

UNIVERSITY OF CAPE TOWN



SCHOOL OF ECONOMICS

Financial Development and Economic Growth Nexus:
A multivariate VAR Analysis of Zambia's Economy

By

Lufeyo Banda

Email: lufeyobnd@gmail.com

ESSA Conference Sept. 2007

Abstract

The debate over the impact of financial development on economic growth in both Less Developed and Developed Countries has continued with no consensus although there is theoretical and empirical evidence that supports both sides of the debate. This study examines the causal relationship between financial development and economic growth for Zambia covering the period 1965-2004. Granger causality testing procedures based on VECM and Toda-Yamamoto are employed for the analysis. The study finds some evidence of both uni-directional and bi-directional causality between financial development growth, though the uni-direction causality seem to prevail more. We also find an indirect causal relationship of credit to growth via growth fixed capital formation. The findings we have disentangled in this paper using the two methods confirms a number of issues some of which are: (1) that in less developed countries like Zambia it is supply-leading hypothesis which features more predominant than demand-following, (2) the indirect causality relationship of credit and growth seems to confirm one possible explanation and that is we have Credit rationing taking place in Zambian economy where firms may find it difficult to source working capital from financial intermediaries for investment projects, (3) Furthermore, the empirical results suggest that long-run steady state exists among the model's seven variables and that efficiency of the financial system seem to play a positive role both in the short-run and long-run dynamics thereby pointing to one critical policy framework and that is Zambia need to continue with the liberalization of the financial sector.

J.E.L. Classification G20, O16

Contents

Abstract.....	i
1 Introduction.....	1
2 Financial Sector Developments in Zambia.....	2
3 Econometric Methodologies.....	4
5 Discussion and Estimation Results.....	6
5.1 Identification of Long Run Model	7
5.2 The Vector Error Correction Model results.....	9
5.3 Toda and Yamamoto Levels VAR Results	11
6 Summary, Implications and Conclusions	12
References.....	13

1 Introduction

Economists in the field of economic development have long recognised and emphasised the existence of a link between financial development and economic growth. Although this issue has proliferated over the last fifty years, it can be traced back to the early discussions of Hamilton (1781) and Schumpeter (1911). These scholars have advocated the hypothesis that financial development leads economic growth - which has come to be known as the finance-lead hypothesis.¹

In the 18th century, the finance-lead hypothesis received further impetus from the liberalisation theorists such as McKinnon (1973) and Shaw (1973), as well as from international financial institutions, viz., the World Bank and the International Monetary Fund. These scholars and institutions advocate that a liberalised financial sector mobilises greater volumes of financial saving and allocates capital to the more productive users, which enhances the productivity of physical capital. The effect of these factors is an increase in economic growth.

More recently, the finance-lead hypothesis received yet another impetus from the “new” growth literature (see Pagano, 1993). Financial development can impact on economic growth by raising the savings rate, raising the marginal productivity of capital and increasing the proportion of savings devoted to investment.

In spite of the various support offered towards the finance-lead hypothesis, not all economists subscribe to it. Others advocate an alternative hypothesis, the demand-following hypothesis. They maintain the view that economic growth induces growth in the financial sector. The main proponent of this idea is Patrick (1966). According to Patrick, the early phases of an economy are characterised by the supply-leading finance, but as the economy matures, demand-following hypothesis where the growth of the economy leads finance development takes pre-eminence.

Another dissenting view, associated with Lewis (1955) and Patrick (1966), postulates that there is a feedback relationship between financial development and economic growth. Indeed, a number of empirical studies find a two-way causality between finance development and economic growth (see Greenwood and Jovanovic, 1990; Berthelemy and Varouidakis, 1997; and Greenwood and Bruce, 1997).

In light of the foregoing, it would appear that the controversy surrounding the issue of causal relationship between financial development and economic growth has not been resolved empirically. This is notwithstanding an attempt to do just that, starting with the seminal work of Goldsmith (1969). However, these studies have tended to favour the finance-lead hypothesis.

Despite the vast interest generated in the finance-growth nexus worldwide, most of this work is based on cross-section econometric work - for example, Goldsmith (1983) and Jung (1986). A useful suggestion spelt out in the existing cross-country work, notably Jung (1986), is that a country-specific study is likely to yield robust and conclusive evidence on this controversy.

Thus this paper is motivated to investigate the causal relationship on Zambia based on the following. First, it is expected that a country-specific study for Zambia would generate evidence,

¹ This paper is extracted from my PhD thesis (work in progress).

which is not only robust but also capable of informing economic policy. The argument here is that if national economic policy is to favour a supply-leading experiment in the form of financial restructuring programme, it is necessary that policy makers are able to isolate the relevant financial variables in that economy.

And second, despite the vast interest in the finance-growth nexus worldwide as stated above, in the case of Zambian economy there has only been one study to our knowledge, conducted by Agbetslafa (2003), which made an attempt to investigate the link between financial markets development and economic growth in Sub-Saharan Africa and this included Zambia. This study used cointegrating analysis proposed by Johansen and Juselius. The mode of estimation was based on the bivariate analysis approach and the empirical results obtained support the existence of uni-directional causality running from financial development to growth and this includes Zambia.

The purpose of this paper is thus to utilize the concept of cointegration and place it in the context of a model that tests for Granger-causation between finance, investment and real per capita income for the economy of Zambia where research on this issue has been very limited. To test for robustness of the results we apply the Toda-Yamamoto system. This frame work does not require pre test of the variables. This paper also provides us with an opportunity to compare results from those which have tested the competing hypotheses of causality (i.e., demand-following and supply-leading). Investment variable is included in the vector since it has been argued that financial development via fixed capital formation responses may play a crucial role in affecting real per capita income and vice versa (see Luintel and Khan, 1999), From a statistical viewpoint, this country has a long spanning data-set (1965-2004) which adds favourably to what the techniques that will be employed in the forthcoming analysis are designed for

The structure of this paper is as follows. Section 2 reviews the process of financial development in Zambia and in particular the reforms. Section 3 lays out the methodology of Granger-causality based on VECM and Toda-Yamamoto system. Section 4 gives a brief explanation on the data. Section 5 presents the causality results based on both the VECM and Toda-Yamamoto framework. Finally, section 6 summarises the major findings and offers policy guidance.

2 Financial Sector Developments in Zambia

Soon after gaining political independence in 1964, the government embarked on, among other programmes, a rigorous programme of nationalization of what were considered the key pillars to the economy. By 1980s about 80 percent of the economic and financial activities were in the hands of the state. Over 150 parastatal firms had been established, and this included banks like Zambia National commercial bank, Development Bank, Exim Bank, Savings Bank and Zambia State Insurance Corporation (Profit, 1992).

The world's oil price shocks of the mid and late 1970s dealt a big blow to the Zambian economy. This along with the decline in the terms of trade, resulting from the decline in the price of copper pushed the economy into what would prove to be a long-term stagflation (Kalyalya, 2001). As the economic situation continued to deteriorate, towards the end of the 1980s the government, with the support of the donor community, in particular the Bretton Woods institutions, undertook to carry out some economic and structural reforms. The re-emergence of plural politics in 1990

and the consequent change of government in October 1991 provided additional stimuli to the reform process. More important, unlike the previous Government the newly elected government fully adopted the structural adjustment programme introduced in June 1989 (UNZA, 1993). The core of these reforms was the liberalization of the economy. Henceforth, the government undertook to:

- ✓ Liberalize the economy so that price, rather than state intervention, becomes the basis on which economic resources were allocated. This would ultimately ensure that resources were efficiently allocated through a market mechanism;
- ✓ Re-establish the private sector, through privatisation, as the fulcrum of economic growth rather than the state and
- ✓ Ensure economic stabilization through appropriate monetary policy instrument (Kalyalya, 2001).

All these measures required that all in the management of the economy, including the Central Bank of Zambia (BOZ), played effective roles in the transformation process. Facilitating of the market-based monetary policy instruments also required extensive financial reforms (Mehran et al., 1988). In this regard a lot of effort was made in the reform and liberalization of the financial sector of Zambia, and several measures were implemented between 1992 and 2000.

The developments that have taken place in the financial sector as a direct consequence of the financial reforms include the following, among other things.

- ✚ Interest rates liberalisation, which entailed complete removal of controls on lending and deposit rates;
- ✚ Removal of exchange controls by 1994, in order to promote efficient external payment system, and the attainment of a sustainable external balance;
- ✚ Introduction of the treasury bills tender system in order to strengthen the open market operations tool;
- ✚ Introduction of the interbank market, which has offered financial banks greater flexibility in the management of their liquidity;
- ✚ Introduction of the electronic clearing house in 1999, which helped provide an efficient and reliable clearing and payment system for purposes of lubricating the financial system;
- ✚ Establishment of the formal capital market, the Lusaka Stock Exchange whose effect was to broaden the source of financing (that is relatively cheaper than the commercial banks) to the business community, and
- ✚ Strengthening of the banking laws (by enactment of the 1994 Banking and Financial Act).

Based on all these reforms the economy is now experiencing a modest recovery with positive increases in real incomes since 1999, although the general perception in Zambia is that the reforms have not brought the increase in well being that was promised and expected. Per capita GDP increased by an average 3.5 percent annually since 2003. The two main sectors contributing to this positive development are services and industry on the supply side, while export and investment are the main source on the demand side of the economy. As a result of strong

recovery from the effects of the 2002 drought, agriculture has contributed significantly to real GDP growth for 2003. In addition to this the mining sector has also contributed enormously with the recovering in the prices of copper.

3 Econometric Methodologies

As illustrated by Engle and Granger (1987), evidence of cointegration among variables also rules out the possibility of the estimated relationship being 'spurious'. However, although cointegration indicates the presence or absence of Granger-causality, it does not indicate the direction of causality between variables. This direction of the Granger (or temporal) causality can be detected through the vector error correction model derived from the long run cointegrating vectors. If we exploit the idea that there may exist comovements between energy, prices and real incomes of LDCs and possibilities that they will trend together in finding a long-run stable equilibrium, by the Granger representation theorem we may posit the following testing relationships which constitutes our vector error-correction model:

$$\begin{aligned}
 RGDP_t = & \alpha_0 + \sum_{i=1}^{p-1} a_i \Delta RGDP_{t-i} + \sum_{i=1}^{p-1} b_i \Delta GFDCF_{t-i} + \sum_{i=1}^{p-1} c_i \Delta PVY_{t-i} + \sum_{i=1}^{p-1} d_i \Delta UC_{t-i} + \sum_{i=1}^{p-1} e_i \Delta INT_{t-i} \\
 & + \sum_{i=1}^{p-1} f_i \Delta OPENK_{t-i} + \sum_{i=1}^{p-1} g_i \Delta SPREAD_{t-i} + ect_{t-i} + \varepsilon_t
 \end{aligned}
 \tag{1}$$

$$\begin{aligned}
 \Delta GFDCF_t = & \alpha_0 + \sum_{i=1}^{p-1} a_i \Delta RGDP_{t-i} + \sum_{i=1}^{p-1} b_i \Delta GFDCF_{t-i} + \sum_{i=1}^{p-1} c_i \Delta PVY_{t-i} + \sum_{i=1}^{p-1} d_i \Delta UC_{t-i} + \sum_{i=1}^{p-1} e_i \Delta INT_{t-i} \\
 & + \sum_{i=1}^{p-1} f_i \Delta OPENK_{t-i} + \sum_{i=1}^{p-1} g_i \Delta SPREAD_{t-i} + ect_{t-i} + \varepsilon_t
 \end{aligned}
 \tag{2}$$

$$\begin{aligned}
 \Delta PVY_t = & \alpha_0 + \sum_{i=1}^{p-1} a_i \Delta RGDP_{t-i} + \sum_{i=1}^{p-1} b_i \Delta GFDCF_{t-i} + \sum_{i=1}^{p-1} c_i \Delta PVY_{t-i} + \sum_{i=1}^{p-1} d_i \Delta UC_{t-i} + \sum_{i=1}^{p-1} e_i \Delta INT_{t-i} \\
 & + \sum_{i=1}^{p-1} f_i \Delta OPENK_{t-i} + \sum_{i=1}^{p-1} g_i \Delta SPREAD_{t-i} + ect_{t-i} + \varepsilon_t
 \end{aligned}
 \tag{3}$$

where $(\Delta lnrgdpc, \Delta lngfcf, \Delta lnpvvy)$ are changes in real per capita income, gross fixed capital formation and private credit by the commercial banks respectively. Δ is a difference operator. **ECT** refers to the error-correction term(s) derived from long-run cointegrating relationship via the Johansen maximum likelihood procedure, and $\varepsilon_{i,t}$'s (for $i = 1, 2, 3$) are serially-uncorrelated random error terms with mean zero. In our case Equation 1 will be used to test causation from prices and energy consumption to income. Equation 2 will be used to test causality from income and energy consumption to prices, whereas Equation 3 will test causality from income and prices to energy consumption.

In addition to indicating the direction of causality amongst variables, the VECM approach allows us to distinguish between 'short-run' and 'long-run' Granger-causality. When the variables are cointegrated then in the short-term deviations from this long-run equilibrium will feed back on the changes in the dependent variable in order to force the movement towards the long-run equilibrium. If the dependent variable (say, the change in the energy consumption) is driven directly by this long-run equilibrium error, then it is responding to this feedback. If not, it is responding only to short-term shocks to the stochastic environment. The non-significance of any of the 'differenced' variable which reflects only short-run relationship, however, does not involve such violations because; theory typically has little to say about short-term relationships (see Thomas. 1993). The novelty of the ECM approach to economic modelling and its significance in testing Granger causality, as well as implications for economic theory has been covered extensively in the literature (see Muscatelli and Hurn, 1992 Canova, 1993).

To test for the robustness of the results obtained under VECM we applied the method proposed by Toda and Yamamoto (1995). Toda and Yamamoto developed a simple procedure that involves testing for Granger non-causality in level VARs irrespective of whether the variables are integrated, cointegrated or not. For this purpose, a VAR is estimated not with its 'true' lag order k but with lag order of $(k + d)$, where d is the maximal potential order of integration of the variables. Then, Granger causality is tested by performing hypothesis tests in the VAR ignoring the additional lags $k + 1, \dots, k + d$. Toda and Yamamoto proved that in such a case linear and nonlinear restrictions can be tested using standard asymptotic theory. This method, which like the ARDL technique avoids the low-power unit root and cointegration pre-tests, has recently been applied in several causality studies.

4 Data

The data included in our models was obtained from the World Development Indicators International Financial Statistics and Penn World Tables and we outline their definitions below as follows:

- ❖ The dependant variable is the real per capita which is expressed as $(rgdpc)$
- ❖ Our measure of investment rate $(gfcf)$ is strictly gross fixed capital formation. This proxy is very important component of growth equation as it captures the rate of augmentation of physical capital stock through out the economy
- ❖ The proxy of financial intermediation is captured by credit provided by the financial intermediaries to private sector as a % of GDP. This measure isolates credits issued to the private sector, as opposed to credits issued to the public sector, and it also excludes credit issued by the central bank.
- ❖ The second financial proxy included in our model is the $(spread)$. This represents the wedge between interest rate of loans and deposits. It measures the amount of resources absorbed by the banking sector.
- ❖ The real domestic short term interest rate (int) is included in the model as another explanatory variable. Romer (1990) argues that with increase in the interest rates, agents

discount future output relative to current output at a higher rate. This results in capital moving from productive resources thereby leading to the decline in the growth of the economy.

- ❖ We also included variables which might affect investment. These include financial instability variable (*uc*) and openness of the economy (*openk*). Fedderke (2000) argues that investment is adversely affected by uncertainty. In view of this, we proxied for uncertainty a financial instability index. This is defined as the variance of the difference between the local interest and international interest rate (i.e., US \$ rate). On the other hand the openness of the economy is defined as the sum of imports and exports as a percentage of GDP.
- ❖ Last but not the least *openk* which represents the openness of the economy. By definition its exports plus imports divided by (*rgdpl*). This is the constant price equivalent of the *openc* variable and is the total trade as a percentage of GDP.

The data outlined above was assumed to be consistent for analysis purposes. This assumption was based on the reliability of the data source. Furthermore, because of the number of the countries involved and in order to maintain consistency all data used in the three countries was obtained from the same source which is WDI online data set. It was also subjected to comparison with other online data sources such as the World Bank and Penn World Tables. We found that the differences in values were very insignificant and consequently disregarded other sources for the purposes of our analysis.

5 Discussion and Estimation Results

A necessary but not sufficient condition for cointegration is that all series should share the same integrational properties in a univariate sense. Prior to testing for cointegration, we investigated the integrational properties of each of the variables by applying unit-root testing procedure. Based on augmented Dickey-Fuller tests which are presented in Table 1 below (see Dickey and Fuller, 1981), we could not find any significant evidence that [all the seven variables included in the VAR were not integrated of order one or $I(1)$]. This is indicated by tests of all individual series in level and first difference form.

Table 1: Results of ADF Unit Root Test

Country	Variables	Levels	1 ST Difference		
Aug Dickey-Fuller statistic					
Zambia	<i>rgdpc</i>	T	-1.29	NT	-6.40
	<i>gfcf</i>	T	-1.34	NT	-7.03
	<i>pvv</i>	T	-1.42	NT	-4.95
	<i>spread</i>	NT	-1.20	NT	-9.52
	<i>uc</i>	T	-1.71	NT	-6.14
	<i>openk</i>	T	-2.69	NT	-6.77
	<i>int</i>	NT	-2.91	NT	-8.20

Note: Mackinnon (1991) critical values are -3.50 in levels and -2.92 for the 1st difference.

Given the common integrational properties of these variables, we then proceeded to test for the presence of cointegration in the vector [*lnrgdpc*, *lngfcf*, *lnpvy*, *lnspread*, *lnuc*, *lnint*, and *lnopenk*] by using Johansen and Juselius's (1988) multivariate MLE procedure.² Results of Johansen and Juselius's LR and trace tests are presented in Table 2. The results tabulated in Table 2 below show that both the Maximum eigenvalue (λ_{max}) and the Trace statistics (λ_{trace}) suggest $r = 2$. The hypothesis $r = 0$ is rejected against $r = 1$, and the hypothesis $r = 1$ is rejected against $r = 2$ but the hypothesis that $r = 2$ cannot be rejected against $r = 3$ etc. Though maximum eigenvalue statistic and the trace test are consistent in this model our theoretical prior that there are 3 long-run relationships and this exert a bias in favour of $r = 3$.

Table 2: Johansen estimates-Zambia

Null	Alternative	Statistic	95% CV	90% CV
Cointegration LR test based on maximal Eigenvalue statistics				
$r = 0$	$r = 1$	67.1259	49.3200	46.5400
$r \leq 1$	$r = 2$	49.7522	43.6100	40.7600
$r \leq 2$	$r = 3$	30.6303	37.8600	35.0400
$r \leq 3$	$r = 4$	18.5835	31.7900	29.1300
$r \leq 4$	$r = 5$	15.0456	25.4200	23.1000
Cointegration LR test based on trace statistic				
$r = 0$	$r = 1$	198.0231	147.2700	141.8200
$r \leq 1$	$r = 2$	130.8972	115.8500	110.6000
$r \leq 2$	$r = 3$	81.1450	87.1700	82.8800
$r \leq 3$	$r = 4$	50.5147	63.0000	59.1600
$r \leq 4$	$r = 5$	31.9311	42.3400	39.3400

Order of the VAR=2. List of CVs: *lnrgdpc*, *lngfcf*, *lnpvy*, *lnspread*, *lnuc*, *lnint*, *openk*, *dum75* and *dum92*.

5.1 Identification of Long Run Model

Identifying of the long-run structure basically involves testing hypothesis of financial growth nexus in the form of direct and indirect relationship. Thus, normalization restrictions were imposed on three vectors involving *lnrgdpc* in CV1, *lngfcf* in CV2 and *lnpvy* in CV. In addition to these restrictions six addition zero restrictions were made. The outcome is the just-identified system depicted below. In this just-identified model we report results in equation form only.

$$\lnrgdpc = 0.31\lnngfcf + 1.67\lnpvy - 0.02\lnint + 0.84\lnopenk \quad (4)$$

$$\lnngfcf = 3.88\lnrgdpc + 1.88\lnpvy + 0.35\lnuc + 1.55\lnopenk \quad (5)$$

$$\lnpvy = -0.75\lnrgdpc + 0.13\lnngfcf + 0.14\lnspread - 0.24\lnopenk \quad (6)$$

² Detailed discussion of the Johansen procedure can be found in Cuthbertson *et al.* (1992), and wide-ranging surveys by Clements (1989) and Muscatelli and Hurn (1992).

The coefficient estimation results in equation 4, 5 and 6 show that a direct interpretation of the estimates is not straightforward. When examining these cointegrating vectors we notice immediately how different they are from the theoretical underpinnings of finance and growth nexus. For instance we see that signs of the *lnuc* variable in CV2 and *lnrgdpc* and *lnspread* in CV3) are different from our prior expectation.

We then proceeded to test a number of hypotheses using the above just-identified model as a basic model and imposing over-identifying restrictions. Since we expect the long-run relations to include real per capita income to have equal coefficient we therefore restricted these variables to have equal coefficients. These restrictions produced the over-identified system in the cointegrating vector (31), which is easily accepted with a $\text{CHSQ}(2) = 5.2110$ [.074]. This in essence gives rise to the preferred model of long-run relationship between financial development and economic growth of Zambia.

Long-run cointegrating relations based on over-identifying restricted model:

$$\beta_s = \begin{pmatrix} & \mathbf{vector1} & \mathbf{vector2} & \mathbf{vector3} \\ \mathbf{lnrgdpc} & 1 & -0.66 & -0.66 \\ & & (0.19) & (0.19) \\ \mathbf{lngfcf} & -0.15 & 1 & -0.21 \\ & (0.16) & & (0.10) \\ \mathbf{lnpvy} & -1.14 & -1.13 & 1 \\ & (0.21) & (0.38) & \\ \mathbf{lnspread} & 0 & 0 & 0.15 \\ & (none) & (none) & (0.03) \\ \mathbf{lnuc} & 0 & 0.17 & 0 \\ & (none) & (0.07) & (none) \\ \mathbf{lnint} & 0.01 & 0 & 0 \\ & (0.002) & (none) & (none) \\ \mathbf{lnopenk} & -0.75 & -1.65 & 0.35 \\ & (0.16) & (0.37) & (0.11) \end{pmatrix} \quad (7)$$

where LR test restriction $\text{CHSQ}(2) = 5.2110$ [.074]

Consequently, the long-run cointegrating relationship involving direct and indirect causal relationships between finance and growth is reproduced in the usual equation form as follows:

$$\lnrgdpc = 0.15\lnghcf + 1.14\lnpvv - 0.01\lnint + 0.75\lnopenk \quad (8)$$

$$\lnghcf = 0.66\lnrgdpc + 1.13\lnpvv - 0.17\lnuc + 1.65\lnopenk \quad (9)$$

$$\lnpvv = 0.65\lnrgdpc + 0.21\lnghcf - 0.15\lnspread - 0.76\lnopenk \quad (10)$$

Based on these long-run unique cointegrating equations we move on to our next step which is vector error correction modelling.

From the results reported above the estimates are striking, and show for the first cointegrating vector (CV1) that real per capita income (\lnrgdpc) is determined by \lnpvv with respective long run coefficients of 1.14, which is significant at the one per cent level. Importantly, \lnghcf , \lnint and \lnopenk also appear to affect real per capita income (\lnrgdpc) with coefficients of 0.15, -0.01 and 0.75 which are significant at the five percent level, respectively. These results appeal to yield interesting results. For instance, the first estimate in the cointegrating vector (CV1) supports the endogenous growth view that gross fixed capital formation drives long run economic growth. Similarly the negative effect of interest rates on real per capita income is in agreement with the traditional view of a long run positive link between growth and capital accumulation and a negative long run link between accumulation and cost of capital (see Mishkin, 1981 and Romer, 1990).

The second cointegrating vector (CV2) shows that real per capita income (\lnrgdpc), financial development (\lnpvv) and openness (\lnopenk) all have positive coefficients of 0.66, 1.13 and 1.65 respectively on (\lnghcf) which are significant at the one per cent level.

The third vector (CV3) was eventually normalised on private credit (\lnpvv) after trying the alternative financial development proxy (i.e., \lnspread). The results from this vector seem to give interesting results too. First, we note that the real per capita income (\lnrgdpc) and spreads are statistically significant and all have correct signs. However, within this same vector the \lnopenk though significant has a wrong sign.

The evidence from these three vectors seems to suggest that in the long run financial development positively affect the economic growth and the reverse is true. However, this does not give us the answers to the issue of causality, which of course is the issue for our next discussed under the VECM.

5.2 The Vector Error Correction Model results

Conditional on the above long-run estimates, we have the following expressions for the error correction model.

Table 3: Granger-Causality Tests on VECM

Sources of causation	Full Model		
	$\Delta \ln rgdpc$	$\Delta \ln gfcf$	$\Delta \ln pvy$
$\Delta \ln rgdpc$	-	CHSQ(1) 0.19E-4(0.99)	CHSQ(1) 0.43(0.51)
$\Delta \ln gfcf$	CHSQ(1) 3.52(0.06)	-	CHSQ(1) .83(0.36)
$\Delta \ln pvy$	CHSQ(1) 7.84(0.00)	CHSQ(1) 0.79(0.37)	-
$\Delta \ln spread$	CHSQ(1) 3.40(0.07)	CHSQ(1) 1.68E-3(0.99)	CHSQ(1) 0.04(0.84)
Long-run ECT			
$ECM1(-1)$	-2.68 (-0.13)	1.69 (0.51)	0.61 (0.08)
$ECM2(-1)$	0.21 (-0.00)	-3.77 (-0.34)	-1.94 (-0.08)
$ECM3(-1)$	-4.78 (-0.53)	-0.19 (-0.12)	0.07 (0.02)

In the short run estimates in parenthesis are the coefficients while those for the ECM the terms in parenthesis are p-values.

Having unearthed long run relationships via the cointegrated vector method, vector error-correction techniques are applied. The lagged residuals from the cointegrating regression with the appropriate number of lags are included in the Granger-causality test structure. The lag length structure depends on the restricted error-correction models. For both Models, the restricted error-correction specifications pass a series of diagnostic tests, including serial correlation based on the inspection of Lagrange multiplier.

Table 13 reports the findings for the endogeneity of all variables, based on the error-correction equations. From the three cointegrating vector established above, estimates of the parameters show that the error-correction term measuring the long-run disequilibrium is significant in two out of the three equations (i.e., CV1 $ect_1 = -0.1$, CV2 $ect_2 = -0.34$) and while CV3 $ect_3 = 0.02$ was found not to be statistically significant. Thus, concerning the long run causality, the t -statistic appears to be significant in only the first and second cointegrating vectors. However in the credit vector equation none appear to be significant. This implies that all the variables in the CV1 and CV2 have a tendency to restore equilibrium and take the burden of any shock to the system. In this case the t -tests for the error-correction terms, at the 1% level of significance, indicate that real per capita income is granger caused by $lnpvy$.

These results would imply that a long-run causal relationship running from $lnpvy$ to $lnrgdpc$ exists, although not in the opposite direction, that is, from $lnrgdpc$ to $lnpvy$ (as $lnrgdpc$ is not significant in the third long-run equation). Our results therefore do not lend support to the claims that we have in the long run a bi-directional causality taking place in Zambia. Conversely,

private credit as a proxy of financial development seems to cause and precede real per capita income.

Regarding the short-run dynamics (Granger-causality in the strict sense) of CV1, the Wald-tests suggest that real output is affected by changes in gross fixed capital formation (*lngfcf*), private credit (*lnpvvy*) and spread between lending and borrowing rates (*lnspread*). This finding is based on the significance of the *p*-values of these variables at 10, 5 and 10 percent respectively. The short-run dynamics of CV2 and CV3 indicate that there is no causality existing between variables of interest. This means that only a unidirectional relationship exists from private credit and spread to real per capita income. This of course is in addition to the causal inference running from gross fixed capital formation to growth as mentioned before.

To complete our analysis of the causal relationship in our multivariate framework it is useful to compare these results with those generated by another method. The argument for this like said in chapter earlier on is to check for the robustness of the results. Hence in the next section we discuss the causality relationship between finance and growth in levels using the Toda and Yamamoto framework. It must be pointed out that this only involves the long-run dynamics.

5.3 Toda and Yamamota Levels VAR Results

Results from the VAR estimated using the procedure developed by Toda-Yamamoto (1995) are presented in Table 4. Although the lag order chosen by AIC and SBC was 2, a ($k + 1 = 3$) order VAR was estimated with restrictions placed on lagged terms up to the k^{th} lag. Since all the variables are in levels, no short-run causality flows exists, as was the case with the VECM. Rather, the results provide information about the long-run causal relationship among variables in the system.

The results obtained in Table 4 seem to indirectly render support the supply-leading hypothesis found in VECM approach. In this case we found that *lnpvvy* to Granger-cause *lngfcf* and in turn *lngfcf* to Granger-cause *lnrgdpc*.

Furthermore, we found that *lnrgdpc* is Granger-caused by *lnspread* and *lnpvvy* Granger-caused by *lnrgdpc*. This slightly contrasts with the results obtained under the VECM where only the supply-leading hypothesis seems to be supported by the results. However in both models (i.e., VECM and Toda-Yamamoto) we have indirect support for supply-leading hypothesis from *lnpvvy* to *lnrgdpc* via *lngfcf*.

Two issues come out from this modelling: first is the support in both models for the indirect causality relationship running from private credit to real per capita income via investment. Second is the support of the direct causal relationship running from spread to real per capita income and also real per capita income causing private credit. With regard to the rest of the hypotheses we found that we could not reject the hypothesis of “Granger no-causality” even at 10 percent level of significance (for more details see *p*-values in Table 3 and 4.

Table 4: Results of long-run causality test based on Toda-Yamamoto

Variables	Order of VAR Model	Source of causation			
RGDPC	1	RGDPC	GFCF	PVY	SPREAD
		-	$\chi^2(1)=4.23$ [0.04]	$\chi^2(1)=0.37$ [0.54]	$\chi^2(1)=12.17$ [0.00]
GFCF	1	$\chi^2(1)=0.09$ [0.77]	-	$\chi^2(1)=3.94$ [0.05]	$\chi^2(1)=0.04$ [0.84]
		$\chi^2(1)=3.91$ [0.04]	$\chi^2(1)=0.47$ [0.49]	-	$\chi^2(1)=1.19$ [0.27]
PVY	1	$\chi^2(1)=0.02$ [0.89]	$\chi^2(1)=0.82$ [0.37]	$\chi^2(1)=0.05$ [0.83]	-

Optimal lag length is determined by AIC and SC. VAR order = k+dmax where k is the lag length used in the system and dmax is the maximum order of integration in the system. Here, it is I(1) and k=1.

6 Summary, Implications and Conclusions

The purpose of this paper was to examine the causality issue between real income and financial development in a multivariate context bringing in the investment as a third variable in Zambia. In so doing various recently developed time-series techniques such as unit root testing, multivariate cointegration and procedures in vector error-correction modelling were introduced and illustrated both with respect to exposing additional channels of causation to emerge and economic intuition of long-run relationships. Furthermore a procedure such as Toda Yamamoto was applied in order to check for robustness of the results.

Finally, although in both models we seem to have at least one measure of the financial system (credit or spread) affecting per capita output directly, we also had indirectly causal relationship of credit via the investment rate to real per capita income. Credit extension was found to have both direct and indirect influence on the real sector. One possible explanation for the indirect association between financial intermediation and the real sector may be attributed to the presence of credit rationing within the Zambian economy.

Furthermore, from the results of the various financial policy reforms which have been undertaken so far, they seem to suggest that progress has been achieved in improving and modernizing the financial systems. However, much remains to be done, for instance by properly sequencing and completing the reform process Zambia could benefit more from the efficient pulling and allocation of resources. In view of this the government need to continue with the financial policies they have started

References

- Agbetsiafa, D. K. (2003). *The finance growth nexus: Evidence from Sub-Saharan Africa*. Dordrecht (Netherlands): Springer Press.
- Banda, L., (2006). 'Finance-Growth Nexus; A Multivariate Analysis of Zambia's Economy'. *Unpublished PhD Thesis*: University of Cape Town
- Bethlehem, J.C., Vardoulakis, A., (1997). "Economic Growth, Convergence Clubs and the role of Financial Development". *Oxford Economic Papers*, Vol. 48: 300-328.
- Canova, F. (1993). Vector autoregression models: specification, estimation, inference, and forecasting, in *Handbook in Applied Econometrics: Macroeconomics*, (eds), M. H. Pesaran and M. Wickens, Basil Blackwell. Oxford, pp. 73-138.
- Dickey. D. A. and Fuller. W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root, *Econometrica*, 49, 1057-72.
- Engle, R.F, and Granger, C.W.J. (1987). "Co-integration and Error Correction: Representation, Estimation and Testing", *Econometrica*, 55, 251-276.
- Granger C.W.J, (1969). "Investigating causal relation by Econometric Models and Cross Spectra Methods," *Econometrica*, Vol. 37, 24-36.
- Greenwood, J., and Bruce, S, (1997) "Financial markets in development, and the development of financial markets," *Journal of Economic Dynamic and Control* 21(1).
- Greenwood, J., and Jovanovic, B (1990). "Financial Development, Growth and Distribution of Income," *Journal of Political Economy*, Vol.37, pp. 464-475.
- Hamilton, A., (1781) *Banks and Politics in America: From a civil war*, Princeton University Press, NJ.
- Johansen, S. and Juselius, K. (1991). "Maximum Likelihood Estimation and Inferences on Cointegration-with applications to the demand to the demand for money," *Oxford Bulletin of Economics and Statistics*, Vol.52, No.2.
- Jung.W.S, "Financial Development and Economic Development: Intonation Evidence," *Journal of Current Anthropology*: University of Chicago, 986.
- Lewis, W.A., (1955). *Theory of Economic Growth*, George Allen and Unwin, London.
- Luintel, K.B. and Khan, M. (1999). "A Quantitative Reassessment of the Finance-Growth Nexus: Evidence from a Multivariate VAR", *Journal of Development Economics*, 60,381-405.

- McKinnon, R.I., (1973). *Money and Capital in Economic Development*, Brookings Institution, Washington, D.C.
- Mehran, H., et al., 1998, 'Financial Sector Development in Sub-Saharan African Countries,' *Occasional Paper* 169, (Washington DC: International Monetary Fund).
- Muscateili, V. A. and Hurn, S. (1992) Cointegrating and dynamic time series models. *Journal of Economic Survey*. 'i, 6. 1-43.
- Pagano. M, (1993). "Financial markets and Growth: An Overview," *European Economic Review*. Vol.42. pp. 81-93.
- Patrick. H, "Financial Development and Economic Growth in underdeveloped Countries," *Journal of Economic Development and Cultural Change*. Vol. 14: pp. 174-189, 1966
- Profit (Magazine), 1992.
- Schumpeter, J.A. (1911), *Theorie der wirtschaftlichen Entwicklung*, Dunker & Humblot, Munchen.
- Shaw, E.S. (1973), *Financial deepening in Economic Development*, Oxford University Press, New York.
- Thomas, R.L. (1993), *Introductory Econometrics: Theory and Applications* (Longman, London).
- Toda, H.Y. and T. Yamamoto, (1995). "Statistical Inference in Vector Autoregressions with Possibly Integrated Processes," *Journal of Econometrics*, Vol.66, pp. 225-250.
- UNZA, 1993, *Analysis of the 1993 Budget*, mimeo, Economics Department, The University of Zambia.