INFLATION, CAPITAL ACCUMULATION AND ECONOMIC GROWTH IN IMPORT-DEPENDENT DEVELOPING ECONOMIES

BY

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A Paper Prepared for the 14th Annual Conference on Econometric Modelling for Africa

8-10 July 2009

Abuja, Nigeria

ABSTRACT

This paper adopts an inter-temporal optimization theoretic framework within which the representative agent derives utility from money balances and financial asset holdings. The super-neutrality of money is removed by modelling today's output as a function of yesterday's capital stock. The empirically analytical framework makes use of a hexa-variate panel vector autoregressive (PVAR) approach on data from 30 sampled import-dependent developing economies. The variables included in the empirical PVAR model are inflation, capital accumulation, output growth rate, interest rate, exchange rate, terms of trade and import dependence. Our empirical results suggest that the long-run static impact of capital accumulation and economic growth on inflation is negative. Besides, inflation and economic growth had dampening effects on capital accumulation contemporaneously in the long-run. The short-run dynamics also indicate that while it is possible for any previous disequilibrium in the inflation, capital accumulation and economic growth relationship, the speed of adjustment to equilibrium is so low that it will take a long time for any imbalance to be corrected. Exchange rate and import-dependency ratio produce short-run dynamics that drive economic growth in import-dependent developing economies. It is, therefore, recommended that in order to reduce inflation in the long-run in import-dependent economies, macroeconomic policies should be directed at enhancing economic growth and capital accumulation.

KEYWORDS: Inflation, Capital Accumulation, Economic Growth, Panel VAR

JEL CLASSIFICATION: C32, C33, D92, E22, E31, O50

1.0 INTRODUCTION

The crucial role of capital in economic growth and development process has been recognised since the pre-Keynesian era when the classical ideology monopolized economic thinking and policy formulation. Without doubt every nation in the world today still lays tremendous emphasis on capital accumulation by stressing the need for raising the level of investment in relation to output. This emphasis is traceable to the short-term fiscal policies and national development plans of both the developed and the developing economies over the past four decades.

One important trend in development process which has remained consistent since civilisation is that all developed nations are industrialized. Industrialization is associated with heavy investment financed through capital accumulation. Rapid and sustainable real economic growth is a necessary condition for economic development. Meanwhile, for this type of growth to occur, there is the need for a relatively stable macroeconomic environment which is an indicator for low risks and a condition for attracting investment and boosting entrepreneurial activities. Entrepreneurs and investors will always shy away from undertaking projects associated with high risks. By implication, even though a certain level of inflation may be important in attracting investment, there is the need to keep inflation at manageable limits in order to propel economic growth.

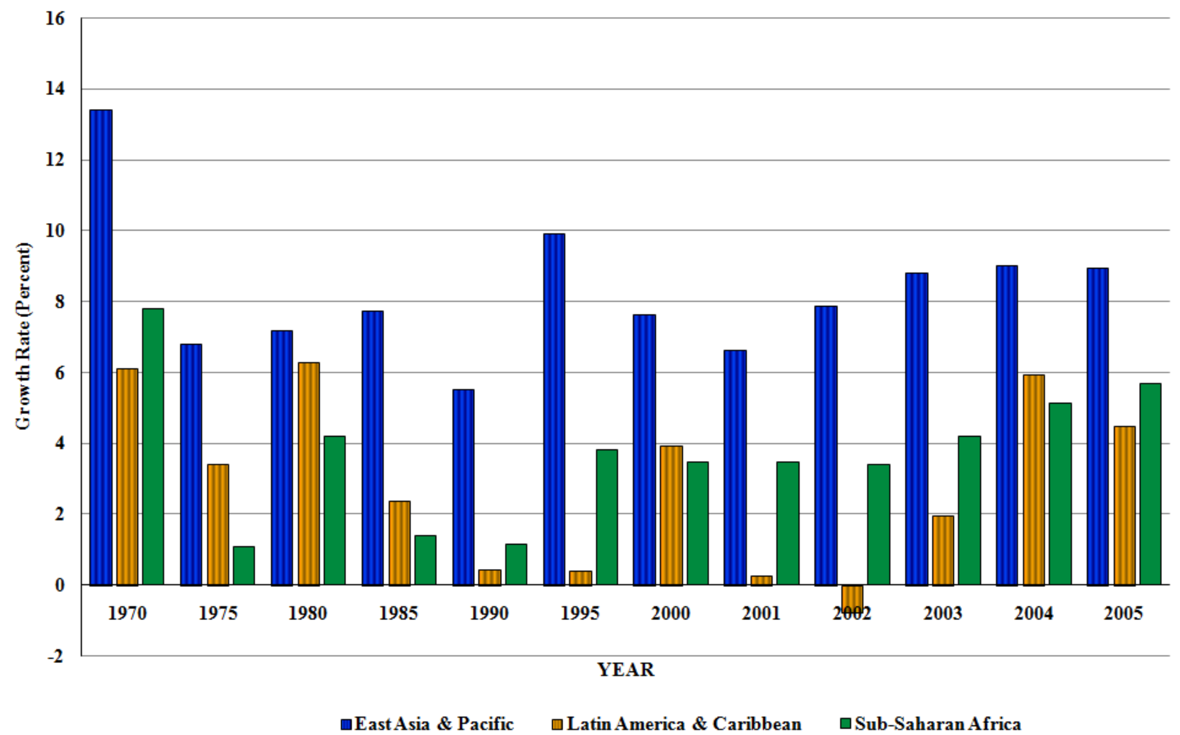
The macroeconomic policy formulation challenge confronting many developing countries today is how to achieve low rate of inflation, manageable trade and balance of payments deficits, and higher saving and investment rates to finance long-run economic growth. This problem has become even more complex in today's world of globalisation where developing countries are prone to further underdevelopment if the appropriate policy-mix is not prudently formulated and cautiously implemented. For example, a country which is experiencing astronomical rates of inflation risk suffering from low investment, low productivity, high import-dependence and worsening balance of trade and payments.

Given the scenario above, it is imperative to understand the macrodynamic interlinks among inflation, capital accumulation and economic growth. This is because while theoretical literature is quite emphatic about the relationship exiting among inflation, capital accumulation and economic growth, empirical literature is still ambiguous on the impact, direction, and the strength of the relationship across countries, regions and empirical methodology. This paper, therefore, aims at ascertaining the empirical case for import-dependent developing countries within the context of panel vector autoregression. The next section of the paper discusses the trends in economic growth, investment and inflation in developing countries, whilst the literature review and theoretical framework are presented in Sections 3 and 4 respectively. In Section 5, issues related to the type and source of data, the specification of the empirical model and the methodology are presented. Section 6 presents the empirical findings whilst Section 7 discusses the results. Section 8 concludes and provides some policy guidelines.

2.0 GROWTH, INVESTMENT AND INFLATIONARY EXPERIENCES IN DEVELOPING COUNTRIES

Figure 1 below shows the real GDP growth rates for the countries included in the panel[1] on regional basis. The real GDP growth rates clearly shows that countries in East Asia and the pacific region experienced the highest growth rates whilst those in Latin America and the Caribbean experienced the least growth rates during between 1970 and 2005. Apart from EAP which recorded real growth of about 13.4 percent, none of the sub-regions recorded an average growth rate beyond 10 percent for the three and half decades. The sub-region which recorded the most inconsistent real growth is the LAC especially for the period between 1975 and 2004.

Figure 1: Real GDP Growth Rates for Developing Regions, 1970-2005



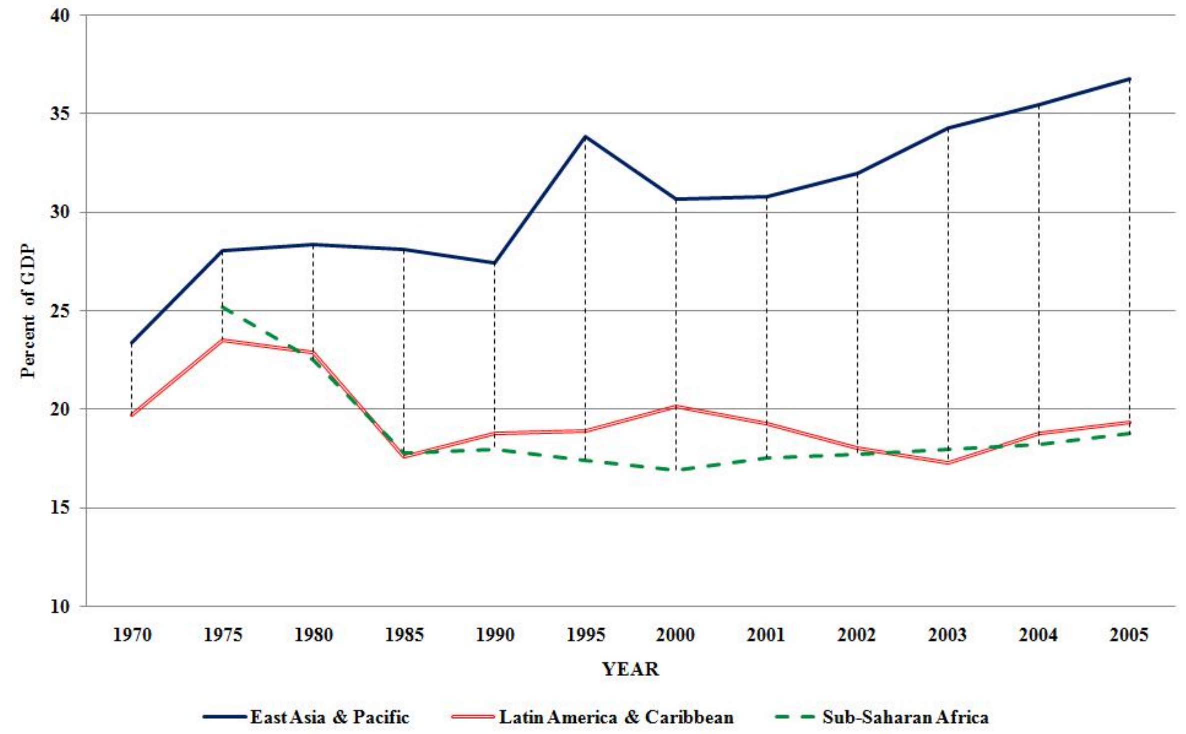
Source: Authors' own estimation

The trends in the investment/GDP ratio are shown in Figure 2 below. Generally, there has not been a consistent investment growing trend in any of the sub-regions. Countries in EAP countries, however, witnessed a more robust and consistent investment/GDP growing trend

[1] See the Appendix for the list of countries included in the panel.

particularly from the 1990s. Countries from LAC and SSA recorded low growth in investment/GDP ratio over the 35-year period. In fact, the investment/GDP growth trends of LAC and SSA are approximately the same during the period under consideration, except for the 1990-2002 period when the ratio for LAC countries was slightly above that of SSA countries.

Figure 2: Gross Fixed Capital Formation as a Percentage of GDP for Developing Regions, 1970-2005



Source: Authors' own estimation

3.0 LITERATURE REVIEW

3.1 Capital Accumulation and Economic Growth

According to neoclassical economists, the stock of capital of a nation increases through the process of net investment. Net investment is the difference between the net national income and how much of the income the nation spends on consumption in the same accounting period. Once capital accumulation enhances the production capacity of a nation, there is no gainsaying that it is most essential to any growth and development process of an economy. It is this idea that formed the basis of virtually all growth models that emerged since the era of the neoclassical school.

The central assumption underlying the neoclassical thinking is that once an economy converges at its steady-state, the growth rates of per capita income, consumption, investment and capital stocks are all equal to the exogenous state of technological progress. Whereas fiscal policy does not affect the steady-state growth rate in neoclassical model, in endogenous growth models, fiscal policy does influence the steady-state growth rate. As a result of this, these models have some inherent dynamics which enable fiscal policy to play a recognisable role in the process of economic growth.

From the standpoint of development economists, it is generally believed that capital accumulation is the springboard for the escape of low level equilibrium trap involving a vicious cycle of poverty. For instance, Rostow (1960) observes that for the process of economic development to actually take-off, there is the need for sustained growth in terms of critical growth in the ratio of investment to national income. Similarly, Lewis (1955) notes that the process of economic development involves transforming an economy from being a 5% saver and investor to that which is saving and investing at least 12% of its net income.

On refining the general works of Neoclassicals and Keynesians, as well as the specific works of Harrod (1939, 1948) and Domar (1946) growth models, Solow (1956) opens a new chapter in development economics by pioneering an economic growth model based on the assumption that increasing capital accumulation, population and technical efficiency are the sources of economic growth. Even though the Solow model was criticized on the grounds of the its over-simplicity for ignoring many other factors and for the prediction that all economies would eventually grow at the same rate which has been widely refuted empirically, the role of three factors identified by Solow as propellers of economic growth has not been doubted. Hence, Arrow (1962) and Solow (1986) made some modifications to the original model by incorporating human capital or knowledge into the model.

Many of the empirical studies on exploring the determinants of economic growth examined the impact of a set of macroeconomic variables including governance, investment, international trade, government expenditure, financial sector development and foreign capital inflows. The general conclusions from these studies are that investment and economic growth have a positive robust relationship with the former often determining the latter (Levine and

Renelt, 1992). Thus, relationship between investment and growth may be uni-directional from either side or bi-directional. Probably, this is what might have informed Romer (1986, 1987) and Lucas (1988) to further emphasize the role of investment in the process of economic growth under their new growth theory.

3.2 Inflation, Capital Accumulation and Economic Growth

Theoretically, it has been established that inflation causes many distortions in an economy. When prices of consumables increase, real income of households decreases and hence, they cannot buy as much as they used to buy previously. Inflation also discourages economic agents from saving due to the fact that money is worth today than tomorrow. In the long-run, therefore, inflation reduces economic growth because the economy needs a certain level of savings to finance investment projects which stimulate economic growth. Another devastating effect of inflation is that it makes it more difficult for entrepreneurs to plan their activities, especially with regard to how much to produce since under inflationary periods, it is more difficult to predict effective demand and the average costs of production. Furthermore, higher rates of inflation may also impair the effective functioning of financial institutions and markets as well as discourages their integration with global markets. In this regard, higher rates of inflation usually culminate in increasing the level of uncertainty with respect to future prices, interest rates, and exchange rates, which in turn increase the risks among potential trade partners, and thereby discouraging both domestic and foreign trade. With regard to commercial banking, higher rates of inflation also erode the value of the depositor's savings as well as the value of bank loans and other financial credits; and therefore, both the propensity to save and lend money fall considerably. Accordingly, the uncertainty associated with inflation increases the risk associated with investment, production and the efficient functioning of markets.

Quite clearly, there may be direct and indirect effects of inflation on investment. By increasing transactions and information costs, inflation directs adverse consequences for long-run economic growth. For instance, during inflationary periods, nominal values become uncertain which makes investment planning difficult, and hence the reluctance of rational entrepreneurs to engage in contracts under high circumstances of uncertainties. This reluctance to enter into contracts will, in the long-run, inhibit investment and hence undermine the growth of an economy. In effect, inflation may inhibit investment resulting in financial recession (Hellerstein, 1997). In an inflationary economic environment, financial intermediaries will be less willing to offer long-term financing for capital formation and growth. Both lenders and borrowers will also be less willing to enter into long-term contracts. High inflation is often associated with financial repression as governments are compelled to take some actions such as price and interest rate ceilings to protect sensitive sectors of the economy. However, these controls are detrimental to long-run growth and economic development, because under this circumstance capital may not be allocated to the most efficient sectors of the economy. Economic growth may be related to uncertainty and macroeconomic instability where temporary uncertainty about the macroeconomy causes potential investors to wait for its resolution, thereby reducing the rate of investment (Pindyck and Solimano, 1993).

Given the above, recent theoretical literature has increasingly focussed on the role uncertainty plays in formulating investment decisions (Dixit and Pindyck, 1994). According to Chirinko (1996) it is now well-known that the combination of the typically irreversible nature of investment, uncertainty about the future benefits or costs of the investment project, and some flexibility about investment timing, may significantly influence the investment behaviour. Specifically, therefore, there may be a benefit to be achieved by waiting in an unstable and uncertain environment which is often proxied by fluctuations in the general price level in an economy.

Conclusions from some recent empirical works by Fischer (1983, 1991, 1993), Kormendi and Meguire (1985), Grier and Tullock (1989), Gylfason (1991), Grimes (1991), Burdekin *et al* (1991), Roubini and Sala-i-Martin (1992), Levine and Zervos (1992), De Gregorio (1993), and Stanners (1993) suggest that the inflation undermines long-run economic growth. More specifically, De Gregorio (1992a, 1992b) and Cardoso and Fishlow (1989) have shown that developing countries, especially those of Latin America which experienced low growth rates and have also suffered from high rates of inflation.

As macroeconomic instability is due to high rates of inflation, the likelihood of the adverse effect on economic growth is because inflation creates uncertainty about the future with regard to the outcome of private investment. Serven and Solimano (1992) in a multicountry panel data study find that macroeconomic instability in the form of real exchange rate variability or charges in general price level have a negative effect on investment.

Using a sample of countries from Asia and the Organisation for Economic Cooperation Development (OECD), Malla (1997) empirically analyzed the relationship between inflation and economic growth for these countries separately. Having controlled for labour and capital inputs, the empirical results show that for the Asian developing countries, there was no statistically significant correlation between inflation and economic growth. For the OECD countries, however, there exists a statistically significant negative relationship between economic growth and inflation. It was, therefore, concluded that there is an inconclusive or inconsistent relationship between inflation and economic growth.

Mallik and Chowdhury (2001) examine the short-run and long-run dynamics of the relationship between inflation and economic growth for selected South Asian countries viz. Bangladesh, India, Pakistan, and Sri Lanka using cointegration and error-correction models. Two interesting results were revealed: (i) the relationship between inflation and economic growth is positive and statistically significant, and (ii) the sensitivity of growth to variations in inflation rates is smaller than that of changes in growth rates. These results imply that although mild inflation stimulates economic growth, rapid economic growth absorbs into inflation by overheating the economy.

Taking Brazil as an example of a country experiencing high rates of inflation, Faria and Carneiro (2001) examine the inflation-economic growth nexus using annual data for the period 1980 and 1995 within the framework of a vector autoregression. The findings suggest that although the relationship between inflation and economic growth was negative in the short-run, inflation does not affect economic growth in the long-run.

Khan and Senhadji (2001) investigate the inflation-growth relationship for groups of countries classified as industrial and developing with focus on threshold effects using an econometric methodological approach originally developed by Chan and Tsay (1998) and Hansen (1999, 2000). The dataset used was on 140 countries which generally covered the period 1960-1998. The results of this study reveal the presence of threshold beyond which inflation exerts a negative effect on growth, but rates of inflation below the threshold have no effects on growth. Specifically, the results suggest that threshold is far higher for developing countries than the developing countries and averaged between 11-12 percent and 1-3 percent respectively.

Sweidan (2004) analyzes the Jordan economy to determine if the relationship between inflation and economic growth has a structural breakpoint during the 1970-2003 period. The results point to the fact that there is a significant positive relationship between inflation rate of below 2 percent and economic growth. Besides, a structural breakpoint effect occurs at an inflation rate equal to 2 percent. Beyond this threshold level, inflation negatively affects economic growth.

From the empirical results reviewed above, it is quite clear that the impact on inflation on growth and investment is inconclusive. It suggests that the issue of inflation-growth nexus is not straightforward, and this can only be resolved under some unique contexts. For instance, the empirical model and analytical framework could be of some significance just as the underlying fundamental macroeconomic differences such as whether or not a country is small-open or large-open as well as import-dependent or it is a net exporter. Besides, the rate of inflation and capital accumulation process could be of some relevance in explaining the actual correlation existing among inflation, capital accumulation and growth in developing countries.

4.0 THEORETICAL FRAMEWORK

This study constructs a dynamic general equilibrium model to form its theoretical framework. The model is essentially an economy-wide inter-temporal dynamic framework with a representative agent characterisation, which seeks to establish the relationship between capital accumulation, inflation and economic growth. The representative agent has money-in-utility-function (MIUF) preference relation which is separable in consumption, labour supply and real balance holdings, following Sidrauski (1967), Turnovsky (2000), Walsh (2003) and Ahortor (2008).

4.1 The Representative Agent's Behaviour

The representative agent seeks to solve the following inter-temporal problem:

$$\underset{(x,z,l,m,f,b,b^*,k)}{Max} \sum_{t=1}^{\infty} \beta^t \left[u(x_t,\ z_t) + v(1-l_t) + \phi(m_t,\ f_t) \right] \quad \textbf{(4.1)}$$

subject to:

$$m_t + b_t + \sigma_t \left(f_t + b_t^* \right) \ = \ w_t + y_t^d - x_t - \sigma_t z_t - \iota_t \ \text{(wealth constraint)} \quad \textbf{(4.2)}$$

$$k_t \ = \ \iota_t + \left(\frac{1-\delta}{1+\pi_t} \right) k_{t-1} \ \text{(capital accumulation constraint)} \quad \textbf{(4.3)}$$

where:

$\beta^t \equiv$ time discount factor.

$x_t \equiv$ amount of home good consumed by the individual in period *t*.

$z_t \equiv$ amount of imported good consumed by the individual in period *t*.

$l_t \equiv$ total labour supply by the individual in period *t*.

$m_t \equiv$ real domestic balances held by the individual in period *t*.

$f_t \equiv$ real foreign balances held by the individual in period *t*.

$b_t \equiv$ domestic bond holdings by the individual in period *t*.

$b_t^* \equiv$ foreign bond holdings by the individual in period *t*.

$k_t \equiv$ capital accumulation by the individual at the end of period *t*.

$\iota \equiv$ total net investment

$w_t \equiv \left(\frac{1}{1+\pi_t} \right) m_{t-1} + \left(\frac{\sigma_t}{1+\pi_t} \right) f_{t-1} + \left(\frac{1+i_{t-1}}{1+\pi_t} \right) b_{t-1} + \sigma_t \left(\frac{1+i_{t-1}^*}{1+\pi_t} \right) b_{t-1}^* \equiv$ total financial wealth of the individual at the beginning of period *t*, noting that this initial wealth will lose its purchasing power as a result of a rise in the general price level in period *t*.

$\sigma_t = \frac{e_t p_t^*}{p_t} = \frac{e_t\left(1+\pi_t^*\right)}{\left(1+\pi_t\right)} \equiv$ the real exchange rate in period *t*, with $p_t^* \equiv$ foreign price level, $p_t \equiv$ domestic price level, and $e_t \equiv$ nominal exchange rate at time *t*. $1+\pi_t = p_t / p_{t-1}$, $1+\pi_t^* = p_t^* / p_{t-1}^*$, $i_t \equiv$ nominal domestic interest rate, and $i_t^* \equiv$ nominal international interest rate at time *t*.

$y_t^d \equiv \left(1-\tau_t\right) y_t - h_t \equiv$ total disposable income per capita in period *t* where $\tau \equiv$ income tax rate and $h \equiv$ lump-sum tax per capita.

4.2 Preference Relations and the Production Function

The preference relation for consumption goods is Edgeworth complementary which exhibits relative risks aversion in substituting imports for exports. The preference relation for financial asset holdings is also a complementary utility function with relative risk aversion in substituting real domestic money balances for real foreign money balances. The utility function for leisure also has relative risk aversion characterisation with substitution of work for leisure.

The production function assumes the form of a Cobb-Douglas production function with the two traditional factors of production and a productivity shock emanating from public investment.

$$y = \exp\left(g_t\right) l_t^{\vartheta} \left(\frac{1}{1+\pi_t}\right)^{1-\vartheta} k_{t-1}^{1-\vartheta} \tag{4.4}$$

The introduction of public investment into the production function is informed by the fact that in most developing economies where the private sector is not positioned to play its key role as the leading propeller of growth; public investment becomes the main source of economic growth. Equation (4.4) establishes the dynamic relationship between output and inputs. Capital stock enters the production function in its lagged form because of the assumption that today’s production makes use of yesterday’s capital stock which is largely consistent with the accelerator principle of investment. The direct consequence of this assumption is that the present real value of yesterday’s capital stock diminishes with the level of inflation. Thus, modelling output in real terms prompts the inclusion of inflation rate in the production function. It must also be noted that the production function exhibits constant returns to scale and satisfies all the Inada conditions[2].

4.3 Monetary Policy Stance

Monetary authorities are assumed to be implementing rule-base monetary policy. It is further assumed that monetary authorities adjust the monetary base using Taylor-type monetary policy rule. The rule is, however, modified substantially to reflect the general view that the simple Taylor rule is sub-optimal when applied in small open developing economies. Ball (1998) observes that, in open economies, inflation targets and Taylor rules are sub-optimal unless they are modified in important ways. He suggests that the appropriate policy instrument to focus on is the 'monetary conditions index' which is a weighted average of interest rate and exchange rate. Svensson (2003) notes that the simplicity of instrument rules such as the Taylor's one makes commitment and policy credibility technically feasible. Besides, simple monetary policy rules may be relatively robust across models. He, however, identifies three problems associated with a Taylor-type rule. First, if there are other important state variables than inflation and output gap, the rule may not be optimal. For smaller and more open economies (than the US), the real exchange rate, the terms of trade, foreign output, and foreign interest rate seem to be the minimum essential state variables that have to be added.

Thus, the modified Taylor-type monetary policy rule adopted follows Sanchez-Fung's (2000) formulation as specified in equation (4.5) below.

$$m_t^b = \left(\frac{1}{1+\pi_t}\right) m_{t-1}^b + \partial_1 e_t^g + \partial_2 y_t^g \qquad \textbf{(4.5)}$$

where $e_t^g \equiv$ the difference between the equilibrium exchange rate and the official exchange rate; $y_t^g \equiv$ the output gap in the economy at time *t*; and ∂_1, ∂_2 are exchange rate and output gap adjustment coefficients respectively. Under this policy scenario, there will be both

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[2] A production function $f()$ that guarantees the stability of an economic growth path in a neoclassical growth model satisfies the Inada conditions if: $f(0) = 0,\ f'(0) = \infty,$ and $f'(\infty) = 0.$

direct and indirect monetary policy shocks from monetary base adjustments and changes in money multiplier respectively. The direct monetary policy shock will emanate from exchange rate and output gaps in the economy. Here, monetary policy may be time dynamically inconsistent in the short-run but not in the long-run. Equation (4.5) is consistent with the general view that instruments frequently used in advanced countries, such as the interest rate, are less likely to be implemented in developing economies, given the different transmission mechanism of monetary policy in such economies. Thus, the most likely demand management instrument to be used by monetary authorities in developing economies is the monetary base.

4.4 Inflation and Policy Environment

In developed economies, inflation is treated as a demand phenomenon. This is reflected in demand management approaches of controlling inflation. Indeed, one of the most popular dictums in economics is the assertion by Friedman (1968) that "inflation is always and everywhere a monetary phenomenon". However, it is noted in the literature that in developing economies, inflation may have both demand and supply underpinnings. Supply-side inflationary fundamentals are mainly structural bottlenecks that keep supply below demand for goods and services. Thus, in this paper, it is assumed that determinants of inflation are both demand- and supply-side related. In a typical small-open developing economy, the supply-side factors that influence inflation are adequately reflected in the output and exchange rate gaps. The overall effect of these factors will also be dependent upon the demand-side factors such as the prevailing monetary policy. For simplicity, it is assumed that there exists long-run neutrality of monetary policy after taking into consideration all structural bottlenecks and factoring in output and exchange rate gaps. Hence, the rate of domestic inflation in a small-open developing economy is given as

$$\pi_t = \gamma_t^{mb} + \gamma_t^{e-g} + \gamma_t^{y-g} \quad \textbf{(4.6)}$$

Where γ_t^{mb} is the natural growth rate of the monetary base, γ_t^{e-g} is the growth rate in monetary base emanating from exchange rate gap, and γ_t^{e-g} is the growth rate in monetary base when output gap is factored into the monetary policy rule.

4.5 Steady State Solution

The objective function and the various policy constraints were solved using dynamic programming. Solving the various Euler equations derived from the Bellman equation produces inter-temporal marginal utility functions, balance of payments and economy-wide resource constraints, among others. From the equilibrium balance of payments constraint, investment (change in capital stock) relates to both demand- and supply-side factors as follows:

$$\left[k_t - \left(\frac{1-\delta}{1+\pi_t}\right)k_{t-1}\right] = y_t - \left(x_t + x_t^g\right) - \sigma_t\left(z_t + z_t^g\right) - \Delta m_t + \Delta m_t^b - \sigma_t \Delta f_t + \left(\frac{\sigma_t i_{t-1}^*}{1+\pi_t}\right)BP_{t-1} - \sigma_t BP_t + \sigma_t a_t^* \tag{4.7}$$

where BP is net foreign asset holdings or the balance of payments position, and a^* is the official development assistance flows.

5.0 DATA AND EMPIRICAL MODEL

5.1 Panel Vector Autoregressive (PVAR) Modelling

The dynamic stochastic general equilibrium framework shows the dynamic interrelationship between inflation, capital accumulation and output. The desire to make the empirical econometric model consistent with the dynamic general equilibrium theoretical framework calls for the use of a vector autoregressive (VAR) model. However, constructing a tri-variate VAR model using just the three key variables of interest will not be able to unearth the indirect relationships that are crucial for the understanding of the sluggish response of investment to inflation as noted in most empirical findings. Hence, to capture both the direct and indirect relationships between these variables, a hexa-variate VAR model is formulated. The key variables to consider, as suggested by the theoretical framework, are inflation, investment, output, money supply, exchange rate and import (import-dependence index which is measured as the ratio of imports to exports). The extension of the VAR model to include the aforementioned six variables is also informed by the desire to capture both the demand- and supply-side effects simultaneously.

Given the fact that the hexa-variate VAR framework requires sufficient data points, a country case study will not produce meaningful results since annual data points for a particular country will be insufficient to meet degrees of freedom requirements. Thus, this paper develops a panel VAR (PVAR) for 30 sampled import-dependent developing economies. This approach is a combination of the traditional VAR methodology with Panel Data Analysis Technique (PDAT). While the traditional VAR treats all the variables in the system as endogenous, the PDAT allows for unobserved individual heterogeneity (Love and Zicchino, 2005). The standard hexa-variate PVAR model is formulated as follows:

$$INF_{c,t} = \beta_{1,0} + \sum_{i=1}^{m} \beta_{1,i} INF_{c,t-i} + \sum_{i=1}^{m} \theta_{1,i} INV_{c,t-i} + \sum_{i=1}^{m} \eta_{1,i} GRW_{c,t-i} + \sum_{i=1}^{m} \alpha_{1,i} IMP_{c,t-i} + \sum_{i=1}^{m} \gamma_{1,i} MSS_{c,t-i} + \sum_{i=1}^{m} \phi_{1,i} EXR_{c,t-i} + \mu_{1,c,t} \quad \textbf{(5.1)}$$

$$INV_{c,t} = \beta_{2,0} + \sum_{i=1}^{m} \beta_{2,i} INF_{c,t-i} + \sum_{i=1}^{m} \theta_{2,i} INV_{c,t-i} + \sum_{i=1}^{m} \eta_{2,i} GRW_{c,t-i} + \sum_{i=1}^{m} \alpha_{2,i} IMP_{c,t-i} + \sum_{i=1}^{m} \gamma_{2,i} MSS_{c,t-i} + \sum_{i=1}^{m} \phi_{2,i} EXR_{c,t-i} + \mu_{2,c,t} \quad \textbf{(5.2)}$$

$$GRW_{c,t} = \beta_{3,0} + \sum_{i=1}^{m} \beta_{3,i} INF_{c,t-i} + \sum_{i=1}^{m} \theta_{3,i} INV_{c,t-i} + \sum_{i=1}^{m} \eta_{3,i} GRW_{c,t-i} + \sum_{i=1}^{m} \alpha_{3,i} IMP_{c,t-i} + \sum_{i=1}^{m} \gamma_{3,i} MSS_{c,t-i} + \sum_{i=1}^{m} \phi_{3,i} EXR_{c,t-i} + \mu_{3,c,t} \quad \textbf{(5.3)}$$

$$IMP_{c,t} = \beta_{4,0} + \sum_{i=1}^{m} \beta_{4,i} INF_{c,t-i} + \sum_{i=1}^{m} \theta_{4,i} INV_{c,t-i} + \sum_{i=1}^{m} \eta_{4,i} GRW_{c,t-i} + \sum_{i=1}^{m} \alpha_{4,i} IMP_{c,t-i} + \sum_{i=1}^{m} \gamma_{4,i} MSS_{c,t-i} + \sum_{i=1}^{m} \phi_{4,i} EXR_{c,t-i} + \mu_{4,c,t} \quad \textbf{(5.4)}$$

$$MSS_{c,t} = \beta_{5,0} + \sum_{i=1}^{m} \beta_{5,i} INF_{c,t-i} + \sum_{i=1}^{m} \theta_{5,i} INV_{c,t-i} + \sum_{i=1}^{m} \eta_{5,i} GRW_{c,t-i} + \sum_{i=1}^{m} \alpha_{5,i} IMP_{c,t-i} + \sum_{i=1}^{m} \gamma_{5,i} MSS_{c,t-i} + \sum_{i=1}^{m} \phi_{5,i} EXR_{c,t-i} + \mu_{5,c,t} \quad \textbf{(5.5)}$$

$$EXR_{c,t} = \beta_{6,0} + \sum_{i=1}^{m} \beta_{6,i} INF_{c,t-i} + \sum_{i=1}^{m} \theta_{6,i} INV_{c,t-i} + \sum_{i=1}^{m} \eta_{6,i} GRW_{c,t-i} + \sum_{i=1}^{m} \alpha_{6,i} IMP_{c,t-i} + \sum_{i=1}^{m} \gamma_{6,i} MSS_{c,t-i} + \sum_{i=1}^{m} \phi_{6,i} EXR_{c,t-i} + \mu_{6,c,t} \quad \textbf{(5.6)}$$

where *INF* denotes rate of inflation measured as annual growth in consumer price index, *INV* stands for investment proxied by gross fixed capital formation to GDP, *GRW* represents annual growth in gross domestic product (*GDP*), *IMP* is a ratio of import/exports as a proxy for import-dependence, *MSS* denotes money supply, the exchange rate (*EXR*) is measured as the value of a national currency to the US dollar, c is the panel identity or cross-country identifier, whilst *m* is the optimal lag length of each variable selected in accordance with the

Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (SBC). Apart from *INF* and *IMP*, all the variables are in real terms.

The standard PVAR model made up of equations (5.1 – 5.6) can be succinctly put in a matrix notation as follows:

$$X_{c,t} = A_0 + A_1 X_{c,t-1} + A_2 X_{c,t-1} + ... + A_m X_{c,t-m} + E_t \tag{5.7}$$

where X is a (6×1) vector system variables, A_0 is a (6×1) vector of constants, $A_{1,2,...,m}$ is a (6×6) matrix of coefficient estimates, E is a (6×1) vector of system innovations, while c and m are as defined above. In the presence of cointegration, the PVAR in equation (5.7) is transformed into panel vector error-correction model (PVECM) as

$$\Delta X_{c,t} = \sum_{i=1}^{m-1} \Gamma_i \Delta X_{c,t-i} + \Pi X_{t-m} + \in_{c,t} \tag{5.8}$$

where Δ is the difference operator,

$$\Gamma_i = \sum_{j=i+1}^{m} A_j - I \text{ , and}$$

$$\Pi = \sum_{i=1}^{m} A_i - I$$

The rank of the matrix Π in model (5.8) determines the number of cointegrating vectors. If the matrix Π is of full rank, $r = n$, the PVECM reduces to the usual PVAR in levels of stationary variables within the context of panel data. Hence, model (5.7) will be estimated instead of model (5.8). If Π is a null matrix, such that $r = 0$, the PVECM represents a panel VAR in first differences, provided $X_t \sim I(1)$ (Enders, 1995, Harris, 1995). In other words, if the rank is zero, there is no cointegrating vector. This implies the variables are non-stationary and non-cointegrated and model (5.8) will be estimated in first differences provided the variables are integrated of order one. If the rank is one or more, $0 < r < n$, we have one or multiple cointegrating vector(s). In this case, model (5.8) becomes a PVECM.

The advantages of PVAR framework are that, first of all, it has the capacity to deal with the simultaneity problem between capital accumulation and economic growth, thus avoiding the difficult task of determining which variables are truly exogenous. Secondly, the

PVAR framework allows for different economic and institutional arrangements in each country. Thirdly, this framework allows the econometrician to identify not only the short-run effects but also the long-run cumulative effects of inflation on capital accumulation and economic growth by allowing for interactions among these variables, including both the contemporaneous correlation and the dynamic feedback. This particular merit attributable to our empirical model is highly essential for the analytical framework because the transmission role in the inflation-growth nexus since investment might have a sluggish response to inflation. Finally, the PVAR captures both the stochastic patterns and co-movements of macroeconomic variables and allows for the study of dynamics in terms of deviations from the equilibrium across countries (Kireyev, 2000; Hoffman, 2003).

5.2 Data and Estimation Techniques

Annual panel data involving 30 import-dependent countries comprising 12 Latin America and the Caribbean (LAC) countries, 13 Sub-Saharan Africa (SSA) countries, and five East Asia and the Pacific countries from 1970 to 2006 was used in the analysis. The main source of data is the *International Financial Statistics* published by the International Monetary Fund (IMF).

The time series properties of the data are examined using Levin, Lin and Chu (LLC), Breitung *t* (BT) and Im, Pesaran and Shin (IPS) (1997) panel stationarity tests and Larsson, Lyhagen and Lothgren (3L) (2001) panel cointegration tests. The choice of 3L test over those of McCoskey and Kao (MCK) (1998) and Pedroni (1997, 1999 and 2000) panel cointegration tests is informed by the fact that the 3L is a system panel cointegration test based on Johansen's (1988) maximum likelihood estimator (Asteriou, 2006).

6.0 PRESENTATION OF RESULTS

6.1 Unit Test Results

The panel unit root tests were conducted using three techniques: Levin, Lin and Chu (LLC), Breitung *t* (BT) and Im, Pesaran and Shin (IPS). The results are reported in Table 1. LLC and BT statistics assume common unit root process, while IPS assumes individual unit root process. The results indicate that, at one-percent level of significance, only inflation (INF) and real GDP growth (RGDPG were stationary at levels according to all the three statistics. The real exchange rate in its logarithmic form was also stationary but at five-percent significant level according to all three panel unit root test statistics. According to either one or all of the three panel unit root statistics, the import–export ratio (IMPRAT), real investment (LRINV) and real broad money supply (LRMSS) were not stationary. Indeed, all the test statistics show that LMRSS was not stationary at levels. The six system variables were all found to be stationary in first differences according to the three panel unit root tests. Thus, apart from INF and RGDPG which are *I(0)*, the remaining four variables are stationary in their first-differences and, hence are integrated of order one or *I(1)*.

Table 1: Panel Unit Root Test Results

VARIABLES	**PANEL UNIT ROOT TEST STATISTICS**					
	Levin, Lin & Chu *t*		**Breitung *t***		**Im, Pesaran and Shin**	
	At Level	1st Diff	At Level	1st Diff	At Level	1st Diff
IMPRAT	-6.64646 (0.0000)	-17.0280 (0.0000)	-1.00776 (0.1568)	-12.2755 (0.0000)	-5.43081 (0.0000)	-19.4962 (0.0000)
INF	-10.2740 (0.0000)		-8.18126 (0.0000)		-8.56026 (0.0000)	
LREXR	-1.88339 (0.0298)	-12.1819 (0.0000)	-2.14069 (0.0161)	-14.8010 (0.0000)	-1.78144 (0.0374)	-15.3921 (0.0000)
RGDPG	-8.50254 (0.0000)		-6.86424 (0.0000)		-11.7092 (0.0000)	
LRINV	-2.50938 (0.0060)	-11.8025 (0.0000)	-0.03550 (0.4858)	-10.5929 (0.0000)	-2.68467 (0.0036)	-13.5288 (0.0000)
LRMSS	1.36409 (0.9137)	-10.9495 (0.0000)	1.83988 (0.9671)	-8.91757 (0.0000)	1.24994 (0.8943)	-11.8326 (0.0000)

Source*: Authors' Computations* **Note**: *figures in brackets are significance probability values.*

6.2 Panel Cointegration Test Results

The cointegration tests were conducted and the results are presented in Tables 2 and 3. In Table 2, the trace statistic of 111.9151 (critical value of 47.85613) indicates that the null hypothesis of the system having at most two cointegrating equations should be rejected at the five-percent significance level. However, the trace statistic of 8.901536 (critical value of 29.79707) indicates that the null hypothesis of the system having at most three cointegrating equations should be accepted at the five-percent significance level. Thus, according to the trace statistic, the hexa-variate system has three cointegrating equations.

Table 2: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.361221	808.1977	95.75366	0.0001
At most 1 *	0.193402	337.5916	69.81889	0.0001
At most 2 *	0.093449	111.9151	47.85613	0.0000
At most 3	0.007061	8.901536	29.79707	0.9921
At most 4	0.001371	1.461005	15.49471	0.9992
At most 5	1.97E-05	0.020703	3.841466	0.8855

Source*: Authors' Computations*

Table 3 below shows that, according to the maximum eigenvalue statistic of 103.0136 (critical value of 27.58434), the null hypothesis of at most two cointegrating equations should be rejected. However, the maximum eigenvalue statistic of 7.440531 (critical value of 21.13162) indicates that the null hypothesis of at most three cointegrating equations in the system should be accepted at the five-percent significant level. The maximum eigenvalue statistics, therefore, indicate the presence of three cointegrating equations in the hexa-variate model.

Table 3: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.361221	470.6060	40.07757	0.0001
At most 1 *	0.193402	225.6765	33.87687	0.0001
At most 2 *	0.093449	103.0136	27.58434	0.0000
At most 3	0.007061	7.440531	21.13162	0.9345
At most 4	0.001371	1.440302	14.26460	0.9984
At most 5	1.97E-05	0.020703	3.841466	0.8855

Source: *Authors' Computations*

The choice of appropriate number of cointegrating equations is informed by economic theory. Normalising the cointegrating relationships and imposing structural restrictions on the cointegrating coefficients reveal that the assumption of one cointegrating equation is consistent with standard economic theories underpinning the hexa-variate model. The study proceeded, therefore, to estimate the panel vector error-correction model using one cointegrating equation where normalisation was done on each of the three variables of interest: inflation, investment and economic growth.

6.3 Estimated Results of Static Cointegrating Models

From Table 4 below, the inflation equation shows that capital accumulation and economic growth had long-run static negative impacts on inflation. Broad money supply and import-dependency ratio had long-run static positive impacts on inflation. Exchange rate tended to have a long-run static positive impact on inflation but this impact was not significant at the five-percent level. In the capital accumulation (investment) equation, inflation and economic growth had dampening effects on capital accumulation contemporaneously in the long-run.

Broad money supply and import-dependency ratio had significant positive impacts on capital accumulation in the long-run. The long-run contemporaneous impact of real exchange rate on capital accumulation was insignificant during the study period. In the economic growth equation, inflation and capital accumulation had significant long-run static negative

Table 4: Static Cointegrating Estimated Results

VARIABLE	EQUATIONS		
	INF	LRINV	RGDPG
INF	**1**	**-0.003920**	**-0.001056**
		(0.00162)	*(0.00044)*
		[-2.41294]	[-2.41572]
LRINV	**-255.1240**	**1**	**-0.269375**
	(134.192)		(0.14161)
	[-1.90119]		[-1.90220]
RGDPG	**-947.0952**	**-3.712293**	**1**
	(38.9895)	*(0.15292)*	
	[-24.2910]	[-24.2760]	
LRMSS	**333.1214**	**1.305723**	**0.351730**
	(126.508)	*(0.34363)*	*(0.13308)*
	[2.63321]	[3.79975]	[2.64297]
LREXR	**37.02456**	**0.145124**	**0.039093**
	(92.4714)	*(0.36387)*	*(0.09805)*
	[0.40039]	[0.39884]	[0.39869]
IMPRAT	**362.7441**	**1.421834**	**0.383007**
	(140.473)	*(0.55022)*	*(0.14794)*
	[2.58231]	[2.58414]	[2.58900]
CONSTANT	**-1731.238**	**6.785869**	**1.827945**

Source: *Authors' Computations*

Note: *figures in italics are standard errors, while those in square brackets are t-statistics.*

impact on economic growth. Again, broad money supply and import-dependency ratio had significant long-run contemporaneous positive impacts on economic growth. The impact of real exchange rate on economic growth was, however, insignificant though there was a tendency for long-run contemporaneous positive impact.

6.4 Empirical Results of the Short-Run Dynamics

Table 5 below reports the results of the panel vector error-correction model (PVECM). The error-correction term (ECT) has significant negative coefficients in the inflation and economic growth equations, indicating that any previous disequilibrium in the inflation and growth equations will be corrected in the current period. However, the magnitudes of the coefficients of the ECT in these equations are small, implying that the speed of adjustment to equilibrium in the inflation and economic growth relationships is very low. The capital accumulation equation has an insignificant negative ECT coefficient, indicating that though the speed of adjustment is statistically zero, there is a tendency for any past disequilibrium to be corrected in the current period.

In the short-run inflation equation, the past level of inflation had a significant negative impact on the current level of inflation. Capital accumulation and economic growth dynamics had insignificant positive impact on current level of inflation, while import-dependency ratio had insignificant negative impact. Broad money supply had significant positive dynamic impact on inflation. Real exchange rate impacted significantly positively on inflation in dynamic terms. From the capital accumulation equation, inflation, exchange rate and import dependency ration did not impact dynamically on investment. While the past level of investment had a significant negative impact on current level of investment, economic growth and broad money supply had significant dynamic impacts on investment. The short-run economic growth equation (D(RGDPG)) shows that the short-run dynamics of economic growth, inflation, capital accumulation and money supply did not matter over the study period. However, the real exchange rate had significant dynamic positive impact, while import-dependency ratio had significant dynamic negative impact on economic growth in import-dependent economies over the study period.

Table 5: Short-Run Dynamics (PVECM) Results

Error Correction:	D(INF)	D(LRINV)	D(RGDPG)	D(LRMSS)	D(LREXR)	D(IMPRAT)
ECT	-0.008767	-1.49E-07	-0.000985	1.81E-06	-8.04E-07	3.90E-06
	[-2.37382]	[-0.11582]	[-19.0698]	[2.03456]	[-0.69743]	[0.67749]
D(INF(-1))	-0.338227	4.90E-06	0.000139	-3.89E-05	1.68E-05	-1.56E-05
	[-12.0248]	[0.50008]	[0.35318]	[-5.75268]	[1.91851]	[-0.35686]
D(LRINV(-1))	52.44247	-0.115899	-1.155461	0.025720	0.009803	-0.542793
	[0.49527]	[-3.13986]	[-0.78005]	[1.01037]	[0.29654]	[-3.29077]
D(RGDPG(-1))	2.718009	0.001723	-0.018279	-0.000637	9.44E-05	0.000437
	[1.23269]	[2.24153]	[-0.59261]	[-1.20207]	[0.13717]	[0.12725]
D(LRMSS(-1))	439.0984	0.182590	-0.849394	-0.042952	-0.022284	0.509507
	[3.14783]	[3.75489]	[-0.43528]	[-1.28084]	[-0.51168]	[2.34479]
D(LREXR(-1))	-850.0699	0.023279	3.358109	-0.013813	-0.069252	-0.227453
	[-8.32900]	[0.65431]	[2.35202]	[-0.56297]	[-2.17333]	[-1.43066]
D(IMPRAT(-1))	-25.56951	0.007309	-0.546817	-0.000570	-0.009246	-0.093317
	[-1.29923]	[1.06542]	[-1.98616]	[-0.12042]	[-1.50479]	[-3.04390]
CONSTANT	-28.20696	0.032172	0.096382	0.052750	-0.004151	0.003114
	[-1.41711]	[4.63649]	[0.34614]	[11.0237]	[-0.66791]	[0.10042]
R-squared	0.214038	0.027070	0.489594	0.040317	0.009742	0.028221
Adj. R-squared	0.208758	0.020534	0.486165	0.033870	0.003090	0.021693
F-statistic	40.53771	4.141752	142.7872	6.253626	1.464506	4.322887
Log likelihood	-8194.226	165.4357	-3711.279	555.6257	281.2028	-1406.480
Akaike AIC	15.62329	-0.299878	7.084340	-1.043097	-0.520386	2.694249
Schwarz SC	15.66105	-0.262113	7.122105	-1.005332	-0.482622	2.732013
Mean dependent	0.045688	0.037217	-0.014013	0.051568	-0.004756	0.008814
S.D. dependent	669.1350	0.209654	11.61576	0.145577	0.186117	0.937402

Source*: Authors' Computations* **Note**: *figures in square brackets are t-statistics.*

7.0 DISCUSSION OF RESULTS

The negative impacts of economic growth and capital accumulation on inflation in the long-run point to the structurally-induced or supply-side inflationary trend in most developing economies. Thus, as structural bottlenecks are removed for investment and economic growth to take place, inflation tends to slowdown in the import-dependent economies over the long-run. This point is further buttressed by the insignificant impacts of capital accumulation and economic growth on inflation in the short-run. The positive signs of the capital accumulation and economic growth coefficients are indications of some kind of overheating in the short-run. This means that supply-side policies could not have short-run impact on inflation in import-dependent developing economies. To a very large extent, these findings are in support of the conclusions drawn by Romer (1986, 1987), Lucas (1988) and Levine and Renelt (1992).

Broad money supply impacted positively on inflation in the long-run, confirming the theoretically-posited positive correlation between money supply and inflation as argued by the Monetarists. That import-dependency ratio had a positive long-run impact on inflation corroborates the view that most of the inflationary trend experienced in import-dependent developing economies are due to imported inflation. The significant short-run dynamics of inflation emanate principally from broad money supply and the real exchange rate. This suggests that controlling inflation in the short-run could only be achieved by demand management policies.

Contemporaneously, there is a negative correlation between capital accumulation and economic growth in the long-run. This means that increasing investment today may actually lead to economic slowdown today. The short-run dynamics, however, indicate that economic growth has a positive impact on capital accumulation as predicted by the neoclassical economic growth and development models. The negative impacts of the past levels of investment and economic growth on their current levels respectively suggest that import-dependent developing economies find it difficult sustaining the level of capital accumulation and economic growth. Since these are short-run phenomena, they cannot be attributed to changes in the business cycle. The difficulty in sustaining economic growth and investment in import-dependent developing economies could be explained by the fact that these economies are bombarded continuously by external shocks, notably oil price shocks. This fact is supported by the empirical evidence that import-dependency ratio depresses economic growth in these economies in the short-run.

Another interesting result is that, though the real exchange rate does not have any significant impact on inflation, capital accumulation and economic growth in the long-run, it does have significant dampening effect on inflation and expansionary effect on economic growth in the short-run. This is consistent with output gap theories and competition theories of international trade. Thus, properly realigning the real exchange to reflect economic fundamentals in the short-run can have desirable impact on inflation and growth in import-dependent developing economies.

8.0 CONCLUSION AND POLICY RECOMMENDATIONS

This study was set out to investigate the relationships between inflation, capital accumulation and economic growth in import-dependent developing economies. It adopted an inter-temporal optimization theoretic framework within which the representative agent derives utility from money balances and financial asset holdings. The super-neutrality of money was removed by modelling today's output as a function of yesterday's capital stock. The empirically analytical framework made use of a panel vector autoregressive (PVAR) approach on data from 30 sampled import-dependent developing economies. The key variables included in the PVAR model were inflation, capital accumulation, output growth rate, money supply, exchange rate, and import-dependency ratio. Levin, Lin and Chu (LLC), Breitung t (BT) and Im, Pesaran and Shin (IPS) panel unit-root tests were conducted to determine the stationarity of the system variables. Most of the variables were found to be integrated of order one, while the rest was of order zero. Further, Larsson, Lyhagen and Lothgren (3L) (2001) panel cointegration test was carried out to determine the long-run co-movement of the variables. The system variables were found to be cointegrated and the Granger Representation Theorem was evoked for the specification of the panel vector error-correction model (PVECM).

From the cointegrating relationships, capital accumulation and economic growth had long-run static negative impacts on inflation. Broad money supply and import-dependency ratio had long-run static positive impacts on inflation. The long-run influence of real exchange rate on inflation was statistically zero. Besides, the study has established that inflation and economic growth had dampening effects on capital accumulation contemporaneously in the long-run. Broad money supply and import-dependency ratio were found to have positive impacts on capital accumulation in the long-run. Moreover, while inflation and capital accumulation had long-run static negative impacts, broad money supply and import-dependency ratio had long-run contemporaneous positive impacts on economic growth.

The short-run dynamics also indicate that while it is possible for any previous disequilibrium in the inflation, capital accumulation and economic growth relationship, the speed of adjustment to equilibrium is so low that it will take a long time for any imbalance to be corrected. In the short-run, real exchange rate has a positive impact on economic growth but a dampening effect on inflation. Money supply and the exchange rate generate crucial short-run dynamics for inflation relationship while exchange rate and import-dependency ratio produce short-run dynamics that drive economic growth in import-dependent developing economies.

It is recommended, therefore, that in import-dependent developing economies,

- demand management policies such as a reduction in real broad money supply should be adopted to reduce inflation in the short-run;
- both demand management and supply-side policies should be pursued for the control of the rate of inflation in the long-run;
- exchange rate policy that ensures international competitiveness of domestically produced goods should be pursued, while economic openness policy that ensures availability of critical inputs for industry and agriculture must be adopted for short-run economic growth; and,
- Overreliance on imports should be reduced over the long term through aggressive export promotion to ensure long-run economic growth.

REFERENCES

Ahortor, Christian R.K. (2008), Capital Flows and Macroeconomic Management in Ghana, *Unpublished PhD Thesis*, Department of Economics, University of Ibadan.

Arrow, K.J. (1962), "The Economic Implications of Learning by Doing," *Review of Economic Studies*, 29: 155-173.

Asteriou, Dimitrios (2006), *Applied Econometrics: An Modern Approach using Eviews and Microfit*, Hamsphire: Palgrave Macmillan.

Burdekin, R.C.K., Thomas Goodwin, Suyono Salamun, and Thomas D. Willet (1994) "The Effects of Inflation on Economic Growth in Industrial and Developing Countries: Is there any Difference?" *Applied Economic Letters*, October, 175-177.

Breitung, Joerg (2000), "The Local Power of Some Unit Root Tests for Panel Data," in B. Baltagi (ed.), *Nonstationary Panels, Panel Cointegration, and Dynamic Panels, Advances in Econometrics*, Vol. 15, JAI: Amsterdam: 161-178.

Chirinko, R.S. (1996), "Investment under Uncertainty: A Review Essay," *Journal of Economics Dynamics and Control*, 20: 1801-1808.

De Gregorio, J. (1993), "Inflation, Taxation, and Long-Run Growth," *Journal of Monetary Economics*, 31: 271-298.

Dixit, A.K. and R.S. Pindyck (1994), *Investment under Uncertainty*, Princeton: Princeton University Press.

Domar, E. (1946), "Capital Expansion, Rate of Growth, and Employment," *Econometrica*, 14: 137-147.

Enders, Walter (1995), *Applied Econometric Time Series*, New York: John Wiley.

Fischer, Stanley (1993), "The Role of Macroeconomic Factors in Growth," *Journal of Monetary Economics*, 32(10): 485-512.

Friedman, Milton (1968), "The Role of Monetary Policy," *American Economic Review*, 58(1, March): 1-17.

Grier, K.B. and G. Tullock (1989), "An Empirical Analysis of Cross-National Economic Growth," *Journal of Monetary Economics*, 24: 51-77.

Grimes, A. (1991), "The Effects of Inflation on Growth: Some International Evidence," *Weltwirtschaftliches Archiv*, 127: 631-644.

Harrod, R. (1939), "An Essay in Dynamic Theory," *Economic Journal*, 49: 14-33.

Harrod, R. (1948), *Towards a Dynamic Economics*, London: Macmillan.

Hellerstein, Rebecca (1997), "The Impact of Inflation," *Regional Review*, Federal Reserve Bank of Boston, 7(1, Winter): 18-24.

Hoffmann, Mathias (2003), "Fixed versus Flexible Exchange Rates: A Panel-VAR Analysis", A Research Work which is part of *The Analysis of International Capital Markets: Understanding Europe's Role in the Global Economy*, funded by the European Commission under the Research Training Network Programme.

Im, K.S., M.K. Pesaran and Y. Shin (1997), "Testing for Unit Roots in Heterogeneous Panels," *Manuscript*, Department of Applied Economics, University of Cambridge.

Inada, Ken-Ichi (1963), "On a Two-Sector Model of Economic Growth: Comments and a Generalization," *The Review of Economic Studies*, 30(2): 119-127.

Johansen, Soren (1988), "Statistical Analysis of Cointegrating Vectors," *Journal of Economic Dynamics and Control*, 12(2/3): 231-254.

Kireyev, Alexei (2000), "Comparative Macroeconomic Dynamics in the Arab World: A Panel VAR Approach", *IMF Working Paper*, WP/00/54.

Kormendi, R.C. and P.C. Meguire (1985), "Macroeconomic Determinants of Growth," *Journal of Monetary Economics*, 16: 141-163.

Larsson, R., J. Lyhagen and M. Lothgren (2001), "Likelihood Based Cointegration Tests in Heterogeneous Panels," *Econometric Journal*, 4: 109-142.

Levin, A., C.F. Lin and C.S. Chu (2002), "Unit Root Tests in Panel Data: Asymptotic and Finite Sample Properties," *Journal of Econometrics*, 108: 1-24.

Levine, R. and D. Renelt (1992), "A Sensitivity Analysis of Cross-Country Growth Regressions," *American Economic Review*, 82: 942-963.

Lewis, A. (1955), *The Theory of Economic Growth*, London: Allen & Unwin.

Love, Inessa and Lea Zicchino (2006), "Financial Development and Dynamic Investment behavior: Evidence from Panel VAR", *The Quarterly Review of Economics and Finance*, 46: 190–210.

Lucas, R.E. Jr (1988), "On the Mechanics of Economic Development," *Journal of Monetary Economics*, 22: 3-42.

McCoskey, S. and C. Kao (1998), "A Residual-Based Test for the Null Hypothesis of Cointegration in Panel Data," *Econometric Reviews*, 17: 57-84.

Pedroni, P. (1997), "Panel Cointegration: Asymptotic and Finite Sample Properties of Pooled Time Series with an Application to the PPP Hypothesis: New Results," *Working Paper*, Indiana University.

Pedroni, P. (1999), "Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors," *Oxford Bulletin of Economics and Statistics*, Special Issue, 61 (November): 653-670.

Pedroni, P. (2000), "Fully Modified OLS for Heterogeneous Cointegrated Panel," *Advances in Econometrics*, 15: 93-130.

Pindyck, R.S. and A. Solimano (1993), "Economic Instability and Aggregate Investment," *NBER Macroeconomic Annual*.

Romer, P. (1986), "Increasing Returns and Long-Run Growth," *Journal of Political Economy*, 94: 1002-1037.

Romer, P. (1987), "Growth Based on Increasing Returns Due to Specialization," *American Economic Review*, 77: 56-62.

Rostow, W.W. (1960), *The Stages of Economic Growth*, Cambridge University Press.

Sánchez-Fung, José R. (2000), *Estimating a Taylor-Type Monetary Policy Reaction Function for the Case of a Small Developing Economy*, http://www.standford.edu/-johntayl/papers. [Accessed: February 28, 2009].

Sidrauski, Miguel (1967), "Rational Choice and Patterns of Growth in a Monetary Economy," *American Economic Review*, 57(2): 534-544.

Solow, R. (1956), "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics*, 70: 65-94.

Stanners, W. (1993), "Is Inflation and Important Condition for High Growth?" *Cambridge Journal of Economics*, 17: 79-107.

Walsh, C.E. (2003), *Monetary Theory and Policy*, 2nd Edition, Cambridge: MIT Press.

APPENDICES

APPENDIX: List of Countries in the Panel			
Country Code	**Country**	**Region**	**Import-Dependence**
1	Barbados	LAC	3.176619597
2	Belize	LAC	2.149954179
3	Bolivia	LAC	1.098931431
4	Costa Rica	LAC	1.266790767
5	Dominican Rep.	LAC	2.959360441
6	El Salvador	LAC	1.414313564
7	Guatemala	LAC	1.428935679
8	Honduras	LAC	1.305077910
9	Mexico	LAC	1.267384625
10	Nicaragua	LAC	2.059825502
11	Panama	LAC	3.115193727
12	Paraguay	LAC	1.665242588
13	Benin	SSA	4.203012650
14	Ethiopia	SSA	2.612145415
15	Ghana	SSA	1.194952870
16	Kenya	SSA	1.604581706
17	Mali	SSA	1.819756891
18	Niger	SSA	1.352621735
19	Rwanda	SSA	2.890942999
20	Senegal	SSA	1.643822080
21	Seychelles	SSA	4.050569438
22	Sierra Leone	SSA	2.933656585
23	Sudan	SSA	1.905796979
24	Tanzania	SSA	2.372739955
25	Togo	SSA	1.593922538
26	Bangladesh	EAP	2.114087486
27	Fiji	EAP	1.559919866
28	Nepal	EAP	2.772328268
29	Sri Lanka	EAP	1.358798493
30	Thailand	EAP	1.232345841