

# **The Effects of External Debt Burden on Capital Accumulation A Case Study of Rwanda**

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## Abstract

This study attempts to examine the nature of the relationship between high levels of external debt and capital accumulation with the case study of Rwanda. Unsustainable levels of debt can generate various macroeconomic effects including the decline of domestic investment, which will result over a period of time in a smaller capital stock, and ultimately in lower output and income.

Both theoretical literature and empirical studies suggest that a deleterious interaction exists between a heavy debt burden (or a debt overhang) and capital accumulation. Foreign borrowing has a positive impact on investment up to a certain threshold, but beyond this level, its impact is adverse. Although several empirical investigations give evidence in support of the debt overhang hypothesis, another strand of empirical studies suggest that debt crisis has no effects on capital accumulation. Thus, the effects of the debt burden may vary significantly across countries in a given period and across periods in a given country.

The present study uses a quantitative analysis method in attempting to capture the relative magnitude of the effects of high levels of debt on physical capital accumulation, but also to identify the channels of transmission of these effects. Two investment equations are estimated distinctly including the debt to exports ratios and the debt to revenues ratios as explanatory variables. The debt- to- revenues ratios are used in order to capture the “crowding out” effects, while the debt to exports ratios serve to explore the “import compression” effects.

## **Declaration**

I declare that “The Effects of External Debt Burden on Capital Accumulation: A Case Study of Rwanda” is my own work, that it has not been submitted 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.

Andre HABIMANA



## Abbreviations and acronyms

CIRR	Commercial Interest Reference Rate
EFF	Extended Fund Facilities
FDI	Foreign Direct Investment
GDF	Global Development Finance
GDP	Gross Domestic Product
HIPC	Heavily Indebted Poor Countries
IDA	International Development Association
IMF	International Monetary Fund
LICs	Low-Income Countries
MDGs	Millennium Development Goals
MINECOFIN	Ministry of Finance and Economic Planning
NPV	Net Present Value
ODA	Official Development Assistance
PRSP	Poverty Reduction Strategy Paper
SBA	Standby Arrangements
US\$	United States Dollars



## **Dedication**

To Lilian AKIBA, my wonderful wife and best friend, and to my children: Yannick,  
Mélissa and Dorian, for your love and patience.



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## Chapter 1: Introduction

Between 1980 and 1990, the low-income countries' total stock of external debt grew rapidly from US\$ 125 billion (in 1980) to US\$ 419 billion (in 1990), when in contrast, gross national product increased only slightly (from US\$ 0.9 trillion in 1980 to US\$ 1.3 trillion in 1990); in other words, the debt-to-GDP ratio increased from less than 14% in 1980 to over 31% in 1990 (Gunter, B., 2002:5). In the second half of the 1990s, policymakers and citizens around the world have been increasingly concerned that high external indebtedness in many developing countries is limiting capital accumulation, growth and development (Patillo, Poirson, and Ricci, 2004:3). In their previous study (2002:19), using a large panel data set of 93 developing countries over 1968-1998, they found empirical support for a nonlinear impact of debt on the economy: at low levels, debt has positive effects; but above particular thresholds or turning points, additional debt begins to have a negative impact. Their findings suggest that the average impact of debt becomes negative at about 160-170 percent of exports or 35-40 percent of GDP; the marginal impact becomes negative at much lower debt levels, about the half of the above ones, while the positive effect seems to be positive at even lower levels. However, they found that it is very difficult to estimate accurately the turning points. Clements and others (2003:5) found that the above results are robust across different estimation methodologies and specifications, and suggest that doubling debt levels slows down annual per capita physical capital growth by about half to a full percentage point.

This type of analysis appears very relevant for current debt policy debates, when a large number of Heavily Indebted Poor Countries (HIPC) are now receiving debt relief under the HIPC and enhanced HIPC initiative ([www.worldbank.org/hipc](http://www.worldbank.org/hipc) accessed October 2005), so as to support their development objectives, embodied in their Poverty Reduction Strategies and in the Millennium Development Goals–MDGs ([www.un.org/millenniumgoals](http://www.un.org/millenniumgoals) accessed October 2005 ). The HIPC initiative defines a country as heavily indebted if the so-called “traditional debt relief mechanisms” are unlikely to reduce its external debt to a sustainable level, debt sustainability being largely determined by a net present value (NPV) debt-to- export ratio of 200-250% (Gunter, B., 2002: 6). The above ratio has been

revised by the World Bank and the IMF and reduced to a NPV debt-to-export ratio of 150% under the enhanced HIPC initiative framework (Gunter, B., 2002: 6).

Rwanda has been elected for assistance under the enhanced HIPC Initiative in December 2000, by the Executive Boards of the International Development Association (IDA) and the International Monetary Fund (IMF). After the full application of traditional debt relief mechanisms, the public and publicly guaranteed external debt of Rwanda at end 2001 was US\$1,261 million in nominal terms. This translates to US\$ 634 million in NPV (Net Present Value) terms and an NPV debt-to-exports ratio of 523 %, well above the debt sustainability threshold of 150% for the NPV of debt-to-exports ratio or the solvency ratio (MINECOFIN, 2002:28). According to the above MINECOFIN's report, the NPV of debt is calculated on loan-by-loan data using the average currency-specific commercial interest reference rate (CIRR) for the six-month period ending December 2001 and converted into US dollars using the end-December 2001 exchange rate. Moreover, the NPV debt-to-government revenue ratio at the same period is 374%, far beyond the sustainability threshold ratio of 250% (MINECOFIN, 2002:28). At end-December 2003, the external public and publicly guaranteed debt rose to US\$ 1473.2 million in nominal terms from US\$ 1412.8 million in 2002, an increase of 4 percent due basically to positive net flows (disbursements minus amortization payments) and the variations of the exchange rate that are responsible alone for 67% of the increase (MINECOFIN, 2004:9). The present value of the external debt at end 2003 is estimated at US\$ 928million, also well above the sustainability thresholds ratios (MINECOFIN, 2004:9).

To address the debt sustainability concern, the authorities of Rwanda, through the Ministry of Finance and Economic Planning (MINECOFIN), are committed to design and implement a favorable macroeconomic framework in order to meet development objectives, especially the Millennium Development Goals, while at the same time ensuring that external debt remains sustainable. This macroeconomic framework is characterized by a gradual increase in the national savings rates, in both the government and the private sector, on one hand; but also the framework is projected to be consistent with the needed improvements in infrastructure that are needed to support the increases in

private investment and GDP growth rates (MINECOFIN, 2002:17). On the other hand, the macroeconomic framework is intended to be consistent with a gradual and realistic reduction of current accounts deficits and the heavy dependence on foreign savings, which would lead to an improved debt sustainability picture with beneficial effects on capital accumulation and sustainable growth (MINECOFIN, 2002:17). According to MINECOFIN's report, the general aim is to embark on a virtuous cycle of decreasing savings-investment imbalances, debt sustainability, and high growth rates. But does the high level of external debt impede physical capital accumulation and break the above so-called "virtuous cycle"?

With the case study of Rwanda, this paper attempts to explore the adverse effects of the high levels of external debt, in examining empirically the nature of its relationship and capital accumulation, specifically the physical capital accumulation. It also tries to examine the channels of transmission of these adverse effects.

The paper is structured as follows: Chapter one deals with the conceptualized problem statement and the research questions, the purpose of the study with its limitations and delimitations as well as the motivation of the study. Chapter two gives a theoretical background and some empirical considerations with the related literature. Chapter three examines the special context of Rwanda, which gives some structural and macroeconomic features followed by the external debt structure of the country. Chapter four describes the methodological approach used by the study in collecting and analyzing the data. Chapter five contains the results of the empirical results and the analysis of the findings on the relationship between the high levels of external debt of Rwanda and physical capital accumulation. Finally, chapter six summarizes the paper and gives some recommendations and concluding remarks.

## **1.1 Research Problem**

Debt and its sustainability has been the subject of heated debate. Developing countries have seen their debt burden, particularly external debt, remain high as a proportion of GDP, despite various efforts to reduce it.

Unsustainable levels of debt can generate various macroeconomic effects including the decline of domestic investment and the net foreign investment, which will result over a period of time in a smaller capital stock, and ultimately in lower output and income (Serieux and Samy, 2001:3-4). According to the same authors, in addition to the crowding out of physical capital, a heavy public debt can severely slow human capital accumulation; hence lower economic growth (Serieux and Samy, 2001: 1-4).

## **1.2 Research questions**

Does external debt affect capital accumulation in Rwanda?

Through which avenues does the debt burden affect capital accumulation in Rwanda?

Can investment in Rwanda benefit from the HIPC initiative debt relief?

## **1.3 Purpose of the research**

The purpose of the research is to explore how and through which channels external debt affects physical capital accumulation in the context of Rwanda and to contribute, on the basis of empirical findings of the study, in reflecting on how to design evidence-based and result-oriented borrowing policies for the country, without leading to an unsustainable accumulation of debt.

## **1.4 Delimitation of the study**

The analysis will consider quantitative data from 1965 up to 2001, and the scope of this study covers only the external debt associated with the Highly Indebted Poor Countries

(HIPC) debt relief Initiative. Proposed and launched jointly by the Bretton Woods institutions in September 1996, the HIPC initiative was intended to be a comprehensive solution to the repeated HIPC's' unsustainable debt, which would allow them to exit permanently from repeated debt rescheduling by reducing their external debt stock to sustainable levels (Gunter, 2002:6).

### **1.5 Limitations of the study**

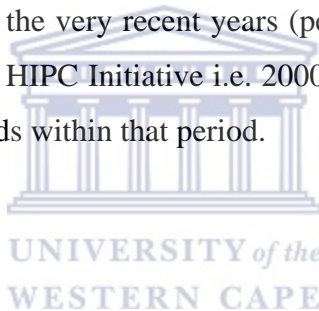
The study attempts to cover the impact of the stock of external debt and the debt service on physical capital investment, but it does not examine the human capital aspect of investment. The study lacks quality data at some point, for instance the level of human capital underdevelopment is proxy by the illiteracy rate instead of the rates of primary and secondary school enrolment, because of the lack of consistent data for several years. Moreover, some data related to the very recent years (period between the decision point and the completion point of the HIPC Initiative i.e. 2000-2004) were not available, so as to capture the external debt trends within that period.

### **1.6 Motivation of the study**

Several theoretical and empirical studies on debt issues (see next section) indicate that the effect of debt on the economy could occur through all the main sources of growth, including crowding out physical capital accumulation. The motivations for choosing this study are twofold:

To examine the effects of the external debt burden on capital accumulation for a low-income country like Rwanda, from an academic perspective.

To respond to a professional concern as a staff of the Ministry of Finance and Economic Planning of Rwanda, on how to translate the existing burdensome debt into a beneficial financing instrument, and to get some insights on how to design a framework for debt sustainability.



## 1.7 Conceptual framework

Both theoretical literature and empirical studies suggest that a deleterious interaction exists between a heavy debt burden (or a debt overhang) and capital accumulation (Pattilo et al, 2004:3). As the above authors put it, the capital-accumulation channel is supported, in particular, by two arguments. First, the debt overhang concept, defined by Krugman (1988:2) as the presence of an existing inherited debt sufficiently large that creditors do not expect with confidence to be fully repaid, implies that when external debt grows large, investors lower their expectations of returns in anticipation of higher and progressively more distortionary taxes needed to repay debt, so that investment is discouraged, which, in turn, slows capital-stock accumulation. This argument is also supported by Agenor and Montiel (1996:549). Secondly, high debt levels may constrain growth by lowering total factor productivity growth. For example, governments may be less willing to undertake difficult and costly policy reforms if it is perceived that the future benefit in terms of higher output will accrue partly to foreign creditors. Therefore, the poorer policy environment is likely to affect the efficiency of investment and productivity.

The theoretical literature suggests that foreign borrowing has a positive impact on investment and growth up to a certain threshold, but beyond this level, its impact is adverse (Clements and others, 2003:4). On the other hand, several empirical investigations have also found evidence in support of the debt overhang hypothesis (Deshapande, 1997: 185). According to Serieux and Samy (2001:4), the debt servicing crowd out public expenditure, thus reducing total investment and possibly reducing the quality of investment. As they put it, high debt service levels may also lead to import compression that result in lower investment through reduced capital imports.

Most of the low-income countries are also credit-rationed, in the sense that they do not have access to international capital markets, because their levels of debt are unsustainable (Serieux and Samy, 2001:5). As they put it, the high levels of outstanding debt make it

impossible to borrow in international markets, constraining the domestic budgetary financing and foreign exchange earning and consequently capital accumulation.

Although several empirical investigations have evidence in support of the debt overhang hypothesis, some other studies suggest that the debt crisis has no effects on capital accumulation and growth. According to Richard Wagner (1996: 130), the Ricardian equivalence must provide a point of departure for any analysis of public debt, as well as servicing as a necessary constraint on any effort at aggregate modeling. While the conventional analysis of debt suggests that debt affects capital accumulation, and thereby long-term economic growth, the Ricardian argument asserts that debt does not alter capital accumulation (Elmendorf and Mankiw, 1998:36). In essence, the Ricardian argument combines two fundamental ideas: the government budget constraint and the permanent income hypothesis. The government budget constraint says that lower taxes today imply higher taxes in the future if government purchases are unchanged; the present value of the tax burden is invariant to the path of the tax burden, and issuing of government debt to finance a tax cut represents not a reduction in the tax burden but merely a postponement of it (Elmendorf and Mankiw, 1998: 37). The permanent income hypothesis says that households base their consumption decisions on permanent income, which depends on the present value of after-tax earnings. Because a debt-financed tax cut alters only the path of the tax burden but not its present value, it does not alter permanent income, or capital accumulation. This statement contradicts the predictions of the conventional analysis (held by most economists and almost all policymakers) of the government debt, but both views continue to have adherents (Elmendorf and Mankiw, 1998: 35).

Thus, the effects of the debt burden may vary significantly across countries in a given period and across periods in a given country.

The present study will use a quantitative analysis method in attempting to capture if there are any adverse effects of high levels of debt on physical capital accumulation in Rwanda and to identify the channels of their transmission.

## **Chapter 2: Literature Review**

The government's debt policy has important influence over the economy both in the short run and in the long run (Elmendorf and Mankiw, 1998: 14). Since the debt crisis of the early 1980s, the relationship between external debt, capital accumulation and ultimately economic growth continues to attract considerable interest from policymakers and academics alike. Low-income countries face serious challenges in meeting their development objectives, given the heavy burden of their external debt. Even though the risks are different, excessive debt in low-income countries is a serious problem and debt sustainability remains an essential condition for economic stability.

This chapter presents a theoretical background on capital accumulation and debt issues in six sections. The first section gives some insights on capital accumulation and how it is measured. The second section reviews the literature on the debt overhang theory. The third section discusses the debt distress and the sustainability thresholds of debt. Section four examines the debt relief and the related HIPC (Heavily Indebted Poor Countries) initiative with the linkage with capital accumulation and the debt sustainability issue. The two last sections of the chapter deal respectively with the relationship between debt and capital accumulation, and the evolution of the external debt burden in Low-Income Countries (LIC's).

### **2.1 Capital accumulation: definition and measurement**

According to the New Palgrave Dictionary of Economics (1987: 14-19), economists have analyzed the accumulation of capital in two different ways. The most common has been to see it as the expansion of the productive potential of an economy with a given technology, which may be improved in the process. But it has also been understood as the outright transformation of the technical and productive organization of the economy. The first approach leads to analyses based on the idea of steady growth, subsuming the concerns of the second under the heading of "technical progress". Such an approach rests a conception of capital as productive goods or, in more sophisticated versions, as a fund



providing command over productive goods. According to the Palgrave dictionary, this is not wrong; it is merely inadequate. Capital must also be understood as a way of organizing production and economic activity, so that the accumulation of capital is the extension of this form of organization into areas in which production, exchange and distribution were governed by other rules. Accumulation then implies the transformation of institutions as well as production.

The creation of physical and human capital represents production not intended for direct consumption. Rather, the creation and accumulation of capital are intended to increase the level of productivity of a nation and thus allow for an increase in the production of goods and services at future date (Ruby, 2003:5). As he puts it, deferring consumption (savings) depends on the ability of the nation to first meet the basic needs of its citizens with existing production technology and resource availability.

The originators of the classical tradition saw accumulation as a transformation of the economy. Adam Smith was the first to realize that the Wealth of a Nation is not in the accumulation of commodities, nor in the resource reserves that a nation may happen to possess; but rather wealth exists in the productive knowledge of its people (Ruby, 2003:1). He emphasizes that the ability to transform resources into desired goods and services represents the true source of a nation's wealth. In other words, physical and human capital represents the true source of wealth.

Thirlwall summarizes the main theories of growth and development from classical times to the present as follows and his review gives interesting insights on capital accumulation:

The classical theory of Adam Smith finds that there are reasons for optimism since capital accumulation brings along the division of labour and the possibility of self-sustaining growth as new investment opportunities open up (Thirlwall, 2002:3).

The classical refinements of Malthus, Ricardo and Marx gave reasons for pessimism: the population growth leads to diminishing returns, subsistence wages, declining profits, and the stationary state (Thirlwall, 2002:7-10). Agriculture, in particular, suffers from diminishing returns, tending to increase the price of food and land rents as population grows and presses upon a fixed supply of land and natural resources.

Harrod and Domar dynamised Keynesian theory. They indicated that equilibrium growth depends on the savings rate and the capital-output ratio, or productivity of investment (Thirlwall, 2002:13-14). According to the Harrod-Domar model, the prime mover of the economy is investment and it has a dual role: it creates demand and capacity.

The neo-classical growth theory posits the convergence thesis and demonstrates that through the Cobb-Douglas production function that output is a function of labour and capital and the level of technology, and there are constant returns to scale but diminishing returns to each factor separately (Thirlwall, 2002:21).

The new (endogenous) growth theories also show that variables that may affect the growth rate include population growth, the savings and investment rate (Thirlwall, 2002:39). According to the same author (1999: 85), capital accumulation is as much the endogenous consequence of growth as the exogenous cause of growth.

The creation of wealth is also based on knowledge, the ability to take raw inputs and convert them into output with value greater than the sum of the individual parts. Empirical studies find that human capital or the educational attainment of the labor force affects the output and the growth of an economy. Benhabib and Spiegel (1994:143) give two approaches to treat human capital:

First, the standard approach is to treat human capital as the average years of schooling, and as an ordinary input in the production function;

An alternative approach, associated with endogenous growth theory, is to model technological progress, or the growth of total factor productivity, as a function of the level of education or human capital.

Human capital accumulation has long been stressed as a prerequisite for economic growth. As Benhabib and Spiegel put it (1994: 144-145), human capital levels affect directly aggregate factor productivity through the following channels: (1) Following Romer (1990a), human capital may directly influence productivity by determining the capacity of nations to innovate new technologies suited to domestic production; (2) Quoting Nelson and Phelps (1966), human capital levels affect the speed of technological catch-up and diffusion, in other words, the ability of a nation to adopt and implement new technology from abroad is a function of its domestic human capital stock; (3) An additional role for human capital may be as an engine for attracting other factors, such as physical capital. Quoting Lucas (1990), Benhabib and Spiegel (1994:145) suggest that physical capital fails to flow to poor countries because of their relatively poor endowments of complementary human capital.

To conclude, the creation and accumulation capital are major determinants in maintaining and improving standards of living and economic growth.



## **2.2 Debt overhang theories**

The theoretical literature suggests that foreign borrowing has a positive impact on investment and growth up to a certain threshold level; beyond this level, however, its impact is adverse (Clements and others, 2003:4). The high cost of unsustainable debt for economic growth and development is borne out by the experience of many heavily indebted poor countries, and has been a focus of debate in the literature. But why would large levels of accumulated debt lead to lower capital accumulation and ultimately growth and through which channels is this likely to occur?

The most well known explanation comes from the debt overhang theories developed by Sachs and Krugman. The later (1988:2) defines the “debt overhang” as the presence of an existing inherited debt sufficiently large that creditors do not expect with confidence to

be fully repaid. These theories show that if there is some likelihood that in the future debt will be larger than the country's repayment ability; expected debt-service costs will discourage further domestic and foreign investment. The existence of a potential debt overhang tax may affect the incentives of policymakers, but also those facing the private sector. As Sachs puts it (1998: 47), a heavy foreign debt burden of a developing country government impedes economic growth through several channels. Higher debt tends to undermine macroeconomic stability by increasing budget deficits. If debt service is covered by higher taxes rather than by an increased budget deficit, the high rates of taxation tend to undermine growth by introducing serious distortions in the economy, including heightened barriers to trade (via trade taxes), capital flight, tax evasion and reduced work effort.

Claessens and Diwan (1990:31-33) provide a typology of debt crises including the following categories:

Debt overhang: the burden of debt is so heavy that future growth in the economy is effectively compromised. The debtor country cannot invest, and so cannot meet future debt obligations without new loans as well as debt relief.

Weak debt overhang: outstanding debt is too large to be resolved merely by the provision of new money. However, if the country could use some commitment mechanism to indicate that it would use the new money for investment, then it could escape from the debt overhang.

Claessens and Diwan (1990: 29) define a commitment mechanism as an institution that creates an incentive for debtor countries to invest new money in productive activities, rather than using money for present consumption.

Strong debt overhang: the debt is so large that the country will not choose to invest new money until some debt is written off.

Liquidity trap: Outstanding debt is too large, and attractive investment opportunities go begging since the low level consumption does not allow further sacrifices of present consumption for future consumption. This liquidity effect is a failure of the capital market.

Sachs, as quoted in Berthelemey (2001:4), introduced in 1986 the notion that a debt reduction could create favorable incentives in an indebted country. According to Berthelemy, the above notion was based on the idea that a too heavy burden of debt service would imply that all efforts to improve future revenues through investment and reforms would only increase the future payments to creditors, therefore creating a bias towards immediate consumption of all available incomes and against adjustments efforts. Outstanding debt ultimately becomes so large that investment will be inefficiently low without sizable debt or debt service reduction.

Another strand of the debt overhang theory emphasizes the point that large debt stocks increase expectations that debt service tends to be financed by distortionary measures (inflation tax or cuts in public investment) as in Agenor and Montiel (1999:565). According these authors (1999:566), the uncertainty about future taxes for private domestic agents may adversely affect the domestic economy, over and above any disincentive effects on policymakers. As long as there is a shortfall on the budget, the future tax rate in the economy is unknown. Irreversible private activities such as investing in physical capital and acquiring claims on the domestic financial system are likely to be postponed until the uncertainty is resolved. Private investors will prefer to exercise their option of waiting and may choose to reduce their investment, or affect their resources towards quick financial returns with high risk or opt to transfer their money abroad (Agenor and Montiel, 1999: 566).

The empirical literature has found mixed empirical support for the debt overhang hypothesis. Relatively few studies have econometrically assessed the direct effects on the debt stock on investment. According to Serieux and Samy (2001:5), several empirical investigations, among them Elbadawi et al in 1997, Deshpande in 1995, Serven and Solimano in 1993, and Savvides in 1992, have found evidence in support of the debt overhang hypothesis. Most of the empirical studies find that one or more debt variables are significantly and negatively correlated with investment or growth. Clements and Others (2003:19) found that the stock of debt service does depress public investment. They suggest that the relationship is nonlinear; with the crowding-out effect intensifying

as the ratio of debt service to GDP rises. They found that, on average, every one percentage point increase in debt service as a share of GDP reduces public investment by about 0.2 percentage point.

A number of researchers including, Savvides in 1992, Hansen in 2001, Dijkstra and Hermes in 2003, find that there is any statistically significant negative effect of external debt on growth (Clements and others, 2003:4). Patillo and others (2002:19), using a large panel data of 93 developing countries over the period 1969-1998, find that the average impact of external debt on per capita GDP growth is negative for the net present value of debt levels above 160- 170 percent of exports and 35-40 percent of GDP. In their more recent study, Patillo and others (2004:16) apply a growth accounting framework to a group of 61 developing countries and their results suggests that on average, doubling debt reduces by almost 1 percentage point both growth in per capita physical capital and growth in total factor productivity.

### **2.3 Debt distress and debt sustainability**



The concept of debt sustainability has been central to the discussions of the HIPC debt relief initiative. The IMF defines “debt sustainability” as “a situation in which a borrower is expected to be able to continue servicing its debts without an unrealistically large correction to the balance of income and expenditure” (IMF, *Assessing Sustainability* 2002:4). As Martin puts it nicely (2004:4-5), debt sustainability incorporates several sub-components: solvency, liquidity and vulnerability. These are defined as follows:

Solvency is a situation in which the present discounted value of the government’s current and future primary expenditure is no greater than the present discounted value of income, net of any initial indebtedness;

Liquidity is a situation in which the liquid assets and available financing are sufficient to meet or roll-over its maturing liabilities;

Vulnerability: the risk that solvency or liquidity is not possible.

Sustainability is therefore a situation in which both solvency and liquidity can be achieved without any foreseen major correction in the balance of income and expenditure, taking into account the vulnerability risks. Therefore, ideally, international initiatives would make maximum contributions to ensure that low-income countries are solvent, liquid and protected against vulnerability.

According to Hjertholm (1999:5), two perspectives are normally considered when evaluating debt sustainability:

One relates sustainability to debt capacity problems, where the debtor is unable or unwilling to honor debt service obligations as they come due. The tangible evidence of such problems occurs when payment arrears accumulate and debt is rescheduled or forgiven. The necessary conditions to maintain debt service capacity over time i.e. to remain solvent include an output growth rate equal to or exceeding the cost of borrowing, measured by the rate of interest. The major factors that determine the incidence of debt capacity problems include debt and debt service to export ratios, balance of payments indicators such as various current account and reserve ratios, general economic indicators including the GDP growth rate, the money supply and the share of exports and domestic investment in GDP. Only a few of the above indicators have been adopted by the World Bank and the IMF, and integrated in the HIPC initiative scheme.

The second perspective considers the problem arising when the foreign debt burden is so large that it affects economic development, irrespective of whether the debt is fully serviced or not. As Hjertholm puts it (1999:14), empirical evidence suggests a relatively strong statistical relationship between high debt burdens and poor economic performance, such as investment and human development. He emphasizes that the main channel for these adverse effects of large debt burdens are fiscal effects, of which two are particularly important: the cash-flow effects arising from reduced public expenditures, and the disincentive effects associated with a large debt overhang.

The cash-flow effects can occur in import compression, if the ability of the economy to substitute between imported and home produced capital goods is limited, leading to a

decline in investments. Import compression can occur at the balance of payments level and at the budgetary level through the effects of public debt service on the import-content of government's expenditures (Hjertholm, 1999: 15); reductions in the import capacity of the government, as a result of the debt service, can thus reduce government investment activity. As the above researcher puts it, that such cash-flow effect has indeed been at work in several low-income countries, and this is confirmed for 23 sub-Saharan African Countries (Hjertholm, 1999:15).

Besides the direct effects from reduced public investment and lower imports, there are disincentive effects arising from a high debt burden through tax disincentives (a tax on investment returns that discourage investors), but also disincentives can arise from general macroeconomic instability that impedes private investment, including monetary expansion and inflation from monetizing debt service obligations, the exchange rates and the recourse to exceptional financing (such as payments of arrears and debt rescheduling), which tends to maintain uncertainty. Those public debt-induced fluctuations in macro variables and exceptional financing may signal fiscal distress and inadequate ability on the part of the government to control fiscal events, leading to heightened investors' uncertainty about the future direction of the macro economy and thus reduce the incentive to invest (Hjertholm, 2001: 20).

Kraay and Nehru (2004:8) define debt distress episodes as periods when any one or more of the three following conditions hold: (a) the inability to service external obligations resulting in an accumulation of arrears, (b) a country receives debt relief in the form of rescheduling and/or debt reduction from the Paris Club, or (c) the country receives substantial balance of payments support from the IMF under its non-concessional Standby Arrangements or Extended Fund Facilities (SBA/EFF). The first condition is the most basic measure of debt distress. Kraay and Nehru's analysis found that three factors that explain the variation in the incidence of debt distress include the debt burden, the quality of policies and institutions, and shocks (2004:31).



The IMF staff analysis, on the other hand, defines debt-distress episodes as situations marked by significant arrears accumulation (in excess of five percent of total debt) on obligations to official creditors (IMF and IDA, 2004:54). This is a broad definition of debt distress, in the sense that it encompasses episodes of severe distress, where countries accumulate arrears continuously over a long period of time, and less severe episodes, where countries accumulate arrears in some but not all years. Non-distress episodes are defined as at least three consecutive years in which the stock of arrears to official creditors is smaller than five percent of the total debt stock (IMF and IDA, 2004:54).

Another strand of the literature on debt sustainability, for example Cohen (1996:4), attempted to find a discontinuity in the relationship between debt burden indicators (usually the external debt-to-export ratio) and the incidence of default or market-based indicators (such as the premium over benchmark interest rates on debt securities traded in the secondary market). In his paper, he found that above a threshold range of about 200-250 percent of the present value of debt-to-export ratio, the likelihood of debt default climbed rapidly, he then suggests that debt matters and that the above thresholds are a reasonable target to alleviate the debt crisis and reach debt sustainability (Cohen, 1996:21). This range then became the benchmark adopted by the original HIPC Initiative in 1996, and was subsequently lowered in 1999 under the enhanced HIPC framework.

Debt sustainability can be assessed on the basis of indicators of the debt stock or debt service relative to various measures of repayment capacity (typically GDP, exports, or government revenues). According to the Bretton Woods Institutions (IMF and IDA, 2004:13), each of these indicators has its merits and its limitations, suggesting that they should be used in combination. As they suggest, conceptually, debt sustainability assessments should be based on a government's net worth, in present value terms, which is the difference between its debt and the present value of its future primary surpluses. However, given that such an assessment must rely on very long-term projections, they are less useful for practical purposes, as they do not identify potential liquidity problems. The practical convention is therefore, to assess debt sustainability on the basis of the above-mentioned indicators. Under the enhanced framework, a NPV debt to export ratio above

150% (down from 200-250%) is considered to be unsustainable. For countries having an export to-GDP ratio of at least 30% (down from 40%) and government revenue to GDP ratio of at least 15% (down from 20%), a NPV debt to government revenue ratio of more than 250% (down from 280%) is considered to be unsustainable (Gunter, 2002:6).

Sachs (2002:21) finds that the current definition of debt sustainability in the enhanced HIPC initiative is arbitrary. As he puts it a ratio of debt to exports of 150% or a ratio of debt to government revenue of 250% cannot truly be judged to be sustainable or unsustainable except in the context of each country's needs, which themselves must be carefully spelled out; it is perfectly possible for a country to have a "sustainable" debt and significant debt servicing under these formal definitions while millions of its people are dying of hunger or disease.

Debt sustainability is important, as an essential condition for economic stability. Irrespective of whether debt-service obligations are expected to be financed by a country's own resources or by additional aid inflows or debt relief, excessive debt levels create adverse incentives for private and public investment that drive long-term growth. On the creditors' side, there is also risk from unsustainable debt burdens in low-income countries, in that they may be forced into new lending or debt relief for the purpose of maintaining positive net transfers (IMF and IDA, 2004:10). The above risks show the relevance of the HIPC Initiative to break the cycle of debt crises, and debt burden accumulation.

## **2.4 Debt Relief and the HIPC Initiative**

The external debt of many low-income countries has increased significantly since the 1970s. And since the onset of the debt crisis in the early 1980s, many heavily indebted poor countries (HIPC) continue to have difficulties in paying their external debt obligations on a timely basis. As Brooks and others put it (1998:6), a combination of factors that are behind the increase in the external debt burden include: (1) Exogenous factors, such as adverse terms of trade shocks and adverse weather conditions; (2) The

lack of sustained macroeconomic adjustment and structural reforms; (3) Non concessional lending and refinancing policies of creditors; (4) Inadequate debt management, and (5) Political factors including wars and social strife.

The HIPCs continue to be indebted to a variety of creditors, including Paris Club bilateral creditors, non-Paris Club bilateral creditors, commercial banks and multilateral institutions (Boote and Thugge, 1997:4). Over the past decade, different options of traditional mechanisms have been designed and implemented by the international community, in order to provide needed external finance and to reduce the debt burden of the highly indebted countries. These so-called “traditional mechanisms” can be summarized as follows (Boote and Thugge, 1997:9):

The adoption of stabilization and economic reform programs supported by concessional loans from the IMF and the World Bank;

In support of these adjustment programs, flow rescheduling agreements with the Paris Club creditors on concessional terms followed by a stock-of-debt operation after three years of good track records under both IMF arrangements and rescheduling agreements;

Agreement by the debtor country to seek at least comparable terms on debt owed to non-Paris Club bilateral and commercial creditors facilitated by IDA (International Development Association) debt-reduction operations on commercial debt;

Bilateral forgiveness of ODA (Official Development Assistance) debt by many creditors; and new financing on appropriately concessional terms.

From the increasing evidence that the HIPCs continued to suffer from unsustainable debt despite the so-called “traditional mechanisms” of dealing with the debt problems, the Bretton Woods institutions jointly proposed and launched the HIPC initiative in September 1996. It was intended to be a comprehensive solution to the repeated HIPCs’ unsustainable debt, which would allow HIPCs to exit permanently from repeated debt rescheduling by reducing their external debt stock to sustainable levels (Gunter, 2002:6). However, three years later after launching the initiative, the IMF and the World Bank agreed to enhance the original HIPC framework in order to provide broader, deeper and

faster debt relief, particularly through a lowering of the ratios considered to provide debt sustainability.

The initiative has had a substantial impact in reducing debt stocks and debt service as well as reallocating the savings on debt-service payments to poverty-reducing expenditures (IMF and IDA, 2004:11). As a result of HIPC relief, debt stocks for the 27 HIPCs that have reached the decision point are projected to decline by about two-thirds in NPV terms; the debt-service is projected to be about 30 percent lower during 2001-2005 than in 1998 and 1999 to 9.9 percent in 2002; annual debt service is projected to be about 30 percent lower during 2001-2005 than in 1998 and 1999, freeing about US\$ 1.0 billion in annual debt-service savings; and poverty-reducing expenditures increased from about US\$ 6.1 billion in 1999 to US\$ 8.4 billion in 2002 and are projected to increase to US\$ 11.9 billion in 2005. (IMF and IDA, 2004:11).

But once again, voices are mounting that even the enhanced HIPC framework does not provide long-term debt sustainability, and the various critiques include that (Gunter, 2002:11):

The debtor countries had little or no say in the final adoption of the framework;

The HIPC initiative has been designed around the concept of what debt reduction is needed according to inappropriate debt sustainability indicators, instead of what debt reduction is needed for sustainable development;

The linking of HIPC debt relief to PRSP's (Poverty Reduction Strategy Papers) implies excessive conditionality that delayed the provision of the enhanced HIPC debt relief;

The evidence so far seems to indicate that HIPC debt relief has been deducted from traditional development assistance.

Some other voices, though in minority (Gunter, 2002:7), believe and claim that no further debt relief should be provided. Some of the key arguments being that:

Debt relief is not just; since the majority of the world's poor people live in countries that are not eligible for HIPC debt relief;

Debt service is not the cause of growing poverty but a symptom of waste; and

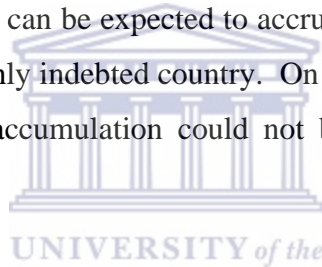
Debt service cannot crowd out social expenditures as long as a country receives a multiple of its debt-service payments in terms of new loan disbursements and grants.

Against the above arguments, Gunter (2002:7) argues that the fact that the majority of the world's poor people live in countries that are not eligible for HIPC debt relief may indicate inappropriate HIPC eligibility criteria, not an argument against debt relief per se. Moreover, while it is true that excessive debt is the result of failed investments, there are many reasons for these failures including, corruption, and falling terms of trade, conflicts; but they also reflect poor lending decisions on the part of the creditors. Finally, even if debt service does not crowd out social expenditures as long as new loans and grants exceed debt-service payments, social expenditures could be higher if debt service were lower.

In summary, the HIPCs typically rely on foreign capital to finance a chronic shortfall of domestic savings over investment, i.e. a gap in their external current account. This by itself is not problematic, as long as the foreign savings are channeled into productive investment that allows the country to grow and generate future export earnings (and thus foreign exchange) with which to repay foreign creditors. In theory, based on the notion of diminishing marginal returns to capital, developing countries should be able to generate higher returns than more advanced economies, creating the incentives to capital inflows and enabling them to catch up (IMF and IDA, 2004:12). And the same logic applies, in principle, also to certain categories of government spending such as education that is expected to have positive effects on a country's growth potential. This suggests that if the HIPC debt relief funds are timely released and wisely used, this may boost capital accumulation and eventually lead to debt sustainability. As Boote and Thugge put it (1997:17), the debt relief under the HIPC initiative may improve the debtor country's incentive to invest in the framework of the poverty reduction strategies.

## 2.5 Debt and Capital Accumulation

High debt stocks appear to affect growth through their dampening effects on both physical capital accumulation and total factor productivity (Pattilo and others, 2004:19). As they suggests, the size of the effects are similar to that of the effect on output growth: on average, for countries with high debt levels, doubling debt will reduce output growth by one percentage point and reduce growth in both per capita physical capital and total factor productivity by almost as much. Moreover, their study suggests that, in terms of the contributions to growth, approximately one-third of effect of debt at high levels of indebtedness occurs via physical-capital accumulation and two-thirds via total factor productivity growth, but the impact of high debt on human capital accumulation is very small (Pattilo and others, 2004: 19). They find that their results are consistent with the speculation that high debt reduces the incentive to invest and to undertake good policies, since the return on such actions can be expected to accrue partly to lenders rather than to citizens and politicians of a highly indebted country. On the other hand, they suggest that the impact on human-capital accumulation could not be detected, perhaps because it operates with very long lags.



Serieux and Samy (2001:14) find that the debt burden can have a depressing effect on growth through the government budget by crowding out public investment and effecting both a reduction in private and total investment and a fall in the productivity of investment. The same study supports the adverse effect of high levels of debt on human capital development, through the government budget, but it was found only at the secondary education level (Serieux and Samy, 2001: 15).

Clements and others (2003:5) also suggest that external debt service in contrast to the total debt stock can also potentially affect growth by crowding out private investment or altering the composition of public spending. As they put it, other things being equal, higher debt service can raise the government's interest bill and the budget deficit, reducing public savings; this, in turn, may either raise interest rates or crowd out the credit available for the private investment. Moreover debt service payments can also have

adverse effects on the composition of public spending by squeezing the resources available for infrastructure and human capital. The burden of large debt sooner or later can lead to extreme scarcity in liquidity, negatively impacting upon capital accumulation. The incentive effect of this hypothesis refers to the low public and private investment because a larger and larger share of resources is transferred abroad for debt servicing. In other words, some of the returns from investing in the domestic economy are effectively taxed away, crowding out social and capital spending.

## **2.6 Evolution of the External Debt Burden in Low-Income Countries**

The external debt burden of many low-income developing countries has increased significantly since the 1970s and reached peaks in the early 1990s, and was accompanied by disappointing performance in their struggle against poverty.

According to the IMF (2003:6), for the HIPC's alone, nominal debt stocks rose from moderate levels in the early 1980s to some 800 percent of exports and 160 percent of gross national income in the mid-1990s, in many cases constituting a debt overhang that may have contributed to these countries' poor growth performance. As they put it, in a global environment in which many economies prospered from growing trade and financial integration, for instance most of the East Asian countries, some of the world's poorest countries were left further behind, seemingly unable to put large amounts of net external financing to good use. However, the debt problem was only one of several factors contributing to slower growth.

The debt crisis developed slowly, the first manifestation of problems being payment difficulties that were addressed through new net lending and flow rescheduling. Much of the new flows were in the form of new debt, and grants were earmarked and not used to relieve the overall debt burden. This contributed to push debt-service payments into the future, adding to debtor countries' solvency problems. The debt stocks of these countries reached unsustainable levels and indebtedness was considered among the factors that impede investment and growth. It is only in the early 1990s that the Paris Club began to

consider stock-of debt operations, leading to the HIPC Initiative in 1996, with its comprehensive treatment of all outstanding obligations (IMF, 2003: 9).

The factors behind the increase in the external debt burden in most of the crisis countries are varied and interrelated. In most cases, no single factor was responsible; rather, it was a combination of factors that led to the increase in the debt, including (Brooks and others, 1998: 6):(1) vulnerability to exogenous shocks, such as adverse terms of trade and, to a lesser extent, adverse weather conditions; (2) the lack of sustained adjustment policies, particularly when facing exogenous shocks, which gave rise to sizeable financing needs and failed to strengthen the capacity to service debt; this includes inadequate progress in most cases with structural reforms that would promote sustainable growth of output and exports; (3) non concessional lending and refinancing policies of creditors (4) inadequate debt management reflected in unrestrained borrowing at unfavorable terms; (5) political factors, such civil war and social strife often with devastating economic consequences. The above factors apply similarly to Rwanda, with a particular situation exacerbated by four years of war that started in 1990 and culminated in genocide (1994), which left a devastated economy with unsustainable high levels of debt.

## **Conclusion**

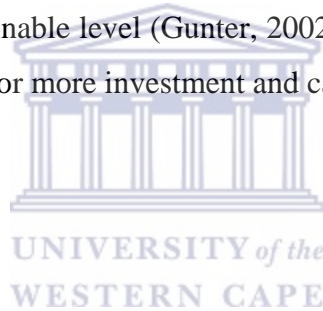
This chapter reviewed some relevant theoretical and empirical literature on the nature of capital accumulation as true source of wealth. Moreover, it reviewed the literature on the theories of debt overhang and debt sustainability, the consequences of high levels of debt on capital accumulation, and gave some insights on the current HIPC debt relief initiative, its potentiality and challenges to boost investment. It also examined the evolution and the causes of the debt crisis in low-income countries.

From the originators of the classical tradition of growth theories to the tenants of the new endogenous growth theories, capital accumulation is found to be the prime mover of the economy. As Thirwall puts it nicely (1999: 85), capital accumulation is as much the endogenous consequence of growth as the exogenous cause of growth.



A substantial body of economic theory and empirical studies support the debt overhang hypothesis that posits that a heavy debt burden adversely affect the economy through different channels including the disincentive effect as well as the crowding out effect and the import compression effect.

Debt sustainability is important as an essential condition for economic stability. The section on debt distress and debt sustainability defines debt sustainability and debt distress, examines the variations in the incidence of debt distress as well as the main causes of the debt distress. Moreover, the section reviews the literature related to the debt sustainability indicators that can signal the likelihood of debt distress and that are the benchmarks of the HIPC initiative. The key slogan of the HIPC initiative was that sustainable development requires sustainable debt, and thus the goal was to reduce the HIPC's external debt to a sustainable level (Gunter, 2002:6). This suggests that the HIPC may create positive incentives for more investment and capital accumulation.

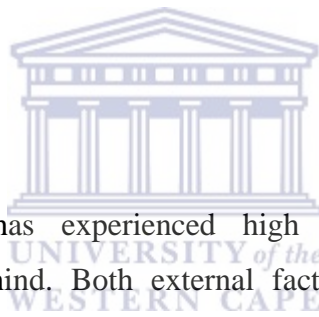


## **Chapter 3: Economic Characteristics of Rwanda**

The economic structure of Rwanda reflects a chronic failure to achieve sustainable growth in a context of a large and growing population. This failure became increasingly evident in the 1980s and early 1990s, leading to severe structural problems. Secondly, the war and the genocide of 1994 left a horrific legacy, further impoverishing the country and leaving a number of specific problems and challenges, including an economy in ruins with high levels of debt.

This chapter presents the economic characteristics of Rwanda in three sections. The first section gives some structural features of the country. The second section presents some macroeconomic characteristics, followed by the structure of the external debt in section three.

### **3.1 Structural features**



While Rwanda's economy has experienced high population growth, economic transformation has lagged behind. Both external factors and national policies have contributed to this. With a per capita gross domestic product of only 242 US dollars in 2004, Rwanda is moreover highly indebted. Its agriculture-dominated economy consists mainly of small and increasingly fragmented farms producing to meet subsistence needs, and contributes for 43% of GDP (MINECOFIN, PRSP 2002: 6).

Coffee and tea continue to be the country's principal exports. Although agricultural production per capita and crop yields were declining steadily since the mid-1980s, economic policy did not do enough to encourage agricultural transformation. The manufacturing sector accounts for 20% of GDP and is dominated by import-substituting industries. In the 1960s and 1970s prudent financial policies, coupled with generous external aid and favorable terms of trade, fostered sustained growth, but in the 1980s, the country suffered massive terms of trade shock when international coffee prices fell. As a

result, per capita income fell sharply during the 1980s and early 1990s, worsening during the four years of war that culminated in the genocide of 1994 (World Bank, 2003:20).

Recently, GDP has again been growing steadily under a program of improved tax collection, accelerated privatization of state enterprises, and continued improvements in export crop and food production. Nevertheless, the country now faces the following microeconomic structural problems (MINECOFIN, PRSP 2002:7):

Low agricultural productivity, which was aggravated by the failure of past agricultural policies, in particular the failure to make the transition in the early 1980s from low-value agriculture to high-value farming;

Low human resource development, especially in literacy and skills development;

Limited employment opportunities, with an oversupply of unskilled workers in comparison to their low demand;

High population density and growth;

Environmental degradation and poor infrastructure.

The failure to address these microeconomic problems has contributed to an economy characterized by (MINECOFIN, PRSP 2002:7):

A very weak export base of US\$ 16 per capita compared to an average of US\$ 100 in Sub-Saharan Africa, with a heavy dependence on the export of agricultural products, particularly tea and coffee;

Vulnerability to external price shocks;

A narrow revenue base, averaging 8.7% of GDP, compared to an average of 17.7% of GDP in sub-Saharan Africa;

Low measured private investment at the average of only 8% of GDP.

### **3.2 Macroeconomic features**

A World Bank study on education in Rwanda (2003:24-26) summarizes nicely the macroeconomic conditions of the country since 1980 as follows: Rwanda 's gross

domestic product (GDP) has been expanding at only 1.1 percent a year between 1980 and 2002, and per capita GDP in 2000 was only about three-quarters as high as in 1980.

On the revenue side, revenues, including grants, ranged between 11 and 14 percent of GDP during the 1980s. In the 1990s, they were generally higher, between 13 and 18 percent, except in 1994. Because grants make up a significant share of these revenues (40% of total revenues in 2001), the volume of revenue mobilized domestically has grown only slowly in two decades, from about 8.5 percent of GDP in the early 1980s to about 10 percent by the late 1990s and early 2000s. Compared with other countries, this level of domestic revenue generation is on the modest side; the corresponding averages around 2000 were 15.8 percent of GDP for 30 low-income African countries, 17.4 percent for 11 non-African low-income countries, and 11.6 percent for the seven countries other than Rwanda with per capita GDP between US\$ 200 and US\$ 300.

According to the above same study, on the expenditure side, total public current and capital spending in the late 1990s and early 2000s, as a percentage of GDP, was about the same as in the 1980s- that is, around 20 percent. The ratio of public spending to total revenues was lower in the late 1990s and early 2000s than in the 1980s and early 1990s, a trend that is consistent with rising total revenue in the past two decades. Current spending net of interest- one measure of the cost of running the government, has remained relatively stable throughout two decades, although the data for the most recent years, 1998 to 2001, show a slight increase over the averages in the 1980s.

**Table 1: Some stylized economic indicators**

	1970	1980	1990	1995	1996	1997	1998	1999	2000	2001
Gross National Income (Millions of US\$)	220	1165	2572	1299	1368	1835	1983	1920	1796	1685
Gross national income per capita (US\$)	-	250	310	200	200	210	230	240	240	220
Exports of goods and services (Millions of US\$)	-	184	150	99	89	158	122	121	127	163
Imports of goods and services (Millions of US\$)	-	335	380	391	387	501	441	464	456	468
GDP growth (% annual change)	-	9	5.9	6.4	6.7	7.9	8.1	8.3	8.5	8.7
Gross domestic investment (% of GDP)	-	16.1	15.6	13.4	14.4	13.8	14.8	17.2	17.5	18.4
Gross public investment (% of GDP)	-	12.2	10.2	9.3	8.3	6.8	6.3	6	6.6	7.1
Gross private investment (% of GDP)	-	0	5.5	5.3	5.1	5.5	8	10.9	11.6	11.8
Foreign direct investment-FDI (Millions of US\$)	0	16	8	2	2	3	7	2	8	5
Revenues as share of GDP	-	12.2	12.9	18.1	16.7	17.2	15.9	15.8	19.0	18.2
Inflation rate	1	16	1	64	22	9	12	7	4	3
Illiteracy rate	72	60	47	40	40	40	38	33	33	33
Spending on education as % of GDP	-	3.0	-	-	2.0	2.0	2.2	3.4	3.2	3.3

**Source:** World Bank- Global Development Finance (GDF) 2002.

The above table shows that the gross national per capita income has been decreasing from 250 US dollars per capita in 1980 to 220 US dollars in 2001 (12% decrease). The gross domestic investment has been decreasing throughout two decades (from 1980 to 1998, and started to increase very slightly only from 1999. On the other hand, gross public

investment decreased from 12.2% of the GDP in 1980 and fell to 6.6% of the GDP in 2001 (84.8% decrease). The net foreign investment decreased dramatically on the same period reaching the lowest level at 87% decrease. The data on social expenditures shows that the spending on education as a percentage of GDP decreased during two decades and only reached the 1980 level in 1999 (3% of GDP).

### **3.3 External debt structure**

After the full application of traditional debt relief mechanisms, the public and publicly guaranteed external debt of Rwanda at end 2002 was US\$ 1,261 million in nominal terms. This translates to US\$ 634 million in NPV terms and an NPV debt-to-export ratio of 523.4 percent. Multilateral creditors account for 88 percent of all official debt outstanding (MINECOFIN, 2003:28). IDA is the largest creditor, accounting for 50 percent of total debt in NPV terms, followed by the African Development Bank Group and the IMF which account for 17 and 10 percent respectively of the total NPV stock of debt. Bilateral creditors account for about 12 percent, divided between Paris Club debt (8 percent of total stock of debt) and non-Paris Club creditors. Commercial creditors account for roughly 0.1 percent of the NPV of debt (MINECOFIN, 2003:28).

A report from the Ministry of Finance provides following figures on the use of external debt at end 2001 (MINECOFIN, 2001: 2): (1) nearly 80% of the foreign debt stock was used to finance the Public Investment Programs; (2) the sector of transport and communications is the major beneficiary with 28 percent of the shares; (3) only 17 percent of the foreign debt was allocated to agriculture that employs 90 percent of the population and contributes to 43 percent of GDP; (4) the sectors of energy benefited of only 14 percent of the total external debt; (5) the sector of industry that employs 2 percent of the population and contributes to 20 percent of GDP received only 3 percent of the funding from the foreign debt; (6) health, education and public service account for 18 percent of the total external debt stock; and 18 percent of the total foreign debt was allocated to economic reforms and the post-genocide economic stabilization.

**Table 2: Debt indicators and the current account balance**

	1970	1980	1990	1995	1996	1997	1998	1999	2000	2001
Total external debt stock	5	190	712	1029	1043	1111	1226	1292	1271	1261
Total debt service paid	1	8	21	20	18	22	21	31	35	18
Total loans purchased	0	34	62	68	62	92	104	111	65	76
Grants (excluding technical cooperation)	10	68	145	566	333	124	199	228	211	154
Grants as % of GDP	-	8.5	12.9	18.1	16.7	17.2	15.9	15.8	19.0	18.2
Grants as % of total revenue	-	30.1	-	62.4	44.3	39.4	33.3	37.7	48.2	39.9
Current account balance	-	-48	-86	57	-8	-62	-83	-143	-115	-118
External debt-to exports ratios	-	103.4	474.8	1040.9	1176.9	704.9	1006.7	1063.8	998.6	787.3
Total debt service-to-exports ratio	-	4.1	14.0	20.5	19.8	14.1	17.0	25.9	27.5	11.3
External debt-to GNI ratios	2.2	16.3	27.7	79.2	76.2	60.5	61.8	67.3	70.8	76.3
Short-term debt/total external debt	0.0	13.7	6.6	3.1	3.3	6.9	4.0	4.2	3.0	2.8
Concessional debt/ Total external debt	31.0	74.4	92.6	93.5	93.6	88.7	90.9	89.7	90.1	90.5
Multilateral debt/ Total external debt	1.3	47.8	76.2	78.9	79.9	76.5	78.3	78.0	78.3	79.1

**Source:** World Bank- Global Development Finance (GDF) 2002

The above table tells that the stock of external debt has been increasing on a sustained high rate, from 5 millions of US dollars to 190 millions of US dollars in 1980 (97% increase); from 190 millions to 712 millions in 1990 (733% increase); and from 712 millions to 1261 millions of US dollars in 2001(44% increase. Total external debt increased dramatically between 1980 and 1990 due to the fall of prices of coffee and tea, the two principal export commodities of the country. This contributed to worsening the external account imbalances and to further contracting new loans. Total external debt accumulated also between 1990 and 1995 from 712 millions US dollars to 1029 millions US dollars (30% increase) because of the war that started in 1990 and culminated in the genocide in 1994. This was coupled with a sharp decrease (34%) in exports due to a combination of the deterioration of the terms of trade and a reduction in exports volume. Moreover, the external debt increased slightly after the genocide because of the accumulation of arrears in that period.

More than 90% of the total external debt has been contracted on a long-term basis, and as from 1990, concessional loans have been privileged (90% of the total external debt). Moreover, again from 1990, 78% of the total external debt was contracted from multilateral creditors. All debt indicators increased sharply as from 1980, but begun to decrease from 2000. Rwanda's economic condition was greatly affected by the 1994 genocide and the ensuing social and military developments. This resulted in the emergence of very large external current account imbalances reflecting very low or negative savings to GDP ratios for both the private and public sectors. The external imbalances have basically been covered by foreign savings provided through donor flows catalyzed by the international response to the genocide. This is reflected by the sharp increase of grants (74% increases in 1995) that decreased gradually from then onwards.

In this context, a key issue is the steps necessary for a successful graduation of Rwanda from this excessive reliance on unpredictable donor funds in the long term and its eventual integration into international capital markets. If the existing fiscal and external imbalances were to continue over time, chances are that the low levels of savings and investment would not recover adequately. Thus, macroeconomic stability and growth



may not be sustainable over the long term unless the imbalances are progressively reduced and debt sustainability is attained and conserved.

## **Conclusion**

The economic structure of Rwanda reflects a chronic failure to achieve sustainable growth. Its characteristics include among others: (1) a gross national per capita income that has been decreasing regularly; (2) a gross domestic investment that has been decreasing in two decades, especially the gross public investment that decreased dramatically throughout the period under study; (3) high levels of external debt; (4) unpredictable levels of inflation with very high peaks; (5) diminishing rates of illiteracy, but yet very high; (6) very large external current account imbalances; (7) excessive reliance on unpredictable foreign savings.

This study attempts to explore if there is any causality relationship between the high levels of external debt and physical capital accumulation in the context of Rwanda, so as to contribute on reflecting on how to prevent excessive debt accumulation of the country, by linking its borrowing potential to its current and prospective ability to service debt; and by channeling the debt relief into productive investment that allows the country to grow and generate future repayment capacity.

## Chapter 4: Research Methodology

This chapter discusses the methodology applied in conducting the study. In order to capture the relationship and the magnitude of the effects of high levels of debt on the capital accumulation variables, a quantitative research method is required as it involves the relationship between quantifiable variables.

### 4.1 Research method

A quantitative analysis used in this study is the Engle-Granger Two-step Approach. This approach to long run estimation follows a two-step procedure. First, the approach consists in testing whether there is co-integrating (long-run equilibrium) relationship between the variables, by means of the unit root test applied to the residuals. Secondly, once the residuals are found to be stationary, the next step is to estimate the equation by including the error correction variables (Harris, 1995: 52-55).

In this exercise, each variable is tested for stationarity (the stochastic properties are invariant with respect to time, i.e., the mean, the variance and the covariance do not depend on time), and later, the functions at study are re-estimated utilizing the stationary variant of the variables. As Gujarati puts it (1999: 455), a stochastic process is said to be stationary if its mean and variance are constant over time and the value of the covariance between two time periods depends only on the distance or lag between the two time periods and not on the actual time at which the covariance is computed. Put differently, a stochastic process is said to be stationary, if the joint and conditional probability distributions of the process are unchanged if displaced in time (Charemza and Deadman, 1997:118).

A test of the order of integration of all variables is performed because non-stationary variables will often lead to a problem of spurious regressions. Statistics such the “t” and DW statistics, and measures such as  $R^2$  do not retain their traditional characteristics in the presence of non-stationary data; running regressions with such data could produce results

which erroneously indicate through misleading values of  $R^2$ , DW and t statistics, that a meaningful relationship exists among the regression variables (Kennedy, 2003:268). In fact, although many scientific time series data are stationary, most economic time series data are trending (i.e., the mean changes over time) and thus clearly cannot be stationary (Kennedy, 2003:264). As he puts it (2003:275), the essence of co-integration is that co-integrated variables share a common trend, which is removed when producing the co-integrating regression residuals.

Once the variables are tested for stationarity, the exercise consists in estimating the static OLS regression model in order to obtain the estimates of the co-integration vectors (i.e., the estimates of vectors  $\tilde{y}$  which establish a long-run stationary relationship between the non-stationary variables in the model). Such approach, which ignores any short-run dynamic effects and the issue of endogeneity, is justified on the grounds of “super consistency” of the OLS estimators (Harris, 1995:8), that states that the OLS estimators of  $\tilde{y}$  with non-stationary I (1) variables converge to their true value at a much faster rate than does the usual OLS estimators with stationary I(0), assuming co-integration. The most common form of testing for co-integration is based on an ADF unit root test applied to the residuals from the OLS regression; in other words, from the estimation of the co-integrating (long-run equilibrium) relationship (Kennedy, 2003: 270).

The economic interpretation of co-integration is that if two (or more) series are linked to form an equilibrium relationship spanning the long-run, then even though the series themselves may contain stochastic trends (i.e., be non-stationary) they will nevertheless move closely together over time and the difference between them will be stable i.e. stationary (Harris, 1995:22). Thus the concept of co-integration mimics the existence of a long-run equilibrium to which an economic system converges over-time; and from co-integration with equilibrium, it is possible to make sense of regressions involving non-stationary variables (Harris, 1995: 22-23). If these are co-integrated, then regressions analysis imparts meaningful information about long-run relationships.

Co-integration is linked closely to the use of short-run error-correction (ECM) formulation of the dynamic models. The ECM has several distinct advantages including that it incorporates both short-run and long run effects, and that all the terms in the models are stationary so that standard regression techniques are valid (Harris, 1995: 24-25). Thus, the Engle-Granger Two-step Approach used provides immunity from the spurious regression problem, given that the variables in levels co-integrate.

In summary, the methodology used is the following: first, the unit root tests are necessary to determine the order of integration of the raw data series; the second step consists in running the co-integrating regressions suggested by economic theory; the third stage is to apply an appropriate unit root test to the residuals from these regressions to test for co-integration; fourth, if co-integration is accepted, the final step is to use the lagged residuals from the co-integrating regressions as error correction terms in an ECM (Kennedy, 2003: 270), a short-run Error Correction Model in order to obtain the information of the speed of adjustment to equilibrium. According to Charemza and Deadman (1997: 154-155), the fact that variables are co-integrated implies that there is some adjustment process which prevents the errors in the long run relationship becoming larger and larger; and currently, the ECM represents the most common approach to situations where it is wished to incorporate both the economic theory relating to the long run relationship between variables, and the short run disequilibrium behaviour.

The testing for unit roots is done using the Augmented Dickey Fuller approach (ADF test) and the econometric software used is Eviews (3.1).

## **4.2 Data Sources**

The following are the various sources of the data for this study:

Global Development Indicators 2002(World Bank)

Global Development Finance 2002(World Bank- GDF CD 2002)

### 4.3 Data Description

In order to determine the nature of the relationship and the magnitude of the effects of debt on physical capital accumulation, the study estimates two investment equations. The model is borrowed from Serieux and Samy (2001:5-9), in their study on the nature of the relationship between debt and growth, in a cross section of 53 low and lower-middle income countries covering the period 1970-99, where they estimates an investment equation, a human capital growth equation, and a growth equation.

Quoting Fry (1989), Serieux and Samy (2001:5-6) explain that the investment equation is based on the simple accelerator of investment. As they put it, the model provides a useful framework for empirical estimates of the determinants of investment in developing countries because it does not require estimates of the capital stock or the rate of return on investment that are not available for most developing countries, which is the case for Rwanda. Thus, the model seems to be relevant to analyze the particular context of Rwanda, where preliminary investigations show that external debt has been accumulating at a very high rate since 1980, while the gross public investment, the net foreign investment and the gross domestic investment have been largely decreasing in the same period.

The basic equation suggests that the speed of adjustment of the capital stock i.e. the ratio of investment over GDP is determined by the rate of growth of the economy, the debt ratios, the rate of inflation, the illiteracy rate and the lagged value of the rate of investment. In the first equation, the debt ratios to revenues serve as explanatory variables, in order to capture the “crowding out” effects, while in the second equation the debt ratios to exports are used, so as to explore the “import compression” effects.

According to the IMF (2003: 19), both debt-stocks and debt service indicators provide important information on countries' debt burdens, implying that both should be drawn on when assessing debt sustainability. Debt-stock indicators are generally used to assess potential concerns, providing information about future debt-servicing commitments and prospective payment difficulties if a country's capacity to repay does not expand. Debt-service indicators, which are typically expressed relative to fiscal revenues and exports, measure the extent to which debt service crowds out alternative uses of resources (other public expenditures and imports). The crowding out effect is particularly relevant for countries with limited capacity to raise revenues or obtain market financing (IMF, 2003: 19).

The used debt ratios include the following, as defined by Boote and Thugge (1997:28-30):

The Net Present Value (NPV) of debt to Exports ratio (here defined as DE): net present value (NPV) of outstanding public and publicly guaranteed external debt at the end of the period, expressed as a percentage of exports of goods and services. (Source: World Bank GDF 2002).

The Net Present Value (NPV) of debt to Revenues ratio (here defined as DR): net present value (NPV) of outstanding public and publicly guaranteed external debt at the end of the period, expressed as a percentage of revenues. (Source: World Bank GDF 2002).

The debt service to-exports ratio (DSE): scheduled debt service (interest and payments due on public and publicly guaranteed debt during a year) for the same coverage of debt as in the NPV debt-to-exports ratio, expressed as a percentage of exports for that year. (Source: World Bank GDF 2002).

The debt service to-revenues ratio (DSR): scheduled debt service for the same coverage of debt as in the NPV debt-to-revenues ratio, expressed as a percentage of revenues for that year. (Source: World Bank GDF 2002).

The Net Present Value (NPV) of debt is the sum of all future debt-service obligations (interest and principal) on existing debt, discounted at the market interest rate. Whenever the interest rate on a loan is lower than the market rate, the resulting NPV of debt is smaller than its face value, with the difference reflecting the grant element. The debt-stock indicators based on the NPV of debt are more meaningful than those based on its face value for the purpose of measuring and comparing the stream of future debt-service payments. Loans contracted at the market rate have an NPV that is identical to their face value, and grants (with 100 percent concessionality) have an NPV of zero, while the NPV of all other concessional financing (with an interest rate that is below the discount rate) falls somewhere in the between (IMF, op. cit 19-20).

According to Serieux and Samy (2001:3), the size of the debt-to-revenue (DR) ratio is an indicator of the magnitude of the debt overhang disincentive effect. In particular, it indicates the expected future cost of debt servicing, and thus, the expected future tax on investment. It could also indicate the probability that the government will resort to inflationary financing of the budget, and thus the cost of macroeconomic instability that maintain uncertainty about the future debt servicing profile, leading to dampen the incentive to invest. The debt service-to-revenue ratio (DSR) is an indicator of the crowding out effect. If a significant portion of government revenue is devoted to debt servicing, there is consequently a reduction in total investment (public and private), and a fall in the productivity of investment because of lost externalities from certain types of public investment.

The other variables used include the illiteracy rate, the inflation rate and the growth rate.

The illiteracy rate (ILL) indicates the proportion of persons within the population above 15 years who cannot read and write (Source: World Bank GDF 2002).

The inflation rate (INF) refers to the annual percentage increase in the price of goods and services (Source: World Bank GDF 2002).

The growth rate of the economy (GW) refers to the annual percentage rate of growth of the Gross Domestic Product (GDP). (Source: World Bank GDF 2002).

The speed of adjustment of the capital stock (INV) here refers to the ratio of investment over GDP (calculated using the World Bank GDF 2002 data on the gross domestic investment and GDP).

The two estimated equations are the following (Serieux and Samy, 2003: 6):

1.  $INV = f(GW, DR, DSR, INF, ILL, INV(-1))$ . In this equation, the size of the debt-to-revenue ratio is an indicator of the magnitude of the debt overhang disincentive effect. The debt service to revenue ratio is included as an indicator of the crowding out effect.

2.  $INV = f(GW, DSE, DE, INF, ILL, INV(-1))$ . This second equation suggests (Serieux and Samy, 2003:6-7) that the speed of adjustment of the capital stock (INV) is determined by the rate of growth of the economy (GW), the debt service-to-exports ratio (DSE), the debt-to-exports ratio (DE), the rate of inflation (INF), the illiteracy rate (ILL), and the lagged value of the rate of investment. The effect of the broader view of the debt overhang hypothesis, particularly with respect to the anticipated external account effect, can be captured through the debt-to-exports ratio (DE). All the debt variables are expected to have significant and negative coefficients if there are disincentive and crowding out effects of the debt burden. Moreover, the inflation and the illiteracy rates are also expected to have negative and significant coefficients, when the growth rate and lagged investment should affect the level of investment positively.

The used data are collected from the World Bank Global Development Finance (GDF) CD-ROM 2002 and the series start from 1965 to 2001. The empirical results depend on the accuracy of the data.



## Chapter 5: Empirical Results and Analysis of the Findings

This chapter presents the empirical results of the study and investigates if there any evidence on whether and through which channels high levels of debt affect investment in physical capital in Rwanda, on the basis of the model developed by Serieux and Samy (2003:6-9) and presented in chapter four.

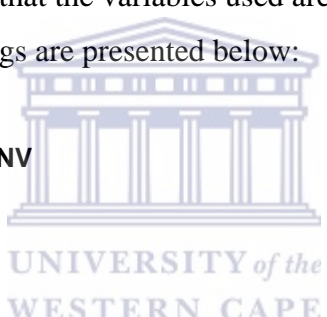
### 5.1 Empirical Results

#### 5.1.1 Testing the variables for stationarity

In this study, the test for stationarity is carried out by means of the Augmented Dickey – Fuller (ADF) in order to ensure that the variables used are non-stationary, so as to avoid spurious regressions. The findings are presented below:

##### Test of the dependent variable INV

*At level*



ADF Test Statistic	-1.491504	1% Critical Value*	-4.2505
		5% Critical Value	-3.5468
		10% Critical Value	-3.2056

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\*MacKinnon critical values for rejection of hypothesis of a unit root.

*At first  
difference*

ADF Test Statistic	-5.397611	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

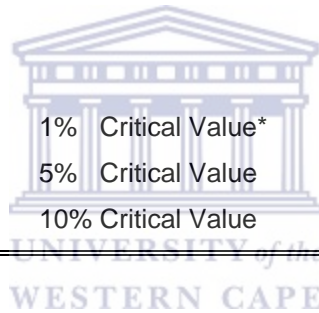
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The above values are the critical values for rejecting the null hypothesis of a unit root at various significance levels (10 per cent, 5 per cent and 1 per cent) based on the Dickey-Fuller distribution (Harris, 1995:29). The level of significance used in this study is 5%. At level, the computed Dickey Fuller is less than the critical at 5% with trend and intercept in absolute terms. Therefore the null hypothesis which says that there is unit root (meaning non-stationarity) is accepted. At first difference, the ADF test shows the absolute value of the computed Dickey-Fuller is greater than the critical at 5%. Hence the null hypothesis is rejected, meaning that the variable is stationary at first difference. The variable INV is integrated of order 1 and it is written I(1) as it is differenced once to become stationary.

**Test of the explanatory variables: GW, DR, DSR, DE, DSE, ILL, INF and INV1**

*GW at level*

ADF Test Statistic	-3.262298	1% Critical Value*	-4.2505
		5% Critical Value	-3.5468
		10% Critical Value	-3.2056



*GW at first difference*

ADF Test Statistic	-7.327681	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

*DR at level*

ADF Test Statistic	-0.897778	1% Critical Value*	-3.6353
		5% Critical Value	-2.9499
		10% Critical Value	-2.6133

*DR at first difference*

ADF Test Statistic	-5.173167	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

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*DSR at level*

ADF Test Statistic	-1.386159	1% Critical Value*	-3.6353
		5% Critical Value	-2.9499
		10% Critical Value	-2.6133

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*DSR at first difference*

ADF Test Statistic	-4.254358	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

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*ILL at level*

ADF Test Statistic	-2.988177	1% Critical Value*	-4.2505
		5% Critical Value	-3.5468
		10% Critical Value	-3.2056

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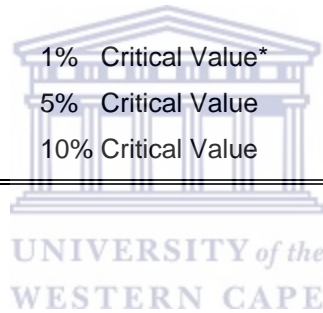
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*ILL at first difference*

ADF Test Statistic	-4.402821	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

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*INF at level*

ADF Test Statistic	-3.261344	1% Critical Value*	-4.2505
		5% Critical Value	-3.5468
		10% Critical Value	-3.2056

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*INF at first difference*

ADF Test Statistic	-6.695493	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

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*DSE at level*

ADF Test Statistic	-2.235435	1% Critical Value *	-4.2505
		5% Critical Value	-3.5468
		10% Critical Value	-3.2056

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*DSE at first difference*

ADF Test Statistic	-5.345331	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

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*DE at level*

ADF Test Statistic	-2.239631	1% Critical Value*	-4.2505
		5% Critical Value	-3.5468
		10% Critical Value	-3.2056

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### *DE at first Difference*

ADF Test Statistic	-4.192523	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

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From the results above, at 5%, all the explanatory variables are found non-stationary at levels. They are stationary after the first difference. This means that they are all integrated once to get stationary; they are all  $I(1)$ . A variable is said to be integrated of order  $d$ , written  $I(d)$ , if it must be differenced  $d$  times to be made stationary (Kennedy, 2003: 268). Thus a stationary variable is integrated of order zero, written  $I(0)$ . Since the above variables are non-stationary and have got the same order of integration, they may be co-integrated (have a long-run relationship) according to Engle-Granger approach.

The model borrowed to Serieux and Samy (chapter 4:41) is related to physical capital accumulation and suggests that the speed of adjustment of the capital stock can be determined by the following variables: the rate of growth of the economy, the debt service-to-revenue ratio, the debt-to revenue ratio, the debt service-to-export ratio, the debt-to export ratio, the rate of inflation, the illiteracy rate as a proxy of the level of human capital underdevelopment, and the lagged value of the rate of investment. As they put it (2001:6), the debt variables are expected to have significant and negative coefficients as indicators of the debt overhang disincentive effect, the crowding out effect, but also the import compression argument. The size of the debt-to-revenue ratio gives the picture of the level of the debt overhang disincentive effect, particularly the future cost of debt servicing. The debt service-to-revenue ratio is indicative about the crowding out effect of the debt service burden crowds out public investment. The debt service to exports ratio can give indications concerning the import compression argument since the imports are paid by means of the export earnings. With regards to external account effect, the debt to exports ratio can be an indicator of a broader view of the debt overhang hypothesis. The illiteracy rate is a negative indicator of the quality of human

capital and should have a negative and significant coefficient if the quality of human capital affects the level of investment. The inflation rate should also have a negative coefficient. The growth rate and lagged investment are expected to have positive coefficients.

### 5.1.2 Long-run models regression

#### 1. $INV = f(GW, DR, DSR, ILL, INF, INV1)$

Dependent Variable: INV

Method: Least Squares

Date: 09/19/05 Time: 15:04

Sample(adjusted): 1966 2000

Included observations: 35 after adjusting endpoints

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	22.60348	5.869651	3.850907	0.0006
GW	0.107961	0.043009	2.510193	0.0181
ILL	-0.240555	0.066591	-3.612447	0.0012
INF	-0.124591	0.026354	-4.727574	0.0001
DR	-0.061977	0.026822	-2.310658	0.0284
DSR	-0.213024	0.085642	-2.487383	0.0141
INV1	0.044687	0.015763	2.834966	0.0084
R-squared	0.731218	Mean dependent var.	13.22857	
Adjusted R-squared	0.673622	S.D. dependent var.	3.135055	
S.E. of regression	1.791041	Akaike info criterion	4.180327	
Sum squared resid	89.81916	Schwarz criterion	4.491397	
Log likelihood	-66.15573	F-statistic	12.69563	
Durbin-Watson stat	2.107260	Prob(F-statistic)	0.000001	

The econometric evaluation reveals that the direction of influence of all the variables used is consistent with the economic theory. Moreover, the problem of hetero-

scedasticity is corrected using the white test by the software and there is no sign of serious multi-co linearity problem. The serial correlation is tested by means of the H-statistics since the regression contains the lagged value of the regressed (autoregressive model), and the test shows that there is no autocorrelation. The computed h is  $-1.89$  and  $-1.96 < h < 1.96$  ( $h = [1 - DW/2] * [n/1 - n(SE)^2]$ , where DW is the Durbin Watson statistics, n is the number of observations and SE the standard error of the lagged variable). The above results also show that 67% of the investment could be explained by the model, considering the adjusted  $R^2$  (0.6736). On the other hand, the results suggest the following economic interpretation: a unit rise in the lagged investment leads to an increase in actual investment by 0.04469 units, and the growth rate has a positive and significant effect on investment as the rise in growth rate by one unit leads to a rise in investment by 0.1079 units. As expected, the inflation and the illiteracy rates have negative and significant effects on investment; the rise in inflation by one unit lowers investment by 0.1246 units, while a rise by one unit in the illiteracy rate lowers investment by 0.2405 units. The debt indicators also show a negative and significant relationship with investment, a unit rise in the debt to revenue ratio and in the debt service to revenue ratio respectively lowers investment by 0.062 and 0.127 units. The significant relationship can be explained by the debt overhang disincentive and the crowding out of the public investment effects associated respectively to the debt to revenue ratio and to the debt service to revenue ratio.

## 2. $INV = f(GW, DE, DSE, ILL, INF, INV1)$

Dependent Variable: INV

Method: Least Squares

Date: 09/19/05 Time: 16:04

Sample(adjusted): 1966 2000

Included observations: 35 after adjusting endpoints

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	24.37225	6.464267	3.770304	0.0008
GW	0.102051	0.044773	2.279299	0.0305

ILL	-0.256817	0.072607	-3.537077	0.0014
INF	-0.123665	0.027589	-4.482425	0.0001
DE	-0.004734	0.002052	-2.307042	0.0287
DSE	-0.183003	0.083921	-2.180654	0.2477
INV1	0.366476	0.017394	2.106914	0.0442
<hr/>				
R-squared	0.738613	Mean dependent var.	13.22857	
Adjusted R-squared	0.682602	S.D. dependent var.	3.135055	
S.E. of regression	1.766230	Akaike info criterion	4.152428	
Sum squared resid	87.34794	Schwarz criterion	4.463498	
Log likelihood	-65.66750	F-statistic	13.18684	
Durbin-Watson stat	2.169853	Prob(F-statistic)	0.000000	

The regression with the debt to exports ratios shows similar results than those found with the debt to revenue ratio indicators. Given that the data used in both models are non-stationarity at levels, there is risk to run spurious regressions. Also, it is necessary to establish that there is a long-run relationship between these variables (i.e. that the variables co-integrate). This is done by testing the residual series for stationarity.

### 5.1.3 Testing the residuals for unit root

After running the co-integrating regressions suggested by economic theory (long-run models), the next step is to apply an appropriate unit root tests to the residuals from these regressions to test for co-integration.

RESID 01

ADF Test Statistic	-6.042543	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation



Dependent Variable: D(RESID01)

Method: Least Squares

Date: 09/20/05 Time: 11:50

Sample(adjusted): 1968 2000

Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID01(-1)	-1.207426	0.029868	-4.042543	0.0004
D(RESID01(-1))	-0.086432	0.018117	-0.477076	0.6369
C	-0.038071	0.624782	-0.060935	0.9518
@TREND(1965)	0.002862	0.029406	0.097324	0.9231
R-squared	0.674402	Mean dependent var.		0.050939
Adjusted R-squared	0.640720	S.D. dependent var.		2.672967
S.E. of regression	1.602177	Akaike info criterion		3.893816
Sum squared resid	74.44213	Schwarz criterion		4.075211
Log likelihood	-60.24796	F-statistic		20.02230
Durbin-Watson stat	2.030975	Prob(F-statistic)		0.000000

RESID 02

ADF Test Statistic	-6.490181	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RESID02)

Method: Least Squares

Date: 09/20/05 Time: 11:52

Sample(adjusted): 1968 2000

Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID02(-1)	-1.045062	0.029942	-3.490181	0.0016
D(RESID02(-1))	-0.185045	0.018652	-0.992079	0.3294
C	0.098801	0.626739	0.157642	0.8758
@TREND(1965)	-0.004138	0.029615	-0.139725	0.8898

R-squared	0.669265	Mean dependent var.	0.060218
Adjusted R-squared	0.635051	S.D. dependent var.	2.652017
S.E. of regression	1.602111	Akaike info criterion	3.893733
Sum squared resid	74.43599	Schwarz criterion	4.075128
Log likelihood	-60.24660	F-statistic	19.56114
Durbin-Watson stat	1.963051	Prob(F-statistic)	0.000000

The null hypothesis of a unit root and thus no co-integration is based on a t-test with a non-normal distribution. There are two major reasons for not using the standard Dickey-Fuller tables of critical values (Harris, 1995: 54): First, because of the way it is constructed, the OLS estimator chooses the residuals to have the smallest sample variance, even if the variables are not co-integrated, making the residual as stationary as possible, thus, the standard DF distribution would tend to over-reject the null hypothesis; secondly, the distribution of the test statistic under the null hypothesis is affected by the number of regressors (n) included in the model, thus, different critical values are needed as n changes. Since the critical values also change depending on whether a constant and/or trend are included, and with the sample size, there are a large number of permutations, each requiring a different set of critical values with which to test the null hypothesis.

Quoted in Harris (1995:54-55), Mackinnon has linked the critical values for particular tests to a set of parameters of an equation of the response surfaces with the following relation:

$$C(p) = \phi_0 + \phi_1 T^{-1} + \phi_2 T^{-2}$$

Where C(p) is the P percent critical value and T being the number of included observations in the residual series. It is possible to obtain the appropriate critical value for any test involving the residuals from an OLS equation where the number of regressors (excluding the constant and the trend) lies between: 1 < n < 6. The C (p) value for the above residual series is calculated as follows:

$$C(p) = -4.9767 - 20.883/33 - 9.05/332 = -5.6178$$

The C(p) value (-5.6178) being less negative than the t-values of -6.04254 and

-6.40181 respectively, the null hypothesis of no co-integration is not accepted at 5% level of significance. The residuals are I(0) and therefore, there is co-integration between the dependent variable INV and its explanatory variables, in other words, there is a long-term relationship between INV and its explanatory variables.

Once co-integration is accepted, the final step is to use the lagged residuals from the co-integrating regressions as error correction terms in an ECM, a short-run Error Correction Model in order to obtain the information of the speed of adjustment to equilibrium. The short-run model regressions are presented below:

#### 5.1.4 Short-run model regressions

$$INV = f(GW, DR, DSR, ILL, INF, INV1)$$

Dependent Variable: D(INV)


Method: Least Squares

Date: 09/21/05 Time: 11:50

Sample(adjusted): 1967 2000

Included observations: 34 after adjusting endpoints

White Heteroskedasticity-Consistent Standard Errors & Covariance



Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.026791	0.675065	0.039686	0.9686
D(GW)	0.042747	0.020993	2.036271	0.9713
D(DR)	-0.082942	0.023940	-3.464591	0.6459
D(DSR)	-0.127040	0.061930	-2.051353	0.3024
D(ILL)	-0.589411	0.450821	-1.307418	0.7609
D(INV1)	0.052839	0.012825	4.120033	0.9053
RESID01(-1)	-0.963106	0.329094	-2.926540	0.0069
R-squared	0.786276	Mean dependent var.	0.147059	
Adjusted R-squared	0.744337	S.D. dependent var.	2.284763	
S.E. of regression	1.624695	Akaike info criterion	3.989758	
Sum squared resid	71.27008	Schwarz criterion	4.304008	
Log likelihood	-60.82588	F-statistic	6.376811	
Durbin-Watson stat	2.012707	Prob(F-statistic)	0.000285	

## 2. $INV = f(GW, DE, DSE, ILL, INF, INV1)$

Dependent Variable: D(INV)

Method: Least Squares

Date: 09/21/05 Time: 11:45

Sample(adjusted): 1967 2000

Included observations: 34 after adjusting endpoints

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.119340	0.687666	0.173544	0.8635
D(GW)	0.044832	0.020978	2.137093	0.8920
D(DE)	-0.073025	0.021072	-3.465533	0.0203
D(DSE)	-0.077797	0.027410	-2.838274	0.0770
D(ILL)	-0.790506	0.469999	-1.681933	0.5011
D(INV1)	0.336353	0.118089	3.033212	0.9737
RESID02(-1)	-1.514326	0.375808	-4.029521	0.0053
R-squared	0.807357	Mean dependent var.		0.147059
Adjusted R-squared	0.720103	S.D. dependent var.		2.284763
S.E. of regression	1.582760	Akaike info criterion		3.937458
Sum squared resid	67.63849	Schwarz criterion		4.251709
Log likelihood	-59.93679	F-statistic		6.960800
Durbin-Watson stat	2.022333	Prob(F-statistic)		0.000150

As seen in chapter 4, the general concept of co-integration entails that if there is a long run relationship between two (or more) non-stationary variables, deviations from this long run path are stationary. Also the results of the regressions from the series transformed with the use of the co-integrating vectors can be tested by means of the usual methods of statistical inferences.

## **5.2 Analysis of the Findings**

### **5.2.1 Statistical Results**

The chapter has considered the long and the short-run models. The distinction is based on the notion of equilibrium; that is, the long-run is a state of equilibrium where economic forces are in balance and there is no tendency to change, while the short-run depicts the disequilibrium state where adjustment to the equilibrium is occurring (Harris, 1995: 25). The regression results of the short-run models above show that: most of the explanatory variables are statistically significant (the absolute values of the t-statistics are greater than two); the signs of the coefficients also show that they are consistent with economic theory. Moreover, the lags of the RESID01 (-1) and RESID02 (-1) are significantly negative, meaning that the short run dependent variable is higher than the average long run equilibrium. Every year, the value falls respectively by 1.138518 and 0.963106 until equilibrium is reestablished. The h-statistics shows that there is no serial autocorrelation (the h values are respectively -0.46153 and -0.71120 in both regressions and they are in the range between the critical values i.e.-1.96 and 1.96). The models perform rather well, considering the adjusted  $R^2$  (74 % and 72% respectively in the two regressions), a high variation in investment is explained by the variations in the explanatory variables. The debt to revenues ratio, the debt service to revenues ratio, the debt to exports ratio and the debt service to exports ratio are found to impact significantly and negatively on investment.

### **5.2.2 Economic interpretation of the results**

#### **The debt to revenues ratios**

The results related to the debt indicators appear to lend support to the presumption of a “debt overhang” as suggested by a substantial body of economic theory. The heavy debt burden adversely affects investment. On one hand, since the bulk of Rwanda is basically a public sector liability (nearly 80% of the foreign debt stock was used to finance the

public investment programs), debt servicing cost reduces public investment, therefore reduces total investment directly and indirectly by affecting complementary private investment; it can also impact on the quality of investment. As mentioned in chapter three, the ratio of public spending to revenues was lower in the 1990s and early 2000s than in the 1980s. During the same period, the debt to revenues ratios increased dramatically in early 1990s, reaching a peak in 1994, while the debt service to revenue ratio have been rising on a regular basis. The gross public investment decreased from 12.2 % of GDP in 1980 and fell to 6.6% in 2001 (84.8% decrease). This is the crowding out effect of the debt burden on the public investment expenditure that, most likely, may have negative impact on the private investment spending. In fact, the same period shows a large decrease of the net foreign investment that reached the lowest level at 87% decrease. Furthermore, the gross private investment shows any improvement as a percentage of GDP over almost two decades, starting to rise only slightly as from 1998. Normally, public expenditures may crowd-in private investment, especially in Rwanda, where infrastructural, educational and health facilities are weak. The potential positive externalities from the government expenditures are lost, since a substantial part of the public expenditure is allocated to the external debt service.

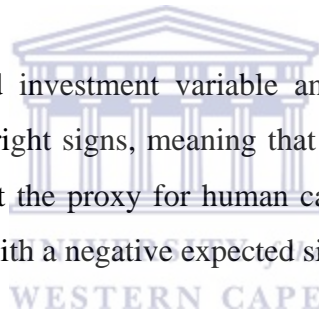
On the other hand, in addition to the above direct effects from reduced public investment, the results tend to support the possibility of a disincentive effect through higher taxes on investment returns necessary to service the debt, and to face any increase in the fiscal deficit. The economic indicators over the period under study show that the revenues as a share of GDP are stable between 1980 and 1990, but have risen steadily reaching a peak of 30 percent increase as from 1995 onwards, while, over the same period of time, the gross domestic investment as a percentage of GDP has been decreasing on a regular basis. This suggests the presence of higher taxes instead of a steady growth of businesses.

### **The debt to exports ratios**

In addition to the crowding out effect, there is a related cash-flow problem associated with the public debt service: the import capacity of the government is reduced, thus, there is an import compression effect that occurs through the import-content of the government expenditures; leading to the reduction of the government investment activity and the lost of the complementarity's effects with the private sector investment spending. The imports of goods and services increased only slightly (13 percent) between 1980 and 1996. The total increase in imports value over the period is only USD 52 million, depicting partly the import compression effect over one decade and a half, associated with the deterioration of the terms of trade.

### **The other explanatory variables**

The coefficients of the lagged investment variable and the growth rate of GDP are positively significant with the right signs, meaning that the above variables are positive determinants of investment, but the proxy for human capital development (illiteracy) is not found significant, though, with a negative expected sign.



## Chapter 6: Conclusions

Dealing with the debt problems of the highly indebted poor countries, specifically their external debt burden, has been an important element of the development agenda from the 1990s. The initial objective was to reduce the debt overhang of those countries, and gradually, the aim shifted to achieving sustained growth and poverty reduction while preserving long-term debt sustainability.

Unsustainable levels of debt can generate various macroeconomic effects including the decline of physical capital accumulation that lead ultimately to lower output and income. On the other hand, increasing and improving capital accumulation over time is an important element for sustainable growth and stability, and for achieving the poverty reduction targets.

This study attempted to examine the nature of the relationship between high levels of external debt and capital accumulation in Rwanda, by means of a quantitative analysis, and tries to contribute in reflecting on how to design evidence-based and result-oriented borrowing policies, without leading to an unsustainable accumulation of debt.

Both theoretical literature and empirical studies suggest a relatively strong relationship between a heavy debt burden or a debt overhang and poor economic performance, including investment. Major channels for these adverse effects of debt are fiscal effects, of which the most important are: a cash-flow effects arising from reduced public expenditures and disincentive effects associated with a large debt overhang. A closely related cash-flow problem associated with debt service is import compression that can occur both at the balance of payments level and at the budgetary level through the effects of public debt service on the import-content of government expenditures. Reductions in the import capacity of the government reduce government investment activity, but also impact on the potential positive externalities on private investment. Moreover, besides the direct effects from reduced public investment and lower imports, there are disincentive effects arising from a high debt burden through tax disincentives (a tax on



investment returns that discourage investors), but also disincentives that can arise from general macroeconomic instability, impeding private investment. Those public debt-induced fluctuations in macro variables and exceptional financing may signal fiscal distress and inadequate ability on the part of the government to control fiscal events, leading to heightened investors' uncertainty about the future direction of the macro economy and thus reduce the incentive to invest.

The debt overhang hypothesis is supported by a number of empirical investigations as reviewed in chapter two, where one or more debt variables are found significantly and negatively correlated with investment, with the crowding-out effect intensifying as the ratio of debt service rises. Nevertheless, a number of other studies found no statistically significant negative effect of external debt on growth and that debt does not alter capital accumulation. Therefore, the effects of the debt burden may vary significantly across countries.

In the light of the above contradictory predictions held by the conventional analysis (the debt overhang hypothesis supported by most economists and almost all policymakers) and the adherents of the Ricardian equivalence (debt does not alter capital accumulation), this study attempts to analyze the specific case of Rwanda, a HIPC country in the process of designing a forward-looking debt and borrowing strategy, while implementing a poverty reduction strategy.

The results of the empirical findings suggest that the debt variables impact significantly and negatively on investment. The above results concur with the findings of Serieux and Samy (2001:14-15) in their study on the nature of the relationship between debt and growth, in a cross section of 53 low and lower-middle income countries covering the period 1970-99. They also concur with empirical findings of Deshapande (1997:185) that demonstrates that the relationship between external debt and investment for a sample of 13 severely indebted countries is consistently a negative one, and those of Pattilo and others (2004:19) that suggest a strong negative effect of high debt on physical-capital accumulation.

On one hand, the debt to revenue ratios has adverse effects on investment. The debt servicing cost reduces public investment, therefore reduces total investment directly and indirectly by affecting complementary private investment; it can also impact on the quality of investment. This is suggested by the negatively significant debt to revenue ratios, and depicted by the high levels of debt to revenues ratios associated with the decrease in the public investment and the gross domestic investment. On the other hand, the results tend to support the possibility of a disincentive effect through higher taxes on investment returns necessary to service the debt, and to face any increase in the fiscal deficit. The economic indicators show that the revenues as a share of GDP have been rising throughout the period under study, associated with a large decrease of the gross domestic investment.

Another view of the debt overhang hypothesis can be picked up by the debt to exports ratios, considering the anticipated external account effect. In addition to the crowding out of public investment through the government budget, leading indirectly to a reduction of the private and the total investments, through the external account, the heavy debt burden impacts negatively on investment through the import compression effect that causes a reduction in imported inputs or in capital goods, and ultimately affects investment negatively.

These above dampening effects of high levels of debt on physical capital accumulation affect also growth, as “capital accumulation is as much the endogenous consequence of growth as the exogenous cause of growth” (Thirlwall, 1999: 85). This is problematic, since Rwanda relies strongly on foreign capital to finance a chronic shortfall of domestic savings on investment (a chronic deficit of the external current account). Given that the foreign capital arrives basically either under a tied or earmarked grant format or insufficient concessional loans, the funds are not necessarily used most efficiently and channeled into productive investment that allows the country to grow and generate future export earnings (and thus foreign exchange) with which to repay foreign creditors. This suggests that the country needs badly the HIPC debt relief funds to be timely released in

order to boost capital accumulation and eventually lead to sustainable levels of external debt.

Debt sustainability is crucial for macroeconomic stability and it incorporates several sub-components, including: solvency, liquidity and vulnerability that need to be addressed in an appropriate way, through more efficient investment. The reduction in debt stocks can only help to attain debt sustainability at a point in time, but long-term debt sustainability depends crucially on export performance and on the amounts and terms of new financing. This suggests that there is need for structural transformation in terms of domestic savings and investment. The HIPC debt relief will be beneficial for boosting investment and the overall economy, but it is not a panacea. As Gunter puts it (2003:23) “debt reduction alone is not enough to get development in the poorest countries back on rails”, debt relief will provide long-term debt sustainability only if a country pursues sound economic, social and structural policies that stimulate economic growth and help attract increased investment, especially from private sources.

To conclude, there is need to learn from the past mistakes and to replace the non-concessional financing with concessional loans and grants, in other to boost investment, on the basis of prudent economic projections and taking into account the country vulnerability to shocks. This suggests that, even though external financing leads to accumulation of debt, debt should be manageable so as the higher growth generates the resources to service it. This should be taken into account in formulating new borrowing policies. External borrowing can be only beneficial if it does generate an adequate increase in a country’s capacity to repay including GDP, fiscal and exports revenues.

## Appendix

### Testing for Unit Root

#### *I.Inv*

*INV at level*

ADF Test Statistic	-1.491504	1% Critical Value*	-4.2505
		5% Critical Value	-3.5468
		10% Critical Value	-3.2056

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(INV)

Method: Least Squares

Date: 09/14/05 Time: 10:28

Sample(adjusted): 1967 2000

Included observations: 34 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INV(-1)	-0.244485	0.163919	-1.491504	0.1463
D(INV(-1))	-0.455917	0.167290	-2.725306	0.0106
C	2.687087	1.629256	1.649273	0.1095
@TREND(1965)	0.039733	0.049062	0.809851	0.4244
R-squared	0.385254	Mean dependent var.		0.147059
Adjusted R-squared	0.323779	S.D. dependent var.		2.284763
S.E. of regression	1.878821	Akaike info criterion		4.209297
Sum squared resid	105.8990	Schwarz criterion		4.388868
Log likelihood	-67.55804	F-statistic		6.266883
Durbin-Watson stat	1.875205	Prob(F-statistic)		0.001971

*INV at first difference*

ADF Test Statistic	-5.397611	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(INV,2)

Method: Least Squares

Date: 09/13/05 Time: 11:45

Sample(adjusted): 1968 2000

Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INV(-1))	-1.679579	0.311171	-5.397611	0.0000
D(INV(-1),2)	0.056445	0.176176	0.320391	0.7510
C	0.988889	0.726777	1.360650	0.1841
@TREND(1965)	-0.034772	0.034021	-1.022081	0.3152
R-squared	0.812698	Mean dependent var.		0.121212
Adjusted R-squared	0.793322	S.D. dependent var.		4.083179
S.E. of regression	1.856291	Akaike info criterion		4.188250
Sum squared resid	99.92864	Schwarz criterion		4.369645
Log likelihood	-65.10613	F-statistic		41.94329
Durbin-Watson stat	2.094418	Prob(F-statistic)		0.000000

2. *GW (Growth Rate)*

*GW (Growth Rate) at level*

ADF Test Statistic	-3.262298	1% Critical Value*	-4.2505
		5% Critical Value	-3.5468
		10% Critical Value	-3.2056

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GW)

Method: Least Squares

Date: 09/14/05 Time: 10:33

Sample(adjusted): 1967 2000

Included observations: 34 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GW(-1)	-1.223105	0.268090	-4.562298	0.0001
D(GW(-1))	0.124415	0.181691	0.684766	0.4987
C	6.900265	4.927717	1.400296	0.1717
@TREND(1965)	-0.107980	0.223583	-0.482951	0.6326
R-squared	0.550306	Mean dependent var.	-0.029412	
Adjusted R-squared	0.505336	S.D. dependent var.	17.99577	
S.E. of regression	12.65684	Akaike info criterion	8.024404	
Sum squared resid	4805.871	Schwarz criterion	8.203976	
Log likelihood	-132.4149	F-statistic	12.23732	
Durbin-Watson stat	1.991334	Prob(F-statistic)	0.000021	



*GW (Growth Rate) at first difference*

ADF Test Statistic	-7.327681	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GW,2)

Method: Least Squares

Date: 09/13/05 Time: 11:50

Sample(adjusted): 1968 2000

Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GW(-1))	-2.124780	0.289966	-7.327681	0.0000
D(GW(-1),2)	0.427868	0.168132	2.544835	0.0165
C	-1.334324	5.888976	-0.226580	0.8223
@TREND(1965)	0.069568	0.277162	0.251003	0.8036
R-squared	0.790746	Mean dependent var.		0.000000
Adjusted R-squared	0.769099	S.D. dependent var.		31.52281
S.E. of regression	15.14737	Akaike info criterion		8.386744
Sum squared resid	6653.846	Schwarz criterion		8.568139
Log likelihood	-134.3813	F-statistic		36.52928
Durbin-Watson stat	2.208990	Prob(F-statistic)		0.000000

### 3. DR (Debt to Revenue Ratio)

#### DR (Debt to Revenue Ratio) at level

ADF Test Statistic	-0.897778	1% Critical Value*	-3.6353
		5% Critical Value	-2.9499
		10% Critical Value	-2.6133

\*MacKinnon critical values for rejection of hypothesis of a unit root.

#### Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DR)

Method: Least Squares

Date: 09/14/05 Time: 10:39

Sample(adjusted): 1967 2000

Included observations: 34 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DR(-1)	-0.090031	0.100282	-0.897778	0.3762
D(DR(-1))	-0.290163	0.175920	-1.649403	0.1092
C	4.997894	3.716829	1.344666	0.1885
R-squared	0.138507	Mean dependent var.		2.058824
Adjusted R-squared	0.082927	S.D. dependent var.		16.48129

S.E. of regression	15.78313	Akaike info criterion	8.439857
Sum squared resid	7722.318	Schwarz criterion	8.574536
Log likelihood	-140.4776	F-statistic	2.492029
Durbin-Watson stat	2.065142	Prob(F-statistic)	0.099174

*DR (Debt to Revenue Ratio) at first difference*

ADF Test Statistic	-5.173167	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DR,2)

Method: Least Squares

Date: 09/13/05 Time: 11:54

Sample(adjusted): 1968 2000

Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DR(-1))	-1.555672	0.300719	-5.173167	0.0000
D(DR(-1),2)	0.157392	0.183451	0.857955	0.3980
C	0.956076	6.327915	0.151089	0.8810
@TREND(1965)	0.119195	0.298547	0.399250	0.6926

R-squared	0.680203	Mean dependent var.	0.090909
Adjusted R-squared	0.647120	S.D. dependent var.	27.40935
S.E. of regression	16.28217	Akaike info criterion	8.531231
Sum squared resid	7688.161	Schwarz criterion	8.712625
Log likelihood	-136.7653	F-statistic	20.56081
Durbin-Watson stat	2.034019	Prob(F-statistic)	0.000000



#### 4. DSR (Debt Service to Revenue Ratio)

##### *DSR (Debt Service to Revenue Ratio) at level*

ADF Test Statistic	-1.386159	1% Critical Value*	-3.6353
		5% Critical Value	-2.9499
		10% Critical Value	-2.6133

\*MacKinnon critical values for rejection of hypothesis of a unit root.

##### Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DSR)

Method: Least Squares

Date: 09/14/05 Time: 10:41

Sample(adjusted): 1967 2000

Included observations: 34 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DSR(-1)	-0.145705	0.105114	-1.386159	0.1756
D(DSR(-1))	-0.297370	0.169771	-1.751593	0.0897
C	0.145294	0.119366	1.217217	0.2327
R-squared	0.185394	Mean dependent var.		0.029412
Adjusted R-squared	0.132839	S.D. dependent var.		0.576578
S.E. of regression	0.536918	Akaike info criterion		1.678154
Sum squared resid.	8.936704	Schwarz criterion		1.812833
Log likelihood	-25.52862	F-statistic		3.527611
Durbin-Watson stat	1.938698	Prob(F-statistic)		0.041657

##### *DSR (Debt Service to Revenue Ratio) at first difference*

ADF Test Statistic	-4.254358	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DSR,2)

Method: Least Squares

Date: 09/13/05 Time: 11:58

Sample(adjusted): 1968 2000

Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DSR(-1))	-1.305244	0.306802	-4.254358	0.0002
D(DSR(-1),2)	-0.047506	0.185342	-0.256316	0.7995
C	0.112514	0.222726	0.505168	0.6173
@TREND(1965)	-0.003840	0.010448	-0.367547	0.7159
R-squared	0.686004	Mean dependent var.		0.000000
Adjusted R-squared	0.653522	S.D. dependent var.		0.968246
S.E. of regression	0.569933	Akaike info criterion		1.826615
Sum squared resid	9.419875	Schwarz criterion		2.008010
Log likelihood	-26.13916	F-statistic		21.11931
Durbin-Watson stat	2.009516	Prob(F-statistic)		0.000000

5. *ILL (Illiteracy rate)*

*ILL (Illiteracy rate) at level*

ADF Test Statistic	-2.988177	1% Critical Value*	-4.2505
		5% Critical Value	-3.5468
		10% Critical Value	-3.2056

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(ILL)

Method: Least Squares

Date: 09/14/05 Time: 10:43

Sample(adjusted): 1967 2000

Included observations: 34 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ILL(-1)	-0.411585	0.137738	-2.988177	0.0056
D(ILL(-1))	0.029213	0.165302	0.176722	0.8609
C	31.96745	11.03275	2.897505	0.0070
@TREND(1965)	-0.539107	0.174048	-3.097456	0.0042
R-squared	0.268454	Mean dependent var.	-1.235294	
Adjusted R-squared	0.195300	S.D. dependent var.	0.923065	
S.E. of regression	0.828037	Akaike info criterion	2.570612	
Sum squared resid	20.56934	Schwarz criterion	2.750184	
Log likelihood	-39.70041	F-statistic	3.669688	
Durbin-Watson stat	2.006789	Prob(F-statistic)	0.023036	

*ILL (Illiteracy rate) at first difference*

ADF Test Statistic	-4.402821	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

\*MacKinnon critical values for rejection of hypothesis of a unit root.

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Augmented Dickey-Fuller Test Equation

Dependent Variable: D(ILL,2)

Method: Least Squares

Date: 09/13/05 Time: 12:01

Sample(adjusted): 1968 2000

Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ILL(-1))	-1.188535	0.269948	-4.402821	0.0001
D(ILL(-1),2)	0.035680	0.180400	0.197781	0.8446
C	-1.186482	0.421994	-2.811612	0.0087
@TREND(1965)	-0.016754	0.018144	-0.923405	0.3634
R-squared	0.582819	Mean dependent var.	-0.030303	
Adjusted R-squared	0.539662	S.D. dependent var.	1.380327	
S.E. of regression	0.936527	Akaike info criterion	2.819937	

Sum squared resid	25.43543	Schwarz criterion	3.001331
Log likelihood	-42.52895	F-statistic	13.50471
Durbin-Watson stat	2.046912	Prob(F-statistic)	0.000011

## 6. INF (Inflation)

### INF (Inflation) at level

ADF Test Statistic	-3.461344	1% Critical Value*	-4.2505
		5% Critical Value	-3.5468
		10% Critical Value	-3.2056

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(INF)

Method: Least Squares

Date: 09/14/05 Time: 10:46

Sample(adjusted): 1967 2000

Included observations: 34 after adjusting endpoints



Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF(-1)	-0.766443	0.221429	-3.461344	0.0016
D(INF(-1))	0.082665	0.184297	0.448541	0.6570
C	4.608528	4.520822	1.019400	0.3162
@TREND(1965)	0.174117	0.222565	0.782318	0.4402
R-squared	0.352314	Mean dependent var.	-0.088235	
Adjusted R-squared	0.287546	S.D. dependent var.	14.28152	
S.E. of regression	12.05460	Akaike info criterion	7.926900	
Sum squared resid	4359.400	Schwarz criterion	8.106472	
Log likelihood	-130.7573	F-statistic	5.439590	
Durbin-Watson stat	1.959455	Prob(F-statistic)	0.004151	

*INF (Inflation) at first difference*

ADF Test Statistic	-6.695493	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(INF,2)

Method: Least Squares

Date: 09/13/05 Time: 12:04

Sample(adjusted): 1968 2000

Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INF(-1))	-1.836072	0.274225	-6.695493	0.0000
D(INF(-1),2)	0.406889	0.169556	2.399732	0.0231
C	1.760816	5.154243	0.341625	0.7351
@TREND(1965)	-0.089672	0.242457	-0.369846	0.7142
R-squared	0.709721	Mean dependent var.	-0.090909	
Adjusted R-squared	0.679693	S.D. dependent var.	23.40588	
S.E. of regression	13.24672	Akaike info criterion	8.118590	
Sum squared resid	5088.795	Schwarz criterion	8.299985	
Log likelihood	-129.9567	F-statistic	23.63468	
Durbin-Watson stat	1.996951	Prob(F-statistic)	0.000000	

## 7. DE (Debt to Export Ratio)

### DE (Debt to Export Ratio) at level

ADF Test Statistic	-2.239631	1% Critical Value*	-4.2505
		5% Critical Value	-3.5468
		10% Critical Value	-3.2056

\*MacKinnon critical values for rejection of hypothesis of a unit root.

### Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DE)

Method: Least Squares

Date: 09/14/05 Time: 10:49

Sample(adjusted): 1967 2000

Included observations: 34 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DE(-1)	-0.360567	0.160994	-2.239631	0.0327
D(DE(-1))	-0.186296	0.182160	-1.022703	0.3146
C	-107.1300	92.00440	-1.164401	0.2534
@TREND(1965)	14.31399	6.891203	2.077140	0.0464
R-squared	0.245610	Mean dependent var.	23.41176	
Adjusted R-squared	0.170171	S.D. dependent var.	222.5440	
S.E. of regression	202.7263	Akaike info criterion	13.57172	
Sum squared resid	1232938.	Schwarz criterion	13.75129	
Log likelihood	-226.7193	F-statistic	3.255748	
Durbin-Watson stat	1.886493	Prob(F-statistic)	0.035252	

### DE (Debt to Export Ratio) at first Difference

ADF Test Statistic	-4.192523	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DE,2)

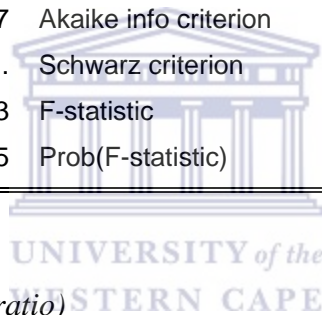
Method: Least Squares

Date: 09/13/05 Time: 12:13

Sample(adjusted): 1968 2000

Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DE(-1))	-1.338044	0.319150	-4.192523	0.0002
D(DE(-1),2)	-0.015648	0.193884	-0.080707	0.9362
C	17.15403	86.57620	0.198138	0.8443
@TREND(1965)	0.961361	4.128616	0.232853	0.8175
R-squared	0.660785	Mean dependent var.	-9.181818	
Adjusted R-squared	0.625694	S.D. dependent var.	364.0271	
S.E. of regression	222.7137	Akaike info criterion	13.76286	
Sum squared resid	1438441.	Schwarz criterion	13.94426	
Log likelihood	-223.0873	F-statistic	18.83053	
Durbin-Watson stat	1.918525	Prob(F-statistic)	0.000001	



8. DSE (Debt Service to export ratio)

*DSE (Debt Service to export ratio) at level*

ADF Test Statistic	-2.235435	1% Critical Value*	-4.2505
		5% Critical Value	-3.5468
		10% Critical Value	-3.2056

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DSE)

Method: Least Squares

Date: 09/14/05 Time: 11:03

Sample(adjusted): 1967 2000

Included observations: 34 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DSE(-1)	-0.610297	0.273011	-2.235435	0.0330
D(DSE(-1))	0.176897	0.246935	0.716371	0.4793
C	-2.806039	2.313549	-1.212872	0.2346
@TREND(1965)	0.516785	0.199988	2.584084	0.0149
R-squared	0.212719	Mean dependent var.		1.205882
Adjusted R-squared	0.133991	S.D. dependent var.		6.366481
S.E. of regression	5.924621	Akaike info criterion		6.506241
Sum squared resid	1053.034	Schwarz criterion		6.685813
Log likelihood	-106.6061	F-statistic		2.701953
Durbin-Watson stat	1.943528	Prob(F-statistic)		0.063188

*DSE at first difference*

ADF Test Statistic	-5.345331	1% Critical Value*	-4.2605
		5% Critical Value	-3.5514
		10% Critical Value	-3.2081

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DSE,2)

Method: Least Squares

Date: 09/13/05 Time: 12:16

Sample(adjusted): 1968 2000

Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DSE(-1))	-1.690678	0.316291	-5.345331	0.0000
D(DSE(-1),2)	0.386901	0.224704	1.721828	0.0958
C	-1.055623	2.416740	-0.436796	0.6655
@TREND(1965)	0.151304	0.115504	1.309944	0.2005
R-squared	0.651036	Mean dependent var.		0.000000
Adjusted R-squared	0.614936	S.D. dependent var.		9.987492



S.E. of regression	6.197591	Akaike info criterion	6.599411
Sum squared resid	1113.894	Schwarz criterion	6.780806
Log likelihood	-104.8903	F-statistic	18.03435
Durbin-Watson stat	2.189239	Prob(F-statistic)	0.000001



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