THE DETERMINANTS OF THE PERFORMANCE OF TRADABLE EQUIPMENT AND NON-TRADABLE STRUCTURES INVESTMENT IN UGANDA.

CHARLES AUGUSTINE ABUKA
University of Pretoria
School for Economic Sciences
Department of Economics April 2003
Contact E-mail Address: caabuka@avu.org

Abstract
Aggregate dmnges in an economy's capital stock can be disaggregated int o tradable capital equipment and non-tradable structures investment and depending on tjie circumstances involved, tJiese two types of investment can respond in different ways to various shocks. Casual observation suggests .that decomposing investment data int o equipment and structures may be important in analysing the behaviour of aggregate investment. Models, which do not distinguish bettveen equipment and structures, may not adequately explain aggregate investment response and measures of investment response that fail to make the desegregation risk systematic bias. These bias results because investment in these two areas is not undertaken infixed proportions. Tills study will present a stylised analysis of tlie performance of equipment and structures investment in Uganda from 1980 to 2002; estimate models to extract the differential impacts of tlie terms of trade shocks, aid and erratic infrastructure services. To fix the ideas, factors deemed to be of specific importance for each type of investment are included t o account for its evolution over the period under review. It hopes to derive lessons that could inform future policy.
KEY WORDS: Equipment, Structures, Tradable, Non-tradable, Infrastructure and Investment**.**

Introduction and Problem Statement

The focus of most studies has been on the traditional determinants of aggregate investment performance in African economies. However, the unique responses of equipment and structures investment to various shocks have not been adequately investigated. This proposal seeks to contribute to work in this area by drawing on Uganda's experience. Collier and Gunning's (1996) analysis suggests that decomposing investment data into tradable capital (equipment) and non-tradable capital (structures) may be important in analysing the behaviour of aggregate investment. This study recognises that there are important external and internal dynamics that may affect the composition of investment spending in an economy.

Some of the external dynamics arise from terms of trade effects. It is conceivable that compositional changes in investment could be related to absolute changes in the income of agents that follows an improvement or deterioration in the terms of trade. In the Ugandan case terms of trade movements during the period under investigation were mainly driven by temporary coffee shocks. These shocks affected relative prices such as the real exchange rate. For example an appreciation

of the real exchange rate due to an improvement in the terms of trade makes tradable machinery and equipment cheaper while depreciation, increases the price of tradable equipment relative to non-tradable structures investments. This line of reasoning can help settle the issue of whether compositional shifts in investment relate to changes in this key relative price. Some of the external factors alluded to above, could be in the form of capital inflows. These inflows are mainly in the form of aid and private remittances. Abstracting from other forms of inflows we follow a suggestion that in an aid dependent economy such as Uganda, aid inflows could have a differential impact on tradable and non -tradable investment. Aid increases the amount of tradable goods in the economy, pushing up the relative price of non-tradable goods and shifts resources a way from tradable investment (Arrellano et al, 2002).

Literature on the impact of trade shocks suggests that the state of the financial sector is an important determinant of how windfall incomes may be intermediated. T his leads us to examine whether the state of the domestic financial system could play a role in encouraging non-tradable capital investment while penalising tradable capital investment This is because temporary improvements in the earnings of agents, beca use of poor domestic financial markets cannot be appropriately intermediated. Indeed the resultant higher savings from increased incomes are directed towards acquisition of domestic non-tradable assets such as buildings (Jayasuriya, 1999).

Other important considerations relate to the pattern of government reconstruction expenditure. Government spending on reconstruction has largely dominated the post war recovery efforts in Uganda. Literature suggests that government reconstructionexpenditure tends to be non-tradable intensive. We investigate whether; the pattern of government expenditure had differential impacts on tradable and non-tradable investment over the period in question (Harrigan, 1999). In addition, depreciation allowances provided under the tariff schedule and the spread between the domestic lending and savings rates could have been important determinants of investment over the period under review.

The study by Reinikka and Svensson (1999) suggest that in a situation where poor infrastructure is a binding constraint at micro level, it could indeed have differential effects on the performance of machinery and equipment versus structures investment. This is because uncertainties regarding public utilities (such as power and telecommunications) are important determinants of firm level manufacturing investment patterns. This line of argument is important in the sense that erratic public infrastructure forces firms to spend on facilities such as own generators, power stabilisers and water storage. This may affect the composition of investment.

In summary, the analysis suggests that compositional shifts in aggregate investment could be related to terms of trade changes, aid inflows, real exchange rate, the pattern of government expenditure, the state of the financial sector constraints and erratic infrastructure services. Using Ugandan time series data on

tradable and non-tradable investment we attempt to sign the effect of each of these factors over the period 1980 to 2002 and suggest implications for policy.

Study Objectives

The main objectives of this study are twofold;

(i) Investigate the factors that have led to differential performance of tradable capital and non-tradable structures investment in Uganda.

(ii) Use the results of the exercise in (i) above to derive policy lessons for the future.

Hypotheses

The underlying basis of the study is that decomposing investment data into tradable capital (equipment) and non-tradable capital (structures) is important in analysing investment behaviour. In the light of this, we specifically investigate the following hypotheses in our two models:

(i) Terms of trade movements generate differential impacts on components of aggregate investment. This is because terms of trade improvement leads to a real exchange rate appreciation which makes tradable machinery and equipment cheaper while the reverse movement raises the price of tradable equipment relative to non -tradable structures investments.

(ii) Aid has a differential impact on tradable and non-tradable investment Aid increases the amount of tradable goods in the economy, pushing up the relative price of non-tradable goods and shifts resources a way from tradable investment,

(iii) Different aspects of the state of the domestic financial sector affect different types of investment in different ways. For example a poor state of the financial sector may encourage non-tradable capital investment while penalising tradable capital investment. This is because temporary improvements in incomes of agents in the economy are not well intermediated because of poor domestic financial markets. The net result is that higher savings are directed towards acquisition of domestic non-tradable assets such as buildings. On the other hand the interest rate sp read may be important for firms that borrow to finance the import of equipment.

(iv) Erratic infrastructure leads firms to allocate spending differentially as between machinery and equipment versus structures investment.

(v) There are also factors that we think could be important for the specific types of investment. For example, government expenditure has a positive impact on non -tradable investment. This is because government reconstruction expenditure is non-tradable intensive. Other specific factors relate to provisions for depreciation allowances. These are likely to be important for equipment investment.

Structure of the Study

The remainder of the proposal is organised as follows. Section 2 presents background information on Uganda's macroeconomic and investment performance. Part three examines various underlying theoretic and empirical aspects regarding the behaviour of equipment and structures investment. The last

and final section presents the methodological issues and suggested manner of empirical implementation.

Macroeconomic and Investment Performance

Macroeconomic Performance

During the period 1980 to 1987 the Ugandan economy was characterised by heavy involvement by the state in economic activity. This involvement was par tly reflected in the pursuit of an import substitution strategy, without due regard to competitiveness. There was recourse to protectionism through an array of tariff and non -tariff barriers while the existence of an overvalued exchange rate helped distort domestic terms of trade. The level of distortion was reflected in the high premium between the official and parallel market exchange rates, which reached 1000%, by January 1987. In the repressed financial sector, resource mobilisation collapsed as the monetary sector contracted and monetary depth fell significantly.

The year 1987 marked the beginning of policy reversal. This was mainly through the restoration of monetary and fiscal discipline in addition to deregulation, which provided incentives for efficient capital accumulation. The reduction of excessive government borrowing significantly reduced inflation. Complimentary policies also came via the reduction in marginal personal income tax rates, corporation tax rates and import tariff bands. There was a lowering of the marginal personal income tax rate from 60 per cent in 1989 to 30 per cent along with a broadening of the tax category. In tandem, there was a reduction of the corporate income tax to 30 per cent, which is the same as the top personal income tax rate. Initial action to streamline investment incentives was also under taken. Furthermore, there was a rationalisation of import tariffs with a reduction in the number of tariff bands initially to four from six and a compression of the tariff band to 0-30 per cent from 0-50 per cent. The tariff band was lowered further to 0-20 per cent in 1997. In a nutshell, tax reforms have included the replacement of the complicated structure of sales and other indirect taxes by a uniform VAT system. The reforms also involved the simplification and the reduction of duty rates, and the implementation of the 1997 Income Tax Law, which eliminated exemptions and preferential tax rates, which had characterised direct taxation.

The internal trade and marketing system and domestic prices were also deregulated and, as a complement surrender requirements, foreign exchange rationing and import licensing were abolished with the liberalisation of the current and capital accounts. Privatisation became the official policy as the need to reduce public ownership and subsidies gained popular support. Reforms were effected in the financial sector with the aim of promoting efficiency and competition in financial intermediation. As a result interest rates were liberalised and free entry and exit allowed into the financial system. As a result, Uganda reversed policy and management failures that were destructive to the economy and investment climate. Economic fundamentals were restored while state commercial misadventures were addressed through privatisation. Income per capitarose in real terms. Annual inflation was brought down from the three digit levels of the late 1980's to 30 per cent in 1993, 7.1 per cent in 1997 and further down to 5.9 per cent in 2002. Good performance on inflation came from deceleration in the annual rate of growth of

broad money (M2) from over 176.7 per cent in 1987 to 7.9 per cent per annum in 1998 and 8.5 per cent per annum in 2002.

In spite of the substantial improvement in the macro aggregates, the ratio of broad money to GDP remains low even by sub-Saharan African standards. This appears to reflect residual problems with the underlying structure of the domestic financial system (Wandera (2002). The ratio of broad money to GDP improved from 9.2 percent in 19 80 to 12.3 percent in 1993. The average ratio over the period 1994 to 2001 has been about 12.4 percent of GDP. Ugandan spreads between the lending and deposit rates have also remained high. This could have an impact on the behaviour of would be borrowers a nd the level of investment in the economy. During the period under review, the spread rose from 4 percent in 1980 to an average of 17.6 percent over the period 1996 to 2000.

Table 1 provides some indicative macroeconomic numbers, which are important for our analysis. For example, two episodes of improvement regarding the terms of trade can be identified. The first was during 1983 to 1986 when the index rose from 286.6 to 303.4 which is an improvement of 5.9 percent and the second episode was during 1994 to 1995 when the index improved from 169.5 to!94,6. This represented a growth of 14.8 percent. All the improvements appear to be related to the increase in the international coffee price. Regarding the real exchange rate a marked depreciation occurred durin g 1990 to 1992 where the index moved from 98.9 to 105.6 a depreciation of 6.8 percent. An appreciation in the real exchange rate was recorded in 1994/95 were the index moved from 98.9 in 1993 to an average of about 80.1 in 1994 -95. The real exchange rate index depreciated by 21.8 percent over the period 1997 to 2001, coinciding with a period in which terms of trade also declined.

TABLE 1. UGANDA: SOME INDICATORS OF MACROECONOMIC PERFORMANCE 1995-2001

Indicator	1995	19%	1997	1998	1999	2000	2001
Real GDP Growth	8.4	4.7	5.3	9.1	6.2	4.8	6.4
GDI % of GDP	18.7	18.4	18.2	20.2	213	21.6	22.4
Private Investment % of GDP	12.8	13.3	13.4	14.5	14.8	14.6	15.7
Public Investment % of GDP	5.9	5.1	4.9	5.7	6.5	6.9	6.7
Aidasa%ofGNI	14.7	11.3	13.0	9,6	9.2	133	13.0
Terms of Trade (1991=100)	194.6	165.6	180.5	165.2	149.1	141.6	134.5
Real Exchange Rate (1991=100)	81.2	80.6	75.0	84.5	88.5	92.9	97.6
Broad Money (M2) to GDP Ratio						123	12.4
Lending Rate (a)	20.2	20.3	21.4	20.9	21.6	22,9	
Deposit Rate (b)	3.1	3.2	3.8	4.1	3.9	4.0	
Interest Rate Spread (a-b)	17.1	17.1	17.6	16.8	17.7	18.9	

Source: Bank of Uganda, Uganda Bureau of Statistics.2001 .Statistical Abslra c t. Republic of Uj

Background to the Budget 2002/2003.

Uganda has received substantial amounts of aid during the period under review. According to the African Development indicators (2002) aid as a percentage of GNI increased from 9.2 percent in 1980 to a peak of 26.2 percent in 1992. Over the period 1995 to 2000 it averaged 11.8 p ercent In per capita terms, it rose from US$ 8.9 in 1980 to US$ 36.9 in 2000. Parts of the aid inflows from donors relate to reconstruction expenditures and debt relief initiatives. In response, there was an increase in foreign exchange reserve cover. Foreign exchange reserves in June 2000 fiscal year covered 4.4 months of imports of goods up from only 2.2 months cover in 1992.

One of the environments in Uganda, which deserves attention, is erratic infrastructure services at the firm level. A number of inefficiencies have been identified in utility provision and distribution (Reinikka and Svensson (1998). These conditions are characterised by an uncertain, erratic and irregular supply of electricity. The attendant power surges and widespread load shedding often interrupt operations and result in under capacity utilisation. Utilities in Uganda suffered from such chronic under investment, poor maintenance and service reliability for a long time that they represented a severe obstacle to the conduct of business and the attraction of investment. These services were poorly managed, provided under monopoly conditions by state enterprises that were in disastrous financial conditions. *Telecommunications services* in Uganda had an appalling record of low penetration rates, long waiting times for connection and poor quality. Such a quality of services affected investment andimprovement of the business environment required attention to problems of infrastructure bottlenecks (UNCTAD (1999) and Reinikka and Svensson (19 99).

Performance of Equipment and Structures Investment in Uganda

At constant prices the share of investment in GDP was 13.5 per cent in 1983 it rose to 22.9 per cent in 1995 before winding down to 21.2 per cent in 1999 and 20.1 per cent in 2001 (see tables 3 and 4). The composition of investment between public and private appears to have changed radically. In 1987 public investment was 11.1 per cent of GDP; this was higher than the 10.7 per cent share of GDP in private investment while in 1988 the shares were approximately equal. By 1995 private investment was double public investment.

Equipment investment (machinery and vehicles) when measured at constant prices rose from 5.4 percent of GDP in 1983 to a peak of 11.1 percent of GDP in 1987. It dro pped in the next three years before recording 7.1 percent of GDP in 1990. The downward trend in the share of machinery and vehicles seems to have continued in the 1990's with a peak level of 9.0 percent of GDP only attained in 1995 during the coffee boom p eriod. Otherwise tradable capital as a share of GDP has averaged just about 6.3 percent of GDP over the twelve-year period from 1990 to 2001. This period was also characterised by structural adjustment and significant liberalisation of the economy.

Again measured at constant prices, the share of structures investment in GDP has tended to dominate. Structures investment increased from 8.1 percent of GDP in

1993 to reach 9.5 percent of GDP in 1987 and closed the nineteen eighties at 10.3 percent of GDP. In the 1990's the share of construction continued to increase reaching a peak of 15.4 percent of GDP in 1999. During the period 1990 and 2001 it averaged about 13.4 percent of GDP. If indeed the conjunction that the bias in aggregate investment towards structures is an optimal reaction to the nature of income shock and other binding constraints then casual evidence suggests that this period can be analysed to help explain differential performance between the two classes of investment in Uganda. The role of income shocks (terms of trade, capital inflows), state of the financial system and deficient public infrastructure in this process becomes paramount. Figures 1,2,3 and 4 show the evolution of the terms of trade, real exchange rate, structures and equipment investment.

TABLE 2: INVESTMENT AS A SHARE OF GDP AT MARKET PRICES, 1983 - 1992

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
					Current Prices					
Fixed Investment	9.0	9.4	8.3	9.5	12.3	11.3	11.4	15.2	17.4	15.7
Private	7.0	7.2	6.6	5.4	5.7	5.7	5.8	7.8	9.3	8.7
Public	2.0	2.3	1.7	4.1	6.6	5.7	5.6	7.4	8.1	7.0
Equipment	3.0	3.4	3.0	3.7	5.8	4.6	4.5	6.2	6.8	5.5
Private	1.6	1.8	1.6	1.9	3.1	2.4	1.6	2.6	3.1	2.6
Public	1.4	1.6	1.4	1.7	2.7	2.1	2.9	3.6	3.7	2.9
Structures	6.0	6.0	5.3	5.8	6.6	6.8	6.9	9.0	10.5	10.2
Private	4.4	4.3	4.0	4.4	4.1	4.4	4.2	5.2	6.1	6.1
Public	1.6	1.7	1.2	1.4	2.5	2.5	2.7	3.8	4.4	4.1
					Constant 1991 Prices					
Fixed Investment	13.5	13.4	13.5	15.1	21.7	19.7	18.4	18.0	17.4	16.2
Private	7.7	7.4	7.8	8.4	10.7	9.8	7.9	8.7	9.3	9.2
Public	5.8	6.0	5.7	6.6	11.1	9.8	10.4	9.3	8.1	7.0
Equipment	5.4	5.3	5.8	7.1	11.1	9.3	8.0	7.6	6.8	5.5
Private	2.8	2.8	3.1	3.7	5.9	4.9	2.8	3.2	3.1	2.6
Public	2.5	2.5	2.7	3.3	5.2	4.4	5.2	4.4	3.7	2.9
Structures	5.4	5.3	5.8	7.1	11.1	9.3	8.0	7.6	6.8	5.5
Private	2.8	2.8	3.1	3.7	5.9	4.9	2.8	3.2	3.1	2.6
Public	2.5	2.5	2.7	3.3	5.2	4.4	5.2	4.4	3.7	2.9

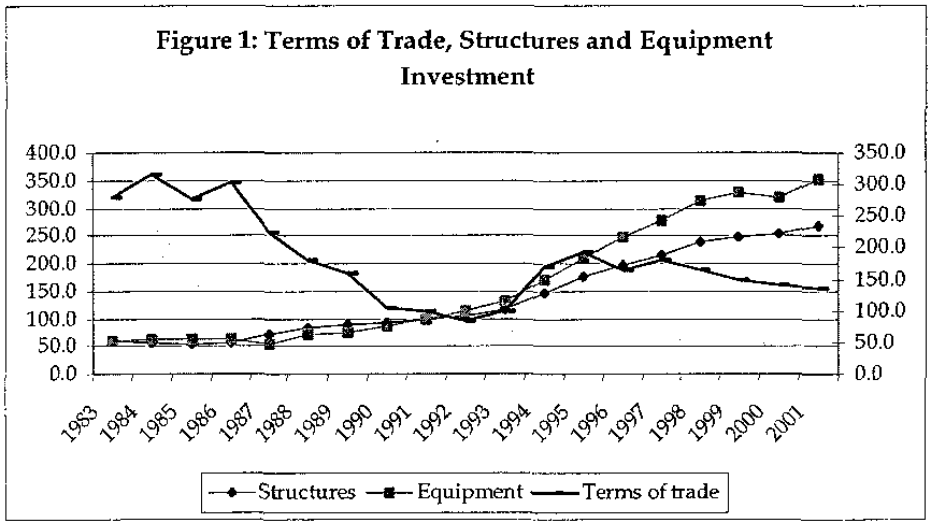
Source: Uganda Bureau of Statistics

TABLE 3: INVESTMENT AS A SHARE OF GDP AT MARKET PRICES, 1993 - 2001

	1993	1994	1995	1996	1997	1998	1999	2000	2001
					Current Prices				
Fixed Investment	17.2	15.9	18.7	18.4	18.2	20.2	21.3	21.6	22.4
Private	10.4	10.6	12.8	13.3	13.4	14.5	14.8	14.6	15.7
Public	6.8	5.3	5.9	5.1	4.9	5.7	6.5	6.9	6.7
Equipment	5.7	5.0	6.7	4.8	4.8	5.5	5.9	5.6	5.6
Private	3.0	3.0	4.1	2.9	3.5	3.8	3.6	3.7	3.8
Public	2.7	1.9	2.6	1.9	1.3	1.7	2.3	1.9	1.8
Structures	11.4	10.9	12.0	13.6	13.5	14.7	15.4	15.9	16.8
Private	7.4	7.5	8.7	10.4	9.8	10.7	11.2	10.9	11.9
Public	4.0	3.4	3.3	3.2	3.6	4.0	4.2	5.0	4.9
					Constant 1991 Prices				
Fixed Investment	16.3	19.1	22.9	21.2	21.4	21.8	21.2	20.2	20.1
Private	9.9	12.5	15.1	14.7	15.0	15.2	14.4	13.6	14.0
Public	6.4	6.6	7.8	6.5	6.4	6.6	6.8	6.7	6.1
Equipment	5.3	6.4	9.0	6.3	5.9	6.1	5.7	5.2	5.2
Private	2.8	3.9	5.6	3.8	3.4	3.3	2.7	2.7	2.7
Public	2.5	2.5	3.5	2.5	2.5	3.1	3.6	2.8	2.7
Structures	11.1	12.7	13.9	14.9	15.5	15.7	15.4	15.0	14.9
Private	7.1	8.5	9.5	10.9	11.6	12.0	11.8	11.0	11.4
Public	3.9	4.2	4.3	4.0	3.9	3.8	3.7	4.0	3.6

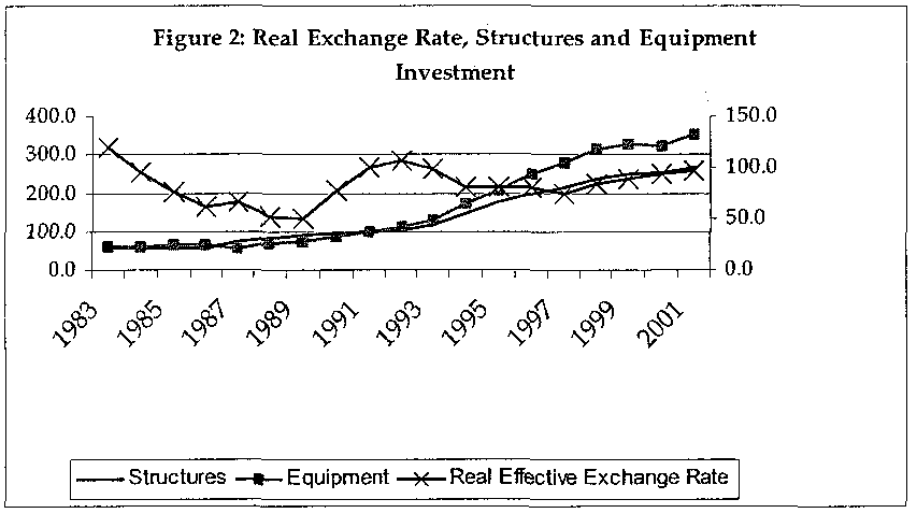
Source: Uganda Bureau of Statistics

FIGURE 1: TERMS OF TRADE, STRUCTURES AND EQUIPMENT INVESTMENT



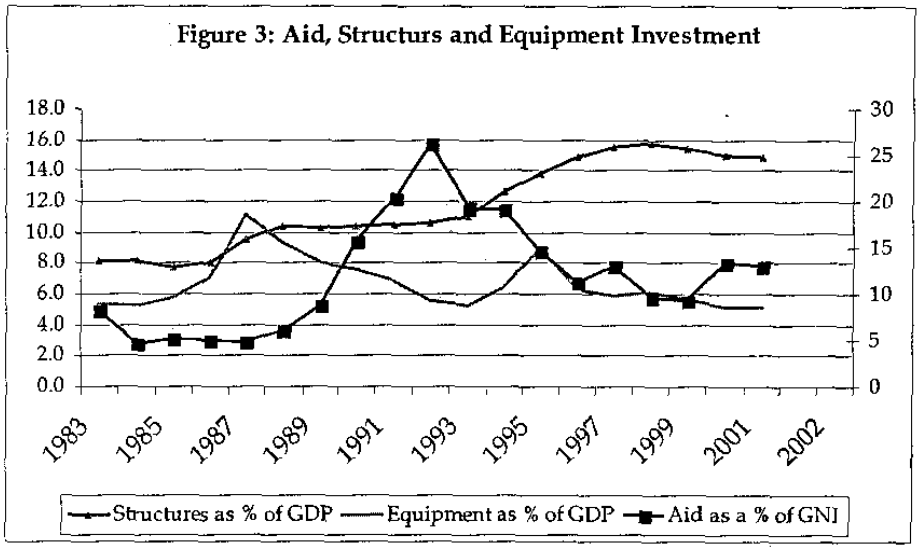
Source: Bank of Uganda and Uganda Bureau of Statistics

FIGURE 2: REAL EXCHANGE RATE, STRUCTURES AND EQUIPMENT INVESTMENT



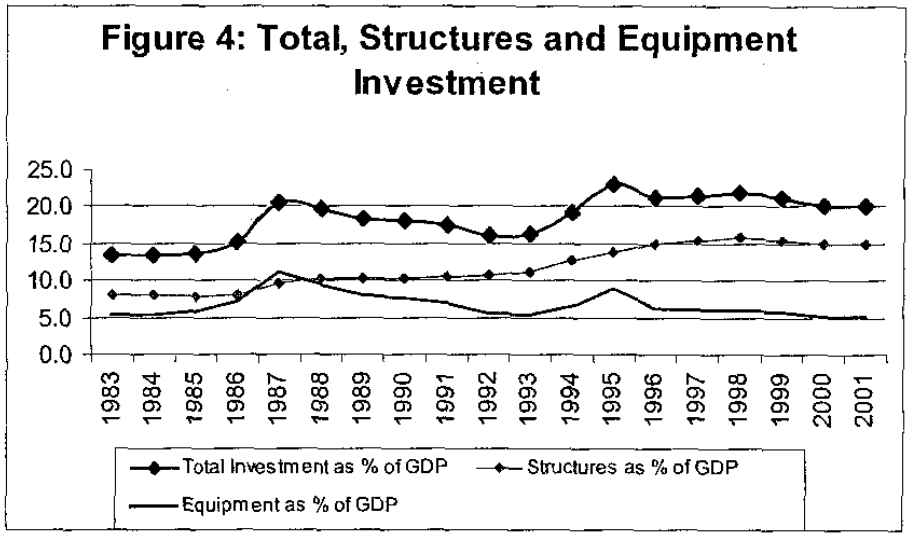
Source: Bank of Uganda and Uganda Bureau of Statistics

FIGURE 3: AID, STRUCTURES AND EQUIPMENT INVESTMENT



SOURCE: WORLD BANK AND UGANDA BUREAU OF STATISTICS

FIGURE 4: TOTAL, STRUCTURES AND EQUIPMENT INVESTMENT



Source: Uganda Bureau of Statistics

Review of the Theoretical and Empirical Literature

In this section we investigate models that specifically assist us in understanding what might cause compositional shifts in aggregate investment. These issues may need to be looked at in terms of agents' responses to income shocks. Since relative prices are affected, different responses in performance with respect to equipment and structures investment could result. In addition, when an economy is faced with transitional dynamics because of structural transformation, it could experience shifts in the sectoral allocation of capital. Given this background, the critical issue becomes one of delineating factors that determine movements in the pattern of investment spending from sectors that are tradable capital intensive to those that are non-tradable capital intensive. It is to some of these practical issues that we now turn.

Behaviour of Equipment and Structures Investment

In the Dutch Disease theory an income shock has two effects namely a relative price effect and a spending effect. In this theory, an improvement in the *terms of trade* increases the price of an exportable item. This increase not only alters the export items relative price, it also affects it's relative profitability. The key point is that the resulting increase in national income leads to higher expenditures on both tradable and non-tiadable goods. In a small open economy, which faces exogenously given tradable goods prices, this higher demand for tradable goods is met by higher imports without any price change. However, the higher demand for non-tradable goods whose prices are determined by domestic supply and demand leads to an increase in their prices as well as their relative profitability. The spending effect tends to raise the relative prices of non-tradable goods to tradable goods, that is, it appreciates the rea 1 exchange rate.

Depending on the relative magnitudes of the relative price and spending effects, and the factor intensities, the non-tradable sector may expand or contract (Jayasuriya 1999:233). However, the diminished relative profitability of the tradab le goods sectors, which are unaffected by the export price increase, unambiguously leads to their contraction.

Analysis of construction booms on the other hand assumes that agents have access to well-functioning capital markets and can correctly anticip ate temporary shocks. Under this framework, the permanent income hypothesis would predict that such shocks lead primarily to savings rather than expenditures. The implication of this statement is that the spending effect in Dutch disease literature would be minor. Significant effects would mainly be in the asset markets. The resulting increased savings can be held in many forms depending on the range and characteristics of available assets. Hence factors such as the nature of the *domestic financial system* and the capital market, the exchange regime, the nature of controls on foreign asset acquisition and the degree of integration of the domestic and world capital markets become important. In many developing countries private agents are constrained in their capacity to acquire foreign assets and domestic financial markets are insulated, to varying degrees, from the world markets (Jayasuriya 1999:234). In these circumstances, higher savings resulting from a positive shock, perceived as being temporary, would b e directed towards acquisition of domestic

assets including non-tradable capital goods such as buildings. In Dutch disease literature, increased spending leads to higher prices of non-tradable consumer goods and services. In construction booms, higher dema nd for assets leads to increase in prices of non-tradable assets, such as buildings and generates a construction boom. To the extent that part of the savings are deposited in the domestic financial sector, there will be a downward pressure on domestic interest rates, such deposits will facilitate easing of liquidity constraints; hence, investment is encouraged.

The theory of construction booms combines the Dutch disease disagregation of goods into tradable and non-tradable with an inter -temporal analysis. Here, the construction sector is the major beneficiary of the external shocks. A construction boom that results is much more pronounced than the primary export boom that induced it. The line of argument is that since capital is partly non-tradable, its price rises due to an increase in investment. Because individuals can hold foreign assets, they can protect the real value of the windfall savings and return these when capital prices have fallen. It is therefore, optimal to continue investing domestically after the end of the commodity boom. This argument gives a central role to foreign assets. In their study of the Kenyan coffee boom Bevan, Collier and Gunning (1999:66) indicate that it led to a massive increase in the demand for non-tradable capital goods, giving rise to a construction boom. The reason why windfall savings must be translated into investment plans is simple. It is easier to increase purchases of tradable capital goods rapidly because these can be imported. It is more difficult to increase the purchases of non-traded capital largely because land must be purchased and buildings designed before they can be gradually constructed. The Ivorian Cocoa and Coffee boom according to Ghanem (1999) led to a construction boom with an appreciation of the *real exchange rate* and a rise in the price of non-tradable investment goods relative to non -traded consumption goods.

De Long and Summers (1991) indicate that investment externalities result from tradable equipment investment but not from non-tradable structures investment because only machines embody most advances in technical knowledge. Manufacturing also accounts for the largest component of private research and development. It is plausible that equipment investment will give rise to important external economies. In addition, countries investing more heavily in and enjoying lower equipment prices should grow more rapidly.
One important implication of the above result is that since commodity booms result in a higher relative price of non-tradable capital goods, substitution effects will favour equipment investment. Hence, it is possible for a construction type boom to result even if capital is sector specific. This is because the spending effect raises the marginal productivity of capital in the product! on of non-tradable consumption goods. The same effect is true even when investment needs the services of non-tradable capital goods. It is argued that during investment booms, there will be a bias towards equipment This is because structures require time to plan and construct and, in the aggregate must compete for limited non-tradable goods supply. However, equipment can be imported (Collier and Gunning, 1999:33). Equipment investment according to this view is more effective in

generating growth than structures investment. Again, evidence (Devarajan, 1999) for Cameroon suggests that if investment is skewed heavily towards structures, it reduces the overall return on investment. This is in part because structures lack the growth externalities of capital equipment and mainly because the unit cost of structures rises.

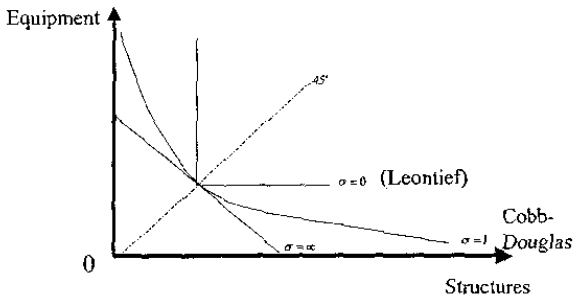
An increase in spending income can also come from an exogenous capital inflow. Some of these inflows are in form of aid (Arellano et al 2002) and private remittances (Azam and Shahabuddin 1999). In the case of a massive *inflow of aid,* this has been shown to increase the amount of tradable goods in the economy, this pushes up the relative price of non tradable goods and shifts resources away from tradable investment. Aid shifts resources towards the non-tradable sector causing the tradable sector to reduce in relative size, even if the amount of resources available for consumption increases (Arellano et al 2002:16).

Political economy literature places emphasis on the role of government during perio ds in which there is massive reconstruction of the economy. *Government spending* may provide services, which are productive, either because they enhance private production or because they are a direct utility to private agents, it will alter the pattern of demand and may in consequence alter the relative price of non-tradable goods. The high share of structures during investment booms may be due to the disproportionate involvement of the public sector as this kind of investment is frequently in infrastructure. Investment might be undertaken by government, which may choose low return infrastructure projects. In Africa, this kind of response has been uncovered (Harringan 1999) in Malawi. Indeed, for Malawi, the income boom resulted in an immediate increase in the demand for non-traded capital goods. The increase in the demand for non-traded capital goods was much larger than that for traded capital goods hence implying a construction boom in the public sector. However, most of the projects were poorly chosen with low rates of return and so did little to increase the economy's permanent income.

Private Sector Response to a Temporary Shock

Figure 5 shows the producer preferences of equipment and structures, which is robust enough to encompass all the possibilities; the fixed coefficient or Leontief case, the Cobb-Douglas and the perfect substitution case.

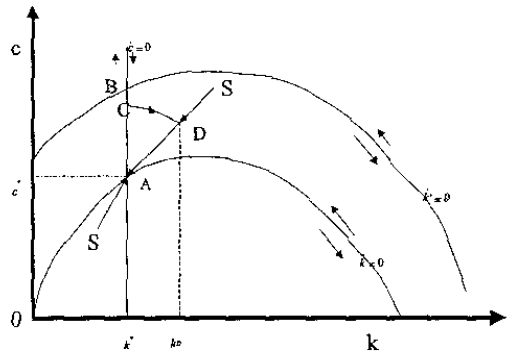
Figure 5: Producer Preferences of Equipment and Structures



Source: Adapted from Heathfield and Wibe(1987) p.97

Figure 6 is a phase diagram, based on private agents' responses to temporary shock. The detailed derivation is in Appendix 1.

Figure 6:Private Response to a Temporary Shock



There are two paths which converge to the steady -state equilibrium at A; these form the stable branch SS. The initial equilibrium is at A, where c and k are both constant. This is the Modified Golden rule steady state level of c and k. The aid shock shifts the $\dot{k} = 0$ locus upwards to $\dot{k}' = 0$. If the boom were permanent, equilibrium would shift instantaneously to point B: the extra income would simply be consumed. With a temporary aid inflow, consumption will not rise to the full extent. Adjustment starts at point C, which lies below $\dot{k}' = 0$, hence k increases as c falls along the path CD. When the aid inflow ends, the $\dot{k}' = 0$ locus shifts back to its original position so that point D now lies above the locus. Hence after aid stops, the economy moves to the left in the diagram; the k and fall to its initial level.

Therefore, adjustment to a temporary shock involves two phases. During the first phase, the structures -equipment capital stock increases as part of the aid income is invested. One possible reason for this is that, government investment is structures -intensive. The other reason is that aid drives a wedge between the relative prices of tradables (equipment) and nontradables (structures) in favour of the latter. What could be happening in the Uganda case (more structures) could be transitional dynamics whereby the country is moving from point C to D. In the post aid period, the investment is reversed, enabling a higher consumption level (see also Collier and Gunning, 1999).

Empirical Model for Equipment and Structures Investment

In summary, the above theoretical and empirical review suggests a number of testable propositions regarding the behaviour of tradable and non-tradable investment. It is possible to test some of these propositions in the Ugandan case. The first, of these propositions is that changes in tradable and non-tradable investment should be related to the absolute magnitude of the income shock from the *terms of trade* improvement. This is the common strand in export commodity booms (Ghanem 1999, Bevan Collier and Gunning 1999). In addition, terms of trade movements also affect the real exchange rate which is important for

investment, a depreciation in the real exchange rate increases the price of tradable goods relative to non-tradable goods and vice versa. In periods when real effective exchange rate appreciates tradable machinery and equipment will be cheaper than the non-tradable (Collier and Gunning 1999).

Another key idea relates to capital inflows. For example, it is argued that *aid* increases the amount of tradable goods in the economy. This pushes up the relative price of non -tradable goods and shifts resources a way from tradable investment (Arellano et al 2002:16). Compositional shifts in investment could therefore be related to how agents perceive the income shock from the aid inflows. It is also argued that in circumstances of *poorly developed financial systems,* higher savings resulting from a temporary positive income shock will be directed towards acquisition of domestic non -tradable capital goods such as buildings rather than tradable capital equipment 0ayasuriya 1999). This is also an important testable proposition.

The other propositions relate to infrastructure and government spending. It is argued that, in an environment of *erratic infrastructure services* firms allocation of spending towards of tradable and non tradable investment is affected. Lastly, government reconstruction spending is intensive in non-tradable rather than in tradable goods (Harrigan 1999). Given these propositions our equations for equipment and structures investment are specified below.

The Equipment Investment Equation

The important factors in the equipment equation relate to the effect of the real exchange rate *(rer),* and the impact of erratic infrastructure services (epi)**.** Two other factors that we argue are specific to equipment investment relate to the interest rate spread (rs) and the provisions for depreciation allowances *(da).*

$$Ln\left(\frac{I_e}{gdp}\right)_t = \beta_0 + \beta_1 \ln(rer)_t + \beta_2 \ln(rs)_t + \beta_3 \ln(da)_t + \beta_4 \ln(epi)_t + \varepsilon_{et} \qquad (1)$$

We expect the following relationships to obtain;

$\beta_1 > 0,\ \beta_2 > 0, \beta_3 > 0, \beta_4 > 0,$

The Structures Investment Equation

In the structures equation, die important factors relate as in the case of equipment investment to the effect of the real exchange rate *(rer),* and the impact of erratic infrastructure services (epi). Again we argue that the state of the financial system represented by the ratio of broad money to GDP $\left(\frac{m2}{gdp}\right)$ and government expenditure $\left(\frac{gov}{gdp}\right)$ are factors that are specific to infrastructure investment.

$$Ln\left(\frac{I_s}{gdp}\right)_t = \phi_0 + \phi_1 \ln(rer)_t + \phi_2 \ln\left(\frac{gov}{gdp}\right)_t + \phi_4 \ln(epi)_t + \varepsilon_{st} \qquad (2)$$

As in the case above, we expect the following relationships to obtain;

$\phi_1 < 0, \phi_2 < 0, \phi_3 < 0, \phi_4 < 0$

The Real Exchange Rate Equation

Given the direct quotation of the exchange rate (i.e.Ush/$), it is postulated that the real exchange rate is affected negatively by the terms of trade *(tot)* and aid to GDP ratio $\left(\frac{aid}{gdp}\right)$

$$Ln(rer) = \gamma_0 + \gamma_1(tot)_t + \gamma_2 \ln\left(\frac{aid}{gdp}\right)_t + \varepsilon_{rert} \qquad (3)$$

This means that an increase in the independent variables leads to an appreciation of the real exchange rate.

Equations 1,2 and 3 form a system of simultaneous equations. The Greek letters are structural coefficients and hypothesis tests will be made upon their signs and magnitudes. However, the simultaneous equations suffer from simultaneity bias since the expected values of the estimated structural coefficients may not be equal to the true structural coefficients. In view of this, we use simultaneous equation techniques.

To ensure that numerical estimates of the structural coefficients can be recovered from estimated reduced-form coefficients (impact or short-run multipliers), the order and rank conditions of identification are used. Using the two techniques, the system is overidentitled (Appendix 2).

In view of the overidentification, we will use three-stage least squares (3SLS). 3SLS is the two-stage least squares version of the Seemingly Unrelated (SUR) method. The 3SLS estimator takes account of the fact that the structural equations may be disturbance related and makes use of the covariance matrix of the distur bances among the equations within the framework of SUR (Judge etal. 1988, p.655). It is thus asymptotically more efficient than the two-stage least squares estimator. Indeed the asymptotic covariance matrix of the 3SLS is identical with that of the Full Information Maximum Likelihood (FIML).

Data Sources

Secondary data covering the period 1980 to 2002 will be obtained mainly from institutional publications. From of the Bank of Uganda use will be made of the institutions Annual and Quarterly Economic Reports. The Ministry of Finance Planning and Economic Development will be relied on for various Budget Speeches and publications of the Background to the Budget series. The Uganda Bureau of Statistics will provide data from its Statistical Abstract series and Key Economic Indicators. Publications of the international financial institutions such as the African Development Bank International Monetary Fund and the World Bank will also be consulted.

Data will be gathered on total investment expenditure broken down into construction and machinery components. These aggregates will be collected in both current and constant price series. Data on Gross Domestic product will also be obtained as well as that on the ratios of construction, machinery investment to G DP at constant and current prices. Other variables on which data will be obtained relate to the real exchange rate, terms of trade, broad money, deposit and

lending rates, and measures of infrastructure, government expenditure and provisions for depreciation allowances in the finance bill.

References

Arellano, C. (2002). *Aid and Tradable goods in Aid-Dependent Countries*. International Monetary Fund Washington DC

Azam, J.P and Shahabuddin, Q. (1999). The Remittance Boom in Bangladesh, 1978 -86 in *Trade Shocks in Developing Countries,* edited by P. Collier and J.W. Gunning (Oxford University Press).

Bevan CoIlier, P and Gunning, J.W. (1999). Anatomy of a Temporary Trade Shock: The Kenyan Coffee Boom 1976-79 in *Trade Shocks in Developing Countries,* edited by P. Collier and J.W. Gunning (Oxford University Press).

Collier, P and Gunning, J.W. (1999). Trade Shocks: Theory and Evidence in *Trade Shocks in Developing Countries,* edited by P. Collier and J.W. Gunning (Oxford University Press).

Collier, P. (1997). *A Commentary on the Ugandan Economy*. Unpublished Mimeo.

Collier, P. and Gunning, J.W. (1996). Trade Liberalisation and the Composition of Investment: Theory and African Application, Dept. of Economics, Free University, De Boelelaan 1105, 081 HV Amsterdam, The Netherlands.

Collier, P. and Gunning, J.W. (1999). Explaining Economic Performance. *Journal of Economic Literature.* Vol. XXXVII pp 64-111.

De la Fuente, A. (2000). *Mathematical Methods and Models for Economists.* Cambridge University Press, New York.

Devarajan, S. (1999). Cameroon in *Trade Shocks in Developing Countries,* edited by P. Collier and J.W. Gunning (Oxford University Press).

Easterly, W. (1993). How Much do Distortions Affect Growth? *Journal of Monetary Economics.* 32(1993) 187-212, North-Holland

Ghanem, H. (1999). The Ivorian Cocoa and Coffee Boom of 1976-79 in *Trade Shocks in Developing Countries,* edited by P. Collier and J.W. Gunning (Oxford University Press).

Harrigan, J. (1999). Malawi's Positive 1977-79 Trade Shock in *Trade Shocks in Developing Countries,* edited by P. Collier and J.W. Gunning (Oxford University Press).

Heathfield, D.F. and Wibe, S. (1987). *An Introduction to Cost and Production Function.* Hongkong, MacMillan.

Jayasuriya, S. (1999). Temporary Shocks, Consumption Smoothing and Economic Adjustment: Srilanka, 1973-76 in *Trade Shocks in Developing Countries,* edited by P. Collier and J.W. Gunning (Oxford University Press).

Judge et al. (1988). *Introduction to the Theory and Practice of Econometrics* . John Wiley and Sons, New York.

Knack, S. and Keefer, P. (1995). Institutions and Economic Performance: cross-country Tests Using Alternative Institutional Measures. *Economics and Politics* 7(3): 207-227.

Mathews, R.C.O. (1963). *The Trade Cycle.* Cambridge University Press.

MeyerJ.R. and Kuh, E.E. (1957). *The Investment Decision: An Empirical Study.* Cambridge, Massachusetts: Harvard University Press.

Reinikka, R. and Svensson, J. (1998). Investment Response to Structure Reforms and Remaining Constraints: Firm Survey Evidence from Uganda.

Reinikka, R. and Svensson, J. (1999). How Inadequate Provision of Public Infrastructure and Services Affects Private Investment Development Research Group, The World Bank, Washington D.C.

Serven, L. (1998). Macroeconomic Uncertainty and Private Investment in LDCs; An Empirical Investigation. The World Bank, Washington D.C.

Summers, L.H and De Long, J.B. (1991. Equipment Investment and Economic Growth. Quarterly Journal of Economics, Vol. 106 no.4 pp 445 -502.

Svensson, J. (1998). Who Must Pay Bribes and How Much? Evidence From a Cross -Section of Firms in Uganda, Mimeo, The World Bank.

The World Bank (1994). *The private Sector in Uganda:* Results of the World Bank Enterprise Survey.

The World Bank (2002). *African Development Indicators*, Washington, D.C

UIA, (1999). *Analysis of Investment Performance* 1991-1998 April 1999.

UNCTAD, (1999). *Investment Policy Review of Uganda*, Geneva, August.

Appendix 1: A Model of Private Response to a Temporary Shock

In this paper the production function is one in which output is a function of equipment *(K_E)* and structures *(K_s)* capital[τ].

Using K_E as a numeraire, all the production variables are divided by K_E,

$$y=f(k) \quad (A.2)$$

The accumulation of the ratio of structures to equipment capital then becomes

$$\dot{k} = f(k) - \delta k - c + b \quad (A.3)$$

Where $\frac{C}{K_e}$ = c and b $b = \frac{B}{K_E}$

Where δ is the rate of depreciation, assumed equal across capital types. The production function is neoclassical and b is the income shock. It is further assumed that identical, infinitely lived dynasties of producer-consumers maximize the present discounted value of the utility of future consumption;

$$\int_0^{\infty} u(c)e^{-\rho t}dt \quad (A.4)$$

where p is the time preference rate.

The dynamic optimisation problem becomes

$$\underset{c}{Max}\int_0^{\infty} u(c)e^{-\rho t}dt \quad (A.5)$$

Subject to equation (A.3) and the transversality conditions;

k_0 = k(0) and k_∞, = free

To obtain the necessary conditions for a solution, we use the Pontryagin maximum principle (De la Fuente, 2000 p,567-569). The state and control variables are k and c respectively. The current-value Hamiltonian for the problem is

$$H^c = U(c) + m\,[f(k) - \delta k - c + b] \quad (A.6)$$

Where $m = \lambda e^{\rho t}$. λ is the shadow price of k.

The Pontryagin maximum principle conditions are;

$$\frac{dH^c}{dc} = U'(c) - m = 0 \Rightarrow U'(c) = m \quad (A.7)$$

Which states that, optimally, the marginal utility of consumption per capital equipment unit should be equal to the shadow price of the structures per capital equipment unit amplified by

the exponential term, $e^{\rho t}$.

$$\frac{dH^c}{dm} = f(k) - \delta k - c + b = \dot{k} \quad (A.8)$$

Equation (A.9) is generated from Fontryagin's maximum condition $-\frac{dH^c}{dk} + \rho m = \dot{m}$

and the fact that $\frac{dH^c}{dk} = m[f'(k) - \delta]$ which lead to $-m[f'(k) - \delta] + \rho m = \dot{m}$. This equation can be reorganized to get;

$$-m[f'(k) - \delta - \rho] = \dot{m} \quad (A.9)$$

The transversality condition is $\lim_{t\to\infty} \lambda(t) = \lim(e^{-\rho t} m(t)) = 0$ which means that at the end of the planning period the shadow price of the structures per capital equipment unit is zero. Differentiating equation (A.7) with respect to time yields;

$$U''(c).(\dot{c}) = \dot{m} \qquad \text{(A.10)}$$

Equations (A.7) and (A.10) are substituted in equation (A.9) to get;

$$-U'(c)\,[f'(k) - \delta - \rho] = U''(c)\,.\,\dot{c} \qquad \text{(A.11)}$$

Dividing through by U"(c)c leads to;

$$\frac{-U'(c)}{U''(c)c}\left[f'(k) - (\delta + \rho)\right] = \frac{\dot{c}}{c} \qquad \text{(A.12)}$$

The term $\frac{-U'(c)}{U''(c)}$ is the instantaneous elasticity of intertemporal substitution, which is the inverse of the elasticity of marginal utility. Similarly, consumers prefer a flat consumption

profile (risk-averse) and the term $\frac{-U'(c)}{U''(c)c}$ is the inverse of ihe *Arrow-Pratt measure of relative risk aversion,* which can be interpreted as the degree of tolerance. The critical differential equations are

$$\frac{\dot{c}}{c} = \frac{-U'(c)}{U''(c)c}\left[f'(k) - (\delta + \rho)\right] \qquad \text{(A.13)}$$

$$\dot{k} = f(k) - \delta k - c + b \qquad \text{(A.14)}$$

At the steady state $\dot{c}$ = 0, which implies that equation (A.13) equals zero. But $\frac{-U'(c)}{U''(c)} \neq 0$, hence the term in square brackets equal zero; i.e. $f'(k) \sim (5 + p) = 0$

$$f'(k) = (S + p) \qquad \text{(A 15)}$$

Equation (A.15) is the Modified Golden Rule

Similarly, at steady state

$\dot{k} = 0$ then f(k) - δk – c + b = 0 hence,

c = f(k) – δk + b (A.16)

$$\frac{d\dot{k}}{dc} = -1 < 0 \quad and \quad \frac{d\dot{c}}{dk} = \frac{-U'(c)}{U''(c)} f''(k) < 0 \qquad \text{(A.17)}$$

Equation (A.17) shows the movement of the trajectories of c and k in the state (c, k) plane. Specifically, the equation shows that *c* should follow the (+, 0, -) sign sequence as k increases(going eastward). Hence the c-arrowheads should point upward to the left of the $\dot{c}$ = 0 curve, and downward to the right of it. Similarly $\dot{k}$ should follow the (+, 0, -) sign sequence as c increases (going northward). Hence the k-arrowheads should point eastward to the below the $\dot{k}$ - 0 curve, and westward above it. These streamlines show the dynamics in the phase diagram (Figure 6 in the main text).

Appendix 2: Order and Rank Conditions of Identification

Table 4: Order Conditions of Identification

Equation No.	*No.of predetermined variables excluded (K-k)*	*No.of endogenous variables included less one (m-1)*	*Identification status*
1	**11-4=7**	**2-1=1**	**Over identified**
2	**11-4=7**	**2-1=1**	**Over identified**
3	**11-3=8**	**1-1=0**	**Over identified**

The order condition is stated as $K - k \geq m - 1$ where;

M = The number of endogenous variables in the system. In the above system, 3

m = The number of endogenous variables in a given equation

K = The number of predetermined variables in the model including the intercept. In the above system, 11

k = The number of predetermined variables in a given equation

This shows that the system is over identified. However, the order condition is a necessary but not sufficient condition for identification. The sufficient condition is provided by the rank condition of identification. To get the rank condition, equations 1,2 and 3 are written as follows

Table 5: Rank Condition of Identification

	Coefficients of the variables										
Eqn No.	1	$\ln\left(\frac{I_e}{gdp}\right)$	$\ln\left(\frac{I_s}{gdp}\right)$	*ln(rer)*	*ln(rs)*	*ln(da)*	*ln(epi)*	$\ln\left(\frac{M2}{gdp}\right)$	$\ln\left(\frac{gov}{gdp}\right)$	ln(tot)	$\ln\left(\frac{aid}{gdp}\right)$
1	$-\beta_0$	1	0	$-\beta_1$	$-\beta_2$	$-\beta_3$	$-\beta_4$	0	0	0	0
2	$-\phi_0$	0	1	$-\phi_1$	0	0	$-\phi_4$	$-\phi_2$	$-\phi_3$	0	0
3	$-\gamma_0$	0	0	1	0	0	0	0	0	$-\gamma_1$	$-\gamma_2$

The rank condition of identification in our case, where there are 3 equations in 3 endogenous variables, is that an equation is identified if and only if at least one nonzero determinant of order (3-l)(3-l) can be constructed from the coefficients of the variables (both endogenous and predetermined) excluded from that particular equation but included in the other equations of the model.

For equations 1,2 and 3 to be identified, we must obtain at least one nonzero determinant of order 2 x 2 from the coefficients of the variables excluded from each equation but included in other equations. Indeed, one of such determinants is;

$\begin{vmatrix} -\phi_2 & 0 \\ 0 & -\gamma_1 \end{vmatrix} \neq 0$ for equation (1), $\begin{vmatrix} -\beta_2 & 0 \\ 0 & -\gamma_1 \end{vmatrix} \neq 0$ for equation (2), $\begin{vmatrix} -\beta_2 & \beta_4 \\ 0 & -\phi_4 \end{vmatrix} \neq 0$ for equation (3).