Effects of trade openness and foreign direct investment on industrial performance in Ghana

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Abstract

This paper analyzes the macroeconomic implications of trade openness and foreign direct investment (FDI) on industrial performance in Ghana. The paper argues that in Ghana industrial performance is affected adversely by trade openness through a number of mechanisms including monetary policy, fiscal policy, and FDI. The methodological approach consists of analyzing a set of macroeconometric models using quarterly data for the period 1983(1)-2006(4) under general-to-specific parsimonious conditions. Unrestricted Cointegrating and Vector Error-Correction Models were estimated to examine the static and dynamic long-run effects as well as the short-run dynamics of the system and the speed of adjustment to the long-run equilibrium. The findings indicate that industrial performance is largely impeded by trade openness, high lending rate of commercial banks and, to a lesser extent, corporate tax. The main positive determinants of industrial performance are raw material availability, previous level of economic performance, industrial wage, and a moderate rate of inflation. It is, therefore, recommended that effective policies should be directed at stabilizing the macroeconomy to reduce the operational risks of banks which would reflect in lower lending rates, making the agricultural sector more vibrant for increased supply of raw materials to the industrial sector, and paying attractive industrial wages to workers. It is also recommended that policymakers should formulate and implement prudent policies that would appropriately harness domestic capital to finance industrial activities rather than over-relying on FDI (that does not have significant long-run impact on industrial performance in Ghana.

1.0 INTRODUCTION

Developing countries and certainly Ghana experienced severe economic crises between the early 1970s and mid-1980s in particular. This was the era when low, stagnant or negative real growth rates, huge balance of payments deficits arising from deteriorating terms of trade for primary products, heavy external debt burdens, inappropriate government policies, mismanagement of state funds, high population growth rates and widespread poverty, illiteracy, ignorance and diseases were closely associated with these economies.[1] The diagnostic studies conducted by the International Monetary Fund (IMF) and the World Bank revealed that, broadly, these economies were suffering from distorted market prices through controls and overvaluation of local currencies; inefficient fiscal structure and ineffective fiscal policies; corrupt and bureaucratic practices; and large as well as inefficient civil service with government involvement in direct production of goods and services. Besides, these economies were characterized by underdeveloped and shallow financial markets controlled by government through disproportionate utilization of public debts, interest rate fixation and directed credit to inefficient sectors of the economy; and, inward-looking trade policy with huge tariffs and non-tariff barriers to protect the uncompetitive industrial sector stifling innovative response to global competition.

In a bid to circumvent these economic crises in developing countries, the IMF and the World Bank, acting as the principal partners in development finance, responded with a paradigm shift in donor policy towards economic recovery and structural adjustments. A distinguishing feature of this policy was to make donor assistance conditional on recipient government's commitment to restructuring economic policies from restrictive to an open and liberal state. Trade openness and other market-based policies were the prominent pillars of the economy-wide conditionality. The reform of existing interventionist trade policies was considered crucial to the process of industrialization, with increased exposure to foreign competition acting as a stimulus to technical and economic efficiencies and real growth.

The open-trade policy prescribed for Ghana under the Economic Recovery Programme and Structural Adjustment Programme (ERP/SAP) includes reforms towards currency devaluation, exchange rate unification, reduction or elimination of trade taxes, removal of quantitative restrictions and foreign exchange rationing, adoption of pricing formula linked to world market trends, and export sales privatization. In the opinion of the IMF and the World Bank, the implementation of these policies would lead to increased mobilization of domestic resources, enhancing the efficiency of scarce resource utilization, pooling Foreign Direct Investment (FDI), re-orienting external trade to expand exports, and advancing the capacity of the public and productive sectors to perform more efficiently.

Universally, economists and policymakers concur that foreign investment can contribute significantly towards the expected structural transformation and industrialization. Even though foreign investment generally accounts for a small share of gross investment, it remains a crucial means of obtaining technologies, capital, managerial skills, and access to export markets. If developing countries are successful in attracting substantial inflows of foreign investment, they can accelerate the creation of market systems and restructuring of their economies. Currently, governments of developing countries are pre-occupied with creating attractive environments for

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[1] In addition to these, Sub-Saharan African countries, in particular, severely suffered from oil price shocks in 1973 and 1979, high inflation rates, political instability, mass exodus of skilled labour, and unfavourable climatic conditions for agricultural output expansion.

foreign investment through the formulation and implementation of various market-based economic policies.

The problem, however, is that in today's world of globalization, attracting foreign investment has become very competitive because it is now sourced more from multinational corporations and private institutions that are profit-oriented unlike in the past when governments and public institutions collaborate to take the lead mainly for the sake of political motives. In the contemporary globalized world, the economic environment that is more likely to attract FDI is where the intervention of policies in the form of good governance, ideal judicial system, laws favouring taxation, productive incentives and repatriation of profits; easy access to information and currency convertibility; well-defined property rights and privatization; abundant natural resource base including adequate availability of energy and water supply; adequate and cheap trained productive workers; institutional requirements are less bureaucratic; efficient distribution system with widespread social infrastructure including transport, information and communication technology; political stability; large market size; economic stability and growth concurrently prevail.

The Ghanaian economy, though small-open and poor in per capita terms, does not lack the aforementioned pre-conditions entirely. Implicitly, the Ghanaian economy is a potentially good destination for FDI in the competitive global world. However, Ghana is still finding it difficult to attract the required capital towards industrialization under a liberal external trade regime which has been implemented under ERP/SAP since 1983 notwithstanding the fact that Ghana has been acclaimed as one of the most successful countries in implementing ERP/SAP alongside Uganda, and Mozambique as per government deficit, inflation rate, and privatization criteria (UNCTAD, 1999). According to World Economic Forum (1998) an analysis of sampled data (1992-97) on 23 African countries shows that Ghana is not among her peers as a top recipient of FDI. During the same period the ratio of FDI to GDP rose by 81%, 35%, and 33% in Uganda, Tanzania, and Mozambique, respectively. Perhaps, the Ghanaian economy has only succeeded in becoming a large consumer of foreign goods rather than producer of industrial goods for exports. There are some who still argue that it is possible that in the absence of the open-trade policy reforms, the industrial sector would have performed even worse than it is today.

Based on the foregoing, the relevant research questions that this paper seeks to address with particular reference to the Ghanaian economy since the implementation of ERP/SAP in 1983 are: (i) does open-trade policy promote long-run industrial performance? (ii) what is the impact of FDI and open-trade policy on industrial performance? (iii) how do short-run variations in trade openness impact on long-run performance of the industrial sector? (iv) does the implementation of open-trade policy cause increased foreign direct investment? and (v) what are the macroeconomic determinants of industrial performance? The broad objective of this paper, therefore, is to empirically analyze the implications of trade openness for industrial performance since its implementation in Ghana in 1983. Specifically, within the context of the Ghanaian economy, this paper attempts to analyse econometrically the short-run and long-run impacts of trade openness and FDI on industrial performance; trace the line(s) of causality among trade openness, FDI and industrial performance; and suggest appropriate policy guidelines for action. The remaining part of

the paper is organized as follows: the next section reviews the relevant literature; the empirical models and methodology are specified in section 3 while the estimated results are presented and discussed in the following section; section 5 outlines the policy implications and recommendations and section 6 concludes.

2.0 THEORETICAL FRAMEWORK AND LITERATURE REVIEW
2.1 Theories of Trade Openness and Foreign Direct Investment (FDI)

Economic transformation and modernization are widely hypothesized to spur up growth and development process. The fundamental focus of traditional theories of economic development is on how developing countries would succeed in getting the right quantum and quality of savings, investment, and various forms of foreign assistance required to put these economies along a sustainable growth path in a stable political environment. As far as developing countries are concerned, the challenge is to implement economic policies that will result in a sustainable rise of income in real per capita terms through rapid industrial growth such that a low-income traditional economy is metamorphosed into a high-income industrialized economy as suggested by Lewis (1954), Rostow (1960), Harrod (1948) and Domar (1947).

The fundamental theoretical framework of FDI as suggested by MacDougall (1960), Hymer (1976), Buckley and Casson (1976), Agarwal (1980), Casson (1982), Helleiner (1989), Dunning (1983) and Vos (1994) have led to four distinct schools of thought on FDI namely the *neoclassical*, *industrial organisation*, *eclectic*, and *portfolio choice* paradigms.

The conventional *neoclassical paradigm* on international capital flows was formulated on the premise that capital flows among nations is driven by interest rate differentials under conditions of perfect competition. The model postulates among others that under unconstrained capital mobility condition, there are positive welfare effects for both capital exporting and capital importing countries given the unique state of factor endowment, political environment, expected rate of return, information asymmetries, government economic policies on taxation and other incentives. In addition, the model embraces the flexible-accelerator type of private investment theory which is set out by outlining a framework of capital requirements of profit-maximization and multiple-product monopolist. Given the existence of some degree of monopoly power in its product market, a multinational firm is assumed to determine the profit-maximizing level of production and, hence, the capital requirements in each host country.

The *industrial organisation theory* assumes that foreign enterprises have oligopoly power in host country markets where these markets are imperfect with barriers to entry and unique firm-specific attributes such as product technology, managerial skills and economies of scale as a result of which foreign firms have advantages over their local counterparts. The *eclectic theory*, on other hand, is formulated in line with the traditional Herscher-Ohlin-Samuelson trade model that seeks to explain the spatial distribution of some varieties of output that further explain trade in manufactured and skilled labour-intensive commodities across countries with factor endowment differentials.

The *portfolio choice theory* takes into account the element of uncertainty in connection with capital flows such that investors are assumed to consider not only rates of return, but also risks associated with selecting a portfolio of foreign investment. This theory is based on the

observation that fluctuations in rates of return on capital within, and more so between countries are not perfectly correlated. Hence risks might be reduced by a diversification of investment portfolios. This implies that the destination of new foreign capital is driven by the composition and location of current investment portfolio held.

In sum, the theories of FDI suggest that broadly the interplay of social, geopolitical, economic, and uncertainty and risk factors are essential in determining the direction of international capital flows as influenced by supply and demand forces. In general, FDI flows to countries with higher prospects of net gain on investment which is an indication that the associated benefits exceed the costs of foreign investment. Growth in real gross domestic product can be used to proxy for the net gain on investment.

The effects of international trade openness on domestic industrial sector have remained ambiguous in many developing countries. Trade liberalisation embodies openness, outward orientation and a liberal economic system measuring the degree of integration of a domestic economy with the global economic forces. A liberal trade regime occurs when there is elimination or reduction of trade intervention by governments so that the liberal trade environment has become synonymous with free trade. According to Dean, *et al.* (1994) trade openness via liberalisation enhances the integration of a nation's trade regime into the global economy requiring opening up of the external sector to the international community and the dismantling of international trade barriers.

Advocates for trade openness (Smith, 1776; Ricardo, 1817; Mishimizu and Robinson, 1986; Nishimizu and Page, 1991; Tybout, 1992; Helleiner, 1989, 1994) argue that trade openness promotes competition which in turn propagates pressure for increased efficiencies, product improvement and technical change, factor productivity and lowering costs of production, overall economic growth by raising profits which stimulate growth, foreign capital investment and inflows of expertise, and enhanced equal access to scarce resources which improves the overall resource allocation and eliminates corruption in the system. The important role of trade strategy as a determinant of industrial performance is based on the crucial role of incentives (Lall, 1992) and the superiority of outward-orientation is related to the degree and neutrality of government interventions in the incentive structure. It is argued that the combination of lower protection and neutrality of incentives between import substituting and export activities have the potential of producing both static and dynamic trade benefits.

Todaro (1994), Elbadawi (1992), Elbadawi, *et al* (1992), and Demery (1994), in contrast, criticize the rationale of trade liberalisation and openness. They argue that the irony that free trade exists in a world of unionism, interrupted national protection and international non-competitive pricing policies are enough bases for ineffectiveness of openness. Empirical evidences from Latin America and Africa fail to lend support to the superiority of SAP or trade liberalisation-implementing economies over those that did not implement it. In fact, some studies have even shown that countries that did not follow SAP or open-trade policy outperformed their counterparts which did pursue the policies in investment, saving, exports, external balance, inflation and economic growth (Elbadawi, *et al.* 1992; Demery, 1994). Besides, it was observed that the non-

existence of an international agency to protect and promote the interest of economically weaker nations at the global front has seriously polarized the world into the extreme cases of the rich (North) and the poor (South) (Todaro, 1994).

Killick (2000) analyzing the impact of SAP on the Ghanaian economy based on 1960-94 data noted that the economy remained the same in terms of structure, growth, financial deepening, composition of exports, rigidity and low saving-investment ratios since 1960. In effect, the Ghanaian economy fails to witness any significant positive transformation towards industrialization and still remains import dependent, over-reliant on primary exports, fragile and rigid financial sector with credit constraints.

Similarly, Easterly (2005) in an *ex post* analysis concluded that there is no empirical justification for openness to trade and markets, because the intensive recipients of structural adjustment loans experienced the same near-zero per capita income growth rate as non-recipients, as well as, "the same current account deficit, government deficit, black market premium and inflation rate, and near-zero real overvaluation and real interest rate." Mosley and Toye (1991), Adedeji (1999), Crisp and Kelly (1999) and McGregor (2005) also obtained similar results from various empirical works.

2.2 Globalization and Foreign Direct Investment (FDI)

Generally, economists believe that globalization is not an entirely new phenomenon given that international trade openness and foreign capital flows, the most commonly used indicators of globalization, grew rapidly and became popular with the onset of the 20th century (Bhalla, 1998; Tsie, 2000). A common element of globalization is the rise in international trade flows and the increase in the degree of openness of world economies particularly the small-open economies which until about three decades ago were predominantly characterized by pursuing rigid inward-looking trade policies. Across the world today, in relation to advanced countries, the relative rise in export-GDP ratio has been much more robust while export of services are rising faster than export of goods mainly due to improved possibilities of storage, value-addition and data communication in developing countries (Bhalla, 1998; ILO, 1999). This has given credence to the revised pro-liberalized trade strategy being widely pursued by developing countries in today's globalized world.

Globalization has implications for economic, political, social and cultural settings of every country. Globally, FDI flows increased by 24 percent per annum during the 1991-2000 decade in real terms whilst developing countries witnessed a 20 percent rise for the same period (World Bank, 2002). Quite obviously, the emerging relative equality in foreign capital flows could be explained by the integration of the world economy as proposed by the concept of trade openness and globalization. According to Bhalla (1998) and ILO (1999), the fundamental essential features of economic implications for globalization on an economy can be summarized as follows:

- the rapidly expanding international trade, facilitated by modern technologies, transfer of innovative ideas and market information. A growth in foreign trade as a proportion of GDP is commonly used as an indicator of globalization which is also a proxy for trade openness;

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- the rising internationalization of production, distribution and marketing of goods and services as a result of the adoption of new organizational forms of production by multinational enterprises and growth in stock markets as well as foreign direct investment;

- the growing global competition among producers and suppliers of goods and services;

- the rise in FDI and other foreign capital flows; and,

- the adoption of economic reforms and openness to trade and investment policies undertaken by developing countries. These reforms are facilitated by the adoption of new technology and innovative practices including information technology.

Even in the face of considerable fluctuations in FDI, on the average, there has been uninterrupted increase in short-term capital flows, especially to developing and emerging market economies (ILO, 1999). The dramatic rise in capital flows is attributed to the collapse of fixed exchange rate regime, deregulation and openness to finance and trade, and the opportunities this case has provided for speculation on floating exchange rates. In the opinion of Streeten (1993), globalization of financial flows has been unequal in that there are hardly any flows to low-income countries. Among developing countries, it is those with substantial human capital and prudent economic policies notably the empowerment of the private sector and liberal or market-based economic policies that are expected to attract critical foreign capital.

Technological progress through intense competition and technological innovation has been stimulated by globalization. Today, the world has become borderless because of satellites and the internet. Cellular phones have also accelerated communication across the globe. More enterprises are growing into multinationals whilst existing multinational firms are increasingly expanding their scope of operations on a global scale with its associated new challenges. For instance, in order to cope with international competition, firms are compelled to introduce some amount of flexibility into their internal operations as well as vary their relationship with local and foreign counterparts (ILO, 1999). A large majority of the poor such as rural peasant farmers in developing countries are either excluded or marginalized by the merits of globalization process (Streeten, 1993).

The empirical studies on globalization lend little support for its justification as a driver of economic progress in developing countries. For instance, Hoang and Liao (2002) found that globalization positively influenced growth and the sovereignty of domestic governments of China and Vietnam but this was at the cost of worker exploitation by multinational firms, risk associated with capital flows and a threat of social stability. Sindzingre (2005) found that globalization induces positive transformation of institutions and trigger virtuous paths for growth and poverty reduction.

3.0 DATA, MODEL SPECIFICATION AND METHODOLOGICAL APPROACH
3.1 Model Specification, Methodological Approach and Estimation Techniques
3.1.1 The Empirical Parsimonious Models
From the literature reviewed, FDI and trade openness (*TOP*) are likely to have some specific effects on industrial performance through increased access to foreign capital and technology as well as external markets. Therefore, in line with the works of Kutan and Vukšić (2007), Girma, *et al* (2007), and Barrios, *et al* (2005), the relevant empirical parsimonious models formulated to determine the implications of FDI and *TOP* on the industrial performance within the context of the Ghanaian economy are specified in models 1, 2 and 3:

Model 1: $\quad INP_t = \alpha_{10} + \alpha_{11}LNR_t + \alpha_{12}RYP_{t-i} + \alpha_{13}TOP_t + \alpha_{14}Z_{it} + \mu_{1t}$

Model 2: $\quad INP_t = \alpha_{20} + \alpha_{21}LNR_t + \alpha_{22}RYP_{t-i} + \alpha_{23}TOP_t + \alpha_{24}FDI_t + \alpha_{25}Z_{it} + \mu_{2t}$

Model 3:
$$\Delta INP_t = \beta_0 + \sum_{i=1}^{4}\beta_{1i}\Delta LNR_{t-i} + \sum_{i=1}^{4}\beta_{2i}\Delta RYP_{t-i} + \sum_{i=1}^{4}\beta_{3i}\Delta TOP_{t-i} + \sum_{i=1}^{4}\beta_{4i}FDI_{t-i} +$$
$$\sum_{i=1}^{4}\beta_{5i}\Delta Z_{t-i} + \beta_6\hat{\varepsilon}_{t-i} + \mu_t$$

where at any time period $_t$, given the stochastic term (μ) and the intercept (α_{i0}, β_0) with all variables in their natural logarithmic state, *INP* denotes industrial performance measured as the share of the industrial sector to total domestic output (GDP); whilst real *GDP* denoted as (*RYP*) is included in the models as an explanatory variable to examine the possible impact of the domestic market size on *INP*. Trade openness index computed as (exports + imports)/GDP and symbolized as (*TOP*); FDI is the net flows of investment from foreign countries to acquire a lasting management interest accounting for at least 10 percent of voting stock; and Z_i is a vector of other macroeconomic determinants of *INP* originally comprising industrial wages *(MWG)*, political stability (P*OL*), cost of borrowing from commercial banks *(LNR)*, real effective exchange rate *(REX)*, raw materials proxied by agricultural output *(RWM)*, bank credit to private sector (*CPS*), corporate tax *(CTX)*, and the rate of inflation *(INF)*. The estimated residual ($\hat{\varepsilon}$) is stable and follows the normal distribution trend. Models 1 and 2 were estimated to examine the cointegrating relationships whereas model 3 was specified for evaluating the dynamic short-run impact of the regressors on *INP*.

In this study, two central theoretical postulations were tested. The restricted model (Model 1) examines the specific-policy static long-run impact of trade openness on industrial performance excluding foreign direct investment in Z_i; the unrestricted model (model 2) estimates the broad-policy static and dynamic long-run implications of trade openness on industrial performance assuming that trade openness led to an increase in the net inflows of foreign investment to the industrial sector; whilst model 3 examines the short-run implications of model 2. The *a priori* signs of the estimated coefficients are $\alpha_{i0}, \beta_0; \alpha_{i2}, \beta_2; \alpha_{i3}, \beta_3; \alpha_{24}, \beta_4 > 0$ whereas $\alpha_{i1}, \beta_1; \beta_6 < 0$ and $\alpha_{14}, \alpha_{25}, \beta_5 \neq 0$.

3.1.2 Lag Determination, Empirical Model Parsimony Process and Granger-Causality Test

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The Johansen-Juselius (1990) approach was adopted in the estimation of the models. The appropriate number of lags, which offers the value of ρ, is chosen according to the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (SBC). The parsimonious empirical model was determined based on the concurrent least value of AIC and SBC at the instance of no autocorrelation with reference to Durbin-Watson (DW) statistic. Upon the selection of the appropriate empirical model for estimation, the study verified the Granger-causality conditionality of the key variables notably *INP*, *FDI*, and *TOP* using the standard F-statistic under the hypothesis: $H_0 : A_{xy}(L) = 0$ (*y* does not Granger-cause *x*); where $A_{xy}(L)$ represents the coefficients of lagged values of *y* on *x*.

3.1.3 Stationarity Test
The time series properties of the variables were explored to determine the order of integration of each variable included in the models. The essence of this test is to avoid spurious regression problems normally associated with time series econometric modeling (Granger and Newbold, 1974). In this paper, the popular Augmented Dickey Fuller (ADF) test and the Phillips-Perron stationarity test were applied. The two tests were used simultaneously because while the ADF procedure is the most popularly used test for stationarity, it nevertheless requires homoskedastic and uncorrelated errors in the underlying structure. The PP non-parametric test generalizes the ADF technique, allowing for less restrictive assumptions for the time series in question. Both procedures were adopted so as to guarantee that the essential inferences regarding the issue of stationarity are not essentially driven by the choice of test procedure.

3.1.4 Cointegration Test
A set of variables are cointegrated if they individually follow a unit root process, but jointly move together in the long-run. Individually, movements appear random and unpredictable but the location of one variable, say *Y* can provide information on another variable say *X*. If the estimated errors of *Y* regressed on *X* are stationary, then there is evidence of cointegration according to Engle-Granger procedure. The Johansen-Juselius (1990) cointegration technique is employed to augment the Engle-Granger test. The order of VAR(ρ) considered in the cointegration tests is determined according to SBC and AIC criteria.

3.1.5 Data Transformation and Estimation Procedure in the Presence of Severe Autocorrelation
Given that the empirical models 1-3 specified above are represented generally as equation (4) below:

$$Y_t = \kappa_0 + \kappa_1 X_{1t} + \kappa_2 X_{2t} + \kappa_3 X_{3t} + \dots\dots + \kappa_k X_{kt} + \mu_t \tag{4}$$

where it is discovered that μ_t is severely autocorrelated by first-order such that $\mu_t = \rho\mu_{t-1} + \varepsilon_t$, it follows that if equation (4) holds for $_t$, then it will equally hold for $_{t-1}$ period. In effect,

$$Y_{t-1} = \kappa_0 + \kappa_1 X_{1t-1} + \kappa_2 X_{2t-1} + \kappa_3 X_{3t-1} + \dots\dots + \kappa_k X_{kt-1} + \mu_{t-1} \tag{5}$$

Multiplying (5) through by ρ,

$$\rho Y_{t-1} = \rho\kappa_0 + \kappa_1 \rho X_{1t-1} + \kappa_2 \rho X_{2t-1} + \kappa_3 \rho X_{3t-1} + \dots\dots + \kappa_k \rho X_{kt-1} + \rho\mu_{t-1} \tag{6}$$

and subtracting (6) from (4) results in:

$$Y_t - \rho Y_{t-1} = \kappa_0 (1-\rho) + \kappa_1 (X_{1t} - \rho X_{1t-1}) + \kappa_2 (X_{2t} - \rho X_{2t-1}) + \kappa_3 (X_3 - \rho X_{3t-1}) + ...$$
$$+ \kappa_k (X_{kt} - \rho X_{kt-1}) + (\mu_t - \rho \mu_{t-1}) \quad (7)$$

Rewriting equation (7) above, we have:

$$\hat{Y}_t = \kappa_t + \kappa_1 \hat{X}_{1t} + \kappa_2 \hat{X}_{2t} + \kappa_3 \hat{X}_{3t} + ... + \kappa_k \hat{X}_{kt} + \hat{\mu}_t \quad (8)$$

where $\hat{\mu}_t$ now satisfies all the fundamental assumptions underlying the classical linear regression model as in line with the properties of Ordinary Least Squares (OLS) including where $E(\hat{\mu}_t, \hat{\mu}_{t-i}) = 0$. To avoid loss of the first observation of each variable as a result of the quasi-differencing, these first variables were transformed using the formula $\hat{Y}_1 = Y_1 \sqrt{1-\rho^2}$ and $\hat{X}_{i1} = X_{i1} \sqrt{1-\rho^2}$.

3.2 Data Description and Sources

Quarterly or annual time series data from secondary sources were obtained from the Trades Union Congress, International Monetary Fund (IMF), Bank of Ghana (BoG), Internal Revenue Service (IRS), and the Ghana Statistical Service (GSS).

Table 1: Data Description and Sources

Variable	Notation	Description and Sources
Industrial Performance	INP	The share of industrial output as a proportion of nominal GDP as published by GSS and IMF.
Corporate Tax	CTX	Tax rate on annual profits of corporate bodies. Source: IRS and GSS.
Real GDP[*]	RYP	Real gross domestic product used as a proxy for domestic market size and economic performance. Source: IMF and GSS
Inflation Rate	INF	Computed as the rate of growth in consumer price index as obtained from Bank of Ghana (BoG) and GSS.
Lending Rate	LNR	Average nominal lending rate of commercial banks to the manufacturing sector. This was computed based on the reported data obtained from BoG.
Industrial Wage	MWG	Average nominal minimum wage rate paid to a full-time employee in the industrial sector. Source: Trade Unions Congress of Ghana.
Raw Materials	RWM	Agricultural output as a share of nominal gross domestic product as obtained from GSS and IMF.
Real Effective Exchange Rate	REX	The weighted real exchange rate of the cedi to the foreign currencies of Ghana's major trading partners. Source: IMF.
Foreign Direct Investment	FDI	Net flows of investment from foreign countries to acquire a lasting management interest accounting for at least 10 percent of voting stock as reported by the IMF.
Trade Openness	TOP	Computed as the sum of exports and imports as a ratio of GDP which is the traditional and the most widely used index for trade openness or globalization

[*]The study employed the Non-Linear Growth Approach suggested by Gaynor and Kirkpatrick (1994) in transforming annual data such as INP, RYP and RWM into quarterly series. For the Non-Linear Growth Approach, a second degree of polynomial function is specified to capture one turn, up or down, in the series while for more than one turn in the series, a high degree polynomial is specified accordingly.

4.0 THE EMPIRICAL RESULTS

4.1 Results of Unit Roots Test

The results as presented in Table 2 below show that generally all the variables included in the model are non-stationary in levels but become stationary after first-differencing. Thus, each variable included in the empirical models was found to be integrated of order one. This result provides a necessary, but not sufficient rationale for estimating cointegrating and error-correction models as specified in 3.1.1 above.

Table 2: Results of Unit Root Tests *(constant, time trend included)*		
	ADF Test Stat	Phillips-Perron (PP) Test Stat	
Variables	ADF Average Critical Value(5%): **3.461**	PP Average Critical Value(5%): **3.461**	Remarks
CTX	9.693362	9.706582	I(1)
FDI	9.864115	9.932275	I(1)
INP	9.539157	9.540019	I(1)
INF	9.70846	11.20207	I(1)
LNR	7.187731	6.765417	I(1)
MWG	9.837048	9.865996	I(1)
RWM	10.79308	12.56019	I(1)
RER	9.759739	19.01291	I(1)[*]
TOP	12.6466	13.56159	I(1)
The H_o is that a series is non-stationary against an alternative hypothesis (H_1) of a series being stationary. The rejection of the H_0 for both ADF and PP tests is based on the MacKinnon critical values. The lag lengths were automatically determined in accordance with SIC. [*]Indicates variable is I(0) under PP test but I(1) under ADF test			

Source: Author's Estimations

4.2 Results of Cointegration Test

For the sufficient condition for adopting error-correction and cointegrating estimation procedure, the Johansen Maximum Likelihood (JML) test was adopted to determine the cointegrating rank of the system of each empirical model and the number of common stochastic trends driving the entire system. The results of the JML tests are summarized in Appendices C1 and C2. The cointegration modeling was undertaken within the context of an unrestricted vector error-correction model that allowed for a constant term. The rationale behind the adoption of this assumption was based partly on the results of the unit root and the essence to ensure that the ultimate solution does not fall into equations of higher degree polynomial terms. The maximal Eigenvalue tests indicate the presence of at most one cointegrating vector for each model though the trace tests show higher cointegrating vectors.

4.3 Results of Granger-Causality Test

The results of Granger-causality test are presented in Table 3 below. These results indicate that over the initial 12-quarter lag span, there are no traces of causality between industrial performance (*INP*) and foreign direct investment (*FDI*) as well as between *INP* and trade openness (*TOP*). However, with the exception of lags 2 and 5, *TOP* strongly drives FDI with an apparent dual causality occurring at lags 8, 11 and 12.

Table 3: Results of Granger Causality Test

Number of Lags	**Variables**: FDI, INP, TOP *(from upper variable to lower variable, p-values)*					
	FDI INP	INP FDI	TOP INP	INP TOP	TOP FDI	FDI TOP
1	0.61492	0.87082	0.55060	0.86177	0.03388	0.11497
2	0.76710	0.98780	0.73940	0.87294	0.11876	0.20523
3	0.76657	0.94862	0.67130	0.96625	0.05248	0.42467
4	0.37788	0.99331	0.44006	0.99049	0.09205	0.49771
5	0.99921	0.99783	0.99790	0.99595	0.01587	0.57298
6	0.99982	0.99922	0.99934	0.93746	0.06816	0.23684
7	0.99983	0.99875	0.96370	0.95947	3.8E-05	0.36453
8	0.99979	0.99916	0.95010	0.97739	3.5E-05	0.07025
9	0.92474	0.99881	0.49089	0.99043	3.4E-05	0.11521
10	0.93307	0.99921	0.55134	0.98604	1.9E-05	0.19878
11	0.94433	0.99482	0.50084	0.97291	4.9E-05	0.02472
12	0.92600	0.99781	0.56632	0.96574	1.1E-05	0.03609

Source: Author's estimations

4.4 Results of the Empirical Models

The empirical results of the cointegrating models clearly indicate that there is an evidence of severe positive autocorrelation in the original models specified in 3.1.1 above (see Appendices A and B for details). Based on this revelation, the study proceeded with estimating the empirical models 1-3 in the mode of transformed generalized-differences as specified in (8) above rather than using the natural values.[2] The empirical results are summarized in Tables 4-7 below.

In Tables 4 and 5 below, the results of the estimated static long-run models are presented. The results show that under static long-run equilibrium condition, corporate tax (*CTX*), real effective exchange rate (*REX*) and foreign direct investment (*FDI*) are not statistically significant determinants of industrial performance (*INP*). From both results, our diagnostic tests show that not less than 75% of the variations in industrial performance during the period under investigation are attributable to the regressors. This implies the estimated regression lines can be described as good-fits while the other diagnostic test statistics suggest that the estimated coefficients are unbiased and consistent. For instance, the estimated results from the static long-run models confirm the fact that the findings can be considered as efficient and reliable given the non-significance of the reported F-statistics of the White Heteroskedasticity and the Ramsey RESET tests at 5% level of significance. The Durbin-Watson statistics of approximately 2 is an indication that after data transformation in line with the procedure outlined in 3.1.5, the residual from each of the two models is now auto-uncorrelated.

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[2] The estimated values for the first-order autocorrelation coefficient (ρ) were 0.655952 and 0.608778 for models 1 and 2 respectively.

Table 4: Estimated Results of Static Long-Run Model

Estimated Results of Static Long-Run Model 1

$$\hat{INP_t} = 2.0504 - 0.2907L\hat{NR_t} + 0.3363R\hat{YP}_{t-1} + 0.9281T\hat{OP_t} + 0.1323C\hat{TX_t} + 0.0199M\hat{WG_t} + 0.2579R\hat{WM_t} - 0.3103R\hat{EX_t} + 0.5212INF_t$$

$$(2.03)^{**} \quad (-4.57)^{***} \quad (4.71)^{***} \quad (0.84) \quad (1.31) \quad (2.68)^{**} \quad (2.05)^{**} \quad (-0.50) \quad (1.79)^{*}$$

R-Squared	0.7747	White Hetero	1.3292 {0.2000}
Adj. R-Squared	0.7518	Ramsey RESET 1.	1624 {0.1465}
Durbin-Watson Stat	1.9393	F-statistic	48.801 {0.0000}

t-statistics are in ( ), F-probabilities are presented in { }; $^{*}/^{**}/^{***}$ significant at 10%/5%/1% levels respectively

Table 5: Estimated Results of Static Long-Run Model

Estimated Results of Static Long-Run Model 2

$$\hat{INP_t} = 2.6698 - 0.9739L\hat{NR_t} + 1.3441R\hat{YP}_{t-1} - 12.8941T\hat{OP_t} - 0.3503FDI_t + 0.7259C\hat{TX_t} + 1.0307M\hat{WG_t} + 1.2137R\hat{WM_t}$$

$$(2.07)^{**} \quad (-4.29)^{***} \quad (5.40)^{***} \quad (-1.96)^{**} \quad (-0.78) \quad (1.31) \quad (2.55)^{**} \quad (2.03)^{**}$$

$$-1.8914R\hat{EX_t}$$
$$(-0.67)$$

R-Squared	0.7905	White Hetero	1.4114 {0.1261}
Adj. R-Squared	0.7672	Ramsey RESET	0.7183 {0.3967}
Durbin Watson stat	1.9502	F-statistic	53.0397 {0.0000}

t-statistics are in ( ), F-probabilities are presented in { }; $^{*}/^{**}/^{***}$ significant at 10%/5%/1% levels respectively

The estimated results from the static long-run model 2 presented in Table 5 above suggest that the quantity of raw materials (*RWM*), the size of the Ghanaian economy in the last quarter (*RYP_1*), nominal industrial wage rate (*MWG*) and the rate of inflation (*INF*), are in order of importance, the most important positive drivers of industrial performance (*INP*) in the long-run. Also, in the long-run, trade openness (*TOP*) necessitating from the concept of globalization and the commercial banks lending rate (*LNR*) to the industrial sector are critical factors that undermine industrial performance in Ghana.

Table 6: Estimated Results of Dynamic Long-Run Model

Estimated Results of Dynamic Long-Run Model

$$\hat{INP_t} = 4.7447 + 1.904I\hat{NP}_{t-1} - 0.1752L\hat{NR_t} + 1.1034R\hat{YP_t} + 1.0039R\hat{YP}_{t-1} - 0.0830R\hat{YP}_{t-4} - 12.1087T\hat{OP}_{t-1} - 12.4295T\hat{OP}_{t-2}$$

$$(4.13)^{***} \quad (6.57)^{***} \quad (-2.96)^{***} \quad (1.86)^{*} \quad (1.92)^{*} \quad (-2.84)^{***} \quad (-2.37)^{**} \quad (-2.44)^{**}$$

$$-31.2160T\hat{OP}_{t-3} - 11.0478T\hat{OP}_{t-4} + 0.0101F\hat{DI_t} - 0.5459C\hat{TX_t} + 0.0972M\hat{WG_t} + 0.0963M\hat{WG}_{t-4} + 2.0224R\hat{WM_t}$$

$$(-4.82)^{**} \quad (-2.15)^{**} \quad (1.85)^{**} \quad (-4.28)^{***} \quad (3.18)^{***} \quad (3.00)^{***} \quad (6.48)^{***}$$

$$-0.0711R\hat{WM}_{t-4} + 0.0864I\hat{NF_t}$$
$$(-3.34)^{***} \quad (3.35)^{***}$$

R-Squared	0.9036	ARCH	1.3156 {0.1802}
Adj. R-Squared	0.8815	Ramsey RESET	1.3292 {0.2002}
F-statistics	37.31{0.000}	White Hetero stat	0.0768{0.6735}

t-statistics are in ( ), F-probabilities are presented in { }; $^{*}/^{**}/^{***}$ significant at 10%/5%/1% levels respectively

In consistency with the findings of the static long-run equilibrium models, the empirical results from the dynamic long-run model (presented in Table 6 above) suggest that in the long-run, trade openness, corporate tax and lending rate of commercial banks, are in descending order of importance, the key factors that undermine higher industrial performance in Ghana. Indeed, all the previous levels of trade openness have significant negative impact on long-run industrial performance in Ghana. This result also indicates that domestic market size and the availability of raw materials have significant positive impacts on long-run industrial performance. Similarly, the rate of inflation, present and the past values of industrial wage rate, present volume of raw materials, FDI and industrial performance as at the past-four quarter are crucial long-run positive determinants of industrial performance in Ghana. The results as presented in Table 6 above show that the regression line has a good fit and the estimated model does not suffer unduly from violating any of the classical assumptions underlying OLS.

The empirical findings of model 3, which can also be described as efficient, reliable and a good-fit are presented in Table 7 below. This model was estimated to determine the short-run dynamics of model 2. In consonance with the long-run results, trade openness and lending rate of commercial banks to the manufacturing sector are found to be factors that are responsible for the under-industrialization of the Ghanaian economy. Current and previous levels of corporate tax and the rate of inflation have negative short-run impacts on industrial performance in Ghana. Increased inflows of FDI, immediate past size of the domestic economy (RYP_1), current size of raw materials, and the degree of industrial performance during the past-four quarter are significant positive drivers of industrial performance. One striking result from the dynamic short-run model is that industrial wage rate and real effective exchange rate do not have any significant short-run impact on industrial performance.

Table 7: Estimated Results of Dynamic Short-Run Model

Estimated Results of Dynamic Short-Run Model

$$\Delta I\hat{N}P_t = 0.7896 + 0.4784\Delta I\hat{N}P_{t-4} - 0.2928\Delta L\hat{N}R_t - 0.1222\Delta L\hat{N}R_{t-4} + 0.9015\Delta R\hat{Y}P_{t-1} - 7.2761\Delta T\hat{O}P_{t-3} + 0.0451\Delta T\hat{O}P_{t-4}$$
$$(1.67)^* \quad (4.04)^{***} \quad\quad (-2.02)^{**} \quad\quad (-2.47)^{**} \quad\quad (2.28)^{**} \quad\quad (-1.88)^* \quad\quad (3.02)^{***}$$

$$+0.0098\Delta F\hat{D}I_{t-1} + 0.0114\Delta F\hat{D}I_{t-2} - 0.0104\Delta F\hat{D}I_{t-3} - 0.0091\Delta F\hat{D}I_{t-4} - 0.1878\Delta C\hat{T}X_t - 0.2208\Delta C\hat{T}X_{t-3}$$
$$(2.34)^{**} \quad\quad (2.30)^{**} \quad\quad (-1.42) \quad\quad (-1.19) \quad\quad (-2.37)^{**} \quad\quad (-2.44)^{**}$$

$$+0.7156\Delta R\hat{W}M_t - 0.4780\Delta R\hat{W}M_{t-4} - 0.1091\Delta I\hat{N}F_{t-4} - 0.6499\hat{\varepsilon}_{t-1}$$
$$(3.97)^{***} \quad\quad (-3.77)^{***} \quad\quad (-2.15)^{**} \quad\quad (-6.72)^{***}$$

R-Squared	0.8180	**ARCH**	0.1153 {0.7350}
Adj. R-Squared	0.7262	**Ramsey RESET**	1.0816 {0.1190}
F-statistics	64.655{0.000}	**White Hetero stat**	0.0633{0.7489}

t-statistics are in ( ), F-probabilities are presented in { }; */**/*** significant at 10%/5%/1% levels respectively

Δ *is the first-difference operator;* $\hat{\varepsilon}$ *is the error-correction term*

The results of the short-run dynamics also show that nearly 65% of any disequilibrium in industrial performance is corrected in the next quarter in the presence of past industrial performance, CTX, LNR, TOP, FDI, RWM, and INF.

5.0 POLICY RELEVANCE AND RECOMMENDATIONS

The empirical results lend credence to the view that the arbitrary opening of the Ghanaian economy to foreign trade in response to the emerging concept of globalization is the main factor responsible for the stagnant growth and poor performance of the industrial sector. This result, which justifies the apprehension of the pessimistic school on trade openness in a globalized world and the empirical works of McGregor (2005), Easterly (2005), Killick (2000), Demery (1994), Elbadawi, *et al.* (1992) among others, suggests that the foreign trade sector of Ghana appears to be "over-liberalized" which might mean that there are no effective harmonized framework for close monitoring and standardization of imports. A further implication is that as a result of trade openness, the Ghanaian economy is virtually participating in globalization as a major consumer of foreign goods rather than as an essential producer and exporter of industrial goods. By this finding, it is recommended that there is the urgent need to conduct further studies on trade openness so as to determine the optimal level upon which the appropriate national policy would be formulated towards saving the economy from the excesses of the current arbitrary openness policy to foreign trade.

Contrary to public criticisms of the government and outcry of employers in relation to government frequent upward adjustments in minimum wage in recent times, which was thought to be responsible for high operational expenses and low industrial performance, the findings of this study suggest that, in the long-run, higher industrial wages are highly important in enhancing industrial performance in Ghana. Interestingly, in the short-run, industrial wage is not statistically significant in explaining industrial performance. This is not amazing since Ghana is known to be relatively labour-abundant with associated low wages; hence higher wages could serve as a motivation for higher labour productivity for an improved industrial performance. Therefore, it is recommended that to promote long-run industrial performance in Ghana, there is the need to pay more realistic wages to industrial workers.

The implementation of open-trade policy just as foreign direct investment inflows does not Granger-cause industrial performance directly. Rather, the relevance of implementing open-trade policy is seen in the extent to which it causes net foreign capital inflows to the Ghanaian economy. This implies that in a globalized world, the mere implementation of open-trade policy is not a panacea for higher industrial performance unless it is able to attract foreign direct investment. Probably, this is why the empirical results on causality show that at higher lags such as 8, 11, and 12 bi-directional causality exists between trade openness and foreign direct investment. This position is confirmed by the estimated result obtained from our restricted model where with the exclusion of foreign direct investment from the model, the implementation of trade openness policy fails to have any significant impact on long-run industrial performance in Ghana. However, when the model was re-estimated under unrestricted condition where both foreign direct investment and trade liberalisation are simultaneously included, the long-run impact of trade liberalisation emerge to be the most significant factor undermining industrial performance in Ghana.

Further, since it turns out that lower rates of inflation are necessary for propelling short-run industrial performance whereas in the long-run, inflation has a consistent positive impact on industrial performance, this study proposes a policy framework in the form of a harmonized macroeconomic policy-mix that should be implemented towards achieving a moderate rate of inflation in order to improve upon the long-run industrial performance in Ghana. As the rate of inflation is made moderate and manageable, lending rates of commercial banks must be significantly reduced to attract investors to seek additional working capital for expansion and

propelling higher industrial performance. Alternatively, the Central Bank of Ghana should encourage more financial institutions to enter into the banking and finance industry so as to increase competition which would ultimately result in lower lending rates which are a necessary requirement for higher industrial performance both in the short-run and the long-run.

Finally, as a policy response to improve industrial performance in Ghana, it is imperative for policy focus on ensuring higher performance of the agricultural sector that is to support the industrial sector with the increased supply of raw materials. This policy prescription is informed on the finding that the size of raw materials is a significant determinant of industrial performance in the short-run as well as the long-run. The finding that both in the short-run and the long-run, the size of raw materials at lag 4, and the level of economic performance in the long-run at lag 4 have negative impacts on current level of industrial performance is a manifestation of the fact that the usual booms and recessions associated with business cycles are well predicted by the investors in industrial sector of Ghana.

6.0 CONCLUDING REMARKS

Within the framework of multivariate cointegration and vector error-correction modeling, this study has provided an insight into the macroeconomic factors that explain industrial performance since the implementation of economic reform programme in 1983 with reference to Ghana. Within the context of the Ghanaian economy, the study reveals that the main factors that undermine industrial performance are trade openness and lending rates, whilst the availability of raw materials, industrial wage rate, rate of inflation, and domestic market size or economic performance promote industrial performance particularly in the long-run. Generally, the findings of this paper support the view that in this modern world of globalization, arbitrary implementation of open-trade policy by a developing country like Ghana is detrimental to industrial performance. In the short-run, real effective exchange rate and industrial wage rate are not significant factors that explain the level of industrial performance in Ghana. Though foreign direct investment appears to exert some positive long-run impact on industrial performance in Ghana the impact is very weak given the low estimated coefficients. It is possible that some conditionalities that are often associated with official FDI to developing countries might not be directly favourable to initiating higher industrial performance. Furthermore, it appears substantial FDI go to non-manufacturing sectors particularly services for which reason FDI does not have any significant impact on industrial performance. In order to guarantee a high industrial performance, there is the need for the government of Ghana to implement prudent macroeconomic policies to ensure that raw materials are made readily available but at the same time there is need for the economy to exhibit signs of robust growth and growing domestic market for industrial products through real economic growth.

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Appendix A: Estimated Results of Model 1 in the Presence of Autocorrelation

Dependent Variable: Industrial Performance (INP) estimated by OLS
Sample (adjusted): 1983Q2 2005Q4; Included observations: 91 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF	0.190986	0.088463	2.158984	0.0338
INT	0.223849	0.034913	6.411722	0.0000
CTX	0.328985	0.081322	4.045461	0.0001
MWG	-0.017600	0.004431	-3.962886	0.0002
RYP(-1)	0.472621	0.081770	5.779883	0.0000
RWM	-0.405705	0.157913	-2.569168	0.0120
REX	4.15E-06	0.001811	0.002292	0.9982
TOP	-8.618192	4.728437	-1.822630	0.0720
C	2.831625	10.73731	0.263718	0.7927
R-squared	0.927308	F-statistic		130.7566
Adjusted R-squared	0.920216	Prob(F-statistic)		0.000000
Durbin-Watson stat	0.744520	Ramsey RESET (1.3727)		0.134907*

* non-significant at 5% for model misspecification

Appendix B: Estimated Results of Model 2 in the Presence of Autocorrelation

Dependent Variable: Industrial Performance (INP) estimated by OLS
Sample (adjusted): 1983Q2 2005Q4; Included observations: 91 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF	0.019548	0.008749	2.234255	0.0282
INT	0.213269	0.035071	6.081113	0.0000
CTX	0.310384	0.081137	3.825439	0.0003
FDI	-0.011340	0.006662	-1.702140	0.0926
MWG	-0.000174	4.38E-05	-3.976694	0.0002
RYP(-1)	0.00521	0.000857	6.076498	0.0000
RWM	-0.374283	0.157205	-2.380857	0.0196
REX	-8.52E-05	0.001791	-0.047592	0.9622
TOP	-8.973604	4.679327	-1.917712	0.0587
C	0.976028	10.67103	0.091465	0.9273
R-squared	0.929819	F-statistic		119.2392
Adjusted R-squared	0.922021	Prob(F-statistic)		0.000000
Durbin-Watson stat	0.777897	Ramsey RESET (0.6994)		0.811873*

* non-significant at 5% for model misspecification

Appendix C1: Results of Johansen Maximum Likelihood Cointegration Test
(for Model 1: Variables excluding FDI)

Trend assumption: Linear deterministic trend
Series: INP CTX INF INT MWG RWM REX RYP TOP
Lags interval (in first differences): 1 to 2
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.644561	306.1467	237.3709	0.0000
At most 1	0.549048	169.0850	197.5297	0.0633
At most 2	0.401229	113.2059	145.6154	0.0891
At most 3	0.381494	87.56001	96.75366	0.1434
At most 4	0.230928	54.80006	69.81889	0.4274
At most 5	0.153114	31.43129	47.85613	0.6433
At most 6	0.105390	16.64046	29.79707	0.6665
At most 7	0.072816	6.728804	15.49471	0.6094
At most 8	1.73E-06	0.000154	3.841466	0.9917

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.644561	72.06168	60.43354	0.0000
At most 1	0.549048	50.87912	56.36261	0.0676
At most 2	0.401229	45.64591	48.99872	0.0587
At most 3	0.381494	32.75995	43.07757	0.0563
At most 4	0.230928	23.36877	33.87687	0.5025
At most 5	0.153114	14.79083	27.58434	0.7646
At most 6	0.105390	9.911655	21.13162	0.7529
At most 7	0.072816	6.728649	14.26460	0.5217
At most 8	1.73E-06	0.000154	3.841466	0.9917

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Appendix C2: Results of Johansen Maximum Likelihood Cointegration Test
(for Models 2 and 3: Variables including FDI)

Trend assumption: Linear deterministic trend

Series: INP CTX INF INT MWG RWM REE RYP TOP FDI

Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.658704	270.3620	249.2354	0.0000
At most 1	0.561043	204.6867	210.3709	0.0679
At most 2	0.439914	141.4083	169.5297	0.0959
At most 3	0.389410	99.81800	125.6154	0.1269
At most 4	0.280035	75.91174	95.75366	0.5097
At most 5	0.161626	46.67052	69.81889	0.7732
At most 6	0.147126	30.98060	47.85613	0.6675
At most 7	0.111715	16.81681	29.79707	0.6535
At most 8	0.067722	6.273594	15.49471	0.6632
At most 9	0.000366	0.032570	3.841466	0.8567

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.658704	85.67534	74.50472	0.0000
At most 1	0.561043	61.27839	63.43354	0.0699
At most 2	0.439914	49.59025	52.36261	0.0798
At most 3	0.389410	43.90629	46.23142	0.0870
At most 4	0.280035	29.24122	40.07757	0.4748
At most 5	0.161626	15.68992	33.87687	0.9620
At most 6	0.147126	14.16379	27.58434	0.8112
At most 7	0.111715	10.54321	21.13162	0.6925
At most 8	0.067722	6.241025	14.26460	0.5825
At most 9	0.000366	0.032570	3.841466	0.8567

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values