Government Capital Spending and Financing and its Impact on Private Investment in Kenya: 1964-2006

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Abstract

This paper examines the relationship between public investment and its financing on private investment in Kenya for the period 1964-2006. Using an error correction framework and time series data for the fiscal years 1964-2006, the study shows that investment in agriculture has a significant positive effect on private investment, while domestic debt has a significant negative effect. Political risk, real exchange rate, external debt, and tax though negatively related are insignificant. Investment in infrastructure has an insignificant positive effect. These findings have important policy implications that investment in agriculture crowds-in private investment. To encourage private investment, the government should channel increased resources to the agricultural sector. Domestic debt crowds-out private investment, thus the government should reduce its dependence on domestic borrowing to finance budget deficit.

JEL classification:
Key words: Public expenditure, tax and debt financing, private investment, error correction.

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1. Introduction

Background

On attaining independence, the Government of Kenya sought the path of rapid economic growth to meet some of the challenges it was facing. Among the measures adopted to realize this rapid growth were deliberate incentives to the private sector. The result of these bold measures was a steady growth in private investment during the first decade of independence by an average of 15.76% of GDP. The second decade had a mixed trend, but the average growth remained relatively high at 17.56% of GDP, with most of this growth coming in the early part of the second decade. The third decade saw the annual growth decline to 16.47% of GDP, while the fourth decade witnessed a marked decline in private investment to 12.01% of GDP. Public investment grew at an average rate of 7.74% in the first decade, 9.78% of GDP in the second decade, 8.39% of GDP in the third, and 5.14% of GDP in the fourth decade. The growth in GDP can be characterized as generally high during the first decade, except for 1970. It averaged 5.82% in the first decade, 4.13% in the second decade, and 3.65% in the third decade. Most of the declines in this phase were witnessed in the later part. In the fourth decade, GDP growth was 5.63%; this was the first half of the National Alliance of Rainbow Coalition (NARC) regime. The overall general decline was attributed to inappropriate policies, inadequate credit and poor international terms of trade, lack of export incentives, tight import controls, and foreign exchange controls. Other factors contributing to the slow growth were poor infrastructure, high power costs, increased power outages, increased fuel costs, and high levels of uncertainty associated with political trends in Kenya. The political scenario witnessed increased political intolerance, and increased political agitation for liberal political dispensation. These broad trends are summarized in Table 1.

Table 1: Selected economic indicators, 1964-2006

	1964-1973	1974-1985	1986-2002	2003-2006
Real exchange rate	7.58	10.23	49.98	76.85
Private investments*	15.76	17.56	16.47	12.01
Public investments*	7.74	9.78	8.39	5.14
GDP	5.82	4.13	3.65	5.63
Investment in agriculture*	0.95	3.47	5.22	9.66
Investment in Infrastructure*	8.11	5.95	6.88	10.26
External debt*	2.96	5.99	38.42	37.92
Domestic debt*	1.52	3.16	16.13	12.15

continued next page

Table 1 Continued

patronage expenditure added pressure on interest rates. The economy got a brief reprieve in 2003 when NARC came into power. This was shortlived as NARC was a loose coalition of interests without a coherent long term strategy. Thus, it was no wonder that the constitutional referendum in 2005 provided a perfect opportunity for the split in the already dysfunctional coalition. The fiscal indiscipline of the KANU regime repeated itself as indicated by increased recurrent expenditure and the financial scandals.

Many critics argue that the NARC government was politically a repackaged KANU. Although the repackaging was based on a reform platform, there was no collective will to conclusively carry out the reforms, as the reformers were mainly last minute converts due to the NARC euphoria, and for very personal political reasons. They remained ideologically rooted in KANU's non-reform philosophy. This argument finds further credence in the fact that the NARC leadership comprised of a galaxy of former KANU stalwarts. It is further argued that the so-called reform-minded wing of KANU that walked out had really no reform agenda nor ideological persuasion. NARC was thus a strong KANU minus the chairman. From this argument, one may therefore look at Kenya as having two broad regimes for the period 1964-2006.

The period 1964-1982 marks the first regime. In this regime, there were two presidents (Jomo Kenyatta and Daniel arap Moi) but same ideological leaning, broadly the same power brokers and the same philosophy. This period was characterized by a strong central government and strong patronage politics. It is a period characterized by controls, both on macroeconomics and political power. Dissenting views were not tolerated, and the country became a single-party state, first de-facto and later de-jure (Troup and Hornsby, 1998).

The period 1983-2002 witnessed an ideological shift. The attempted coup in August 1982 provided the real ground for Moi to exert his authority and marked a noticeable shift in political behaviour from his predecessor. There was a shift in power base from those perceived to have been close to the predecessor to a new crop of leaders who owed total allegiance to the incumbent. This period also saw the structural adjustment period and the democratization wave sweeping across the world. It marked the end of the Cold war and America's strong push for more democratic space. The agitation for the repeal of Section 2A of the Constitution, which made Kenya a single-party democracy intensified. Relations with the donors got strained to the extent that the Paris Club suspended lending to Kenya. This only made the regime more intolerant. Fiscal discipline gave way to "political discipline" (sycophancy), increased patronage expenditure and political repression. With the donors' sustained pressure on the regime, Section 2A was repealed in 1991 to pave way for the first multiparty elections.

With the repeal of Section 2A, the government changed its tactics to benevolent dictatorship, rewarding those who supported it and punishing those who did not. The crackdown on political dissent became more severe, and ethnic balkanization slowly replaced political balkanization with the adverse consequence of ethnicized politics and expenditure trends. It further gave rise to ethnic tension, which occasionally played itself out in ethnic violence. In the latter years of this period, politics took a strongly ethnic leaning as the many parties formed found their strongholds in ethnic blocs. Elections became more and more violent and ethnic clashes became frequent. Public expenditure became a tool for coalition building to win elections, rather than achieving its basic goal of provision of public goods and services.

	1964-1973	1974-1985	1986-2002	2003-2006
Total tax*	14.98	21.73	24.51	19.18
Political risk	5.32	7.75	8.54	3.83

Source: Government of Kenya Statistical Abstracts (various issues); World Development Indicators (various issues); African Development Indicators (various issues); International Financial Statistics; The PRS Group; Nordal (2001)

It is important to highlight some of the policies and external factors influencing the above trends in Kenya. The fiscal framework can be divided into three phases:

(i) The pre-crisis period (1964-1973). During this period, the economy witnessed a mixed growth performance. Favourable factors included increased investment of smallholder farmers, favourable incentive structures, low rates of inflation, and unrestricted trade (Ronge and Kimuyu, 1997);

(ii) The oil crisis and post-oil crisis of 1973-1985. The economy succumbed to the first oil crisis in 1973/1974, leading to the first ever balance of payment (BOP) crisis. In order to contain the situation, the government undertook comprehensive import restrictions and price controls. The 1978 coffee boom temporarily eased the crisis but was shortlived. However, the boom worsened the fiscal account as it led to an expansion in public expenditure, which could not be sustained beyond the boom and could not be reversed either. The economy suffered a second oil shock in 1979/1980. The government changed from being a net provider of investment to a net user of investment funds. This change had a negative impact on private investment. GDP growth declined as inflation soared;

(iii) The structural adjustment period and beyond (1986-2006): This period witnessed a number of conditionalities and externally determined policy interventions whose aims were to contain the economic decline. The result was a lowering of tariffs and the reduction of import controls in pursuit of trade liberalization. In order to encourage investment, the government implemented several investment schemes, duty and tax concessions and incentives. During this period, the policy environment was characterized by policy reversals as the government failed to boldly adopt the hard policy prescriptions. In 2003, NARC came to power and marked a major change in the democratization process.

External debt was initially the preferred mode of financing revenue gaps. However, from the mid 1980s, this changed. The change was occasioned by the frosty relationship between Kenya and her development partners on account of her human rights record and failure to open up the democratic space. In this period, donors withheld aid to force the government to liberalize both economically and politically. The government, in order to balance her ever increasing budget, mostly recurrent, resorted to increased domestic borrowings. This put extreme pressure on interest rates and inflation (Islam and Hasan, 2007). As the pressure to democratize increased, the regime responded with more patronage politics (Robinson and Torvik, 2008). This came at a great cost to the economy as coalition building expenditure defied any economic rationalization. Such

investment crowds-in, and which one crowds-out private investment?

Objectives of the study

The main objective of this study is to analyse the effects of government investment expenditure and financing on private investment in Kenya.

The specific objectives are to:

(i) Determine the effect of government capital spending and related variables on private investment across time and regime.

(ii) Analyse the effect of different modes of financing public capital spending on private investment.

Research questions

The following research questions were used to guide the study:

(i) What is the effect of government investment expenditure in agriculture, and infrastructure on private investment?

(ii) What is the effect of real exchange rate, and political risk on private investments?

(iii) What is the effect of financing (debt and tax financing) of public expenditure on private investment?

Justification of the study

In view of the need to rationalize public expenditure given the scarce revenues, the study provides an empirical basis to argue for expenditure re-orientation to such areas that provide the maximum benefits. In terms of financing, the study provides empirical results on the relationship between tax and debt financing of public expenditure, and how this relates to private investment. This is important in debt management and tax administration.

The study provides empirical country evidence on the issue of crowding-in and crowding-out of private investment by government investment and its mode of financing. On political economy, the study provides indication on the effects of different political regimes on public expenditure in terms of political behaviour and how it affects expenditure patterns and types, and how this in turn affects private investment. The period covered has significant political implications as it witnessed a change from a multiparty democracy to a single-party democracy, followed by benevolent dictatorship and back to multiparty democracy. This had implications on public expenditure, which is largely a political decision.

2. Review of literature

The period 2003-2006 saw KANU out of office. However, the structure of governance remained predominantly KANU. The NARCgovernment soon ran into ideological bankruptcy, and open disagreements and grandstanding became the norm rather than the exception. These conflicts culminated in the politically defining moment of the 2005 referendum on the constitution, which saw the collapse of the coalition (Troup and Hornsby, 1998).

Statement of the research problem

Government expenditure and its financing have a far-reaching effect on the overall direction of the economy, and are influenced by the politics of the day. A large expenditure budget financed through foreign borrowing adversely affects the country's debt position and the private sector. Kenya, being a highly indebted country aggravates this by increased reliance on debt financing. Borrowing turns out to be more costly in the long-run, as it crowds out private investment by increasing the cost of doing business. The cost of doing business has been high not only because of increased interest rates, but also due to dilapidated infrastructure, insecurity, hence increased risks, and high taxes. Thus, today, Kenya ranks low as an investment destination.

Tax-financed expenditure in an economy where the tax base is narrow (largely formal employment) and compliance low places a heavy tax burden on a few captive taxpayers. These are in turn burdened by high tax rates, which make savings and investment difficult. Little has been done in the way of widening the tax base and increasing compliance through aggressive tax education. Therefore, in terms of incentives to the private investor, it appears that whereas government expenditure and financing could have provided that much needed direct and indirect incentives, this has not happened.

In view of the above, evidence in Kenya points to a declining performance of the private sector, which has largely been below 15% of GDP in the period 1995-2006. This is in contrast to the performance of the private sector in Latin America at 16%, in advanced countries at 18%, and in the newly industrialized countries at 16.5% over the same period (Oshikoya, 1994). The theoretical and empirical literature shows the positive role of the private sector in the growth of the economy. A declining or very low performance of the private sector under the given incentives calls for analysis of the determinants of private investment to identify the factors behind the low or declining share. The problem is, therefore, to explain the private sector's investment behaviour in view of government investment expenditure and financing. Does public investment and financing crowd-out or crowd-in private investment? Which category of public

investment made by firms. Accordingly, the theory argues that firms have two choices when faced by an increase in demand. They can either raise prices to cause demand to drop, or increase investment to match demand. Therefore, the level of investment is dependent on changes in the level of output. If investment is linked to changes in output, any policy measure that promotes growth will act as a stimulus for an increase in investment (Lucas, 1967).

In the classical model, supply of funds (savings) determines the amount of fixed business investment. That is, since all savings are placed in the banks, and all business investors in need of borrowed funds go to the bank, the amount of savings determine the amount of available funds for investments. Therefore, in their view, fiscal stimulus could actuate production. They argued that the stimulus would outrun the side effect (that is crowd-out private investment). Firstly, it would increase the demand for labour and raise wages, thus hurting profitability. Secondly, a government deficit would increase the stock of government bonds, reducing their market prices in the process (Seater, 1993).

The neo-classical theory of investment formulated by Jorgensen (1967) posits that the level of investment depends on the volume of output and the user cost of capital. The user cost of capital, on the other hand, depends on the real interest rate, the price of capital goods and the rate of physical depreciation. This is the capital stock adjustment model. In this model, investment is seen as the process of changing the capital stock from its current actual level to a desired level over time. Gross investment is thus the amount of capital needed for new capital stock, plus the amount required to cover for depreciation of the existing capital stock.

According to Tobin's Q theory, investment decision is dependent on the Q-ratio. This is the ratio of the market value of existing capital stock to the stock replacement value. The argument here is that the enterprise will want to invest/divest if the increase in the market value of additional unit exceeds/falls short of the replacement cost. Therefore, in this theory, in the absence of capital market imperfections, value maximizing firms will invest as long as the shadow price of a marginal unit of capital, Q, exceeds unity. Investment stops when the value of this capital unit is equal to its replacement cost (Bo, 2002, 2007; Bo and Elmer, 2007).

Pindyck (1991) interprets a firm's investment decisions as consisting of choices on different portfolios, and uses options-based pricing techniques to analyse investment decisions. Since most fixed investment is irreversible, uncertainty adversely affects corporate investment decisions. Such uncertainty would thus influence the choice of options. Such uncertainty includes the future trends in product prices, interest rates, trade regimes and other economic and political uncertainties. Chen and Funke (2003) argue that investment opportunities can be viewed as "option-rights". In such a situation, an investment project can be assimilated in its nature into purchases of a financial call

Theoretical framework

From a theoretical perspective, the effect of government expenditure on private investments can be either positive or negative. The standard Real Business Cycle (RBC) model predicts a decline in private consumption in response to a rise in government spending. This is because an increase in government spending lowers the present value of after-tax incomes, and thus generates a negative wealth effect on private consumption. This is in contrast to the standard IS-LM model, which predicts that consumption should rise in response to a positive government spending shock. When consumers behave in a non-Ricardian fashion, that is, their consumption is a function of their current disposable income, an increase in income generates an increase in private consumption (Long and Plosser, 1983).

With respect to investment, the standard RBC model argues that an increase in government consumption will have a positive effect on investment. That is, it will induce a rise in employment which, if sufficiently persistent, will lead to a rise in the expected return to capital, therefore triggering a rise in investment. This is contrary to the IS-LM model, which predicts that investment will decline in response to positive government spending shocks. An increase in government spending (if not followed by a corresponding increase in money supply), leads to an increase in interest rate, which in turn will lead to a decrease in investment (Ambler, Cardia and Zimmerman, 2004; Long and Plosser, 1983; Lucas, 1980; Rebelo, 2005).

A large budget financed largely through foreign borrowing affects the debt levels and increases the debt burden. Domestic borrowing to finance the expenditure may adversely affect private investment by reducing savings and crowding-out private investors from the domestic capital market as financial institutions prefer lending to the government. It is intuitive that if there is sufficient liquidity in the financial system, then public borrowing (debt financing) may not affect private investment negatively as interest rates will not be affected significantly. If expenditure is tax-financed, then high taxes reduce the after tax returns to private investment, and thus affect private investment negatively (David and Scadding, 1974; Seater, 1993; Bo, 2007).

There is a rich body of literature on the analysis of the determinants of private investment and the mechanism through which such determinants affect private investment. The interest in the literature can be traced to Keynes investment theories (1936). Keynes argued that investment was largely determined by the "animal spirit of men". Keynes further argued that savings and investment must be identical ex-post, but ex-ante, a difference emerges driven by the fact that savings and investments emanate from independent decisions. In Keynes' view, fiscal policy causes minimal crowding-out of private investment when unemployment is persistently high, above the non-accelerating inflation rate of unemployment (Seater, 1993).

The accelerator theory argues that investment demand is a function of the rate of growth of output. In this theory, the incentive to acquire more capital goods arises not because the current profit records are favourable, but because increases in outputs are putting pressure on firms' existing productive capacity. An increase in productive capacity requires an expansion of the capital stock, which in turn calls for a higher rate of investment spending. As demand and income increases in an economy, so does the

that public investment crowds-in private investment.

The cross country studies focused broadly on similar determinants across the countries. They sought to find out if there was crowding-in or crowding-out of private investment by public expenditure. They came to a general conclusion that public consumption expenditure crowds-out private investment. With regard to public investment, the evidence was that infrastructural investment crowds-in private investment. Such studies include that of Sturm and de Haan (1995) reviewing the empirical evidence for USA and Netherlands, Atukeren (2005) on evidence from developing countries, Aschauer (1989) in the US and Netherlands study, and the study by Erden and Holcombe (2006) on the developed countries. The panel study of 145 countries by Furceri and Sousa (2009), and using time series data for the period 1960-2007, found that government spending produces important crowding-out effect by negatively affecting both private consumption and investment. There are other cross country studies whose findings are basically in agreement with the above. Such studies include Ahmed and Miller (2000), Chibber and Mansoor (1990), Erenburg and Wohar (1995), Greene and Villanueva (1991), Wai and Wong (1982), Karras (1994), Kormendi (1983), Ford and Poret (1991), Evans and Karras (1994) and Bouton and Sumlinski (2000).

There are some studies whose findings were divergent to those discussed above. The study by Sundararajan and Thakur (1980) concluded that there is both a crowding-out and a crowding-in effect. Firstly, public investment competes with the private sector for scarce physical and financial resources, thereby exerting a negative influence on private investment, at least in the short-run. Secondly, public investment compliments private investment by creating infrastructure and thus raising productivity of the capital stock, and reduces the cost of doing business thus crowding-in private investment. Finally, they observed that public investment raises aggregate output and savings, supplementing the economy's physical and financial resources, thus offsetting at least a part of any initial crowding-out effect on private investment. A study by Devaranjan, Swaroop and Zou (1996) found a positive effect of government current expenditure on growth for 43 developing countries. They argued that the expenditure on this category of negative effect must have gone beyond the optimal level. It, therefore, appears that productive expenditures may be unproductive if they go beyond the optimum. This finding brings in the issue of how much expenditure is productive and how much is counter-productive. In a study by Argimon, Gonzales and Rolden (1997), they found that public consumption and public investment negatively affect private investment.

The studies focusing on financing of public expenditure and their effect on private investment are few. The study by Barro (1990) is probably the earliest studies on this issue. This study focused on the tax-financed government expenditure on investment and output. It concluded that higher income taxes reduce the after-tax returns on private investment and thus negatively affect investment. Ahmed and Miller (2000) examined the effects of different fiscal variables on domestic investment. They also distinguished between debt and tax-financed public expenditure. Using pooled time series data for 39 countries, they found that tax-financed government expenditure crowds-out private investment more than debt-financed expenditure.

Despite the above theoretical and empirical studies, there is no consensus on the effects of government spending on private investment in the long-run and the short-run.

option, where the investor pays a premium price to get the right to buy an asset. Such assets are bought at a pre-determined price (exercise price), which eventually differs from the spot market price of the asset (strike price). Therefore, in any investment decision, a firm pays a price which gives it the right to use the capital now or in the future in return for an asset worth the strike price. In this analysis, it is important to take cognizant of the fact that: (i) There is uncertainty about future payoffs from an investment; (ii) an investment does not entail a now-or-never decision; and (iii) the investment is at least partially irreversible.

A distortionary tax-financed increase in government expenditure will have a less expansionary effect on the long-run private capital stock than a lumpsum tax (debt) financed increase, if and only if, the higher public investment requires a higher long-run tax rate (Fisher and Turnovsky, 1998). In case of Cobb-Douglas production function, distortionary tax financing will ensure a positive long-run effect on the private capital stock. If the share of government capital in production exceeds the long-run claim of government investment in output, tax will have a positive effect (Linnemann and Schabert, 2004; Islam and Hasan, 2007).

Empirical studies

Empirical studies on the determinants of private investments are varied in their conclusions with regard to the relationship between private investment and public investment. There are various studies that focused on developing countries, either as individual country studies or as cross country studies. Some studies have also focused on developed countries individually or as cross country study of developed countries or developing countries.

Some studies have been done under the African Economic Research Consortium network, which focused on individual country case studies. Three of these are directly relevant to this study and will be reviewed alongside other documented studies. They are the Nigerian studies of Omoke and Busari (2008), Ekpo (1999), the Ghanaian study by Asante (2000), Zimbabwean study of Jenkins (1998), Sudan by Badawi (2002), Kenyan studies by Ronge and Kimuyu (1992), Wachira (1991), Matin and Wasow (1992), the Portuguese study by Pereira and Andraz (2005), the Pakistan studies by Abdul (2005), Ahmed and Qayyum (2008), Hyder (2001), the Taiwan study by Ho (2001), the US study by Nadiri and Mamuneas (1994), Islam and Hasan (2007), the Bangladesh study by Majumder (2007), the Turkey study by Akkina and Celebi (2002); the Mexican study by Feltenstein and Ha (1999); and the study on Spain by Bajo and Sosvilla (1993). The results of these studies are not unanimous with regard to crowding-out and crowding-in. What is unambiguous is the fact that GDP growth, and investment in both economic and social infrastructure, crowds-in private investment. Quattara (2004), investigating the determinants of private investment in Senegal, found that public investment, real income and foreign aid flows affect private investment positively. The impact of credit to private sector and terms of trade were negative. In a recent study on Benin, Issouf (2008) using structural VAR on annual data found a significant effect of public investment and private investment on growth, and concludes

LIVG	1.14	0.49	0.82	2.44
POR	6.39	2.22	2.80	9.90

Correlation matrix

	LPRIN	LREX	LDBT	LTAX	LEDT	LINFR	LIVG	POR

It is clear that the predictions of the above theories are orthogonal to each other; hence the relationship between government investment and private investment still remains an empirical issue.

3. Methodology

Data description and sources of data

The study used time series data for GDP, private investment, investment in agriculture, and investment in infrastructure. The investment figures were taken as the gross capital formation. All variables are expressed in real terms. The GDP deflator was used to convert nominal GDP into real GDP. The data on real gross private investment was calculated by multiplying the ratio of gross private capital formation to GDP by real GDP. Real investment in agriculture, and infrastructure was computed by multiplying the respective ratio of gross investments to GDP by real GDP. Real tax revenues are taken as the ratio of gross tax revenues to GDP multiplied by real GDP. Real external debt and domestic debt is the ratio of the individual debt to GDP multiplied by real GDP. Political risk was measured by an instability index. The study adopted the polity index used by Monty and Cole (2009). The index rates a country based on political behaviour. This scale ranges from -10 (Hereditary Monarchy) to +10 (Consolidated Democracy). The risk ratings are the reverse of the above, being lowest in consolidated democracy and highest in hereditary monarchy. The most risky is rated as +10 and the least risky as +1.

The main source of data was the African Development Indicators, World Development Indicators, World Development Finance, and International Finance Statistics. These sources were augmented by various issues of Statistical Abstracts of the Government of Kenya. The data on political risk was sourced from Polity IV project, Freedom House data and the PRS group.

Descriptive statistics

Table 2: Descriptive statistics

Variables	Mean	Std. Dev	Min.	Max.
LPRIN	2.76	0.22	2.26	3.14
LREX	2.98	0.95	1.93	4.36
LDBT	1.64	1.06	0.26	3.78
LTAX	3.03	0.24	2.39	3.40
LEDT	2.43	1.18	0.92	4.48
LINFR	1.96	0.21	1.67	2.44

$$\Delta LPRIN = \beta_0 + \beta_i \sum_{1}^{8} \Delta X_i + \alpha_1 \Delta LPRIN_{t-1} + \varphi(ECM_{t-1}) + \varepsilon_t \quad (2)$$

Where $ECM_{t-1} = (x - y)_{t-1}$.

The variables are stationary in first difference and are cointegrated. A cointegration analysis shows the existence of a long-term relationship between private investment and its determinants, in this ,while an error correction representation allows for adjustment towards long-run equilibrium in case of a temporary short-run disturbance from the equilibrium.

5. Empirical results

LPRIN	1.000							
LREX	-0.076	1.000						
LDBT	-0.643	-0.312	1.000					
LTAX	-0.542	-0.541	-0.285	1.000				
LEDT	-0.162	-0.652	-0.094	0.489	1.000			
LINFR	0.329	0.094	0.079	0.464	0.097	1.000		
LIVG	0.718	0.579	0.514	0.017	0.127	0.521	1.000	
POR	-0.341	-0.713	0.428	-0.245	-0.489	-0.294	-0.172	1.000

The correlation matrix shows that the variables are normally correlated both with the dependent variable and with respect to each other.

4. Economic model

The dynamic private investment model is represented as an error correction framework on the basis of the fact that time series data are non-stationary, and that there is cointegration relationship between private investment and its determinants. The error correction representation is given as:

$$\Delta y_t = \beta_0 + \Delta\alpha_1 y_{t-1} + \beta_i \Delta x_t + \varphi(x_{t-1} - y_{t-1}) + \varepsilon_t \quad (1)$$

where y_t is an endogenous variable, y_{t-1} is the lagged value of the endogenous variable, x_{it} are the exogenous variables, $(x - y)_{t-1}$ is the error correction term, Δ is the difference operator, ε_t is the white noise error term distributed as an *iid* and φ is the coefficient of the error correction term, which measures the degree of adjustment to equilibrium, β_0 is intercept coefficient, α_1 is the coefficient of the lagged dependent variable, and β_i is a slope coefficient of the exogenous variables.

From Equation 1, the empirical model is presented as follows:

r=4	56.41	59.46
r=5	33.29	39.89
r=6	17.70	24.31
r=7	8.57	12.53
r=8	5.72	6.51

Source: Maddala and Kim (1998).
NB: ** denotes rejection of the null hypothesis at 5% significant level.

The trace statistics rejects the null hypothesis of the existence of zero or one cointegrating relationships in the private investment equation (also refer to the cointegration graphs in A3 in the appendix).

Identification

From Table 4 and Table 5, there are two cointegrating vectors between the variables: Private investment and its determinants. Error terms from these two cointegrating vectors are presented in Table 3, Table 4 and Table 5. The long-run private investment function is obtained by normalizing the first estimated cointegrating vector on private investment and its determinants. The result of this normalization is given in Table 6.

Table 6: Normalization of first cointegrating vector

Variables	Coefficient	Standard errors	T-values
LIVG	1.265*	0.127	12.541
LDBT	-1.476*	0.117	-5.982
LTAX	-0.897	0.097	-2.373
LEDT	-0.124	0.561	-1.989
LINFR	0.974	0.119	2.097
LREX	-1.219	0.105	-1.998
POR	-0.098	0.122	-1.786
$LPRIN_{-1}$	1.342	0.087	2.037

(*) represent significant at 5% critical values.

The estimated coefficients of LIVG and LDBT are significant and bear a priori signs. It indicates that private investment is determined by investment in agriculture, and domestic debts with elasticity of 1.267 and -1.476, respectively.

Table 7: Test for long-run weak exogeneity (Ho: variable is weakly exogenous to cointegrating vector)

Table 3: Augmented Dickey-Fuller and Philip Peron test for unit roots

Variables in levels	ADF-stats	PP stats	Results	1st Difference	ADF-stats	PP Stats
LPRIN	- 2.872	-2.112	I(1)	"LPRIN	-8.086	-11.891
LREX	-0.098	-0.314	I(1)	"REX	-7.009	-9.325
LDBT	-1.156	-1.686	I(1)	"LDBT	-5.445	-6.573
LTAX	-2.878	-2.543	I(1)	"LTAX	-5.871	-6.879
LEDT	-0.905	-1.235	I(1)	"LEDT	-5.812	-6.792
LINFR	-0.592	-0.783	I(1)	"LINFR	-7.763	-10.712
LIVG	-1.504	-1.239	I(1)	"LIVG	-5.851	-6.315
POR	-2.900	-2.934	I(1)	"POR	-7.468	-9.987

Critical values for ADF at 5%=-3.50, 1%=4.15, *significant at 5%, ** significant at 1%
PP test at 5%=-3.463, 1%=-3.157. NB: All variables are in logs except POR.

The null hypothesis (Ho: I (1)) is not rejected at 5% and 1% levels, therefore necessitating further testing in first difference. All the series are differenced except the POR. The differenced series reject the null hypothesis in favour of the alternative hypothesis of stationarity. Therefore, the series are stationary after first differencing. Both the PP tests and the ADF tests accept the stationarity in first difference at both the 1% and 5%.

The results thus provide ground for cointegration analysis. The variables entering cointegration analysis are ΔLPRIN, ΔLREX, ΔLDBT, ΔLTAX, ΔLEDT, ΔLINFR, ΔLIVG, ΔPOR and $\Delta LPRIN_{-1}$. The Johansen's cointegration results are presented in Table 4 and Table 5.

Table 4: Johansen's integration rank test

Hypothesis Ho: r ≤	Max-Eigen Statistic (λ_{max})	95% critical value
r= 0	85.78	65.21
r ≤ 1	69.33	59.78
r ≤ 2	40.12	53.90
r ≤ 3	33.25	47.15
r ≤ 4	26.23	41.00
r ≤ 5	21.63	35.17
r ≤ 6	16.07	28.82
r ≤ 7	10.19	22.99
r ≤ 8	4.41	15.69

Table 5: Johansen's test for the number of cointegrating vectors

Ho:r ≤	Trace statistic	95% critical value
r=0	216.58	175.77**
r=1	166.58	141.20**
r=2	106.61	109.99
r=3	80.80	82.49

significant long-run effect on private investment.

The empirical evidence on investment in agriculture in the long-run indicates that the effect is positive and significant. It can be argued that Kenya, being an agriculture economy with over 70% of the population being directly or indirectly employed in agriculture, would do well to focus investment in this sector. A stimulus in the agriculture sector has an expenditure multiplier effect that stimulates demand and in turn has a positive effect on private investment (the accelerator theory).

Domestic debt has negative and significant effect; this implies that in the long-run, debt increases the cost of financing by pushing up the interest rates. This negatively affects private investors. Apart from increasing the cost through an increase in interest rate, domestic debt can also be inflationary if used largely to finance government consumption expenditure. During the larger part of this period, government consumption expenditure increased, while investment as a percentage of total expenditure declined. Domestic debt affects private investment with a lag. This is because debt works through the interest rate and inflation channels to affect private investment.

Short-run dynamic model of private investment: The error correction approach

The cointegrating vector β′ in Table 8 constitutes a restricted long-run stationary relationship, and describes the error correction term.

$$ECT = LPRIN - 0.907LREX - 1.436LDBT - 0.794LTAX - 1.185LEDT + 1.032LINFR + 1.645LIVG - 0.587POR + 0.179\ LPRIN_{-1} \quad (3)$$

The error correction model involves the estimation of the model in stationary forms of the variables and adding an error correction term as another explanatory variable.

The modelling approach adopted here is the "general to specific". In this approach, the study starts with three lags, and sequentially reduces the lags until the model consists of only significant parameters. Three lags were chosen as the starting point due to the many parameters being estimated and the data point (annual data). All variables are in first difference. The results of the estimated parsimonious dynamic error correction model are shown in Table 10.

A statistically negative significant coefficient of the ECM_{t-1} suggests that market forces are operating to restore long-run equilibrium following short-run disturbances.

Table 10: Error-Correction Model of private investment [ΔLPRIN]

Explanatory variable	Coefficient	Standard error	t-ratio
$\Delta LPRIN_{-1}$	+0.172 0	084	+2.05
$\Delta LREX_{-1}$	-0.077	0.130	-0.597
$\Delta LDBT_{-2}$	-0.142	0.077	-4.385

continued next page

Table 10 Continued

Variable	χ^2 (prob)	Decision over Ho.	Inference
LPRIN	4.153(0.05)	Rejection	Not exogenous
LREX	1.003(0.54)	Acceptance	Exogenous
LDBT	3.967(0.08)	Rejection	Not exogenous
LTAX	2.105(0.65)	Acceptance	Exogenous
LEDT	2.456(0.39)	Acceptance	Exogenous
LINFR	1.982(0.73)	Acceptance	Exogenous
LIVG	4.751(0.09)	Rejection	Not exogenous
POR	0.654(0.81)	Acceptance	Exogenous
$LPRIN_{-1}$	0.010(0.93)	Acceptance	Exogenous

Respective α coefficients on variables are linearly restricted to equal zero. The linear hypothesis of zero alphas on LDBT, LTAX, LEDT, LINFR, POR and $LPRIN_{-1}$ are accepted, since associated likelihood ratio χ^2 values are insignificant (p-probability in parentheses). Long-run weak exogeneity does not characterize LDBT and LIVG. Since the reported likelihood values are significant, we reject the null of weak exogeneity. We also run similar weak exogeneity test for LPRIN. This is also rejected indicating that a significant long-run stationary feedback to LPRIN exists.

Considering the conclusions from Table 7, the long-run exogeneity of LREX, LTAX, LEDT, LINFR, POR, and $LPRIN_{-1}$ are used to re-estimate the model. We preserve the cointegrating rank of two and impose one long-run restriction on respective adjustment coefficients on LREX, LTAX, LEDT, LINFR, POR, and $LPRIN_{-1}$ (no restriction on βs except identifying restrictions). Resultant restricted standardized αs and βs are shown in Table 8 and Table 9.

Table 8: Restricted co-integrated vector

	ΔLPRIN	ΔLREX	ΔLDBT	ΔLTAX	Δ LEDT	ΔLINFR	ΔLIVG	ΔPOR	$\Delta LPRIN_{-1}$
(a) Restricted standardized eigenvectors β'									
β'	1.00 (rest.)	- 0.907 (2.246)	-1.436 (-7.105)	-0.794 (-1.976)	-1.185 (-2.421)	1.032 (3.125)	1.645 (9.274)	-0.587 (-2.271)	0.179 (2.795)
					α				

Table 9: Restricted standardized adjustment coefficients α:

ΔLPRIN	-0.467(-3.428)
ΔLREX	0.000(rest.)
ΔLDBT	-0.832(-3.609)
ΔLTAX	0.000 (rest.)
ΔLEDT	0.000(rest.)
ΔLINFR	0.000(rest.)
ΔLIVG	0.977 (4.299)
ΔPOR	0.000(rest.)
$\Delta LPRIN_{-1}$	0.000(rest.)

t-statistics are in parentheses

The result shows that real domestic debt and real investment in agriculture have

heteroscedasticity-test; F- statistics = 11.937[0.7483]; Serial-correlation test F-statistics=0.372[0.0794], Normality test x^2=3.9231.

The residuals were subjected to a number of diagnostic tests such as linearity, autocorrelation, heteroscedasticity, serial correlation, and normality. The results for the test were positive at the 5% level. Thus, the residuals passed these tests.

The error correction term, ECM_{-1} in the estimated equation is significant and with the correct sign. ECM_{-1} shows that 65% of the disequilibrium in the private investment is corrected immediately, i.e. in the next year.

In the estimated dynamic error correction model, the coefficient of the lagged domestic debt is negative and significant. This shows that debt financed government expenditure crowds-out private investment through heavy tax burdens that reduce profitability, reduce disposable income and therefore consumption, and increases inflation if government expenditure is for recurrent budget. During this period, government expenditure moved in favour of recurrent expenditure. As the government continued to look inward for funding, and given the financially repressed domestic market with government controlled banks, the private investor got locked out of financing.

The coefficient of investment in agriculture is positive and significant and substantially large. This shows the centrality of agriculture in the Kenyan economy. Over 70% of the total population is dependent on agriculture for a livelihood. Investment in agriculture affects private investment through the demand and supply side. The domestic market is thus affected by the performance of the agricultural sector. Agriculture being the source of income indirectly affects the quality of labour as private funds for education come from agriculture. Thus, agriculture indirectly affects the quality of labour and the labour participation rate.

The other determinants, though having the expected signs, are insignificant. Lagged changes in private investment show the herding behaviour of investors. Real exchange rates working through the cost side affect private investment. External debt through debt overhang negatively affects private investment, and the tax rates are 'nearly' significant. This attests to the negative effect on private investment of tax-financed government expenditure if the tax revenue goes largely to finance recurrent expenditure. This unfortunately has been the trend in public finance in Kenya.

Investment in infrastructure has an insignificant positive effect. This is because investment in infrastructure takes a long time to complete, and also given the pressure on the budget, not much infrastructural investment has been forthcoming. A lot of the infrastructural investments are the subject of investigations due to over-invoicing and cost adjustment, accounting issues and tendering problems. The effect of political instability, though having the correct sign is insignificant. This can be explained by the fact that compared to the rest of the Horn of Africa and, indeed the entire sub-Saharan Africa, Kenya has been relatively stable with many of the economic fundamentals favouring private investment. Kenya also offers a substantially well qualified professional and experienced cheap labour force. These advantages may have over-ridden the political instability witnessed during the single-party rule.

6. Econometric issues

Explanatory variable	Coefficient	Standard error	t-ratio
∆LEDT	-0.154	0. 018	-0.938
$\Delta LTAX_{-1}$	-0.063	0.269	-2.549
“LIVG	0.644	0.798	+8.421
“LINFR	0.221	0.199	+1.112
“POR	-0.016	0.013	-1.534
ECM_{-1}	-0.651	0.153	-5.341
Constant	-0. 030	0.048	-2.320

R^2 =0.8015; F=15.631[0.000]; ** Adjusted R^2 =0.7451; Sum of squared residuals=0.1891 log likelihood 37.932 DW=2.03
Schwarz Criterion=-1.975; Akaike Inform Criteria= -2.890 Prob. of (F-statistics= [0.0030].

Diagnostic tests
Ramsey’s RESET (test for linearity) = 2.O65 [0.017] “LM-test’ (test for Autocorrelation) x^2 (1) =_3.2798; White

of heteroscedasticity in the error terms μ_t. The second advantage is that a user does not have to specify a lag length for the test regression. As such the Phillips-Perron (PP) test gives the same result as the ADF, and the critical values are similar to those of the ADF tests (Enders, 1995; Stock and Watson,-1993; Munnell, 1990). The test confirms the results of the ADF unit root test (Table 5.1).

Modelling cointegration: The autoregressive formulation

Since all $\Delta y_t ... \Delta y_{t-k+1}$, are all I (0) but y_t is I (1), in order for this estimation to be consistent, then Π_i should not be a full rank. Let the full rank be n and the reduced rank be r. If n=r, then the variables in y_i are I (0), while if the rank of Π_i is zero, then there are no cointegrating relations (Harris, 1995; Johansen and Juselius, 2000). Usually, in modelling such relationships, Π_i assumes reduced rank; that is $r \leq (n-1)$, this gives us: $\Pi_i = \alpha\beta'$. Where ± is an n x r matrix and β' is an r x n matrix. βX_{t-1} are the r cointegrated variables, β' is the matrix of coefficient of the cointegrating vectors, that is the long-run coefficient, and ± has the interpretation of the matrix of the error correction terms. The cointegrating coefficients are the weights in the linear combination, which reduces the variables to stationarity. The cointegrating vector is usually normalized on one of the variables. An invalid normalization arises if the variable on which the cointegrating relationship is normalized has a zero coefficient (Boswijk, 1996; Lutkepohl, 2004; Doornik and Hendry, 2001; Hendry and Juselius, 1999; Granger and Newbold, 1974).

The rank of the matrix Π_i, that is the number of cointegrating relation(s) was determined using the two commonly used likelihood ratio (LR) test statistics as provided in Johansen (1988): the trace statistic(λ_{trace}) and the maximum eigenvalue(λ_{max}) with their test statistics given as:

$$\lambda_{trace} = -T \sum_{i=r+1}^{n} \log(1 - \hat{\lambda}_i) \tag{6}$$

$$\lambda_{\max} = -T \log(1 - \hat{\lambda}_{i+1}) \tag{7}$$

Where λ_i is the *i-th* largest eigenvalues of the Π_i matrix in Equation 7. This test was conducted under the null of r=0 and then r=1.

The trace test, tests the hypothesis that there are at most r cointegrating vectors, while the maximum eigenvalue test, tests the hypothesis that there are r+1 cointegrating vectors versus the hypothesis that there are r cointegrating vectors.

Unit root analysis

It is important to ascertain the order of integration, i.e. the presence or absence of unit roots in the time series. In testing for unit root, the H_0: is simply $\phi = 0$, i.e., there is a unit root in $y_t = \phi y_{t-1} + \mu_t$ against the one-sided alternative of $\phi < 1$ $\phi <. H_0$: series contains a unit root against $H1$: series is stationary. In this test, the commonly used regression is:

$$\Delta y_t + \psi y_{t-1} + \mu_t \tag{4}$$

so that a test of $\phi = 1$ is equivalent to a test of $\psi = 0$ (since $\phi - 1 = \psi$). This is based on Augmented Dickey-Fuller test (ADF). A series is stationary if $\phi < 1$, where ϕ is the coefficient of the explanatory variable and $\phi - 1 = \psi$, if $\phi = 1$ then $\psi = 0$. If the final model includes a constant and deterministic trend, the critical Dickey-Fuller value at 5% is -3.41, while the value for a 1% is -3.96. On the other hand, the corresponding values for a constant and no deterministic trend are -2.86 and -3.43, respectively, for finite sample size (Maddalla and Kim, 1998; Sjoo, 2003).

Given that all the variables are non-stationary at 5% and 1% levels, that is, they are all I (1) variables (Table 5.1) and that they become stationary after first differencing, a cointegration test was carried out to determine whether the variables are cointegrated.

The Phillips-Perron test

The Phillips-Perron (PP) test differs from the ADF tests mainly on how it deals with serial correlation and heteroscedasticity in the errors. The tests are non-parametric and avoid the problem of serial correlation in the error terms without adding lagged differenced terms. The tests are similar to the ADF tests, but differ from the latter in that they incorporate an automatic correction to the ADF procedure to allow for autocorrelated residuals. The tests are usually interpreted in the same manner as the ADF tests. The test is presented as:

$$\Delta y_t = \beta' D_t + \pi y_{t-1} + \mu_t \tag{5}$$

Where μ_t is I (0) and may be heteroscedastic, D_t contains deterministic components (constant or constant plus time trend). The PP test corrects for any serial correlation and heteroscedasticity in the errors μ_t of the test regression by directly modifying the test statistics t_π = o and T_π.

Under the null hypothesis that $\pi = 0$, the PP Z_t and Z_π statistics have the same asymptotic distributions as the ADF t-statistic and normalized bias statistic. One advantage of the PP tests over the ADF tests is that the former are robust to general forms

$$\begin{Bmatrix} \beta_1 = -1\ \beta_2 = 0 \ldots \beta_{1n-1} = 0 \\ \beta_2 = 0\ \beta_2 = -1 \ldots \beta_{n-1} = 0 \\ \ldots \\ \ldots \end{Bmatrix}$$

$$\ldots$$

$$\beta_{n-1} = 0\ \beta_{n-2} = 0 \ldots \beta_{n-n-1} = 1$$

(Patterson, 2000; Johansen, 1991)

Determining the lag length

In order to determine the lag length, the paper used the sequential rule discussed by Hall (1994). This rule, known as the general to specific rule, begins with a large value of $\kappa(\kappa_{\max})$, tests the significance of the last coefficient and reduces κ iteratively until a significant statistic is encountered. Setting higher lags and reducing them by eliminating insignificant lags downwards as far as possible would give the correct lag length. However, care was taken not to destroy the assumption of white noise variables and without compromising on the degrees of freedom. The LM test, the Durbin Watson test, the F-test and the white test were done to check for misspecification.

Error correction

This is a dynamic system with the characteristics that a deviation of the current state from its long-run relationship will be fed into its short-run dynamics. This model is therefore important in that it provides a consistent integration of short-run dynamic adjustments with long-run equilibrium specification as indicated by the dynamic relationship specified below:

$$y_t = \beta_0 + \beta_1 x_t + \beta_2 x_{t-1} + \alpha y_{t-1} + \mu_t \quad (8)$$

$$\Delta y_t = \beta_0 + \beta_1 \Delta x_t + \varphi(x_{t-1} - y_{t-1}) + u_t \quad (9)$$

Where $\varphi(x_{t-1} - y_{t-1})$ is the error correction term.

7. Conclusions and policy implications

To identify the model, we imposed zero and exclusion restriction, we also imposed identifying restriction on β. In doing so, we denoted the column of β as β_i, a k x 1 vector and the vector/matrix of restrictions on β_i as R_i of dimension g_i x k. Then the exclusion restriction is $R_i \beta_i = C_i$, where C_i is a g_i x 1 vector of constants with R_i being a g x k vector and $C_i = 0$. There is no redundancy restriction on R_i, which therefore has rank g_i; and R_i has rank=1.

Suppose there are r cointegrating vectors, and assuming a normalization has been imposed, i.e. one element in each β_i has been normalized to 1, then for generic identification, there must be at least r-1 independent restrictions of the form $R_i \beta_i = 0$ placed on each cointegrating vector. In the problem under analysis, since r=2, there are 2-1=1 restrictions. Since R_i is a g_i x k, to identify the i^{th} cointegrating vector, $g_i \geq r$-1. Certainly, if $g_i \leq r$-1, the cointegrating vector cannot be identified. This condition is a necessary but not a sufficient condition (Patterson, 2000; Lutkepohl, 2004). Given the decomposition $\Pi = \alpha\beta'$, the identification of the parameters in β' requires the imposition of at least r-1 a priori restrictions on each of the cointegrating vectors. A necessary and sufficient condition for the identification of the long-run parameters is that $rank\{R(I_r \otimes \beta)\} = r^2$. Thus, the exact identification of the cointegrating relationships of a long-run private investment is given as:

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The empirical discussion in this paper reveals that private investment is positively and significantly affected by public investment in agriculture. Domestic debt has a significantly negative effect. In the short-run, investment in agriculture has a significant positive effect. Domestic debt has a significant negative effect on private investment. In view of the emphasis on the privatization and the realized need for the role of private sector as indicated in the government policy documents, public investment in agriculture has an important role to play in stimulating private investment. Therefore, the government drive to invest more in agriculture is a move in the right direction. Being an agriculture-based economy where over 70% of the population is dependent on agriculture, an agricultural stimulus package would, through the crowding-in effect, have a multiplier effect in the economy.

The policy issue in stimulating private investment is to sustain investment in agriculture at sufficiently high levels in the long-run. This would entail sustained budgetary resource allocations in sufficiently large measures. Debt financing of the public expenditure needs to be used cautiously as they tend to negatively affect private investment. In terms of financing, debt and tax financing need to be efficiently used as they tend to crowd out private investment.

The need to stimulate demand without inflation is important. This will be possible by encouraging domestic production. Agricultural production seems to provide this avenue. Public development expenditure needs to be increased as it has the twin effect of reducing cost and encouraging agricultural development. Both have positive effects on private investment.

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Appendix

A1: Derivation of error correction model

$\Delta y_t=\beta_0+\beta_1\Delta x_t+\varphi(x_{t-1}-y_{t-1})+u_t$

If $y_t=y^*$ and $x_t=x^*$ for all t, and if $\mu_t=0$, then $y^*=\beta_0+\beta_1 x^*+\beta_2 x^*+\alpha_1 y^*$ then

$(1-\alpha_1)y^*=\beta_0+(\beta_1+\beta_2)x^*$ therefore $y^*=\beta_0/1-\alpha_1+(\beta_1+\beta_2/1-\alpha_1)$

Let φ =1-α1, and $\beta_2=\varphi-\beta_2$ where φ is the common value of $\beta_1+\beta_2=1-\alpha_1$.

$y_t=\beta_0+\beta_1 x_1+(\varphi-\beta_1)x_{t-1}+(1-\varphi)y_{t-1}+\mu_t$

Therefore $y_t=\beta_0+\beta_1 x_t-\beta_1 x_{t-1}+\varphi x_{t-1}-\varphi y_{t-1}+y_{t-1}+\mu_t$

Implies that $y_t-y_{t-1}=\beta_0+\beta_1(x_t-x_{t-1})+\varphi\ (x_{t-1}-y_{t-1})+\mu_t$

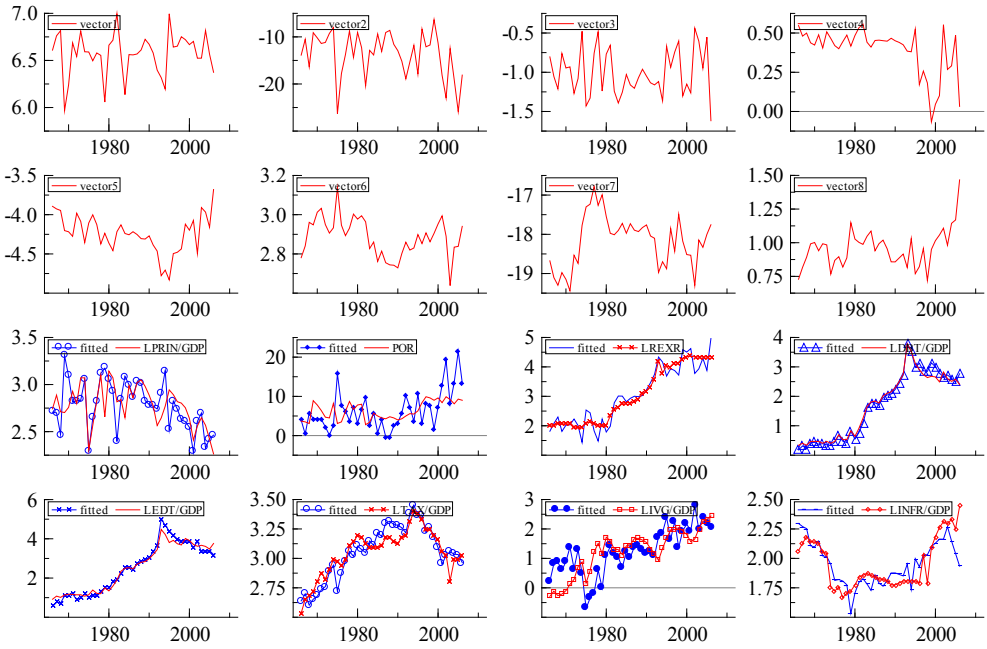
Finally $\Delta y_t=\beta_0+\beta_1\Delta x_t+\varphi\ (x_{t-1}-y_{t-1})+\mu_t$

A2: Table AR(1) with a drift and a time trend t-test

Sample size 1%, 5%	
25 -4.38	-3.60
50 -4.15	-3.50
100 -4.04	-3.45
250 -3.99	-3.43
500 -3.98	-3.42
" -3.96	-3.41

Adopted from Maddala and Kim (1998)

A3: Cointegration graph


vector1
vector2
vector3
vector4
vector5
vector6
vector7
vector8
fitted
LPRIN/GDP
POR
LREXR
LDBT/GDP
LEDT/GDP
LTRX/GDP
LIVG/GDP
LINFR/GDP
1980
2000

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