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An econometric analysis of fixed investment in Namibia

Michael Nokokure Humavindu

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Contact details:
  Michael Humavindu, Resource Economist, Directorate of Environmental Affairs, Ministry of Environment and Tourism, Private Bag 13306, Windhoek, NAMIBIA. Tel: +264-61-249 015; Fax: +264-61-240 339; email: mh@dea.met.gov.na

Table of contents

List of Tables

List of Figures

Acronyms

ADF	augmented Dickey–Fuller
BON	Bank of Namibia
CMA	common monetary area
ECM	error correction model
FIML	full information maximum likelihood
GDP	gross domestic product
H–P	Hodrick–Prescott
LSE	London School of Economics
nampremium	Namibian premium
PINV1	Namibian fixed investment
rgiy	ratio of government investment to output
VAR	vector autoregressive system
VECM	vector error correction model

Abstract

This paper investigates the determinants of aggregate fixed investment in Namibia. Empirical work on Namibian investment functions has gained momentum only recently. To date, there are only two studies on fixed investment in Namibia. Both studies accounted for nonstationarity in the data by employing the Engle–Granger two-step procedure in their analysis. This work aims to complement the existing work by using a more comprehensive econometric analysis. The main focal point of this analysis is the use of the Johansen–Juselius cointegration technique. In addition the paper also investigates some descriptive issues by applying the Hodrick–Prescott filter analysis. Some policy and future research implications are drawn from the results.

1. INTRODUCTION

The purpose of this work is to estimate fixed investment behaviour in Namibia within a cointegrated vector autoregressive system (VAR) framework.[1] Investment is defined as the process of capital formation where resources are acquired or created for production.[2] Fixed investment is normally the appropriate investment aggregate to use when the effect of domestic investment on economic growth is being analysed. In this study, investment refers to fixed investment.

The effect of investment on the economy could be analysed in two ways.[3] First, on the supply side, investment determines the rate of accumulation of physical capital and thereby long-term productive capacity. Second, on the demand side, changes in investment expenditures induce shifts in the aggregate level of employment and personal income through direct and indirect effects. The experience of investment in Namibia has been unusual for a developing country. While other developing countries often save less than they invest (becoming net borrowers), Namibia saves more than it invests. Most of the capital outflow is to South Africa, where investors are able to earn superior returns. Yet this situation also deprives the Namibian economy of the wider direct and indirect benefits of domestic investment.[4]

Namibia's economic development is constrained by this failure to create enough investment opportunities to absorb domestic savings. Consequently, the situation also presents the need for economic research into aspects of investment for policy evaluation. One related task is to identify determinants of fixed investment in Namibia. It is also important to investigate the influence of investment volatility on the Namibian business cycle. These two aspects define the core objectives of this study.

The paper is organised as follows. Section 2 summarises previous empirical work on investment functions in Namibia. Section 3 presents economic theory concerning aggregate investment behaviour. In Section 4, an account of the econometric methodologies employed in this work is presented. Estimation results are presented in Section 5; as is the conclusion in Section 6.

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[1] A Vector Autoregressive system (VAR) is a system whereby a variable is explained by its own lagged values and the lagged values of all other variables in the system. See Hendry (1995).

[2] Lund (1971) identifies five separate classes of investment: investment in human capital; in intangible assets; in financial assets; in stocks and work in progress; and in fixed assets.

[3] Berndt, 1990:225 and Agénor & Montiel, 1999:95.

[4] Emerge 2001, 1998:13.

2. PREVIOUS WORK ON INVESTMENT FUNCTIONS IN NAMIBIA

To date, two studies on private domestic investment behaviour in Namibia have been carried out. The studies employed time-series techniques that account for the nonstationarity in the data. Cointegration analysis and error correction modelling were employed to determine the long- and short-term impacts of determinants of investment in Namibia. The Engle–Granger two-step procedure was applied in both studies. Table 1 indicates the variables used in the two studies.

Table 1. A summary of the existing empirical work on private investment determinants in Namibia

Study	Period	Conventional investment theory factors	Policy-related factors	Open-economy factors
Harupara	1970–96	Real GNP*, real interest rates, real GDP	Public investment, inflation, credit to private sector	Real exchange rate, terms of trade
Shiimi and Kadhikwa	1980–96	Real income**, interest rates	Inflation, ratio of public investment to GDP	

* This variable and the terms of trade variable were dropped from the long-run investment equation since they were found to exert no significant impact on private capital formation.

** Real income was dropped from the long-run investment equation due to its correlation with the ratio of public investment to GDP.

Adapted from: Harupara (1998) and Shiimi and Kadhikwa (1999).

Harupara (1998) concludes that public investment, real output, credit to private sector and the depreciation of the exchange rate positively affect investment in the long run. Inflation and real interest rates affect investment negatively in the long run. In the short-run, private investment is an increasing function of public investment and output. In the short run inflation, real interest rates and the depreciation of the exchange rate affects investment negatively. Although the study considers terms of trade, it fails to incorporate trade flow variables (exports and imports) in its estimation. Trade flows have been found to be measures of openness that displays the most consistent relationship with investment.[5] Harupara (1998) advocates the maintenance of macroeconomic stability, which will encourage and foster private investment.

Shiimi and Kadhikwa's (1999) main findings are that interest rates and the ratio of government investment to GDP are significant determinants of investment in the long run. The ratio of government investment to GDP is highly significant in the short run. However the rate of interest rate and inflation are also significant, but with little impact in the long run. The study does not consider open-economy factors such as trade flows and exchange rate. The study notes that though various factors are responsible for the low investment record in Namibia, remedial measures are particularly needed to stem the shortage of skilled labour.

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[5] See Ndikumana (2000).

In conclusion, it appears that neither study incorporated open-economy factors of investment determination. In addition, causality issues, as between real output and investment were not addressed. Nevertheless, the studies are both important and can prove to be a sound foundation on which to base more comprehensive analysis. This paper attempts to take a step towards that goal. The paper will use a more comprehensive econometric methodology. This will not only investigate nonstationarity, cointegration and error correction, but also correlation issues.

3. THEORIES OF INVESTMENT DEMAND

Kopcke (1985) presents five aggregate investment behaviour models (see Table 2 below). The accelerator model proposes that investment depends on lagged values of some measure of output and as well as lagged value of capital stock.[6] The neoclassical approach moves further away from such a bivariate specification—investment behaviour, in the neoclassical approach depends not only output, but also on prices, interest rates and features of the tax laws. The model posits that factor prices, notably the user cost of capital, should be taken into account in explaining aggregate investment behaviour. However a particular drawback of the neoclassical model is that it does not rationalise the rate of investment or movement toward the optimal capital stock.

Tobin's q model postulates that net investment depends on the ratio of the market value of business capital assets to their replacement value.[7] The q model provides a rigorous framework for specifying the effect of market value on investment. The main criticism of q theory is that its use tends to be chosen on an *ad hoc* basis rather than on optimisation theory. Thus, theory is silent on the factors that govern the shape and length of the distributed lag specification. In practice there are also numerous problems, such as measuring marginal rather than average user cost of capital, accounting for intangibles that affect market value and incorporating tax factors (Berndt, 1990:263).

Investment behaviour in the cash flow model depends on internal cash flow, because these funds are the pre-eminent and most convenient source of financing for business fixed investment. Criticism of the cash flow models arises because the models are not clear on the role of cash flow. Does cash flow affect optimal capital stock directly or does it affect the speed of adjustment from current capital stock to optimal capital stock?[8] Finally, time series or autoregressive models are seen as classic examples of measurement without theory. In their simplest forms, investment is explained by previous investment expenditure. Autoregressive models do not assess directly the effects of changes in business conditions or economic policy on investment. Therefore, such models may be sub-optimal relative to encompassing structural models.

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[6] The main problem with the accelerator models was the absence of prices (user cost of capital). However the models were quiet successful in their empirical applications. See Kopcke (1985).
[7] See Kopcke (1985) and Berndt (1990).
[8] See Berndt (1990).

Table 2. Five investment models

Accelerator	$I_t = a + \sum_{i=0}^{n} Q_{t-i} + cK_{t-1}$
Neoclassical	$I_t = a + \sum_{i=0}^{n} bi(Q_{t-i}/R_{t-i-1}) + \sum_{i=1}^{n} c_i(Q/R)_{t-1} + dK_{t-1}$
q model	$I_t = (a + \sum_{i=1}^{n} b_i[(q-1)(K)]_{t-1} + cK_{t-1})UCAP$
Cash Flow	$I_t = a + \sum_{i=0}^{n} b_i(F/C)_{t-1}$
Autoregression	$I_t = a + \sum_{i=1}^{n} b_i I_{t-i}$

C: price index for capital goods
F: cash flow
I: real investment
K: real stock of capital
Q: real output
q: ratio of financial market valuation of net business assets to replacement costs
R: user cost of capital
UCAP: capacity utilisation rate

Source: Adapted from Kopcke (1985)

Developments in explaining investment at both the aggregate and micro level continue.[9] Recent developments in the investment literature have focused on three areas of inquiry: uncertainty and irreversibility, investment incentives and the impact of property rights and income distribution.[10]

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[9] See Caballero (1997) for an excellent summary of recent developments in explaining investment.

[10] It is not the purpose of this paper to delve into these areas. The reader is advised to consult Bernanke (1983); Abel (1983); Schmidt-Hebbel *et al* (1996); Dixit and Pindyck (1994); Carruth *et al* (1998) and Caballero (1997). The main argument is that conventional investment models fails to consider three issues crucial in determining investment. The first of the issues is that most investment decisions face inherent uncertainty about future benefits and costs from investing. In such a situation, investors attach (subjective) probabilities to the net returns of various investment projects. The second issue is that investors can control the timing of their investment, thereby waiting for relevant information that may reduce the uncertainty. The final issue is that most investment decisions are partly or completely irreversible. Substantial economic costs will be involved in attempting to put capital stock to new uses once it has been installed.

4. ECONOMETRIC APPROACH AND MODEL

An econometric analysis was carried out to examine the co-movements of the cyclical components GDP and determinants of investment in Namibia, using a de-trending technique called the Hodrick–Prescott filter (H–P). The London School of Economics, or 'LSE' approach, incorporating cointegration will be the main methodology for modelling investment in Namibia. The 'LSE' approach has emerged as one of the leading approaches to time series modelling. One of its main tenets is the concept of general-to-specific modelling. The approach starts from a general dynamic statistical model which captures the essential characteristics of the underlying data generating process. Standard testing procedures are then used to reduce the models' complexity by eliminating statistically insignificant variables. At every stage, the validity of reductions is checked to ensure the congruence of the selected model (Krolzig and Hendry, 2000:1).

4.1 Examining co-movements between investment and other variables: The H–P filter methodology

The co-movements between investment and the other variables used in this work are examined for the period 1982 to 1999, using annual Namibian data. Gross domestic product (GDP) is used to measure the output cycle. GDP and variables such as the ratio of government investment to output (rgiy) are examined in their relations with fixed investment. To model the relations, a de-trending technique, the H–P filter is employed.[11]

The H-P filter methodology simply characterises an observed time series, y_t, as the sum of an unobserved trend component, y_t^*, and a residual cyclical component, y_t^c:

$$y_t = y_t^* + y_t^c \tag{1}$$

With a given parameter λ, y_t^* is extracted by minimising the loss function:

$$min \sum_{t=1}^{T} (y_t - y_t^*)^2 + \lambda \sum_{t=2}^{T-1} [(y_{t+1}^* - y_t^*) - (y\varepsilon_t^* - y_{t+1}^*)] \tag{2}$$

In short, the aim is to select the trend component that minimises the squared deviations from the observed series, subject to the constraints that changes in y_{t+1}^* vary gradually over time. The higher the λ, the smoother the resulting series is forced to be. For this study $\lambda = 100$, which is the usual practice for annual data.[12] Applying the H-P methodology leads to a stationary series, allowing the use of standard time series analysis, for example cross correlations.. The aim here is to measure the degree of co-movements of a series g_t with output y_t through the magnitude of the correlation coefficient $\rho(j)$, j $\varepsilon\{0, \pm 1, \pm 2, \ldots\}$. The series can be cyclical, a-cyclical or counter-

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[11] See Agenor and Montiel (1999) pp.128–9. The H–P filter method decomposes all macroeconomic series into nonstationary and stationary and so enables empirical characterisation of the data.

[12] There are criticism directed at the H-P filter methodology, which are discussed in Agenor and Montiel (1999).

cyclical depending on whether ρ(0), is positive, zero, or negative (Agenor and Montiel, 1999).

4.2 Time series characteristics of the data and cointegration

Our first step is to examine the time series characteristics of the data. We employ the Augmented Dickey-Fuller (ADF) tests to determine the order of integration of each. The following regression is run to apply the ADF tests:

$$y_t = a + b y_{t-1} + cT + \sum_{i=1}^{n} d_i \Delta y_{t-i} + e_t \tag{3}$$

In equation (3), the null hypothesis is that b=1 (has a unit root) and the number of lags, n, is chosen as the minimum necessary for white noise residuals. The application of time series with a unit root in empirical investigations can lead to spurious results.[13] This means that the regressions will have high R^2, t-statistics that are significant, but the results will have no economic meaning. The regression results will appear good, because the least squares estimates are not consistent and the customary tests of statistical inferences do not hold (Enders, 1996).

4.3 The vector autoregressive model

To test for long run relations between the variables employed in this work, we employ the Johanssen–Juselius cointegration technique. This technique provides maximum likelihood tests for the number of cointegrating vectors in two cases. In the first case, the model allows for deterministic trends in the integrated variables, whereas in the second case it does not. The general VAR provides the basis for our cointegration analysis. VARs characterise the joint behaviour of a group of variables conditional on their past values and, possibly, on a group of deterministic variables which may include a constant term, a linear trend, seasonal dummies and event-specific dummies.[14]

Krolzig and Hendry (2000) outlines the basic VAR model including deterministic terms and with independent Gaussian errors: the K-dimensional time series vector Y_t is generated by a vector autoregressive process of order p, denoted VAR (p) model:

$$y_t = A_{1} y_{t-1} + \ldots A_{p} y_{t-1} + B d_t + \varepsilon_t \tag{4}$$

In (4) $t=1 \ldots T$; and the A_i and B are coefficient matrices and the initial values of $Y_0 = (y_0, \ldots, y_{1-p})$ are fixed. The innovation process ε_t is an unobservable zero-mean white noise process with a time-invariant positive-definite variance-covariance matrix

$$\varepsilon_t = y_t - E\left[y_t \big| Y_{t-1} \right]. \tag{5}$$

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[13] See Enders (1996).
[14] See Gennari (1999).

which is assumed to be Gaussian:

$$\varepsilon t \sim NID(0, \sum)$$ (6)

Therefore the expectation of Y_t conditional on the information set $Y_{t-1}=(Y_{t-1}, y_{t-2}, \dots, y_{1-p})$ is given by:

$$E\left[y_t | Y_{t-1} \right] = Bd_t + \sum_{j=1}^{p} A_j y_{t-j}.$$ (7)

In our model we focus on processes where the only deterministic term is an intercept, $Bd_t = v$.

4.4 Model specification, data description and source

The investment function is specified as follows:

$lpinv1 = c + a_1 lgdp1 +/- a_2 lrgiy - a_3 lnampremium + \varepsilon$ (8)

The definitions of the variables in the above equation are given in Table 3 below.

Table 3. Sources of variables employed in the study

Variable	Source
Gross Domestic Product (gdp1)	Bank of Namibia annual reports (BON), Department of Finance reports (1995=100)
Domestic Private Fixed Investment (pinv1)	BON annual reports, Department of Finance reports, Central Bureau of Statistics National accounts reports (1995=100)
Namibian premium (nampremium)	The differential between real Namibian interest rates and South African real deposit rates, from BON reports and South African interest rates from South African Reserve Bank bulletin (1995=100)
Ratio of government investment to output (rgiy)	Bank of Namibia annual reports (BON), Department of Finance reports (1995=100)

In equation 8, ε and c denotes the error and constant terms respectively. Aggregate annual data covering the period 1982–99 will be used for analysing investment behaviour in Namibia. All data figures are expressed in Namibia dollars, unless otherwise stated.[15] We take the natural log of all the variables in our econometric model.

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[15] Namibia is part of the common monetary area (CMA). One Namibia dollar is equal to one South African Rand.

5. EMPIRICAL RESULTS AND CONCLUSIONS

This section will present the empirical results and conclusions. The unit roots tests and cross correlations are reported on first. Results of the cointegration analysis are reported thereafter. In concluding the paper, some policy implications of the study and directions for future research are offered.

5.1 Unit roots tests

Augmented Dickey–Fuller tests are used to determine the level of integration of the variables used. Table 8 below shows that the variables are all integrated of the first order in levels (except for ratio of government investment).

Table 4. Unit root results

Variable	Period	Lags	Deterministic component			Level of integration
			None	Constant	Trend and constant	
gdp1	1982–99	1	2.383	-0.6666	-2.845	I(1)
lgdp1	1982–99	1	2.385	-2.562	-2.991	I(1)
Δgdp1	1982–99	1	-2.633**	-3.964**	-3.875**	I(0)
Δlgdp1	1982–99	1	-2.895**	-3.825**	-4.019*	I(0)
pinv1	1982–99	1	1.592	-0.193	-3.058	I(1)
lpinv1	1982–99	1	1.625	-0.7479	-2.66	I(1)
Δpinv1	1982–99	1	-2.782**	-3.792*	-3.638	I(0)
Δlpinv1	1982–99	1	-2.547*	-3.309*	-3.159	I(0)
namprem	1982–99	1	-1.539	-1.527	-3.4	I(1)
lnamprem	1982–99	1	-1.46	-1.469	-3.359	I(1)
Δnamprem	1982–99	1	-4.29**	-4.194**	-4.498*	I(0)
Δlnamprem	1982–99	1	-4.29**	-4.194**	-4.498*	I(0)
rgiy	1982–99	1	-2.75**	-4.611**	-5.098**	I(0)
lrgiy	1982–99	1	1.372	-3.621*	-1.233	I(0)
Δrgiy	1982–99	1	-6.633**	-6.488**	-6.314**	I(0)
Δlrgiy	1982–99	1	-2.427*	-2.689	-3.159	I(0)

Δ is the difference operator

* Reject H_0 at 5% level
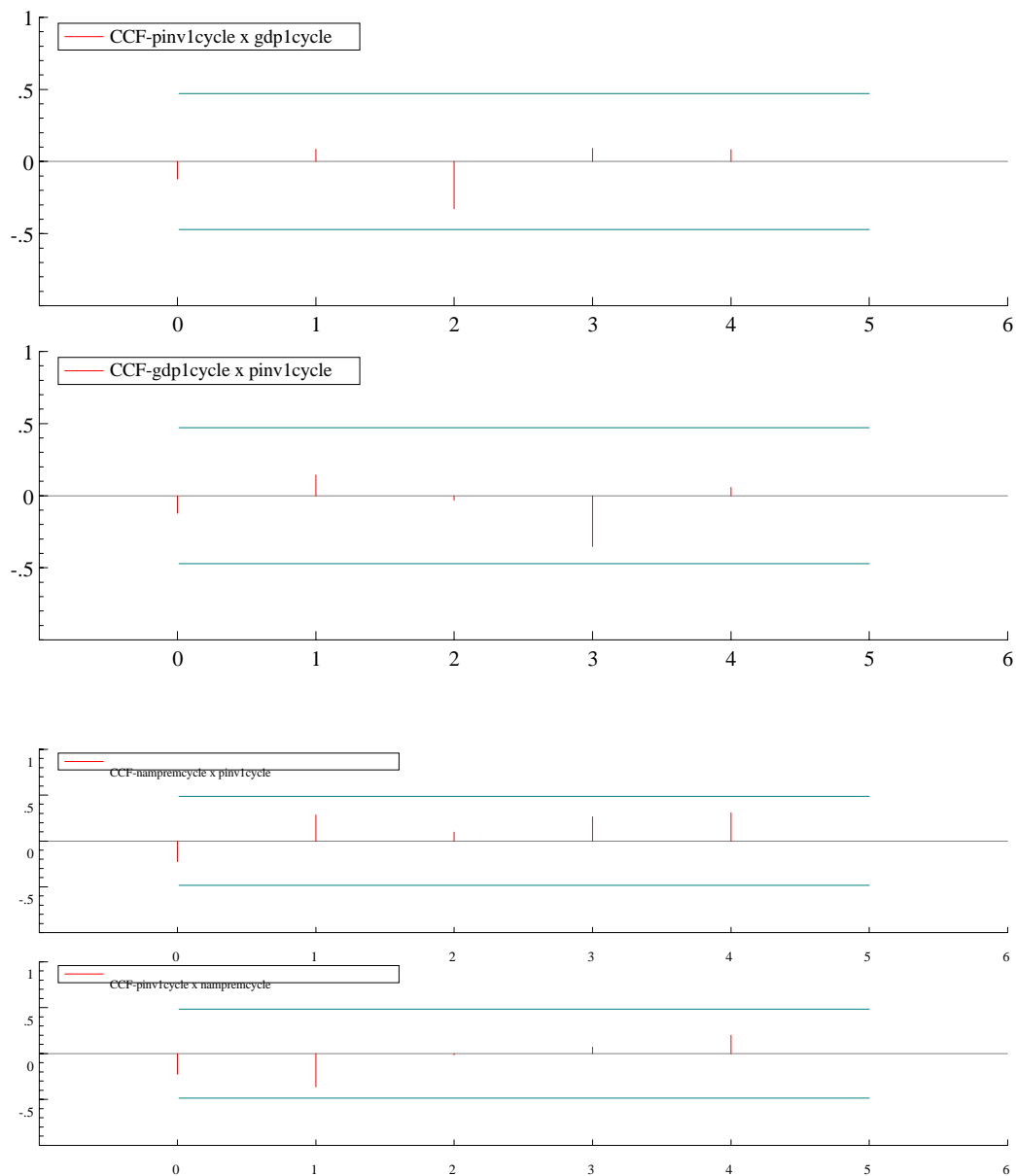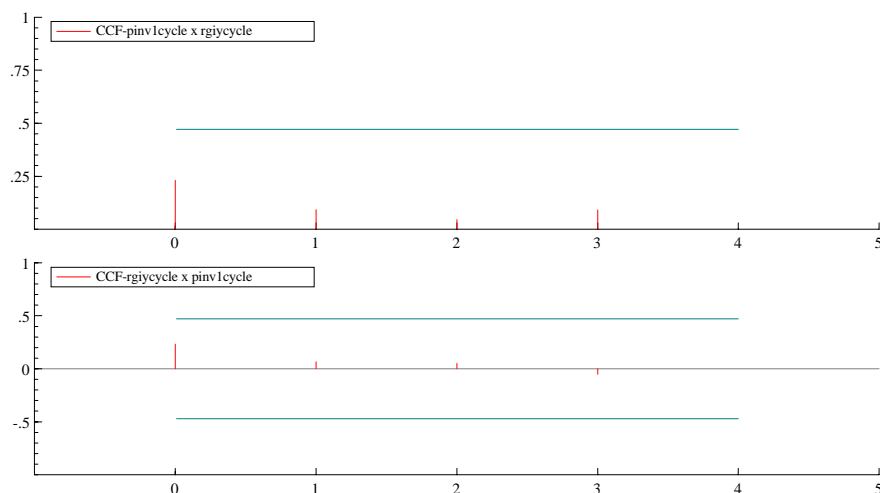
** reject H_0 at 1% level

5.2 Examining correlations

As described earlier, we first examined correlations between Namibian fixed investment (PINV1) and output (GDP), Namibian premium (nampremium) and ratio of government investment to output (rgiy). We employ the H–P filter. Figure 1 below presents the results (which were estimated using PcGive).

Figure 1. Cross correlations

The figure indicates that private fixed investment is weakly correlated with output, the ratio of government investment to output and the Namibian premium. In fact the correlations appears to be insignificant. Implications can be drawn from the correlation investigations: it appears that using this data set, we cannot expect to gain a lot on short-run dynamics. We should rather focus on the long run results, which is part of the co-integration analysis.

5.3 Cointegration Analysis

Table 9 below shows the results of the trace and maximum eigen-value tests used to determine the number of cointegrated vectors in the VAR. The results provide strong evidence for at least one cointegrating relationship. Cointegration graphics (Figure 2) also shows support for at least one cointegrating relationship. Only the first vector (Vector 1) seems stationary.

Table 5. Estimated number of cointegrating vectors: 1982–99

Ho: rank=p	-Tlog(1-mu)	using T-nm	95%	-T\Sum log(.)	using T-nm	95%
p = 0	37.78**	28.34*	27.1	62.3**	46.73	47.2
p <= 1	17	12.75	21.0	24.52	18.39	29.7
p <= 2	7.37	5.527	7.521	5.64	15.4	14.1
p <= 3	0.1505	0.1129	3.8	0.1505	0.1129	3.8

Number of lags used in the analysis: 1

Variables entered unrestricted: constant

Note: Estimations used the PC-GIVE Professional packages.

14

Figure 2. Cointegration graphics
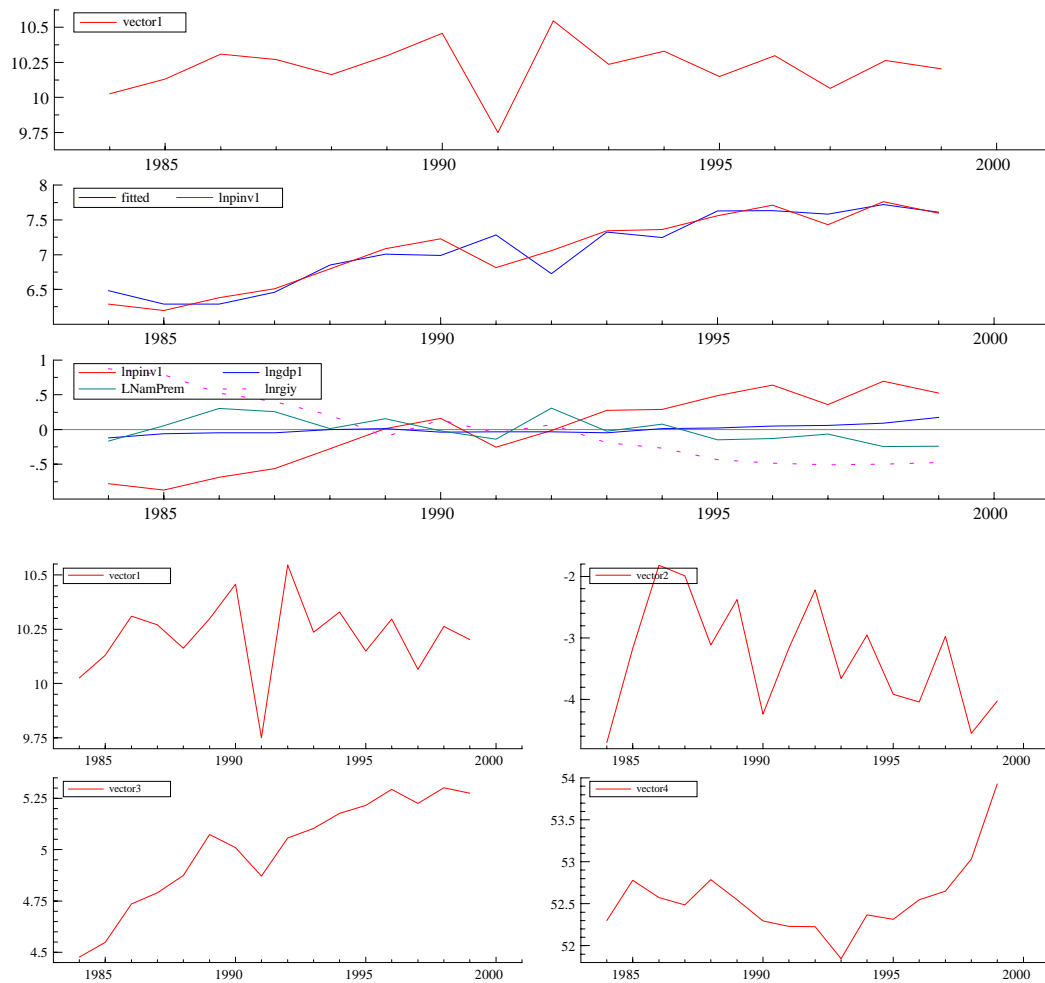
5.4 Weak exogeneity tests

Long-run weak exogeneity refers to the hypothesis that a variable influences the long run development of other variables in the system, but is not influenced by them. Weak exogeneity is also referred to as the hypothesis of 'no levels feedback'.[16] Weak exogeneity testing implies a null restriction on the long-term component in the marginal processes for Δgdp1, Δrgiy, Δnamprem and Δlpinv1. Results for the weak exogeneity are reported in Table 10 below.

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[16] See Hendry and Juselius (2001).

Table 6. Weak exogeneity test results

Variable	Test statistics	Assumed rank of long run matrix
lgdp1	Chi^2(1) = 2.0506 [0.1521]	1
lnamprem	Chi^2(1) = 13.609 [0.0002]**	1
lrgiy	Chi^2(1) = 16.321 [0.0001] **	1
lpinv1	Chi^2(1) = 17.343 [0.000] **	1
* Indicates rejection at 5% level		
** indicates rejection at 10% level.		

The null hypothesis of weak exogeneity could be rejected at the 1% level for all the marginal processes with the exception marginal process for lgdp1. Consequently, only lgdp1 could be treated as weakly exogenous for the purposes of this model. In estimating our long run relations, we need to incorporate the restrictions as suggested by results in table above.

5.5 Long run model

The estimated long run relations, which incorporate restrictions as suggested by the weak exogeneity results are presented in Table 11.

Table 7. Long run relations

\beta'	lgdp1	lrgiy	lnamprem
lpinv1	0.00000	-0.86428	-3.2368
Standard errors of beta'	0.00000	0.43876	0.038004

In the long run, fixed investment is negatively correlated with the ratio of government investment to output and the Namibian premium. Thus in contrast to earlier empirical work, this study finds evidence of government investment crowding out private investment in Namibia.

5.6 Dynamic equations

To conclude our results section, we report on the dynamics (or equilibrium conditions results). The vector error correction model (VECM) was estimated using full information maximum likelihood (FIML). The results are reported in Table 12.

Table 8. Dynamic modelling by full information maximum likelihood

Equation 1 for Dlpinv1

Variable	Coefficient	Std.Error	t-value	t-prob
Dlrgiy	-0.48158	0.24190	-1.991	0.0679
ecm1_1	-0.72150	0.32757	-2.203	0.0463
Constant	3.8554	1.7281	2.231	0.0439

\sigma = 0.203549

Equation 2 for Dlnamprem

Variable	Coefficient	Std.Error	t-value	t-prob
ecm1_1	-25.078	7.0302	-3.567	0.0034
Constant	132.44	37.181	3.562	0.0035

\sigma = 4.45129

loglik = 9.6919717 log|\Omega| = -1.29226 |\Omega| = 0.274649 T = 15
LR test of over-identifying restrictions: Chi^2(1) = 0.142785 [0.7055]

Diagnostic tests
Dlinv1 :Portmanteau 3 lags= 1.6639
Dlnprem :Portmanteau 3 lags= 3.5481
Dlinv1 :AR 1- 1 F(1, 11) =   1.826 [0.2037]
Dlnprem :AR 1- 1 F(1, 11) =   2.2599 [0.1609]
Dlinv1 :Normality Chi^2(2)=   0.4018 [0.8180]
Dlnprem :Normality Chi^2(2)=   3.2968 [0.1924]
Dlinv1 :ARCH 1 F(1, 10) = 0.45829 [0.5138]
Dlnprem :ARCH 1 F(1, 10) = 0.81523 [0.3878]
Dlinv1 :Xi^2   F(4, 7) =   1.8562 [0.2230]
Dlnprem :Xi^2   F(4, 7) =   0.1636 [0.9503]
Dlinv1 :Xi*Xj F(5, 6) =   1.3628 [0.3546]
Dlnprem :Xi*Xj F(5, 6) =   0.18901 [0.9561]
Vector portmanteau 3 lags= 5.4075
Vector AR 1-1 F(4, 20) =   0.62645 [0.6491]
Vector normality Chi^2(4)=   3.0091 [0.5563]
Vector Xi^2 F(12, 16) =   0.79573 [0.6506]
Vector Xi*Xj F(15, 14) =   0.60204 [0.8297]

Short-run dynamic analysis is useful since it includes information on both short and long run parameters. Long-run parameters are captured through the error correction model (ECM) term in Table 12 above. The ECM term is negative, thereby confirming earlier assertion that the variables are cointegrated. The ECM implies a very fast speed of adjustment, around 70% per annum for the investment equation. The diagnostic statistics are strongly supportive of the short run empirical model. Tests for over identifying restrictions (LR), autoregressive conditional heteroskedasticity (ARCH), chi-square test for normality (NORM), serial correlation (AR) and goodness-of-fit test in stationary autoregressive moving-regressive-average models (Portmanteau) are passed with ease. The acceptable diagnostics are also reflected in Figure 3 below.

Figure 3. Dynamic modelling graphs
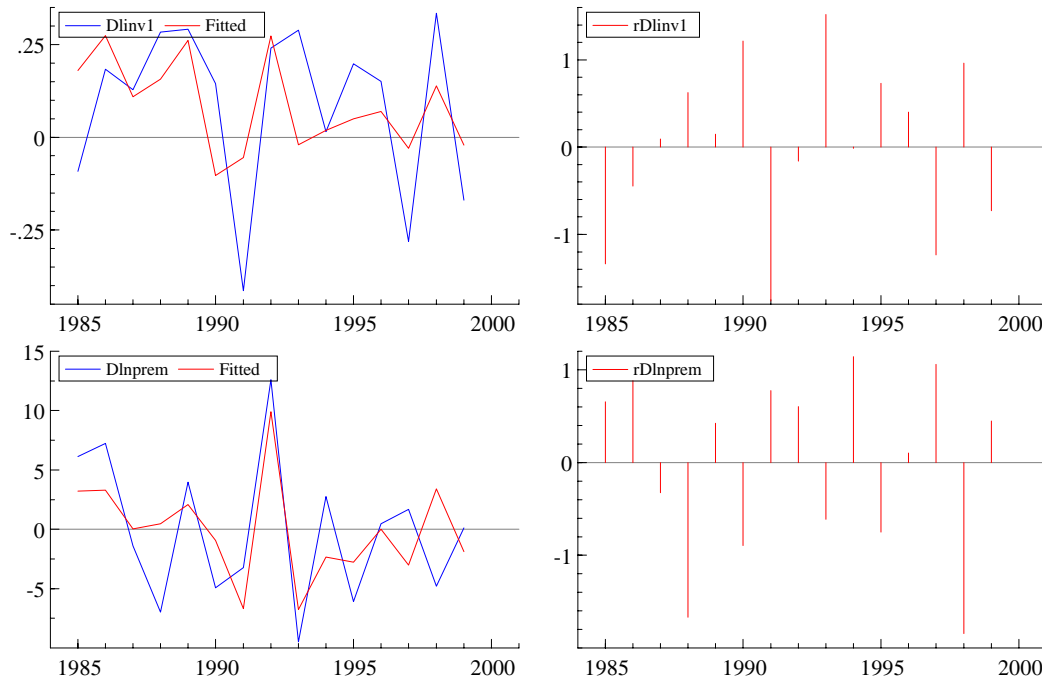
5.7 Policy implications and concluding remarks

This paper has explored the short run and long run coefficients of private fixed investment in Namibia. These coefficients are calculated using a sample of annual observations between 1982 and 1999. Employing multivariate cointegration analysis one significant cointegrating vector was discovered. In the long run, the ratio of government investment and the interest differential between South African and Namibian rates are significant determinants of fixed investment. A crucial finding is that output (GDP) is not significant for investment in Namibia. This finding warrants further investigation. In addition we examined degrees of correlation between fixed private investment and the other variables employed in the study. The results show that the correlations are insignificant.

Of importance are the findings that government investment tends to crowd out private investment in both the long- and short-run. The stability of the short run dynamic model for private fixed investment is also a noteworthy aspect. Some inferences for policy and future research can be drawn.

An important implication for policy is that the ratio of government investment and interest rates differentials are major determinants of private investment in Namibia. Thus some emphasis should be placed on these two variables in efforts to enhance and stimulate private investment in Namibia.

For future empirical work, insignificance of output (GDP) should be investigated further. There is also a need for empirical work to examine in detail the relationship between public and private investment in Namibia. Previous empirical work on investment in Namibia has found public investment having a crowding in effect on private investment. This work has, in contrast to previous work, found public investment to have a crowding out effect on private investment. Future empirical work should attempt to disaggregate public investment into various components. This might aid in finding out which components of public investment crowd out and which ones crowd in private investment.

In conclusion, it should be noted that this study did not accommodate aspects of irreversibility and uncertainty in its empirical analysis. As these two issues are gaining ground in the investment literature, it might be worthwhile for future work to incorporate them.

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