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Effects of External Shocks, External Debt and Stabilisation Policies on the Zambian Economy

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ABSTRACT

FACULTY OF SOCIAL SCIENCES
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The thesis consists of three papers. The first paper analyses the effects of shocks to the copper price on the Zambian economy in both the pre and post liberalisation periods. The paper finds that the predictions of the theory on the effects of external shocks are qualified not only by the control regime in operation but also by the existence of a huge external debt.The results from econometric tests and counterfactual analysis show that shocks to the copper price can have Dutch Disease consequences in a liberalised economic environment. However, the effect is not strong. We argue that this is more likely a result of the country's heavy indebtedness. We also show that with the reversal of the net foreign asset position after the negative shock of 1974, there is no guarantee that a positive shock will lead to an investment boom. In a controlled regime, we find that the Dutch Disease effects of a positive copper price shock are ameliorated . These results do not come out clearly from previous studies.

The second paper analyses the effect of stabilisation policies in the face of limitations in external financing. The results from econometric tests show that the use of the monetary approach to correct for balance of payments disequilibria is inappropriate in Zambia. However, monetary policy is appropriate for controlling inflation and stabilising the exchange rate but has no effect on real GDP. The results also show that the real exchange rate has an insignificant effect on the balance of payments. The relative price effects (real exchange rate effects) work through imports and not exports so that the overall effect is insignificant. Since investment has a high import content, a policy of devaluation adopted in order to correct for balance of payments disequilibria has adverse effects on investment and hence future growth.

The third paper applies the intertemporal model of the current account to Zambia. The results from econometric tests show that the correlation between savings and investment in Zambia is low, contrary to the results found by Feldstein and Horioka using a sample of OECD countries. This result suggests that investment in Zambia is explained more by external transfers than domestic savings. The low correlation between savings and investment is caused by the low correlation between output and investment and the high volatility of consumption relative to output. The former is explained by country's external debt burden, which discourages investment, and lack of access to international capital markets. The results also show that the trade balance in Zambia is procyclical rather than countercyclical.

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Contents

List of Tables

List of Figures

Introduction

Much of modern macroeconomics originates in North America. Applied work uses American data, and theoretical work assumes an economic structure consistent with the salient features of the United States. Even for the analysis of other developed market economies this has proved unsatisfactory: these economies behave differently and face different problems. Burda & Wyplosz (2001) in the preface to their book 'Macroeconomics: A European Text' state that 'while European countries differ from one another, they differ in more significant ways from other advanced economies'. Their central objective, therefore, was to provide a European Macroeconomics textbook. For developing countries, the problems posed in applying modern macroeconomics are even more severe because economic structures are so different. Financial markets are often virtually absent, many economies are small, open, heavily indebted and periodically hit by temporary trade shocks, and most of them are heavily regulated by government controls wholly unfamiliar in North America.

Because of the evident gap between modern macroeconomics and the characteristics of many developing countries, two 'mutually hostile' approaches have coexisted. Modern neoclassical macroeconomists (to the extent that they have worked in developing countries) have tended to make little concession to different economic structures; meanwhile structuralists have paid great attention to the particular features of the economies they have studied but have not attempted to demonstrate rigorously how these features affect the applicability of the 'orthodox' policy advice. The lack of attention to institutional characteristics in the neoclassical approach and the absence of viable micro foundations in the structuralists' theories have tended to make the exchange between the two polemical.

Bevan et al (1994) in their book 'Controlled Open Economies: A Neoclassical Approach to Structuralism' provide a body of neoclassical theory which is purpose built for a class of developing countries, namely, small, open economies with weak financial markets and subject to a variety of government controls and liable to periodic temporary shocks to their terms of trade. They refer to this class of countries as controlled open economies.

Until the 1980s, the predominant concerns of development economics were sectoral: problems of agriculture, problems of industry or the interactions between them such as migration. During the 1980s, the predominant concerns shifted to macroeconomic issues. This is because the sectoral issues, which had not necessarily been solved, were swamped by even greater problems i.e.macroeconomic shocks.

Shocks are defined (Bevan et al 1994) as rapid unanticipated changes and can occur either because constraints upon agents alter or because preferences of agents alter. Constraints may suddenly alter either because of changes in productivity or world prices. Shocks can either be permanent or temporary.

Many developing countries are prone to temporary trade shocks and it has come to be recognised that such shocks pose difficult policy problems. Shocks are common because for many developing countries, their export sectors are highly undiversified and consist to a substantial extent of a narrow range of primary products whose prices are volatile.

The Dutch Disease theory is the earliest in the analysis of the effects of external shocks . Neary (1984) provided a summary of the real and monetary aspects of the Dutch

Disease phenomenon. His analysis was essentially comparative static. Corden (1984) provided a survey and consolidation of Dutch Disease economics extending the analysis to include the effects of migration, international capital mobility, the domestic absorption effect, and most importantly the dynamics of savings and investment.

Bevan et al (1994) analysed how a temporary terms of trade shock can lead to an investment boom in the non-tradable goods sector. This has been referred to as the "construction boom". Their analysis emphasised the importance of expectations and of the control regime in determining the outcomes. They have argued that the standard predictions of the Dutch Disease theory are qualified by the existence of pervasive controls. They also argued that trade shocks are frequently mishandled so that the gains from a positive shock are small while the losses from negative shocks are large.

Most developing countries have recently adopted IMF/World Bank stabilisation and adjustment programmes which emphasize liberalisation of markets. These countries have also seen an increase in their external debt burdens since the debt crisis of 1982. The neoclassical approach to structuralism developed by Bevan et al (1994) focuses mainly on the effects of positive terms of trade shocks that occurred before the 1982 debt crisis. The effect of debt is not analysed. In addition, their approach does not include the effect of stabilisation policies which many countries adopted following the debt crisis. Following the negative price shock of 1974, the positive resource balance that the Zambian economy had enjoyed in previous years was reversed. This, coupled with the international debt crisis of 1982, left the economy with a huge external debt. In 1983, the country adopted an adjustment and stabilisation programme supported by the IMF and the World Bank.

This thesis contributes to the empirics on the neoclassical approach by including the effect of debt and of stabilisation policies using a case study of Zambia.

Zambia attained independence from Britain on October 24 1964. The leader of the United National Independence Party (UNIP), Dr. Kenneth Kaunda became the first president. In the period shortly after independence, the first republic, the country experienced rapid economic growth as a result of a sharp rise in the international price of copper (the economy's main export staple). The second republic began in 1972 with the introduction of the one party system. Shortly after this, in 1974, the price of copper fell sharply. This shock was perceived to be temporary so that the country responded by accumulating external debt from the international financial markets. With the increase in interest rates following the debt crisis in 1982, the external indebtedness of the economy grew. The lack of access to international capital markets following the debt crisis forced Zambia to adopt an IMF/World Bank supported structural adjustment program in 1983. The IMF policy package included, among other things, devaluation of the exchange rate and servicing of existing external debts. There was increasing pressure on the exchange rate created by lack of access to foreign credit and the obligation to service existing debt. Dissatisfaction concerning the prevailing economic conditions led to countrywide riots and ransacking of supermarkets in 1986. In 1987, the authorities abandoned the IMF/World Bank supported economic policies in favor of domestically generated policies under the theme 'Growth from own resources'. This was called the New Economic Recovery Program (NERP).

The need for external financing brought Zambia to negotiation with the IMF and a new policy framework paper was signed in September 1989. This coincided with the agitation for a return to multiparty politics which led to a phase of simultaneous liberalisation and democratization and the birth of the third republic. The Movement for Multiparty Democracy (MMD) took over government in 1991 under the leadership of Dr. Frederick Chiluba who became the second Republican President. Since then, the government of Zambia has been implementing IMF/World Bank stabilisation and adjustment policies.

Dr. Chiluba was succeeded by Mr. Levy Mwanawasa in the controversial elections that took place in December 2001. Mr. Mwanawasa's government faces serious challenges created by the continuing fall in the copper price and the withdrawal of Anglo American corporation (a major mining investor) from Konkola Copper Mines (a major mining company) at the beginning of the year 2002.

Macroeconomic events in the country can be summarized in figures 1 to 4. In figure 1, we see that GDP growth was high during the copper boom of 1964 -1974. Investment as a percentage of GDP was high and the trade balance was in surplus and the economy accumulated positive financial assets. After the negative shock of 1974, investment declined until the late 1980s when the copper price rose again. In recent months the copper price has persistently remained below $ 0.90 per pound.

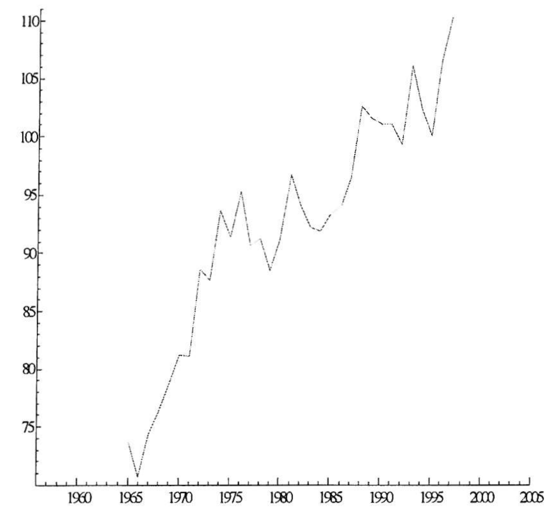

Fig 1:Real GDP

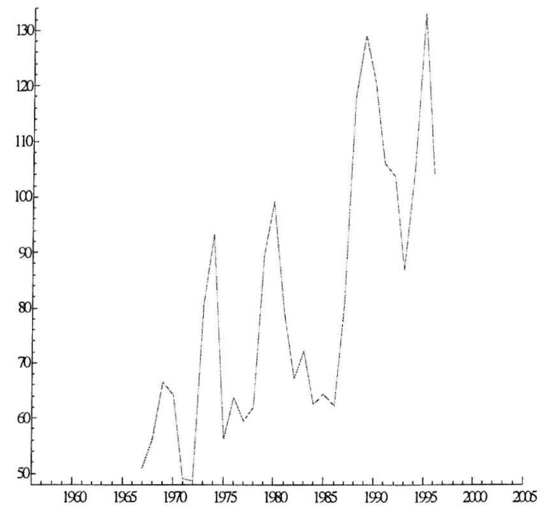

Fig 2: Copper Price in Cents Per Pound

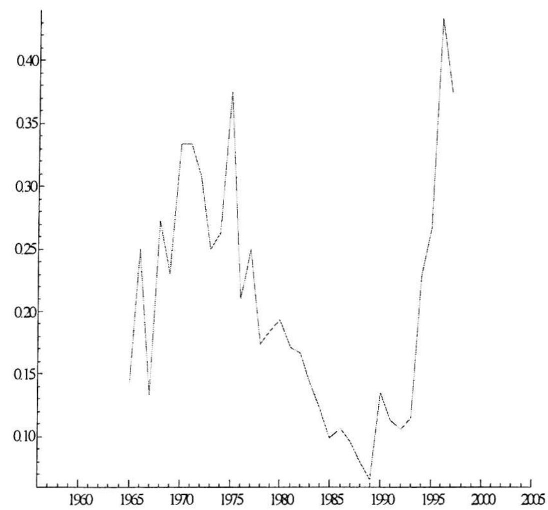

Fig 3: Investment as a fraction of GDP

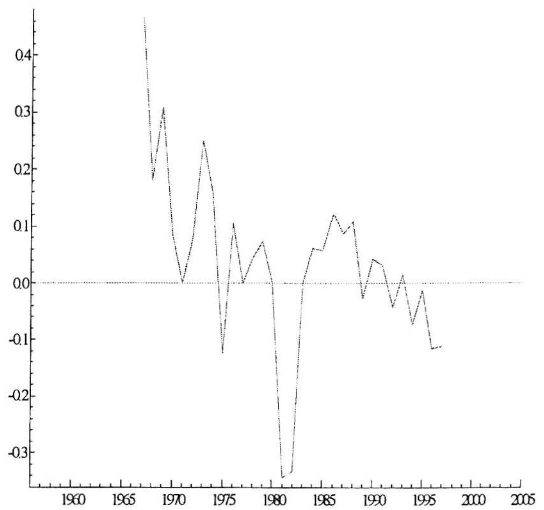

Fig 4:Trade balance as a fraction of GDP

The thesis also contributes to the literature by adopting a different approach to determining the presence of Dutch Disease effects of terms of trade shocks. The approach we use is based on the 123 model suggested by Devarajan (1993). Rather than focusing on the effect of copper price shock on agriculture and manufacturing output, we analyse the effect of a terms of trade shock on the equilibrium real exchange rate and the movement of the actual real exchange rate to its new equilibrium level. This approach is useful given the inadequacy of data on the real economy in most developing countries.

We also contribute by using the cointegration technique in determining the effect of the copper price on consumption, investment, prices and the money supply. The results enable us to characterize the expectations of the agents in the economy and to determine whether or not there is an investment response to copper price shocks. Previous literature relied solely on counterfactual analysis of savings and investment.

The thesis also contributes to the empirics of the intertemporal theory of the current account by applying it to a heavily indebted developing country such as Zambia. Most of the empirical work on the intertemporal theory of the current account has been applied to OECD countries.

The thesis is divided into three papers; the first paper analyses the effect of copper price shocks on the Zambian economy, the second analyses the effect of stabilisation policies while the third applies the intertemporal model of the current account to Zambia.

In the first paper, entitled " **Effects of Copper Price Shocks on the Zambian Economy**" we have carried out econometric tests and counterfactual analyses using data from Zambia. The results suggest that the effect of term of trade shocks depends not only on the control regime but also on the external indebtedness of the economy. According to Bevan et al (1994) for instance, a positive terms of trade shock has Dutch Disease effects and leads to an investment boom, which when it falls on non-tradable goods leads to a "construction boom". The Dutch Disease effects are affected by the nature of the control regime. We argue that these standard predictions of the theory are qualified not just by the control regime in operation when the shock occurs but also by the external indebtedness of the economy.

Bevan et al (1994) applied their new approach to the Kenyan Coffee booms of 1975-1983 and to the Tanzanian Economic Decline of 1975-1984. Aron (1999) applied the same approach to Zambia for the copper price shock of 1964-1974 and to the decine of 1975-1980. For all these countries, these were periods characterized by economic controls.

In terms of the Dutch Disease effects, we know that in a controlled economy, the predicted appreciation of the real exchange rate as a result of a positive shock may be muted by controls on domestic prices and on the exchange rate. Using the 123 model developed by Devarajan (1993) we argue that during the copper price shock of 1964 to 1974, the real exchange rate did not appreciate to its new equilibrium level due to controls on prices and the exchange rate. A fixed exchange rate regime was in operation until 1973. Anecdotal evidence suggests that the positive copper price shock had Dutch Disease effects on the agricultural sector (de-agriculturalisation). The counterfactual analysis from the 123 model suggests that the Dutch Disease effects were ameliorated by the control regime . Previous authors (Maipose 1997, Aron1999) have argued that the real exchange rate was overvalued during the period of the positive shock in Zambia. They argue that the overvalued exchange rate contributed to the growth of the capital intensive manufacturing sector. Using 1980 data, Kayizzi-Mugerwa (1991), in his Multi-sector General Equilibrium study on Zambia, found that the boom had no effect on agriculture output and exports but had a negative impact on manufacturing output and exports. His later result is inconsistent with the resource expansion effect of the boom. This result is also contrary to that of Aron

(1999) who found that the protected importables sector, manufacturing, grew dramatically from a low base.

Our argument, however, is that the real exchange rate was undervalued during the boom period, since controls prevented the nominal exchange rate from appreciating to its new equilibrium level. However, It was during the period of the negative shock that the exchange rate was overvalued. This was the case because the nominal exchange rate and domestic prices did not adjust to their new equilibrium levels after the negative shock. Moreover, since trade controls were more stringent after the negative shock, the resource contraction effect may have had an appreciating effect on the real exchange rate. In fact Aron (1999) found that the negative shock caused a sharp contraction of the import intensive industrial sector.

In characterizing the expectations of agents after a shock has occurred, previous authors have focussed on the effect of the shock on savings using counterfactual analysis comparing the level of savings without the shock and actual savings (Bevan 1994, Aron 1999). We take a rather different approach by analysing the effect of shocks on consumption using cointegration analysis. The results of the cointegration tests agree with the counterfactual results obtained by Aron (1999). The absence of cointegration between consumption and the copper price suggests that agents in Zambia treat shocks to the copper price as temporary. We also observe that there is no cointegration between the copper price and investment. This suggests that the investment boom does not occur despite the fact that agents save the windfall when a positive shock occurs. We argue that the investment response depends on the net foreign asset position of the country.

When a country is facing a debt overhang problem, the country's savings are used to service the debt rather than to finance domestic investment. The importance of the external debt position can be seen more clearly from the econometric results based on post-liberalisation data. Zambia liberalised most of its markets in 1991 so that by basing our analysis on the post-liberalisation period, the effect of controls is removed. As explained by Neary (1984), the appreciation of the real exchange rate following a positive terms of trade shock occurs mainly through an appreciation of the nominal exchange rate. Our results show that the nominal exchange rate and the copper price cointegrate. There is, however, no cointegration between the copper price and the consumer price index. The consumer price index is used as a proxy for the domestic price level. Given the external indebtedness of the economy, the spending effect from a positive shock plays an insignificant role as most of the windfall is used for debt servicing. The net result of this is that the real exchange rate does not appreciate to its new equilibrium level. The Dutch Disease effects are therefore muted by the external debt position. This result is further supported by the fact that the relation between the copper price and non-traditional exports, although having the correct negative sign, is statistically insignificant.

Another reason why the real exchange rate may not appreciate to its new equilibrium position is related to the nature of investment and growth constraints that the economy faces. In the two gap models, two types of constraints are identified, the savings constraint and the foreign exchange constraint. From the third paper we see that Zambia is a foreign exchange constrained economy. An increase in the availability of foreign exchange increases production in both the tradable and non-tradable sectors. As a result, the spending effect does not lead to a substantial increase in the relative price of non-tradable goods. This effect is referred to as the resource expansion effect. Rattso and Torvick (1998) argued that trade restrictions imposed by most developing countries while reducing the openness of the economies have not necessarily reduced the impact of external shocks. Instead, the restrictions introduce a new transmission channel for external shocks. Under import rationing for instance, real exchange rate depreciation can go hand in hand with a positive external shock contrary to the Dutch Disease story. This outcome is the result of the resource expansion effect; a higher export price stimulates growth by improving the import capacity of the economy. We argue however that while Aid inflows in Zambia can lead to a real depreciation by increasing the import capacity of the economy, the copper price shocks have little impact on the import capacity of the economy because most of the windfall is devoted to debt servicing. The resource expansion effect of a positive terms of trade is operative when the economy is solvent.

Marsh (1998) developed a rigorous model of investment under uncertainty arguing that investment booms in response to commodity price shocks are likely but not certain to occur. Marsh's paper emphasised the role of uncertainty regarding the duration of the shock and of the irreversibility of investment once installed. These factors tend to reduce the expected returns on investment and thus tend to reduce the investment response to a positive terms of trade shock. Our results on the non responsiveness of investment to copper price shocks provide evidence in support of Marsh's model predictions.

In the second paper, we analyse the **"Effect of Stabilisation Policies on Macroeconomic Performance in Zambia"**. Most developing countries have at one time or another faced the twin problems of high domestic inflation and a deficit in the balance of payments. These are caused by the excess of aggregate demand over aggregate supply. In order to reduce these pressures, most governments have adopted IMF stabilisation programmes.

The IMF stabilisation programme is based on the monetary approach to the balance of payments and the Polak Model. Advocates of the monetary approach to the balance of payments (Khan, 1981) argue that the balance of payments is essentially a monetary phenomenon; that balance of payments deficits arise because of the excess of flow supply of money over flow demand for money. Balance of payments deficits can therefore be corrected through a reduction in domestic credit. Price stability can also be attained by controlling the growth rate of domestic money supply.

An important question often asked in relation to IMF programmes is whether such programmes work in terms of improving the current account balance, increasing international reserves, lowering inflation and raising the growth rate. Khan and Knight (1981) conducted econometric tests using a sample of 29 developing countries and found that an excess supply of real money balances results in an increase in the rate of inflation and a deterioration in the balance of payments. However, the balance of payments adjustment occurs with some inertia, unlike the equilibrium model which assumes that international reserves flows will immediately offset any excess supply of money.

Khan and Haque (1998) surveyed the evidence yielded by cross country studies on the success of IMF programmes. They found that these studies, especially the more recent ones, generally conclude that the IMF-supported programmes have been successful in stabilising the economies. However, they argued that there is no theoretical guarantee that Fund adjustment packages will achieve their desired outcomes. They describe Fund programs as complex packages of policy measures, which combine aggregate demand policies with supply-enhancing relative price policies. The theory underlying the dynamic link between the policy package and a set of multiple macroeconomic variables is not well established. They also argue that Fund supported programs are only one of the macroeconomic "shocks" to a country with a programme. External shocks such as changes in the terms of trade or in the cost of servicing debt etc will also affect the country's ability to achieve the objectives of the programme.

Przeworski and Vreeland (2000) used a bivariate version of the Heckman selection model to estimate the effect of participation in the IMF programmes on economic growth. They found evidence that governments enter into programmes under the pressures of foreign reserves crisis but they also bring in the Fund to shield themselves from the political costs of adjustment policies. They concluded that programme participation lowers growth rates for as long as the country remains under the programme. Once countries leave the programme, they tend to grow faster but no faster than they would have without programme participation.

We contribute to this debate by evaluating the success of the stabilisation programme in Zambia in terms of its effects on the balance of payments, on prices, the exchange rate and on growth. The results of our various econometric tests (the Johansen cointegration test, Granger causality tests and static long run regressions) suggests that the IMF stabilisation programme (Financial Programme) is successful in stabilising prices and the exchange rate. The monetary approach to the balance of payments is inappropriate for eliminating balance of payments disequilibria . The results, however, show that balance of payments deficits can be corrected through exchange rate devaluation as suggested by the Polak model. However, due to the high concentration of exports on copper, devaluation improves the balance of payments by depressing imports rather than by encouraging exports. A reduction in imports decreases investment since the economy is heavily dependent on imported capital goods for investment. Furthermore, devaluation has adverse consequences for the fiscal budget when the external budget balance is in deficit.

Both Granger causality tests and variance decomposition analysis suggest that domestic credit has an insignificant effect on reserves. Changes in reserves at the central bank are caused mainly by balance of payments receipts and debt servicing.

In appendix 2.C , we also analyse the effect of shortfalls in balance of payment support on the financial programme (stabilisation programme) itself. Surprisingly, no extensive contribution has been made to examine the effect of shortfalls in balance of payments on a country under the IMF programme. A notable exception is a paper by Adam and Bevan (1996) who argued that the stabilisation programme becomes infeasible when there are significant reductions in donor balance of payments support. We contribute to this work by carrying out econometric tests on the effect of shortfalls in donor support using variance decomposition analysis from a VAR model. The results of variance decompositions suggest that the increase in domestic credit that occurs as a result of a shortfall in balance of payments support reduces credit to the private sector. In an attempt to meet the programme benchmarks, the central bank offsets the increase in net claims on government caused by a shortfall in balance of payments support by reducing credit to the private sector.

The third paper is entitled "**An Application of the Intertemporal model of the Current Account to Heavily Indebted Developing Countries: A case of Zambia**". The paper contributes to the empirics of the intertemporal approach to the current account. The intertemporal model of the current account with perfect international capital mobility implies that domestic absorption in the economy (consumption and investment) should not depend on current income[Obstfeld and Rogoff (1996)]. The Hall (1978) result implies that consumers want to smooth their consumption based on their permanent income which is essentially the present value of their expected future income. They borrow when current income is less than permanent income and save when current income is above permanent income. In response to fully permanent shocks consumption rises by the full increase in current income or more.

The investment response to a permanent productivity shock should not be constrained by the amount of available savings. Investors can finance their investments with foreign capital.

The effect of permanent and transitory shocks on the current account can be explained by the consumption and investment responses. A positive temporary income shock increases savings but does not give rise to an investment response. The current account deficit (surplus) decreases (increases). On the other hand a positive permanent shock leads to an increase in investment with no change in savings. This worsens the current account balance.

The intertemporal model implies a low correlation between savings and investment in an open economy with perfect international capital mobility. Feldstein and Horioka (1980) tested this hypothesis using data from OECD countries and found that the correlation between savings and investment was high. This was a puzzle because the international financial markets in developed countries are believed to be characterized by a high degree of capital mobility. The correlation between savings and investment is expected to be high in developing countries who have limited access to international financial markets especially after the 1982 debt crisis.

We contribute to this empirical work by carring out a similar test for Zambia and discover that the correlation between savings and investment is very low. This would be a puzzle if we interpret it as evidence of perfect international capital mobility in the spirit of the Feldstein and Horioka result. However, the result shows the importance of external financing in determining investment and therefore growth in Zambia. Chenery and Strout (1966) argued that most undeveloped economies depend heavily on external resources to increase their per capita income. In the context of the three gap-models Bacha (1990), we interpret the result to mean that the economy has a binding foreign exchange constraint. This is supported by other econometric tests that relate investment to foreign transfers which are measured by the trade balance. The importance of external transfers is supported by the high correlation between investment and imports. Zambia relies quite heavily on imported capital goods for its capital formation. Moreover, Mazumdar (2001) found evidence in favour of the claim that imported machinery leads to higher growth in developing countries.

Baxter and Crucini (1993) attempted to provide an explanation for the observed high savings-investment correlation in OECD countries. They identified the central determinants of the savings-investment correlation as the output-investment correlation, the consumption-investment correlation and the volatility of consumption relative to output. The major determinant is the output-investment correlation. For OECD countries, this correlation is quite high . In addition, the volatility of consumption relative to output is less than one. This is due to the consumption smoothing behaviour of agents that is expected to occur in developed countries.

Contrary to the results obtained by Baxter and Crucini (1993) for OECD countries, our results for Zambia show that the correlation between output and investment is very low. We also observe that the volatility of consumption relative to output is greater than one. These two factors lead to a low correlation between savings and investment in Zambia..

Interestingly enough, the low correlation between output and investment in Zambia cannot be explained by the persistence of output shocks. Using Campbell and Mankiw's (1987) measure of persistence, we find that output shocks in Zambia are persistent. We therefore seek an alternative explanation and argue that the low correlation between output and investment can be explained by the existence of an unsustainable debt that has negatively impacted on investment. Despite the persistence of output shocks, the returns from investment are reduced by debt service obligations. The relevant margins required for production and investment decisions are therefore distorted. We also argue that the investment response to a persistent productivity shock would be hampered by lack of access to international capital markets.

The high volatility of consumption relative to output is in contrast with evidence from developed economies. Consumption in developing countries is not smooth. An explanation from the theorerical model suggests that this could be a consequence of non-stationarity in the GDP series. With non-stationarity, consumption smoothing implies that an unexpected increase in output causes an even greater increase in consumption. When there are permanent shocks to output which have a protracted impulse response, output adjusts to its permanent level gradually while consumption jumps to the new level directly. However, imperfections in domestic capital markets and limited access to international capital markets causes consumption to be closely linked to current income.

We also provide evidence on current account cycles in Zambia. Kose (2002) attempted to explain the sources of business cycles in small open developing countries using a variant of the specific factors model. Kose concluded that in response to positive productivity and world price shocks, both of which induce positive income effects, agents increase their imports of capital goods and capital inputs instead of saving by buying foreign assets. The intertemporal model of the current account in this case implies a worsening of the current account. In fact Kose finds a relatively high negative correlation between the trade balance and aggregate output.

The results of our econometric tests for Zambia contradict those of Kose's. We find a low correlation between investment and output and a positive correlation between output and the trade balance. While Kose does not explicitly model the effect of the external debt on investment, he acknowledges the fact that a significant fraction of developing country exports is used to pay back their large foreign debt. Our argument is more in agreement with that of Marsh (1998) who showed that the investment response to a terms of trade shock (or productivity shock) is not certain to occur when there is uncertainty about the duration of the shock and when capital is irreversible once installed. A large external debt burden creates uncertainty about a country's future economic policies which may be dictated by the creditors. In addition lack of access to international credit markets limits the investment response especially in a country facing the foreign exchange constraint.

Chapter 1
The Effects of Copper Price Shocks on the Zambian Economy

1.1 Introduction

Zambia is a highly mineral dependent country. At independence from Britain in 1964, copper supplied 90 percent of Zambia's foreign exchange earnings, over 60 percent of its tax revenues, 20 percent of the formal sector employment and contributed almost half of the GDP (Maipose 1997). Mineral dependence has persisted despite the mines' long-drawn-out decline and despite significant growth of the non-traditional export sector in the second half of the 1990's.

During the period 1964 to 1972 the Zambian economy experienced rapid economic growth not only in comparison with earlier periods but also in comparison with growth rates achieved in many other sub-Saharan countries. This was because copper production and prices were high enough to earn foreign exchange and generate tax revenues on a scale that was not far short of the absorptive capacity of the economy (G.S Maipose 1997).

When copper prices began to fall in 1974, the country resorted to external financing and pursued demand management polices aimed at attaining macroeconomic stability and correcting balance of payments deficits.

Until 1983 no policies were pursued to change the structure of the economy to make it less dependent on the mining sector by boosting non-traditional exports. When a new political party (MMD[1]) took over government in 1991, they implemented across the board economic liberalisation measures. Despite the good prospects created by these measures, sustained macroeconomic stability has not been achieved. Economic performance has depended greatly on the sound performance of the mining sector and on external aid inflows. The economy also failed to achieve sustained growth in GDP as a result of the poor performance of the mining sector in this period. The poor economic performance has been exacerbated by unfavorable weather conditions.

The main drawback to the effectiveness of economic policies is the external debt that the economy accumulated after the negative shock of 1974. This has significantly reduced investment and thus the ability of the economy to service its debt from its resources. The external debt burden has prevented any positive copper price shocks from being translated into savings and investment as was the case after the postive shock of 1964. The country has, inevitably, relied on external aid inflows to avoid defaulting on external debt service and to finance its investment.

The country is currently on a program with the IMF and performance under the program benchmarks relies on aid inflows.

This paper analyses the effects of shocks to the copper price on the Zambian economy in both the pre and post liberalisation periods. The pre liberalisation period was characterized by the existence of pervasive controls that qualified the standard predictions of the theory on the effects of terms of trade shocks. However, the net foreign asset positions was positive until after the negative copper price shock of 1974. In the post liberalisation

1 MMD stands for Movement for Multiparty Democracy

period, the controls were non-existent but the economy was heavily indebted. Previous studies have analysed the effects of shocks in periods characterized by economic controls (Aron1999, Kayizzi-Mugerwa 1991). By analysing the effect of shocks in the post liberalisation period, we are able to explain how the external debt position can also qualify the predictions of the theory. In summary the paper investigates the effects of controls in the pre libarlisation period and the effect of external debt in the post-liberalisation period.

The results from econometric tests show that shocks to the copper price can have Dutch Disease consequences in a liberalised economic set-up.The effect is, however, not strong. We argue that this is a result of the country's indebtedness. Using cointegration, we find a long-run equilibrium relationship between the nominal exchange rate and the copper price and between non-traditional exports and the copper price. We also find that the copper price shock has very little effect on the money supply and on prices. These results do not come out clearly from previous studies. By employing the 123 model by Devarajan et al (1993), the paper also shows that in a controlled regime, the Dutch Disease effects are ameliorated. During the period of the positive shock, in 1964 through 1974, the real exchange rate did not appreciate to its new equilibrium level because the nominal exchange rate was fixed. Conversely, during the negative shock, after 1974, the real exchange rate did not depreciate to its new equilibrium level. It is during the slump that the exchange rate was overvalued, contrary to the widely held view that the rate was overvalued even during the positive shock period. Maipose (1997) argued that the Zambian Kwacha became increasingly overvalued from 1964 onwards and that the international competitiveness of the nontraditional export sector declined and diversification away from copper was discouraged.

We also show that the resource expansion effect of the boom, which is greatest under trade restrictions, may have had a depreciating rather than an appreciating effect on the real exchange rate during the period of the positive shock. The reverse is true during a slump. According to the theory of "construction booms" a positive shock leads to an increase in construction. Using cointegration analysis, it is demonstrated that agents treated the shocks to the copper price as temporary. We find no long run relationship between the copper price and total domestic consumption. Savings in the first positive shock led to an investment boom, supporting the predictions of the theory. However, with the reversal of the net foreign asset position after the negative shock of 1974, there is no guarantee that a positive shock will lead to an investment boom. The dissaving that occurred during the negative shock, exacerbated by oil shocks and high interest rates in the 1980's, left the country with a huge debt burden that has become a brake on the country's economic progress.

The rest of the paper is organised as follows; section 1.2 presents the theoretical framework for analysing the effects of external shocks; section 1.3 analyses the effect of copper price shocks on consumption and investment in both periods; sections 1.4 and 1.5 provide the empirical evidence from the post-liberalisation and pre-liberalisation periods respectively; section 1.6 concludes. Results of econometric tests are presented in the appendix (Tables).

1.2 Theoretical Framework

At the start of the 1980s, the economic theory needed to analyse the type of macroeconomic events being experienced in developing countries had not been developed. The macroeconomic theories of the developed countries were not directly applicable. They were often closed economy models and their primary concerns were aggregate unemployment and inflation. The problems facing developing countries in the 1980s were not predominantly inflation and unemployment but how to respond to external shocks e.g. a temporary fall in foreign income. While macroeconomic shocks of the 1980s had more than one cause, external shocks were undoubtedly central. In many countries, negative shocks had been preceded by temporary positive shocks such as the coffee and tea booms of the 1970s. It has been argued in Bevan et al (1994) that these opportunities had been so badly mismanaged that by the early 1980s, these countries would have been in serious difficulties even in the absence of negative shocks. In the following two sub sections, two theories are presented: the Dutch Disease theory[2] and the theory of Construction Booms[3]. Considering the fact that most developing countries have imposed a wide array of economic controls, which impinge on the predictions of the theories, the third subsection is devoted to giving a brief discussion of the theory of compatible control regimes as discussed in Bevan et al (1994).

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[2] The theory is based on a consolidation of booming sector economics by W. M. Corden "Booming Sector and Dutch Disease Economics: Survey and Consolidation" Oxford Economic Papers 36 (1984). We have not made any modifications to this work. Our contribution lies entirely on testing the empirical validity of the model predictions.

[3] The analysis is based entirely on the " Theory of a Temporary Windfall in a Controlled Economy" advanced by Bevan, Collier and Gunning in their book " Controlled Open Economies. A Neo-classical Approach to Structuralism". No modification to the models is made. In our empirical analysis we attempt to explain why the model predictions may not work.

1.2.1 The Dutch Disease Theory

The term Dutch Disease refers to the adverse effects on manufacturing of the natural gas discoveries of the nineteen sixties, essentially through the subsequent appreciation of the Dutch real exchange rate. In what follows, the real and monetary aspects of the Dutch Disease are analysed.

1.2.2 Real Aspects: Spending Effect and Resource Movement Effect

The fundamental assumption underlying the Dutch Disease theory is that the shock is permanent and is perceived as such by agents in the economy. The economy under consideration is small in relation to the rest of the world. There are three sectors, the Booming sector (B), the lagging tradable sector (L) and the non-tradable sector (N). The first two produce tradable goods facing given world prices. It is assumed that the tradable goods are not consumed domestically. Output in each sector is produced by a factor specific to that sector and by labour, which is mobile between all three sectors and moves between sectors to equalise wages in all three employments. All factor prices are flexible, and all factors are internationally immobile. A boom in B has the initial effect of raising aggregate incomes in factors initially employed there. The boom can occur in any of the following three ways:

- If there is a once and for all exogenous technical improvement in B represented by a favourable shift in the production function.
- If there has been a windfall discovery of new resources

- If there is an exogenous increase in the price of B's product on the world market relative to the price of its imports.

Spending Effect

If some part of the extra income in B is spent, whether directly by factor owners or indirectly through being collected in taxes and then spent by the government, and provided the income elasticity of demand for N is positive, the price of N relative to the price of tradables must rise. This is a real appreciation. It will draw resources out of B and L into N as well as shifting demand away from N towards B and L.

In figure 1.1, the vertical axis represents the relative price of N to L (Pn). The supply curve is derived from the transformation curve between N and the two tradables. The demand curve shows the demand for N. The spending effect has shifted the demand curve from Do to D1 and thus raising Pn, drawing resources out of L into N.

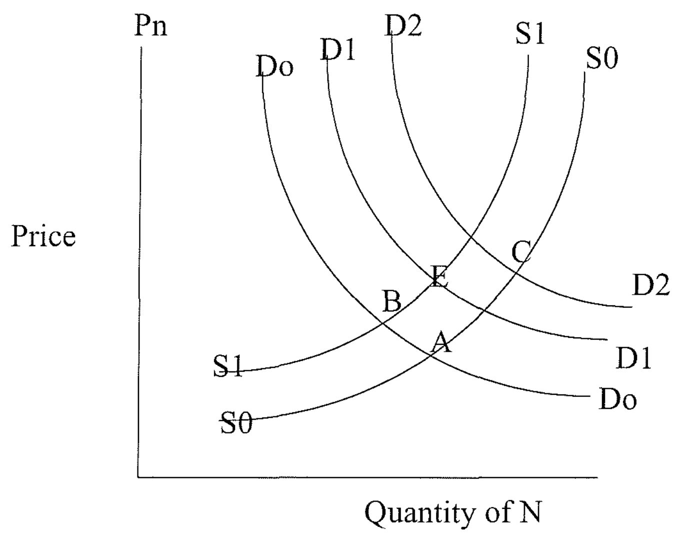

Fig 1.1: Effect of a Permanent Windfall

Resource Movement Effect

In addition, the marginal revenue product of labour rises in B as a result of the boom so that, at a constant wage, the demand for labour in B rises and this induces a movement of labour out of L and out of N. This effect has two parts

- The movement of labour out of L into B lowers output in L. This can be called direct de-industrialisation because it does not involve the market for non-traded goods and thus does not require an appreciation of the real exchange rate.
- There is a movement of labour out of N into B at a constant real exchange rate. This is represented in Figure 1.1 by the shifting of the supply curve from So to S1.This creates excess demand for N additional to that created by the spending effect and so brings about additional appreciation as the relative price of non-traded goods rises. This leads to an additional movement of labour out of the L into N, reinforcing the de-industrialisation resulting from the spending effect. This can be called indirect de-industrialisation.

The final output in the non-traded goods sector can be higher or lower depending on the relative magnitude of the spending and resource movement effects. The spending effect tends to increase, while the resource movement effect tends to lower output in the non-traded goods sector.

In terms of income distribution, both effects tend to lower the real rents of the specific factor in L. This is the essential problem of the Dutch Disease, at least seen from the point of view of this factor. This outcome is moderated with international capital mobility. In addition, both effects raise the wage W defined in terms of L because both increase the demand for labour. But the price of non-tradables increases, so bearing in mind that wage earners also consume N, their real wage falls with a rise in Pn. In effect the real wage could fall or rise.

1.2.3 Monetary Aspects of the Dutch Disease

So far, only the aspects of the Dutch Disease that concern the allocation of resources have been analysed. Most of the policy issues it raises involve monetary considerations. We consider in this section these issues assuming that the economy is characterised by the static model. We have already assumed that the economy under consideration is small in relation to the rest of the world for traded goods, so it is natural to assume that it is also small in asset markets. If we further abstract from distortions such as controls on international capital movements, political risk, and transaction costs, then domestic and foreign assets may be viewed as perfect substitutes. In addition, we assume that there is a third asset, domestic money, which is not held by foreign residents. We begin the section by considering the market for the non-traded asset. To do this, we make use of figure 1.2, where the vertical axis measures the nominal price of non-tradables Pn, and the horizontal axis measures the nominal exchange rate, e (i.e. the home currency price of a unit of foreign currency). Provided the relative price of L and B remains constant, e may be interpreted as the domestic price level for traded goods. Each ray from the origin corresponds to the relative price of non-traded goods to traded goods and thus to the real exchange rate

We assume that the desired level of real money balances is determined by a conventional money demand function:

$$m - p = \alpha y - \delta i \tag{1.1}$$

Where i is the domestic interest rate, m, p and y are the logarithms of the nominal money demand, the price level, and the level of real income respectively. Equation (1.1) is related to the nominal exchange rate in two ways. First, the domestic price level p is a weighted average of the prices of non-traded and traded goods:

$$P = \Theta P_n + (1 - \Theta)e \tag{1.2}$$

Where Θ is the share of non-tradables in the composite price index. This means that changes in the nominal exchange rate, which affect the domestic price level have an impact on real money balances. Second, through the interest parity condition, expected changes in the exchange rate influence the link between the domestic interest rate and the world interest rate (which by our small country assumption, the home country is too small to affect). For convenience, we ignore the expected changes in the exchange rate and assume that domestic and world interest rates are identical. The money market equilibrium, which is obtained by substituting the domestic money supply into equation (1.1), is depicted by the downward sloping locus DD in figure 1.2.

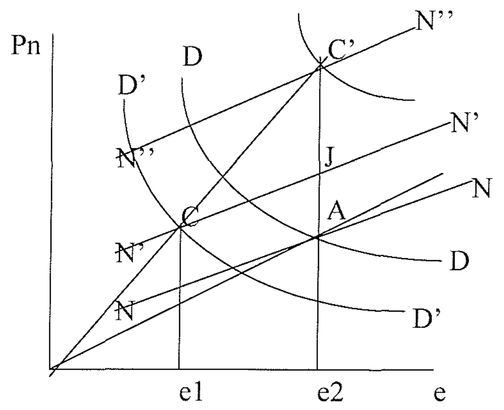

Fig 1.2. Monetary Asepects of the Dutch Disease

If the exchange rate is flexible and the money market is always in equilibrium, the economy must always lie along this locus. A rise in the price of non-tradables must always be accompanied by a fall in the exchange rate if the domestic money supply is to be willingly held when income is at its full employment level and the domestic interest rate equals the world interest rate. Alternatively, under a fixed exchange rate, the economy may be at a point above the equilibrium locus. This reflects a shortfall of the actual money balances below the desired. This disequilibrium must be offset by a build up of foreign exchange reserves to augment the domestic money supply. Hence all points above the equilibrium locus correspond to situations of balance of payments surplus and all points below correspond to situations of balance of payments deficits.

The depiction of the initial equilibrium is completed by adding the conditions for equilibrium in the non-traded goods market. Obviously, a rise in the price of non-traded goods induces excess supply of non-traded goods while an increase in the exchange rate induces excess demand for non-traded goods[4] (this is assumed to occur through the sub-

[4] In this case, the assumption that traded goods are not consumed domestically, implied in the core model, is relaxed.

stitution effect between non-traded goods and traded goods). The equilibrium locus in the non-traded goods is therefore upward sloping. The pre-boom equilibrium is established at the intersection of the two loci (A).

After the boom, both the resource movement and the spending effect create an excess demand for non-traded goods so that the non-traded goods locus shifts upwards. The rise in real income also raises demand for money and if domestic money supply is not increased, the price level must fall to restore money market equilibrium. This effect of the boom shifts the money market equilibrium locus downwards. Provided the nominal exchange rate is allowed to float freely, the new equilibrium will be at a point were the two new loci interest i.e. at C. The net result is the real exchange rate appreciation so that domestic prices of traded goods unambiguously fall but the price of non-traded goods falls or rises compared to the pre-boom level. The net result depends on the relative shifts of the money market and the goods market equilibrium loci.

Effect of fixing the exchange rate

What happens if the nominal exchange rate is not free to change but instead remains equal to its initial value? On impact, with constant nominal money supply, the shifts in the two equilibrium loci are just as described above and if the price of non-traded goods is free to adjust, the economy moves in the short run to point J in figure 2. The change in the relative price of non-tradable goods, and hence the extent to which the real side of the economy adjusts, is less than is required for long run equilibrium to be achieved. This is so because the spending effect has been dampened by a leakage into hoarding, which is reflected in a balance of payments surplus. Since desired money balances are now greater than the actual, the equilibrium at point J cannot be permanently sustained. Instead, the trade surplus leads to a build up of foreign exchange reserves so that provided the authorities do not attempt to sterilise this inflow, the domestic money supply gradually increases. This causes the N'N' and the D'D' curves to drift upwards and so the equilibrium point moves upwards from point J. The process can only end when the post-boom equilibrium point is attained at point C'. At this point the two loci intersect, the surplus is eliminated and the economy reaches its new long run equilibrium. The implications are clear; a fixed exchange rate delays the effects of the boom and gives rise to inflationary rather than deflationary pressures. The required rise in the relative price of non-traded goods is brought about by the rise in their nominal price rather than a fall in the nominal prices of traded goods.

The assumption adopted so far is that the domestic monetary authorities adopt a neutral stance. If the authorities are committed to a fixed exchange rate but are concerned about inflationary consequences of the boom, their only option is to sterilise the subsequent flow in reserves. This amounts to what Corden (1981) called exchange rate protection: the central bank acts so as to suppress the real appreciation, so protecting the traded goods sector and mitigating the extent of de-industrialisation.

The cost of such a policy does not arise from a divergence between foreign and domestic relative prices (as with orthodox tariff protection). Rather, to the extent that the policy is successful, it arises from a reduction in aggregate consumption below the level of national income reflected in continuing balance of payments surpluses.

1.2.4 The Theory of Construction Booms

The Dutch Disease theory is essentially comparative static. It treats the shock as a permanent change. Yet, most of the shocks that hit developing countries are in some sense temporary so that we should expect short-term dynamic effects to be crucial. For example, they might give rise to larger fluctuations in savings. The Dutch Disease theory abstracts from the savings route by assuming point expectations of permanence. Agents usually attach some degree of transience to shocks so that some of the windfall is saved which subsequently increases permanent income through the returns on these savings. With any information content, therefore, a price shock leads to some revision of permanent income and hence consumption. In consequence, the demand for non-tradable consumer goods will normally rise. This demand must be met by increased production, which in most cases requires an increase in the stock of buildings.

Except in the special case of perfect world capital markets, the fluctuations in savings will be reflected in domestic investments. Since investment usually requires non-tradable capital goods, windfall savings will then cause a temporary "construction boom".

The non-tradable capital goods sector has not previously received much analytic attention. The range of activities that fall in this sector varies between economies but one activity which is almost invariably so characterised is construction (Buildings).

There are three routes through which an increase in export prices leads to a construction boom:

- Through a temporary increase in savings

- Through a permanent increase in consumption
- Through an increase in the marginal efficiency of investment in the non-traded sector.

The advance from the theory of the Dutch Disease to the analysis of external shocks is called the theory of construction booms (Bevan et al 1994).

The saving effect of a trade shock

Most shocks have implications for savings propensity because they are in some sense perceived as temporary. The rise in the copper prices in the late 1980s was similar to those of the previous decades. An exporting country such as Zambia should expect such fluctuations. When expectations are not revised, permanent income rises to the extent that the extra savings out of the windfall yield a sustainable flow of income.

Under imperfect international capital markets and in the presence of imperfectly correlated risk, part of the increased asset holding will be held in foreign financial assets and part in domestic real assets. Standard portfolio theory asserts that risk averse agents will typically want to hold a well-diversified portfolio of risky assets in order to gain from the benefits of diversification. Most developing countries can lend but they cannot borrow at world interest rates. The borrowing rate is higher, country specific and upward sloping. The dispersion between the borrowing and lending rates is the risk premium for the risk faced by the international financial community. This risk bears little relation to the risk faced by the country's own nationals. If the domestic capital market is reasonably efficient, the domestic rate of return will be equated to the country's borrowing rate in the international capital market if it is a net debtor and to the lending rate if it is a net creditor. For a capital short economy, the domestic internal rate of return will always be higher than the foreign lending rate so that additional assets are more likely to be invested in domestic real assets than in foreign financial assets. Therefore, with imperfections in credit markets, fluctuations in savings will alter the availability and cost of domestic finance and therefore give rise to fluctuations in domestic investment.

The change in the propensity to save would not have an effect on investment if it left the cost of funds unaltered. This would be the case if the country had access to perfect world capital markets and in the presence of perfectly correlated risk, so that it would borrow and lend at a given world interest rate. If agents correctly forecast export prices and credit markets are perfect, then fluctuations in export prices have no consequences for any sector of the economy. Current income fluctuates around a permanent income path to which expenditure is equated through changing foreign financial assets and financial liabilities. All windfall savings would be invested abroad and would leave domestic interest rates unaltered. However, for a typical developing country, the cost of foreign funds is higher than the savers could get on the world market. Windfall savings are, therefore, invested domestically. At the margin, domestic investment is financed from domestic savings. The interest rate is now endogenous; it falls until it reaches the rate on foreign assets.

In figure 1.3, the pre- windfall marginal cost of funds (MCF) schedule is made of three sections, a flat portion denoting domestic savings at the opportunity cost of funds which is the world deposit rate; a vertical portion which is the rate charged by foreign banks before they will consider lending to domestic agents and an upward sloping portion denoting how the spread will widen as agents attempted in aggregate to borrow more. As a result of the windfall, the MCF schedule shifts to the right to MCF' and may lower the spread as the country's perceived creditworthiness improves. The effect is to augment investment by the amount a-b and foreign financial assets by b-c.

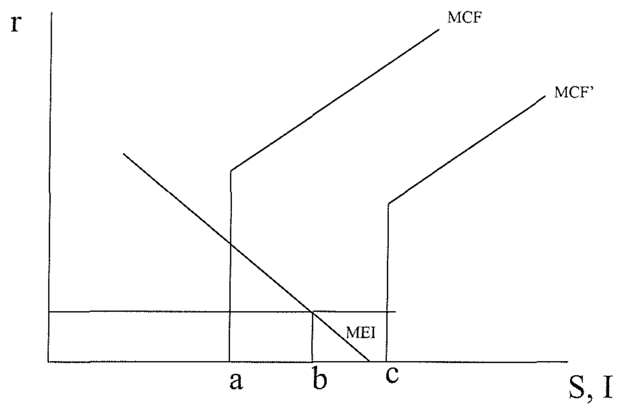

Fig 1.3. The effect of a windfall on domestic and foreign investment

The above model is now disaggregated to show the differential effects within the tradables and non-tradable sectors (figure 1.4). In the pre-boom equilibrium, domestic financial intermediation is assumed to have equalised marginal efficiency of investment in the two sectors at a level r_o above the world rate of interest.

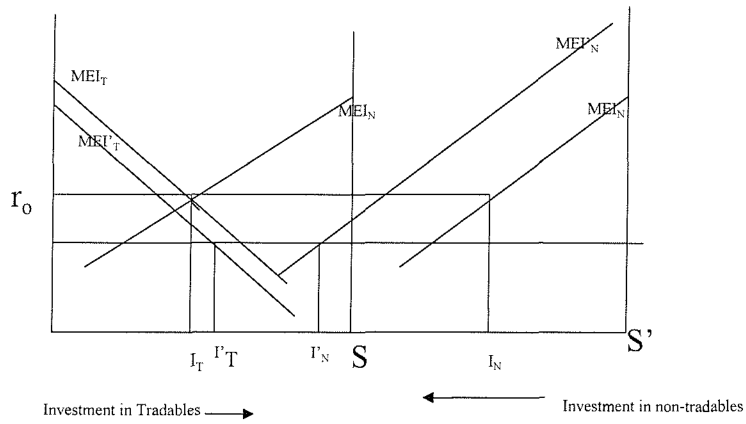

Fig 1.4. Effect of the windfall on the marginal efficiency of investment

The windfall augments savings by the amount S-S'. During the temporary adjustment phase, investment in the non-tradable sector increases both because of the increase in the relative price of non-tradable goods which shifts the marginal efficiency of investment schedule in the non-tradable goods sector upwards to MEI'$_N$ and because of the lower opportunity cost of funds at the margin (a movement down the MEI'$_N$). Investment in the tradable sector is ambiguous because the effect of the opportunity cost of funds is offset by the fall in the marginal efficiency of investment, which is represented by a backward shift in the MEI curve. The domestic opportunity cost of funds cannot fall below the world rate; otherwise agents will divert their investment into foreign financial assets.

There are several important asymmetries, which imply that the theory of booms developed here will not carry over to slumps merely by a reversal of the sign. Firstly, there may be asymmetries in the speed of price adjustment; prices rise more rapidly in response to excess demand than they fall in response to excess supply. Secondly, whereas with a boom it is possible to accumulate foreign financial assets, it may not be possible to borrow during a slump. Whereas with the boom it is always possible to add to the domestic capital stock, during a slump the rate of capital decumulation is constrained by the rate of depreciation. Finally, whereas a positive shock increases investment, a negative shock need not reduce it. This is so because the rise in the domestic cost of funds consequent upon the fall in export prices is offset by a rise in the marginal efficiency of investment in the tradable sector while capital decumulation in the non-tradable sector is constrained by the rate of depreciation.

The effect on the marginal efficiency of investment

As explained in the static model of the Dutch Disease theory, a positive shock leads to an increase in the relative price of non-tradable goods. If labour is mobile and capital is sector specific, a flow of labour to the non-tradable sector increases the marginal productivity of capital in the non-traded sector. Thus marginal efficiency of investment increases in the non-tradable sector. If capital markets are perfect (funds flow to the assets with highest risk adjusted returns), then the return on investment will always be the higher of the returns to investment in the two sectors. Thus post shock investment will be directed to the non-tradable sector.

A negative shock and a consequent fall in the relative price of non-tradables means that labour flows to the tradable sector and marginal efficiency of investment rises in the tradable sector. Thus whereas a positive shock increases investment, a negative shock need not reduce it.

When we incorporate factors such as uncertainty in the duration of the price shocks and the irreversibility of investment once installed, it may not be so obvious that investment increases in response to a price shock (Marsh 1998). Marsh formulated a model in which he showed that the losses that are incurred following the reversal of the shock are taken into account in forward looking investment decisions. In the context of the Zambian economy, uncertainty about the duration of the shock coupled with the indebtedness of the mining sector and the economy in general weakens the investment response to positive shocks. The copper price shock of 1964-1974 is an exception since it was the first one of its type.

Effect of the Temporary Shock on Money Supply

From portfolio theory, we see that agents typically want to hold a diversified portfolio of risky assets, foreign and domestic. Many agents are not in a position directly to diversify their asset accumulation into interest bearing foreign financial assets. Instead, this activity is likely to be performed by specialised agents, in particular banks, against whom the majority of private agents acquire claims denominated in domestic currency. If the banking system operates through a cash-to-deposits ratio, an increase in deposits causes an increase in the demand for foreign currency. The supply of domestic currency increases as the agents convert their windfall foreign currency into domestic currency. The banks will hold cash and some foreign financial assets as a counterpart against the increase in deposits. The former will be a liability of the monetary authority while the later will be reflected in the balance of payments as an outflow. As a counterpart to its liability against banks, the monetary authority will also hold some foreign financial assets and will be reflected in an increase in reserves. This then means that the government is a custodian of part of the foreign financial assets temporarily and indirectly accumulated by private agents, with the fraction being determined by the cash to deposits ratio.

This implies that even in an unregulated open economy, a temporary trade shock will have short-term monetary repercussions. The foreign financial assets trajectory has as its counterpart a money supply trajectory.

1.2.5 The Theory of Compatible Control Regimes

Governments in developing countries set an array of controls that have macroeconomic effects. They set the exchange rate, trade and other taxes, import quotas, price controls, foreign exchange controls, ceilings on interest rates, liquidity ratios for banks; they determine the magnitude and composition of government expenditure and they incur domestic and foreign liabilities. These policies are collectively referred to as the "control regime"(Bevan et al 1994). A control regime in which policies are consistent with each other at a macro level is referred to as a compatible regime.

If the Government intervenes with economic controls, the dynamic adjustment process becomes complicated. The presence of pervasive controls constrains the set of possible outcomes of trade shocks, qualifying the standard predictions of the theories, which assume flexibility in goods and factor markets. For example, price controls if enforced would constrain the expected expansion of the non-traded goods sector during a positive shock.

Rattso and Torvick (1998) argued that the African-style regulation of foreign trade has made the economies more vulnerable to external shocks. They also showed that in the

African-style closure model, an increase in the export price might lead to a real exchange rate depreciation contrary to the predictions of the Dutch Disease theory. This occurs when the economy imposes import rationing based on the availability of foreign exchange (what Bevan et al referred to as "an endogenous trade policy regime"). The fundamental assumption in the model by Rattso is that production in the non-traded goods sector relies on imported intermediate goods. The increase in the export price increases the availability of foreign exchange thus leading to excess supply in the non-traded goods market. If this supply response dominates the spending effect from the increased income arising from the positive shock, the price of non-tradable goods falls and the real exchange rate depreciates. This is commonly referred to as the resource expansion effect. This effect can be significant especially if the unemployment level is high. In addition to the supply effect, increased import capacity can switch consumption away from goods produced domestically to non-competitive consumer imports.

Bevan et al (1994) reach a similar result with endogenous capital stock in a conventional version of the dependent economy model. With a temporary positive shock, agents save part of the income. When the economy is faced with an imperfect capital market, part of these savings will be invested domestically. The increased capital in the non-traded goods sector increases supply, and this in isolation pulls the relative price of non-traded goods down. However, this result is dependent on the economy's net foreign asset position. If the economy is heavily indebted, the savings go towards repayment of debt instead of investment.

Compatible Trade, Monetary and Exchange rate Policies

In developed countries, trade policy is usually peripheral to macroeconomic performance: trade taxes are usually low and do not change markedly. In developing countries however, governments impose high barriers to trade (often in the form of quotas) and actively vary them as a key instrument of monetary policy. This is often done behind the rhetoric of import substituting industrialisation. It has often been the central bank that has determined the height of trade barriers, with an eye on foreign exchange reserves.

The standard macroeconomic model of small open economies (the Salter model), was designed for developed economies and thus abstracts from trade policy. Exportables and importables are treated as a single aggregate. The focus of analysis in such a model is the relative price of tradables to non-tradables; a price commonly referred to as the real exchange rate.

The concept of the real exchange rate has come to be applied to the analysis of structural adjustment programmes in developing countries. But structural adjustment involves major changes in trade policy. As a result, for given world prices, the domestic relative price of importables to exportables is substantially altered. In these circumstances, tradables can no longer be treated as a Hicksian composite good. With the loss of this fundamental assumption regarding the constant relative price among tradable goods, the concept of the real exchange rate becomes problematic.

A macroeconomic model that is suitable for developing countries must disaggregate tradables, enabling the interactions between trade, monetary and exchange rate policies to be investigated.

The Model[5]

It is assumed that three commodities, exportables, importables and non-tradables are produced domestically and it is also assumed that exportables are not consumed domestically. Two factors are used in the production process; labour is mobile between sectors while capital is sector specific. The domestic relative price of importables is determined by a fixed exchange rate, e, and an import quota at the tariff equivalent t_q. Nominal income is the sum of production and the value of the quota entitlements.

The government taxes the private sector income at a rate t. Budget balance is imposed: government expenditure, g, equals tax revenue, tr. The government issues money so that the supply of money is exogenous. The private sector's demand for money is a demand for bank deposits, d. The government controls the money supply by setting the cash ratio . Imports are subject to quantitative restrictions so that the volume of imports is given. Table 1.1 summarises the disaggregation and notation of this model.

[5] A full exposition of the model is given by Bevan et al (1994)

Table 1.1: Disaggregation of the Model

	Domestic Price	World Price
X (Exportable)	P_x	P_x^*
M (Importable)	P_m	1
N (Non-tradable)	p_n	(na)
C (Domestic currency)	1	$1/e$
D (Bank deposits)	1	(na)
F (Foreign currency)	e	1

The government has four instruments: the tax rate (t), the cash ratio (β), the exchange rate, e, and the quantitative restrictions (QRs), determining the level of imports (m).These policy instruments cannot be chosen independently. Only certain combinations of policy variables are compatible. The model consists of the following equations.

$$(1-t)r(P_x, P_m, P_n) + (P_m - e)\left(S_{pm} - r_{pm}\right) + g + d = (1+\alpha)S(P_m, P_n, U) \quad (1.3)$$

Equation (1.3) describes the economy's budget constraint. Total revenue plus money stock equals total expenditure plus the transactions demand for money. S and r denote expenditure and revenue respectively so that S_{pm} and r_{pm}, the derivatives of the functions with respect to the price of importables represent the quantities demanded and produced respectively.

$$(S_{pn} - r_{pn}) = n(P_x, P_m, P_n, U) = 0 \quad (1.4)$$

$$\alpha S(P_m, P_n, U) = d \quad (1.5)$$

Equations (1.4) and (1.5) describe the equilibrium conditions for non-tradables and for money (bank deposits). Equation (1.4) represents the net compensated demand for non-tradables, which by definition is equal to zero.

$$S_{pm} - r_{pm} = m(P_x, P_m, P_n, U) \tag{1.6}$$

Equation (1.6) says that the imports are equal to the controlled level m

$$P_x = eP_x^* \tag{1.7}$$

$$g = tr \tag{1.8}$$

$$d = \frac{c}{\beta} \tag{1.9}$$

$$f \geq \gamma(S_{pm} - r_{pm}) \tag{1.10}$$

Equation (1.8) imposes budget balance and (1.9) links the supply of bank deposits to the stock of currency through the cash ratio. Equation (1.10) states that the government's transactions demand for foreign currency cannot be more than the level of reserves. Some algebraic manipulation of the above equations shows that:

$$e(P_x^* r_{px} - m) = 0 \tag{1.11}$$

Which says that the model implies external equilibrium: the value of exports equals the value of imports. The model implies an endogenous trade policy regime, with less stringent trade restrictions during positive shocks. This model also implies that the increased availability of foreign exchange brought about by a positive shock results in increased production of non-tradables with a high import content in production. This may lead to a depreciation of the real exchange rate in contrast with the predictions of the Dutch Disease theory.

In the P_m, P_n space, the non-tradable goods equilibrium locus has a positive slope while that of money market has a negative slope as illustrated in the figure 1.5.

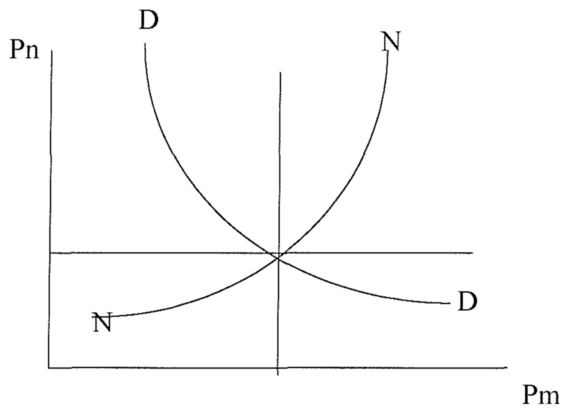

Fig 1.5. Equilibrium in the money and goods markets

To illuminate this point, consider the fact that the composite price index for the economy is given by the weighted sum of the domestic prices of non-tradable goods and importables:

$$P = \Theta P_n + (1 - \Theta)P_m \tag{1.12}$$

Where Θ is the weighting factor. From equation (1.5), which describes the money market equilibrium, we infer that given constant real income and money supply, an increase in P_m must be associated with a decrease in P_n.

A compatible policy set is one in which the exchange rate, the tariff rate and the money supply (e, t_q, β) ensure equilibrium in both the goods market and the money market.

The equilibrium money supply is determined by the exogenous variables such as P_x and P_m. This means that the changes in the real exchange rate have an impact on the equilibrium money supply.

Changes in the copper price or the international price of importables have implications for the equilibrium money supply. Abstracting from income effects, the appreciation in the nominal exchange rate, consequent upon the positive shock, reduces the composite price level in the economy creating excess money supply. Thus, a move to a compatible policy set requires a reduction in the money stock. Making the money supply rather than P_m exogenous amounts to asking what the world price of importables ought to be for the exogenously determined money supply to be consistent with equilibria. The income effect of an increase in the copper price on the other hand requires an increase in the money supply.

Policy Changes

Governments in developing countries often change policies in response to positive or negative shocks. We use the model to investigate the effects of policy changes designed to achieve either stabilisation or liberalisation. Bevan et al (1994) defined stabilisation as a move from an unsustainable to a sustainable position and liberalisation as a movement between sustainable positions. If the government starts from a compatible set of policies, it may wish to change them. In particular, trade liberalisation is likely to generate improved resource allocation. However, for liberalisation to be sustainable, other policies must be changed in such a way that a new set of compatible polices is eventually established. Trade liberalisation must for example be accompanied by a devaluation (liberalising devaluation) if relative prices have to be maintained and equilibrium in the money market achieved. The policy changes must satisfy the following equation;

$$\frac{(1+t'_q)}{(1+t_q)} = \frac{e}{e'} = \frac{d'}{d} \tag{1.13}$$

The impact effect of a trade liberalisation from t_q to t'_q is to lower the price of importables. A devaluation from e to $e\prime$ has an impact effect upon prices by raising the domestic price of tradables. A policy package comprising of trade liberalisation and devaluation has no impact on the price of importables by virtue of satisfying equation (1.13). Since there is no impact effect upon the price of non-tradables, the above policy package has no impact upon the price level and so the demand for money is unaltered (except for income effects of-course.)

If however, it occurs that as a result of liberalisation, goods market equilibrium is achieved even with a slight increase in the relative price of non-traded goods relative to importables, it follows that the required devaluation to maintain goods market equilibrium is less than the amount of the liberalisation.

However, such a liberalising devaluation package, while it has the correct impact upon relative prices shifts the economy to a monetary disequilibrium. This is so because the change in the price of importables and the exchange rate unambiguously lowers the composite price level (equation 1.12) in the economy so that with the initial nominal money supply, there is an excess supply of real money balances unless this is fully offset by the income effects. The maintenance of monetary equilibrium consequent upon trade liberalisation requires a change in the money supply. The policy instrument that would achieve this instant reduction in the nominal money stock is not government expenditure or taxation that can only affect flows but rather the cash ratio, which the government imposes on banks.

1.2.6 Summary of Theoretical Models and Expectation from Empirical Results

The models we have presented have the following implications for the effect of an increase in the copper price:

- An appreciation in the real exchange rate with Dutch Disease effects
- An increase in domestic investment leading to a construction boom
- An increase in the money supply to maintain money market equilibrium after an increase in the demand for money arising from an increase in incomes and from the asset effect.
- An increase in the consumer price index if the income effect on domestic prices dominates the effect of the nominal exchange rate appreciation.
- From the theory of compatible regimes, we see that a set of compatible policies may be rendered incompatible ex-post as a result of external shocks or a change of policies. For instance, positive terms of trade shock may change the equilibrium supply of money. The supply of money is therefore also expected to chgange following a shock to the copper price.

- The theory of compatible control regimes also implies that imports depend on the amount of foreign exchange available leading to an endogenous trade policy regime. This means that an increase in foreign exchange availability consequent upon an increase in the copper price should lead to increased importation of capital and intermediate goods. If production of non-tradable goods requires a significant amount of imported inputs, this should unambiguously lead to an increase in the production of non tradable goods and a depreciation of the real exchange rate. Hence, its possible to have a real exchange rate depreciation after a positive terms of trade shock.

These implications are investigated empirically in the next sections. Our empirical analysis begins by investigating whether agents perceive shocks to the copper price to be permanent or temporary. Previous research has relied solely on the use of counterfactuals. In this paper, we use cointegration analysis as well. After characterizing the expectations of the agents in the economy, we then analyse the effect of copper price shocks in the post and pre-liberalisation periods separately.

1.3 Effect of the Copper Price Shock on Consumption and Investment.

In this section, we use cointegration to determine whether there is a relationship between the copper price and consumption and between the copper price and investment. The cointegration results will help us establish whether agents treat the copper price shocks as temporary or permanent. The sample data covers both the pre-liberalisation and post-liberalisation periods (1971 to 1996). Consumption includes both private and Government consumption. Domestic investment is proxied by gross fixed capital formation.

1.3.1 Estimation Procedure

In order to test for cointegration, we first need to establish the order of integration of the variables involved. The standard procedure for determining the order of integration of a time series is the application of the augmented Dickey Fuller test, which involves regressing Δy_t on a constant, y_{t-1} and several lags to render the disturbance term white noise. Table 1.9 (page 85)presents the augmented Dickey Fuller test results for all the variables involved in the analysis.

After determining that the series are of the same order of integration, we then test whether the linear combination of the series that are nonstationary in levels are cointegrated.

Engle and Granger (1987) introduced the cointegration methodology to avoid spurious regression problems associated with the modelling of non-stationary series. Two or more variables that are non-stationary in levels are said to be cointegrated when there exists at least one linear combination of the variables that is stationary. In other words, there is a long run equilibrium relationship that exists among the variables. The Engle Granger methodology of testing for cointegration involves the following three steps; first the variables are tested for their order of integration to establish whether they are of the same order of integration. Second, a regression involving the variables is run. If the variables are cointegrated, an ordinary least squares regression yields a super consistent estimator of the conitegrating parameters. The residuals of the equation are tested for stationarity using the augmented Dickey-Fuller tests. The last step involves the estimation of the equilibrium correction model.

Although the Engle and Granger (1987) procedure is easily implemented, it has several important defects including the need to place one variable on the left side of the equation as the regressand and use the rest of the variables as regressors (normalisation). The problem is compounded by the lack of a systematic procedure for dealing with multiple cointegrating vectors. Another serious defect of the Engle-Granger procedure is that errors made in the first step are carried into the second step.

An alternative to the Engle-Granger procedure, the Johansen (1988) maximum likelihood estimation procedure avoids these problems. A brief discussion of the Johansen procedure is provided. We begin with the following K-lag vector autoregressive (VAR) representation

$$X_t = \alpha + \Pi_1 X_{t-1} + \Pi_2 X_{t-2} ......\Pi_k X_{t-k} + \mu_t \tag{1.14}$$

Where X_t is a $p \times 1$ vector of nonstationary I (1) variables, α a vector of constant terms, Π_1 $\Pi_2 .....\Pi_k$ are $p \times p$ coefficient matrices and μ_t is a $p \times 1$ vector of white Gaussian noises. To examine the existence of cointegrating relationships within a stationary system, we use an equilibrium correction re-parameterization. This is achieved by adding and subtracting $\Pi_i X_{t-i}$ for $i = 1...k-1$ on the right hand side. This gives the error correction form as

$$\Delta X_t = \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-1} + \Pi_k X_{t-k} + \varepsilon_t \tag{1.15}$$

where $\Gamma_i = -(I - \Pi_1 + \Pi_2 + ...\Pi_i)$ (for $i = 1, 2, ..k - 1$) and $\Pi_k = -(I - \Pi_1 + \Pi_2 + ...\Pi_k)$

The Γ_i are the dynamic vector parameters of the model, and the Π_k matrix contains the long run parameters of the model and may or may not be cointegrated. The rank of the Π_k matrix indicates the number of cointegrating relationships existing between the variables in X_t. The Π_k is the product of both the long-run relationship between the variables and the 'feedback' or equilibrium correction effects. Thus $\Pi = \alpha\beta'$, where β' contains the cointegrating vectors while α contains the corresponding feedback effects from the equilibrium relationship to the dynamic equations in ΔX_t

The exact method by which we derive and evaluate the cointegrating vectors in $\Pi = \alpha\beta'$ is included in Johansen (1995). In summary, the number of distinct cointegrating vectors can be obtained by checking the significance of the characteristic roots of Π_k, which can be ordered as;

$\lambda_1 > \lambda_2 > \lambda_3........\lambda_p$

These characteristic roots are called eigenvalues. If the variables in X_t are not cointegrated, the rank of Π_k is zero and all the characteristic roots will equal zero. The number of significant vectors is determined by the value of the maximal eigenvalue statistic, which is a likelihood ratio test for the hypothesis that there are at most r cointegrating vectors. The statistic is of the form; $\eta = -T\log(1 - \lambda_i)$ where i is the ith eigenvalue

The test statistic is compared against critical values computed by Johansen (1988) found in Ostewald-lenum (1992). The trace statistic tests the hypothesis that the number of cointegrating vectors is less or equal to r and is of the form;

$$\eta_{trace} = -T \sum_{i=r+1}^{p} \log(1 - \lambda_i)$$

With two variables, $p = 2$ there can be at most one cointegrating vector.

The results presented in Table 1.10 (page 85) indicate that we do not reject the null of no cointegration between the copper price and total consumption. The results also show no cointegration between the copper price and investment .

We conclude that in aggregate, a high fraction of the windfall from a postive copper price shock is saved. This means that agents in the economy are aware of the temporary nature of copper price shocks and therefore save most of the windfall. However, the results also show that a positive shock does not necessarily result in an investment boom as predicted by the theory. One explanation for this result could be the uncertainty regarding the duration of the shock and the fact the high costs associated with the irreversibility of investment as suggested by Marsh (1998). Another explanation is that with the high levels of debt, a significant part of the windfall goes towards servicing of debt. The disincentive effect of debt is analysed in the third paper. During the first positive shock of 1964, we would expect the shock to lead to an investment boom since the country's net foreign asset position was positive. Aron (1999) obtained this result using a counterfactual analysis and showed that there was an increase in construction output and prices during the boom period.

The result also indicates that during the period of the negative shock, consumption is smoothed through foreign borrowing. This, however, comes more in the form of Aid than private capital inflows.

The next section looks at the empirical evidence in the post-liberalisation period before we analyse the effect of controls.

1.4 Empirical Evidence in the Post-liberalisation Period

In this section, we test for the validity of the theoretical predictions presented in the previous sections based on post-liberalisation data (1992 onwards). In the standard models, equilibrium in the goods and money markets is attained under the assumption of flexible prices. It is therefore prudent to start by analysing the effects of copper price changes using data in the post liberalisation period. This is then contrasted with the results from the pre-liberalisation period in section 1.5.

1.4.1 The Data

The sample used consists of monthly data covering the period 1994 to 1999. This is the period of the third Republic when virtually all aspects of the economy were liberalised after the MMD government took over power in 1991.

1.4.2 The Dutch Disease effects of Copper Price Shocks

The first key relationship established in the theory is that a shock to the copper price leads to a change in the nominal exchange rate, especially in the liberalised exchange rate regime.

Using cointegration, we test for the existence of a long run relationship between the copper price and the nominal exchange rate.The result rejects the null hypothesis of no cointegration in the variables. The cointegrating relationship has a negative feedback coefficient in the equation of the nominal exchange rate. However, the restriction of a zero adjustment coefficient in the equation of the exchange rate is accepted with a p-value of 39 percent while that of the copper price is rejected with a p-value of 0.0001. The results of these restrictions are presented in Table 1.11(page 85)

The Error Correction Model of the Nominal Exchange Rate

As long as two variables are cointegrated, causality (in the Granger sense) must exist in at least one direction, either unidirectional or bidirectional. Evidence of cointegration among variables also rules out the possibility of the estimated relationship being 'spurious'. However, although cointegration indicates the presence or absence of Granger causality, it does not indicate the direction of causality between the variables. This direction of causality is detected from the vector equilibrium correction model derived from the long run cointegrating vectors. The Granger causality can be evidenced through the statistical significance of the t-test of the lagged error correction terms. The insignificance of the t-test of the lagged error correction terms indicates econometric exogeneity of the dependent variable.

In our bivariate model of the copper price and the log of the exchange rate, the error correction model of the nominal exchange rate is estimated using cointegrating vectors from Johansen' just identifying restrictions.The results presented in Table 1.12 (page 85) show that the coefficient of the error correction term is not statistically different from zero with a t-value of 0.65. However, when we estimate the error correction model for the copper price, the t-value of the error correction term is -3.9 (Table 1.13, page 86). This result suggests that the exchange rate in Zambia Granger causes the copper price and is inconsistent with our small open economy assumption which implies that Zambia has no influence on the world price of copper. However, we observe that the lagged change in the copper price has a significant negative effect on the nominal exchange rate. In Appendix 1.B we test the hypothesis that the cointegrating parameters are related by the ratio 1:2.6 (for the log of the nominal exchange rate and the copper price respectively). This hypothesis is accepted, confirming the appreciating effect of the copper price on the nominal exchange rate. We also test for the weak exogeneity of the copper price, which is rejected.

The results from cointegration tests and the error correction model suggest that the copper price has a significant short run effect on the nominal exchange rate. Before we draw any firm conclusions, we carry out single equation regressions of the nominal exchange rate on the copper price. Using the Akaike Information Criteria and Swharz Bayesian criteria, we select a lag length of 2. The results presented in Table 1.14 (page 86) show that the copper price has an appreciating effect on the nominal exchange rate. This is in agreement with the Dutch Disease theory.

According to the Dutch Disease theory, the appreciation in the real exchange rate consequent upon the rise in the copper price causes a decline in the non-booming tradable sector. In the context of the Zambian economy, we may classify the non-traditional export sector as representing such a sector. Since the real exchange rate is I(0) we cannot use cointegration to determine whether there is an equilibrium relationship between the real exchange rate and the copper price. We instead use three alternative approaches; in the first, we use a VAR model to determine if there is a relationship between the real exchange rate and the copper price; we then test directly for cointegration between the copper price and non-traditional exports; we also use a counterfactual approach using the 123 model to determine whether the real exchange rate adjusts to its post-shock equilibrium level

Testing for Dutch Disease Effects using a VAR model

'Apart from estimating the effect of the copper price on the real exchange rate (RER), we also use the bivariate VAR model to determine the effect of the copper price shock on the nominal exchange rate (ER), the money supply $(M1)$, non-traditional exports (NTE) and the consumer price index (CPI) . We estimate a VAR model of the form;

$$\Delta X_t = \alpha + \beta_1 \Delta X_{t-i} + \beta_2 \Delta P_{t-i}^C + U_t \tag{1.16}$$

where $i = 1..P$; P refers to the lag length. X_t represents any of the variables mentioned above.

In the VAR model, the change in the copper price is specified as an exogenous variable. The results in Table 1.14 indicate that an increase in the price of copper has an appreciating effect on the real exchange rate. The effect is however statistically insignificant. While the increase in the copper price has an appreciating effect on the nominal exchange rate, we would fairly deduce that the effect on the domestic price of nontradables is weak. We draw this conclusion from the overall negative effect of the copper price on the consumer price index. When an economy is heavily indebted, the windfall arising from a positive copper price shock is used for external debt repayment rather than increasing domestic consumption and investment. Debt works like a tax on income so that the windfall income arising from an improvement in the terms of trade does not translate one for one into an increase in disposable income. As a consequence, the spending and resource movement effects described in the theoretical models are weakened.

Effect of the Copper Price on Non-Traditional Exports

Since both the copper price and non-traditional export series are I (1), we can use cointegration tests. The results presented in Table 1.10 (page 85) indicate that the variables are cointegrated. The results of the error correction model for non-traditional exports (Table 1.15 page 86) show a statistically significant negative coefficient of the error correction term. However, the effect of the lagged change in the copper price is insignificant. In appendix 1.B, we test the hypothesis that the cointegrating parameters for the log of non-traditional exports the copper price are the same (this test can be done without identifying the cointegrating vectors). We also carry out a test for the weak exogeneity of the copper price. Both hypotheses are accepted.

An ordinary least squares regression of non-traditional exports on the copper price shows a lagged negative relationship between the variables although the effect is statistically insignificant (Table 1.15, page 86). Although this result is in agreement with the prediction of the Dutch Disease theory, we argue that the effect is mitigated by the external financial situation of the country. We conclude therefore that the standard prediction of the Dutch Disease theory together with its dynamic extension, are qualified not just by the existence of controls but also by the county's indebtedness.

Counterfactual Analysis using the 123 Model

The real exchange rate is computed using the purchasing power parity (PPP) approach. Following this approach, the real exchange rate is defined as the nominal exchange rate multiplied by an index of world prices divided by an index of domestic prices. The PPP approach is to find a prior benchmark year in which the current account is in equilibrium at a sustainable level (perhaps, but not necessarily, zero). The real exchange rate for that year is assumed to be the desired real exchange rate for the post shock period. The required nominal exchange rate is then computed using the inflation differential between the country and its trading partners. By assumption, the change in the equilibrium real exchange rate is zero.

The PPP approach has been criticised on both empirical and theoretical grounds. An obvious problem is that the external environment and the structure of the economy will likely have changed since the last time the economy was in equilibrium. Consequently, the equilibrium real exchange rate for the benchmark year will no longer be appropriate for the post-shock period. Another strand of criticism has focussed on the appropriate empirical definition of the real exchange rate. In neoclassical trade theory, the real exchange rate is defined as the relative price of tradable to non-tradable goods (Salter- Swan model). In the empirical application of the PPP approach, however, the usual practice is to measure the domestic prices using an aggregate index, which includes not only non-tradables but also tradables produced or imported by the country. Similarly, the foreign price index includes not only tradables but also non-tradables produced by the country's trading partners.

In implementing the Salter-Swan model, there are problems regarding the definition of non-tradable goods. Further, the Salter-Swan model does not distinguish between imports and exports. At a sectoral level, exportables and import substitutes are quite different. In developing countries for example, exportables are usually primary goods or light manufactures whereas imports consist largely of intermediate and capital goods for which there are limited domestic substitutes. Aggregating these two into a single tradables sector, therefore, gives a distorted view of how a country adjusts, say, to changes in international terms of trade.

Devarajan et al (1993) presented an approach to the computation of the equilibrium real exchange rate that resolves these theoretical and empirical difficulties. They used a model in which there are three goods, the exportable (E), the importable (M) and the non-tradable (D). It is assumed that only two goods are produced, the non-tradable good and the exportable. The country also consumes two goods, the domestic goods and the import. The model is referred to as the 1-2-3 model. The equations and definitions of the model are summarized in Table 1.2. The production possibility frontier is defined as the constant elasticity of transformation (CET) equation 1 of Table 1.2. Profit maximization by producers given the CET transformation frontier yields the first order conditions of equation 3. The relative supplies of the domestic good and exports depend on their relative prices, P_d and P_e , and on the elasticity of transformation.

The domestic good is also an imperfect substitute for imports in consumption, with a constant elasticity of substitution function (equation 2). The first order condition for utility maximizing consumers is given by equation 4, which defines the import demand function. Domestic prices for exportables and importables are given by equations 5 and 6 where R which is the nominal exchange rate is taken as numaraire. Finally, equation 7 imposes the balance of trade constraint. The system is a general equilibrium model with two production activities and three distinct goods.

Table 1.2: The 1-2-3 Model

ITEM OR SYMBOL	EQUATION OR DEFINITION
Production possibility frontier (1)	$X = G(E, D; \Omega)$
Import aggregation function (2)	$Q = F(M, D; \sigma)$
Export Supply function (3)	$\frac{E}{D} = g\left(P^e, P^d; \Omega\right)$
Import demand function (4)	$\frac{M}{D} = f\left(P^m, P^d; \sigma\right)$
Domestic price of imports (5)	$P^m = R \times \pi^m$
Domestic price of exports (6)	$P^e = R \times \pi^e$
Balance of trade (7)	$M \times \pi^m - E \times \pi^e = B$
Numeraire (8)	$R = 1$
Endogenous Variables	
E	Exports
M	Imports
D	Domestic goods sold on the domestic market
Q	Composite good (absorption)
P^e	Domestic price of exports
P^m	Domestic price of imports
P^d	Domestic price of non-tradable good
R	Nominal exchange rate
Exogenous Variables	
X	Aggregate output
π^e	World price of exports
π^m	World price of imports
B	Balance of trade
Ω	Elasticity of transformation in supply
σ	Elasticity of substitution in demand

The Analytics of the Equilibrium Real Exchange Rate

We can rewrite the first order conditions as;

$$\frac{M}{D} = K_1 \left(\frac{P^d}{P^m}\right)^{\sigma} \tag{1.17}$$

$$\frac{E}{D} = K_2 \left(\frac{P^e}{P^d}\right)^{\Omega} \tag{1.18}$$

In addition, we rewrite the balance of trade B, as a share of export earnings $(\lambda - 1)$;

$$\pi^m.M = \lambda.\pi^e.E \tag{1.19}$$

where

$$B = (\lambda - 1)\pi^e.E = \pi^m.M - \pi^e.E \tag{1.20}$$

The parameter λ provides a measure $(\lambda - 1)$ by which imports can exceed exports. Log differentiating equations 1.17 to 1.20 yields:

$$\widehat{M} - \widehat{D} = \sigma(\widehat{P}^d - \widehat{P}^m) \tag{1.21}$$

$$\widehat{E} - \widehat{D} = \Omega(\widehat{P}^e - \widehat{P}^d) \tag{1.22}$$

$$\widehat{\pi}^m + \widehat{m} = \widehat{\lambda} + \widehat{\pi}^e + \widehat{E} \tag{1.23}$$

Since R is the numeraire, the change in the nominal exchange rate is zero ($R = 0$) so that the changes in the domestic prices of imports and exports correspond to the changes in the international prices. An important feature of the model is that it recognises that the incentive to consume imports versus domestic goods is different from the incentive to produce for the export versus domestic markets. In effect there are two real exchange rates in the model, the import or demand real exchange rate and the export supply real exchange rate;

$$R^m = \frac{R.\pi^m}{P^d} = \frac{P^m}{p^d} \tag{1.24}$$

$$R^e = R.\frac{\pi^e}{P^d} = \frac{P^e}{P^d} \tag{1.25}$$

The first captures the incentive to consume tradable versus non-tradable goods whereas the second captures the relative profitability of producing for the domestic or export markets.

The only endogenous price in the model is the price of the domestic good. It is common to all and will affect both measures identically. Because the price of the domestic good is the important price in determining the real exchange rate, we can solve it in terms of the rates of change in the world prices of imports and exports and in the sustainable trade balance. Subtracting equation (1.22) from equation (1.21), substituting $\widehat{M} - \widehat{E}$ in equation (1.23) and manipulating yields

$$\widehat{P}^d = \frac{(\sigma - 1)\,.\widehat{\pi}^m + (1 + \Omega).\widehat{\pi}^e + \widehat{\lambda}}{\sigma + \Omega} \tag{1.26}$$

Equation 1.26 is the core result. It gives the equilibrium change in the price of the domestic good for a given change in the world price or in foreign capital inflows under the assumption that the nominal exchange rate does not change. The above equation can be rewritten with the rate of change in the nominal exchange rate included explicitly as:

$$\widehat{R} - \widehat{P}^d = -\frac{(\sigma\widehat{\pi}^m + \Omega.\widehat{\pi}^e)}{\sigma + \Omega} + \frac{(\widehat{\pi}^m - \widehat{\pi}^e)}{\sigma + \Omega} - \frac{\widehat{\lambda}}{\sigma + \Omega} \tag{1.27}$$

The first term on the right of the equation adjusts the price level deflated exchange rate (on the left side of the equation) for world inflation, the second term accounts for the terms of trade and the third term accounts for any change in the sustainable balance of trade. An increase in world inflation, and an improvement in both the terms of trade and sustainable balance of trade entail an appreciation in the price-deflated exchange rate.

Equation (1.27) can be rearranged to define a real PPP exchange rate variable, RER, whose rate of change equals the change in the nominal exchange rate minus the inflation differential between the home country and its trading partners. The change in the nominal exchange rate, which is consistent with both the change in the equilibrium real exchange rate and the inflation differential is given by;

$$\widehat{RER} = \widehat{R} - \left(P^d - \frac{\sigma.\widehat{\pi}^m + \Omega.\widehat{\pi}^e}{\sigma + \Omega} + \frac{(\widehat{\pi}^m - \widehat{\pi}^e)}{\sigma + \Omega} - \frac{\widehat{\lambda}}{\sigma + \Omega} \right) \quad (1.28)$$

The usual PPP approach corrects for the effect of differential inflation, ignoring the terms of trade and the balance of trade effects. Equation (1.28) indicates that in the 123 model, the equilibrium real exchange rate will change when there are changes in the international terms of trade or the balance of trade. When there is no change in the equilibrium real exchange rate, the nominal exchange rate is adjusted for the difference between domestic and foreign inflation rates only. In the context of the Zambian economy for instance, an improvement in the terms of trade and the sustainable trade balance lead to an appreciation in the equilibrium real exchange rate so that the actual real exchange rate depreciates relative to the new equilibrium real exchange rate. These two factors and a depreciation in the nominal exchange rate work in the same direction.

As either the elasticity of substitution in demand or the elasticity of transformation in supply (σ or Ω) approaches infinity, the model collapses to the standard small country model, in which all goods are tradable. In the limit, the change in the domestic price equals the change in the import price as σ approaches infinity, and equals the change in the export price as Ω approaches infinity. In both cases, the real exchange rate is independent of the balance of trade because the domestic price of the perfect substitute (for either exports or imports) is determined by the exogenous world price.

With elasticities less than infinity, an increase in the balance of trade deficit always generates a real appreciation, faithfully generating a Dutch Disease scenario where the real exchange rate appreciates when the economy acquires a windfall increase in foreign exchange earnings. The effect of a rise in the world price of imports, which corresponds to a worsening terms of trade, depends on the value of the elasticity of substitution between imports and domestic goods. If the elasticity is less than unity, a typical case for developing countries, then an increase in import prices generates a fall in the equilibrium price of non-tradable goods . In developed countries where the elasticity may be more than one, an increase in import prices leads to an increase in domestic prices. Resources are diverted from exportables into the production of domestic substitutes for the importable good. The volume of trade thus falls.

We can see more clearly from Table 1.3 how the change in the terms of trade affects the equilibrium real exchange rate. The computation of the equilibrium real exchange rate requires little more information than that required to do the PPP calculations. During the period 1994 to 1997, the average realised price of copper decreased by 33 percent. We assume that the price of imports remained constant. This is because of the practical difficulties in measuring unit value indices for both imports and exports in Zambia. This assumption implies that the deterioration in the terms of trade is generated mainly by the fall in the copper price. In the Table 1.3, we see that the 33 percent fall in the copper price alone necessitates equilibrium changes in the domestic price level ranging from negative

33 to negative 83 percent, depending on elasticities. Devarajan (1993) computed average elasticities for Cameroon. He used 0.5 for the export elasticity of transformation and 0.6 for the import substitution elasticity.

Using these elasticities for Zambia, the decline in domestic prices required to achieve equilibrium is 45 percent. Using the decomposition in equation (1.28), the equilibrium real devaluation required purely as a result of the fall in the copper price in the period is 30 percent. The required adjustment for differential inflation is therefore 15 percent. The inflation differential accounts for only a small part (33 percent) of the equilibrium change in the domestic price level. Using the PPP approach (computed at Bank of Zambia), the real exchange rate depreciated by only 8 percent. A significant part of the depreciation as a result of the worsening terms of trade is missed. The base year for the computation of the real effective exchange rate in Zambia is 1994. This is the year in which the economy attained some reasonable stability.

Table 1.3: Changes in the Equilibrium Domestic Price level in Zambia, 1994-1999

Export Transformation ELASTICITY(Ω)	Import Substitution Elasticity(σ)				
	0.25	0.50	0.60	0.75	1.00
0.25	-82.5	-55.0	-48.5	-41.3	-33.0
0.50	-66.0	-49.5	-45.0	-39.6	-33.0
0.60	-62.1	-48.0	-44.0	-39.1	-33.0
0.75	-57.8	-46.2	-42.8	-38.5	-33.0
1.00	-52.8	-44.0	-41.3	-37.7	-33.0

1.4.3 The effect of Copper Price Shocks on the Money Supply

In this section, we test the hypothesis that a temporary trade shock will have monetary repercussions so that a foreign financial assets trajectory has as its counterpart a money supply trajectory. Since the series are of the same order of integration i.e I(1)[6], we use the cointegration method to ascertain whether there is a long run equilibrium relationship between the copper price and the money supply. The sample covers monthly data from 1995 to 1999.

According to the results presented in Table 1.10 (page 85), we do not reject the null of no cointegration between the copper price and the money supply, contrary to the prediction of the theory. One possible explanation for this could be that the sample covers the period in which the economy was fully liberalised in both its current and capital accounts. Private agents are free to hold foreign financial assets so that the amount of the windfall savings that find their way into the domestic economy may be small compared with the period of controls when most of the windfall savings were held by the central bank through the central bank retention of export earnings and through the asset effect. Another possible explanation may be the effect of sterilisation efforts conducted at the Central Bank through the sale of treasury bills and through open market operations. The impact effect of shocks to the copper price is, therefore, reflected more in movements in the nominal exchange rate.

When the windfall is used for debt repayment, it is unlikely to be reflected in an increase in reserves and the money supply.

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6 Monthly M1 data in the post liberalisation period is I (1) in contrast with annual data which is I(2).

1.4.4 Effect of Copper Price Shocks on the Consumer Price Index

We test for cointegration between the copper price and the consumer price index using the Johansen procedure. Both variables are I(1). The results (Table 1.10, page 85) show that there is no cointegration between these variables.

The tentative conclusion we can draw from this result is that the change in the real exchange rate, which follows a change in the price of copper, occurs mainly through a movement in the nominal exchange rate. This is the result predicted by the theory in an economy characterized by a liberalised foreign exchange market. It is important to note however that the sample covered is short and data on the CPI is not without errors (e.g. it includes the price of imported goods). The conclusions drawn here are therefore subject to this caveat.

In summary, the counterfactual analysis using the 123 model suggests that the real exchange adjustment to a terms of trade shock is far less than predicted by the model. Cointegration tests suggest that any real exchange rate changes occur mainly through changes in the nominal exchange rate rather than through the money supply and domestic prices. As a result of the country's heavy indebtedness, most of the windfall realised from a positive shock is used for debt servicing. The spending effect of a boom is therefore reduced. Consequently, the decline in non-traditinal exports as a result of a positive shock to the copper price is muted despite the absence of controls.

1.5 Empirical evidence in the pre-liberalisation period

If the Government intervenes with economic controls, the dynamic adjustment process becomes complicated. The presence of pervasive controls constrains the set of possible outcomes of trade shocks, qualifying the standard predictions of the theories, which assume flexibility in goods and factor markets. For example, price controls if enforced would constrain the expected expansion of the non-traded goods sector during a positive shock. We start our analysis of the effect of copper price shocks in a controlled economic environment with a narrative of macroeconomic events since independence in 1964. We divide the period into three episodes; the boom period, the demand management period and the structural reform period.

1.5.1 The Boom Period 1964 - 1974

Magnitude of the Boom

A large positive external shock occurred during the period 1964 to 1974. This was punctuated by small negative shocks in the 70's. The shock had reached its peak in 1969, when the terms of trade had increased by 98% relative to the 1964 level.

Copper consumption growth was rapid after 1964 due to the Vietnam War and high world economic growth. However, capacity growth lagged growth of demand. As a result, a protracted but discontinuous trade shock ensued. In order to estimate the size of the positive shock, we construct a non-shock counterfactual for the period 1964-74. In creating the counterfactual, we assume that the price remained at the 1963 level. We also make a conservative assumption that the volume of copper production does not respond to a change in the copper price. Kayizzi-Mugerwa (1991), using a Multi-sector Equilibrium Model for Zambia, noted that a price boom does not increase mineral output. An OLS regression of copper production on the price shows an insignificant t-value as shown in Table 1.4. The magnitude of the windfall is estimated in Table 1.5.

Table 1.4: Modelling Copper Production (Q) by OLS.

The present sample is 1968-1995

Variable	t-value	t-prob	Part R^2
Constant	1.5	0.15	0.09
Q_1	11.1	0.00	0.84
P^C	-0.61	0.55	0.02
P^C_1	-0.72	0.48	0.02

Table 1.5: Magnitude of the boom (US $' millions)

Year	Value of	Counterfactual	Windfall	Import	Adjusted
	Exports	Exports		Price Index	Windfall
1963	292	292	0	100	0
1964	346	325	22	103.2	21
1965	402	347	55	106.5	52
1966	562	299	263	124.2	212
1967	550	311	239	154.8	155
1968	659	338	321	164.5	195
1969	888	385	504	157.3	320
1970	791	356	436	175.8	248
1971	567	333	234	183.9	127
1972	616	365	251	195.2	129
1973	1002	358	644	221.0	291
1974	1208	373	835	274.0	305
Total			3804		2055

The present value of the windfall in 1964 is computed by discounting these gains using an appropriate risk adjusted required rate of return. Since we do not have the rate of return on physical assets, we use 10 percent which was the rate used by Bevan et al (1994) in their analysis of the cofffee boom in Kenya during the period 1975-1983. The present value of the windfall at the beginning of 1964 was US $ 1089 million. This represents a permanent income rise of US $ 109 million; approximately 20 percent of the 1963 GNP.

Characterization of the Economic Control Regime

After Zambia attained independence in 1964, existing economic controls were reinforced and new ones were added. Virtually every aspect of the economy was controlled.

The nature of economic controls somewhat depended on external sector developments. The magnitude of trade restrictions, for instance, tended to change with the availability of foreign exchange (an endogenous trade policy regime). Monetary policy was also linked to the availability of foreign exchange with episodes of financial repression and temporary financial liberalisation.

The controls probably exerting the greatest influence on behaviour and outcomes during the boom period and its aftermath were the exchange rate policy, interrelated restrictions on imports and foreign exchange and credit control. Price and wage controls were also applied, although enforcement was patchy.

The exchange rate was not changed until 1973 when Zambia got the first standby financial assistance from the International Monetary Fund. The fixed exchange rate was maintained by imposing tight capital and trade restrictions. In 1971, after a shock to the copper price, stringent exchange controls were imposed to protect foreign exchange reserves. These controls were further tightened after the copper price collapsed in mid-1974.

Positive net foreign assets were acquired until 1970, but depleted thereafter, turning negative from 1975 (Table 1.6, page 75).

The magnitude of trade restrictions tended to change with the availability of foreign exchange (an endogenous trade policy regime) being tighter during periods of negative than positive shocks. Policy tightened following the negative price shock of 1974. One impact of trade policy was the burgeoning of a capital-intensive manufacturing sector during the boom and its rapid contraction from 1974. This firmly supports the argument by Rattso and Torvick (1998) that as a result of import rationing, a positive trade shock can lead to a depreciation of the real exchange rate through the resource expansion effect, contrary to the predictions of the Dutch Disease theory.

Also linked to the availability of foreign exchange were episodes of financial repression and temporary financial liberalisation. Monetary policy changes were principally effected through changes in the minimum liquidity ratio, reserve requirements and directives to commercial banks. Interest rates had virtually no role as a tool of monetary policy.

During periods of high copper prices and budget surpluses, total liquid assets in the banking system increased and the fruits of the expansion in credit fell to the parastatal and private sector enterprises. The coincidence of budget deficits with balance of payments deficits during slumps, on the other hand, saw drastic declines in private sector credit.

Price controls were applied to three major categories of prices from independence: producer prices of agricultural products, prices of essential commodities and prices of products of parastatal companies. Parastatals were particularly disadvantaged by the failure to adjust prices during negative shocks; profitability fell sharply necessitating large subsidies from the Government. These became very costly for the budget.

Real wages grew strongly after independence in all sectors. Average mining wages exceeded those in most other sectors. This reinforced the contractionary effect of the real exchange rate appreciation in the agricultural sector.

Dutch Disease Effects of the Boom

We now turn to the impact of the boom on the goods market. An unanticipated rise in permanent income will normally lead to a rise in the demand for non-tradables and hence an increase in their relative prices and a transient windfall leads to a construction boom. We have shown that agents treated the rise in the copper price as temporary and their savings behaviour is consistent with what optimising agents with such an information set would do.

The first question we address is whether there were Dutch Disease effects. According to standard Dutch Disease analysis and its dynamic extension, the nominal exchange rate is expected to appreciate during the boom period. The booming tradables sector would expand output, attracting labour through higher wages and causing a contraction of the non-booming tradables sector. However, as we have shown, copper production did not show any tendency to increase during the boom period. The non-booming tradable sector is predicted to decline as the boom progresses. Conventionally, this occurs by squeezing manufacturing; but in Zambia non-mineral exports were largely agricultural. The value of agricultural production declined during the boom period (Aron 1999), indicating a possibility of some Dutch Disease type effects. There could have been other contributory factors such as controls on producer prices, which decreased farmer's incomes. This reduced the rural urban terms of trade resulting in rural urban migration. To the extent that the Dutch Disease effects were operative, rural urban migration may be indicative of a negative resource movement effect.

If the nominal exchange rate is held at a constant rate, the predicted real exchange rate appreciation occurs through an increase in the nominal money supply and prices, unless the increase in the money supply is sterilised. There is anecdotal evidence in the literature (Aron1999, Maipose 1997), which suggests that as a result of the exchange rate controls, the Zambian currency (Kwacha) was overvalued during the period. In Tables 1.6 and 1.7, we attempt to validate this assertion using a simple counterfactual analysis for the changes in the equilibrium real exchange rate caused by changes in the terms of trade. Table 1.6 shows that the nominal exchange rate remained constant throughout the boom period. The overvaluation could, therefore, have come from an increase in domestic inflation. We compare the required changes in the domestic price level using the 123 model by Devarajan et al (1993) with the actual movement in consumer prices.

With an improvement in the terms of trade of 98 percent at the peak of the boom in 1969, compared to the 1964 level, Table 1.7 indicates that the increase in the domestic price level should have ranged between 98 percent and 245 percent. These figures define the magnitude of the appreciation in the equilibrium real exchange rate. The magnitude of the increase depends on the export elasticity of transformation and the import substitution elasticity. In Table 1.6, we see that the price level increased by only 42 percent. This was partly caused by price controls and by the resource expansion effect of an increase in foreign exchange on manufacturing production. There is therefore insufficient evidence to show that the exchange rate during the boom era was overvalued. To the contrary we may be inclined to conclude that the real exchange rate was actually undervalued, partly as a result of the fixed exchange rate policy, and partly through insufficient price adjustment. Therefore, the Dutch Disease effects cannot be explained by the trends in the nominal exchange rate and prices. Using 1980 data, Kayizzi-Mugerwa (1991), in his Multi-sector General Equilibrium study on Zambia, found that the boom had no effect on agriculture output and exports but had a negative impact on manufacturing output and exports. His result is inconsistent with the resource expansion effect of the boom. This result is also contrary to that of Aron (1999) who found that the protected importables sector, manufacturing, grew dramatically from a low base.

Table 1.6: Macroeconomc Developments (1964-1974)

	Copper	Discount	ExRate	NFA	CPI	Investment
	Price	Rate	K/US $	(K millions)		% of GDP
1964	33.75		0.71		9.5	
1965		4.5	0.71	149	10.2	14
1966		4.5	0.71	158	11.3	25
1967	50.95	5	0.71	134	11.9	13
1968	56.15	5	0.71	140	13.1	27
1969	66.44	5	0.71	268	13.5	23
1970	64.04	5	0.71	382	13.8	33
1971	49.02	5	0.71	182	14.7	33
1972	48.58	5	0.71	75	15.4	30
1973	80.58	5	0.65	68	16.4	25
1974	93.26	5	0.64	75	17.7	26

Table 1.7: Change in the Equilibrium Domestic Price level

Export Transformation Elasticity	Import Substitution Elasticity				
	0.3	0.5	0.6	0.8	1.0
0.25	245.0	163.3	144.1	122.5	98.0
0.50	196	147	133.6	117.6	98.0
0.60	184.5	142.5	130.7	116.1	98.0
0.75	171.5	137.2	127.0	114.3	98.0
1.00	156.8	130.7	122.5	112.0	98.0

The economy saw an increase in domestic investment to GDP ratio during the period of the boom. Similarly investment in foreign assets was positive. According to the theory, this has the effect of stretching the investment boom beyond the period of the positive shock. In fact, the investment to GDP ratio rose to 37% in 1975 and dropped below 20% from 1978. The accumulation of foreign assets during the boom has the advantage of preventing a bunched investment boom that would lead to a significant rise in the price of non-tradable capital goods. Collier and Gunning (1995) argued that the increase in the price of nontradable capital goods could, however, lead to a switch to increased imports of capital goods which are more efficient.

1.5.2 Demand Management Period (1974-83)

Problems started during the second republic (the one party regime), which coincided with an unprecedented economic decline triggered off by the fall in the copper price in 1974. One party politics was introduced in 1972. A few years later, copper prices fell and remained depressed until the late 1980's.

In response to the negative shock, a two-part demand related adjustment was adopted. This was a strategy that concentrated on reducing expenditure and the mobilisation of external short-term credit complemented by minor devaluations to discourage imports and to enhance the profitability of the mining sector.

Zambia concluded standby arrangements with the IMF in 1973, 1978, 1981 and 1983. All four arrangements emphasised the need to reduce spending especially by the Government, without any attempt to restructure the economy. This became a persistent process sustained by foreign loans. According to the IMF, whose financial programme is based on the Polak (1957) model, it is generally easier to reduce absorption than to increase production. As a result, policies affecting absorption are often put in place when a rapid decline in the current account deficit is mandatory. Domestic absorption declined during the period 1974-1979, increasing again after 1979 when the copper price increased sharply. The decline in domestic absorption during the negative shock can be partly explained by a fall in investment (Table 1.8). Aron (1999) shows that there was a rapid fall off in construction during the slump. Kayizzi-Mugerwa (1991) showed that there was unimpeded decline in domestic investment during the period 1978 to 1988. The impact of this drastic decline in capital formation can be seen in the deteriorated infrastructure, worn-out machinery and the weak construction sector.

Table 1.8: Investment as a percentage of GDP

Year (19')	75	76	77	78	79	80	81	82	83
Investment	37	21	25	17	18	19	17	17	14

Given the status and the creditworthiness the country enjoyed at that time, the profile of Zambia's loans were largely commercial; short term and non-concessional. As a result of this and the increase in world interest rates in the early 1980's, Zambia's external debt grew rapidly and became a brake on the country's economic development.

The chosen solution of demand related adjustment had become the thrust of the policy regime for almost 10 years. This was done without an attempt to change the structure of the economy either through resource re-allocation, institutional reform, or the liberalisation of markets.

Goods Market

When we employ the 123 model by Devarajan, the depreciation of the equilibrium real exchange rate following the negative shock should have been 31 percent. However, the consumer price index rose by 343 percent during the period while the nominal exchange rate depreciated by only 162 percent. These estimates indicate that the real exchange rate was overvalued during this period of the negative shock, rendering it difficult for the recovery of the non-booming tradables sector from any earlier Dutch Disease effects. Since trade controls were more stringent after the negative shock, the resource contraction effect may have had an appreciating effect on the real exchange rate. Aron (1999) found that the negative shock caused a sharp contraction of the import intensive industrial sector.

1.5.3 Structural Reform Period (1983 onwards)

After 1983, the thrust of economic policy was characterized by a combination of expenditure reduction measures to attain macroeconomic stability and expenditure switching policies for more efficient resource allocation and the promotion of exports mainly through exchange rate adjustment.

The period under review can be demarcated into three distinct economic policy reform phases. The first was the World Bank/IMF supported stabilisation and drastic expenditure switching policies from 1983 to 1987. This was followed by the homemade state intervention and control phase known as the new economic recovery programme (NERP). This was put in place when Zambia broke away from the IMF programme from 1987 to 1989. The last phase is the diversified economic and political reform period from 1990 and as continued by the new government, which came into power 1991. These phases represent shifts in policy and the degree of commitment at the level of implementation.

First Structural Adjustment Programme

In 1983, Zambia reached a structural adjustment agreement with the IMF and the World Bank. The agenda of policy included resource reallocation within the public sector, the liberalisation of a wide range of markets, and devaluations, which after 1985 became the dominant policy instrument through the weekly foreign exchange auction. The economy became increasingly indebted during the period. The IMF package increased the nation's obligation to service its debt and outstanding arrears. Zambia, therefore, saw not only an increase in the outflow of foreign funds but an increasing pressure on the currency. In May 1987, the Government abandoned the donor supported structural economic reforms and developed its own programme with the theme of "growth from own resources".

The New Economic Recovery Programme (NERP)

The new economic recovery programme was adopted following a break from the IMF. The programme entailed abandonment of structural adjustment and the agenda of policy reform contained a wide range of measures as follows:

- Revaluation of the exchange rate from US $ = K25 to K 8 in May 1987 followed by a devaluation to K10 in 1988 and again to K 16 in June 1989.
- Downward Adjustment in the interest rate
- Guided trade liberalisation focussing on removing the restrictions on imports of intermediate capital goods and raw materials and controlling of imports of consumer goods that were also domestically produced.
- Control of prices of basic goods
- Imposition of a wage freeze
- Reduction of Government expenditure and deficit financing
- Selective and targeted food subsidies through the use of coupons
- A debt service moratorium by imposing a 10 percent ceiling on debt servicing after deducting the needs of the key economic lifelines - the mining company, Zambia Airways and imports of oil and fertiliser.
- Debt-equity swaps

- Foreign exchange retention for non-traditional exporters was increased from 50 percent to 100 percent.
- A return to the administrative allocation of foreign exchange taking into account priority economic sectors.
- Retrenchment and re-deployment in the public sector

The need for donor support brought Zambia back to negotiations with the IMF and a new policy framework paper was approved in September 1989. This development coincided with the agitation for the restoration of multiparty politics and led to new phase of simultaneous economic liberalisation and democratization and the birth of the third republic.

Despite the good prospects in terms of macroeconomic stability, all the indicators of macroeconomic stability -inflation rate, interest rate, exchange rate, and the rate of money supply growth- have not been stable for any considerable period of time. The economy became permanently handicapped after the negative shock of 1974. Policies adopted at the time left the economy with a huge debt burden, which has deterred the country's economic progress. Noticeable achievement in macroeconomic stability appears to depend more on external inflows of aid than on internal market resilience.

In addition, the extent to which some monetary, fiscal and trade policies were sequenced at the level of implementation was rather disruptive to creating conditions for sustainable development. The across the board reforms, leading to the lack of appropriate sequencing, appear to have contributed to poor economic performance. For example;

- Liberalisation of imports had been undertaken before adjustment of the exchange rate and before removal of policy restrictions that discouraged exports.
- Interest rates were significantly increased prior to both fiscal discipline by the Government and the commercialisation of the public enterprises (the main borrowers from the banks)

This led to an inflation- devaluation spiral with a harmful impact on the adjustment process. Import liberalisation without adequate depreciation of the real exchange rate failed to moderate the balance of payments deficit, promoted deindustrialisation, and discouraged exports.

1.6 Conclusion

Empirical evidence in the post-liberalisation period in Zambia seems to support the prediction of the Dutch Disease theory that an increase in the copper price leads to de-industrialisation in the non-booming non-traditional export sector. However, as a result of the economy's indebtedness, the resource movement and spending effects are dampened so that the overall effect is weak. The appreciation of the real exchange rate occurs mainly through nominal exchange rate appreciation rather than increased money supply and domestic prices. In fact, an increase in the copper price reduces the composite price level through the appreciation of the nominal exchange rate.

In the pre-liberalisation period, economic controls such as the fixed exchange rate and price controls reduced the negative effect of the real exchange rate appreciation on the lagging sector. Contrary to the anecdotal evidence in the previous literature that the real exchange rate was overvalued during the boom, we argue that in fact it was undervalued. The real exchange rate did not appreciate to its new equilibrium level. The equilibrium real exchange rate changes as a result of a change in the terms of trade and a sustainable trade balance. The overvaluation, however, occurred during the slump when the depreciation in the nominal rate was insufficient to offset the increase in domestic inflation. Trade restrictions, through the resource expansion and resource contraction effects in the booms and slumps respectively, have provided another channel for explaining the under-valuation and over-valuation in the two periods.

During the boom period of 1964-74, investment (proxied by gross fixed capital formation) expanded. Agents perceived the boom as temporary so a great part of the income was saved, leading to a construction boom. Problems started during the period of the negative shock, which, unfortunately, was misperceived to be temporary but persisted until the late 1980's. The huge debt, which was accumulated during this period, has become a major brake on the country's progress despite the occurrence of another positive shock beginning 1988. Any foreign exchange windfalls are used for debt servicing instead of investment. The central argument we make in this paper, therefore, is that the standard predictions of the theory are qualified not just by the control regime but also by the economy's international investment position.

As a result investment is no longer dependent on the price of copper but on external aid flows most of which are not without conditionalities. The impact of aid and the accompanying stablisation programmes is analysed in the next paper.

1.A Tables

Table 1.9: Augmented DickeFuller Test Results

The sample for consumption and investment covers annual data from 1971-1996 while the rest of the variables consist of monthly data from 1994 to 1999.

Variable	Description	Ordrer of Integration
C	Consumption	1
I	Investment	1
ER	Nominal Exchange Rate	1
RER	Real Exchange Rate	0
P^C	Copper Price	1
CPI	Consumer Price Index	2
$M1(Annual)$	Broad Money	2
$M1(Monthly)$	Broad Money	1

Table 1.10: Cointegration Results (Copper Price and Variable)

The sample for consumption and investment covers annual data from 1971-1996 while the rest of the variables consist of monthly data from 1994 to 1999

Variable	$Trace$	$95\%C.V$	α	$\chi^2(1)$ for $\alpha = 0$
ER	21.82**	15.4	-45.389	0.75[0.39]
NTE	27.2**	15.4	-5.5884	10.9[0.0010]
$M1$	3.476	3.8	-0.00696	
CPI	15.74*	15.4	-4.2306	
C	8.971	15.4	0.00204	
I	7.919	15.4	0.000124	

Table 1.11: Zero Restrictions on the α coefficient

(Cointegration test between the copper price and the exchange rate)

Sample covers monthly data from 1994 to 1999

Equation for which $\alpha = 0$	$\chi^2(1)$
lER	0.75[0.39]
P^C	15.8[0.0001]

Table 1.12: ECM for the Nominal

Exchange Rate (lER).

59 observations from 1994 M3 to 1999

Regressor	Coeff	Std.Error	T-Ratio	Prob
$Intercept$	-0.037	0.075	-0.49	0.62
$\Delta P^C(-1)$	-0.066	0.021	-3	0.003
$\Delta lER(-1)$	0.45	0.11	4	0.000
$ecm(-1)$	0.016	0.024	0.65	0.228

Table 1.13: ECM for the Copper

Price (P^C)

59 observations from 1994 M3 to 1999

Regressor	Coeff	Std.Error	T-Value	Prob
$Intercept$	1.8	0.46	3.90	0.000
$\Delta P^C(-1)$	0.139	0.1299	1.07	0.289
$\Delta lER(-1)$	0.137	0.6722	0.20	0.839
$ecm(-1)$	-0.577	0.146	-3.9	0.000

Table 1.14: Results of Bivariate VARs

(Copper Price and Variable)

Sample covers monthly data from 1994 to 1999

Table shows coefficients while t-values are in parenthesis.

Variable	Cont	Lag1	Lag2
RER	0.99(0.14)	–11.08(-1.71)	12.1(1.71)
lER	-0.033(-1.51)	-0.050(-2.41)	0.035(1.49)
$M1$	–0.01(-1.63)	0.053(1.04)	0.043(0.79)
CPI	-0.004(0.212)	-0.009(-0.513)	0.01(0.618)
NTE	-3.22(-0.69)	-1.65(-0.39)	-6.212(-1.37)

Cont. refers to the contemporaneous effect

Table 1.15: ECM for Non-Traditional

Exports (NTE).

Sample covers monthly data from 1994 to 1999

Regressor	Coeff	Std.Error	T-Ratio	Prob
$Intercept$	1.3214	0.36776	3.6	0.001
$\Delta P^C(-1)$	0.13734	0.19590	0.70	0.49
$\Delta lNTE(-1)$	-0.17761	0.11885	-1.5	0.141
$ecm(-1)$	-0.82485	0.23271	-3.54	0.001

1.B Hypotheses on the Long-Run and Adjustment Coeffcients.

The I(1) model H(r) can be formulated as the condition that the rank of Π is less or equal to r. This formulation shows that I (1) models form a nested sequence of models

$H(0) \subset ... \subset H(r) \subset .... \subset H(p)$

Where $H(p)$ is the unrestricted VAR model or the I(0) model, and $H(0)$ corresponds to the restriction $\Pi = 0$, which is just a VAR model of the process in differences. The models in between ensure cointegration. The β are the cointegrating vectors and the $\beta' X_t$ is the disequilibrium error. The coefficient α measures adjustment to past equilibrium errors once these have been uniquely defined.

The parameters α and β are not uniquely defined in the sense that given any choice of α and β and any non-singular matrix $\xi(r \times r)$, the choice $\alpha\xi$ and $\beta(\xi')^{-1}$ will give the same Π. One way of expressing this is that what the data can determine is the space spanned by the columns in β, the cointegrating space and the space spanned by α, the adjustment space.

Any two choices of β are related by the non-singular transformation $\xi(r \times r)$, i.e. $\beta_1 = \beta_2\xi$. One cannot estimate the individual coefficients of β unless one specified a normalization or identification. This is obvious for $r = 1$ where estimation of a single coefficient has no meaning, but where the estimation of the ratio of the two coefficients is what one is interested in.

Even though one cannot estimate individual coefficients without identifying the system, it is nevertheless possible to test some hypothesis on the parameters without necessarily identifying the system first. Natural economic questions can be formulated as simple linear restrictions on the cointegrating space. In a four variable VAR model, the hypothesis that the cointegrating relation contains only the first two variables can be written as that $R = [1, 1, 0, 0]$. The restriction that these coefficients are equal with opposite sign can be expressed as the indirect parameterization $R'\beta = 0$. It is convenient to express these restrictions in the direct parametrization in terms of $H = R\perp$:

$$\beta = H\varphi \tag{1.29}$$

where $H\ (p \times s)$ is known and $\varphi(s \times r)$ is the parameter to be estimated. For $R = (1, 1, 0, 0)'$ the matrix H is given by

$$H = \begin{bmatrix} 1 & 0 & 0 \\ -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \tag{1.30}$$

such that $H\varphi = (\varphi_1, -\varphi_1, \varphi_{2,}\varphi_3)'$. The condition can also be expressed geometrically as a restriction on the cointegrating space $sp(\beta) : sp(\beta) \subset sp(H)$

In other words, whereas the restriction $\text{II} = \alpha\beta'$ gives rise to the estimation of an $r-$dimensional subspace chosen in R^P, the restriction above restricts the subspace to lie in the given subspace $sp(H)$ of R^P. This hypothesis about the coefficients can be formulated without first identifying the cointegrating relations, since it is formulated as a restriction that holds for all the vectors in $sp(\beta)$.

The hypothesis that only the differential in the last two variables enters the long run relation can be expressed with the choice

$$R = \begin{bmatrix} 0 \\ 0 \\ 1 \\ 1 \end{bmatrix}, R \perp = H = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & -1 \end{bmatrix} \tag{1.31}$$

If the hypothesis is that the last variable is excluded from the cointegrating relations, this can be formulated as

$$R = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}, R \perp = H = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix} \tag{1.32}$$

In our bivariate VAR model including the log of the nominal exchange rate and the copper price (in that order), we test the following restriction;

$$R = \begin{bmatrix} 1 \\ 1 \end{bmatrix}, R \perp = H = \begin{bmatrix} 1 \\ 2.6 \end{bmatrix} \tag{1.32}$$

The above restriction is accepted with a p-value of 0.95. The associated $\beta = H * \theta$ is

$$\beta = \begin{bmatrix} 2.6 \\ 6.7 \end{bmatrix} \tag{1.1}$$

The above restriction imposes a ratio of 1: 2.6 on the cointegrating parameters despite the fact that β is not identified. This result shows that there is a negative relation between the nominal exchange rate and the copper price. We carry out a similar test for the log of non-traditional exports and the copper price (in that order) with the following restriction;

$$H = \begin{bmatrix} 1 \\ 1 \end{bmatrix} \tag{1.2}$$

This hypothesis is accepted with a p-value of 0.80. What this result implies is that the coefficients on non-traditional exports and the copper price are equal. The increase in the copper price has an almost equal negative effect on the log of non traditional exports.

An interesting question is whether any linear combination of the variables in the model is stationary. This amounts to asking the question as to whether a given vector say $b' = (1, -1, 0, 0)$ is a cointegrating vector. More generally one can consider a given set of s vectors b $(p \times s)$ and ask whether they belong to the cointegrating space. This can be expressed as

$$\beta = (b, \phi) \tag{1.33}$$

where the $p \times (r - s)$ matrix containing the other cointegrating vectors is to be estimated. This hypothesis can be expressed as

$$sp(b) \subset sp(\beta) \tag{1.34}$$

The above can be used to formulate the hypothesis that one of the components of the vector X_t is in fact stationary. If for instance we take $b' = (0, 0, 1, 0)$, then the hypothesis specifies that the third variable is stationary. Thus the stationarity of individual series can be formulated in a natural way in terms parameters in a multivariate system, and is a hypothesis that is conviniently checked inside the model rather than a question that has to be addressed before the analysis starts. Thus one can include in the cointegration analysis, variables that are economically useful as long as they are I(1) or I(0). By adding an extra variable to the vector $X_{t,}$ we add an extra cointegrating vector, that is we add an extra dimension to the cointegrating space. This possibility to have unit vectors as cointegrating vectors allows us to have a definition of I(1) that allows both I(1) and I(0) components.

The general hypothesis is of the form

$$\beta = (H_1\varphi_1, H_2\varphi_2) \tag{1.35}$$

where for $i = 1, 2$, H_i is $p \times s_i$ and φ_i is $s_i \times r_i$ with $r_i \leq s_i \leq p$ and $r_1 + r_2 = r$. We impose $p - s_1$ restrictions on one set of cointegrating vectors and $p - s_2$ on the remaining vectors.

The natural question to ask about the adjustment coefficient is whether the coefficients on α is zero for a certain subset of equations. This hypothesis means that the subset of variables is weakly exogenous, for the long run parameters and the remaining adjustment parameters. The hypothesis can be formulated as a linear restriction on the columns of α as follows.

$$\alpha = A\psi \tag{1.36}$$

If $r = 1$, we formulate the weak exogeneity of the last three variable in a four variable model as

$$A = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix} \tag{1.37}$$

Zeros in a row of α means that the disturbances from this equation cumulate to a common trend since $\alpha\perp$ contains the corresponding unit vector.

In our bivariate VAR models, we use the above hypothesis to test for the weak exogeneity of the variables. In the model including the log of the nominal exchange rate and the copper price (in that order), exogeneity of the copper price is specified as follows;

$$A = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \quad (1.38)$$

This hypothesis simply means that the copper price is weakly exogenous for the long run parameters and the remaining adjustment parameters. This hypothesis is strongly rejected with a p-value of 0.0002. We go on to test for the weak exogeneity of the nominal exchange rate using the following specification,

$$A = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \quad (1.39)$$

This hypothesis is accepted with a p-value of 0.78. In the bivariate model involving the log of non traditional exports and the copper price, we test for the weak exogeneity of the copper price and accept it with a p-value of 0.39. The hypothesis that non-traditional exports are weakly exogenous is rejected with a p-value of 0.0004.

Chapter 2
Effect of Stabilisation Policies on Macroeconomic Performance in Zambia.

2.1 Introduction

Since the negative copper price shock of 1974, Zambia has experienced twin problems of high inflation and a deficit in the balance of payments. To reduce these pressures, an IMF supported stabilisation programme has been adopted. The International Monetary Fund plays an important role in the adjustment efforts of its member countries by assisting in the design of programmes aimed at achieving viability of the balance of payments, accompanied by price stability and a sustainable high rate of growth. They also provide financing to support these programmes[7]. Broadly defined, stabilisation (or financial programme) is a package of policies designed to eliminate disequilibria between aggregate demand and aggregate supply in the economy, which typically manifests itself in balance of payments deficits and rising prices.

While no single theoretical model underlies all financial programmes, a broad framework within which most of them are formulated has evolved in the IMF over the years. Within this framework, there is a fairly well defined relationship between money supply,

[7] Santaella (1996) details the macroeconomic characteristics of countries prior to their adopting a Fund supported program. Typically, the countries are suffering from a worsening current account balance, a loss of international reserves and an increase in inflation.

the balance of payments and domestic prices in which the supply of and demand for money play a central linking role.

The effects of these policies on the real sector are treated less explicitly. When feedbacks from the real sector are taken into consideration, the analysis is made on a more informal case-by-case basis rather than in the context of an explicit formal methodology. It is therefore difficult to say a priori whether a given financial programme will have undesirable effects on growth and employment, something that has worried policy makers and academic economists alike. Robicheck (1967) observed that in implementing a financial programme, one has to be aware of the need to frame programmes that are compatible with the aspirations for rapid growth.

IMF programmes are controversial. Governments that enter into agreements with the IMF claim that it is for the better, yet incidences of strikes, riots and ransacking of supermarkets manifest that IMF programmes mobilise some resistance. In Zambia, the riots that took place in 1986 forced the authorities to abandon the IMF programme in 1987. Scholarly opinion is also divided: statistical findings range over a spectrum of possible conclusions. Khan and Haque (1998) concluded that IMF-supported programs are generally successful in stabilising the economies. On the other hand, Przeworski and Vreeland (2000) claim to have found evidence that programme participation lowers growth rates.

In fact, Khan and Haque (1998) argued that there is no theoretical guarantee that Fund adjustment packages will achieve their desired outcomes. They describe Fund programs as complex packages of policy measures, which combine aggregate demand policies with supply enhancing, relative price policies. The theory underlying the dynamic link between the policy package and a set of multiple macroeconomic variables is not well established. They also argue that Fund supported programs are only one of the macroeconomic "shocks" to a country with a programme. External shocks such as changes in the terms of trade or in the cost of servicing debt will also affect the country's ability to achieve the objectives of the programme.

This paper is aimed at establishing the appropriateness of the analytical approach used in the design of the financial programme using a case study of Zambia. The effectiveness of IMF stabilisation policies on the balance of payments depends crucially on the exchange rate regime in operation. In Zambia, the IMF policies have been applied to the economy largely under a flexible exchange rate regime. The exchange rate was fixed until 1973. After the negative shock of to the copper price in 1974, reserves have remained inadequate to support a fixed exchange rate for any considerable period of time. We should therefore expect the stabilisation policies to be ineffective in correcting balance of payments disequilibria.

In appendix 2.C of the paper, we have some results on the effects of adverse aid shocks on the programme and how policy responses to such shocks affect macroeconomic variables such as the nominal exchange rate, inflation, interest rates and private sector credit, all of which have implications for economic growth. This work is still in progress and it is important since the financial programme is drawn with the assumption that debt service obligations are financed by aid inflow.

The paper begins by describing the general macroeconomic framework, which is consistent with both the World Bank and the IMF analytical approaches in section 2.2. Sections

2.3 describes the analytical approach of the IMF. The World Bank model is included in appendix 2.B. Sections 2.4 and 2.5 provide an emprical investigation of the link between the money supply, the balance of payments, the exchange rate, real GDP and inflation. Section 2.6 concludes.

2.2 The General Macroeconomic Framework

The general macroeconomic framework presented in this section is consistent with both the IMF and the World Bank analytical approaches. It assumes that the economy is divided into four sectors, the private sector, the public sector, the external sector and the domestic banking system, which is assumed for simplicity to consist solely of the central bank.

2.2.1 The Private Sector

The private sector budget constraint is given by;

$$Y - T - C_P - \Delta K = \Delta M + \Delta F_P - \Delta D_P \tag{2.1}$$

The private sector uses the sale of its output goods (Y) to pay for taxes (T), for consumption (Cp) and investment (ΔK) and accumulate financial assets. The private sectors net accumulation of financial assets consists of money (ΔM) and foreign assets (ΔF_P), minus borrowing from the banking system (ΔD_P).

2.2.2 The Public Sector

The public sector receives taxes and uses the proceeds for consumption (Cg). It does not engage in any investment and any surplus is devoted to the accumulation of foreign financial assets (ΔFg) net of borrowing from the banking system (ΔDg). This gives the following public sector budget constraint:

$$T - C_g = \Delta F_g - \Delta D_g \tag{2.2}$$

2.2.3 The External Sector

The foreign sector receives revenues in the form of imports purchased by the domestic economy (Z) and it spends on domestic exports (X). The external sector budget constraint is given by:

$$X - Z = \Delta F + \Delta R \tag{2.3}$$

ΔF is the change in foreign assets for both the private and public sectors and ΔR is the change in reserves.

2.2.4 The Financial Sector

Finally, the central bank is a financial intermediary, which acquires assets in the form of international reserves and claims on the domestic private and public sectors (ΔD) and supplies its own liabilities in the form of money to the private sector. These transactions must satisfy the following balance sheet constraint:

$$\Delta M = \Delta R + \Delta D \tag{2.4}$$

Summing (2.1) to (2.4) yields;

$$Y - C_P - C_g - \Delta K - X + Z = 0 \tag{2.5}$$

Equation (2.5) is the national income identity. In the following section, we utilise these balance sheet constraints in the IMF financial programming model.

2.3 The IMF Financial Programming Model

The Fund's task is to provide advice to countries on macroeconomic policy and to finance temporary balance of payments disequilibria. When the balance of payments deficits are not inherently temporary, they must be rendered so by corrective policy measures, which typically involve a reduction in domestic credit expansion and devaluation. The Fund approach to balance of payments adjustment is based on the models by Polak (1957) and Robicheck (1967). The fundamental ingredients of this approach are:

- Real GDP is assumed to be exogenously determined

$$Y = Py \tag{2.6}$$

where Y denotes nominal GDP, P denotes the domestic price level and y is real GDP, which is regarded as exogenous. The change in nominal GDP can be approximated as:

$$\Delta Y = \Delta P y' + P' \Delta y \tag{2.7}$$

In this equation, both last period's real GDP, $y\prime$ and last year's price level $P\prime$ are predetermined. The change in real GDP is exogenous while the change in the domestic price level is the endogenous variable.

- The velocity of money is assumed to be constant:

$$\Delta M^D = v \Delta Y \tag{2.8}$$

The v is a constant, which represents the inverse of the income velocity of money and M^D is the demand for nominal balances.

- The money market is assumed to be in flow equilibrium. Therefore;

$$\Delta M^s = \Delta M^D = \Delta M \tag{2.9}$$

where M^S is the supply of money.

These three equations together with identity (2.4) permit the change in foreign exchange reserves to be expressed in terms of exogenous variables and policy variables as follows:

$$\Delta R = v \Delta P y' + v P' \Delta y - \Delta D \tag{2.10}$$

ΔD, which consists of domestic credit to the private and public sectors is a policy variable controlled by the monetary authorities. Equation (2.10) is the fundamental equation of the monetary approach to the balance of payments, which was pioneered by the Fund. The balance of payments is expressed as the difference between the private flow demand for money and the flow of domestic credit. The model is based on the assumption of a constant velocity of money and the exchange rate.

In this simple model, increases in domestic credit will be offset by decreases in foreign reserves on a one for one basis. Based on a targeted change in foreign exchange reserves, and a projected change in real GDP and hence money demand, the solution to equation (2.10) provides the desired path for domestic credit. Since policy makers' loss functions in countries facing balance of payments problems presumably attach little weight to positive deviations of R from its desired value, the targeted expansion in domestic credit is set as a ceiling. Thus equation (2.10) provides the rationale for the use of credit ceilings as performance criteria in Fund programmes. By monitoring the expansion of domestic credit, it is possible to determine if the program is on track in achieving the targeted increase in reserves. From the above description, it is obvious that the demand for money plays a critical role.

For domestic credit to have a predictable effect on the balance of payments, the demand for money must bear a stable relationship to a limited set of independent variables. What is needed in this framework is that the demand for money, or velocity, responds in a predictable fashion to changes in variables such as real income and prices.

Equation (2.10), however contains two endogenous variables -ΔR and ΔP- so that it is not possible to find a unique solution for both conditional on a chosen expansion of credit. The solution is depicted in figure 2.1.

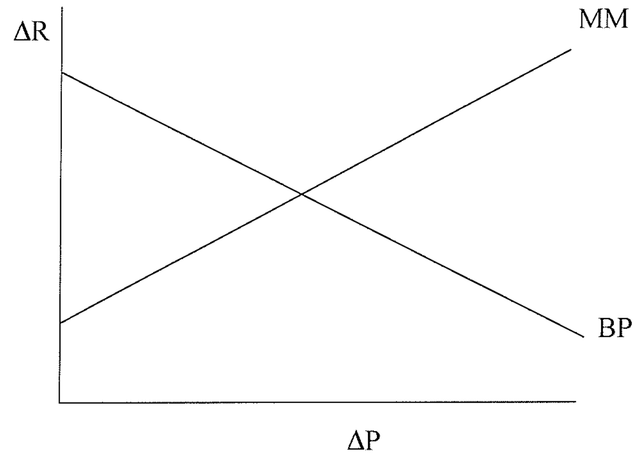

Fig 2.1: The Polak Model

Equation (2.10) is a straight line in the $\Delta R - \Delta P$ space, denoted MM, with intercept of $vP\prime\Delta y - \Delta D$ and a positive slope of $vy\prime$. The intuition behind is that an increase in the price level reduces real money balances and thus leads to excess demand for money. To achieve equilibrium in the money market, the nominal money supply must be increased through an increase in reserves. A reduction in the rate of expansion of domestic credit will shift the line upwards, so an improvement in the balance of payments will be associated with any rate of inflation ΔP. But altering the rate of credit expansion can only alter the position of the line. It cannot determine where the economy will be found along this line at any moment of time so that the domestic price level will be indeterminate in this model.

This indeterminacy is removed by taking into account the balance of payments identity (2.3) and an import demand function. Letting imports depend on nominal GDP, the latter can be written in the form:

$$Z = aY \tag{2.11}$$

$$Z = a(Y' + P'\Delta y + y'\Delta P) \tag{2.12}$$

When we substitute (2.12) into the balance of payments identity (2.3), we have;

$$\Delta R = X - \Delta F - a(Y' + P'\Delta y) - ay'\Delta P \tag{2.13}$$

This defines the second relationship between the change in reserves and the change in prices. Equation (2.13) is the well known Polak model which is a straight line BP with intercept $X - \Delta F - a(Y\prime + P\prime\Delta y)$ and a negative slope equal to $-ay\prime$. The intuition behind is that an increase in prices raises nominal income at a constant real income level, increasing imports through the marginal propensity to import parameter a. Its intersection with the positively sloped line MM yields the equilibrium levels of the balance of payments (ΔR) and inflation (ΔP).

In order to permit shifts in the BP line, we modify the Polak model by including the influence of the nominal exchange rate on prices, imports and exports. The price level is now defined as follows:

$$\Delta P = (1 - \Theta)\Delta P_D + \Theta\Delta e \tag{2.14}$$

ΔP_D is an index of domestic prices, Θ is the share of importables in the overall price index and e is the nominal exchange rate defined as the domestic currency price of a unit of foreign currency. This introduces an additional policy variable in form of the exchange rate. We also allow imports to depend on the relative price of importable goods in terms of domestic goods as follows:

$$Z = Z' + (Z' - b)\Delta e + b\Delta P_D + a\Delta y \tag{2.15}$$

where b is a positive parameter that measures the responsiveness of the volume of imports to the relative price of importables. According to equation (2.15), increases in domestic real GDP and in domestic prices raise spending on imports, while devaluation will reduce imports if the volume of imports is sufficiently responsive to relative prices[8].

Finally, the volume of exports is assumed to depend on the relative price of foreign goods in terms of domestic goods, while net foreign capital inflows are taken as exogenous in foreign currency terms;

$$X = X' + (X' + c)\Delta e - c\Delta P_D \tag{2.16}$$

$$\Delta F = \Delta f(1 + \Delta e) \tag{2.17}$$

Δf are net foreign capital inflows in foreign currency terms. Substituting the price identity (2.14) into the version of (2.10), derived from (2.4), as well as (2.15), (2.16), and (2.17) into the balance of payments identity (2.3) allows the expanded model (the Monetary and the Polak Model) to be written as[9];

---

8 It is possible for expenditure on imports to rise after a devaluation purely as a result of valuation effects. This occurs if the volume of imports is not responsive enough to the relative prices

9 It assumed that the initial prices are equal to unity. $P = P_D = eP_f = 1$

$$\Delta R = vy'(1-\Theta)\Delta P_D + vy'\Theta\Delta e + v\Delta y - \Delta D \tag{2.18}$$

$$\Delta R = (X' - Z' - \Delta f)(1 + \Delta e) + (b + c)\left[\Delta e - \Delta P_D\right] - a\Delta y \tag{2.19}$$

In the expanded model, the variable in the horizontal axis becomes ΔP_D, the change in domestic prices. More importantly, control over the nominal exchange rate, e allows the authorities to shift the locus traced out by equation (2.13) so that a better balance of payments outcome can be attained for a given rate of inflation. With two instruments at their disposal, the authorities can now attain the targeted values for both the balance of payments and the rate of inflation.

The model presented thus far is a classical form of the Polak model in which we have nominal income on the horizontal axis. With real income fixed, the model can be presented with the change in prices only on the horizontal axis. The Keynesian closure model is one solved for the change in real GDP taking the price level as given. The Keynesian model predicts a deterioration in the balance of payments and an increase in real income as a result of an increase in domestic credit. The classical closure on the other hand predicts a deterioration in the balance of payments and rising inflation.

The above analysis has shown how credit ceilings can be derived from the basic monetary model. In practice, the ceiling on the expansion of total domestic credit is frequently accompanied by a ceiling on the expansion of credit to the non-financial public sector. This sub-ceiling plays a dual role. On one hand it assists in the monitoring of the overall domestic credit ceiling since in the Fund's experience, violations of the overall credit ceilings frequently tend to originate from excessive expansion of credit to the public sector. More importantly, the public sector sub-ceiling ensures that the availability of credit to the private sector is not curtailed by the overall credit ceiling. Formally, the expansion of credit to the private sector functions as a secondary target in Fund stabilisation programmes. Such a target, say D_p^*, can be achieved by the expansion of credit to the public sector as an instrument, according to:

$$\Delta D_G = \Delta D - \Delta D_p^* \tag{2.20}$$

The target value of private credit expansion is typically related to the projection of nominal GDP. For example, it may be postulated that the expansion of credit to the private sector keep pace with the increase in GDP. Thus, the targeted expansion of private credit would be derived from a demand for credit relationship such as;

$$\Delta D_P^* = (\frac{D_P}{Y})'\Delta Y \tag{2.21}$$

From the non-financial public sector's budget constraint, equation (2.21) fixes the public sector budget constraint from below the line (from the financing side). The public sector must adjust to this programmed deficit by increasing revenue and or reducing expenditure.

A similar model to the one presented above was used by Flood and Garber (1984) in analysing the collapse of fixed exchange regimes. They built a perfect foresight model around five equations:

$$\frac{M_t}{P_t} = a_0 - a_1 \dot{i}_t \tag{2.22}$$

$$M_t = R_t + D_t \tag{2.23}$$

$$\dot{D} = \mu \tag{2.24}$$

$$P_t = P_t^* S_t \tag{2.25}$$

$$i = i^* + \dot{S}_t / S \tag{2.26}$$

Equation (2.22) is the money demand equation in which the real money demand is specified as a function of the interest rate. Equation (2.23) specifies the components of nominal money supply M_t as reserves (R) and domestic credit (D). The growth rate in domestic credit is given by equation (2.24). Equation (2.25) provides the basic purchasing power parity (PPP) condition while equation (2.26) is the uncovered interest parity (UIP) condition.

Using equations (2.25) and (2.26) in (2.22), we obtain

$$M_t = \beta S_t - \alpha \dot{S}_t \tag{2.27}$$

where $\beta = (a_o P^* - a_1 P^* i^*)$ and $\alpha = a_1 P^*$

If the exchange rate is fixed, reserves adjust to maintain money market equilibrium. The quantity of reserves at any time is given by:

$$R_t = \beta S_t - D_t \tag{2.28}$$

The rate of change of reserves i.e, the balance of payments is

$$\dot{R} = -\dot{D} = \mu \tag{2.29}$$

Under a fixed exchange rate regime, $\dot{S} = 0$ so that $M_t = S_t\beta$. This is equivalent to saying that the money supply should equal the foreign money supply and demand multiplied by the foreign price level and the exchange rate. Reserves will therefore equal $M_t - D_t = \beta S_t - D_t$.

The equations above are an illustration of how the growth in domestic credit leads to the depletion of reserves and eventually to the collapse of a fixed exchange rate regime. The probability of an attack on the reserves of the central bank depends on the amount of initial reserves and the growth rate in domestic credit. The time that reserves run out is given by the following relation:

$$T = \frac{(\beta S - D)}{\mu} \tag{2.30}$$

The attack on the fixed peg takes place before the time that reserves run out. The above equation means that an increase in reserves delays the attack while an increase in the domestic credit hastens the attack on the central bank reserves.

2.3.1 Summary of Theoretical Models and Expectation from Empirical Results

The monetray model of the balance of payments included in the IMF analytical framework has the following implications for the balance of payments and prices.

- A reduction in domestic credit improves the balance of payments position and reduces domestic inflation

- A devaluation improves the balance of payments position but at a cost of increased inflation

- A combined policy, involving a reduction in domestic credit and a devaluation will lead to enhanced balance of payments improvement with an ambiguous effect on inflation, which depends on the relative magnitudes of the two effects.

The Polak model, which also forms part of the IMF analytical approach, has the following implications for the balance of payments

- The balance of payments is determined by imports, exports and capital flows.

- Exports are determined by the nominal exchange rate and domestic prices i.e. by the real exchange rate. Exports are also driven by the international price of exports. For a country such Zambia, which relies heavily on copper, we should expect the price of copper to significantly affect the value of exports.

- Imports are determined by the real exchange rate and by nominal income through the marginal propensity to import parameter.

These implications are investigated empirically in the next two sections. Section 2.4 focuses on the Monetary model while section 2.5 analyses the Polak model

2.4 Empirical Analysis: Monetary Model

In order to determine the effectiveness of IMF stabilisation programmes in Zambia, we analyse the effect of monetary policy on inflation and the balance of payments. Our analysis is also extended to include the effect on the exchange rate and real income. Three different approaches are used. In the first approach, we analyse the effect of domestic credit on reserves and the exchange rate using Granger causality tests and variance decompositions. In the second, we use a cointegrated VAR model, starting with an analysis of the demand for money in Zambia followed by variance decomposition analysis using an equilibrium correction framework. In the third, we focus on the effect of the money supply only as measured by M1. We start by describing the statistical properties of the series.

2.4.1 Data and Statistical Properties of the series

The sample used in this analysis covers annual data for the period 1965 to 1999. This is the period over which data is available for all the variables of interest. For some variables, data goes as far back as 1964 and for some it goes beyond 1999. All the data used in this analysis was obtained from the International Financial Statistics (IFS) of the IMF.

We start by first determining the statistical properties of the series used in the analysis. Unit root tests are conducted to determine whether the series are stationary processes. The procedure used here is the standard Dickey Fuller and augmented Dickey Fuller tests. The null hypothesis is that of a unit root. A significant test statistic would reject the null and accept stationarity.

Table 2.01: Descriptions of Variable

Variable	Description
TB	Trade Balance
R	Comercial Bank Weighted Lending Rate
ER	Exchange Rate
P	Consumer Price Index
Y	GDP
$M1$	Money Supply
DC	Net Domestic Assets (Credit) of the Bank of Zambia
P^C	Copper price
RES	Gross International Reserves

Table 2.02 Unit Root Tests

Sample period 1965-1999

Variable	Order of Integration
Trade Balance	0
Interest Rate	0
Exchange Rate	1
Consumer Price Index	2
Real GDP	1
Money Supply (M1)	2
Domestic Credit	2
Copper Price	1
Reserves	1

Table 2.01 provides descriptions of the variables included in the model. From the results presented in the Table 2.02 we notice that the log of the Consumer Price Index (P), the supply of money measured by M1 and the Net Domestic Assets at Bank of Zambia (DC) are I (2) variables. This implies that inflation is a non-stationary variable. However, the rate of change of the inflation rate is stationary. The real supply of money and the real Net Domestic Assets, both deflated by the consumer price index are I(1) . The trade balance and the interest rate are stationary while the rest of the variables are I (1).

2.4.2 Empirical Analysis based on changes in Domestic Credit

The macroeconomic effects of changes in domestic credit depend on the exchange rate regime. Under a fixed exchange rate regime, some (or all) of the changes in domestic credit will be offset by changes in reserves through the balance of payments, reducing (or eliminating) the effects on domestic variables. With a flexible exchange rate, the value of the currency will adjust. This may increase the domestic effect of changes in the money supply (as suggested by rigid price models), or neutralise any real effects (as suggested by the monetarist models). Small country monetarist models predict that under a fixed exchange rate, changes in the money supply will be completely offset by variations in foreign reserves restoring the original money supply. This result is derived from the monetary equilibrium condition with the assumption of exogenous income (at potential output), prices (due to purchasing power parity) and interest rates (assuming perfect capital mobility). Models with less restrictive assumptions (e.g. resources are not fully employed, capital is not very mobile and reserve flows are sterilised) imply a balance of payments offset that may be smaller than the minus one value predicted in the monetarist model.

Granger causality tests are carried out using bivariate VARs using block non-causality tests. We use bivariate VARs because the effect of one variable on another cannot be isolated in a multivariate model. However, a five variable VAR is estimated, (domestic credit, foreign reserves, the exchange rate, prices and income) and variance decompositions are used to determine the degree to which the domestic credit shocks explain changes in reserves and the exchange rate. In addition, the effects of domestic credit shocks on income are evaluated. The VARs are also used to evaluate the sources of inflation, comparing the extent to which shocks to domestic credit and the exchange rate explain inflation.

Inferences drawn from VARs can be sensitive to the lag length chosen. We use the Akaike Information Criteria (AIC) and the Shwarz Bayesian Criteria (SBC) to specify the lag structure of the equations in the VARs. As usual , the SBC chooses a shorter lag length than the AIC. Based on the AIC, we choose a lag length of one. We then perform block exogeneity tests for each of the variables in the model.

In determining the effect of domestic credit on reserves and other variables, we use the "block Granger non-causality test". It provides a statistical measure of the extent to which lagged values of a set of variables are important in explaining another set of variables, while lagged values of the latter variables are included in the model. Our interest is in determining the effect of domestic credit on reserves, the exchange rate, inflation and real income. We therefore use bivariate VAR models for each of them separately. In the first model, we include domestic credit and reserves, in the second model we include domestic credit and the exchange rate and so on for inflation and real income.

The variables used in the VARs are the second differences of domestic credit and prices measured by the consumer price index and first differences for rest of the variables. The results presented in Table 2.03 show that domestic credit Granger causes the exchange rate and inflation but not real GDP and reserves. There is no Granger causality in either direction between real income and domestic credit and between domestic credit and reserves. The log likelihood ratio statistic for testing the null hypothesis that the coefficients of a subset of jointly determined variables in the VAR are equal to zero is not rejected in the case of changes in reserves and real GDP but rejected in the case of changes in the exchange rate and inflation. However, the causality from reserves to domestic credit is relatively stronger than the reverse (with p-values of 0.48 and 0.84 respectively). This phenomenon could be a result of monetary authorities responding to exogenous changes in reserves in order to meet IMF programme benchmarks. For example, the Government typically finances shortfalls in balance of payments support by borrowing from the central bank (see appendix 2.C on the effect of Aid Shocks). Reserve money, however, does not change as a result of this if there are adequate reserves which are run down.

Table 2.03: Granger Non-Causality Tests Independent Variable

Sample period: 1965-1999

Lag 1

Dependent Variable	DC	Y	P	ER	RES
DC		0.7[0.7]	0.99[0.61]	2.3[0.32]	1.5[0.48]
Y	1.6[0.45]				
P	15[0.0]			7.7[0.02]	
ER	12[0.003]		1.3[0.5]		2.7[0.3]
RES	0.36[0.84]			1.8[0.41]	

We observe strong Granger causality from domestic credit to the exchange rate but no Granger causality between the exchange rate and reserves. The latter result suggests that external shocks that affect reserves such as Aid flows have little effect on domestic variables. This could be a result of deliberate responses by the monetary authorities. We have shown in appendix 2.C shortfalls in donor balance of payments support have a significant negative effect on private sector credit.

Our conclusion from Granger causality tests is that domestic monetary policy (defined here as change in domestic credit) is not effective in correcting balance of payments disequilibria (measured by changes in reserves) but effective in stabilising the exchange rate and inflation. The results also show that the exchange rate Granger causes inflation and that monetary policy does not affect real income.

Further evidence is provided by variance decompositions. A brief description of the methodology used in this section is provided in appendix 2.A. Table 2 4 provides the percentage of the forecast error of each variable that is due to shocks to itself and due to other variables in the model after fifty years. In order to assign variance shares to the different variables, the errors in the model must be orthogonalised. It has become standard to use the Choleski decomposition. The variance decomposition can be sensitive to the ordering chosen. In our model, the variables are ordered as follows DC ,Y, P, ER, RES. The ordering was chosen under the assumption that domestic credit is likely the most exogenous of the variables since it is under the control of the monetary authorities. In order to check the robustness of the results, we estimated the model under a different ordering with reserves coming before domestic credit. The contemporaneous correlation between domestic credit and reserves makes it difficult to distinguish the balance of payments offset from sterilization of reserve flows. If sterilization occurs immediately while the balance of payments adjusts with some lag to changes in domestic credit, then reserves should be placed before domestic credit.

Table 2.04: Orthogonalized Variance Decomposition

Sample period: 1965-1999

Order of VAR:1

	Source of Variation				
Dependent Variable	DC	Y	P	ER	RES
DC	0.87	0.05	0.01	0.04	0.03
Y	0.09	0.7	0.11	0.09	0.01
P	0.10	0.04	0.76	0.10	0.01
ER	0.30	0.08	0.33	0.27	0.03
RES	0.20	0.02	0.02	0.24	0.52
Variance Decomposition based on different Ordering of the Variables					
Dependent Variable	RES	DC	Y	P	ER
RES	0.91	0.03	0.01	0.02	0.03

The results from variance decompositions (Table 2.04) show that the exchange rate has a higher effect on reserves than domestic credit (24 and 20 percent respectively). This result is consistent with the Granger non-causality tests where the p-value for the effect of domestic credit on reserves is 0.84 compared with 0.41 for the effect of the exchange rate. However, both variables do not Granger cause the change in reserves. Income and prices, put together, account for an insignificant 4 percent of the variation in reserves.

The results of the variance decomposition based on a different ordering of the variables in the model are also shown in Table 2.04. With reserves coming before domestic credit, the results show an even smaller effect of domestic credit on reserves. Domestic credit accounts for only 3 percent of the variation in reserves with 91 percent of the variation coming from its own shocks.

We also estimate the model with the exchange rate coming before the prices in Table 2.05. We find in this case that the exchange rate accounts for 55 percent of the variation in inflation while domestic credit accounts for 10 percent just as in the original model. In comparison with the original ordering, domestic credit and the exchange rate now account for 65 percent of the variation in prices instead of 20 percent.

Table 2.05: Variance Decomposition with the exchange rate before prices

Sample period: 1965-1999

Order of VAR:1

	Source of Variation				
Dependent Variable	DC	Y	ER	P	RES
RES	0.21	0.02	O.12	0.15	0.52
ER	0.30	0.07	0.59	0.01	0.03
P	0.10	0.04	0.55	0.30	0.01

In summary all the results show that domestic credit in Zambia has a stronger effect on the exchange rate than on the balance of payments. This result seems to be at odds with the theory given our earlier characterization of the control regime in Zambia, especially shortly after independence in 1964. The nominal exchange rate in Zambia was fixed until 1973. During this period, however, the economy was enjoying a foreign exchange windfall from favourable copper prices. The effect of an increase in domestic credit on reserves in this period is likely to be offset by the inflow of reserves from exports earnings. After the negative copper price shock of 1974, reserves have for a long time been quite low . The economy cannot afford to fix the exchange rate using reserves. Any attempt to do so would last for only a short period. It is not surprising therefore that domestic credit has a significant effect on the exchange rate rather than on reserves.

Despite some episodes of fixed exchange rates regimes, the government in most cases has resorted to frequent devaluations in response to unfavorable developments in the external environment.

The results also show that inflation in Zambia is driven by the exchange rate and domestic credit and that domestic credit has an insignificant effect on real GDP.

From Granger causality results and variance decompositions, it seems fair to say that the IMF stabilisation policy of targeting the growth rate in domestic credit is successful in controlling inflation and stabilising the exchange rate but ineffective in eliminating balance of payments deficits measured by a change in reserves.

2.4.3 Empirical Analysis using a Vector Equilibrium Correction Model

In this section, we analyse the effect of monetary policy on the balance of payments and the exchange rate based on the monetary disequilibrium model of Khan (1981).

There are two monetary approaches to the balance of payments, one developed in the IMF and one under the leadership of Harry Johnson in Chicago. The IMF approach is an evolutionary development of the Khan/Keynes multiplier model in an open economy. Johnson's approach is anti-Keynesian. It posits the essentially monetary character of the balance of payments. Johnson argues that the balance of payments is essentially a monetary phenomenon. Johnson's criticism of the Keynesian model was specifically directed at the basic assumption on which this system of balance of payments rests. The Keynesian system assumes that the monetary consequences of balance of payments surpluses or deficits can be and are sterilized by the monetary authorities so that the surplus or deficit can be treated as a flow equilibrium. The monetary approach assumes and in some cases asserts that these monetary inflows or outflows are not sterilized or cannot be within the period relevant for policy analysis but instead influence the domestic money supply. They introduced a new causal approach to the balance of payments where they argue that it is the expenditure of unwanted cash balances that leads to the import surplus and the subsequent outflow of reserves. The balance of payments position is considered to be a reflection of decisions on the part of residents to accumulate or run down their stock of money balances. The Johnsonian approach assumes that the demand for money does not change once equilibrium has been attained. Any injection of money is considered excessive and the official settlements account is the place where the excessive money must be disposed of. Hence, credit creation must cause a balance of payments deficit of equal size. The monetary approach does not say through which account "above the line" this will happen.

Polak (2001) has argued that economic agents can get rid of excess holdings of money in two ways, by buying foreign goods or much more easily by repaying domestic credit to the banking system. Whether and to what extent credit creation leads to one or the other result will, to begin with, depend on how it takes place. When credit creation takes place in the form of open market operations in a fully equilibrated credit market, the Johnsonian assumption that the operation has no effect on the demand for money may approximate reality. In those circumstances, however, they are most likely to react to the imbalance in their cash position by the repayment of loans from the domestic banks and only a small part of the credit creation will lead to a loss of reserves- unless the linkage of the country to the international capital markets is so perfect that most of the newly created money will at once flow abroad. In many developing countries, however, credit is rationed and credit creation is associated with the creation of additional incomes. The Fund's monetary approach takes domestic credit creation as a proxy for an autonomous increase in demand. While the IMF approach also finds that the full amount of credit creation will over time leak out through the balance of payments, their model does not support Johnson's dictum that the loss of reserves reflects the excess of money in the economy. Polak has argued that the increase in the rate of credit creation or the higher level of exports caused, for example by an increase in the price of an economy's main export staple will raise the money supply only gradually as the new economic situation persists. But this impulse will, more or less at once, raise the annual level of incomes of those who benefit from it and thereafter, income in the country will continue to rise as a result of successive spending rounds. As the demand for holding money increases correspondingly, the economy will experience a shortage of money, to be met only gradually by an increase in its supply. Yet inspite of this shortage of money, money will be spent to pay for additional imports as expenditure is partially adjusted to the higher income level. In the step by step approach of the Polak model, the stock of money remains below its income equivalent until the end of its income period. If one accepts the basic model that the demand for money is a function of the level of income, and that the supply of money builds up only gradually over time, the conclusion must be that any cause that raises income while creating additional money will be accompanied by a shortage of money. In an equilibrated money market, the shortage of money would be reflected by a rise in the rate of interest.

Khan and Knight (1981) use the following specification in determining the impact of excess money balances and relative prices on the balance of payments.

$$\Delta \log R_t = \lambda_1 \left[\log M_t^d - \log M_{t-1}\right] - \lambda_2 \left[\log P_{t-1} - \left[\log\left(e_{t-1} P_{t-1}^*\right) - \log \beta_0\right]\right] \quad (2.31)$$

M_t^d refers to the demand for money, at time t, M_{t-1} refers to the supply of money at time $t-1$ and P refers to the price level. The overall balance of payments, represented by a change in the stock of international reserves, ΔR (in terms of domestic currency), is specified as a positive function of the excess demand for nominal balances and a negative function of the deviation of the domestic price level from its purchasing power parity equilibrium denoted by $[\log(e_{t-1}P_{t-1}) - \log \beta_0]$. β_0 denotes the equilibrium real exchange rate. This specification is a dynamic version of model presented in section 2.3. Models in the tradition of the monetary approach to the balance of payments do not distinguish between the current account and the capital account. They make no prediction as to whether domestic residents rid themselves of excess money balances by increasing expenditure (domestic absorption) relative to output or by purchasing financial assets abroad.

Most empirical applications of the monetary approach to the balance of payments assume that the change in a country's international reserves is exactly equal to the difference between flow supply of money and flow demand. This standard assumption does not seem realistic in the context of developing countries, where the degree of international mobility of goods and assets may not be sufficient to allow an excess supply of money to be offset fully and instantaneously by the balance of payments leakages. The equation specified above is consistent with the monetary approach to the balance of payments, but includes a degree of dynamic adjustment as measured by the parameter λ_1. Thus it allows for inertia in the response of flows to monetary disequilibria in the short run while still retaining the feature that the effect of an expansion of domestic credit on the money stock is completely offset in the long run. Khan and Knight (1981) specified the demand for money functions as follows:

$$\log M_t^d = \beta_1 + \lambda_3 \log Y_t - \lambda_4 r + \lambda_5 \log P \tag{2.32}$$

Where Y refers to real income and r to the nominal intestest rate. Substituting the above equation into the balance of payments equation (2.31) yields the following equation:

$$\begin{aligned} \Delta \,\text{logR} \;\; = \;\; & \lambda_1 \left[\beta_1 + \lambda_3 \log Y_t - \lambda_4 r + \lambda_5 \log P_t - \log M_{t-1}\right] \\ & \text{-}\lambda_2 \left[\log P_{t-1} - \log(e_{t-1} P_{t-1}) + \beta_0\right] \end{aligned} \tag{2.33}$$

The approach adopted in this section is to use cointegrating errors as a measure of excess real balances. We start by analysing money demand in Zambia. The conventional money demand equation includes income and the interest rate as determinants of money demand. We use a formulation which is typically used for developing countries in which the interest rate on other financial assets is excluded from model. This follows directly from the paucity of financial alternatives to money in developing countries. The relevant substitution in such countries is therefore between money and goods, or real assets, with the opportunity cost being the expected rate of inflation. The variables included in the money demand equation are the real money supply, measured by the M1 deflated by the consumer price index, real GDP deflated by the GDP deflator, and the inflation rate. All these variables are I (1). The following dummies are included in the model, D3 for 1977, D4 for the period 1986 to 1988, and D5 for 1989. All the dummies are statistically significant in the model. After 1977, Zambia was on the second standby financial arrangement with the IMF. This was necessitated by the negative price shock of 1974. The emphasis was on the reduction of Government spending. The period 1986-1988 relates to the time when Zambia adopted its New Economic Recovery Programme with emphasis on growth from own resources. In 1989, the country concluded a new policy framework paper with the IMF, with emphasis on the liberalisation of markets and devaluation.

Econometric Procedure

Our objective is to analyse the effect of monetary disequilibrium on reserves using a cointegrated vector equilibrium model. The general vector equilibrium correction model is specified as follows:

$$\Delta X_t = a_0 + a_1 t - \Pi X_{t-i} + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + U_t \tag{2.34}$$

Π is the long run multiplier matrix while Γ_i are the short run coefficient matrices capturing the short run dynamic effects. The variables specified as I(1) variables in the model are the log of real money (M1), the log of real GDP and the log of inflation. The intercept enters unrestricted while the trend is restricted to lie in the cointegrating space. The results of the cointegration analysis based on the Maximal Eigenvalue of the stochastic matrix are summarized in the Table 2.06.

Table 2.06: Cointegration Results.

Variables in the cointegrating vector are $M1$, Y and ΔP

31 observations from 1967 to 1997. Order of VAR = 2.

Null	Alternative	Statistic	95% Critical Value
r =0	r=1	29	25
r<=1	r=2	9	19
r<=2	r=3	3	12

The results based on the trace of the stochastic matrix suggest that the null of no cointegration is rejected. However, when we use the model selection criteria, the AIC suggests a rank of two while SBC and HQC suggest a rank of one. It is therefore fair to conclude that there is one cointegrating vector.

Using the cointegrating vectors from the Johansen procedure, we obtain the results of the equilibrium correction model for the log of M1. The results are presented in the Table2.07.

Table 2.07: Error Correction Model for M1.

Dependent Variable is $\Delta M1$

31 observations from 1967 to 1997. Order of VAR = 2.

Regressor	Coeff	Std.Error	T -Ratio[Prob]
Intercept	-2.1974	0.45206	-4.86[0.00]
$\Delta M1_{-1}$	-0.27798	0.13223	-2.10[0.047]
ΔY_{-1}	0.85624	0.45753	1.87[0.074]
$\Delta\Delta P_{-1}$	-0.28768	0.093010	-3.1[0.005]
ECM_{-1}	-0.34501	0.071896	-4.8[0.00]
$D3$	-0.17564	0.076151	-2.3[0.03]
$D4$	0.27673	0.061597	4.5[0.00]
$D5$	-0.21181	0.096600	-2.2[0.04]

Table 2.08: Cointegrated vectors in Johansen estimation (normalized in brackets)

Sample period: 1965-1999

$M1$	Y	ΔP	$Trend$
0.55885(1.0000)	-0.98812(-1.7681)	0.95292(1.7051)	0.035149 (0.062896)

The results show that demand for money in Zambia is positively related to real GDP and negatively to the rate of inflation. The signs support our assumption regarding the money demand function for developing countries. The equilibrium correction model shows a significant negative coefficient for the M1 equation.

In analysing the effect of monetary disequilibria on the balance of payments, measured in this case by a change in reserves, we include reserves among the I(1) variables in the model with everything else remaining the same. The cointegration results based on the maximal eigenvalue statistic are presented in Table 2.09.

Table 2.09: Cointegration Results. Variables in the cointegrating vector are $M1, Y$, ΔP and RES

31 observations from 1967 to 1997. Order of VAR = 2.

Null	Alternative	Statistic	95% Critical Value
r =0	r=1	38	31
r<=1	r=2	21	25
r<=2	r=3	10	19
r<=3	r=4	6	12

The results from trace statistic also show that there is one cointegrating vector. The results based on the model selection criteria, however suggest two cointegrating vectors in all cases (AIC, SBC,HQC). The results of equilibrium correction model for reserves is presented in Table 2.10.

Table 2.10a: Error Correction Model for RES

Dependent Variables is ΔRES

31 observations used for estimation from 1967 to 1997

Regressor	Coeff	T -Ratio[Prob] for ΔRES
Intercept	19.9	0.04[0.97]
$\Delta M1_{-1}$	-27	-0.17[0.86]
ΔY_{-1}	271	0.56[0.58]
$\Delta\Delta P_{-1}$	38	0.33[0.74]
ΔRES_{-1}	-0.04	-0.16[0.87]
ECM_{-1}	-3.07	-0.03[0.97]
$D3$	-44	-0.47[0.64]
$D4$	-28.35	-0.45[0.66]
$D5$	-35.51	-0.33[0.75]

Table 2.10b: Error Correction Model for ER

Dependent Variable is ΔlER

31 observations used for estimation from 1967 to 1997

Regressor	Coeff	T -Ratio[Prob] for ΔlER
Intercept	-0.097	-0.057[0.96]
$\Delta M1_{-1}$	-0.82	-1.56[0.13]
ΔY_{-1}	-2.19	-1.14[0.27]
$\Delta\Delta P_{-1}$	-0.50	-1.13[0.27]
ΔlER_{-1}	0.411	1.64[0.12]
ECM_{-1}	-0.05	-0.14[0.89]
$D3$	-0.12	-0.34[0.74]
$D4$	0.0084	0.034[0.97]
$D5$	-0.77	1.8[0.07]

The results show that the ECM has an insignificant effect on reserves. In order to determine the relative effects of the monetary disequilibria on the balance of payments and the exchange rate, we use orthogonalised forecast error variance decomposition of the cointegrated VAR at a 50 year forecast horizon. Structural shocks are identified using the Choleski decomposition with M1 as the most exogenous variable. The results of the variance decompositions are presented in Table 2.11.

Table 2.11: Orthogonalised Forecast Error Variance decomposition
for Reserves (RES) and the Exchange rate (ER)
31 observations from 1967 to 1997. Order of VAR = 2.

	Source of Variation			
Dependent Variable	$M1$	Y	ΔP	Own Shock
RES	0.008	0.002	0.01	0.98
ER	0.01	0.14	0.35	0.50

The variance decomposition analysis above shows that variables in the money demand equation have a greater effect on the exchange rate than reserves. They account for only 2 percent of the variation in reserves while accounting for 50 percent of the variation in the exchange rate.

2.4.4 Empirical Analysis based on Money Supply (M1)

In this section, we analyse the effect of monetary policy, measured by changes in M1 on the balance of payments, the exchange rate, inflation and real income. Nominal money supply is used for determining the effect on inflation and the exchange rate while real money supply is used for determining the effect on the balance of payments and real income.

Inflation and the Exchange Rate

A quantitative macroeconomic framework used in various forms by a number of authors to gauge the effect of stabilisation policies in developing countries is the monetary disequilibrium model developed by Khan (1981), which is based on the monetary approach to the balance of payments. The domestic rate of inflation relative to the foreign rate is assumed to be positively related to the excess supply of real money balances and a negative function of the deviation of the of the domestic prices from their purchasing power parity equilibrium level. Formally, Khan's specification is written as follows:

$$\begin{aligned}\Delta \log P_t &= \lambda_1 \left(logM_{t-1} - logM_t^d\right) - \lambda_2 \left[\log P_{t-1} - \log\left(E_{t-1}P_{t-1}^f\right) - \beta_0\right] \\ &+ \lambda_3 \Delta \log\left(E * P^f\right) + \lambda\end{aligned} \quad (2.35)$$

where P is the domestic price level, E is the exchange rate in units of domestic currency per unit of foreign currency and P^f is the foreign price level. M is the stock of real money balances deflated by the domestic price level. λ is a constant, reflecting the steady state properties of the system.

The monetary disequilibrium model has been analysed in the previous sections. We focus here on the effect of the supply of money alone (measured by M1). We use a three variable cointegrated VAR model including the growth rate in money supply ($\Delta lM1$), the exchange rate (lER) and the inflation rate (ΔlP). The variables $lM1$ and lP are I(2) and are therefore differenced for inclusion the cointegration analysis. The cointegration results show the existence of two cointegrating vectors. The results of variance decompositions from the cointegrated VAR model at a fifty year horizon are presented in Table 2.12.

Table 2.12: Orthogonalized Forecast Error Variance

Decomposition for variable lER and ΔlP

Cointegration with unrestricted intercepts and

restricted trends in the VAR

31 observations from 1967 to 1997. Order of VAR = 2.

	Source of Variation		
Dependent Variable	$\Delta lM1$	lER	ΔlP
lER	0.52	0.42	0.06
ΔlP	0.66	0.07	0.26

The results show that money supply growth accounts for 52 percent of the variation in the exchange rate and 66 percent of the variation in inflation. These results reinforce our earlier conclusion that the IMF prescription of targeting the growth rate of the supply of money is an appropriate instrument for controlling inflation and stabilising the exchange rate in Zambia.

Balance of Payments and Real GDP

In the previous section, we established that money supply growth has a significant effect on inflation and the nominal exchange rate. In this section, we explore its effect on the balance of payments and real income. We estimate two separate bivariate VARs including real M1 and reserves in one and real M1 and real GDP in the other. All the variables used are in real terms. The results of cointegration tests show that we cannot reject the null of no cointegration between reserves and M1. We therefore proceed by estimating an unrestricted VAR model. We use the Choleski decomposition to identify the structural shocks. The results of the cointegration analysis and of the variance decomposition are summarised in Tables 2.13 and 2.14.

Table 2.13: Cointegration with unrestricted intercepts and restricted trends in the VAR

Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix

32 observations from 1967 to 1998. Order of VAR = 2.

List of variables included in the cointegrating vector: $LM1$, RES, $Trend$

List of I(0) variables included in the VAR: $D3, D4, D5$

List of eigenvalues in descending order 0.42434 0.14406 0.00

Null	Alternative	Statistic	95% Critical Value
r =0	r=1	17	19
r<=1	r=2	5	12

The results based on the maximal eigenvalue statistic suggest that we do not reject the null hypothesis of no cointegration. The trace statistic for the null of no cointegration is 22 with a critical value of 26. The AIC suggest a rank of one while both, the SBC and the HQC suggest a rank of zero. It is therefore reasonable to accept the null of no cointegration. Instead of using a cointegrated VAR model, we use an ordinary VAR model. The results of the variance decompositions from the VAR model are presented in table 2.14.

Table 2.14: Orthogonalised Forecast Error Variance Decomposition for variable ΔRES and $\Delta lM1$

Based on 31 observations from 1968 to 1998. Order of VAR = 2

List of variables included in the unrestricted VAR: $DLRM1$ and $DRES$

List of deterministic and/or exogenous variables: $INPT$, $D3$, $D4$, $D5$

Dependent Variable	$\Delta lM1$	ΔRES
ΔRES	0.03	0.97
$\Delta lM1$	0.88	0.12

The results clearly show no close link between reserves and real money supply. Table 2.15 shows the results of cointegration tests between the money supply and real GDP. We also do not reject the null of no cointegration.

Table 2.15: Cointegration with unrestricted intercepts and restricted trends in the VAR

32 observations from 1967 to 1998. Order of VAR = 2.

List of variables included in the cointegrating vector: $LM1$, lY, $Trend$

List of I(0) variables included in the VAR: $D3$, $D4$, $D5$

List of eigenvalues in descending order 0.25881 0.11237 0.00

Null	Alternative	Statistic	95% Critical Value
r =0	r=1	9	19
r<=1	r=2	4	12

The results from this section reinforce our earlier conclusion on the ineffectiveness of monetary policy as a means of eliminating balance of payments deficits. We also observe that monetary policy has no effect on real GDP, implying that it is also ineffective in stimulating economic activity in Zambia.

2.5 Empirical Analysis: Polak Model

The Polak model is based on the national income identity in which the balance of payments is determined by exports, imports and net foreign capital flows. The model is expanded to include the effect of relative prices (which we interpret as the real exchange rate) on both exports and imports. The model also includes the effect of nominal income on imports through the marginal propensity to import. The Polak form of the financial programming model can be given a classical closure in which it can be solved for the price level while taking output to be exogenous. It can also be given a Keynesian closure in which it is solved for real output taking the price level as given.

The model summarised by figure 2.1 (page 101) implies that for a given level of inflation, the overall balance of payments can be improved by a nominal exchange rate devaluation, a reduction in domestic credit or a combination of both policies. A nominal devaluation with no change in domestic credit will lead to an increase in domestic prices but the real exchange rate depreciates, overall, as reflected by an improvement in the balance of payments. A combined policy of devaluation and a reduction in domestic credit should therefore lead to a greater improvement in the balance of payments position at a lower cost in terms of increased inflation. The combined policy should lead to a higher real exchange rate depreciation.

In modelling the balance of payments using the Polak model, we focus on the trade balance. A problem with the monetary model is that it does not distinguish through which accounts above the line the balance of payments adjustment occurs. It is therefore more appropriate to analyse the effect of policy variables such as domestic credit and the exchange rate on the current account (or the trade balance due to incomplete current account data). The trade balance is modelled as a function of the copper price, given the economy's heavy dependence on copper for its export earnings; nominal income, which affects imports; the exchange rate and the domestic price level are intended to capture the effect of relative prices. The model we estimate is;

$$TB = \beta_0 + \beta_1 \Delta Y + \beta_2 \Delta P^C + \beta_3 \Delta ER + \beta_4 \Delta \pi \tag{2.36}$$

where TB refers to the trade balance, Y to nominal GDP, P^C to the copper price, ER to the exchange rate and π to the inflation rate. We use the static long run parameters (dynamic multipliers) in determining the effect of the variables on the trade balance. In a simple model:

$$Y_t = \beta_0 Z_t + \beta_1 Z_{t-1} + \alpha_1 Y_{t-1} + U_t \tag{2.37}$$

A static equilibrium is defined by: $E[Z_t] = Z^*$ for all t. In which case $E[Y_t] = Y^*$ will be constant if $\alpha < 1$, and Y_t will converge to:

$$Y^* = KZ^* \tag{2.38}$$

where $K = (\beta_0 + \beta_1) / (1 - \alpha_1)$. K and the associated standard errors are the static long run parameters. K gives the total effect of a change in Z on Y.

The static long run equation obtained after an OLS regression of the trade balance on GDP, the copper price, the real exchange rate and inflation is;

$$\underset{SE}{TB} = \underset{(40.08)}{251} - \underset{(362.4)}{432.9} * \Delta Y + \underset{(5.607)}{14.28} * \Delta P^C + \underset{(341.6)}{126.9} * \Delta ER + \underset{(541)}{511.9} * \Delta\pi \tag{2.39}$$

The results of the model show that the trade balance is driven mainly by the exogenous variable, the changes in the price of copper (P^C). We also observe a negative, but insignificant, effect of the nominal GDP (Y) on the trade balance. This effect is a result of its effect on imports. The effect of the nominal exchange rate and prices are also statistically insignificant. The nominal exchange rate has a positive effect. This is also a result of its effect on imports.

Since the export sector is highly concentrated, we do not expect changes in the relative prices to have a significant effect on exports. In fact, in the original version of the Polak model, the exports are considered to be exogenous. It is therefore, more appropriate to analyse the effect of income and relative prices on the balance of payments by considering the effect of these variables on imports. The static long run equation for imports is given by:

$$\underset{SE}{IM} = -\underset{(0.03)}{0.0047} + \underset{(0.28)}{0.5} * Y + \underset{(0.0045)}{0.0045} * \Delta P^C - \underset{(0.26)}{0.47} * \Delta ER - \underset{(0.48)}{0.07} * \Delta\pi \tag{2.40}$$

The results show that imports respond positively to nominal income and negatively to the nominal exchange rate. The copper price also has a positive effect on imports. The effect of the change in the copper price reinforces the resource expansion effect of an increase in the copper price that we discussed in the first paper. The results support the predictions of the theory implied by the Polak model on the effect of the exchange rate on imports. The consumer price index has a negative coefficient. We would expect the consumer price index to have a positive coefficient instead of a negative one. This result could be due to multicollinearity between the variables, especially between the copper price and the exchange rate and between the exchange rate and the consumer price index. The R^2 is 0.68 but there are hardly any significant parameters in the model at 95 percent level of confidence.

In modelling exports, we take account of the fact that Zambia is heavily dependent on copper so that the value of exports depends largely on the copper price The static long run equation for exports is;

$$\underset{t-value}{EX} = \underset{(-.6)}{-0.016} + \underset{(0.005)}{0.012} * P^C \underset{(-0.05)}{-0.003} * \Delta ER - \underset{(-0.15)}{0.04} * \Delta\Delta P \tag{2.41}$$

The static equation shows that exports are largely determined by the change in the copper price. The consumer price index and the nominal exchange rate do not have a significant impact on exports. This is due to the highly undiversified structure of the export sector in Zambia.

2.5.1 Interpretation of Results and Policy Implication

The results from econometric tests suggest that the monetary disequilibrium model is inappropriate in explaining balance of payments developments in Zambia. However, the results show a strong relationship between money supply on one hand, and inflation and the exchange rate on the other. The results, however seem to support the predictions of the Polak model in which the balance of payments is determined by the real exchange rate and nominal income. This relative price effect works through imports rather than exports. This is so because of the economy's highly undiversified export structure.

Our conclusion therefore is that the policy prescriptions of the IMF which emphasise tight monetary policies are incapable of eliminating balance of payments disequilibria but are successful in reducing inflation and stabilising the exchange rate. An effective policy for improving the balance of payments is devaluation. This works by depressing imports with adverse consequences for investment. Devaluation increases the cost of imported capital goods needed for investment. This aspect is analysed in greater detail in the third paper.

In addition to its negative effect on domestic investment, devaluation, in a country with balance of payments shortfalls, hurts the budget . In the face of persistent balance of payments shortfalls, an exchange rate depreciation increases the overall budget deficit in domestic currency terms. The domestic currency deficit (ΔC_g) is given by;

$$\Delta C_g = \beta_d + ER(ds - bop) \tag{2.42}$$

where ER is the nominal exchange rate, ds is external debt service and bop is balance of payments support . If we assume that β_d, the balance on the domestic budget is broadly exchange rate neutral, and if $ds > bop$ then trivially, an exchange rate depreciation increases the overall budget deficit and makes it difficult to meet the reserve money benchmarks. The government may thus be predisposed to avoid an exchange rate depreciation even when it may be beneficial to the exportable sector and the level of domestic interest rates. In the appendix, we analyse the implications of shortfalls in balance of payments support on the IMF financial programme.

2.6 Conclusion

From the results of econometric tests carried out in this paper, we can conclude that the monetary approach to the balance of payments used by the IMF is inappropriate. Using Granger causality tests, variance decomposition analysis and cointegration, we find that monetary policy is effective in controlling inflation and stabilising the exchange rate but has no effect on real GDP.

The balance of payments position is exogenously determined mainly by the copper price. Relative prices (the real exchange rate) have an insignificant impact on the balance of payments. While they have a significant effect on imports, their effect on the undiversified export sector is insignificant.

The Polak model is only applicable to imports. However, in a country heavily dependent on imported capital goods for its capital formation, a policy of devaluation reduces investment. This hampers growth, reducing the country's ability to return to a sustainable balance of payments position. These and other aspects relating to the intertemporal models of the current account are analysed in the third paper.

We also show that a policy of devaluation worsens the fiscal budget in the presence of Aid shortfalls. The government will therefore be predisposed to avoid a depreciation of the nominal exchange rate even though this may be beneficial for the balance of payments.

In appendix 2.C, we show that aid shocks, defined as the shortfall of balance of payments over debt service do not have a significant negative effect on key macroeconomic variables in Zambia. The effect of the increase in net domestic assets on reserve money is offset by a fall in gross international reserves. This result cannot, however, be sustained over a long period of time because gross reserves eventually get depleted especially after donor support is withheld due to failure to meet the benchmarks. The consequence is that gross reserves are run down to only a few weeks of imports. When this occurs, we would expect to see the shortfalls in balance of payments support having an effect on reserve money and the money supply. The only variable that bears the brunt of an aid shock is credit to the private sector. Attempts by the monetary authorities to meet the NDA benchmark in the face of an aid shock result in reduced central bank claims on banks. This forces banks to reduce credit to the private sector.

2.A Appendix: Variance Decompositions

If we wanted to forecast the values of X_{t+1} conditional on the observed values of X_t, we have:

$$X_{t+1} = A_0 + A_1 X_t + \epsilon_{t+1} \tag{2.43}$$

If we take the conditional expectation of X_{t+1}, we obtain:

$$EX_{t+1} = A_0 + A_1 X_t \tag{2.44}$$

The one step ahead forecast error is:

$$X_{t+1} - EX_{t+1} = \epsilon_{t+1} \tag{2.45}$$

Similarly updating two periods, we get

$$X_{t+2} = A_0 (I + A_1) + A_1^2 X_t + A_1 \epsilon_{t+1} + \epsilon_{t+2} \tag{2.46}$$

The two-step ahead forecast error is:

$$\epsilon_{t+2} + A_1 \epsilon_{t+1} \tag{2.47}$$

In general, the $n - step$ ahead forecast error is given by:

$$\epsilon_{t+n} + A_1 \epsilon_{t+n-1} + A_1^2 \epsilon_{t+n-2} + A_1^{n-1} \epsilon_{t+1} \tag{2.48}$$

The forecast error can also be considered in terms of a vector moving average of the form:

$$X_{t+n} = \mu + \sum_{i=0}^{n-1} \Phi_i \epsilon_{t+n-i} \quad (2.49)$$

so that the n-step ahead forecast error is:

$$X_{t+n} - EX_{t+n} = \sum_{i=0}^{n-1} \Phi_i \epsilon_{t+n-i} \quad (2.50)$$

Focussing solely on one series, say, the Yt sequence, we see that the n-step ahead forecast error is:

$$\begin{aligned} Y_{t+n} - EY_{t+n} &= \Phi_{11}(0)\epsilon_{y(t+n)} + \Phi_{11}(1)\epsilon_{y(t+n-1)} \ldots + \Phi_{11}(n-1)\epsilon_{y(t+1)} \quad (2.51) \\ &+ \Phi_{12}(0)\epsilon_{z(t+n)} + \Phi_{12}(1)\epsilon_{z(t+n-1)} \ldots + \Phi_{12}(n-1)\epsilon_{z(t+1)} \end{aligned}$$

The n-step ahead error variance is given by:

$$\begin{aligned} \sigma_y n^2 &= \sigma_y^2 \left[\Phi_{11}(0)^2 + \Phi_{11}(1)^2 .. + \Phi_{11}(n-1)^2\right] + \quad (2.52) \\ &\sigma_z^2 \left[\Phi_{12}(0)^2 + \Phi_{12}(1)^2 .. + \Phi_{12}(n-1)^2\right] \end{aligned}$$

The variance of the forecast error increases as the forecast horizon n increases. It is possible to decompose the $n - step$ ahead forecast error variance due to each one of the shocks. Respectively, the proportion of the forecast error variance due to shocks on (ϵ_{yt}) and (ϵ_{zt}) sequences are:

$$\frac{\sigma_y^2\left[\Phi_{11}(0)^2+\Phi_{11}(1)^2..+\Phi_{11}(n-1)^2\right]}{\sigma_y n^2} \tag{2.53}$$

and

$$\frac{\sigma_z^2\left[\Phi_{12}(0)^2+\Phi_{12}(1)^2..+\Phi_{12}(n-1)^2\right]}{\sigma_y n^2} \tag{2.54}$$

The forecast error variance decomposition tells us the proportion of the movements in a sequence which are due to its own shocks versus shocks to the other variable.

2.B Appendix: The World Bank Model

The IMF financial programming model can be interpreted as a short run model of stabilisation and adjustment. "Adjustment" in this context refers to balance of payments while "stabilisation" refers to the price level in the classical mode and to real output in the Keynesian mode. It contains no aggregate production function and does not determine capacity output.

In contrast the Bank has been charged with the responsibility of financing growth and development over the medium term. The basic approach that the Bank uses for its macroeconomic projections and policy work, therefore, emphasises the relationship among savings, foreign capital inflows, investment and growth. This approach is reflected in the revised minimum standard model (RMSM) that has been the basis of country economic projections in the Bank for several years. It has remained the most widely used tool for making macroeconomic projections across countries and to facilitate comparisons across countries. The RMSM is essentially an accounting framework that links the national accounts with the balance of payments, with particular attention to the foreign financing gap and the projections of foreign borrowing. The concern is with medium term growth and its financing, as such interest is focussed on real variables only. Prices are assumed constant. In the context of the general macroeconomic framework presented in section 2.2, the RMSM basically posits the following three additional relationships:

- It is assumed that the incremental capital-output ratio (ICOR) is either historically or technologically given. Thus output as a function of investment may be written as;

$$\Delta y = \rho^{-1} \Delta K \qquad (2.55)$$

where ΔK is total investment and ρ is the incremental capital-output ratio. This relationship allows one to obtain either the growth of GDP based on the level of investment, or the required level of investment consistent with the desired growth.

- The balance of payments is defined by the following equations:

$$Z = Z' + aY - be \qquad (2.56)$$

$$X = X' + ce \qquad (2.57)$$

so that we get

$$\Delta R = X' - Z' - a(Y' + \Delta Y) + (b + c)e - \Delta F \qquad (2.58)$$

The above equation expresses the balance of payments as a function of the change in income with a negative slope $-a$.

- The final relationship required in the RMSM is the private sector savings function. This is essentially reduced to a stable, historically given savings rate (s). Given such a savings rate, the implied consumption function may be specified as:

$$C_P = (1 - s)(Y - T) \tag{2.59}$$

We can express the change in reserves as the excess of domestic savings over investment and the change in net foreign assets as follows:

$$\Delta R = sY' + T(1 - s) - G - \Delta F + (s - \rho)\Delta Y \tag{2.60}$$

The above equation defines the second relationship between the change in reserves and income. The equation has a negative slope since $s < \rho$. This is shown in figure 2.B.1.

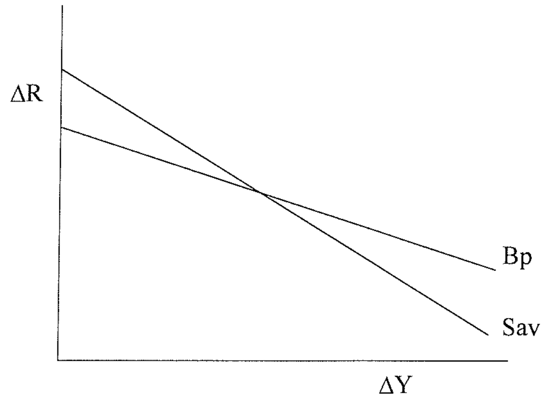

Fig 2.B.1: Balance of Payments and Output Determination in the Bank Framework

The desired solution in R and Y can be derived by shifting the policy variables (G, e). Real devaluation (e) is mainly used to strengthen reserves (R) while reductions in government spending (G) are used to raise private investment and thus growth. All variables in the Bank model are in real terms and the effect of devaluation is through relative prices.

Thus in their modelling of the external sector, the Fund and the Bank approaches are similar. The main differences between the two are in the use of the monetary approach in the Fund model to explain balance of payments disequilibria and the emphasis on the real sector in the Bank model to determine medium term growth.

For the purpose of the determination of growth, the bank model relies on the assumed relationship between changes in output and investment. The assumption of constant ICOR, which is made here, rests on fairly restrictive assumptions regarding the aggregate production function as well as the returns to the factors of production. In general, a constant ICOR is associated with fixed factor proportions production function where factor substitution is not possible. With factor substitution and assuming a constant returns to scale production function as well as exogenously determined returns to factors of production, the ICOR will be a function of the ratio of the wage rate to the returns on capital. If the ICOR is assumed to remain constant, then it necessarily implies that the ratio of wages to the returns on capital also remains constant.

To determine output in this model, we use the following national income identity;

$$\Delta K = s(Y - T) + T - G + aY - X \tag{2.61}$$

Which yields the condition that domestic investment is the sum of private savings, public saving and the flow of foreign savings. An alternative formulation of the national income identity is:

$$\Delta K = (s + a)Y + (1 - s)T - G - X \tag{2.62}$$

This expression gives a positive relationship between investment and income via the aggregate demand curve with price variables exogenously determined. An increase in output increases both domestic savings according to the savings rate s and foreign savings according to the marginal propensity to import a.

A supply or technological relationship for output determination is obtained using the ICOR and can be written as:

$$\Delta K = \rho Y_t - \rho Y_{t-1} \tag{2.63}$$

which gives another positive relationship between investment and output. The simultaneous determination of output and investment in the Bank model is depicted in figure 2.B.2.

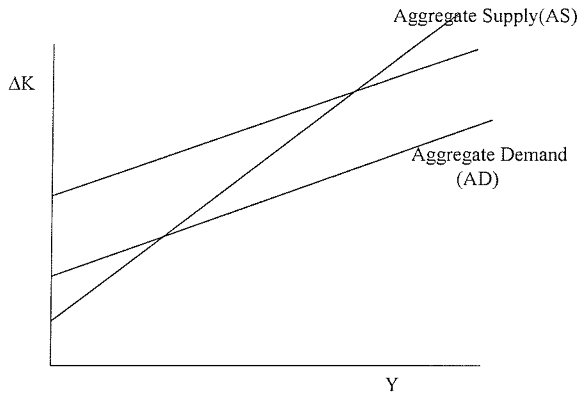

Fig 2.B.2. Investment and output determination in the Bank Framework

The equations trace out positively sloped loci in the $\Delta K - Y$ space. The slopes are given by $(s + a)$ and ρ for the aggregate demand and the aggregate supply curves respectively. Since reasonable values of the $ICOR$ are in the range of 4-7 while s and a are positive fractions, the slope of the AS curve is obviously higher than that of the AD curve. The authorities can shift the locus AD vertically through policy measures that change the amount of domestic saving. The policy measures that are available to this end are public expenditure and tax receipts. A reduction in public spending increases public savings while leaving private sector savings unchanged. This shifts the AD curve upwards resulting in higher output and investment. Similarly, an increase in tax revenue raises public sector savings while reducing private sector savings. The reduction in private saving is however smaller than the increase in public savings because the private sector responds to the decline in its disposable income partly by reducing consumption.

The output targets can be reconciled with the balance of payments targets only if the authorities can exercise some control over net capital inflows or if foreign capital is available perfectly elastically. In this case, ΔF can be considered a policy variable, which is chosen according to

$$\Delta F = X - aY^* - \Delta R^* \tag{2.64}$$

Given an exogenously derived export projection, the levels of the policy variables, G, T and ΔF can be used to achieve the targeted values of ΔY^* and ΔR^*.

Constraints on foreign inflows

If there are constraints on foreign borrowing, then equation 2.64 will operate as a constraint in output determination. Such a model with foreign exchange constraints is one version of the familiar two gap models. The principal use of the RMSM in this case is to determine the growth consequence of the alternative levels of foreign financing.

The foreign exchange constraint creates an over-determinacy in the model which, however, can be removed by introducing more economic behaviour. Bank policy programmes include possible actions in the foreign exchange rate area. In recognition of this, if we include the effect of the exchange rate on imports and exports, we have:

$$Z = aY - be \tag{2.65}$$

$$X = ce \tag{2.66}$$

The net inflow of foreign capital is now changed to

$$\Delta F = -aY^* + (b+c)e - \Delta R^* \quad (2.67)$$

With the introduction of the exchange rate, the model becomes determined even with a constraint on foreign inflows. In this case an exchange rate action can reconcile an income target to the available level of foreign inflows. More precisely, without the inclusion of an exchange rate variable and with a foreign exchange constraint, we had only two endogenous variables with three independent equations. The inclusion of the exchange rate allows three independent equations to determine three variables even when foreign exchange is constrained in supply.

2.C Appendix: Effect of Aid Shocks on the Financial Programme

The macroeconomic programme in Zambia is built around three programme benchmarks. The objective of the benchmarks is to limit the growth of the money supply to a level that is consistent with the non-inflationary growth of the economy and with a sustainable external balance.

The first benchmark is the target for gross and net international reserves. Second, the programme sets a target for the net claims on government by the financial sector (excluding non-bank financial sector claims) while the third consists of a target for the growth of the net domestic assets of the central bank itself. These three are closely interwoven; the level of gross reserves determines in part the net domestic assets of the central bank, as do the central bank's net claims on government. This can most simply be presented as:

$$NFA + NDA = RM \tag{2.68}$$

where NFA stands for net foreign assets, NDA for net domestic assets and RM for reserve money. The Bank of Zambia net foreign assets consist of gross reserves less gross liabilities, which are represented by liabilities to the IMF. The NFA figure is consistently large and negative.

Net domestic assets consist of claims that the Bank of Zambia (BoZ) has on other sectors of the economy (denoted C_g for claims on government, and C_b for claims on the banking sector plus other items, OTH). The sum of net foreign assets and net domestic assets equals reserve money, RM, which consists of currency in circulation (curr), the statutory reserves held at the BoZ by the banking system (SR) plus the net position of "excess" reserves held by the banking system at the BoZ (ER). We can therefore re-express the balance sheet identity in terms of reserve money as:

$$RM = RES - GL + C_g + C_b + OTH \tag{2.69}$$

which readily allows us to consider the sources of growth of reserve money. A deficit financed through borrowing from the central bank increases Cg and reserve money one for one.

The situation is made complex by the fact that it is the government's overall budget and not just its domestic budget that determines the growth in reserve money. The domestic budget balance is defined as domestic revenue less domestic recurrent expenditure, domestically funded capital formation, and domestic interest cost. The overall government budget balance, however, is defined as:

$$\Delta Cg = \beta d + kd + ds - bop - \Delta k \tag{2.70}$$

where Cg is the overall government budget balance, βd is the domestic balance, kd is donor funded capital expenditure, ds external debt service, bop balance of payments support, and Δk is project aid.

The Zambian budget and the macroeconomic programme assume that the external budget is self-financing. In other words, balance of payments support plus project aid is equal to debt service plus foreign funded capital formation. In the case of project financing, this is trivially true so that $kd = \Delta k$. This does not necessarily hold for balance of payments support and debt service. The latter will be paid regardless of whether the former arrives or not. For this reason, we will restrict our analysis to the effects of shortfalls in balance of payment support. When there is a shortfall in balance of payments support, the government has four options:

1. Offset the external budget deficit by running a surplus on the domestic budget. The government usually adopts this strategy in order to meet the programme benchmarks. This strategy, however, proves to be ineffective because it is usually implemented by delaying payments until after the benchmark date. The long-term effect of a balance of payments shortfall on revenue and expenditure is, therefore, insignificant. This is supported by the results of econometric tests on government fiscal responses to balance of payments shortfalls.

2. Government securities (Treasury bills or bonds) could be sold to the non-bank private sector. The consequence is that the deficit is not inflationary. Hence this method of deficit financing does not violate any of the programme benchmarks.

3. The government could finance its deficit by selling securities to the banking sector. This has the effect of increasing net claims on government.

4. The government could finance the deficit by borrowing directly from the central bank. This increases reserve money. This, however, would not occur if it were possible to meet the external financing shortfall by drawing down on the stock of reserves. If reserves are exhausted or if they are already close to their benchmark level, and recourse to borrowing from the Bank of Zambia represents the only mechanism through which the government could honour its debt service obligations, the result would be an increase in reserve money.

In summary, the mechanism by which the impact of a donor balance of payments shortfall on reserve money could be offset would be if gross reserves were sufficiently high and these were run down; if the domestic non-bank private sector were willing to increase their claims against the government; or if a surplus were run on the domestic budget.

Effect of Balance of Payments Shortfalls on the Macroeconomic Programme in Zambia

While the current parlous state of the copper mining industry is one reason for the poor performance of the Zambian economy, shortfalls on balance of payments support have had severe effects on the working of the macroeconomic programme in Zambia. As mentioned earlier, the basis on which the IMF supported macroeconomic programme for Zambia has been built is the assumption that donor balance of payments support would be sufficient to meet external debt service obligations. This view is endorsed prior to each budget year by Aid pledges made at Consultative Group meetings. A key implication of this assumption is that changes in reserve money (and ultimately inflation) will be caused solely by increases in government domestic deficit financing or the explicit injections of the Bank of Zambia. Consequently, the observance of the cash budget should be sufficient to restrain the growth in reserve money. Persistent and cumulative Aid shortfalls cannot be readily financed without allowing net domestic assets to exceed the programme benchmarks or radically altering policy towards the private sector (on taxation or exchange rate policy). In most cases, the government has had to increase both its domestic debt and to monetize the Aid shortfall by borrowing from the Bank of Zambia. What emerges from this discussion is that given the size of the government's external debt service obligations, macroeconomic stability is unusually vulnerable to even small Aid shortfalls especially after the depletion of gross international reserves.

These shortfalls have resulted in net domestic assets of the Bank of Zambia growing much more rapidly than is allowed for in the IMF programme benchmarks. In the process of trying to get close to the benchmarks, government has adopted a tight monetary and fiscal stance. Adam and Bevan (1996) argued that the overwhelming cause of the governments stabilisation difficulties arise from the persistent shortfall of donor balance of payments support compared to external debt service obligations.

As a result of the government being unable to meet the programme benchmarks, further disbursements of balance of payments support are withheld by the IMF and other donors whose support is usually tied to the Government being able to meet the IMF benchmarks. The consequence of this is that gross reserves are depleted to a level of only few weeks of imports.

We have established , using annual data, that domestic credit accounted for an insignificant proportion of the variation in reserves. The variables included in the variance decomposition analysis were domestic credit, income prices and the exchange rate. All these variables accounted for 48 percent of the variation in reserves. Using monthly data from 1994 to 1999, we perform a similar test in order to determine the effect of Aid Shocks (A). Here these are defined as the difference between balance of payments support (BOP) and debt service (DS). The results of variance decomposition after a 10 month horizon are presented in Table 2.16.

Table 2.16: Orthogonalised Forecast Error

Variance Decomposition for variable RES and RM

Unrestricted Vector Autoregressive Model

Sample based on monthly data: 1994-1999

			Source of Variation		
Dependent Variable	DS	BOP	A	ΔRM	ΔRES
ΔRES			0.45		0.55
ΔRES	0.01	0.44			0.55
ΔRM				0.93	0.07
ΔRM	0.045	0.039		0.916	

The results show that Aid shocks account for 45 percent of the variation in reserves. We also observe that 44 percent of the variation in reserves is accounted for by balance of payments receipts while debt service payments account for only 1 percent. We go a step further to analyse the effect of a change reserves on reserve money. The results show that external sector developments that affect reserves have little effect on reserve money, accounting for only 7 percent of the variation in reserve money.

If reserves have little effect on the variation of reserve money and therefore the money supply, it is important to analyse how government responds to shortfalls in balance of payments support to make this result possible. We start by establishing Government responses to adverse Aid shocks by examining the relationship between shortfalls in balance of payments support and variables over which the Government has some control. These variables include Government expenditure, borrowing from the Central Bank, borrowing from Commercial Banks and the use of international reserves.

Government Reponses to Shortfalls in Balance of Payments Support

We use unrestricted bivariate VAR models. In our bivariate model, aid shortfall is specified as an exogenous variable. The variable "shortfall" is the excess of debt service over balance of payment support. To avoid the problem of nonsense regressions, we perform unit root tests for the aid shortfall variable and other variables of interest using the standard augmented Dickey Fuller procedure. Unit root tests are performed again for monthly data. The results presented in Table 2.17 indicate that shortfalls in balance of payments support are stationary. We therefore proceed by differencing the variables that are non-stationary before including them in the model. The results also show that the consumer price index for monthly data is I (1) compared with the I(2) series from annual data. The sample covers monthly data covering from 1994 to 1999. Monthly data before 1994 is not available for most of the variables of interest.

Effect on Government Expenditure

The augmented Dickey Fuller test results indicate that Government expenditure is I(1). In the VAR, we therefore take the first difference of government expenditure. The results presented in Table 2.18 show that the effect of a shortfall in balance of payments support on government expenditure is negative but statistically insignificant. Although the Government typically tries to run a domestic budget surplus in the face of a shortfall in balance of payments support, this strategy is ineffective because it is adopted by delaying payments until after the benchmark period. The long term effect, therefore, is insignificant. As a result, the Government resorts to borrowing either from the central bank or from the private sector. In the next subsection, we investigate the effect of shortfalls in balance of payments support on commercial bank lending to the Government.

Effect on Commercial Bank Lending to Government

The augmented Dickey Fuller test results indicate that government borrowing from commercial banks is a stationary variable. The results from the VAR model show that the effect of shortfalls in balance of payments support on commercial banks loans and advances to Government is insignificant. This leaves us with one possibility; Government borrowing from the central bank. In the next section, we examine the effect of shortfalls in balance of payments support on central bank Net Claims on Government.

Effect on Central Bank Net Claims on Government

The Dickey Fuller test results indicate that Net Claims on Government is a non-stationary variable in levels. We therefore use the first difference in the model. The single equation results of the bivariate VAR model of the change in Net Claims on Government by the Bank of Zambia and shortfalls in balance of payments support show a strong positive relationship between the variables. This suggests that Government resorts to borrowing from Bank of Zambia to finance its external budget deficit. This may have implications for reserve money, money supply, inflation, the nominal exchange rate and interest rates. However, an increase in Net Claims on Government as a result of a shortfall in balance of payments support has little effect on reserve money when the shortfall is financed by a reduction in gross and therefore net international reserves. In the next section, we investigate the effect of aid shortfalls on reserve money.

Effect on Reserve Money

Reserve money is non-stationary in levels but stationary in first differences. We therefore use the first difference in our VAR model. The results show that aid shortfalls have no significant effect on reserve money. We have already established that shortfalls in balance of payments support have a significant positive impact on Net Claims on Government by Bank of Zambia and hence on Net Domestic Assets (NDA). If they have no impact on reserve money, then they must have a negative impact on gross and net international reserves. In the next section, we therefore, test for the relationship between "shortfall" and gross international reserves at Bank of Zambia.

Effect on Net International Reserves

The Dickey Fuller results show that gross reserves are an $I(1)$ variable. We, therefore use the first difference in the VAR model. The results indicate a strong negative relationship between shortfall and gross international reserves. This offsets the impact of an increase in Net Domestic Assets on Reserve Money.

The results of this subsection shows that the response of Government to shortfalls in balance of payments support is not to run a domestic budget surplus through a reduction in domestic expenditure but to borrow from the Central Bank thus increasing Net Domestic Assets at Bank of Zambia.

The effect of the increase in Net Domestic Assets on Reserve Money is, however, offset by a reduction in Gross and Net International Reserves. We can, therefore, predict that shortfalls in balance of payments support have no impact on the money supply and other related macroeconomic variables. This result, however, only holds when there are sufficient reserves at Bank of Zambia. The failure by the Government to meet the targets agreed upon with the IMF on both Net Domestic Assets and on Net International Reserves leads to a further depletion of gross reserves as donors withhold their support. We have stated that NDA has three components, claims on government, claims on banks and other items . In an effort to meet the NDA benchmarks after an increase in claims on government, Bank of Zambia intervenes in the financial market through open market operations to reduce its claims on commercial banks. This tight monetary stance adopted by the central bank leads to a decline in commercial bank lending to the private sector as shown in Table 2.18. In the next subsection, we investigate the effect of shortfalls in balance of payments support on some macroeconomic variables.

Table 2.17: Unit Root Tests

Augmented Dickey Fuller Results with intercept but no time trend				
Variable Name	DF	ADF (1)	ADF (2)	95% CV
Shortfall	-12.18	-8.89	-6.08	-2.8861
Res	-1.0234	-1.0158	-0.93797	-2.9127
DRes	-7.4407	-5.4931	-4.7440	-2.9137
RM	-2.1101	-1.9598	-2.4586	-2.9127
DRM	-8.4660	-4.9625	-4.5335	-2.9137
Int	-4.5734	-4.1033	-3.5758	-2.9035
Exrate	4.4090	1.6333	2.0334	-2.9118
Dexrate	-2.6324	-3.2025	-2.6188	-2.9127
CPI	2.4147	1.5508	1.7978	-2.9035
DCPI	-5.4584	-5.6289	-4.0438	-2.9042
NCG	-0.37980	-0.35713	-0.26339	-2.9035
DNCG	-8.2595	-6.0600	-6.1158	-2.9047
LGVEXP	-1.8765	-0.84339	-O.30687	-2.9035
DLGVEXP	-13.71	-8.99	-6.036	-2.9035
DEBT	-6.4	-4.7	-3.7	-2.9035
PSCRE	-1.6	-1.4	-1.6	-2.9035
DPSCRE	-9.1	-5.6	-4.9	-2.9042

Table 2.18: Effect of Aid Shortfalls on Selected Macroeconomic Variables

(t-ratios and p-values)

Sample based on monthly data: 1994-1999

Dependent Variable	Aid Shortfall	Aid Shortfall (Lag 1)	Aid Shortfall (Lag 2)
DLGVEXP	-0.77 [.44]	0.97[.33]	-1.9[.061]
DEBT	-0.36(O.72)	0.90(0.37)	
DRes	-5.9 (0.000)	0.17[0.87]	-0.25[0.80]
DRM	1. 3015(0.20)		
Int	0.46381 (0.645)	0.99(0.323)	
Dexrate	2.0310(0.041)		
DCPI	0.49452(0.623)	2.2872(0.026)	
DNCG	6.1693(0.000)	2.1406(0.036)	
DPSCRE	-3.7048(0.000)	0.62505(0.534)	

- DLGVEXP:- First difference in the log of Government expenditure.
- Debt:- Government Borrowing from Commercial Banks
- Res:- Gross International Reserves at the Bank of Zambia

- DRes:-First difference in Res
- Int:- Commercial bank weighted average lending rate
- Exrate:- Bank of Zambia nominal exchange rate
- RM:- Reserve Money. DRM is the first difference in Reserve Money.
- DRM:- Changes in reserve money.
- CPI:- Consumer Price Index
- DCPI:- Changes in CPI
- NCG:- Bank of Zambia Net Claims on Government.
- DNCG:- Change in Bank of Zambia Net Claims on Government.
- LGVEXP:- log of Government Expenditure
- DLGVEXP:- Change in the log of Government Expenditure.
- PSCRE:- Commercial Bank credit to the private sector
- DPSCRE:- First difference in PSCRE

Effect on Macroeconomic Performance

Having established Government's response to shortfalls in balance of payments support in the previous section, this section determines the consequence of the response for key macroeconomic variables such as the interest rate, the exchange rate, inflation and private sector credit. Private sector credit is included here because expansion of credit to the private sector is one of the objectives of the IMF financial programme.

We use forecast error variance decompositions. The results presented in Table 2.19 indicate that shortfalls in balance of payments support explain little of the forecast error variances of the nominal exchange rate, the inflation rate and the nominal interest rate. However, they explain over 20 percent of the variation in commercial bank private sector credit. The later result reinforces the significant negative relationship between aid shortfall and commercial bank private sector credit. This is a natural result of attempts to meet the programme benchmark when there is a negative aid shock. The increase in net claims on government is partially offset by a reduction in credit to commercial banks.

Table 2. 19:Orthogonalised Forecast Error

Variance Decomposition for the Nominal Exchange Rate

Sample based on monthly data: 1994-1999

Orthogonalised Forecast Error Variance Decomposition for the Nominal Exchange Rate					
Horizon	SHORTFALL	DPSCRE	INT	DEXRATE	DCPI
0	.037120	.030326	.052220	.88033	0.00
1	.040909	.044392	.046287	.86469	0.004
10	.044638	.062370	.17610	.68076	0.04
20	.043668	.060952	.19187	.66519	0.038327
50	.043652	.060922	.19224	.66485	0.038331
Orthogonalised Forecast Error Variance Decomposition for the consumer price index(DCPI)					
Horizon	SHORTFALL	DPSCRE	INT	DEXRATE	DCPI
0	.0043635	.0072101	.030342	.080949	.87713
1	.024709	.0047677	.025646	.18675	.75813
10	.024085	.010155	.058670	.20623	.70086
20	.023851	.010049	.067765	.20395	.69438
50	.023850	.010048	.067912	.20392	.69427
Orthogonalised Forecast Error Variance Decomposition for the Nominal Interest Rate (Int)					
Horizon	SHORTFALL	DPSCRE	INT	DEXRATE	DCPI
0	.016337	.047431	.93623	0.00	0.00
1	.021311	.025146	.95247	.0010690	.4922E-5
10	.010410	.0052585	.94551	.2880E-3	.038535
20	.010242	.0051567	.94146	.2836E-3	.042861
50	.010233	.0051492	.94142	.2832E-3	.042918
Orthogonalised Forecast Error Variance Decomposition for Private Sector Credit (DPSCRE)					
Horizon	SHORTFALL	DPSCRE	INT	DEXRATE	DCPI
0	.24007	.75993	0.00	0.00	0.00
1	.27891	.70164	.6062E-5	.0067636	.012680
10	.27046	.69056	.0021599	.012607	.024211
20	.26987	.68903	.0042006	.012580	.024319
50.	.26987	.68902	.0042146	.012580	024322

Chapter 3
An Application of the Intertemporal Model of the Current Account to Heavily Indebted Developing Countries: A case of Zambia

3.1 Introduction

In the last two decades, there has been growing interest in testing the intertemporal implications of the open economy models. The distinctive feature of an open economy is the ability to borrow and lend in international capital markets in response to cyclical disturbances. As a result, domestic income and spending can be different as countries can run current account surpluses and deficits. This behavior is the result of consumption smoothing and capital flows to those countries where investment opportunities exist. These two forces shape the dynamics of saving and investment rates and thus the response of the current account.

However, there are imperfections in international capital markets arising from factors such as sovereign debt, especially for low income developing countries. The Zambian economy became increasing indebted after the negative shock of 1974, exacerbated by the debt crisis of 1982. The existence of a huge debt can qualify the intertemporal implications of open economy models. The purpose of this paper is to apply the intertemporal model of the current account to a heavily indebted small open developing country (in this case Zambia) in order to explain the dynamics of investment, consumption and the current account.

The paper is organised as follows; in section 3.2, we present the theoretical model of the intertemporal approach to the current account [10]. In section 3.3, we present the empirical results while section 3.4 concludes.

3.2 The Model

In this section, we present an intertemporal model of the current account. We have seen from other papers that the current account in Zambia depends crucially on the shocks to the copper price because of the economy's heavy dependence on the copper mining sector for its export earnings. We attempt to extend our analysis further to establish how investment and consumption responses to exogenous shocks to output affect the dynamics of the current account

3.2.1 Consumption Dynamics

We assume that the representative individual, faced with uncertainty, maximizes the expected value of lifetime utility,

$$U_t = E_t \left[\sum_{s=t}^{\infty} \beta^{s-t} u\left(C_s\right) \right] \tag{3.1}$$

Subject to the budget constraint given by

$$(1+r)B_t = \sum_{s=t}^{\infty} (\frac{1}{1+r})^{s-t} \left(C_s + G_s + I_s - Y_s\right) \tag{3.2}$$

[10] The model presented in this section is based on material from Chapter 2 of Obstfeld and Rogoff; Foundations of International Macroeconomics (1996). We have made no modifications to this model. Our contribution is in the empirical analysis.

The above equation involves random variables. Taking first order conditions gives the following intertemporal Euler Equation.

$$E_t \{u'(C_s)\} = (1+r)\beta E_t \{u'(C_{S+1})\} \tag{3.3}$$

which implies for $s = t$ that $u'(C_t) = (1+r)\beta E_t \{u'(C_{t+1})\}$

The linear-quadratic "Permanent Income"Model

A variant of this model that has been used extensively in the empirical literature is the linear-quadratic utility model in which the period utility function is given by:

$$U(C) = C - \frac{a_0}{2}C^2, a_0 > 0 \tag{3.4}$$

In order to constrain consumption to follow a trendless long-run path we specify that $(1+r)\beta = 1$. The marginal utility of consumption $u'(C) = 1 - a_0 c$ is linear in consumption. When we substitute this marginal utility into the Euler equation, we obtain Hall's (1978) famous result

$$E_t C_{t+1} = C_t \tag{3.5}$$

That is, consumption follows a random walk. The random walk Euler equation can be used to derive a reduced form for the level of consumption as a function of current and expected future values of output, government spending, and investment.

In the case of quadratic utility, the Euler equation implies that for any $S > t, E_t C_S = E_t C_{s-1} = E_t C_{s-2} .... = E_t C_{t+1.}$ When we substitute C_t for $E_t C_s$ in the expected value budget constraint and then rearranging yields

$$\sum_{s=t}^{\infty}(\frac{1}{1+r})^{s-t}C_t = E_t\left\{(1+r)B_t + \sum_{s=t}^{\infty}(\frac{1}{1+r})^{s-t}(Y_s - G_s - I_s)\right\} \tag{3.6}$$

The solution for C_t is simply an expected value rendition of the permanent income consumption function. With quadratic utility, consumption is determined according to the certainty equivalent principle. People make decisions under uncertainty by acting as if future stochastic variables were sure to turn out equal to their unconditional means.

Effect of Output Shocks on Consumption and the Current Account

Effect On Consumption

In order to examine the effect of output shocks on consumption and the current account, we apply the linear quadratic model presented above. We assume that output follows the following stochastic process

$$Y_{t+1} - \bar{Y} = \rho(Y_t - \bar{Y}) + \epsilon_{t+1} \tag{3.7}$$

Where ϵ_t is a serially uncorrelated disturbance $E_t\epsilon_{t+1} = 0$ and $0 \leq \rho \leq 1$. Because $E_t\epsilon_s = 0$, the preceding stochastic difference equation for output implies

$$E_t\left(Y_s - \bar{Y}\right) = \rho^{s-t}(Y_t - \bar{Y}) \tag{3.8}$$

Forgetting (temporarily) government consumption and investment i.e. $G = I = 0$, the permanent income consumption function can be written as

$$C_t = rB_t + \overline{Y} + \frac{r}{1+r}\sum_{s=t}^{\infty}(\frac{1}{1+r})^{s-t}E_t\left(Y_s - \bar{Y}\right) \tag{3.9}$$

Substituting for $E_t\left\{Y_s - \bar{Y}\right\}$

$$C_t = rB_t + \overline{Y} + \frac{r(Y_t - \bar{Y})}{1+r-\rho} \tag{3.10}$$

This yields a 'Keynesian' consumption function in the sense that higher current output raises consumption less than one for one (except in the special case $\rho = 1$, in which case they rise by the same amount). Under the stochastic process (3.7), output can be written as

$$Y_t = \bar{Y} + \sum_{s=-\infty}^{t} \rho^{t-s}\epsilon_s \tag{3.11}$$

so that shocks effects decay geometrically over time provided $\rho < 1$ (they are permanent only if $\rho = 1$). As a result, unexpected shifts in current output cause smaller unexpected shifts in permanent output, so that consumption smoothing makes consumption respond less than fully to output shocks.

Implication for the Current Account

To see the implications for the current account, we write the consumption function in terms of the unexpected shock to output, the innovation ϵ_t :

$$C_t = rB_t + \overline{Y} + \frac{r\rho}{1+r-\rho}\left(Y_{t-1} - \bar{Y}\right) + \frac{r}{1+r-\rho}\epsilon_t \tag{3.12}$$

Substituting this formula into the current account identity $CA_t = rB_t + Y_t - C_t$ gives

$$CA_t = \rho\left(\frac{1-\rho}{1+r-\rho}\right)\left(Y_{t-1} - \bar{Y}\right) + \left(\frac{1-\rho}{1+r-\rho}\right)\epsilon_t \tag{3.13}$$

An unexpected positive shock to output causes an unexpected rise in the current account surplus when the shock is temporary ($\rho < 1$), because people smooth consumption intertemporally through asset accumulation. A permanent shock ($\rho = 1$) has no current account effect because people simply adjust consumption by the full innovation to output.

Effect of Non-stationarity on Consumption and the Current Account

When we assume that output follows the following stochastic process

$$Y_{t+1} - Y_t = \rho\,(Y_t - Y_{t-1}) + \epsilon_{t+1} \tag{3.14}$$

with $0 < \rho < 1$. This process makes output a non-stationary random variable,

$$Y_t = Y_{t-1} + \sum_{s=-\infty}^{t} \rho^{t-s}\epsilon_s \tag{3.15}$$

The only difference between the above equation and the previous one is that we have Y_{t-1} instead of $\overline{Y}$ on the right hand side. This difference means that under the latter equation, an output surprise ϵ_t, raises Y_{t+1} by $(1+\rho)\epsilon_t, Y_{t+2}$ by $(1+\rho+\rho^2)\epsilon_t$ and so on whereas in the former, the corresponding increases are only $\rho\epsilon_t, \rho^2\epsilon_t$. Because the latter equation makes future output fluctuate by more than ϵ_t, permanent output fluctuates more than current output (except in the special case $\rho = 0$ in which case their fluctuations are the same). Consumption smoothing now implies that an unexpected increase in output causes an even greater increase in consumption. As a result, a positive output innovation now implies a current account deficit-in sharp contrast to what the stationary case predicts.

In the intertemporal approach to the current account presented above, it is generally assumed that the representative agent can borrow freely in world capital markets at the riskless world real interest rate r. If all shocks were country specific (uncorrelated with global shocks), then for a small country r may be treated as exogenous.

3.2.2 Investment

We assume that output is given by the production function $Y_s = A_s F(K_s)$, where the productivity parameter is a random variable. A firm's profit maximizing condition for capital is:

$$A_s F'(K_s) = r \tag{3.16}$$

The firm adds to its capital stock until the marginal product of capital $(A_s F'(K_s))$ equals the cost of capital (r)

Investment is given by $I_s = K_{s+1} - K_s$, and the constrained utility function that the representative individual maximizes can be written as

$$U_t = E_t \left\{ \sum_{s=t}^{\infty} \beta^{s-t} u \left[(1+r) \beta_s - \beta_{s+1} + A_s F(K_s) - (K_{s+1} - K_s) - G_s \right] \right\} \tag{3.17}$$

The consumer maximizes the present value of expected future utility derived from expected future consumption. Differentiating with respect to K_{t+1} yields

$u'(C_t) = E_t\left\{[1 + A_{t+1}F'(K_{t+1})]\,\beta u'(C_{t+1})\right\}$. We know that $U'(C_t)$ is non-random on date t so that dividing it into both sides gives

$$\begin{aligned} 1 &= E_t\left\{[1 + A_{t+1}F'(K_{t+1})]\frac{\beta u'(C_{t+1})}{u'(C_t)}\right\} \\ &= E_t\left\{1 + A_{t+1}F'(K_{t+1})\right\}E_t\left\{\frac{\beta u'(C_{t+1})}{u'(C_t)}\right\} + Cov\left\{A_{t+1}F'(K_{t+1}), \frac{\beta u'(C_{t+1})}{u'(C_t)}\right\} \end{aligned} \tag{3.18}$$

By using the bond Euler equation, we reduce this expression to

$$E_t\left\{A_{t+1}F'(K_{t+1})\right\} = r - Cov\left\{A_{t+1}F'(K_{t+1}), \frac{\beta u'(C_{t+1})}{u'(C_t)}\right\} \tag{3.19}$$

after imposing $(1 + r)\beta = 1$. This equation differs from the certainty equivalent version of $A_{t+1}F'(K_{t+1}) = r$ only because of the covariance term on the right hand side. Assuming that all domestic capital is held by domestic residents, the covariance is likely to be negative. When capital is unexpectedly productive (A_{t+1} is above its conditional mean), domestic consumption will be unusually high and its marginal utility unexpectedly low. As a result, the expected marginal productivity of capital must be higher than r so that the capital stock is lower than in the corresponding certainty equivalence model.

The intuition is that the riskiness of capital discourages investment. For a country such as Zambia, uncertainty created by the external debt burden reduces investment. Thus investment is affected by changes in the productivity of capital, the interest rate and the risk associated with investment. We abstract from the effect of changes in interest rates and risk and focus on the effect of productivity shocks.

Assuming that the stochastic process governing productivity shocks is

$$A_{t+1} - \overline{A} = \rho(A_t - \overline{A}) + \epsilon_{t+1} \tag{3.20}$$

where $0 \leq \rho \leq 1$ and ϵ_{t+1} is a serially uncorrelated shock with $E_t\epsilon_{t+1} = 0$. When $\rho > 0$, positive productivity shocks do not only raise the path of future output directly, but they also induce investment (by raising the anticipated return to capital), thereby raising expected future output even further.

An unanticipated productivity increase on date t affects the date t current account via two channels. First it raises investment, tending to worsen the current account as domestic residents borrow from abroad to finance additional capital accumulation. Second, the productivity increase affects savings. The magnitude of ρ influences whether date t saving rises, and, if so, whether it rises by more or less than investment. With reasonable generality, the more persistent productivity shocks are, the lower is $CA_t = S_t - I_t$.

If $\rho = 1$, the current account must fall. This is so because the capital stock takes a period to adjust to its new higher level, so that expected future output rises by more than current output. At the same time, current investment rises but expected future investment does not. Saving therefore falls while investment rises.

On the other hand, if ρ is sufficiently far below 1, future output rises by less than current output, raising savings. Savings may rise by even more than investment. In the extreme case $\rho = 0$, there is no investment response at all. The country runs a current account surplus to spread the benefits of its temporarily higher output

Summary of Theoretical Models and Expectation from Empirical Results

The model presented above has the following implications:

- Investment and savings should have a low correlation when the economy is highly integrated in world capital markets.
- When a shock to output is permanent, the current account surplus (deficit) decreases (increases). The investment response to an output shock is reinforced by the consumption response. The effect of the shock to the current account is therefore higher than the investment response.
- Whether the current account will be procyclical or countercyclical depends on the magnitude of the savings response relative to the investment response to an output shock.
- Consumption smoothing implies that output will be more volatile than consumption. However, with non-stationarity of output, consumption responds more than income to a permanent income shocks.

In our empirical analysis, we seek to determine whether the above implications apply to Zambia and to provide some explanations where they do not.

3.3 Empirical Analysis

Our empirical objective is to determine the response of consumption and investment to income shocks in Zambia. In effect, we will be able to establish the effect of shocks to GDP on savings, investment and the current account. Traditional intertemporal models of the current account suggest that the type of response depends on the nature of shocks; whether they are transitory or permanent, and whether they are global or country specific. For developing countries, the response also depends on the country's external indebtedness.

There are two significant stylized facts about modern economies (developed economies in particular). First, domestic savings (s) and domestic investment (I) are positively correlated. Second, that the trade balance and the current account tend to move countercyclically. The savings-investment debate has been the subject of intensive debate because of its alleged implication on the degree of international capital mobility. Martin Feldsten and Charles Horioka (1980) documented a strong cross sectional correlation between saving and investment for a sample of OECD countries as evidence against perfect capital mobility. Most economists, however, believe that the world is characterized by an increasingly high degree of capital mobility The significantly positive relationship between saving and investment has proved to be robust to virtually all alterations of the Feldstein-Horioka test and has been detected in time-series and cross-section data for many countries.

Before determining whether these stylized facts apply to Zambia, and therefore other developing countries with similar characteristics, we first describe the statistical properties of the data we are using.

3.3.1 Statistical Properties of the Data

The data used in the analysis comprises annual data from 1964 to 1999. The data was obtained from the International Financial Statistics of the IMF. The variables used in the analysis are GDP(Y), private consumption (C_P), government consumption (C_G), total consumption (C), investment (I), savings (S) and the trade balance (TB). For all these variables, we carry out augmented Dickey Fuller tests to deterimine their order of integration The results are presented in Table 3.01

Table 3.01: Results of Unit Root Tests

Variable	Y	C_P	C_G	C	I	S	TB
Order of Integration	1	2	1	2	1	1	0

The results presented in the table indicate that all the variables of interest are I (1) except for the trade balance which is I(0) and private consumption which is I(2). Total consumption is also I(2).

3.3.2 Savings - Investment Correlation

The starting point in determining whether the intertemporal model of the current account is applicable to Zambia is to estimate the correlation between saving and investment. An implication of the intertemporal model is that the correlation between savings and investment should be low. A high correlation between savings and investment is generally interpreted as evidence against perfect capital mobility. To assess the relation between savings and investment for a of sample industrialised countries, Feldstein and Horioka (1980) estimated the following equation:

$$\left(\frac{I}{Y}\right)_i = \alpha + \beta \left(\frac{S}{Y}\right)_i \tag{3.21}$$

I refers to investment and S to savings and Y to GDP for country i. With perfect capital mobility, an increase in savings in country i would cause an increase in investment in all countries. The distribution of incremental capital among countries would vary positively with each country's capital stock and inversely with the country's marginal product schedule. In the extreme case in which the country is infinitesimally small relative to the world economy, the value of β implied by perfect world capital mobility would be zero.

In contrast, estimates of β close to one would indicate that most of the incremental saving in each country remains there. Since the excess of gross domestic investment over gross domestic savings is equal to the net inflow of foreign investment, a regression of the ratio of net foreign investment to GDP on the domestic savings ratio would have a coefficient of $\beta - 1$. Testing the hypothesis that β equals one is therefore equivalent to testing the hypothesis that international capital flows do not depend on domestic savings rates. Alternatively, that the current account does not depend on the savings rate.

The estimated β was 0.89 with a standard error of 0.07. According to Feldstein and Horioka, this was evidence that nearly all of the incremental savings remain in the country of origin. These results are quite incompatible with the assumption of complete arbitrage in a perfect world capital market.

The result also implies that in the presence of positive productivity shocks, investment is constrained by the amount of domestic savings. Investors have no access to international capital markets.

Feldestein and Horioka suggested the following explanations for the immobility of capital:

- For most investors, the uncertainties and risks associated with foreign investment are perceived as so great that investment is restricted to the domestic economy.
- There are incidences of restrictions on capital exports.
- There are also institutional rigidities that tend to keep a large segment of domestic savings at home. In the USA for instance, savings institutions (insurance companies, pension funds ..etc.) are required by law to invest in mortgages on local real estates.

We estimate a similar equation for Zambia. In comparing the predictions of the theory with the data, it is necessary that theoretical constructs measure the same economic variables as the data. Saving is measured as output less private and government consumption. The national income accounts measure of savings can differ markedly from true savings. The difference arises when foreigners own shares in domestic firms and firms finance expenditure from retained earnings. The discrepancy is larger when the share of foreign ownership is large.

The national income accounts measure of savings adopted in this paper is simple and has been used extensively in most of the empirical literature on savings-investment correlations. Baxter and Crucini (1993) refer to this measure as "the basic saving" constructed as:

$$S_{Bt} = Y_t - C_t - G_t \tag{3.22}$$

When we assume complete risk-pooling, true saving is generally different from basic saving. In equilibrium, world saving equals world investment and complete risk pooling means that per capita saving is equated across countries. Thus true saving is given by:

$$S_{Tt} = \pi_t I_t + (1 - \pi_t) I_t^* \tag{3.23}$$

Where π_t is the fraction of savings invested domestically and I^* refers to foreign investment. Constructing a direct measure of true saving is prohibitively difficult as it requires information on foreign ownership of shares on a firm by firm basis and information on a firm's financing decision.

The estimates based on the basic saving measure are shown in the equation below:

$$\begin{aligned} \underset{SE}{\Delta \frac{I}{Y}} &= \underset{0.013}{0.007} - \underset{0.11}{0.09} \Delta \frac{S}{Y} \\ R^2 &= 0.024 \end{aligned} \tag{3.24}$$

The variables used in the above equation are I(1) so that first differences of these variables are used in the regression.

We have seen that the specification of the Feldstein and Horioka equation can be reformulated to a regression of the excess of domestic investment over savings i.e. external inflows or the current account deficit on savings. The coefficient on savings using this reformulation is $\beta - 1$ so that the hypothesis of $\beta = 1$ is equivalent to the hypothesis that $\beta - 1 = 0$. This means that the current account balance does not depend on savings. We estimate this reformulation of the original equation and get the following results:

$$\underset{SE}{\frac{TB}{Y}} = \underset{0.024}{0.026} + \underset{0.2}{0.44}\,\Delta\frac{S}{Y} \tag{3.25}$$

The estimates with the inclusion of one lag are presented in Table 3.02.

Table 3.02: Regression of the trade balance $\left(\frac{TB}{Y}\right)$on savings

Sample Period: 1964-1999

Variable	Coefficient	t-value
Constant	-0.0014	-0.109
$\Delta\frac{S}{Y}$	0.98	8.37
$\Delta\frac{S}{Y}_{-1}$	-0.06	0.56
$\frac{TB}{Y}_{-1}$	0.89	8.1

We observe that, in Zambia, the correlation between savings and investment is low. We also see that domestic savings are important in determining the current account in contrast with the Feldstein Horioka result where the coefficient on savings was zero. This result suggests that transitory income shocks that increase savings reduce the current account deficit. We should therefore expect the trade balance and the current account to be procyclical since savings have little effect on investment but a significant effect on the trade balance. In other words, domestic savings are transferred abroad in the form of debt repayment. This result is in contrast with that of Kraay and Ventura (2000) who predicted that for a creditor country such as Zambia, an increased in savings should increase the current account deficit.

The specification used by Feldstein and Horioka ignores the potential endogeneity of the savings ratio. This would clearly be inappropriate in a short run Keynesian framework. A random shock to investment or any other component of aggregate demand would also affect the savings ratio; the estimate of β could not be interpreted as a measure of the effect on investment of exogenous changes in saving behaviour. In order to ensure robustness of our results, we test for the hypothesis that savings do not Granger cause investment.

The idea behind Granger causality is that the cause cannot come after the outcome has occurred. If variable X_t affects a variable Z_t, the former should help make predictions of the latter variable. If Z_t can be predicted more efficiently if the information in the X_t process is taken into account in addition to all the other information in the universe, then X_t is Granger causal for Z_t. Instantaneous causality simply implies the existence of non-zero correlation between the variables. The interpretation of this term is problematic because it does not say anything about the cause and effect relationship. The direction of causality cannot be derived from the Moving Average or VAR representation of the process but must be obtained from further knowledge on the relationship between the variables which may exist in the form of economic theory. The results of Granger causality tests are presented in Table 3.03.

Table 3.03: LR Test of Block Granger Non-Causality in the VAR

****

Based on 28 observations from 1970 to 1997. Order of VAR = 2

List of variables included in the unrestricted VAR: DSGDP, DIGDP

List of deterministic and/or exogenous variables: INPT

Maximized value of log-likelihood = 62.5719

****

List of variable(s) assumed to be "non-causal" under the null hypothesis: DSGDP

Maximized value of log-likelihood = 62.0047

****

LR test of block non-causality, CHSQ(2)= 1.1344[.567]

****

The above statistic is for testing the null hypothesis that the

coefficients of the lagged values of: DSGDP in the block of

equations explaining the variable(s): DIGDP are zero.

The maximum orderof the lag(s) is 2.

****

LR Test of Block Granger Non-Causality in the VAR

****

Based on 28 observations from 1970 to 1997. Order of VAR = 2

List of variables included in the unrestricted VAR: DSGDP DIGDP

List of deterministic and/or exogenous variables: INPT

Maximized value of log-likelihood = 62.5719

****

List of variable(s) assumed to be "non-causal" under the null hypothesis: DIGDP

Maximized value of log-likelihood = 62.1691

****

LR test of block non-causality, CHSQ(2)= .80557[.668]

****

The above statistic is for testing the null hypothesis that the coefficients of the lagged values of: DIGDP in the block of equations explaining the variable(s): DSGDP are zero. The maximum order of the lag(s) is 2.

****

The results presented above show the absence of Granger causality from savings to investment and vice versa (DSGDP and DSGDP refer to the first differences of the ratios of savings to GDP and investment to GDP respectively). The low correlation between investment and savings implies that domestic investment in Zambia is mainly foreign financed. The important role of foreign financing has been recognised by international financial institutions such as the World Bank. The World Bank Revised Minimum Standard Model (RMSM) focuses on the relationship among saving, external capital flows and investment with particular emphasis on the financing gap. The financing gap is the excess of financing requirements for the targeted growth in real income over domestic savings and the predicted capital inflows from the private sector.

External inflows or external transfers can be expressed as the excess of domestic investment (ΔK) over private and government savings using the following national income identity:

$$\Delta K - s(Y - T) - (T - G) = aY - X \qquad (3.26)$$

Y refers to GDP, s to the marginal propensity to save, T to lump sum tax, G to government expenditure and a to the marginal propensity to import. An alternative formulation of the national income identity is:

$$\Delta K = (s + a)Y + (1 - s)T - G - X \qquad (3.27)$$

In more compact form, we have:

$$I = S + (M - X) \qquad (3.28)$$

The above formulation expresses investment as a function of savings (S) and net imports ($M - X$), which provide a measure of external inflows. Since domestic savings play an insignificant role in determining investment in Zambia (from savings-investment correlation results), external financing must play an important role.

The importance of external financing for domestic investment in Zambia is supported by an estimation of the correlation between investment and the trade balance. We estimate the following regression:

$$\Delta\frac{I}{GDP} = a_0 + b_0\frac{TB}{GDP} + U_t \qquad 3.29$$

The investment to GDP ratio (I/GDP) is regressed on the trade balance to GDP ratio (TB/GDP). Since we know, from the national income identity, that foreign savings are transferred to the domestic economy through imports, we also run a regression of investment on imports:

$$\Delta\frac{I}{GDP} = a_0 + b_1\Delta M + U_t \qquad (3.30)$$

Where M refers to the log of imports. The results of the above regressions are tabulated in Table 3.04:

Table3.04: OLS Regression of Investment on the Trade Balance and Imports

Independent Variable is $\Delta\frac{I}{GDP}$

Sample Period: 1964-1999

Dependent Variable	Coefficient	Standard Error	t-value
TB/GDP	-0.22	0.09	-2.4
M	0.09	0.03	2.45

The results presented in Table 3.04 show that the trade balance has a negative correlation with investment, in other words external outflows $(X > M)$ have a negative effect on investment while external inflows $(M > X)$ have a positive effect. We also see in Table 3.04 that the import variable is statistically significant in the OLS regression of Investment on Imports. We can interpret this result in two ways, first that an increase in investment prospects leads to a worsening of the current account through increased imports, particularly of capital and intermediate goods. This would be the interpretation suggested by the traditional models of the current account. The second interpretation simply supports our earlier proposition that domestic investment in Zambia is financed mainly by external resources rather than domestic savings. Since most developing countries in sub-Saharan Africa have limited access to private capital flows, foreign investment financing must come in the form of aid.

The second interpretation is consistent with the "three gap model" of development with a binding foreign exchange constraint. Domestic savings, which have an insignificant effect on investment, are a slack variable. An elaboration of the three gap model of development is provided in appendix 3.A.

The low correlation between savings and investment in Zambia seems to suggest that the Feldstein Horioka (1980) result does not apply to small open developing countries like Zambia. Paradoxically, this relationship would be expected to be stronger in developing countries because they have less access to international capital markets compared to developed economies on which the original result was based.

Several investigators who have constructed such tests -(Dooley, Frankel, and Mathieson (1987)- included a number of developing countries in their cross section samples and investigated the effect of including such countries on their results. These authors concurred in finding that the inclusion of developing nations reduced the strength of the saving -investment correlation in their samples. This result was unexpected because these countries were perceived ex ante as less integrated with world capital markets than industrial countries.

Lensink and White (1998) estimated an econometric model from which they concluded that developing countries in Sub-Saharan Africa have little access to private capital flows despite the remarkable increase in private capital flows since 1987. Private capital flows are concentrated in a small number of countries, which are mostly reasonably affluent. Their econometric analysis of the determinants of private capital flows indicated that a combination of per capita GDP growth, financial development (as indicated by the broad money to GDP ratio) and the openness of a country are important factors in explaining whether a country would be able to attract enough private capital to become independent of aid. Their results show that Zambia is in the group of countries which are potentially aid-dependent. What this implies is that most of the foreign financing for investment in Zambia comes in the form of aid.

International financial institutions like the World Bank and the IMF use the Harrod-Domar model to calculate the financing gap between the required investment and available resources. This financing gap is then filled up with foreign aid (Easterly 1999). The Harrod-

Domar model died out of the academic literature long ago so that Easterly refers to it as the "ghost of the financing gap".

Recent theoretical work has cast doubt on the inference of imperfect capital mobility drawn from the observed saving and investment correlations. Obstfeld (1986) has shown that a deterministic dynamic-equilibrium model with perfect capital mobility produces positive correlations between savings and investment as a result of persistent productivity changes or population growth. Persistent productivity changes and population growth increase both investment and savings. Modigiliani (1970) showed that the traditional life cycle model of consumption implies that a country's saving will be higher where the rate of growth of private income is high and where the working age population is higher relative to the numbers of retirees and younger dependants.

Baxter and Crucini (1993) showed that the observed positive correlation between savings and investment rates arises naturally within a quantitatively restricted general equilibrium model with perfect mobility of financial and physical capital. Their simple model is consistent with the fact that savings-investment correlations are larger for larger countries but are still substantial for smaller countries. Their model is also consistent with the finding that current account deficits are associated with investment booms. Sachs (1981) presents empirical evidence that the current account deficits are associated with investment booms implying that increases in investment are at least partially financed by capital inflows. Baxter and Crucini's paper are an attempt to reconcile Sach's evidence with high time series correlations between savings and investment.

In order to explain the low savings-investment correlation in Zambia and developing countries in general, it would be useful to analyse the determinants of the saving-investment correlation.

Determinants of Saving Investment Correlations

We briefly discuss the central determinants of the savings investment correlations using the basic measure of savings. Let σ_x denote the standard deviation of the variable X, and let $\rho(X,Y)$ denote the correlation between X and Y. The correlation between saving and investment is the variance weighted average of the correlation between income and investment and consumption and investment. For simplicity, we assume that government consumption is constant. The correlation is then given by;

$$\rho(Y-C,I)=\frac{\sigma_y}{\sigma_{sb}}\rho\left(Y,I\right)-\frac{\sigma_c}{\sigma_{sb}}\rho\left(C,I\right) \tag{3.31}$$

which simplifies to

$$\rho(S_B,I)=\rho(Y-C,I)=\frac{\sigma_y}{\sigma_{sb}}\left[\rho(Y,I)-\frac{\sigma_c}{\sigma_y}\rho(C,I)\right] \tag{3.32}$$

Thus the correlation between basic saving and investment is based on

- the correlation between output and investment
- the correlation between consumption and investment and
- the volatility of consumption relative to income.

The equation presented above implies that for a given degree of correlation between consumption and investment, the less volatile consumption is relative to income, the higher is the savings -investment correlation

In the model by Baxter and Crucini (1993) $\rho(Y, I)$ and $\rho(C, I)$ tend to be positive but the consumption investment correlation tends to be weaker than the investment output correlation because of international risk pooling. Further, the relative volatility of consumption, σ_c/σ_y is less than one. The combination of these factors means that the correlation between basic saving and investment is expected to be positive and that the output investment correlation is the dominant term.

The correlation between investment and output in Zambia is low as shown by the results presented in Table 3.17 (page 211). In addition, the relative volatility of consumption to output in Zambia is far greater than one (Table 3.17, page 211). These factors partly explain the low correlation between basic saving and investment in Zambia. These results differ from those obtained by Baxter and Crucini for OECD countries . In contrast with developed economies, consumption in developing countries is not smooth. An explanation from the theorerical model suggests that this could be a consequence of non-stationarity in the GDP series. With non-stationarity, consumption smoothing implies that an unexpected increase in output causes an even greater increase in consumption. When there are permanent shocks to output which have a protracted impulse response, output adjusts to its permanent level gradually while consumption jumps to the new level directly. However, imperfections in domestic capital markets and limited access to international capital markets causes consumption to be closely linked to current income.

According to the model by Baxter and Crucini (1993), the savings investment correlation is sensitive to the persistence of output shocks parameter ρ. The basic savings investment correlation decreases with decreases in ρ essentially because the correlation between investment and output declines with decreases in ρ. When shocks are less persistent, the incentive to move investment goods in response to a shock is decreased. Therefore, it is important that we measure the persistence of output shocks in Zambia in order to determine whether this factor could help explain the observed low savings investment correlation.

We find that the persistence of output shocks is not a factor and argue that the existence of an unsustainable debt has created a disincentive to investment in Zambia and other heavily indebted developing countries. This will bring us to a discussion of the debt overhang hypothesis. We first determine the persistence of output shocks in Zambia.

3.3.3 Persistency of Output Shocks

In measuring the persistence of output shocks in Zambia, we use the approach suggested by Campbell and Mankiw (1987). Campbell and Mankiw questioned the conventional view that fluctuations in output represent temporary deviations from trend. Their argument is that if fluctuations in output are dominated by temporary deviations from the natural rate of output growth, then an unexpected change in output today should not substantially change one's forecast of output in say five or ten years. In measuring the impact of innovations therefore, we ask the question: suppose real GDP falls by 1% lower than one would expect from its past history, how much should one change one's forecast of GDP five or ten years from now?

We model the change in real GDP as the stationary ARMA (p,q) process:

$$\phi(L)\Delta Y_t = \theta(L)\epsilon_t \tag{3.33}$$

where

$$\phi(L) = 1 - \phi_1 L - \phi_2 L^2 - ...\phi_P L^P \tag{3.34}$$

and

$$\theta(L) = 1 + \theta_1 L + \theta_2 L^2 + ...\theta_q L^q \tag{3.35}$$

The equation can be rearranged to arrive at the moving average representation (or impulse response function) for ΔY_t;

$$\Delta Y_t = \phi(L)^{-1}\theta(L)\epsilon_t \tag{3.36}$$

$$\Delta Y_t = A(L)\epsilon_t \tag{3.37}$$

If the change in the log of GDP is stationary, then $\sum\limits_{i=0}^{\infty} A_i^2$ is finite, implying that the limit of A_i as i approaches infinity is zero. In other words, stationarity of the differenced series implies that an innovation does not change one's forecast of the growth over a long horizon. We can derive the moving average of the level of Y_t by inverting the difference operator $(1 - L)$;

$$Y_t = (1 - L)^{-1}A(L)\epsilon_t \tag{3.38}$$

$$Y_t = \beta(L)\epsilon_t \tag{3.39}$$

where

$$\beta_i = \sum_{j=0}^{i} A_j \tag{3.40}$$

Of course, Y_t need not be stationary, and thus β_i need not approach zero as i approaches infinity. Instead, the limit of β_i is the infinite sum of the A_j coefficients, which can also be written as $A(1)$. The value of β_i is exactly what we wish to estimate, since it measures the response of Y_{t+i} to an innovation at time t.

One of the important features of unit root processes lies in the fact that the effect of shocks on the series (or random deviations from their trend) do not die out. In the case of random walk models, the long run impact of shocks is unity. For more general I (1) processes, this long run impact could be more or less than unity.

Estimates of the Campbell and Mankiw Persistence Measure based on Real GDP Data:

We use a measure of persistence using the ARMA modelling approach in Microfit. PCM refes to a measure of persistence based on the ARIMA method described above as suggested by Campbell and Mankiw (1987). We estimate an ARIMA(1,1,2) process. The estimation results are presented in Tables 3.05 and 3.06. The orders for the autoregression and moving average are selected using the Akaike Information Criteria and the Shwarz Bayesian Criteria.

Table 3.05:Model Parameter Estimates Δ ln Real GDP

Sample Period: 1964-1999

	ϕ_1	ϕ_2	θ_1	θ_2
Parameter	0.77186	-	0.6137	0.14848
Standard Error	0.22190		1.7740	0.42758

Table 3.06: Model Impulse Responses in ln Real GDP

Sample Period: 1964-1999

Function	Estimate	Stanadrd Error	T-Ratio
PCM	0.99452	0.34725	2.8640

The PCM estimate is close to unity, which is the persistence measure for a pure random walk model. The t- statistic for this latter test is computed as

$$t_{P_{cm}} = \frac{(P_{cm} - 1)}{SE(P_{cm})} = \frac{0.99452 - 1.0}{0.34725} = -0.015781137 \tag{3.41}$$

Based on the above measure suggested by Campbell and Mankiw, shocks to GDP in Zambia are persistent but not fully permanent. Since the persistence of output shocks does not provide an explanation for the low correlation between investment and output in Zambia, an alternative explanation is provided by the disincentive effects of external debt. This is the subject of our next discussion.

3.3.4 Zambia's External Debt Burden

Both government policy makers and actors in world capital markets spend a good deal of time analysing the "sustainability" of indebted countries' current account deficits. Their purpose is to detect situations in which countries might become bankrupt. It has happened repeatedly, most recently in the decade starting 1982, that countries are cut off from world capital markets because potential investors perceive them to be bad risk. The intertemporal budget constraint of an economy in the infinite horizon model is given by

$$-(1+r)B_t = \sum_{s=t}^{\infty}(\frac{1}{1+r})^{s-t}\,(Y_s - C_s - G_s - I_s) \tag{3.42}$$

Define $TB \equiv (Y_s - C_s - G_s - I_s)$, as the economy's trade balance. The trade balance is the net amount of output the economy transfers to foreigners. The preceding constraint simply states that the present value of an economy's resource transferred to foreigners must be equal to the economy's initial debt to them. Thus the intertemporal budget constraint holds if, and only if, a country pays off any initial debt through sufficiently large future surpluses in its trade balance.

The fact that a country runs persistent current account deficits does not imply that it is about to go broke. A country can register substantial trade surpluses despite running current account deficits. An economy with growing output can run perpetual current account deficits and still maintain a constant ratio of foreign debt to both output and wealth. For an economy growing at the rate of growth $g > 0$, $Y_{s+1} = (1+g)\,Y_s$. If the economy maintains a steady debt-output ratio β_s/Y_s, so that $\beta_{s+1} = (1+g)\beta_s$, the current account identity implies a steady imbalance of

$$\beta_{s+1} - \beta_s = g\beta_s = r\beta_s + TB_s, \tag{3.43}$$

which shows that

$$\frac{TB_S}{Y_S} = \frac{-(r-g)\,\beta_s}{Y_S} = \frac{-\beta_S}{Y_S/(r-g)} \tag{3.44}$$

The first equality above shows that to maintain a constant Debt to GDP ratio, the country need pay out only the excess of the interest over the growth rate. The second equality shows that the necessary trade balance surplus is a fraction of GDP equal to the ratio of debt to the world market value of a claim to the economy's entire future GDP. Thus, the ratio $-(r - g)\beta/Y$ measures the burden a foreign debt imposes on the economy. The higher this burden, the greater is the likelihood that the debt is unsustainable in the sense that the debtor country finds itself unable or unwilling to repay.

We carry out a simple debt sustainability analysis for Zambia (Table 3.07) using the above methodology. In doing so, we assume an interest rate of 10% and a growth rate of 5.5%. The growth rate is the IMF medium term projected growth rate.

Table 3.07: Debt Sustainability Analysis: Scenario I (All in US $ millions)

Year	Debt Stock	GDP	PV-Income	Debt-Burden(%)	TB	Actual TB
1998	6665.9	3790	84222.20	7.9	299	-155
1999	6409	3881	86244.4	7.4	287	-116
Average	6537.45	3835	85222.2	7.7	295	-136

The above analysis shows that in order to maintain a constant debt to GDP ratio, Zambia needs to sustain a trade surplus of US $ 295 million. The average actual trade balance for 1998 and 1999 was US $ -136, giving a shortfall of US $ 431 million.

We recognise the sensitivity of the results to the interest rate and the growth rate. A lower rate of growth of the economy gives a worse scenario than the one presented above. The shortfall in export earnings required to maintain a steady Debt to GDP ratio is higher. This is a plausible scenario in Zambia given the fact that GDP growth in recent years has been far less than the 5.5 projection by the IMF. The growth rate in 1999 for instance was only 2.4%. We carry out similar analysis using an interest rate of 5 percent and a growth rate of 4 percent in Table 3.08.

Table 3.08: Debt Sustainability Analysis: Scenario II (US $ millions)

Year	Debt Stock	GDP	PV-Income	Debt-Burden(%)	TB	Actual TB
1998	6665.9	3790	379000	1.8	68	-155
1999	6409	3881	388100	1.7	66	-116
Average	6537.45	3835	383550	1.7	65	-136

In the second scenario, the trade balance shortfall is US $ 201 million . The country's debt position is likely to remain unsustainable until either some debts are written off or there is a significant increase in export earnings.

Having established the fact the current debt stock in Zambia is unsustainable, we now analyse how this affects investment. Two channels are distinguished; the debt overhang channel and the credit rationing channel.

The debt overhang and the disincentive to Invest

The period since the onset of the debt crisis in 1982 has seen a decline in the rate of investment in the heavily indebted countries (HIC). There is a small but growing body of work which believes that this decline could be systematically related to the debt crisis. The severely indebted countries found themselves in a favourable international economic environment before the crisis. Very low interest rates, the availability of surplus funds through the Euromarket and optimistic expectations resulting in the belief that this state would continue for a long period of time encouraged least developed countries (LLDC) governments to borrow large amounts from commercial banks.

The debt crisis was heralded by Mexico, declaring its inability to continue normal debt servicing in 1982. The realisation that the amounts lent were so large as to place the international financial system on the brink of disaster was strongly felt and the commercial banks responded by cutting down lending. Due to compulsions of macroeconomic policies in the advanced industrial countries, particularly the USA, interest rates rose sharply. This, coupled with the drying up of credit flows, not only meant a sharp rise in debt burdens but also a forced balance of payments adjustment. As other countries followed Mexico's footsteps, the intervention of the IMF in shaping the domestic policies of the heavily indebted countries became more pronounced.

Like other heavily indebted developing countries, Zambia has seen a significant fall in investment since 1980. Table 3.09 provides some data on investment as a percentage of GDP for some years after and before 1980.

Table 3.09: Investment as a Percentage of GDP

Year	1968	1970	1975	1980	1983	1989
% of GDP	27	33	37	19	14	7

The decline in investment was instrumental in converting the debt crisis into a growth crisis for Zambia and other heavily indebted countries (HICs). The decline in investment has reduced the prospect for future growth and the ability of the country to generate resources for repayment. Prima facie, there seems to be a vicious circle in operation: very high levels of debt discourage investment, which in turn reduces the ability to repay, which adds to the pressures of repayment

Thus, the period after 1982 has been described as the period of debt overhang: for several of the highly indebted countries, low commodity prices, high real interest rate, sluggish growth in the industrial countries mean that the present levels of debt cannot be reconciled with present levels of growth. Thus the debt overhang can be described as " the presence of an existing inherited debt sufficiently large that creditors do not expect with confidence to be repaid".

This scenario is the basis for the debt overhang hypothesis (DOH) according to which investment is discouraged if the debt burden is so large that the debtor country is unable to meet its payment obligations in a normal way and involuntary lending takes place. The DOH describes a situation in which the debt burden is not merely large but also distorts the relevant margins considered for production and investment decisions (IMF 1989)

Theoretical work on the DOH has focussed on demonstrating the suboptimality of investment in the presence of a high inherited stock of debt. (Dooley 1989; Borenzstea 1990)

The debt overhang discourages investment in two basic ways: (a) due to its pure disincentive effect, and (b) due to the adjustment measures undertaken by the severely indebted country. Any country with a debt overhang, by definition would be in debt servicing difficulties and so would be undergoing an adjustment programme. These two channels are explained below:

The pure disincentive effect

Due to compulsions of debt servicing in which any country only shares partially in an increase in output and exports, high levels of debt are seen as a tax on investment. This leads to a weakening of the incentive to invest. The problem becomes more acute in the phase of involuntary lending. When foreign obligations cannot be fully met with existing resources and actual debt repayments are determined by some negotiation process between the debtor country and its creditors, the amount of repayment can be linked to the economic performance of the debtor country, with the consequence that at least part of the return to any increase in production would in fact be devoted to debt servicing. This creates a disincentive to invest from the point view of the global interest of the debtor country. For this reason, the debt overhang is also likely to discourage government efforts to undertake adjustment policies and, through actual and expected economic policies, it is likely to spread to the private sector, affecting its incentive to invest or accumulate domestic assets.

In contrast to normal debt servicing, the amount actually paid to service the debt depends on negotiations between the debtor country and its creditors. Thus, increases in production and exports used for repayments may be known to the investors beforehand, thus dissuading them from investing large amounts.

The phenomenon of capital flight from the severely indebted countries is a reflection of this disincentive effect- due to the fear of appropriation of their funds for debt servicing, investors would rather send money outside the country.

It should be emphasised that the large debt per se is not an unconditional predictor of investment. It is the actual service of debt that crowds out investment. Most empirical analysis attempting to show the negative effect of debt on investment hinges on a comparison between the investment rates that prevailed in the 1970's and those that prevailed after the 1982 debt crisis. Such comparisons are not well taken, however, to the extent that they overlook the formidable change of regimes that took place between these two periods. The years before the early 1980's may indeed be characterized as a period of relatively free access to the world financial markets in which an extremely low real interest rate prevailed. The years that followed 1982 could be roughly described as a period during which the abrupt rise in the world interest rate shut out most countries' access to these financial markets. These developments had adverse effects on investment, however indebted a country may have been.

A second effect of the switch of regime from the 1970's into the 1980's is the one referred to in the debt overhang literature: in addition to being kept from borrowing new resources, the indebted countries precipitously had to repay their debts. The impact of this second effect is, however, ambiguous and depends on the efficiency of the rescheduling process.

Another facet of the disincentive effect of the debt overhang pertains to the debtor country governments. In a situation of debt overhang, with low rates of growth and declining standards of living, a government would find it difficult to shift resources from consumption to investment as the people of the debtor nations would be inclined to believe that this shift would be utilised only to service debts.

Deshpande (1997) demonstrated that in countries with debt overhang, the pressures of debt repayment not only dominate policies which affect investment, but also shape expectations. When a country finds it difficult to continue normal debt servicing, there would be an atmosphere of uncertainty: it is not exactly clear at what terms debt will be rescheduled, whether there would be some additional lending, hence what would be the exact change in government policies. Here, external debt would capture the effect of a whole lot of variables which under normal circumstances would need separate consideration.

Crowding out of Domestic Spending by External Resource Transfers

In order to establish the relative effect of transfers to foreigners (which captures external debt service) on investment and consumption (disaggregated into private and government consumption), we regress each of these variables, expressed as a fraction of GDP on the trade balance (also expressed as a fraction of GDP). The following regressions are carried out:

$$\frac{I}{GDP} = a_0 + b_0 \frac{TB}{GDP} \tag{3.45}$$

$$\frac{C}{GDP} = a_0 + b_1 \frac{TB}{GDP} \tag{3.46}$$

$$\frac{G}{GDP} = a_0 + b_2 \frac{TB}{GDP} \tag{3.47}$$

Because of the national income identity, one necessarily has $\sum_{i=0}^{2} b_i = -1$. The results are presented in the Table 3.10. The b_i interpreted as the crowding out of domestic expenditures resulting from transfers abroad. The crowding out effect must however be interpreted with caution. A negative b_i does not necessarily imply that the shift of the trade balance causes investment or consumption to adjust. It may well be, instead, that it is the response of investment to the international environment that caused the trade balance to adjust. The latter would be the case for developed countries with access to international capital markets. For a developing country such as Zambia, the result simply shows the importance of external financial inflows/outflows in explaining investment behaviour. The direction of causality is from the external financing to investment and not investment to external financing.

Table 3.10: Crowding out of domestic spending by transfers.

Sample Period: 1964-1999

Variable	Coefficient	t-value
I/GDP	-.22	-2.4
C/GDP	-.38	-2.8
G/GDP	-.38	-2.8

According to the results of the regressions, the crowding out coefficient for investment is 22 percent and a total of 76 percent for both private and government consumption. Cohen (1993) showed that the crowding out coefficient depended crucially on whether a country rescheduled its debt or not. He found a coefficient of 0.35 for the rescheduling countries and 0.16 for the non-rescheduling countries. The significantly negative coefficient on government and private expenditure is an indication the importance of external financing in explaining consumption behaviour.

The results presented above are supported by variance decompositions to determine the sources of fluctuations in investment. The bivariate VAR models we estimate include investment and the trade balance and investment and imports. In identifying the structural shocks from the VAR model, we use the Choleski decomposition, assuming that the trade balance and imports are the exogenous variables. Our assumption is supported by Granger causality tests in Table 3.11:

Table 3.11: LR stastistics for block non-causality

Sample Period: 1964-1999

	Variable Included in the VAR	
Variables assumed non-causal	Trade Balance	Investment
Trade Balance		$\chi^2(1) = 3.14\,[0.076]$
Investment	$\chi^2(1) = 0.8\,[0.47]$	
Imports		$\chi^2(1) = 5.2\,[0.074]$

Table 3.12: Orthorgonalised Variance Decomposition of Investment

Sample Period: 1964-1999

	Source of Variation	
Imports	Trade Balance	Investment
	0.30	0.70
0.59		0.41

The results from the regression of investment on imports are reinforced by variance decompositions and Granger causality tests. At a 10% level of significance, we reject the null that trade balance and imports do not Granger cause investment. However, we accept the null that investment is non-causal to the trade balance. Variance decomposition results show that 59 percent of the variation in investment is caused by imports. This reduced to 30 percent when we consider the trade balance instead of imports. This result reinforces our earlier conclusion about the non-responsiveness of investment to the copper price which has a significant effect on exports.

This result is in contrast with stylized facts established by Kose (2002). According to Kose, about 90% of the volatility in aggregate investment is explained by world price disturbances. We argue that the investment response to relative price shocks may be limited by the lack of access to private international capital markets. The investment response is also muted by the external indebtedness of the economies.

The main objective of Kose's (2002) paper was to determine the relative contribution of world price shocks to business cycles in small open developing economies. Kose's results from variance decompositions indicated that fluctuations in world prices accounted for 88% of output fluctuations in developing countries. Domestic productivity shocks accounted for only 12%. The prices analysed by Kose are those of major exports and imports. Trade balance dynamics and foreign asset holdings are also heavily affected by relative price fluctuations.

The impact of adjustment measures

As the negotiations between the debtor country and the creditors are conducted with the intervention of the IMF, some aspects of the package of adjustment measures that the latter advocate deserve attention. It has been argued that the brunt of these adjustment measures has been borne by investment. We consider the effects of exchange rate devaluations and of reductions in fiscal deficits.

Exchange rate devaluation

This is an important component of the adjustment package undertaken with a view to improving the balance of payments position. The massive swing in the current account balances that took place after the devaluations in the 1980s was achieved not so much through an improvement in export revenues as import cuts with adverse repercussions for investment. The problem is particularly acute for Zambia because the economy relies heavily on imports for a large proportion of its capital goods.

Thus the IMF admits "the sharp policy adjustment introduced in the immediate aftermath of the 1982 crisis did not adequately address the underlying need to raise domestic savings and improve the efficiency of investment" and that "the burden of external adjustment in the finance constrained countries has had a disproportionate impact on investment, with adverse effects on the countries' future payments capacity".(IMF 1989)

Reduction of government deficits:

Many countries have had to reduce government deficits in order to generate resources to service external debt. For various reasons, the burden of fiscal adjustment has fallen on public sector investment and social spending. Contrary to orthodox expectation, cuts in public spending, particularly in physical infrastructure tend to "crowd out" private investment, since they are often complimentary and not competitive with private sector activities.

When Zambia achieved independence in 1964, it enjoyed one of the highest per capita incomes in the continent. Prior to the copper crisis of 1974, its annual rate of growth was 6%. When copper prices fell, the expectation was that this fall was temporary and the state sought to maintain the levels of consumption and investment by borrowing. This reversed the positive resource balance (gross domestic savings less gross domestic investment) and led to an increase in the debt service ratio, forcing the economy towards international organisations. The turning point came in 1983, when the Zambian government implemented an austerity programme, as part of which capital expenditure was reduced.

Debt Overhang and Credit Rationing

The second channel through which debt affects investment is credit rationing. This channel is more indirect and arises from the higher domestic interest rates that prevail in a debtor economy as a result of the unfavourable position in the international financial markets. It arises from the fact that a highly indebted and non-performing debtor country is unable to obtain additional credit beyond the involuntary rollover of interest and amortization payments that are not met. But, in fact, credit rationing refers to any situation in which the domestic interest rate exceeds the international interest rate because of constraints faced by the debtor in the international financial markets.

Debt overhang and credit rationing although associated with each other may not necessarily be present together. Borensztein (1990) used numerical simulations of a simple rational expectations growth model to show that credit rationing may be a powerful disincentive to investment so that a debtor country would benefit more from access to more lending than from a reduction in existing obligations in terms of the impact on the investment to GDP ratio. He suggested that in order to maximize the impact on investment, debt reduction plans need to be accompanied by additional foreign lending. Since the 1982 debt crisis, this role has been played by official lending.

3.3.5 Effect of Global and Country Specific Shocks on Investment and the Current Account

The objective of this section is to determine whether the observed low negative correlation between investment and the current account for OECD countries applies to Zambia and if so, whether the distinction between global and country specific shocks can help explain this phenomenon. In Table 3.13 we present the correlation between investment and the trade balance in Zambia.

Table 3.13: Correlation:Trade Balance
and Investment
Sample Period: 1964-1999

	TB	I
TB	1	
I	-0.27	1

There is a negative correlation between the domestic investment the trade balance(-0.27). However, the correlation is not high. There is a remarkably consistent correlation between investment and the current account for most of the industrialized countries. Although this correlation is negative as predicted by the theory, the main puzzle is why, with open capital markets, it is not larger. On average, a rise in investment tends to increase the current account deficit by only a third as much . One explanation is that global productivity shocks affect investment but not the current account. The importance of global shocks therefore appears to be an important explanation of why the current account investment correlation is not close to one.

The distinction between global and country specific shocks turns out to be quite important for explaining current account behaviour. If a shock hits all the countries in the world symmetrically, the current account effect will be much smaller than if it hits only one small country. If all countries try to dissave all at once, the main effect will be for global interest rates to rise. Before analysing the separate effects of global and country specific shocks, we determine the effect of output shocks in general on investment.

In the literature on the intertemporal model of the current account some authors have measured productivity shocks using the Solow residual. Glick and Rogoff (1995), for instance, constructed Solow residuals by controlling for changes in labour. In developing countries such as Zambia, where data on labour and capital inputs are not readily available, we seek alternative measures of productivity. Since Zambia is heavily dependent on the copper mining sector, we use changes in copper production as a proxy for domestic productivity changes. Changes in copper production are used as a measure of changes in the efficiency of labour because there has been little investment in the copper mining sector after the negative shock of 1974. In fact, the deterioration in mining output has partly been attributed to the use of dilapidated machinery. Further, employment levels in the mining sector and the economy in general have not increased. In recent years, employment levels have actually fallen.

To ensure that copper production is a good proxy for productivity changes, we regress the change in the log of GDP on the change in the log of copper production. We estimate the following regression.

$$\Delta Y = \alpha + \beta \Delta Y_M + U_t \quad (3.48)$$

Where Y denotes real GDP and Y_M denotes output in the mining sector. The results presented in Table 3.14 show that the coefficient on the change in copper production is statistically significant. This result is supported by the high contemporaneous correlation between output and copper production in Table 3.14:

Table 3.14: Static Solution of Regression of Real GDP on Copper production

Sample Period: 1964-1999

Variable	Coefficient	Std.Error	t-value	t-prob
Constant	0.015	0.0044	3.37	0.002
Y_M	O.22	0.077	2.87	0.008

Output shocks are proxied by output changes in the copper mining sector. In order to determine the investment response to changes in the mining sector, we estimate the following regression;

$$\Delta \frac{I}{Y} = \alpha + \beta \Delta Y_M + U \quad (3.49)$$

In Table 3.15 we present the results of the regression of the change in investment on the change in copper production. The results show that domestic investment does not respond to changes in production in the mining sector.

Table 3.15: Static long run solution for Investment ($\Delta \frac{I}{Y}$)
Regressed on Copper Production (ΔY_M)
Sample Period: 1964-1999

	Coefficient	Std.Error	t-value	t-prob
Constant	-0.00088	0.0072	-0.122	
ΔY_M	-0.007	0.13	-0.0551	0.97

The results lead us to the general conclusion that investment is not responsive to productivity shocks in the mining sector. This result is consistent with the low correlation between output and investment.

We now further our analysis by investigating the effect of global and country specific shocks. There are a number of approaches for decomposing shocks into their local and global components. In this paper, we use a bivariate VAR model.

Using a bivariate VAR model, global and country specific shocks are identified using a Choleski decomposition. The forecast errors from the VAR model are decomposed into orthogonal structural shocks based on the understanding that shocks to the copper price are global in the sense that they affect all countries in the world. Exports are affected by both country specific shocks and global shocks. Therefore, the estimated VAR model includes the copper price and exports. The VAR model is given by:

$$\Delta X_t = \Gamma_0 + \Gamma_1 \Delta X_{t-1} + e_t \tag{3.50}$$

Where e_t are forecast errors;

$$X = \begin{bmatrix} P^C \\ Ex \end{bmatrix} \tag{3.51}$$

P^C refers to the copper price and Ex to exports. Structural shocks are recovered from the forecast errors by premultiplying by a matrix B, given by:

$$B = \begin{bmatrix} b_{11} & 0 \\ b_{21} & b_{22} \end{bmatrix} \tag{3.52}$$

The structural shocks thus recovered are given by;

$$\epsilon_t = Be_t \tag{3.53}$$

ϵ_t is a 2×1 vector of structural shocks and e_t is a 2×1 vector of forecast errors estimated from the VAR model. The structural shocks are therefore given by;

$$\begin{aligned} \epsilon_{1t} &= e_{1t} \\ \epsilon_{2t} &= b_{21}e_{1t} + e_{2t} \end{aligned} \tag{3.54}$$

The number of restrictions needed to identify the structural shocks is $n(n-1)/2$ where n is the number of equations in the VAR. The Choleski decomposition imposes one restriction on the contemporaneous effect of exports on the copper price ($b_{12} = 0$). The above restriction is based on the understanding that Zambia is a small country and does not influence the international price of copper.

Having identified global and country specific shocks, we estimate the following equations in order to determine the effect of the shocks on investment and the trade balance.

$$\Delta\frac{I}{Y} = a_0 + a_1A^C + a_2A^W + U_t \tag{3.55}$$

$$\frac{TB}{Y} = b_0 + b_1A^C + b_2A^W + U_t \tag{3.56}$$

A^C refers to country specific shocks and A^W refers to global shocks. We analyse the effect of global and country specific shocks identified using the above procedure on investment and the current account. The results of OLS regressions are summarised in Table 3.16.

Table 3.16: Static Long Run Solutions of OLS regressions of Investment and the Trade Balance on Global and Country Specific Shocks
Sample Period: 1964-1999

Dependent Variable	t-values of Parameters	
	A^W	A^C
$\Delta\frac{I}{Y}$	0.873	-0.890
$\frac{TB}{Y}$	0.151	-0.279

The t-values of dynamic multipliers show that global shocks have a positive but insignificant effect on both investment and the trade balance with a stronger effect on investment than on the trade balance. This result agrees with the standard intertemporal models of the current account which suggest that global shocks should have an insignificant effect on the current account. However, global shocks also have an insignificant effect on investment although the effect on investment is relatively stronger. This provides an explanation for the low correlation between investment and the trade balance in Zambia .

Country specific shocks have an insignificant negative effect on the trade balance. Standard intertemporal models of the current account would suggest that country specific shocks should have a significant negative effect on the current account (Trade balance in this case) while global shocks should have an insignificant effect. Our result conforms with the predictions of these models in terms of the negative coefficient on country specific shocks despite the effect being insignificant.

The insignificance of the t-values supports our earlier assertion regarding the non-responsiveness of investment to output shocks whether global or country specific, which occurs not as a result of the non-persistence of shocks but of the external debt burden.

Glick and Rogoff (1995) using data from the G-7 countries found that the current account responded less than investment to country specific shocks despite their near unit root behaviour. They found that the current account responds negatively and significantly to country specific shocks with little or no response to global shocks.

Glick and Rogoff showed that the fact that investment responds by more than the current account to country specific shocks would be a puzzle if the country specific shocks followed a random walk. With even a small amount of mean reversion, the results can be fully explained. The current account response to country specific shocks is expected to be larger than the investment response since consumption would move by more than output if productivity shocks follow a random walk. They conclude therefore that their empirical result may be construed as evidence that there is a significant convergent component to productivity across the G-7 countries. The current account response to country specific shocks is muted by the savings effect even with small changes in their persistence ($\rho < 1$).

3.3.6 The Current Account and Output Correlation

The relationship that the current account and the trade balance tend to move countercyclically is well established for developed economies. Bakus and Kehoe (1989) identify this pattern as common to the historical data of ten industrialized countries. Kose (2002), developed a small open economy model in which he showed that the correlation between output and the trade balance was countercyclical for developing economies as well. His model predictions where supported by the empirical results from a sample of 28 non-oil exporting developing countries. Kose argues that in response to positive productivity and world price shocks, both of which induce positive income effects, agents increase their imports of capital goods and intermediate inputs instead of saving by buying foreign assets.

The correlation results in Table 3.17 show that this relationship does not hold in Zambia. We observe a positive correlation between the trade balance and output. In other words, the trade balance is not countercyclical but procyclical. As stated earlier, this feature may be partially explained by the non-responsiveness of investment to output shocks, which is caused by the effect of the external debt burden and a lack of access to international capital markets.

Traditional models of the current account relied on a strong income effect on imports to explain this behavior. The intertemporal equilibrium approach, in contrast, determined endogenously the relative strength of the income and substitution effects and cannot predict unambiguously that the external accounts and output will be negatively correlated. With the occurrence of a positive productivity shock for instance, for the current account or the trade balance to be countercyclical, the pro-borrowing effect caused by an unexpected expansion of future output and the desire to increase investment must dominate the saving effect induced by an increase in current output. Our results suggest that in Zambia, the pro-saving effect arising from a positive shock dominates the pro-borrowing effect. This result occurs despite the relatively higher correlation of consumption with output. From the results tabulated in Table 3.17, we observe a very low correlation (0.042) between output and investment. Total consumption, however, exhibits a higher correlation of (0.44). The high contemporaneous correlation between consumption and income may be a reflection of the credit constraint faced by households in developing countries. Credit constraints cause consumption to be closely linked to current rather than permanent income.

The savings from positive income shock were used to accumulate foreign assets and for domestic investment when the economy had a positive net foreign asset position. With a huge external debt, savings are used to reduce foreign liabilities (debt servicing). Investment booms in the presence of foreign liabilities are a fallacy in developing countries. This result departs from that of Kraay and Ventura (2000) who proposed the rule that the current account response to transitory shocks is given by the savings generated by the shock multiplied by the country's share of foreign assets in total assets. This rule implies that favourable shocks lead to deficits (surpluses) in debtor (creditor) countries. This result is a natural implication of the intertemporal approach to the current account and is supported by evidence from industrialized countries. The assumptions on which this result is based are:

- That an income shock leads to higher savings: This is the basic result of forward looking models of savings and applies whenever consumption smoothing operates as a saving motive.
- That the country invests the marginal unit of wealth as the average one (based on the share of foreign assets in total assets). This is a departure from traditional models of the current account in which a country invests its marginal unit of wealth in foreign

assets. These models predict that favourable income shocks generate current account surpluses that are equal to the saving generated by the shock.

Heavily indebted developing countries are finding it increasingly difficult to increase their indebtednes especially from private capital markets.

Table 3.17: Matrix of Correlations

(Standard Deviations in diagonals)

	Y	I	C	TB	Y_C	P^C
Y	0.036	0.042	0.44	0.14	0.51	0.23
I	0.042	0.26	0.17	-0.27	0.002	-0.27
C	0.44	0.17	0.15	0.16	0.13	-0.14
TB	0.14	-0.26	0.16	257	0.12	0.66
Y_C	0.51	0.0023	0.13	0.12	0.097	0.12
P^C	0.23	-0.27	-0.14	0.66	0.12	17

Y refers to income, I to investment, C to consumption,

TB to trade balance, Y_C to copper production and P^C to the copper price.

Volatility is measured by the standard deviation (σ) of the variable.

Consumption includes both Government and Private consumption

3.4 Conclusion

In this paper, we apply the intertemporal model of the current account to a small open developing country (Zambia). The results of econometric tests suggest that, in Zambia, the correlation between savings and investment is low. This result is not, however, suggestive of a high degree of capital mobility as the Feldstein-Horioka puzzle would suggest.

The low correlation can be explained by the low correlation between output and investment, and the high volatility of consumption relative to output. We argue that the low correlation between investment and output, despite the persistence of output shocks, is caused by the disincentive effects of external debt and the lack of access to credit from international capital markets. The high volatility of consumption relative to output seems to be typical for developing countries as the results by Kose (2002) indicate. This implies that there are permanent shocks to output which have a protracted impulse response and consumption jumps to the higher level directly while output adjustments to its permanent level gradually.

As a result of the non-responsiveness of investment to domestic productivity shocks, the trade balance, and therefore the current account, in Zambia is procyclical rather than countercyclical as suggested by the traditional models of the current account. The pro-saving effect of output shocks dominates the pro-borrowing effect despite the shocks being persistent. Most importantly, even if the output shocks were fully permanent, the investment response would still be limited by the lack of access to credit from the international capital markets. This situation is exacerbated by the accumulated stock of external debt which by itself acts as a disincentive to investment.

Our results also show that global shocks have a relatively stronger effect on investment than on the trade balance which provides an explanation of the low correlation between the trade balance and investment. We also find that country specific shocks have negative though insignificant effect on the trade balance. The result is in accordance with theoretical predictions in terms of the sign despite the effect being insignificant. Overall, both global and country specific shocks have insignificant effects on investment and the trade balance.

Investment behaviour in Zambia is determined more by external inflows. Changes in the copper price explain a very insignificant proportion of the variation in investment, copper production and aggregate output. The limited access to private capital markets makes the country heavily dependent on official aid for its investment. This result differs from those obtained by Kose (2002) who found that over 80 percent of output fluctuations in developing countries were explained by world prices. The results differ probably because Kose's model did not account for the limitations faced by developing countries in accessing investment capital from the international capital market. However, he demonstrated that as the steady state trade balance to output ratio gets larger, world real interest shocks become more important in explaining macroeconomic activity in developing countries.

In view of the importance of debt service in explaining investment, we carried out a simple debt sustainability analysis, which suggests that the current stock of debt in Zambia cannot be sustained by the current level of exports and GDP growth. This situation is likely to persist unless the country's debt is written off.

3.A Appendix: "Three-Gap" Models of Development

The "two gap" model is a popular feature of development economics. It deals with the interaction of the saving constraint and the foreign exchange constraint in the determination of the growth rate of a developing country. More recently, there has been growing interest in the fiscal constraint as a possible gap limiting the growth rates of highly indebted developing countries. We deal successively with the savings gap, the foreign exchange gap and the fiscal gap.

The Savings Gap

From the basic national income identity;

$$I = (Y - C) + (M - X) \tag{3.57}$$

I refers to investment, Y to GDP, C to private and government consumption, M to imports and X to exports. From the balance of payments, the excess of imports over exports equal to foreign transfers i.e. the difference between net capital inflows , F, and net factor service payments abroad, J;

$$M - X = F - J \tag{3.58}$$

so that we have;

$$I = (Y - C) + (F - J) \tag{3.59}$$

When output is at its potential level Y^*, and consumption is given exogenously, then we have the following savings constrained level of investment:

$$I_S = (Y^* - C) + (F - J) \tag{3.60}$$

We split income and consumption into private and government so that we can have private and government savings separately:

$$I_S = S_P + (T - G) + (F - J) \tag{3.61}$$

Where $S_P = Y_P - C_P$. The assumption that output is at its potential level means that private savings and therefore investment are bounded from above, so that

$$I_S \leq \tilde{S}_P + (T - G) + (F - J) \tag{3.62}$$

The Foreign Exchange Gap

From $M - X = F - J$, we assume that imports can be divided into two types, complimentary capital goods imports, M_k, and other imports, M_0. We define net exports, E, as the difference between exports and other imports

$$E = X - M_0 \tag{3.63}$$

and let M_k be given by

$$M_k = mI \tag{3.64}$$

where m, $0 < m < 1$, is the import content of investment. Replacing the above equations into $M - X = F - J$, we have $E - mI = -(F - J)$ so that

$$I = \frac{E + (F - J)}{m} \tag{3.65}$$

When we suppose that E is subject to the upper bound E^*, determined by external demand, then we have the inequality

$$I_E \leq \left(\frac{1}{m}\right)[E + (F - J)] \tag{3.66}$$

which represents the foreign exchange constraint on investment and therefore on growth.

The Fiscal Constraint

As the debt crisis lingers on, there is an increasing feeling that for many highly indebted middle income developing countries, the main source of growth (and inflation) difficulties derive from government budget limitations rather than from foreign exchange constraints or an overall savings restriction.

To formalise the concept, we split capital formation between government investment (I_g) and private investment (I_P) so that

$$I = I_g + I_P \tag{3.67}$$

Using the above in $I = S_P + (T - G) + (F - J)$, we have

$$I_g = S_P - I_P + (T - G) + (F - J) \tag{3.68}$$

We assume that private investment depends on goverment investment so that private investment is bounded above by public investment:

$$I_P \leq k^* I_g \tag{3.69}$$

Where k^* is the ratio of private to public investment ratio in the composite capital stock.

To derive the fiscal constraint, it is assumed that base money is the only financial asset available for the private sector to hold in this economy so that the private sector budget constraint can be written as

$$S_P - I_P = \Delta \frac{M}{P} \tag{3.70}$$

M is the stock of base money and P is the price level. The change in M is assumed to be given by

$$\Delta M = M(\pi, \theta) \tag{3.71}$$

where π denotes the rate of inflation and θ the "propensity to hold," that is, the portion of any income that is devoted to the accumulation of cash balances. Assumimg all foreign capital flows accrue to the goverment, the budget constraint of the consolidated public sector is given by

$$I_g = M(\pi, \theta) + (T - G) + (F - J) \tag{3.72}$$

When we add private investment $(k^* I_g)$ to the above, we have total investment which takes the form

$$I = (1 + k^*) \left[M(\pi, \theta) + (T - G) + (F - J) \right] \tag{3.73}$$

3.4.1 Transfers and the three gaps

The focus of "gap" models is on the implications of such models on the different levels of foreign financing $(F - J)$. The mechanism at work is illustrated in figure 3.A.1

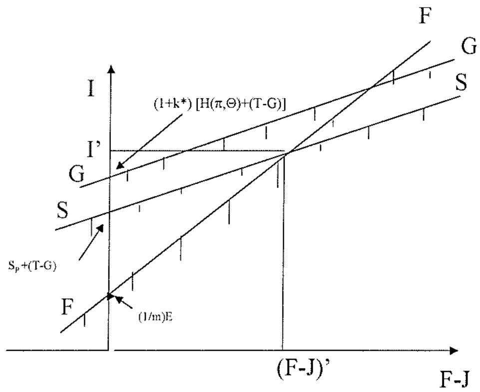

Fig 3.A.1: The three Gap Model

Investment, which is the central endogenous variable is plotted against transfers $(F - J)$. The loci FF and SS represent the foreign exchange and savings constraints, respectively. The slope of SS is unity while that of FF is $1/m$, which is greater than unity. The relative positions of the curves rely on the assumption that $1/mE^* \leq S + (T - G)$. The fiscal constraint is bounded by a locus GG with slope $1+k^*$. The hatched areas beneath the curves represent the feasible regions for investment (that is, the values of I that satisfy the respective inequalities). If net foreign inflows are $(F - J)'$, both constraints are binding and investment is at I'. To the left of $(F - J)'$, the foreign exchange constraint binds. Investment (and therefore capacity growth) is constrained by foreign exchange availability. Since investment is less than the level that satisfies the savings constraint, the economy suffers from the Keynesian excess capacity. If on the other hand $(F - J)$ exceeds

$(F - J)'$,the economy is constrained by domestic savings. Investment will be determined along SS. The slack variable in this case is net exports.

The results presented in this paper suggests that the foreign exchange constraint is the binding constraint in Zambia while savings are the slack variable with little or no effect on investment.

Chapter 4
Summary and Conclusion

In the 1970's the international financial environment was favourable so that many developing countries responded to negative shocks in their terms of trade by accumulating huge external liabilities which have become a brake on their economic development. Most countries substituted external financing for long term supply side adjustment policies. After the 1982 debt crisis, the situation was reversed. Private commercial banks were less willing to provide further finance to developing countries. Most developing countries therefore had to adopt stabilisation and adjustment measures supported by the IMF and the World Bank.

In this thesis, we contribute to the applications of the neoclassical approach to structuralism developed by Bevan et al (1996) by including the effect of debt and of stabilisation policies using a case study of Zambia. We also contribute to the empirics of the intertemporal approach to the balance of bayments by applying the implications of the theory to a heavily indebted developing country (Zambia). Bevan et al (1996) provide a body of neoclassical theory which is purpose built for small open developing countries. They apply their approach in analysing the effect of the 1975-1983 coffee boom in Kenya and Tanzania. While they make extensive analysis of the effects of economic controls, they do not analyse the effects of the external debt situation and of the stabilisation programmes.

In the first paper, we have argued that the existence of a huge external debt qualifies the standard predictions of the theory regarding the effects of terms of trade shocks. The Dutch Disease effects of a terms of trade shock are ameliorated not just by price and exchange rate controls but also by the existence of an unsustainable external debt. In the post liberalisation period where controls never existed, we find that while an increase in the copper price has an appreciating effect on the nominal exchange rate as predicted by the theory, the real exchange rate does not appreciate to its new equilibrium level. We find no cointegrating relationship between the consumer price index and the copper price. Our explanation for this result is that the spending effect which is expected to lead to an increase in the relative price of non-tradable goods to tradable goods is dampened because the windfall is used for debt servicing. This result is reinforced by the counterfactual analysis using the 123 model and the regression of non-traditional exports on the copper price. Although the copper price has a negative effect on non-traditional exports, the effect is statistically insignificant.

We have used the 123 model by Devarajan (1993) as an alternative technique for detecting Dutch Disease effects of terms of trade shocks. During the copper boom of 1964-1974, for instance, the literature is not clear whether Dutch Disease effects existed (Kayizzi-Mugerwa 1991, Maipose 1997, Aron (1999). Using the 123 model, we conclude that the exchange rate in Zambia at the time of the boom was undervalued rather than overvalued as suggested by Aron (1999) and Maipose (1997). Our argument is based on the fact that there was an appreciation in the equilibrium real exchange rate during the boom. Changes in the nominal exchange rate and domestic prices suggest that the actual real exchange rate did not appreciate to its new equilibrium level. Dutch Disease effects were, therefore, mitigated by price and exchange rate controls.

We have argued, further, that an investment boom is not likely to occur in response to a positive terms of trade shock. The windfall from positive shock is used to pay back debts. Using cointegration tests we find no long run relationship between the copper price and domestic investment. This is despite the fact that agents in the economy perceive the shocks to be temporary and therefore save most of the windfall. This result is obtained from a cointegration test of the copper price and consumption where we find no long run relationship between the two variables.

Since it is generally easier to reduce demand than to increase supply, most developing countries responded to negative shocks by adopting demand side adjustment policies. The second paper provides evidence against the appropriateness of some of the demand management policies in correcting balance of payments deficits. We have found that the use of the monetary approach to correct for balance of payments disequilibria is inappropriate in Zambia. Using both domestic credit and M1, we find that these monetary aggregates do not explain a significant fraction of the variation in reserves. Change in reserves are explained mainly by donor balance of payment receipts and payments.

There is, however, evidence to show that the Polak model is appropriate for correcting balance of payments deficits. In the Polak model, the balance of payments is driven by relative prices and income. Our results show that devaluation improves the balance of payments position. However, devaluation improves the balance of payments not by improving exports but by depressing imports. This has adverse consequences for investment which relies on imported capital goods.

The demand management type of adjustment policies that most governments are forced to adopt in the face of external financing constraints tend to retard development. This is because the reduction in domestic absorption falls mainly on investment. The social and political costs of reducing consumption are so high that governments resort to cutting investment expenditure instead. As future domestic supply is reduced, this creates further balance of payments deficits in the future. In appendix 2.C our preliminary results show that the tight monetary polices that are adopted in implementing IMF disinflation policies, especially in the face of shortfalls of balance of payments support tend to have adverse effects on domestic credit to the private sector with severe repercussions for investment.

In the third paper, we provide evidence to show that the predictions of the intertemporal models of the current account may be qualified by the insolvency of the countries.

The results from econometric tests shows that the savings-investment correlation in Zambia is low. This is contrary to the Feldstein Horioka result. Since we cannot interpret this as evidence in favour of perfect international capital mobility, we conclude that investment in Zambia and other developing countries depends crucially on Aid inflows. In the context of the gap models, we have argued that the availability of foreign exchange is a binding constraint on the country's economic development.

The low correlation between savings and investment is caused by the low correlation between investment and output and the high volatility of consumption relative to output. An explanation for the low correlation between income and investment provided by the intertemporal models of the current account is the low persistence of output shocks. We have tested for the persistence of output shocks in Zambia and found that they are persistent. An alternative explanation for the low correlation between output and investment arises from the effects of the debt overhang. We have explained how debt can be a disincentive to investment. Even if shocks were persistent, the relevant margins considered for production and investment decisions are distorted by debt which operates as a tax on investment. Potential investors know beforehand that a fraction of their output from investment will be used for debt servicing.

Finally, we wish to render our support to the recommendation made by Graham Bird (1997) that ' Structural adjustment needs to be accompanied by increased short-term to medium term external financing'. Without this, countries have little option but to adopt disinflationary polices with adverse consequences for investment and the ability of the countries to service debts in the future.

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