirical level.

5.2.1 Supply Side

Collateral There should be an unambiguous positive relationship between tangibility and debt (see Harris and Raviv (1991)). Assets that serve as collateral, in fact, provide an explicit guarantee over debts and reduce the risk of investment from the banks. We use two measures of collateral: the first is the ratio of fixed to total assets; this measure however carries the problem of the precise evaluation of those assets that are classified as fixed. This problem is particularly relevant in transitional economies where fixed assets are often inherited from the old socialist system where prices did not represent a proper measure of value and where it does not exist an efficient secondary market where those assets can be traded. We therefore included as an additional measure the ratio of inventories to total assets; inventories should reduce the two above mentioned problems because it is easier to determine a "correct" price for them and because they can be re-sold on the primary market.

Profitability and growth opportunities If current profits are a good indication of

future profits we should observe a positive relationship between profits and debt (Ross (1977)). At the same time if a firm displays good growth opportunities banks should be more keen to lend to it. We measure the profitability of a firm by the ratio of after tax profits over total assets and its growth opportunities by the ratio of investments over total assets.

Size It is usually assumed a positive relationship between firm size and leverage. Big firms tend to have diversified activities which reduce the risk of bankruptcy. Moreover reputational reasons induce big firms to be more averse to bankruptcy than small firms. In transitional economies an important factor to be considered is the implicit bailout clause that can exists for large state owned firms. Often those firms are considered "too big to fail" both because their bankruptcy could have a destabilizing effect on the whole economic system and because the loss in terms of employment could be socially unacceptable. The existence of an implicit bailout clause may in turn trigger some perverse behavior by the banks that may "gamble for bailout" refinancing loss making state owned firms (Berglöf and Roland (1995, 1997)).
We measure size with two variables: one that captures more the "economic" considerations and is constituted by (the logarithm of) net sales; the other captures more the "political" considerations and is constituted by the level of employment.

Market Share As for the ownership variable (see below) in this case it is crucial to distinguish the issue of the growth of the firms from that one of the risk of the investment in those firms. Generally speaking, in transitional economies, more competitive firms are mainly new private firms which are the first to react to the changing environment and to the new standards imposed by international competition. Those firms should have better prospects of growth with respect to traditional state owned enterprises; we should therefore expect banks to favor in their lending behavior the former type of firms over the latter.
Firms which retain a consistent market power are conversely less dynamic state owned enterprises; even if their long term perspectives are not extremely attractive, in the short run their relevant market share often provides good profitability associated with low risk.

Whether banks' debt is positively or negatively related to firms' market power depend on how strong is the growth effect compared to the risk effect. We measures market power with the share of sales in the four digit industry covered by the firm.

Ownership With respect to the ownership issue we can apply similar considerations to those applied to the issue of market share. State owned firms are often big firms with limited flexibility and ability to compete at international level. Their growth opportunities should therefore be limited. On the other hand the shield determined by their market power, reduces the risk of lending to them. Moreover there is the issue of the implicit bailout clause that is referred to big companies and that contributes significantly in reducing the investment risk. Again it is a question of how strong is the risk aspect compared to growth opportunities.

A different issue is that one of foreign ownership: foreign owned firms or firms in which foreign companies have a significant share should represent certainly the best possible investment opportunity from banks perspective. Those firms in fact have a substantially lower bankruptcy risk and adopt faster international standards in terms of product quality and internal efficiency.
Ownership is measured with two dummies one that represent whether or not a firm is state owned and the other whether or not there is a consistent (greater than 10%) foreign share.

5.2.2 Demand Side

Cash Flows If there is a "pecking order" in firms' financing decisions, the use of internal resources is certainly preferred to bank debt. As a consequence firms with a higher cash flows will be characterized by reduced leverage as they substitute external with internal finance.
Our measure of cash flows is quite standard and is given by profits before tax, interest and depreciation.

Interenterprise Debt The issue of interenterprise debt has been controversial. At the early stages of transition several authors (Calvo and Coricelli (1994)) argued that interenterprise arrears could be a major channel through which soft budget constraints could be carried over. Later studies (Bonin and Schaffer (1995), Schaffer

(1998)) showed that firms learned fast how to implement hard budget constraints in the lending positions among themselves and that interenterprise debt did not constitute a form of soft budget constraint. But interenterprise debt can still convey some information about the capital structure of firms. In the absence of soft budget constraints associated with interenterprise arrears the observation of a negative correlation between bank debt and interenterprise debt can be a signal of the existence of a pecking order of firms' financial decisions (firms with no access to bank credit would resort to trade credit as a substitute). We measure interenterprise debt as the ratio of the net trade credit position (payables - receivables) to total assets.

5.3 The data set and some descriptive statistics

5.3.1 Data set

The data set used in the analysis is constructed merging the information from two sources. We first used a data set deriving from the Hungarian Ministry of Finance that contains information on all firms that paid corporate or profit taxes from 1992 to 1995; this data set covers almost the totality of Hungarian firms, with the exclusion of small shops[2]. Due to substantial changes in accounting data definitions occurred in 1992, the data set results incomplete in some variables in 1994 and 1995. We then used a second smaller data set deriving from the Hungarian Central Statistical Office that contains end of year financial statements of medium-large size firms, from 1993 to 1996[3]. Merging the information from the two sources we obtained data on financial variables (bank debt, interest payments, assets, trade credit etc.) plus information on ownership, employment and on market structure (the degree of concentration in the four digit industry).

The data resulting from the intersection of the two data sets described above suffer from a sample selection bias: as the small data set contains information on medium-large enterprises, in our sample those firms will be over-represented. We acknowledge the presence of this problem but we note that, since large firms are the ones that should generally be the least constrained in the achievement of their optimal capital

[2]The total number of firms ranges from 35000 in 1992 to over 90000 in 1995

[3]The number of firms belonging to this sample ranges from 5000 in 1993 to approximately 7000 in 1996

structure, finding evidence of such constraints for those firms allow our conclusions to be extended *a fortiori* to small firms.

We concentrated our analysis on the manufacturing and on the service sector, therefore we dropped from the sample firms belonging to the following sectors: agriculture, finance, mining, electricity, gas, water, post and telecommunication, public administration, education and health. After some consistency checks[4] we were left with cross sections of approximately 1100 firms that kept the same identification number from 1992 to 1996[5]. Those cross sections allow us to construct a balanced panel.

5.3.2 Descriptive Statistics

The data set accounts for a big share in output and employment in the Hungarian economy, ranging from 32.1% and 37.4% to 22.6% and 20.6% of respectively total employment and sales of the manufacturing and service sectors as a whole (see Table 5.1)[6].

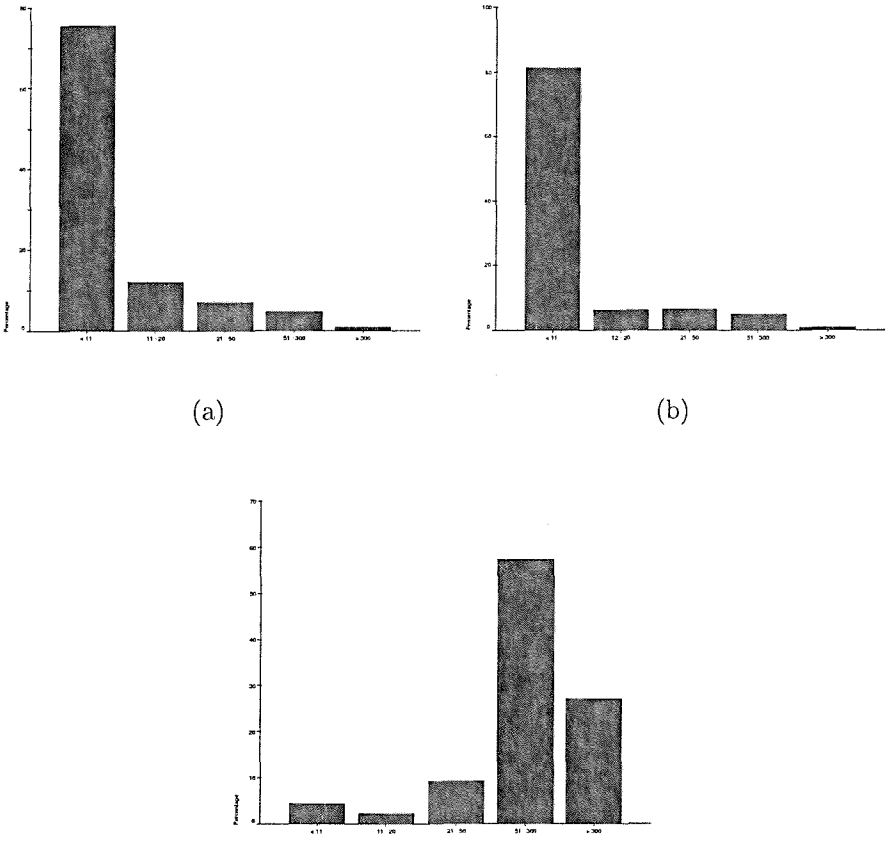
The sample selection bias stressed in the previous section emerges clearly when we compare the employment distribution of firms in different data sets. In figure (5.1, a, b, c) we have plotted the employment distribution of firms in the whole economy as reported by the central statistical office, the employment distribution of firms in the big data set (all firms that paid corporate tax) and the employment distribution of firms in the sample used for the empirical analysis. It is clear that while the first data set matches the distribution of firms of the whole economy, in the data set used for the empirical analysis bigger firms are over-represented[7]. In order to have a better description of the employment distribution of firms in the sample used for the empirical analysis figure (5.1, d) plots the cumulative distribution.

[4]Those consistency checks are described in appendix A which also describes the procedure used to identify outliers.

[5]Using this procedure we could not avoid the following problem: when a big firm is split, a branch or a part of it will keep the same identification number of the original firm while a different identification number will be assigned to the other parts or branches. While the original firm and the branch that keeps the same id are *de facto* different firms, in the sample they are recorded as the same firm.

[6]The drop in the sample's share documented by table 5.1 is explained by the fact that from 1992 to 1995 the total number of manufacturing firms increased considerably, mainly due to the birth of new firms.

[7]The categories used in the figures to divide firms by employment level are set according to the



(a) (b)

(c)

Figure 5.1: Employment distribution of firms, different data sets.

Employment and ownership structure

The ownership structure of firms considered changed considerably during the period investigated. As Table (5.2) confirms the share of state owned firms dropped from 27.8% in 1992 to 7.3% in 1995 while the share of private firms rose from 27.7% in 1992 to over 63% in 1995[8]. This pattern of ownership is quite common in transitional economies.

The observation of mean values of the principal variables by ownership categories (see table (5.4)) confirms some of the priors discussed in the theoretical section. State owned firms are on average bigger than joint ventures and private firms. State owned firms are in turn on average loss making while joint ventures are more profitable than private firms; this latter observation can signal the fact that foreign owned firms restructured more and therefore are more profitable but can also be a signal of a selection bias as foreign firms presumably bought shares in better (and more profitable) firms. State owned firms seem also to have a more restricted access to financing methods than private firms or joint ventures: their cash flows are lower but also the amount of bank debt is lower. As a consequence joint ventures and private firms invest more than state owned firms.

Total employment in the sample dropped heavily from 1992 to 1995 with a cumulative contraction of almost 29% (Table (5.1). The employment contraction is bigger than the one displayed by official statistics on industrial employment that showed a cumulative contraction between 1992 and 1995 of approximately 20% This result is probably due to the sample selection bias as we are considering mainly large and medium sized firms for which labor in excess was comparatively larger than other firms; moreover since our sample do not consider firms that entered the market between 1993 and 1996 we do not capture the growth in employment generated by such firms.

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classification system of the Hungarian Central Statistical Office.

[8]The big fall in the share of cooperatives in 1994 is due to a change in the definition of cooperatives implemented by the Central Statistical Office at the end of 1993.

Year	Employment	Sales
1992	32.1	38.8
1993	31.7	37.4
1994	28.0	34.7
1995	22.6	20.6

Table 5.1: Share of employment and sales over total employment and sales in manufacturing and service sectors.

Year	State	Cooperatives	Joint Ventures	Private	
1992	27.8	20.3	24.2	27.7	100
1993	17.6	20.4	28.3	33.7	100
1994	11.2	0.8	29.4	58.6	100
1995	7.3	0.8	28.5	63.4	100

Table 5.2: Ownership structure of firms: share of each class on the total number of firms

1993	1994	1995
-14.8	-7.8	-6.2

Table 5.3: Percentage change of employment in the sample, with respect to the previous year

	State Owned	Joint Venture	Private
Employment	760.13	424.85	255.97
Profits[a]/Total Assets	-0.015	0.059	0.022
Investment/Capital	0.077	0.245	0.198
Cash Flows/Total Assets	0.017	0.100	0.049
Bank debt/Total Assets	0.099	0.119	0.081

[a] Before tax profits.

Table 5.4: Means of principal variables by ownership group.

	1992	1993	1994	1995
Total	-0.28	-0.38	-0.28	-0.21
State	-0.18	-0.50	-0.15**	-0.19*
Private	-0.39	-0.37	-0.29	-0.21
Big	-0.33	-0.34	-0.26	-0.11**
Small	-0.26	-0.40	-0.31	-0.29

Table 5.5: Correlation coefficients between the *change* in short term debt in $t+1$ and the level of short term debt in t. The year identifies time t.

The amount and distribution of debt

One of the features of Eastern European financial markets that was most concerning was the problem of the initial stock of debt with which firms and banks started the transition process. The presence of a high stock of debt that some firms are unable to repay, may force banks to roll over the debt in order to keep the firms viable and at the same time keep open the option of having (part of) the debt repaid sometimes in the future.

A simple test for the presence of debt rollover is to calculate the correlation coefficients between the *change* in short term debt in period $t+1$ and the level of short term debt in period t. Table (5.5) shows those coefficients. In the presence of debt rollover we expect the correlation to be positive. In fact the correlation coefficients are all negative for the years considered. The correlation is greater for small firms than for big firms[9]; no clear pattern emerges for state versus private firms. The coefficients marked with a * or with ** denote respectively values that are not significant and values that are significant at 10% level.

It seems therefore that the initial stock of debt was not excessively problematic, at least not to the point of triggering debt rollover. This is consistent with the evidence advanced by Cornelli, Portes, and Schaffer (1998) that firms in Eastern Europe were not overloaded by debt (comparing to the standards of western economies) but rather underloaded. Nevertheless, even if firms were not on average exposed to an excessive debt burden, things can still be problematic if it turns out that the *distribution* of debt is source of concern. If debt is in fact concentrated mainly among loss making firms, bankruptcy may really become a serious issue.

We plotted the conditional distribution of debt (total, short-term and long-term)

[9]We defined as big firms employing more than 300 employees.

over firms' after tax profits of the same year. Looking at Figure (5.2, a) we can note that the distribution is fairly unimodal. This is in line with the findings of Bonin and Schaffer (1995) and contrasts with what found by Gomulka (1994) in Poland where a bimodal distribution was observed with a large proportion of debt concentrated in loss making firms. To be precise Figure (5.2, a) shows a "hint" of a bimodal distribution with approximately 9% of bank debt being concentrated in firms with heavy losses compared to total assets; to check if this small peak is showing a real pattern or just picking up some effect peculiar to 1992, we reported also (Figure (5.2, b)) the conditional distribution for 1993 which shows that the peak completely disappears. We can also split total debt between long term and short term debt (Figure (5.2, c,d,e,f)) and in fact we discover that whatever problem the "little peak" in 1992 might cause, it is not due to long term debt, on the contrary it is due to short term debt (less than 1 year).

In the light of this evidence we can therefore conclude that, at least for the sample of firms investigated, there was not a stock problem with huge amount of bank debt (mainly long term debt) being concentrated among loss making firms, and therefore the determinants of debt that will be investigated in the next sections should be determined principally by demand and supply considerations.

The graphs used before can be a useful starting point to investigate issues related to the flows of debt rather than to the stock. In assessing whether or not banks are lending to "good" firms we can look at the conditional distribution of debt at time $t+1$ over profits at time t, and comparing different years we can determine how this conditional distribution changes over time, extracting some information about the dynamics of the relationship between debt and profits. This is done in Figures (5.3), (5.4) and (5.5)[10].

The three Figures show an unambiguous pattern: the distribution of debt (in all the three definitions of it (total, short and long term)) is progressively shifting the majority of the mass (and therefore the mean) towards higher values of profitability. While in 1993, 42.3% (41.5%) of total debt (short term debt) was allocated to firms

[10]We acknowledge the fact that this procedure is not rigorous, nevertheless it is useful to get an idea of the dynamic evolution of debt.

that in the previous years displayed a negative profit/asset ratio, the percentage dropped to 22.6% (24.5%) in 1996. It seems therefore that banks are extracting money from loss making firms and reallocating their debt towards more profitable firms; this could be evidence against the presence of soft budget constraints.

In order to be more precise on this issue we can follow the analysis of Schaffer (1998) looking at the relationship between new credit allocation and profitability. New credit is measured by Net Bank Financing i.e. the change in bank debt minus interest payments normalized by total assets[11]; this measure indicates the direction of flows between banks and firms (i.e. *from* banks *to* firms if NBF is positive, *from* firms *to* banks if NBF is negative) and is plotted against firms profitability. We divide the sample between economic viable and non viable firms[12]; if a firm is economically non viable it is unable to cover its operating costs and should not receive any injection of new loans from the banking sector. Figure (5.6, a) shows that for the majority of economically non viable firms NBF is in fact negative, though there are some firms receiving new credit. Figure (5.6, b) shows another interesting fact: the majority of firms are economically viable *and* display positive profits, nevertheless banks are extracting money from them and not providing new funds. Can this be taken as evidence for the presence of credit rationing? The answer is difficult because to see money flowing from profitable firms to banks is not *per se* evidence of credit rationing as the latter arises when firms willing to take on loans are denied credit. In fact in our case profitable firms may be unwilling to borrow because for instance of high interest rates, preferring instead internal finance. This interpretation, advanced by Schaffer (1998), is certainly part of the story. Nevertheless performing the same analysis for each year of the sample, we note that while the cost of borrowing (i.e. the real interest rate on bank loans) between 1993 and 1996 fell from more than 14% ('93) to less than 7% ('96) (source National Bank of Hungary (1997)), the proportion of economically viable firms with positive profitability and characterized by negative NBF increased from 42% to 58%. This pattern suggests that forms of credit rationing were at work during this period. Finally analysing mean values of

[11]The formula used is $NBF_{i,t} = \frac{B_{i,t} - B_{i,t-1} - I_{i,t}}{A_{i,t}} \times 100$, where B= bank debt, I= interest payment and A=total assets, see Schaffer (1998)

[12]Economic viability is defined as earnings before interest, profit tax, depreciation and extraordinary charges

	1992	1993	1994	1995
Total	-0.12	-0.10	-0.13	-0.08
State	-0.16	-0.14	-0.03*	-0.22
Private	-0.12*	-0.09	-0.14	-0.09
Big	-0.13	-0.08*	-0.14	-0.13
Small	-0.10	-0.11	-0.13	-0.05*

Table 5.6: Correlation coefficient between short term debt and interenterprise debt.

	Firms with debt	Firms without debt
State	12.6	9.8
Cooperatives	0.6	1.0
Joint Ventures	31.6	27.2
Private	55.2	62.0
Total	100	100

Table 5.7: Ownership distribution of firms that use or do not use bank debt. Percentages, year 1994.

NBF for different groups of firms it emerges that NBF is positive only for firms in which there is a foreign ownership (joint ventures) suggesting that those firms are the only group not subject to forms of rationing.

Some descriptive statistics on trade credit can provide useful information. In assessing whether bank and interenterprise debit are substitute or complements we can again use correlation coefficients. We define interenterprise credit as the difference between payables and receivables (when interenterprise credit is positive the firm is a net borrower on the trade credit market). If bank and interenterprise credit are substitutes we would find a negative correlation between the two. Table (5.6) confirms that the two forms of credit were substitutes for all years considered. The correlation coefficient (albeit all small) seem to be higher for private firms.

We lastly analyze one issue that has profound implications for the methodological approach. Approximately 30% of firms in our sample do not use bank debt at all as a form of financing. This figure is quite impressive and needs further investigation. Looking at the ownership structure of the two groups of firms (table 5.7) we note that among the firms that use debt there is a higher proportion of state owned firms with respect to firms that do not use debt (12.6 versus 9.8); moreover there is a higher proportion of joint venture (31.6 versus 27.2) and conversely a lower proportion of private firms (55.2 versus 62). If the observation of zero level of debt is a signal of

	Firms with debt	Firms without debt
Employment	480	204
Net Sales (Mil. Ft)	2.92	0.94
Cash Flows/Total Assets	0.051	0.073

Table 5.8: Firms that use or do not use bank debt. Average values, year 1994.

some sort of credit rationing this result can suggest that state owned firms and joint ventures have an easier access to the credit market with respect to private firms.
We can also note (see table 5.8) that firms that do not use debt are on average smaller than firms which use debt: in 1994 the former have less than a half of the number of employees of the latter and one third of the value of net sales. This can also be a signal of severe forms of credit rationing that are cutting out of the market small firms.
However it is also true that firms that do not use bank debt are on average more profitable and can dispose of a higher amount of cash flows. This may suggest that, due to the high cost of external finance, firms that can do so, use internal finance at the maximum even to the point of not using bank finance at all.
Probably the truth is in the middle, i.e. what we observe is a combination of credit rationing and high cost of external finance, nevertheless the outcome is a particular distribution of debt across firms that in turn affects heavily the methodology used in the empirical analysis. The next section investigates this issue.

5.4 Methodology

In order to investigate the determinants of capital structure choice we follow the approach of Rajan and Zingales (1995) and Cornelli, Portes, and Schaffer (1998) estimating a reduced form equation with a measure of leverage as the dependent variable. Among the different measures of leverage that can be used (total liabilities, total debt, coverage ratio etc.), we restricted our attention to short term bank debt. The choice is motivated by the fact that the time horizon considered (1992-96) is still very close to the pre-transition period where presumably the majority of decisions concerning long-term debt have been taken. Concentrating on short-term debt (defined as debt with less than 1 year maturity) avoid mixing pre-transition with post-transition decisions about the capital structure. Short term debt is the

predominant form of debt for the firms investigated (it accounts for more than 80% of total bank debt); at the same time short term debt has a time horizon sufficiently limited to capture all the relevant changes we are interested in. In any case we have estimated the model also using long term debt instead of short term debt without finding any interesting result: it seems that long term debt is not affected by demand or supply side factors. This is consistent with the hypothesis formulated above that long term debt is mainly inherited from the planning period and is not sensitive to economic considerations (i.e. is not a decision variable in the capital structure choice).

Since only a limited fraction of our firms is quoted, we have mainly book value measures for the relevant variables. It can be argued that decisions about firms' capital structure are taken considering market value figures; fortunately, as shown by Bowman (1980), the cross sectional correlation between book and market value of debt is very high, reducing the potential misspecification problem deriving from the use of book value measures[13].

The observation that 30% of firms in our sample do not use debt conditions heavily the econometric methodology used. This aspect makes the distribution that applies to the sample data a mixture of a continuous and discrete distribution calling for the use of a censored regression (Tobit) model. The general formulation of the Tobit model is constructed as follows: let y^* be the original variable and let y be a new random variable transformed from the original one. The estimated model is:

$$y^*_{i,t} = \beta x'_{i,t} + \epsilon_{i,t} \tag{5.1}$$

$$y_{i,t} = y^*_{i,t} \text{ if } y^*_{i,t} > 0$$
$$y_{i,t} = 0 \quad \text{otherwise}$$

Censored regressions in cross sections is now routine analysis, but when considering panel data this estimation method is not so straightforward. The basic problem is that it is not possible to sweep away fixed effects using the within transformation. The reason is that in presence of a censored distribution the β and the individual

[13] Virtually all studies on firms' capital structure (as Rajan and Zingales (1995) and Titman and Wessels (1988)) do not find any difference between using market and book value variables.

effects (μ) are not anymore asymptotically independent (unless the time horizon is infinite) resulting in an inconsistent estimate of μ_i that is transmitted into inconsistent estimates of β_i. Unlike fixed effects estimates, random effect estimates are consistent. Recently Honoré (1993, 92) used symmetry conditions for the conditional distribution of $y_{i,t}$ on $x_{i,t}$ to derive a GMM estimator for fixed effects. We do not use this approach here because of the limited time horizon we have. Typically in fact GMM estimators sweep out fixed effects by taking first differences; moreover to satisfy the orthogonality conditions the natural candidates are lagged variables; this is particularly true for dynamic panel data (see Arellano and Bover (1997)) for which the process of differencing and constructing lags takes between 4 and 5 time periods.

For this reason, given the limited time domain of our data set we estimated a random effect Tobit model using ML estimators; to control for possible endogeneity we lagged the explanatory variables of one period. We also controlled for individual invariant time effect using a two-way error component model. Equation (5.1) becomes:

$$y^*_{i,t} = \beta x'_{i,t} + \mu_i + \lambda_t + u_{it} \tag{5.2}$$

where μ_i denote unobservable, individual, time invariant, effects, λ_t accounts for any individual invariant time effect and $u_{i,t}$ is the remainder stochastic disturbance[14]. Finally to reduce the problem of heteroscedasticity we normalize the relevant variables by total assets[15].

The distinctions made at a theoretical level (section 5.2) can be very rarely carried over at the empirical level. This problem arises also in the present work, where the estimated reduced form equations do not allow to distinguish demand from supply side effects. The cause of most concern is profitability: we have already stressed that supply side considerations predict a positive relationship between banks' debt and profits. But profits are also a major determinant of cash flows, and demand side considerations predict a negative relationship between debt and cash flows (if debt is more costly than internal finance, firms that have higher internal cash will try to substitute debt with it). Therefore the sign of the coefficient is going to depend on

[14]It is assumed that $u_{i,t} \sim IID(0, \sigma_u^2)$.

[15]An alternative normalization by total sales yielded the same results.

the relative strength of those two effects.

In the case of Eastern Europe, the shock of transition, and the consequent massive change that it entailed, caused short term performance to be a very poor indicator of future long term performance, while on the other hand the widespread presence of credit rationing induced firms to rely heavily on internal finance. We therefore expect profits to capture a demand rather than a supply effect and we have included in the regressions profits as part of cash flows and not as an isolated regressor.

5.5 Empirical Results

5.5.1 Cross sectional evidence

For each year t equation (5.1) becomes:

$$sdta^*_{i,t+1} = \alpha + \beta_1 lsal_{i,t} + \beta_2 cfta_{i,t} + \beta_3 tata_{i,t} + \beta_4 iata_{i,t} + \beta_5 invnta_{i,t} + \beta_6 invta_{i,t} + \beta_7 dfshr_{i,t} + \beta_8 mpshr_{i,t} + \beta_9 demp_{i,t} + \beta_{10} down_{i,t} + \epsilon_{i,t+1} \quad (5.3)$$

The variables are identified as follows: $sdta$= short term debt over total assets, $lsal$= logarithm of net sales, $cfta$= cash flows over total assets, $tata$= tangible assets over total assets, $invnta$= inventories over total assets, $invta$= investment over total assets, $dfshr$= dummy for foreign ownership (takes value of 1 if foreign share of capital is greater than 10%), $mpshr$= share of net sales over total sales in the 4 digit industry, $demp$= dummy for employment (takes value of 1 if employment is greater than 300), $down$= dummy for ownership (takes value of 1 if the firm is state-owned); ϵ identifies the remainder stochastic disturbance.

Table 5.9 shows the results[16].

Size (approximated by the logarithm of net sales) is positively related with debt indicating that big firms tend to have an easier access to bank credit with respect to

[16]The table does not show a measure for *Pseudo-R^2*. As it is well known the widely used formula *Pseudo-R^2*=$1 - L_1/L_0$ (where L_1 and L_0 are respectively the constant-only and full model Log-Likelihoods) works only in the presence of discrete distributions. It breaks down with mixed continuous/discrete distributions like Tobit. For this reason the model χ^2 is reported instead.

	1992	1993	1994	1995
$lsal_t$	.021	.038	.047	.040
	(3.98)	(6.88)	(8.58)	(6.37)
$cfta_1$	-.048	-.139	-.264	-.105
	(-0.95)	(-3.07)	(-5.85)	(-2.03)
$tata_t$	.105	.073	.093	.025
	(3.46)	(2.59)	(3.14)	(0.72)
$iata_t$	-.220	-.219	-.309	-.214
	(-5.13)	(-5.60)	(-7.80)	(-4.60)
$invnta_t$	.325	.280	.326	.281
	(7.27)	(6.82)	(7.77)	(6.05)
$invta_t$	.010	-.006	.050	.098
	(0.19)	(-0.09)	(0.70)	(1.39)
$dfshr_t$	-.005	.002	.024	.004
	(-0.41)	(0.23)	(2.06)	(0.35)
$demp_t$	.027	.008	.011	.045
	(2.12)	(0.71)	(0.91)	(2.97)
$mpshr_t$	.012	-.054	-.028	-.028
	(0.27)	(-1.24)	(-0.66)	(-0.47)
$down_t$	-.041	-.047	-.012	-.008
	(-3.23)	(-4.01)	(-0.77)	(-0.38)
$cons_t$	-.353	-.557	-.734	-.597
	(-4.83)	(-7.41)	(-9.52)	(-6.91)
χ^2	119.78	174.66	259.96	177.94
Uncens. obs.	610	642	643	650
Cens. Obs.	386	403	410	396

Table 5.9: Cross-section estimates; dependent variable: $sdta_{t+1}$ (t-values in parenthesis). The year refers to variables at time t.

small firms. The positive effect of size is much more weak when we consider the more "political" measure, that is the number of employees. The employment dummy is in fact positive and significant only in 1992 and 1995 but it is not significant (with very low t statistics) in 1993 and 1994[17]. It seems therefore that the effect of size indicates that big firms tend to be facilitated in accessing bank debt, because they are more diversified, more than because big firms are "politically" protected by the concern on their employment level.

Another aspect that has to be analyzed jointly with size is the issue of ownership. As big firms are mainly state owned firms which could be protected by an implicit bailout clause by the government, big firms may have easier access to credit simply because they are state-owned. We are reassured by the fact that the dummy for ownership, when significant (1992 and 1993), is negative indicating that private firms are the ones that take on more debt, suggesting that private ownership and not state ownership conveys a positive signal to the credit market[18].

Turning now to the other variables, except for 1995 tangibility is positive and significant; this is in line with the results usually obtained in western-type economies (see Rajan and Zingales (1995)) where debt has a strong positive relation with tangible assets. However it contrasts with the results of Cornelli, Portes, and Schaffer (1998) who find a negative correlation between tangible assets and debt, in Poland and Hungary. The results of Cornelli, Portes, and Schaffer (1998) for Hungary are probably due to the different estimation techniques (they estimate a normal OLS regression): in fact if on our sample, instead of a Tobit, we run a simple OLS regression, the positive effect of tangibility disappears.

As stressed previously in transitional economies fixed assets are probably not a good measure of collateral because they may be overvalued[19] or because there may be an inefficient secondary market. We therefore included in the regression also inventories as an additional measure of collateral. Inventories should reduce both the problem of

[17]We tried a different specification using the dummy at 500 employees obtaining analogous results.

[18]The non significance of the ownership dummy for 1994 and 1995 is probably due to the change in the classification of firms occurred in 1993. We classified as state owned firms both cooperatives and state owned firms (see table 5.2); the significant drop in the number of cooperatives occurred after 1993 explains therefore the non significance of the coefficient.

[19]This is very likely if fixed assets are recorded by their book value.

evaluation and of the efficiency of a secondary market. The coefficient on inventories is in fact positive and strongly significant denoting that they provide a good proxy for collateral.

Apart for the risk of default, banks should also be concerned for firms' future prospects. In our sample firms that have invested more are taken as proxies of firms which have the better growth prospects. The signalling effect of past investment do not seem to enable firms to take on more leverage as investment turns out to be always insignificant in the regressions[20].

Turning now to the two "financial" variables, cash flows and interenterprise arrears, they seem to indicate the existence of a "pecking-order" theory of finance with internal funds preferred over trade credit preferred over bank debt. The availability of internal funds is measured by cash flows which display a negative coefficient (with the exception of 1992 when the coefficient is not significant) suggesting that firms substitute external with internal finance when they have the opportunity to do so (i.e. external finance is more costly than internal finance). At the same time the negative coefficient on interenterprise arrears show that firms tend to substitute bank with interenterprise debt.

The results presented in Table (5.9) show, somewhat surprisingly, that the degree of market power of the firm does not seem to have any effect on the amount of leverage. The variable *mpshr* is never significant for the years considered; we also tried some different specifications, replacing the continuous variable with a dummy and using as an alternative measure of the market power the (log of) number of firms in the four digit industry. Firms' market power does not determine an easier access to the credit market.

Finally, with the exception of 1994, foreign ownership dummy is never significant. The result seems quite robust (we tried different cut-off values as 20 and 30%). This

[20]The presence of investment as a regressor may rise doubts about the existence of possible multicollinearity with other variables, in particular with cash flows. If a firm invested in the past and the investment turned out to be successful it will have higher profits in the subsequent period and therefore higher cash flows. In our sample multicollinearity between those two variables does not seem to be a problem; more precisely the pairwise correlation is always below 30%, and neither the sign of the coefficients nor their significance change when one of the variables is deleted. The investment variable can also create a possible problem of endogeneity we will address this issue in section (5.5.2).

finding is puzzling mainly when referred to the initial years as one would expect that with time and the improvement of efficiency of financial markets the positive signalling role of foreign ownership would diminish[21]. On the other hand the non significance of this variable can indicate the inability to distinguish between demand side and supply side effects. From the demand side in fact we expect banks to favour foreign owned firms but from the supply side foreign owned firms may have access to cheaper internal (i.e. through the foreign owner) finance, reducing in this way the amount of external finance[22].

The results of the cross sections suggest the presence of an underlying problem of asymmetric information in the credit market; this informational problem is reflected in the inability for firms in achieving their optimal capital structure. Evidence for this is provided by the relevance of variables like cash flows and interenterprise debt that suggest the existence of a "pecking order" in firms' financing choices. But on the other hand there are some positive and reassuring signs as bank debt does not seem to be related to state ownership or market power. This in turn suggests that banks are correctly discriminating between firms' types.

5.5.2 Panel evidence

The panel analysis follows the same Tobit procedure than the cross section; equation (5.3) becomes now:

$$sdta^{*}_{i,t+1} = \beta_1 lsal_{i,t} + \beta_2 cfta_{i,t} + \beta_3 tata_{i,t} + \beta_4 iata_{i,t} + \beta_5 invnta_{i,t} + \beta_6 invta_{i,t} + \epsilon_{i,t+1} \quad (5.4)$$

All the variables are defined as in the cross section. We did not include in the regression ownership and market share dummies as they did not add anything to

[21] In fact Csermely and Vincze (1999) with a similar sample find no significant effect of foreign ownership on firms' debt for the year 1996.

[22] Moreover in general one has to be cautious when assessing the role of foreign ownership in capital structure decisions of Eastern European firms. At least in the initial years of transition foreign ownership in fact could represent both solid Western European or also very risky Eastern European (mainly Russian) capital. In our sample we do not have the opportunity of distinguishing foreign ownership by country of origin.

	Coeff.	Std. Err.	t
$lsal_t$	.033	.003	8.864
$cfta_t$	-.060	.021	-2.925
$tata_t$	.033	.017	1.925
$iata_t$	-.117	.020	-5.864
$invnta_t$	.183	.026	7.100
$invta_t$	.051	.024	2.086
χ^2	271.19		
Uncens. obs.	2536		
Cens. obs	1607		

Table 5.10: Panel Estimates: dependent variable: $sdta_{t+1}$

the findings of the cross section (the results of course do not change if we include those variables).

Table (5.10) presents estimated coefficients, standard errors and t values.
The panel results confirm fully what found in the cross-section: all variables maintain their sign and degree of significance. There is only one difference between the cross-section and the panel estimate and it is constituted by investment[23].
Now investment is positive and significant signifying that if a firm invested in the past it is more likely to get credit from the banks. As stressed in the theoretical part this may be due to the fact that past investment can be a signal of future growth opportunities and therefore generate a positive relationship with debt.
There is one consideration that have to be done on this issue: if past investment has been financed by bank debt, the estimated coefficient would effectively capture the effects of another (latent) variable and therefore invalidate the inference about the variable of interest.
However the choice of the dependent variable should reduce the above mentioned problem as short term debt is rarely used to finance investment projects. We calculated the correlation coefficient between past debt and investment and it resulted quite low (around 30%). In any case the results about investment should be taken with a bit of caution.

[23]As explained in the Appendix the estimates presented in table 5.10 present a precise and reliable information on the sign and the significance but not on the size of the parameters. For this reason in interpreting the results we will only look at the sign and significance.

Two of the three year dummies[24] (not reported in Table (5.10)) are significant, indicating the presence of some time effect that is individual invariant. This most likely captures the effects of business cycle factors on the aggregate level of leverage.

5.6 Conclusions

In this work we use a panel consisting of approximately 1100 observations over 5 years of Hungarian firms to investigate the presence of constraints to these firms in achieving their optimal capital structure and more in general the "efficiency" of the banking sector in providing credit.

There is evidence of the existence of a "pecking order" in firms' financing choices suggesting the presence of forms of financial market imperfections that constrain them in the achievement of their optimal capital structure.

On the other hand there are also reassuring signs: in the presence of imperfections in the financial markets, banks could have reacted in two ways: one, the easiest and the most myopic, would have seen banks looking for the short term safety of large monopolistic state owned firms and even gamble for bailout of loss making state owned enterprises. The second way would have seen banks actively trying to resolve the informational problems, allocating funds where it was possible to obtain adequate (and correct) collateral provisions, looking at firms' long term growth opportunities firms etc.

The analysis conducted in this chapter suggests that Hungarian banks seems to have chosen the second way raising hopes of a fast resolution of the problems that are currently afflicting the financial market.

[24] One dummy (1992 in this case) had to be dropped to avoid perfect collinearity.

Appendix

The following consistency checks were applied to the data: we dropped from the sample firms which presented negative values for the following variables: sales, employment, debt (short and long term).

Outliers Identification

The procedure used to identify outliers deserves some attention: it is often difficult to identify influential observations (i.e. observations that, if removed, would change the estimated coefficients markedly); the difficulties increase when we consider multivariate data. In our analysis we employed a method developed by Hadi (1992, 94). This method can roughly be described as follows.

Let X be a $n \times p$ vector representing a random sample of size n from a p-dimensional population and let $D_i^2(C, V) = (x_i - C)^T V^{-1}(x_i - C)$, $i = 1, ..., n$ be an appropriate metric that measures the squared distance between the ith observation (x_i) and a centre estimator denoted as C, relative to a measure of dispersion (V) The method consists in six steps:

1 Order the n observations in ascending order according to a robust distance. The distance chosen by Hadi is

$$D_i^2(C_R, S_R) = \sqrt{\{(x_i - C_R)^T S_R^{-1}(x_i - C_R)\}}$$

where C_R and S_R are robust estimators of the center and covariance matrix. Then divide the observation in two sets: one containing the first ("basic" subset) $p + 1$ observations and the other ("non-basic" subset) containing the remaining $n - p - 1$ observations. The first p observations must be enough for the basic subset to be of full rank; if it is not then increase the number of observations until it is of full rank.

2 Compute $D_i^2(C_B, S_B)$ where subscript B denotes basic.

3 Reorder the observations according to $D_i^2(C_B, S_B)$. Let r the number of observations in the current basic subset. Divide the observations in two subsets: basic with the first $r + 1$ observations and non basic with the remaining $n - r - 1$.

4 Repeat the previous steps until the basic subset contains h observations where h is the integer part of $(n+p+1)/2$. Then go to next step.

5 Let r be the number of observations in the current basic subset. Compute $D_i^2(C_B, c_{np}S_B)$ where c_np is a correction factor that controls for the size of the test.
If $D_{r+1}^2 \geq \chi_{p,\alpha/n}^2$ then declare those observations as outliers and stop. Otherwise go to the next step.

6 Increase the size of the basic subset using the same procedure as step 2 and go to step 5. If $n = r+1$ stop: there are no outliers in data.

In other words, given p variables the procedure defines an initial cluster of points defined as $r = p+1$, selected minimizing the above mentioned measure of distance. Once the initial cluster is defined, it is then expanded taking the $r+1$ closest points (according to the same measure of distance) The procedure is then repeated until some stopping rule (point N.5) is satisfied.

The program Stata, used in the calculations, allow to perform such routine and also to define a "significance" level for the outlier cutoff; as usual in statistical analysis the significance level was chosen to be 5%.
This procedure has the big advantage that allows to deal easily (depending on the speed of the machine used in the calculations) with multivariate data; the routine was compared with other methods of identifying outliers like residuals analysis, tests based on Cook's and Welsch distances etc. In all cases it yielded better results in terms of the overall fit of the model being more parsimonious in terms of the variables identified as outliers.

A note on the Panel Estimator

As stressed in the chapter the panel estimates presented in section 5.5.2 are random effects estimates. The way the estimators are derived is through a quadrature of the likelihood function. This section describes the method applied and its implications.

The random effect μ_i is assumed to be distributed according to a normal distribution $N(0, \sigma_\mu^2)$. It follows that the conditional probability can be expressed in the following way:

$$\Pr(y_i \mid x_i) = \int_{-\infty}^{\infty} \frac{e^{-\mu_i^2/2\sigma_\mu^2}}{\sqrt{2\pi}\sigma_\mu} \left[\prod_{t=1}^{n_i} F(\beta x_{i,t} + \mu_i) \right] d\mu_i \tag{A.1}$$

where

$$F(\beta x_{i,t} + \mu_i) = \begin{cases} \left(\frac{-1}{\sqrt{2\pi}\sigma_\mu} \right) e^{-(y_{i,t} - \beta x_{i,t} - \mu_i)^2/(2\sigma_\mu^2)} & \text{if } y_{i,t} > 0 \\ \Phi\left(\frac{y_{i,t} - \beta x_{i,t} - \mu_i}{\sigma_\varepsilon} \right) & \text{if } y_{i,t} = 0 \end{cases} \tag{A.2}$$

where Φ denotes the cumulative normal distribution.

The integral in A.1 can be approximated using a quadrature formula. In particular the estimator used in this chapter uses the M-point Gauss-Hermite quadrature given by the following:

$$\int_{-\infty}^{\infty} e^{-x^2} f(x) dx \approx \sum_{m=1}^{M} w_m^* f(a_m) \tag{A.3}$$

where w_m^*, a_m^* and M denote respectively the quadrature weights, the quadrature abscissas and the number of quadrature points.

The log-likelihood is then approximated in the following way:

$$L = \sum_{i=1}^{n} w_i \log(\Pr(y_i \mid x_i)) \approx \sum_{i=1}^{n} w_i \log \frac{1}{\sqrt{\pi}} \sum_{i=1}^{n_i} F\left(\beta x_{i,t} + \sqrt{2\frac{\rho}{1-\rho}} a_m^* \right) \tag{A.4}$$

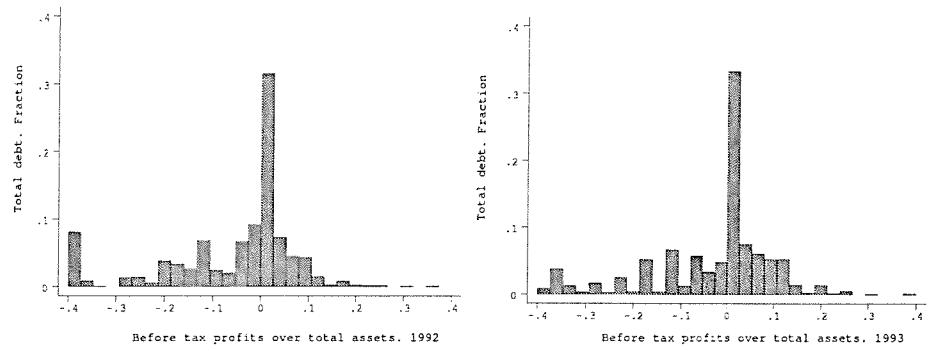
where

$$\rho = \frac{\sigma_\mu^2}{\sigma_\varepsilon^2 + \sigma_\mu^2}$$

denotes the percentage of the total variance explained by the panel-level variance component.

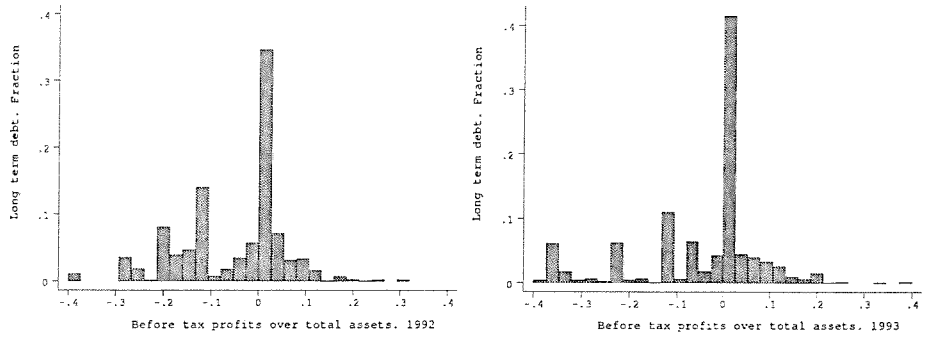
The procedure described above is sensitive to the number of quadrature points, in particular for large panels the approximation may become poor. It is possible to check the sensitiveness of parameter estimates to the variation of the number of

quadrature points. It turns out that our parameters are sensitive to changes in the number of quadrature points, however the sign and the degree of significance of parameters do not change. For this reason the results presented in table 5.10 should be interpreted only as an indication for the sign of the coefficients and not for their exact value.



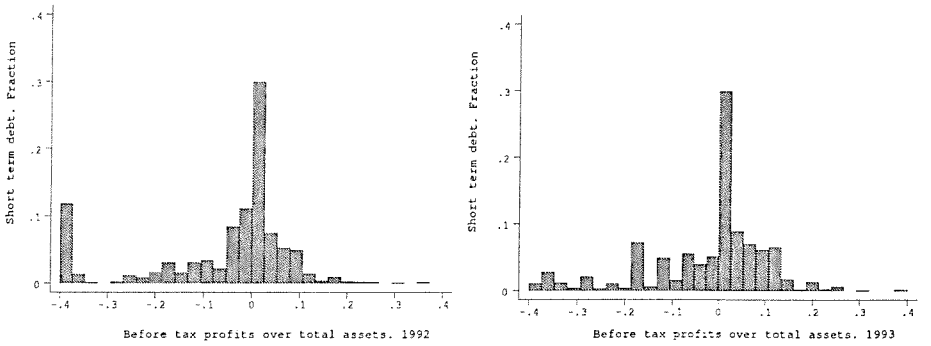
(a)

(b)



(c)

(d)



(e)

(f)

Figure 5.2: Distribution of bank debt, 1992-1993

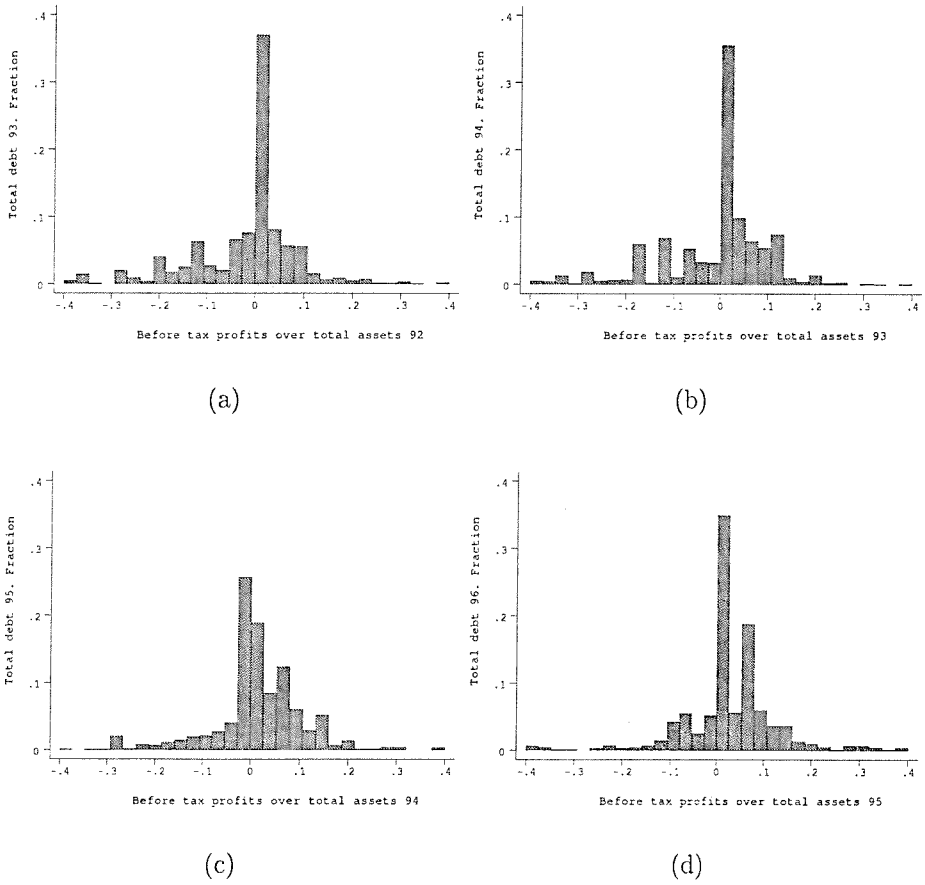


Figure 5.3: Distribution of total bank debt with respect to previous year's profits

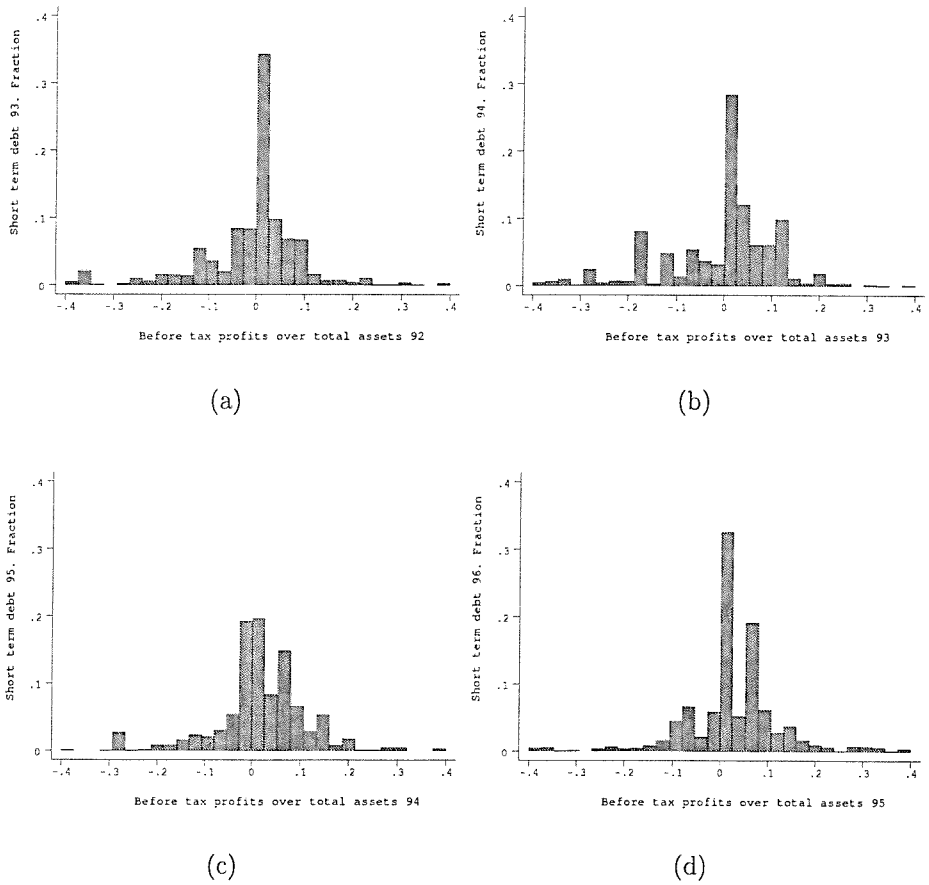


Figure 5.4: Distribution of short term bank debt with respect to previous year's profits

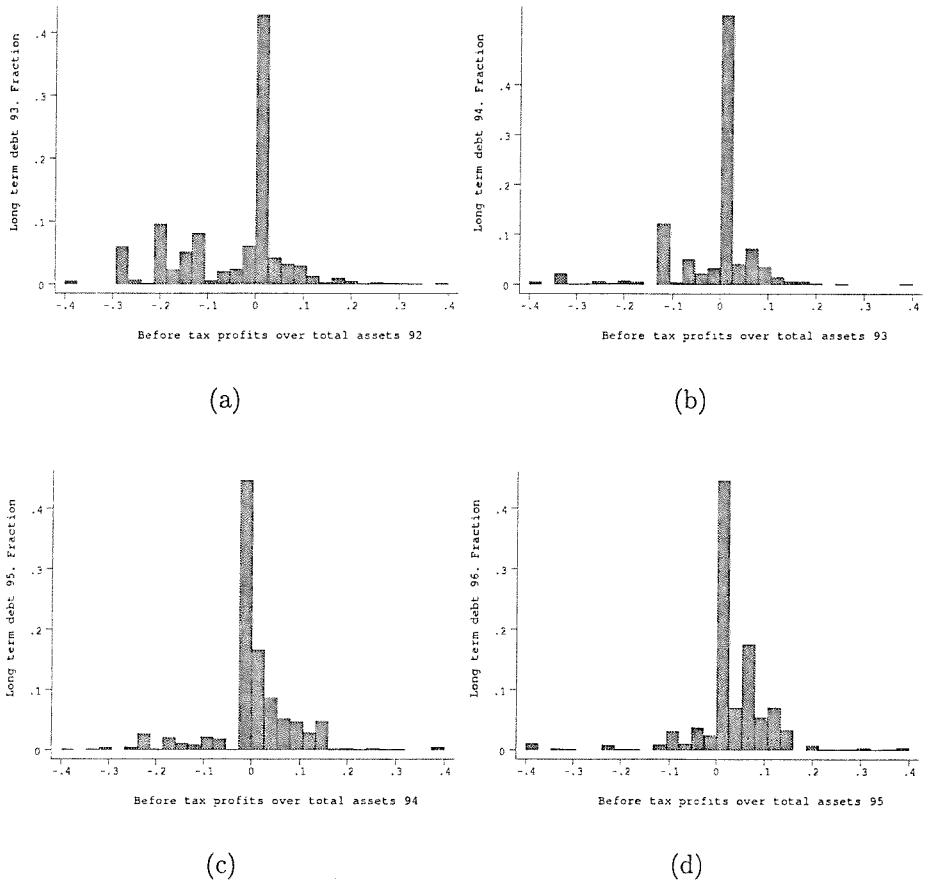
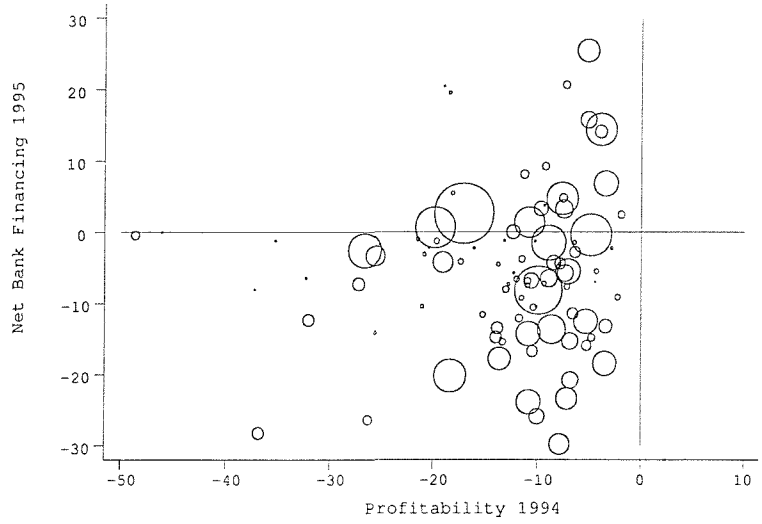
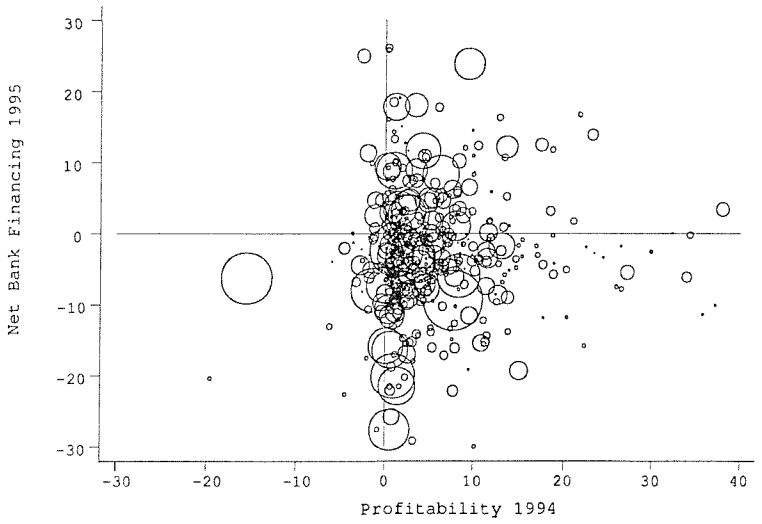


Figure 5.5: Distribution of long term bank debt with respect to previous year's profits



(a)



(b)

Figure 5.6: Net Bank Financing versus Profitability: (a) economically *non-viable* firms, (b) economically *viable* firms. Data are weighted by total debt.

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