UNIVERSITY OF THE WESTERN CAPE

DEPARTMENT OF ECONOMICS

An investigation of the determinants of private investment: *The Case of Botswana.*

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should be a crucial variable. These include uncertainty about interest rates of return, unsophisticated investment decision procedures, the long time frame of investment decisions compared to short-run fluctuations in interest rates, and the possibility that changes in borrowing cost are overshadowed by variations in demand (Shafik, 1992: 275). Our study will address this empirical question in the context of Botswana.

3.3.3   Neoclassical factors

Changes in output are the most important determinant of private investment (Oshikoya, 1994: 583). Neoclassical investment theory suggests that the growth rate of real output is positively related to investment because it indicates changes in aggregate demand for output that investors seek to meet (Chirinko 1993: 1878; Ndikumana, 2000: 383). This relationship can also be readily derived from a flexible-accelerator model with the assumption that the underlying production function has a fixed relationship between the desired capital stock and the level of real output (Mlambo and Oshikoya, 2001:24).

Empirical evidence is consistent with this view and show that high output growth is associated with high investment (Wai & Wong, 1982: 25; Greene and Villanueva, 1991:52; Fielding, 1997: 135; Oshikoya, 1994: 584; Mlambo and Oshikoya, 2001:24). Since there is no ambiguity regarding this variable in the empirical literature, we also expect the sign of the coefficient to be positive in the context of Botswana.

3.3.4   Open economy variables

Beaudry et al. (2001: 653) used the inflation rate as a reasonable proxy for the 'uncertainty' level in the economy. Stable prices improve the informative content of the price system, allowing a favourable allocation of resources (Serven and Solimano, 1992: 29). The expected effects of inflation on private investment are ambiguous. Higher expected inflation lowers the real interest rate, causing portfolio adjustments away from real money balances to real capital, thereby raising real investment (Ghura and Goodwin, 2000: 1822).

Alternatively, anticipated high inflation raises the cost of acquiring capital and thus lowers capital accumulation (Rossiter, 2002: 60). Also, high inflation rates are an indicator of macroeconomic instability, which can have adverse impact on private investment (Oshikoya,

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KEY WORDS

Gross Domestic Product (GDP)

Gross Domestic Investment (GDI)

Private investment

Real interest rate

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Trade

Bank credit

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ABSTRACT

An investigation of the determinants of private investment: The case of Botswana

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Private investment in Botswana in real terms, as well as a ratio to Gross Domestic Product (GDP) has been falling in some periods of 1976-2003. Viewed against the background of growing evidence of a link between investment and economic growth, an inconsistent and downward trend in Botswana's private investment is a matter of concern. The question of what determines private investment behaviour in Botswana therefore becomes an important one. Several studies in developing countries emphasise the importance of Macroeconomic policy in explaining variations in investment, and in particular, identify the macroeconomic determinants of private investment to include; interest rates, output growth, public investment, bank credit to the private sector, inflation, real exchange rate, and the level of trade. This study proceeds in the same vein and evaluates the macroeconomic determinants of private investment in Botswana by means of a regression analysis based on the co-integration and Error Correction Model (ECM) of Engle and Granger (1987). Econometric results of the study support the existence of a short-run dynamic adjustment and the long run equilibrium relationship between these macroeconomic variables and private investment level. Public investment, bank credit to the private sector and the real interest rate affect private investment level in the short run, while GDP growth and real exchange rate affect private investment in the long run.

DECLARATION

I declare that *An Investigation of the Determinants of Private Investment: The Case of Botswana* is my own work, that it has not been submitted before for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Patrick Lesotlho   July 2006

Signed:………………………………

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ACRONYMS

ADF	Augmented Dickey-Fuller
AR	Auto-Regressive
BDC	Botswana Development Corporation
BEDIA	Botswana Development and Investment Agency
BFS	Botswana Financial statistics
BOB	Bank of Botswana
BWP	Botswana Currency (Pula)
CSO	Central Statistics Office
GDI	Gross Domestic Investment
GDP	Gross Domestic Product
ECM	Error Correction Model
FAP	Financial Assistance Policy
OLS	Ordinary Least Squares
SIP	Selibe Phikwe Intensive Project

CONTENTS

CHAPTER ONE
INTRODUCTION

1.1   Introduction

Investment constitutes an important macroeconomic component that matters for economic growth (Collier and Gunning, 1999: 66). As Khan and Reinhart (1990: 20) pointed out, it is necessary in the analysis of investment in developing countries to distinguish between private and public investment, emphasising that in developing countries, it is private investment that plays a greater role than public investment in determining economic growth (Khan and Reinhart, 1990: 21). Also, Collier and Gunning (1999: 69) noted that only private investment may be related positively to the profit rate and to the expected real interest rate within the range of low real interest rates observed in many developing countries.

In the context of Botswana, private investment includes investment in manufacturing, agriculture, infrastructure, construction and services. Gross Domestic Investment (GDI) ratios in Botswana, in real terms and as percentage of Gross Domestic Product (GDP), have shown a downward trend for a considerable period of time (BOB, 1999: 54). Investment ratios were as high as 42 percent of GDP in 1976 but later declined to the lowest record of around 25 percent in 1986 (National Accounts Statistics Bulletin, 2001: 17). The private investment ratios were as high as 33 percent of GDP in 1976 and hovered around 30 percent at the beginning of the 1980s. Since then, private investment ratios have been declining and have not recovered to reach the ratios of the 1970s. Preliminary results relating to private investment levels also show that private investment has been declining, especially after the 1990s (National Accounts Statistics Bulletin, 2003: 25).

A study by Khan & Reinhart (1990: 21) observes that there is a close connection between the level of investment and the rate of economic growth. Also, Chirinko (1993: 1890) reports that countries in which investment remains sluggish over a prolonged period of time face the problem that due to the lack of capital accumulation, the future growth potential is endangered. This conclusion is worrying for a country like Botswana, which has shown some inconsistent and downward trends relating to private investment, both in levels and ratios to GDP. In fact a recent study by Devarajan, Easterly and Pack (2001: 82) shows that private investment in Botswana is correlated, to a certain degree, with economic growth.

This paper evaluates the role of macroeconomic factors in determining private investment in Botswana, controlling for non-macroeconomic factors. The analysis is based on the Engle-Granger (1987) approach, as outlined in Harris (2000: 55). This approach is suitable for the study because it provides mechanisms to deal with the problem of non-stationarity of variables common in time series data (Harris, 2000: 55). The approach has been employed by several other studies, which include Fielding (1997: 138), and Ouattara (2005: 8). The variables used in this investigation are public investment, domestic credit to the private sector, real interest rates, inflation, trade, real exchange rates, and real GDP growth as a proxy for output growth. The study is based on the time series annual data covering the period 1976–2003.

1.2   Problem Statement

Private Investment is key to long-term economic growth (Khan & Reinhart, 1990: 21), and Devarajan, Easterly and Pack (2001: 82) confirmed this correlation for Botswana. However, private investment, in levels and as a percentage of GDP in Botswana has shown an inconsistent and downward trend for some periods during 1976-2003. Declining investment ratios and levels are a problem, firstly because investment matters for growth, and secondly because low investment increase vulnerability in the economy (Mlambo and Oshikoya, 2001: 16). A key challenge facing the country is to come up with policies that would help raise private investment in order to stimulate and sustain economic growth. With a view to drawing some appropriate policy conclusions and implications for Botswana, it is therefore important to identify the determinants of private investment.

1.3   Research Questions

i.   What are the determinants of private investment?

ii.   Which of these factors contributed to the slow growth of private investment in the economy?

iii. What policies, if any, have been undertaken to encourage private investment in Botswana, and what was the outcome of such policy interventions?

1.4 Purpose of the study

Bigsten (1999: 498) has pointed out that the standard macro policy variables, such as exchange rates and trade policies, fiscal and monetary policies, and public service provision, explain a substantial part of investment performance. This paper builds on this assertion by Bigsten and seeks to analyse empirically, private investment and its response to macroeconomic factors in the context of Botswana.

1.5 Hypotheses

The empirical literature on private investment behaviour in developing countries seems to have focused on testing several hypotheses advanced to explain variations in private investment (Oshikoya, 1994: 578). The hypotheses to be tested in this study are that macroeconomic factors help explain variations in the level of private investment; and that these effects can be categorised into short-term and long-term effects. Specifically I hypothesise a relationship between private investment and the seven identified variables: public investment, domestic credit to the private sector, real interest rate, inflation, trade, real exchange rate, and real GDP growth.

1.6 Delimitations

Investment is a broad topic. However this study intends to look only into private investment. Also, the study focuses only on the macroeconomic factors, controlling for non-macroeconomic factors.

1.7 Limitations of the study

As has already been pointed out in this study, investment is key to economic growth. The apparent limitations of this study are that it concentrates on macroeconomic variables and uses aggregative data. This means that there are other important factors, other than macroeconomic factors that explain the relatively good economic growth of Botswana. This controversy itself is a topic for further research and is not addressed in this study. A study that utilises more disaggregated data and seeks to explore sectoral private investment may arrive at different results.

1.8 Significance of the study

As far as I am aware, no study has yet looked specifically into the determinants of private investment in Botswana, although there are studies that looked into the determinants of private investment in other countries in the sub-Saharan Africa region. Oshikoya (1994: 573 - 576), Ghura and Goodwin (2000:1819-1829), Ndikumana (2000: 381-400), Mlambo and Oshikoya (2001: 12-47), Devarajan, Easterly and Pack (2001:81-108) carried out studies to evaluate the determinants of private investment for groups of African developing countries, with similar features to Botswana. However, it is impossible to isolate the Botswana-specific determinants of private investment from these studies.

This study therefore intends to shed light on these issues by identifying the macroeconomic determinants of private investment in Botswana. It is important to identify the determinants of private investment, which would be of great use in the formulation of possible policy intervention to help stimulate and sustain private investment and therefore economic growth.

1.9 Organisation of the study

This study is organised into six chapters. Chapter one deals with the introduction. Chapter two provides some economic background information on Botswana economy. Chapter three reviews the relevant literature on investment. The data sources and the preferred methodology are discussed in chapter four. The empirical analysis and presentation of results are undertaken in chapter five. Chapter six provides some conclusions.

CHAPTER TWO
ECONOMIC BACKGROUND ON BOTSWANA

2.1   Introduction

This chapter provides some insight into the economic background of Botswana, particularly relating to investment. The next section highlights some stylised facts about the Botswana economy. Section 2.3 provides some measures that were undertaken in Botswana in an effort to improve the investment climate. Section 2.4 reviews the trends in investment. Section 2.5 deals with the issue of banking and finance.

2.2   Stylised Facts

Despite being land-locked, and prone to drought, Botswana has become one of the most prosperous countries in Africa (BOB, 2000:22). With a per capita GDP (current prices) of BWP18500 (BFS, 2004: 3), the country is one of only a few African countries classified as a middle-income country (Devarajan, Easterly and Pack, 2001: 82). Botswana has recorded impressive economic growth rates, and averaging slightly in excess of 7% over the past two decades, has been one of the highest in the developing world (BOB, 2001: 26). In the first two decades after independence (1966-1986), Botswana experienced an annual growth rate of 14.3 percent while in the 1990's the economy experienced a growth rate of 13 percent (BOB, 2001: 27).

Much of the economic growth was due to the prolonged expansion of the mining sector, and government expenditure, which has largely been financed by the proceeds of mineral resources, in which diamonds were predominant (BOB, 2001: 33). Currently this sector accounts for about one third of GDP, with the private sector accounting for half and general government the remainder (BOB, 2004). However, indications are that output from the mining sector, especially diamonds is unlikely to show significant growth over the next decade (BOB, 2001: 35). This is mainly attributed to the past growth of the economy, and that the sector that has provided the basis for growth in the past is unlikely to do so to the same extent in the future.

Persistent efforts have been made over many years to diversify the economy but have met with very limited success (BOB, 2002: 23). In particular, recent ventures into textiles and motor vehicle assembly have been disappointing. Many reasons have been advanced for this: inadequate levels of investment, lack of skilled personnel, poor productivity, uncompetitive production costs, unattractive products and remoteness from export markets (BOB, 2002: 46). The fact remains that further efforts are needed to reduce the country's dependence on its non-renewable mineral resources.

The new economic development strategy of the Botswana government is to promote economic growth through the private sector, develop an efficient financial system and provide a stable macroeconomic environment (BOB, 2004: 36). The aim is to reverse the structural bias against the non-mineral sector and achieve a more balanced and diversified economy. Figure 1 below shows that GDP growth rates have been positive for the entire period under review.

Figure 1: GDP growth rates, 1976-2003
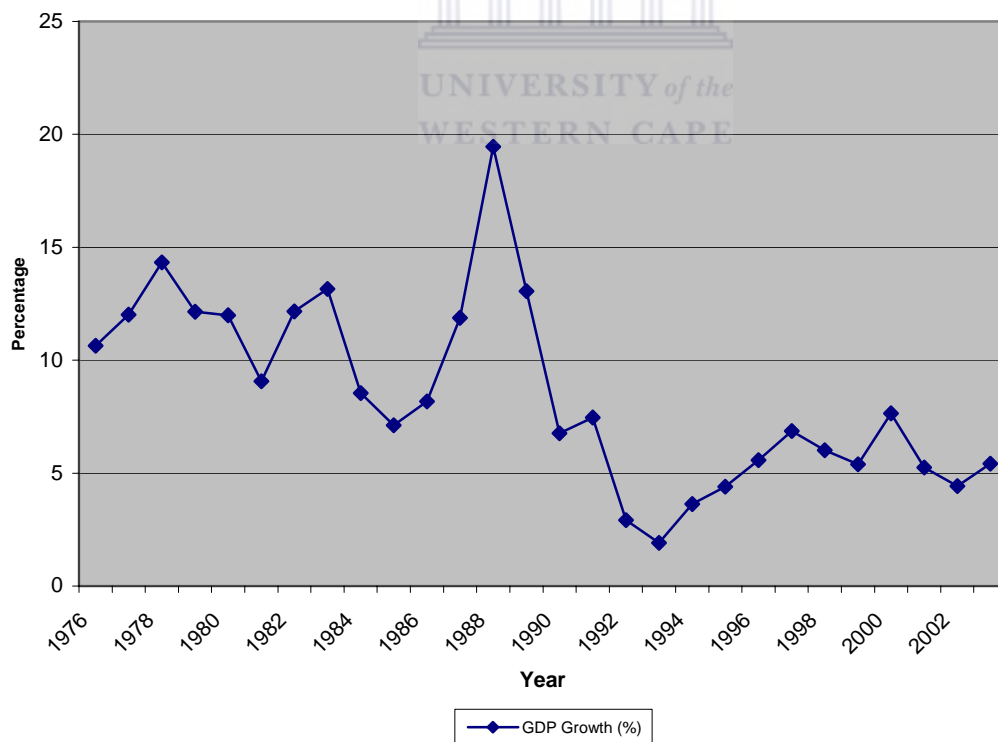
Data Source: Botswana National Accounts Statistical Bulletin, 2004, Ministry
Of Finance And Development Planning, Government of Botswana.

2.3   Measures to improve the investment climate

In the 1970's, government imposed some measures to boost private investment (BOB, 2000:22). The completion of major infrastructure projects in the early 1980s also contributed to an environment conducive to private sector investment (BOB, 2001: 25). The government recognised the risk of being dependent upon one sector and decided to put more emphasis on economic diversification by embarking on macroeconomic policies and policy reforms to, among others, encourage private investment (BOB, 2000:25). The government initiated a number of financial programs that offered credit to the private sector through organisations such as Botswana Development Corporation (BDC). The BDC's main objective is to establish and develop commercially viable businesses through provision of financial assistance to investors with commercially viable projects (BOB, 2000:26).

Other policies included interest rate policy which was intended to ensure that private savings are increased and appropriate investment decisions are made; Financial Assistance Policy (FAP) as a financial incentive to investors; the Selibe-Phikwe Incentive Package (SIP) and Infant Industry Licenses; reducing bureaucracy involved in the securing of foreign exchange for importation of goods and the realignment of the national tax system (BOB, 2000:28). The latter includes change of direction in the tax policy as income taxes were reduced to levels that are low by international standards (BOB, 2001: 35).

In addition the government has established the Botswana Export Development and Investment Authority (BEDIA) in recognition of the importance of private investment in the creation of employment, economic diversification and poverty reduction (BOB, 2000: 28). BEDIA mainly focuses on export development and promoting investment particularly in the manufacturing sector. As a primary government contact point for investors, its objectives include among others; to promote the establishment of manufacturing enterprises for export and import substitution; to promote the establishment of joint ventures between local citizens and foreign investors; and to identify market outlets for locally manufactured goods (BOB, 2000: 27). Further, Botswana has abolished exchange controls, a move aimed at enhancing the country's competitive position as a regional investment destination (BOB, 2000: 28). The abolition of exchange controls has allowed the further development of Botswana's financial markets through the creation of new portfolio investment options (BOB, 2004: 45).

Despite government's efforts and commitment in attracting investment, some of the schemes that were initiated to promote investment such as FAP have not been able to achieve the intended objectives (BOB, 2001: 33). The policy, which was introduced in 1982, was aimed at encouraging investment and employment creation in a range of economic activities. FAP was winded in 2001 after the government realised that it was not cost effective to continue with it (BOB, 2001: 45).

2.4 Trends in Investment

Table 1 shows private and public investment figures for Botswana and other African countries. These are average figures for the periods 1970-79, 1980-89, 1990-99, and 2000-2003 respectively. It is worthwhile to examine the trends in investment in the economy so that some insights into its link with economic performance can be seen (Shafik, 1992:270). Private investment can be measured in two ways. One is to measure investment in terms of ratios to GDP, which gives an indication of investment growth in relation to the economy, because real GDP relates to the general level of economic activity in the country. However, this method has a number of shortcomings, especially if the economy being studied started from a low base, and grew over time. The other method is to measure investment in levels, in real terms. This method helps to overcome the shortcomings inherent in the former, in that it is independent of the extent of the economic level. Nonetheless both methodologies are used in this section to analyse trends in investment.

Table 1: Private and Public Investment Trends

Country	Private Investment/GDP (%)				Public Investment/GDP (%)			
	1970-79	1980-89	1990-99	2000-2003	1970-79	1980-89	1990-99	2000-2003
Botswana	24.5	22.9	19.3	15.4	7.3	8.6	5.1	3.1
Zimbabwe	11.6	8.5	13.1	10.8	6.9	9.6	11.1	8.5
Malawi	7.4	5.5	9.6	7.5	14.8	8.6	9.4	11.5
Mauritius	15.5	13.9	19.1	16.1	6.5	7.3	9.1	7.5
Senegal	11.3	9.2	9.7	10.3	5.4	4.4	3.7	4.8
Kenya	12.8	11.2	10.8	11.8	9.1	7.7	8.2	8.4
South Africa	13.9	13.5	12	13.3	12.9	9.2	5.1	9.6
Zambia	2.4	2.2	3.1	2.5	23.8	9	7.3	16.1

Source: World Development Indicators, 2004; Botswana National Accounts Statistics Bulletin, 2004, Ministry of Finance and Development Planning, Government of Botswana.

According to Botswana Central Statistics Office (CSO) officials, it is standard practise to report national accounts statistics with depreciation accounted for[1]. In this regard the investment figures reported in this study depicts the net investment. Table 1 indicates that overall, Botswana has recorded comparatively higher private investment ratios, while Zambia and Malawi have recorded the lowest. However, interesting facts emerge about the evolution of private and public investment in Botswana. The worrying factor is that domestic investment (private and public) has been declining and has never recovered to reach their 1970s and early 1980's peaks.

Figures 2a and 2b show the evolution of total investment, private investment and public investment in Botswana both in levels and as a percentage of GDP between 1976 and 2003 respectively.

Figure 2a: Trends in Investment (In Levels)
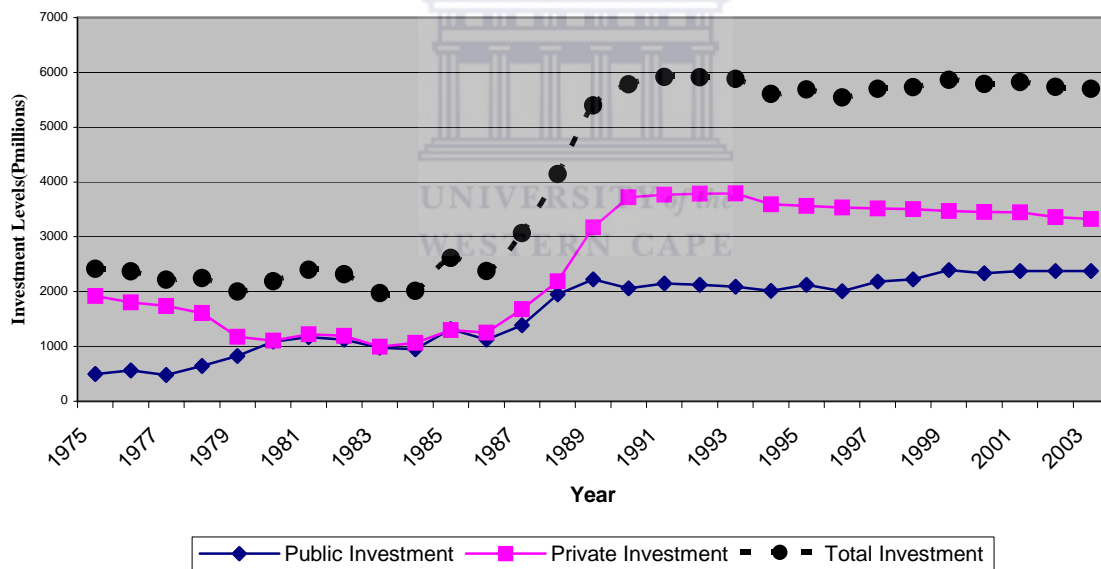
Data Source: Botswana National Accounts Statistics Bulletin, 2004, Ministry Of Finance and Development Planning, Government of Botswana.

Figure 2b: Trends in Investment (% of GDP)
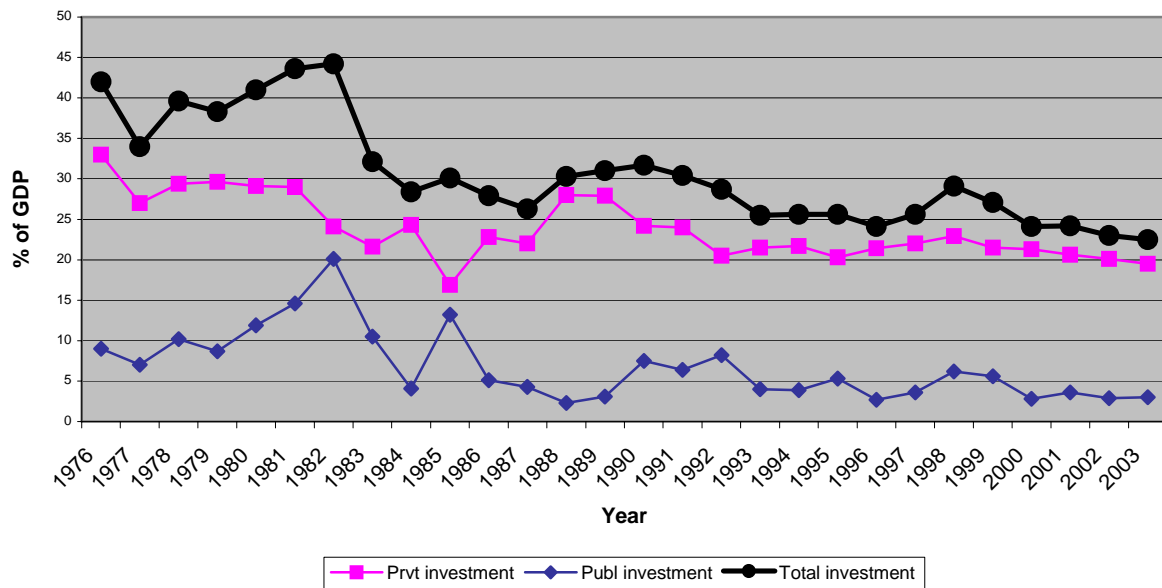
Data Source: National Accounts Statistics Bulletin, 2004, Ministry of Finance and Development Planning, Government of Botswana.

2.4.1 Private Investment

Figure 2a shows trends in investment when measured in levels. Private investment in levels shows a declining trend from 1976 to 1979. Signs of increase in private investment were eminent in 1980, but there was another slump in 1983. From 1989 there was a sharp increase in the level of private investment, until 1992 when it started to fall again. The peak levels were reached during the 1991-1993 period. However from this period, private investment has been declining towards the lowest levels ever to be reached in the period after the 1990s. Just recently, there has been a growing concern that the hindrances to investment in Botswana are long administrative procedures and red tape, compared to its competitors for investors (BOB, 2002: 25). This decline also coincided with the normalisation of South African political situation.

Alternatively, figure 2b shows trends in investment when measured as a percentage of GDP. The disturbing trend, in terms of the steady decline in private investment as a percentage of GDP, began in 1978 and resulted in a marked decline in total investment as a percentage of GDP in the early 1980s. The figure depicts that private investment ratios declined from around 33 percent of GDP in 1976 to 21 percent in 1984. This may be due partly to decreased

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direct foreign investment (BOB, 2001: 25). The highest private investment ratios as a percentage of GDP were realised in the period 1976-81. Private investment ratios show a downward trend for most of the period under study (1976-2003) reaching the lowest ratios ever in 1985. However private investment ratios showed signs of recovery after 1985 rising for the entire 1986-89 period, though still below the peaks reached in the 1970s. After 1989 private investment ratios began to fall again. Since 1998, private investment ratios had been falling and reached ratios below 20 percent in 2002 for the first time since 1986.

2.4.2   Public Investment

It is generally acknowledged that public investment, ceteris paribus, was supportive of private sector investment through the creation and improvement in infrastructure, which was a necessary condition to economic development and growth (Devarajan, Easterly and Pack, 2001: 82). Improvements to national infrastructure continued to be a major concern for the government of Botswana (BOB, 2000:55). Public investment, as a ratio to GDP, reached their peak in 1982, thereafter declined and never recovered to reach the 1980's peak again. In levels, public investment showed a promising trend from 1975 to 1982 only to decline thereafter. From 1988, public investment shows a trend similar to those of private investment in the same period, rising until 1990 and thereafter hovering around the P2000 Million level.

2.5   Banking and Finance

Availability of credit also plays a crucial role in attracting investment (Ndikumana, 2000: 382). The fall in investment such as the one indicated in Figures 2a and 2b can also be explained by the possible lack of profitable investment projects and the inefficient intermediation of the financial system (Ndikumana, 2000:397). The end result of the failure to engage effectively in risk and maturity transformation by the financial system is that internal funding of investment assumes greater importance in the economy (BOB, 2001:37). This therefore highlights the importance of good banking and financial systems in an economy.

For most of the 1980's the financial sector in Botswana was characterised by lack of competition and limited range of financial institutions and instruments (BOB, 2001: 39). Bank credit growth was stagnant until 1979 when it expanded to grow at an annual rate of

19.8 percent between 1979 and 1981 and then it declined in the following year due to the imposition of credit ceilings and interest rates increase of 1981 (BOB, 2001: 37). Credit expansion continued after the removal of restrictive measures, to grow at 25% per annum in the 1983 -1997 period (BOB, 2000:25).

Despite the growth in bank credit, a major concern has been that investment financing in Botswana was broadly dis-intermediated, in that most investment was self financed both by firms and government and also that there was a limited role of financial markets (BOB, 2001: 38). The commercial banking system provided 12 percent and 3 percent of total investment finance in 1991/92 and 1995/96 respectively (BOB, 2002: 36).

The share of credit allocated to the private sector declined in the 1990s whereas credit to the household sector continued to increase (BOB, 2001:47). Authorities therefore, decided to diversify savings sources and developed financial markets through the financial development strategy which included promotion of efficient operation of commercial banks and other private sector financial institutions by encouraging competition within the industry (BOB, 2001: 48). In line with this aspect of the financial development strategy, additional commercial banks were offered licenses to operate in Botswana (BOB, 2002: 25).

CHAPTER THREE

MACROECONOMIC EFFECTS ON PRIVATE INVESTMENT: THEORY AND EVIDENCE

3.1 Introduction

This chapter deals with the review of the existing investment literature relevant to the study. The study argues in the same vein as Mlambo and Oshikoya (2001: 13) that while the decline in Domestic Investment rates is tied in part to an unfavourable external environment, domestic macroeconomic policy factors seem to play a role as well. It is against this assertion that in this study, the emphasis will only be on the macro policy variables. The next section deals with the theoretical considerations relating to the study. Section 3.3 explores the empirical evidence on the subject matter. Section 3.4 provides the summary of this chapter.

3.2 Theoretical Considerations

The study of the determinants of private investment has been afforded extensive detail in formal investment models based on the experiences of developed countries. Chirinko (1993: 1875-1911) provides some insights into the different forms of some of these theoretical models. According to Ghura and Goodwin (2000:1821) there are four general approaches to modelling investment common in the existing investment literature. These broad categories include the flexible accelerator model, which they associate with Keynes (1936); the neoclassical model, which they associate with Jorgenson (1971); Tobin's Q model, which they associate with Tobin (1969) and the expected profits model, which has a number of variants.

The basic notion behind the flexible accelerator model is that the larger the gap between the existing capital stock and the desired capital stock, the greater a firm's investment (Ghura and Goodwin, 2000: 1823). The hypothesis is that firms plan to close a fraction of the gap between the desired capital stock K*, and the actual capital stock K, in each period (Chirinko, 1993: 1875). Within the framework of the flexible accelerator model, output, internal funds, cost of external financing and other variables may be included as determinants of K* (Chirinko, 1993:1875).

Chirinko (1993: 1878) reports that in the neoclassical approach, the desired or optimal capital stock is proportional to output and the user cost of capital (which in turn depends on the price of capital goods, the real rate of interest, the rate of depreciation and the tax structure). Therefore an investment equation results from the gap between desired capital and the actual capital stock (Chirinko, 1993: 1878).

In the Tobin Q theory of investment, the ratio of the market value of the existing capital stock to its replacement cost (the Q ratio) is the main force driving investment (Chirinko, 1993: 1888; Ghura and Goodwin, 2000: 1823). That is to say, enterprises will want to invest if the increase in the market value of an additional unit exceeds the replacement cost.

There are theories hinging on profits or profits earned by business units and industries instead of output (Chirinko, 1993: 1891). This analysis of profit and investment relationship has several variants, one of which is that investment is affected by current profits, the amount of retained profits, or by other variables like output, price and sales, which reflect the profits (Chirinko (1993: 1892). The profit theory posits that the greater the gross profits, the greater will be the level of internally generated funds and in turn the greater will be the rate of investment (Zebib and Muoghalu, 1998: 101).

In addition there is the dis-equilibrium approach, which views investment as a function of both profitability and demand for output (Chirinko, 1993:1901). In this instance, investment decisions have two stages: first is the decision to expand the level of productive capacity, and second, is the decision about the capital intensity of the additional capacity (Serven and Solimano, 1992: 7). The first decision depends on the expected degree of capacity utilisation in the economy, which provides an indicator of demand conditions, while the second decision depends on relative prices such as the cost of capital and labour. The investment decision takes place in a setting in which firms may be facing current and expected future sales constraints (Serven and Solimano, 1992: 7). Therefore, investment depends both on profitability and on the prevailing sales constraints, which determine the rate of capacity utilisation (Serven and Solimano, 1992: 7).

Also, Mlambo and Oshikoya (2001: 23) reports that, it can be deduced from modern theory of investment that the level of investment depends on:

$$I = I(\varDelta\gamma, r, q, \mu) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.................... \quad (1)$$

where, $\varDelta\gamma$, is the expectation of future market conditions, r is the financial constraints of the firm, q is the valuation of the firm in the stock market, and μ is economic and political uncertainty.

It is clear from the discussion above that private investment depends on three broad categories of variables: Keynesian, neoclassical, and uncertainty variables. Variables that may be included in the Keynesian tradition include GDP growth, internal funds and capacity use, while the neoclassical determinants of private investment include Tobin's Q, real interest rate, user cost of capital and public investment (Mlambo and Oshikoya (2001: 18). The uncertainty variables as referred to in Oshikoya (1994: 585) are the variability of the user-cost of capital, real exchange rate, inflation rate, and the debt/GDP ratio.

The investment models have been widely applied using data from several developed countries as noted in Chirinko (1993: 1876). However there are difficulties associated with testing the implications of these models for developing countries. Noted among others are the assumptions, upon which these models are based, like the existence of perfect capital markets, a perfect flow of information, which are not satisfied in most developing countries (Oshikoya, 1994: 583; Ghura and Goodwin, 2000: 1821; Mlambo and Oshikoya, 2001: 24).

The inadequacy of data in developing countries on capital stock also makes it difficult to observe the stock adjustment mechanism, upon which almost all investment theories are based (Mlambo and Oshikoya, 2001: 24). Likewise the study by Zebib and Muoghalu (1998: 100) makes an observation that it is difficult to obtain empirically a production function, from which a functional form of the desired amount of capital could be derived under certain optimisation conditions. Furthermore, the observable interest rates in developing countries often do not reflect the scarcity of capital because capital markets are either small or not functioning (Wai and Wong, 1982: 21), rendering the application of cost of capital unrealistic.

Because of the data limitations involved in empirical models of developing economies, especially for capital stock and appropriate measures of return on investment, some studies,

such as Fry (1998: 12-13) have used the variants of the flexible accelerator model, where the speed of adjustment is influenced by a number of observable variables (Ghura and Goodwin, 2000: 1821). These observable variables may include public investment, credit to the private sector, inflation, the real exchange rate, trade, GDP growth and interest rates. The next section discusses the empirical evidence relating to the effects of these variables on private investment in developing countries.

3.3   Empirical Evidence

The gap between investment models and their application to developing countries has made it necessary for research in developing countries to concentrate on identifying variables that may affect private investment and testing several hypotheses advanced to explain variations in private investment in these economies (Greene and Villanueva, 1991: 39; Oshikoya, 1994: 583; Mlambo and Oshikoya, 2001: 29). In particular the list of variables identified in the literature has tended to include macroeconomic factors and policies, which are the main focus of this study. The rest of this section discusses the impact of these factors on private investment. They are grouped into: policy related factors, financial factors, neoclassical factors and an open economy variables.

3.3.1   Policy-related factors

At the theoretical level the impact of public investment on private investment activity is ambiguous. On the one hand, public investment on social and physical infrastructure by raising private and social rate of return can boost private investment (Oshikoya, 1994: 576). Most of the developing countries have a large component of public investment concentrated on infrastructure projects, which may be complementary to private investment (Oshikoya, 1994: 577). Oshikoya (1994:584) reports that evidence of complementarity between public and private investment has been found by studies such as Blejar and Khan (1984), and Aschauer (1989).

However, increases in public investment may also crowd-out private investment if the additional government borrowing raises domestic interest rates and the future tax burden (Ghura and Goodwin: 2000: 1822).

Studies by Shafik (1992:274) and Rossiter (2002: 66) found a negative effect of public investment on private investment. This study will address this empirical question in the context of Botswana.

3.3.2   The role of financial factors

Changes in the volume of bank credit to the private sector are suggested to have a positive impact on private investment activity among developing countries (Oshikoya 1994: 584; Ndikumana, 2000:382). The basic idea is that some business agents are unable to get financing directly from the debt market, hence these agents are strongly dependent on bank credit (Lounging and Rush, 1995: 517), which has remained the most important source of investment financing among private enterprises in developing countries (Oshikoya, 1994: 584). Additionally this is based on the argument that availability of loanable funds may affect the investment decisions irrespective of the cost of capital (Chirinko, 1993:1899). A positive coefficient is expected in this study.

The direct impact of credit availability on private investment is also confirmed in studies by Wai and Wong (1982:28); Greene and Villanueva (1991: 52) and Ndikumana (2000:383). Since there is no ambiguity regarding the bank credit variable in the literature, we also expect the sign of its coefficient to be positive in our study.

Theoretically, interest rates should be a crucial variable (Shafik, 1992:275). The sign of the real interest is an empirical issue and depends on whether the data supports the McKinnon-Shaw hypothesis or the neoclassical view (Ndikumana, 2000:383). The neoclassical view is that real interest rates are expected to affect private investment negatively since higher interest rates raise the user cost of capital and therefore reduce investment (Ndikumana, 2000: 382). On the other hand the McKinnon-Shaw hypothesis states that interest rates affect private investment positively (Agrawal, 2001: 9).

However, the insignificant effect of interest rates on investment has been a common and often problematic finding in much empirical work (e.g. Shafik, 1992: 274). A number of explanations have been proposed in the literature to explain why it is not possible, in most cases, to obtain a significant coefficient for the cost of funds when in theory the interest rate

1994: 585). Greene and Villanueva (1991: 55) found that a higher inflation rate had a negative effect on private investment for 23 African developing countries in their study. This empirical question will be addressed by our study in the context of Botswana.

The effect of the real exchange rate on private investment can be considered in two ways; the demand side, and the supply side (Serven, 2002: 2). On the supply side the effect of exchange rate is ambiguous. On the one hand real depreciation of the currency raises the cost of imported capital goods, and since a large component of investment goods is imported in developing countries (Ghura and Goodwin, 2000: 1822), depreciation lowers private investment in the non-tradable goods sector. On the other hand devaluation of the real exchange rate, by raising the profitability of the tradable goods sector, would be expected to stimulate private investment in that sector, as suggested by Froot and Stein (1991: 1214).

On the demand side, the effect of the exchange rate is clear (Serven, 2002: 3). The main demand side effects are a reduction in private sector real wealth and expenditure, due to the impact of the rise in the overall price level on the real value of private sector financial assets (Ghura and Goodwin, 2000: 1822). For these reasons, real devaluation decreases domestic demand, and when the firms face sales binding constraints, the slump in aggregate economic activity may induce firms to reduce investment spending (Froot and Stein, 1991: 1215). Our study will also provide an empirical answer to this question in the context of Botswana.

Trade flows, external debt, and black market activities also affect the rate of investment in developing countries (Fielding, 1997:132). Empirical evidence shows that among the many measures of openness, the measure of trade (imports and exports) appears to have the most consistent relationship with investment (Ndikumana, 2000: 384). The volume of trade positively affects domestic investment both through exports and imports (Fielding 1997:132). We also expect a positive relationship between the trade variable and private investment level.

3.3.5   General Macroeconomic variables

A number of studies have been undertaken on the factors that affect private investment in developing countries. Ouattara (2005: 19)'s study on the determinants of investment in Senegal shows that public investment, real income, and foreign aid flows affect private

investment positively, whilst the impact of credit to private sector and terms of trade is negative. Oshikoya (1994: 573-596) carried out an empirical analysis of macroeconomic determinants of domestic private investment in selected African countries with some characteristics similar to that of Botswana. The countries that were included in the sample are: Morocco, Mauritius, Tunisia, Cameroon, being the middle-income countries and Malawi, Tanzania, Kenya and Zimbabwe being the low-income countries. The results of the study seem to indicate that the macroeconomic variables affect private investment in these developing countries differently, depending on whether a country is a low income or middle income country (Oshikoya, 1994: 593).

Acosta and Loza (2004:17) provide an analysis of the macroeconomic factors that potentially affect investment decisions in Argentina, being a developing country in a short, medium and long-run perspective. The results of the study also confirm that real exchange rate, terms of trade, growth in output and public investment affect private investment significantly (Acosta and Loza, 2004: 16).

3.4   Summary

Based on the above arguments and evidence, it is clear that variations in private investment depend on the following variables; GDP growth, interest rates, public investment, real exchange rates, inflation, availability of credit to the private sector, and changes in trade. This paper draws from this conclusion and proceeds to evaluate the impacts of these variables in the case of Botswana. However, we make a distinction as to whether the impact of these variables is felt in the short or long run perspective.

It is important for policy makers to be able to assess how private investment responds to changes in policies. This can be determined by establishing how private investment in the country is decided, that is by analysing the variables that systematically affect it. As noted in Oshikoya (1994:590), a formal framework for studying private investment in developing countries was developed by Blejer and Khan (1984b). Oshikoya (1994:590) referred to this framework as an extension of previous work in the theoretical literature on investment that yielded a well-defined class of models of the flexible accelerator type, which they associate with Jorgenson (1971).

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According to Oshikoya (1994: 590), Blejer and Khan (1984b) focused on the role of government policy and derived an explicit functional relationship between the principal policy instruments and private capital formation. Oshikoya (1994:591) lists two principal conclusions that emerged from Blejer and Khan's (1984b)'s test of formal model for 24 developing countries. The first was the possibility of identifying well-behaved empirical function for private investment in developing countries. The second major conclusion was the establishment of a direct empirical link between government policy variables and private capital formation.

Wai and Wong (1982: 23) incorporated features of the neoclassical model into investment models for developing countries. Their approach took into account the relevant data problems and structural features that caused a gap between the modern theory of investment and the models that were specified for developing countries.

Another strand of investment theories have focused on uncertainty and investment irreversibility as factors that can be seriously harmful to investment decisions (Serven, 2002:15). Investment literature concerned with the analysis of those links has shown that if investment is costly or impossible to reverse, investors have an incentive to postpone commitment and wait for new information in order to avoid costly mistakes (Serven, 2002:22).

CHAPTER FOUR
DATA AND METHODOLOGY

4.1 Introduction

This chapter provides details of the data, as well as the methodology employed in the study. The next section provides data sources, the sample used and variables definition. Section 4.3 outlines the framework to be employed and justification for selecting the preferred methodology. Section 4.4 outlines the investment model that will be estimated. Section 4.5 provides some conclusion.

4.2 Data Sources and Sample

The data covers a wide range of macroeconomic variables that include GDP growth, inflation, bank credit to the private sector, fiscal variables, exchange rates and trade variables. The data used in this study is annual data obtained from different sources as stated below. The sample is for the period 1976-2003. The period was selected specifically because this is the period for which data was available for the selected variables. The sources of the variables used in the study are presented below:

Ip: Private sector's real investment (National Accounts Statistics Bulletin, 2004: 65).

*GDPGR***:** Gross Domestic Product (GDP) growth (National Accounts Statistics Bulletin, 2004: 65).

INF: Inflation rate in annual percentage (Botswana Financial Statistics, 2004: 36).

Ig: Public investment (National Accounts Statistics Bulletin, 2004: 70);

PCRED: Credit to the private sector (Botswana Financial Statistics, 2004: 42)

RINT: Real Interest Rate (Botswana Financial Statistics, 2004: 76).

RER: Real exchange rate (Botswana Financial Statistics, 2004: 80).

Tradelib: Trade Liberalisation index (Botswana Financial Statistics, 2004: 38).

4.3   Framework for the analysis of the study

In this section, the study establishes a conceptual framework upon which the determinants of private investment will be evaluated. The empirical framework employed in this analysis involves the regression of private investment on selected explanatory variables. The analysis of the determinants of private investment can be done through different approaches, which are considered below.

4.3.1   Static Ordinary Least Squares (OLS) Estimation

Economic analysis suggests that there is a long-run equilibrium relationship between the economic variables involved in economic theory under investigation. Applied econometric analysis in trying to estimate these long-run relationships implicitly considers the 'constancy doctrine' of the variables involved, in terms of means and variances being constant while not dependent on time (Gujarati, 2003:820). The empirical relationship can be expressed as:

$$y_t = \alpha + X_t \beta + \varepsilon_t \quad \text{……..................……………………………………………………………} \quad (2)$$

where y_t is private investment in levels, α and β are parameters to be estimated, X_t is defined as observable variables representing factors affecting private investment in a country in year t, and ε_t is a random error term with a mean of zero, representing measurement error and unmeasured and immeasurable factors (Ghura and Goodwin, 2000: 1822).

Oshikoya (1994: 586), Ghura and Goodwin (2000: 1822) have employed this specification when investigating the determinants of private investment. We naturally recognise that studies using this framework are usually interested in finding out whether variables should be included in the model.

Results from these models should be interpreted with caution, as they may be spurious given problems associated with time series data, which is not taken care of in this case. A large number of macroeconomic time series data are characterised by unit root non-stationary processes (Harris, 2000: 62). Under these circumstances, the conventional t and F tests based on these estimation methods are no longer valid, giving misleading inferences (Harris, 2000:63).

4.3.2   Co-integration Technique

A possible way to avoid the problem of spurious regression because of unit roots is to first-difference all economic data before running a regression (Harris,2000: 63). Although this can help solve the question of spurious regressions, Gujarati (2003: 824), indicates that valuable information concerning the long-run relationships among the series postulated by economic theory may be removed following this methodology. As a result, researchers in the field after several revisions included the systematic verification of non-stationarity of the time series economic variables and co-integration, among others.

Co-integration analysis refers to a group of variables that drift together, although individually they are non-stationary in the sense that they tend to go upwards and downwards over time (Harris, 2000: 62). This common drifting of variables make linear relationships between these variables over long period of time thus translating into equilibrium relationships of economic variables (Gujarati, 2003: 825). If these linear relationships do not hold over long period of time then the corresponding variables are not co-integrated (Harris, 2000: 62). Generally, cointegration analysis is a technique used in the estimation of the long-run or, equilibrium parameters in a relationship with non-stationary variables and is used for the construction of the dynamic error-correction models (ECM) in order to verify the validity of underlying economic theories   (Harris, 2000:63). This alternative approach however uses equation 2 as the starting point.

4.3.3   Error Correction Model Technique

Some studies compile, in a single model both the short and long run determinants of private investment (e.g. Fielding, 1997:128; Agrawal, 2001: 9). For that, an Error Correction Model (ECM) can be used. This approach enables the long run equilibrium relationship and the short-run dynamics to be estimated simultaneously (Gujarati, 2003: 824). This type of technique helps to correct the potential bias in the estimation of the coefficients in models with differences that do not take into account co-integration relationships (Agrawal, 2001:9). When these long-term restrictions are ignored, there could be an omitted variable bias (Gujarati, 2003:830).

Harris (2000: 68) summarises the four desirable features of ECM as follows: (i) it avoids the possibility of spurious correlation among strongly trended variables; (ii) the long-run relationships that may be lost by expressing the data in differences to achieve stationarity are captured through inclusion of lagged levels of the variables on the right-hand side; (iii) the specification attempts to distinguish between short-run (first-differences) and long-run (lagged-levels) effects; and (iv) it provides a more general lag structure, and does not impose too specific of a structure on the model.

This study subscribes to both approaches. The OLS approach is used as a starting point, with the co-integration and ECM techniques approach complementing it because it provides some mechanism to deal with the problems identified in the time series data. If co-integrating relationships exist among a set of 1(1) variables, then Granger Representation Theorem suggests that there is a dynamic error correction representation of the data (Harris, 2000:69). This implies that one can construct an ECM that takes into account the short-run dynamics of all variables included in the co-integrating regression. An advantage of co-integration analysis is that through building an error correction model (ECM), the dynamic co-movement among variables and the adjustment process towards long-term equilibrium may be examined (Harris, 2000: 66). The next section develops the model to be estimated.

4.4   Theoretical Specification of the Model

As in Oshikoya (1994: 583); Ghura and Goodwin (2000: 1821) Chapter 2 of this study described some of the difficulties of estimating investment functions for developing countries[2]. Without data on the capital stock and the return on capital, there is little choice in practice but to use some version of the accelerator model (Fry, 1998:12). In this study we proceed in the same manner and thus, the investment function estimated here is based on the accelerator model as developed in Fry (1998: 12-13) and subsequently used by Agrawal (2001: 4).

The accelerator model has the desired real capital stock, K^*, proportional to the real GDP, y:

$$K^* = \alpha y \text{ …………...…………………………………………………...............}\quad (4)$$

Differentiating both sides with respect to time and dividing by y, equation 4 can be expressed in terms of a desired ratio of investment to output $(\text{inv}/\text{y})*$ (Fry, 1998:12-13):

$$(\text{inv/y})* = (\text{INV/Y})* = \alpha G \ \text{…………………...…………………………….................} \quad (5)$$

where **inv** and **INV** denote real and nominal gross domestic investment respectively, Y denotes nominal GDP and G is the growth of real GDP. A partial adjustment mechanism allows the actual investment rate to adjust partially in any one period to the difference between the desired investment and the investment in the previous period:

$$\Delta[\text{INV}/ (\text{Y})]_t = \lambda \ [(\text{INV/Y})* - (\text{INV/Y})_{t-1}]$$

$$\text{or, } (\text{INV/Y})_t = \lambda \ [(\text{INV/Y})* - (\text{INV/Y})_{t-1}] + (\text{INV/Y})_{t-1} \ \text{…………….......................} \quad (6)$$

where λ is the coefficient of adjustment. The flexible accelerator model allows economic conditions to influence the adjustment coefficient λ (Fry, 1998:13; Agrawal, 2000:6). Specifically it is assumed that,

$$\lambda = \beta_0 + (\beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + …)/[\text{INV/Y} - (\text{INV/Y})_{t-1}] \ \text{……………......................……} \quad (7)$$

where Xi are the variables that affect λ and βi are their respective coefficients. The explanatory variables used here are GDP growth (GDPGR), real interest rates (RINT), public investment (I_g), credit to the private sector (PCRED), trade liberalisation (Tradelib), real exchange rate (RER) and annual inflation (INF).

The discussion in chapter 2 and therefore equations (6) and (7) suggests the following long run equation to estimate;

$$I_p = f \ (\text{GDPGR, RINR, } I_g, \text{ PCRED, INF, Tradelib, RER}) \ \text{……………...................…} \quad (8)$$

where I_p, the dependent variable is the level of private investment and the explanatory variables are[3]; GDP growth (GDPGR), real interest rates (RINT), public investment (I_g), credit to the private sector (PCRED), trade liberalisation (Tradelib), real exchange rate (RER) and annual inflation (INF). This specification has been used in various other studies, which

include Oshikoya (1994:581); and Mlambo and Oshokoya (2001; 29). The lagged level of private investment is not included here because it will be captured when constructing the ECM.

4.5   Conclusion

This chapter considered the data issues and the methodological aspect to carry out the investigation of the determinants of private investment. The approaches discussed are the static OLS and the techniques of co-integration and error correction modelling. Our study will combine these approaches. Combined with ECM, cointegration provides the tools to quantify both the long-run relationship and the short-run deviations from equilibrium.

In order to determine both the long run and short run behaviour of investment with regard to explanatory variables, a private investment function is developed and will be estimated at levels to determine the long-run behaviour and, then re-estimated on lagged and differenced terms. The estimation on differenced terms is used to determine the short-run behaviour and the adjustment mechanism by which short-run dynamics adjust towards equilibrium (Gujarati, 2003:824). The error correction term is used to combine both short run and long run dynamics of the model.

CHAPTER FIVE
EMPIRICAL ANALYSIS AND RESULTS

5.1 Introduction

In this chapter, we carry out the empirical analysis of the study and present the results. In section 5.2 we outline the estimation method for the analysis of the study and present the empirical results in section 5.3.

5.2 Estimation Method

The model is estimated using the techniques of co-integration and an error correction modelling. In the search for possible long run relationships between private investment and the explanatory variables, we use the co-integration technique, which Harris (2000: 57) associates with Engle and Granger (1987). We explore the short run dynamics through the ECM that allows us to capture the possible lagged response of private investment. This is the preferred methodology to the static OLS methodology, which will only be used as the starting point, because of the nature of the questions that this study intends to answer.

According to Harris (2000:68), co-integration and ECM analysis involves four steps. First, the order of integration for each of the economic variables of the study must be determined. Second, co-integrating regressions should be estimated with OLS method using the variables with the same order of integration. Third is the test for unit root of the residuals of the cointegrating regressions. The fourth step is to construct the error correction model. The ECM procedure provides a more reliable test of co-integration and simultaneously yields less biased estimates of the long run relation (Harris, 200: 68; Agrawal, 2001:9). However, there are some difficulties with estimating the long-run equation 8 above. The next sections will describe how we have tried to overcome these difficulties in this study.

5.2.1 Tests for Stationarity and Endogeneity

One of the prerequisite for using OLS to estimate the investment function is that all the variables included in the analysis should be stationary (Harris, 2000: 54). A series is said to be stationary if its mean and variance are constant over time and the value of the covariance

between the two time periods depends only on the distance or lag between the two time periods and not the actual time at which the covariance are computed (Gujarati, 2003: 797). The first step therefore is to examine the time series characteristics of the data in order to determine their stationarity condition to avoid spurious OLS estimates in the presence of unit root series (Gujarati, 2003:802).

Estimation results could, of course, be sensitive to the choice of econometric procedure used to remove long-term trends from the data and derive cyclical components (Agenor, McDermott and Prasad, 2000: 254). Applied studies usually use the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests to check for stationarity in data series. Both ADF and PP tests can be applied on the variables in levels and first differences to check for stationarity or unit roots. For our purpose, we employed the ADF test and applied the test to each variable that will be used in the analysis. A desirable feature of the ADF test is that it allows for heteroskedasticity as well as serial correlation in the error terms, thus compensating for the mis-specification of the dynamic structure of time series (Harris, 2000: 65).

The ADF test requires running a regression of the first difference of the series against the series lagged once, lagged first difference terms, and a constant with a time trend of the following form (Harris, 2000:72);

$$\Delta \mu_t = a + bt + c u_{t-1} + \Sigma d \Delta u_{t-1} + v_t, \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \quad (9)$$

where μ_t is the variable of interest, t is the trend and v_t is the error term. The estimation strategy consists of a t-test for the OLS estimate of c, where the null hypothesis is that the series are I(1) and non-stationary. The output of the ADF test is reported in Table 2 below. The estimated ADF statistic is shown in brackets. If the estimated ADF statistic is larger (in absolute) than its critical value then the null hypothesis is rejected suggesting that the series are stationary (Harris, 2000: 68).

Table 2: Unit root tests to determine the order of integration.

Variables	ADF in levels	T/I	ADF in differences	Order of integration, I(d)	Number of lags
Private Investment	-0.1265 (-1.9546)	Intercept	-2.2135* (-1.9552)	I(1)	2
Bank Credit	-2.091811 (-2.9798)	Intercept	-2.79* (-2.6381)	I(1)	2
GDP Growth	-2.29469 (-2.9798)	Intercept	-3.279* (-2.9907)	I(1)	2
Inflation	-2.37099 (-3.7076)	Intercept	-3.204* (-2.99)	I(1)	2
Public Investment	-1.25379 (-2.9798)	Intercept	-3.78855 (-2.9850)	I(1)	2
Real Interest Rate	-1.7275 (-2.9850)	Intercept	-3.6529* (-2.9907)	I(1)	2
Trade liber	-2.4146 (-3.5943)	Intercept	-3.656552* (-3.6212)	I(2)	2
Real exchange Rate	-1.681679 (-3.0521)	Intercept	-7.7016** (-3.066)	I(1)	2

Level of significance: * = 5% , **=1%
T/I: Trend or Intercept; I(d): Order of integration

The results indicate that all the variables are non-stationary at levels as shown in column 2 of Table 2. The estimated ADF statistics (shown in brackets) for each variable is larger than the critical values at all the standard levels of significance. This therefore means that all these variables have to be differenced to transform them to stationarity (Gujarati, 2003: 802).

In the second stage, the order of integration of the non-stationary variables was performed, still by means of ADF tests. After differencing the variables once, they all present I(1) behaviour at 5% significance level, save for trade liberalisation variable, which becomes stationary only after second differencing, i.e. it presents an I(2) behaviour, and will therefore be dropped when carrying out the estimation. Thus the conclusion is that the variables are stationary after first difference.

The selected variables indicate that there is a possibility of endogeneity amongst some explanatory variables, and some explanatory variables with the dependent variable. For example, the RER[4] and real interest rates variables may be correlated; bank credit and interest rates variables may be jointly determined with investment (Serven, 2002: 8). However these

are key variables that are needed in the model and will not be dropped at this stage. The econometric methodology employed in this study will help address this problem.

5.2.2 Testing for co-integration

Upon finding that all the data series are stationary after first difference, the co-integration technique is applied to I(1) variables in order to determine the long run effects of the explanatory variables on private investment (Harris, 2000:68). This requires the application of OLS technique to the estimation of the co-integration regression. The hypothesis of long-run relationship is of the following specification:

$$Ip_t = \alpha_0 + \alpha_1 GDPGR_t + \alpha_2 PCRED_t + \alpha_3 Ig_t + \alpha_4 INF_t + \alpha5 RINTt + \alpha_6 RER_t + \varepsilon_t \ \dots\dots \ (10)$$

Proceeding with all the series that became stationary after first difference, the next step is to check that there exists a long-run equilibrium relationship between the variables. A necessary condition to conclude that a long-term relationship exists is that the series must be co-integrated.

Table 2 shows that at levels, all the variables are not stationary, but after being differenced they became stationary. Also, the variables are integrated of the same order, save for the trade variable, hence equation **10** is run at levels and the residuals obtained will be tested for stationarity. The test enables us to find out if the residuals obtained from the co-integration regression is a white noise process, meaning that the mean and variance are constant (Harris, 2000:69) (i.e. the residuals are stationary). In other words, even if each individual time series is level non-stationary, it has to be determined if the linear combination of the series is level stationary. The advantage of using this procedure is that it can determine the existence of a stable long run (equilibrium) relationship among the non-stationary time series variables (Harris, 2000: 70).

The main purpose of running co-integration regression 10 is to obtain the residuals of the model, and should not to be concerned very much with the significance of the variables at this stage. Table 3 shows the OLS estimated coefficients of each of the variables and their t-statistics.

Table 3: Co-integration regression results, equation 10.

Variable	Coef.	Std.Err.	t-ratio
GDPGR	81.182	24.38	3.32
PCRED	56.553	25.56	2.21
INF	24.8	16.58	1.49
RER	127.21	57.36	2.22
RINT	38.69	12.25	3.15
Ig	-2.197	-0. 41	5.31
Const	60.04	27.56	2.17

$_R{}^2$ adj= 0.734

Durban Watson d-statistic = 1.9053

N=22

Estimates of the variables in levels from the co-integration regression 10 reveal the long run effects of the regressors. All the variables show positive coefficients except for public investment, which shows a negative coefficient (-2.178). Positive coefficients show a positive long run relationship while negative coefficients show a negative long run relationship. Also, all the variables are significant at 5 percent level of significance, except for inflation (t-ratio of 1.49). However this variable will not be dropped at this stage since our interest here was to obtain the residuals from the co-integration regression. The residuals obtained from the co-integration regression results above, will be used in the next sub-section to establish if the co-integration model is valid.

5.2.3   Unit root test for the residuals

The next step is to establish if the co-integration model is valid (Harris, 2000:71). This is accomplished by undertaking a unit root test for the residuals obtained from estimating equation 10, by testing their stationarity condition. The null hypothesis of a unit root and therefore of no co-integration (H_0: $\beta = 0$) is based on a **t**-test with non-normal distribution (Harris, 2000:54). However, unless the estimate of the long run model is already known, and has not been estimated using the static model, it is not possible to use the standard Dickey -Fuller table of critical values (Harris, 2000:71). Thus, alternative critical values are needed as the number of observations changes.

According to Harris (2000:55), MacKinnon (1991) has linked the critical values for particular tests involving the residuals from an OLS equation to a set of parameters of an equation of the response surface estimates. The residuals from co-integrating regression 10 are then evaluated using the ADF test and MacKinnon (1991) response table to determine whether they are I(0) (Harris, 2000: 55). The critical values for the ADF residual based tests are computed using the response surface estimates given in Harris (2000:158) which he associates with MacKinnon (1991) and the following relation; $C(p) = \phi_\infty + \phi_1/T + \phi_2/T^2$ (Harris, 2000:55) where C(p) is the **p** percent critical value and **T** is the number of observations. These critical values are then compared with the usual ADF test statistic. This specification is used for any test involving the residuals from an OLS equation (Harris, 2000:54). The estimated 5 percent critical value for 17 observations when $n = 6$ (number of regressors) is given by:

$$-4.7048 - 17.12/17 - 11.17/(17^2) = -5.7363$$

Thus the decision rule is to reject the null hypothesis of no co-integration if the t-value associated with β is more negative than the computed one (Harris, 2000: 54). The ADF test shows that the hypothesis that the residuals in regression 10 are non-stationary can be rejected. The ADF test statistic (-7.6973) is more negative than the computed value of -5.7363; therefore the decision rule is to reject, at the 5 percent level of significance, the null hypothesis that the residuals are non-stationary. We therefore conclude that the residuals are stationary, indicating that co-integration relationship between private investment and the selected explanatory variables exists. With this knowledge, we proceed to estimate the error correction model.

5.2.4   Error Correction Model (ECM)

Since the evidence from the above section points towards the existence of the co-integration relationship between private investment and other variables, the study will proceed to formulate the ECM (Harris, 2000: 58). The ECM is formulated using the general-to-specific approach, which starts with a general framework and test down to a suitably final model. In this process, the explanatory variables in equation 10 are substituted by first differences and lagged variables of the co-integrating variables so that the short and long run parameters are jointly estimated. The ECM is based on the following specification:

$$\Delta Ip_t = b_0 + \delta ltv_{t-1} + \Sigma \beta_{it} \Delta x_{it} + \Sigma \alpha_{it} \Delta x_{it-1} + \gamma \Delta Ip_{t-1} + \mu_{t-1} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \quad (11)$$

where; Ip = private investment; x_1 = public investment; x_2 = GDP growth; x_3 = real interest rates; x_4 = private sector credit; x_5 = real exchange rate; x_6 = inflation, and μ_t is the error term. Equation 11 states that ΔIp_t, depends on the first differences of the explanatory variables, (Δx_{it}), the lagged values of the explanatory variables, the lagged differenced value of the dependent variable (ΔIp_{t-1}), and also on the equilibrium error term (Gujarati, 2003: 825). The lags, rather than contemporaneous values are included in order to avoid the possible simultaneity bias (Ndikumana, 2000: 390). The advantage of the general to specific approach is that if the general model is rigorously tested for misspecification, the possibility of any dynamic mis-specification is reduced in the final model (Harris, 2000:58).

The variable ltv_{t-1}, is included in equation 11 as an error correction term, which is the residual from the long run co-integration equation 10, reflecting the deviation of private investment from the long-term level in the previous period. The coefficient δ is the dis-equilibrium error correction coefficient, which represents the long-run speed of adjustment (Harris, 2000:61). It also measures the role such dis-equilibrium play in explaining the short run movements in private investment and it is expected to be negative (Harris, 2000:58). The results of the ECM model (11) are presented in Table 4.

5.3   Empirical results

The results in Table 4 show positive and significant coefficients for public investment, bank credit and real interest rates for the short run model. According to the results other variables do not affect private investment level in the short run as they show insignificant coefficients. GDP growth and real exchange rates are significant in the long run. Inflation was insignificant in both cases. This means that in the long run, the variations in private investment level is underpinned by; GDP growth, public investment, and the real exchange rate, while real interest rates, public investment and the availability of credit affect investment behaviour in the short term. The long-term estimates confirm most of the empirical results found in the investment literature (e.g. Oshikoya, 1994:587; Mlambo and Oshikoya, 2001:29).

Table 4: Results of ECM 11: Determinants of Private Investment in Botswana
Dependent Variable: Private Investment

Variable	Coef.	Std.Err.	t-statistic
$\Delta GDPGR_t$	16.73	10.52	1.596
ΔIg_t	-1.07	0.45	-2.37*
$\Delta PCRED_t$	17.53	4.53	3.869*
ΔRER_t	-16.63	10.48	-1.58
$\Delta RINT_t$	25.12	10.23	2.45*
ΔINF_t	28.24	24.45	1.15
Ip_{t-1}	22.42	16.53	1.35
$GDPGR_{t-1}$	43.66	21.52	2.02*
Ig_{t-1}	-32.42	15.22	-2.13*
$PCRED_{t-1}$	61.53	35.24	1.746
RER_{t-1}	26.89	11.42	2.354*
$RINT_{t-1}$	35.75	28.24	1.234
INF_{t-1}	42.33	33.55	1.26
ltv_{t-1}	-0.61	0.30	-2.012*

t-ratio of estimates *, and ** denote a t-ratio significant at the 1% and 5% respectively
R^2 adj = 0.5525

GDP growth was included to capture the accelerator effects, with faster growth expected to lead to higher investment rates (Mlambo and Oshikoya, 2001:29). The coefficient on GDP growth is positive and statistically significant (43.66), suggesting that output recovery will boost the share of private investment in the long run (Ndikumana, 2000:391). This indicates that real GDP growth is a determinant of private investment, confirming similar results by Mlambo and Oshikoya (2001:29). Thus, given that investment is itself a key factor contributing to real GDP growth (Ghura and Goodwin, 2000: 1824), Botswana can indeed benefit from the virtuous cycle that links increased private investment and real GDP growth.

There is evidence that supports the theory of 'crowding out' as public investment affects negatively and significantly private investment in the context of Botswana. The coefficient of public investment is negative and significant (-32.42). This shows that there is competition for resources between the public and the private sector (Acosta and Loza, 2003: 13). This is in line with results found by Shafik (1992:272) in the context of Egypt.

The real exchange rate measures the impact of exchange rate policy on private investment (Fielding, 1997: 136). While a devaluation of the exchange rate might cause the cost of imported capital to increase, thus reducing private investment, an appreciation of the real exchange causes external competitiveness to deteriorate, which may in turn cause investment to decline (Mlambo and Oshikoya, 2001:30). Our results show that an appreciation of the real exchange rate would positively affect private investment in the long-term, since the real exchange rate variable enters the equation positively (26.89), and it is significant.

The variable ltv_{t-1} corrects for the long run equilibrium, and is significant in our case, with the expected sign (it should be negative for equilibrium to be restored). The magnitude of the coefficient of this term (-0.6055) implies that after a shock is given to the system, it takes approximately six periods, which corresponds to six years in our study, for private investment to restore its equilibrium level. The significance of the coefficient associated with the error correction term further supports the acceptance of the co-integration hypothesis (Harris, 2000:59)

The other variables affect private investment in the short-term. These are real interest rates, public investment and credit to the private sector. The real interest rate has a positive sign and is significant (35.75). Thus the data supports the McKinnon-Shaw hypothesis, which posits that higher interest rates on deposits attract more real balances, which allows them to finance more investment (Ndikumana, 2000:383). The result is consistent with the findings by Ndikumana (2000:383) for a group of sub-Saharan African countries.

The relationship between private investment and financial variables is measured by the bank credit available to the private sector (Ndikumana, 2000:384). The availability of credit plays a significant role in boosting private investment, and this is confirmed by the positive and significant coefficient of the bank credit variable (17.53). Our results show that the availability of credit to the private sector, influence private investment in the short-term.

Macroeconomic instability affects investment negatively (Serven, 1998: 7), i.e. investment is depressed by overall instability. Inflation, was used here as a measure of instability. However, the results show that inflation rate has an insignificant impact on private investment level in Botswana, both in the short and long run, as the inflation variable is insignificant in both cases.

CHAPTER SIX
CONCLUSIONS AND IMPLICATIONS

6.1   Introduction

In this chapter we present the conclusions and implications of the findings of the study. Section 6.2 provide some conclusions, and discuss the implications of the findings of the study. The final comments are highlighted in section 6.3.

6.2   Conclusions

The determinants of private investment in developing countries have been widely investigated by a number of studies. This study used a methodology that combines the static OLS methodology with the co-integration and error correction model procedures, which establish both the short-term and long-term effects simultaneously. The results of this study provide some support for the hypothesis that private investment in Botswana, like in other developing countries, is affected by important macroeconomic variables. The results show that macroeconomic factors affect private investment, both in the short term and in the long-term.

The short run variables are public investment, bank credit to the private sector and the real interest rate. The long run variables are GDP growth and real exchange rates. The long-run results confirm similar findings in studies by Oshikoya (1994), Ghura and Goodwin (2000) and Mlambo and Oshikoya (2001). These findings have some important implications.

Particularly this study confirms that real output growth is a significant determinant of private investment in Botswana in the long run. This is an indication that real GDP growth leads to increases in investment. Thus, given that investment is itself a key factor contributing to real GDP growth (Ghura and Goodwin, 2000: 1824), Botswana can indeed benefit from the virtuous cycle that links increased private investment and real GDP growth.

The impact of credit availability on private investment is highlighted in this study. The empirical evidence provided suggests that there would be a reduction in the level of private investment with adverse impacts on the short-term productive capacity of the private sector when the sector is squeezed for credit. This finding confirms the importance of the links between the financial sector and real economic activity in the economic growth process.

The importance of credit implies a need for a well functioning financial system that can transfer resources from savers to investors.

A negative impact of public-sector investment on private investment is confirmed by our empirical result. This suggests that public investment crowds-out the private sector investment. This result could be the reason why private investment levels started to decline in the 1990s.

Mlambo and Oshikoya, (2001:41) recommends that since the magnitude and productivity of investment is an issue of critical importance, it therefore needs immediate attention, in many of the sub-Saharan countries. This conclusion also holds for Botswana. With declining investment levels and ratios in Botswana, this means that both domestic and foreign investments need to be mobilised to effectively achieve sustained economic growth.

6.3   Final Comments

This study has investigated the determinants of private investment in Botswana over the period of 1976-2003, in the short run and long run perspective. It employed the techniques of co-integration and error correction modelling proposed by Engle and Granger (1987), which provided mechanisms to deal with the problems of unit root faced in time series data. The evidence in this study supports the view that macroeconomic factors are important determinants of private investment, in a short run and long run perspective. Applying the general to specific approach to error correction model, our statistical results suggested the existence of stable long run (co-integrating) relationships between macroeconomic variables (except trade variable) and private investment. The variables that affect private investment are consistent with the hypothesised signs and are also found to be statistically significant. In cases where there was ambiguity in the literature, our results have provided the empirical answers in the context of Botswana.

NOTES

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[1] I am grateful to the Central Statistics Office officials, particularly Ms Joy Tauetsile for providing this information.

[2] We also mentioned in Chapter 2 that research on private investment focusing on developing countries had used variants of the accelerator model to analyse the determinants of private investment.

[3] When estimating this equation empirically it has to be decided which variable should be used to approximate demand Y. When using GDP the problem arises since investment is part of GDP. To solve the suspected problem of endogeneity between variables regarding the measurement of Demand and Investment, total demand approximated by GDP, is defined as GDP minus investment and exports. Therefore the GDP growth measure used in this study reflects this transformation.

[4] $RER = XP^f/P$, where X is the exchange rate (number of domestic currency units per South African Rand), P is the domestic price level and P^f is the foreign price level (proxied here by the South African Producer Index, given that South Africa is the most important trading partner with Botswana).

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