Financial sector development and the macrodynamics of 'de facto' dollarisation in developing countries: the case of Ghana

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Financial Sector Development and the Macrodynamics of De Facto Dollarisation in Developing Countries: The Case of Ghana

by

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ABSTRACT
Following the massive economic policy restructuring and reforms since the early 1980s, currency substitution, asset substitution and de facto dollarisation have become common phenomena in nearly all transition and developing economies. High and persistent inflation which have been a perennial feature of developing and transition economies is now known to be highly responsible for currency substitution, asset substitution and de facto dollarisation. This paper presents evidence on the macrodynamics of de facto dollarisation, currency substitution and asset substitution during the era of the implementation of the Financial Sector Adjustment Programmes (FINSAPs) in developing and transition economies with special reference to Ghana. The study has found out that de facto dollarisation whether in the form of asset substitution or currency substitution is highly prevalent and poses a serious threat to fiscal and monetary policies effectiveness in developing and transition economies. In Ghana, the principal long-run mainspring of de facto dollarisation is the ad hoc implementation of financial sector development programme that was embarked upon about two decades ago which has resulted in high exchange rate depreciation and price fluctuations. It is, however, likely that as the financial sector develops over a long period a time will come when further development of the financial sector would no longer instigate de facto dollarisation.

Keywords: Currency Substitution, Asset Substitution, Dollarisation, Financial Sector Development
JEL Classification Numbers: C20, E52, E58, F31, G15, H26, P2

1.0 INTRODUCTION

The US dollar is widely known or believed to possess some key desirable properties. These include the reputation of being a stable currency, and hence it can reliably function as a store of value. Besides, it is generally conceived that the US dollar has the highest global availability and acceptability as a medium of exchange, and further safeguards foreign users against the threat of domestic bank failures, devaluation and inflation. Cash usage preserves anonymity of users because it leaves no paper trail of the transaction for which it serves as the means of payment hence it is the preferred medium of exchange in underground transactions. Indeed, the very characteristics that make the US dollar a popular medium of exchange also makes it difficult to determine the exact amount and location of the US currency circulating abroad. Even so, there is a direct source of information that can be used to determine the approximate amount of the US currency in circulation in different countries.

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Monetary economists most often relate dollarisation of any kind in transition and developing economies to the prevailing conditions of deficiencies of market institutions at the early stage of economic development. The cause of dollarisation can then be summarized as the interacting consequence of perennial high rates of inflation. This causes the domestic currency to become relatively less par excellence than those that have earned a reputation for being relatively successful in maintaining their purchasing power over a reasonable period of time. The consequence is a constant pressure on the exchange rate, undermining the ability of the central bank to maintain the monetary target. Certainly, this negatively affects the effectiveness of implementing monetary and fiscal policies towards macroeconomic stability.

It is quite clear that dollarisation, be it in the form of asset substitution or currency substitution, is a product of flexible exchange rate regime. This system makes room for exchange rate fluctuations based on the forces of demand and supply in the foreign exchange market. For instance, a decline in the demand for domestic money relative to foreign money would increase the equilibrium price level. According to the purchasing power parity, strictly given that interest rates are determined endogenously, the increased domestic price level will lead to devaluation of domestic currency to accommodate the lower money demand, as exchange rate virtually reflects the relative price of currencies.

Nevertheless, consensus has been drawn on the basic property of currency substitution and asset substitution or dollarisation, that it is clearly a phenomenon of money demand, a demand for multiple mediums of exchange and therefore can be analysed within a money demand functional framework that permits simultaneous holding of medium of exchange as well as saving asset denominated in different currencies. By incorporating the effects of currency substitution in the domestic money demand function, the behaviour of monetary aggregates will be altered.

It is therefore understood that the extensive presence of foreign currencies in the monetary aggregates and their counterparts will inevitably lower the demand for domestic currencies in transition and developing economies, while the stability of the velocity of circulation as well as the demand for the local currency will also be affected.

The key underlying problem of this study is that in order to develop the financial sector, there is the need to implement financial liberalisation programmes and policies that will enhance the maximization of the benefits of financial markets through competition, widening and deepening of the financial system. Financial liberalisation, however, promotes increased access to foreign currencies and foreign denominated financial assets in a domestic economy resulting in increased dollarisation and the apparent difficulty in effective monetary policy implementation by central banks of developing countries where price and foreign exchange instability and stickiness have for long been a permanent feature.

From the foregoing a lot of questions have been left unanswered: What is the extent of *de facto dollarisation* in developing and transition economies? Is financial development by way of liberalisation the cause of *asset substitution*, *currency substitution* or *de facto* dollarisation? What are the main macroeconomic determinants of *currency substitution* and *asset substitution*? Are there any lines of causality among *currency substitution*, *asset substitution* and *de facto dollarisation* in developing and transition economies? This paper attempts to answer these questions through the analysis of the macrodynamic interlinks among the phenomena under

investigation. The central objective of this study, therefore, is to find out if financial sector development by way of liberalisation is the principal cause of *de facto* dollarisation in developing countries using Ghana as a case study. Specifically, this is designed to:

i. employ standard and comprehensive formulae to determine the degree of *asset substitution*, *currency substitution*, and *de facto dollarisation* in selected developing and transition countries;

ii. determine the inter-temporal correlations of *asset substitution*, *currency substitution*, and *de facto dollarisation* for selected developing countries and economies in transition;

iii. estimate the short-run and long-run impact of financial sector development of *asset substitution*, *currency substitution* and *de facto dollarisation*;

iv. trace the direction of the line(s) of causality among *asset substitution*, *currency substitution*, *de facto dollarisation*, *financial sector development*, and *inflation* for Ghana; and,

v. evaluate the short-run and long-run macroeconomic determinants of *asset substitution*, *currency substitution*, and *de facto dollarisation* with reference to Ghana.

2.0 LITERATURE REVIEW AND THEORETICAL FRAMEWORK
2.1 Financial Liberalisation and Financial Sector Development Theory
Theory on financial liberalisation leading to financial sector development originated with the works of McKinnon (1973) and Shaw (1973) which focused on financial repression and the need for developing economies to allow real interest rates, along with other financial indicators, to be determined by market forces. Even though the theory traditionally focused on interest rates, the financial repression approach also incorporated the adverse effects of high reserve ratios and government controlled credit programmes, which together contributed to low savings, credit rationing and low investment. By this convention, artificial ceilings on interest rates reduce financial savings, capital accumulation, discourage the efficient allocation of resources and promote credit rationing in the assets market.

Given that real interest rates under financial repressive circumstances are prevented from adjusting to market equilibrium, other non-market forms of clearing such as *queuing* arrangements to ration the available credit in the form of auctions, quantitative restrictions including quotas as well as various forms of *bidding* systems which themselves may be open to nepotism or outright corrupt practices. In essence, the manifestations of financial sector development policy are to eliminate or at least reduce to the lowest possible minimum, repressive forces in the financial markets through market forces. Among the end products of the implementation of a perfect financial sector development policy are the emergence of competitive or equilibrium interest rates, improved higher and regular financial savings (and investment), increased availability of quality and innovative financial assets, the emergence of open currency markets or forex bureaux and a well-functioning capital market.

As expected, not all economists agree to the concept of financial liberalisation. Proponents including Obstfeld (1998) and Mishkin (2001) insist that liberalising the financial sector helps improve the effective functioning of financial systems in many ways. Proponents believe that financial liberalisation is crucial to increasing the availability of *loanable* funds and allowing cross-country portfolio risk diversification which are a necessary condition for financial development. In sharp contrast, however, Diaz-Alejandro (1985), Stiglitz (1994, 2000) and Demirgüc-Kunt and Detriagiache (1998), based especially on the experiences of Latin American

countries in the 1970s, strongly oppose the concept of financial liberalisation as a means of achieving financial development. In their view, wholesale liberalisation will most likely lead to macroeconomic instability and financial crises characterized by widespread bankruptcies, massive government interventions, nationalization of private sector institutions and low voluntary saving from the household sector. In fact, for developing and emerging economies Stiglitz (1994) argues in favour of government intervention in financial markets in the form of prudential regulation and supervision since, *de facto*, the government is the insurer of the financial systems. Kaminsky and Schmukler (2001) lend empirical support to this assertion.

It is important to emphasize that as a result of the implementation of financial liberalisation policy, the concomitant comprehensive reforms have led to the availability and improved mobility of myriad financial assets in different currency denominations. This implies that public access to foreign currencies and financial assets including credit and debit instruments such as bonds denominated in local and foreign currencies have become a more common phenomenon as compared to what prevails under the era of implementing financially repressive policies. The mere presence of forex bureaux, which was hitherto non-existent under an economy financially repressed under fixed exchange rate regime; and the subsequent emergence of forex bureaux under flexible foreign exchange rate regime which forms an integral part of financial liberalisation programme, make the genesis of *de facto dollarisation* in the form of *currency substitution* and *asset substitution* related activities in an emerging or transition economy.

2.2 De Facto Dollarisation, Currency Substitution and Asset Substitution
Currency Substitution is the situation where two or more currencies circulate within a single economy or region to facilitate transactions that are unrelated to international trade and finance. This phenomenon raises some interesting but difficult questions to which, hitherto, economists have been struggling to find clear–cut answers.

In theory, currency substitution *(CS)* and asset substitution *(AS)* are forms of dollarisation that need not go hand in hand given the difference between transactions and speculative motives for holding any kind of money. *De facto* dollarisation takes place when individuals and firms voluntarily choose to use foreign currency either for a transaction substitute (*currency substitution*) or a store of value substitute (*asset substitution*) for the monetary services of domestic currency. In a regime with *de facto* dollarisation, the recorded money supply falls short of the effective money supply due to the omission of foreign currency in circulation *(FCC)*, which is typically unknown and not directly controllable by the local central bank. It is worth pointing out that currency substitution usually coexists with asset substitution. Asset substitution, on the other hand, does not necessarily imply the presence of currency substitution.[1]

Currency substitution is basically the preference and use of a foreign currency over the local currency as a medium of exchange and unit of account especially when it involves deferred payment; while *asset substitution* is the process of using foreign currency rather than the domestic currency as a store of value. In most countries, currency substitution or asset substitution is not *de jure* since it is not normal for a politically independent state to formally adopt a different country's currency to wholly replace or displace its own local currency. Realistically, therefore, currency substitution or asset substitution which has become a common

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[1] Refer to Baliňo, Bennett, and Bornesztein (1999) for details.

phenomenon in developing and transition economies since the past two decades is mainly *de facto*.

There is no precise definition for currency substitution. For instance, while Ramírez-Rojas (1985), Rojas-Suarez (1992), and Mizen and Pentecost (1996) define currency substitution as the substitution between two monies; El-Erian (1988), Cuddington (1989), Agénor and Khan (1992), Baliňo, *et al.* (1992), and Calvo and Végh (1992) define it as situation where the fundamental roles of a domestic currency such as store of value, medium of exchange and unit of account are replaced by a foreign currency. Similarly, according to Freitas (2002), currency substitution is a partial replacement of the domestic currency by a foreign currency either as a store of value, unit of account or medium of exchange. In the view of Giovannini and Turtelboom (1994) currency substitution is the total replacement of a domestic currency by another currency, which is usually official, as was experienced in post-independent Panama in 1904, when the US dollar became a legal tender[2].

McKinnon (1982) defines currency substitution as the use of foreign currency and foreign currency denominated bonds by domestic residents. McKinnon postulates that much exchange rate volatility is due to the process of currency substitution since a shift in portfolios away from the domestic currency to foreign currencies, given the fixed supply of the local currency, will result in the depreciation of the domestic currency against its foreign counterparts.

In the view of Savastano (1996), currency substitution would be less extensive in economies associated with well-developed financial systems with the capacity to offer a medium of exchange that can compensate users for inflation. Therefore, the role of financial institutional structure is critically vital in determining a country's currency substitution behaviour. For instance, one crucial question that must be addressed is whether or not *dollarisation*[3] exhibits a reversibility or non-reversibility behaviour.

Foreign exchange system reforms and development that pave the way for local people to hold foreign currency leads to high currency substitution under high inflationary and unstable economic circumstances (Akcay, *et al.*, 1997 and Selcuk 1994, 2001).

Currency substitution and asset substitution have crucial implications for macroeconomic policies of any country. These include their effects on government revenue mobilization due to inflation and the efficiency of stabilizing macroeconomic programmes. Komárek and Melecký (2001) observe that where there is a high substitutability of the domestic currency with foreign currencies, it will be more difficult for governments to pursue deficit finance by printing money, which in the recent past, has been a common practice in most developing economies. The demand for foreign currencies, on one hand, enhances seigniorage, whilst on the other hand; it may act as an inflationary tax. Thus, in a *dollarized* economy, the resulting government revenue will be reduced at each level of inflationary tax (Komárek and Melecký, 2001).

In the same vein, it has been observed that to a reasonable extent, the displacement of a domestic currency by a foreign currency may promote macroeconomic stabilization and credibility of economic policies in small-open economies. For instance, in transition and developing

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[2] Though Panama has its own currency, the US dollar is central in nearly all business transactions. In fact, the currency notes of Panama is the US dollar, while the local balboa exists only as coins.
[3] *(De facto)* Dollarisation is used in this study to encompass currency substitution and asset substitution.

economies, credibility can increase when foreign currencies in circulation depress monetary authorities' effort to manipulate domestic currency. Thus, in the past, stabilization policies in developing and transition economies were characterized by the fixing of nominal exchange rates or establishing crawling pegs, which normally results in progressive appreciation (or over-valuation) of exchange rates. However, when a domestic currency is significantly displaced by a foreign currency in an economy, there should automatically be narrower fluctuations in exchange rates to ensure stabilization (Komárek and Melecký, 2001).

Feige (2002a,b) and Sahay and Végh (1985) argue that currency substitution involves the use of foreign currency as a means of payment and unit of account, while asset substitution is basically the use of foreign currency as a store of value. In effect currency substitution is symmetric and reversible since any amount of substitution is capable of evoking a corresponding increase or decrease in the use of foreign currencies. Dollarisation, on the contrary, can be viewed as an asymmetric reaction to changeable determinants of the substitution process in the use of foreign currency (Komárek and Melecký, 2001).

Theoretically, the domestic currency of an open economy, in the absence of foreign exchange control, can be readily converted into international tradable goods and other currencies. Other than its intrinsic attributes as a store of value, a medium of exchange and a unit of account, the domestic currency with the characteristics of liquidity and convertibility and hence transformable into any assets has a special position in economic agents' portfolios. However, not all currencies were treated equally. The phenomenon of currency substitution basically reflects the demand by residents of an economy for a combination of currencies as a medium of exchange and other functions that money is expected to perform. In other words, there is an ordinal preference ranking for different currencies, which ultimately transmits into different degrees of currency substitution.

In the view of monetary economists most often currency substitution is the long-run consequence of high and persistent inflation. This is apparently because casual evidence suggests that in countries with high inflation, foreign currencies are used firstly as a store of value, secondly, as a unit of account and finally as a medium of exchange. The process of currency substitution usually begins with substituting foreign money for the domestic money as a store of value, as residents in highly-prone inflation countries are easily aware that their wealth, if denominated in domestic currencies, will lose value promptly by negative real domestic interest rates. That is to say, the opportunity cost of holding domestic money is higher as against having it invested in foreign currencies. Hence, in a liberalized transition or developing economy where an economic agent has the freedom of holding assets in different currencies, normally, a rational agent will like to diversify his portfolio of wealth in favour of foreign currencies and foreign currency denominated assets, because these currencies are capable of giving him a relatively higher degree of purchasing power stability against the background of expectations of higher inflation or exchange rate devaluations. As domestic inflation rate rises, people do not swiftly abandon the domestic medium of exchange for foreign substitutes. Rather, the substitution is gradual, with the extent of substitution increasing with the domestic inflation rate.

The second stage of currency substitution is the unit of account function of money when high inflation persists. This occurs when some prices, especially big-ticket items, are now being quoted in foreign currencies. The process completes itself as transactions begin to be conducted

in foreign currencies as a medium of exchange. In fact, as evidenced by the experience of transition economies in the early 1990s, the degree of currency substitution will not subside immediately after inflation has been stabilized to a moderate or low level. This requires a long adjustment process before the economic agents change their attitude towards their preference for different kinds of money holdings.

The crucial factor that lies in the opportunity cost of holding domestic currency relative to foreign money is the anticipated rate of depreciation of the local currency. An increase in the anticipated rate of depreciation of domestic currencies raises the expected cost of holding domestic money vis-à-vis foreign currencies and this will result in an increase in the share of money balances held in foreign money, *ceteris paribus*.

Another argument against currency substitution is its hindrance to financial and economic developments. Empirical evidence shows that countries with a high degree of currency substitution tend to have low financial depth and less effectiveness of monetary policy. Clearly this affects the stability of the velocity of circulation of and the demand for the domestic currency, making it difficult for the central bank or monetary authorities in formulating and conducting effective monetary policy.

It must, however, be pointed out that there are cases of currency substitution, usually at very low levels, based not on lack of confidence in a local currency but rather on ease of business transactions. For instance, Australia, Russia, Japan, Canada, Switzerland, and other small advanced and stable economies with fairly open trade and financial borders have always exhibited holdings and use of neighbouring currencies for purposes of transactions. The lesson here is that some dollarisation per se is not necessarily a reflection of poor economic conditions or ineffective macroeconomic policy in these countries.

2.3 Empirical Literature

An enormous body of empirical literature (Feige 1994, 1997; Porter and Judson 1996) reveal that averagely not less than 50% or between 40% and 60% of the US dollar circulate outside the US. For instance, by adopting a variant of proxy measure proposed by Feige in 1994, the Bureau of Economic Analysis (BEA) and the Federal Reserve Board of Governors (FED) gave the official estimate in the year 2001 as 50% of the $580 billion of the US dollars in circulation was held outside the US. These aggregate measures indicate that the amount of US currency held abroad is substantial. As at now, the measures are incapable of determining the specific locations of the US dollar held abroad.

Ho (2002) asserts that financial deepening goes side-by-side with high degree of currency substitution in Macao. Ho found out that both economic and financial sector developments have been impressive over the past decades, notwithstanding the strong presence of other foreign currencies in Macao. Nevertheless, currency substitution has indeed affected Macao's financial structure to the extent that foreign currencies take dominance in all financial instruments available in the financial system.[4]

Seater (2002) found out that financial structure does not play any significant role in determining the degree of currency substitution in an economy; rather it is the level of income per head and

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[4] See Appendix A for details.

composition of expenditure for any given level of income that affect the magnitude of currency substitution a country experiences. However, it was found out that the relation between income and currency substitution is as complex as the dependence of currency substitution on the composition of expenditures. That is to say, like dependence on composition of expenditures, it is difficult to say that "high income increases (or decreases) the extent of currency substitution."

There has been near consensus from empirical studies that incidents of currency substitution and asset substitution exhibit non-reversibility behaviour for countries that experienced high and persistent inflation for longer periods as compared to the reversibility behaviour exhibited by countries with moderate and/or short-lived high inflation rates. This implies that the higher and more persistent the inflation in any particular economy, the more inelastic or non-reversible is the demand for holding foreign currencies. This evidence of dollarisation non-reversible hysteresis for countries with longer periods of high and persistent inflation was revealed by Guiddotti and Rodriguez (1992) for Bolivia, Mexico, Peru and Uruguay; Kamin and Ericsson (1993) for Argentina; Clements and Schwartz (1993) and Reding and Morales (1999) for Bolivia; Mueller (1994) for Lebanon; and Mongardini and Mueller (1999) for the Kyrgyz Republic. In contrast, for countries such as Egypt, Chile and Yemen that experienced moderate inflation rates or short-lived high inflation rates there were evidences of reversible dollarisation (Mueller, 1994)[5]. So far, only Freitas (2002) concludes that differences in past levels of dollarisation and inflation fail to show a consistent pattern in Bolivia, Turkey and Indonesia.

In general, empirical evidences reveal that the higher the degree of currency substitution the lower the financial depth and the weaker the effectiveness of monetary policy of any economy. Invariably, this impacts on the stability of the velocity of currency in circulation as well as the demand for the local currency, which makes the central bank or monetary authorities ineffective in formulating and conducting monetary policy.

2.3.1 Evidences of Dollarisation in Developing and Transition Economies
From a historical perspective, the monetary status of the Hong Kong dollar in Macao can be traced back to the year 1865 when Hong Kong started to issue its own currency. The issuing bank, the Hong Kong and Shanghai Banking Corporation Limited, had a prestige to win general acceptance of its notes within the Chinese territories. Therefore, the Hong Kong dollar notes, on account of its ease of portability, became a widely circulated currency within the region, including Macao. Since then, Macao residents seemed to be accustomed to having Hong Kong dollars in their portfolios, even after Macao created its own currency, the pataca, in 1905.

Generally, within developing and transition economies, the possible paramount reasons for the high incidence of *de facto* dollarisation whether in the form of currency substitution, or asset substitution or any concurrent combinations of these phenomena include:
- Macroeconomic instability as a result of high rates of inflation, wide fluctuations and volatility of nominal exchange rates, wide interest rates spread, and the loss of confidence in the domestic currency;
- Episodes of financial market crisis and risk-averse attitude of investors, firms and households in an attempt to hedge against potential financial risk of holding local currency;

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[5] A similar observation was made by Sahay and Végh (1996) for some selected transition economies which experienced moderate or relatively shorter period high inflation rates.

- A history of colonialism (i.e. the continuous link with former colonial masters in trade and public finance);
- Size of the economy and its openness and dependency on international trade;
- Lack of credible macroeconomic policy and non-autonomy of the central bank;
- Over-dependence on imports and continuous current account deficit;
- The lack of higher denomination of bank notes issued by the local central banks;
- The active prevalence of large underground or unofficial economic activities such as money laundering, public sector corruption and bribery, the manufacturing (or smuggling routes or centres) of banned drugs;
- Political instability or uncertainty;
- Imperfect and costly money market information;
- Non-existing or underdevelopment of capital and money markets;
- Low involvement in international capital markets;
- Excessively high international reserves;
- Loss of confidence in the domestic economy due to a combination of the above factors; and,
- High level of international tourism and its allied socioeconomic activities.

3.0 METHODOLOGY

Dollarisation has been tested under a variety of specifications. Our analysis of currency substitution and asset substitution as components of *de facto* dollarisation in the Ghanaian economy is based on the approach that falls into three categories suggested by Komárek and Melecký, (2001). Specifically, we follow the portfolio balance approach suggested by Cuddington (1983) and Branson and Henderson (1985), which we further modify to reflect the conditions prevailing in the Ghanaian economy. For instance, since price levels are usually high in Ghana, we included inflation, which measures the rate of change in price index but not the consumer price index into our model. On Ghana, quarterly data ranging from the fourth quarter of 1987 to the fourth quarter of 2005 was used. The justification for the choice of the study period is linked to the fact that the financial liberalisation programme was initiated in September 1987. Besides, there are no adequate confirmed data on the relevant variables on Ghana for 2006 and beyond. This study classifies a country as highly dollarized if its dollarisation index *(DDI)* is 25 percent or more; averagely dollarized if its *DDI* is 20 percent or more but less than 25 percent; and lowly dollarized if its *DDI* is lower than 20 percent[6].

A time series macroeconometric modelling was employed to identify the determinants of *DDI*, asset substitution index *(ASI)* and currency substitution index *(CSI)*[7] since the implementation of financial sector reforms programme in Ghana. Correlation coefficients are computed to help identify the cross-relationship among *ASI*, *CSI* and *DDI*. In order to empirically explore the potential existence of asset substitution and currency substitution concerning the effect of exchange rates in Ghana where currencies are assumed to compete as store of value within the

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[6] Baliňo, *et al.* (1999), classify countries as highly dollarized if their *DI* is greater than 30 per cent, whilst Winkler, *et al.* (2004) categorise countries as lowly dollarized if *DI* is less than 20%; highly dollarised if *DI* is greater than 70% ; and medium dollarised if *DI* ranges between 20% and 70%.

[7] This does not necessarily mean all the three phenomena will appear in the model specified for empirical analysis. In fact, as to which index, whether *DDI*, *CSI* or *ASI* or a combination of indices that would be included in the model will be dependent upon the findings of our studies indicating the particular phenomenon or a combination of phenomena is found to be prevalent in Ghana.

banking system, the modified versions of the models developed by Giovannini and Turtleboom (1994) and Komárek and Melecký (2001) has been specified for evaluation. Specifically, the study followed the portfolio balance approach suggested by Cuddington (1983) and Branson and Henderson (1985), which was further modified to reflect the conditions prevailing in the Ghanaian economy. The transformation of the adopted models from linear to quadratic model which differs from the linear specification of the adopted models is to help capture the possibility of reversibility of the perceived tendency of *FSD* promoting *ASI*, *CSI*, and *DDI*.

Adopting the general to specific approach, first, a very general dynamic lag structure between the dependent and explanatory variables comprising their lagged levels and first differences is estimated with Ordinary Least Squares (OLS). In the second stage, this overly long general specification is reduced into a parsimonious dynamic adjustment equation, using the variable deletion tests by ensuring that the overall summary statistics do not become significant, the Akaike and Schwarz Information Criteria reach their minimum and so that the residuals do not violate the basic underlying classical assumptions of OLS.

3.1 Measurement Problems
Measurability is the major limitation in the empirical analysis of Financial Sector Development and dollarisation in the form of currency substitution and/or asset substitution.

3.1.1 Financial Sector Development (FSD) Index
Proxies for financial development have been varied. It was presumed that countries with negative real interest rates were financially repressed, while those with positive interest rates were financially developed. De Gregorio and Guidotti (1993), however, argued that real interest rates are not a good indicator of financial repression, and that a better indicator of financial repression, or lack of it thereof, is the ratio of private sector credit to GDP[8]. Other common measures of financial sector development include nominal interest rates, credit to the private sector as a ratio of the total credit by commercial banks, financial deepening *(M₂/GDP)*, and stock price index in economies where capital market exists.

3.1.2 Dollarisation, Currency Substitution and Asset Substitution Indices
The ratio of Foreign Currency Deposits *(FCD)* to broad money *(M₂)* is the simplest proxy for currency substitution in an economy, although this approximation represents only the lower bound for the actual level of currency substitution, given that foreign currencies in circulation are omitted (Komárek and Melecký, 2001). In developing and transition economies where the financial sector is less developed and instability of the macroeconomy is a common feature, more foreign currencies are likely to be in circulation but it is practically difficult to quantify, and as at now impossible to accurately determine.

Sarajevo (2000) observes that the ideal measure of currency substitution is the summation of foreign currencies in circulation in an economy as a means of payment and store of value and all checking accounts and short-term deposits in foreign currencies held by residents in domestic banks and abroad. Sarajevo concedes that due to lack of relevant data in nearly all economies, most empirical studies concentrate on either the ratio of *FCD* to *M₂*, or the ratio of *FCD* to broad monetary aggregates which includes *FCD*.

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[8] In this study, financial deepening and credit to the private sector as a proportion to the total credit by commercial banks are used as measures of financial development.

According to Ho (2003), currency substitution, if defined narrowly, occurs when a foreign currency displaces the domestic currency as a medium of exchange and thereby, accounting for a significant portion of narrow money (M_1). Thus, in the case of developing and transition economies M_1 may be defined as:

(1) $M_1 = TCC+LDD +FCD$

where TCC is the total currency in circulation; *LDD* is the demand deposits denominated in the local currency; and *FCD* is the demand deposits denominated in foreign currencies. Since no data is ever collected on the foreign cash circulating in nearly all countries the world over, total currency in circulation *(TCC)* is virtually denominated in local currency only, while the ratio of demand deposits denominated in foreign currencies *(FCD)* to M_1 is therefore used as a proxy for the degree of currency substitution in narrow money. Therefore, the currency substitution index[9] *(CSI)* in relation to the medium of exchange function of money can be mathematically defined as:

(2) $CSI = FCD/M_1$

Furthermore, currency substitution can be evidenced in broad money supply (M_2) in most developing and transition economies because foreign monetary assets play a key role in the store of value function of money. Consequently, Feige *et al*. (2002a, 2002b) and Ho (2003) suggest that when dollarisation primarily involves the use of foreign denominated monetary assets as substitutes for domestic ones in their capacity as store of value, it is useful to define it as an asset substitution index *(ASI)* and measured as the ratio of foreign denominated monetary assets to domestic denominated assets excluding currency outside banks[10]. Thus, mathematically *ASI* can be expressed as:

(3) $ASI =FCD/(LDD+LTD) =FCD/(M_2-LCC-FCD)$

Conceptually, the overall currency substitution index or *(de facto)* dollarisation index *(DDI)* is determined by adding (2) and (3) together, so that:

(4) $DDI= CSI + ASI$

Since the motives for currency substitution and its implications can be quite different from those of asset substitution, we now turn to an examination of currency and asset substitution indices for the developing and transition economies.

Due to lack of data on foreign currency in circulation *(FCC)*, studies on the *de facto* dollarisation process has been forced to accept the observable amount of foreign currency deposits *(FCD)* as a proxy for dollarisation. Studies of dollarisation and currency substitution, often associated with the International Monetary Fund (*IMF*), employ the ratio of *FCD* to broad

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[9] Feige *et al*. (2002a, 2002b) suggest a measure of the extent of currency substitution that shows the fraction of a nation's total currency supply held in the form of foreign currency. Mathematically, currency substitution index *(CSI)* should explicitly be given as: *CSI = FCC/(FCC+LCC)*.
[10] When data on M_2 and/or *LTD* are not available, but the measures of *QM* are available, *ASI* can be approximated by the ratio of *FCD* to total deposits, which equals *LDD+QM*. These two measures tend to be closely correlated.

money *(FCD/BM)* as the measure of the extent to which countries are *dollarized*. We denote this traditional *de facto* dollarisation index (*DDI*) as:

$$(5) \quad (DDI) \equiv (FCD/BM) = FCD/M_2)$$

When both asset substitution and currency substitution take place, or when *FCD*s are used by firms to make transactions with international partners, we define a comprehensive dollarisation index *(CDI)* that represents the fraction of a nation's broad effective money supply composed of foreign monetary assets. Thus,

$$(6) \quad CDI \equiv (FCC+FCD)/(BM+FCC) = (FCC + FCD)/(M_2+FCC)$$

It is obvious from this mathematical definition of *CDI* that there is currently no possible realistic measurement of *CDI* as long as *FCC* cannot be accurately determined practically or intuitively. The extent of *de facto* dollarisation depends upon various incentives to hold the different assets described in the denominators and numerators of the dollarisation indices.

3.2 The Granger-Causality Test: ASI, CSI, DDI, FSD and Inflation (INF)

McKinnon (1973) and Shaw (1973) hypothesized that one possible outcome of implementing a programme of financial development is a loss of seigniorage generating capacity for the government emerging from decreases in demand for the local currency in the presence of alternative financial assets normally denominated in different currencies. During high inflationary periods in particular, the demand for foreign currencies and foreign currency denominated financial assets upsurges precipitating *currency substitution*[11]. Currency substitution of any form can have significant implications for the capacity of the government to derive revenue normally in the form of inflation tax[12] from money creation.

In order to verify empirically whether or not the implementation of Financial Sector Development *(FSD)* programme in Ghana is the cause of inflation, currency substitution, asset substitution and *de facto* dollarisation the study will employ the statistical test outlined by Granger (1969, 1988) and further developed by Sims (1972).

The study, upon the selection of a reasonable lag length, *l*, corresponding to theories and reasonable beliefs about the longest time over which one of the variables could help predict the other, will run a bivariate regression involving the combinations of *ASI*, *CSI*, *DDI*, *FSD*, and *INF* of the form:

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \ldots\ldots\ldots + \alpha_l x_{t-l} + \beta_1 y_{t-1} + \ldots\ldots\ldots + \beta_l y_{t-l} \qquad (3.2.1)$$

where

   DDI = ASI+CSI; and *FSD* = credit to private sector as a ratio of total credits by commercial banks.

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[11] This occurs when the demand for foreign currency outstrips the demand for the domestic currency in the performance of the basic functions of money especially as a medium of exchange, unit of account and store of value.
[12] Fischer (1982) and Friedman (1971) analyzing from the framework of the quantity theory of money pointed out that seigniorage can be obtained without necessarily creating inflationary pressure if high-powered money is adequately provided to meet the rapidly growing demand for goods and services in the economy. However, the fact remains that in practice, seigniorage is likely to result in inflation tax because that parallelism in the growth of money and the rate of real growth does not take place, especially in LDCs, since lack of simultaneous equilibrium conditions in the product, assets and foreign exchange markets.

For this equation, the Wald statistics for the joint hypothesis specified as $\beta_1 = \ldots\ldots\ldots\ldots = \beta_l = 0$ will be evaluated using the reported *F*-statistics. It is expected *a priori* that there exist a uni-directional line of causality from *FSD* through inflation *(INF)*, *ASI*, *CSI* to *DDI*.

3.3 Unit Root Tests

The study commenced with the tests for stationarity of the endogenous and exogenous variables within the framework of Augmented-Dickey-Fuller (ADF) test procedure. This test is important in order to avoid spurious regression which is common problem when estimating a regression line with data whose generated process follows a time trend. The ADF test requires estimating an equation of the form:

$$\Delta y_t = A_0 + A_1 y_{t-1} + A_2 t + \sum_{l=1}^{p} B_l \Delta y_{t-l} + z_t; \qquad H_0: b=0;\ H_1: b>0, \qquad (3.3.1)$$

where y_t is a vector for all time series variables under consideration in a particular regression model; z_t is the error term; l is the optimal lag length of each variable chosen according to the Akaike and Schwarz Information Criteria such that first-differenced terms make z_t a white noise.

3.4 The Johansen Cointegration Test

In order to determine the number of equilibrium-correction terms that appear in the Dynamic Equilibrium-Correction Mechanism (DECM) models, the Johansen Cointegration Test is employed. This approach yield maximum likelihood estimators of the unconstrained cointegrating vector, and also helps to empirically determine the number of cointegrating vectors without relying on an arbitrary normalization.

3.5 The Models

Within the context of the Ghanaian economy and following Cuddington (1983), Brandson and Henderson (1985), Giovannini and Turtleboom (1994) and Komárek and Melecký (2001) the general mathematical models considered in this study are:

$$(\bullet)_t = f(DAB_t, INF_t, EXR_t, INT_t, FSD_t) \qquad (3.5.1)$$

where ($\bullet$) denotes the respective dependent variables *ASI*, *CSI*, and *DDI* such that *DDI=ASI+CSI*; *DAB* is domestic absorption *(GDP*-net exports*)* measuring the amount of transactions; *INF* is inflation measuring changes in price levels; *EXR* stands for exchange rate of the Ghanaian cedi to the US dollar; *INT* denotes interest rate spread and measured as the difference between lending rates and deposit rates of commercial banks; and *FSD* is an index for Financial Sector Development computed as a ratio of bank credit to the private sector out of total credits.

The corresponding specific Cointegrating Regression Models (CRMs) based on (3.5.1) specified for evaluation are as follows:

$$(\bullet)_t = CON + \alpha_1 DAB_t + \alpha_2 EXR_t + \alpha_3 INF_t + \alpha_4 INT_t + \alpha_5 FSD_t + \alpha_6 FSD^2 + \mu_{it} \qquad (3.5.2)$$

where $_i$ ranges from one to three so that the residual term, μ_{it}, for each of the three dependent variables, *ASI*, *CSI*, and *DDI* is μ_{1t}, μ_{2t} and μ_{3t} respectively. The constant term of the quadratic regression line is *CON* whereas FSD^2 is the square of *FSD*. All other variables are as previously

defined. For all the dependent variables, the expected signs of each of the explanatory variables are that $CON, \alpha_1, \alpha_2, \alpha_3, \alpha_5 > 0$ whilst $\alpha_4, \alpha_6 < 0$.

The DECM models that are determinable alongside (3.5.2) are the simple quadratic Autoregressive Distributed Lag (ARDL) models associated with the CRMs that are evaluated to provide short-run information about the phenomena under study are of the form:

$$\Delta(\bullet)_t = CON + \sum_{i=1}^{4} H_{1i} \Delta(\bullet)_{t-i} + \sum_{i=1}^{4} M_{1i} \Delta DAB_{t-i} + \sum_{i=1}^{4} N_{1i} \Delta EXR_{t-i} + \sum_{i=1}^{4} \Pi_{1i} \Delta INF_{t-i} +$$

$$\sum_{i=1}^{4} P_{1i} \Delta INT_{t-i} + \sum_{i=1}^{4} \Upsilon_{1i} \Delta FSD_{t-i} + \sum_{i=1}^{4} Z_{1i} \Delta FSD^2_{t-i} + \pi \hat{\varepsilon}_{it-1} + v_{it}$$

(3.5.3)

where $\hat{\varepsilon}_t \sim I(0)$ because $(\bullet)_t$ and the explanatory variables are cointegrated such that residual $v_{it} \sim iid(0, \sigma^2)$. The composition of v_{it} is similar to that of μ_{it} as observed in above (3.5.2). The symbol Δ represents the first-differenced form of the variables in the model. The coefficient of the various explanatory variables, $H, M, \ldots\ldots, Z$, are the impact multipliers that measure the immediate impact that a change in the explanatory variables has on a change in the dependent variables. The feedback or adjustment effect is π and it indicates how much of the disequilibrium is being corrected.

3.6 Sources of Data
Quarterly data on domestic currency in circulation (*LCC*), foreign currency deposits *(FCD)*, narrow money (*M1*), broad money (*M2*), nominal exchange rate *(EXR)*, income measured as real GDP *(INC)*, government spending *(GSP)*, exports, imports, consumer price index (*CPI*), and interest rate spread (*INT*) are used. Sources of data included various editions of survey reports and publications of Central Banks of Ghana and the other selected developing and transition countries from the East European Countries (EEC), Commonwealth of Independent States (CIS), and Former Soviet Union (FSU) countries as well as Report of International Transportation of Currency or Monetary Instruments (CMIR), International Monetary Fund (IMF).

4.0 THE EMPIRICAL EVIDENCES
4.1 Results of Unit Root Tests
The results of stationarity test, as presented in Table 4.1.1 have shown that only *ASI*, *DDI*, and *INC* are stationary on levels, hence I(0). All other variables used in this study are stationary after first-differencing and hence are I(1) with the exception of *DAB*, and *EXR* which are I(2) following a further differencing of their first-differences.

Table 4.1.1 Results of Stationarity Tests

VARIABLE	NUMBER OF LAGS*	ADF TEST STATISTIC	CRITICAL VALUE	LEVEL OF SIGNIFICANCE (%)	ORDER OF INTEGRATION
ASI	1	-4.277902	-4.0990	1	I(0)
CSI	2	-4.970658	-4.1035	1	I(1)
DAB	5	-5.577534	-4.1135	1	I(2)
DDI	1	-4.110695	-4.0990	1	I(0)
EXR	4	-5.464302	-4.1109	1	1(2)
FSD	2	-6.640025	-4.1035	1	I(1)
FSD^2	2	-6.717571	-4.1035	1	I(1)
INF	5	-3.581365	-3.4824	5	I(1)
INT	1	-6.289157	-4.1013	1	I(1)

Authors' computations

* Number of lags determined according to the Akaike and Schwarz Information Criteria

4.2 Results of Granger Causality Test

The empirical results revealed that within the Ghanaian context asset substitution drives currency substitution and *de facto* dollarisation within a one-quarter lag interval, whilst the rate of inflation for the last-two quarter Granger-causes asset substitution in the current quarter. The results of the Granger Causality Test are presented in Table 4.2.1 below.

Table 4.2.1: Results of Granger-Causality Test

Pairwise Granger Causality Tests Sample: 1988:4 2005:4	At Lag 1 Observation 68		At Lag 2 Observation 67	
Null Hypothesis:	**F-Stat**	**Prob.**	**F-Stat**	**Prob.**
CSI does not Granger Cause ASI	0.0412	0.8397		
ASI does not Granger Cause CSI	3.6453	0.0606*		
DDI does not Granger Cause ASI	0.0805	0.7776		
ASI does not Granger Cause DDI	3.9703	0.0505**		
INF does not Granger Cause ASI	5.2445	0.0253**	2.8364	0.0663*
ASI does not Granger Cause INF	2.0270	0.1097	1.3783	0.2596
FSD does not Granger Cause INF	3.3508	0.0718*	2.6258	0.0804*
INF does not Granger Cause FSD	0.0523	0.8198	0.0071	0.9930

Authors' computation

Notes: (1) * Significant at 10%; ** Significant at 5%.
(2) Beyond lag 2 and up to lag 5, none of the variables significantly Granger-causes one another. At lags 6, 7 and 8 INF Granger-causes ASI. Again, INF Granger –causes FSD at lags 7 and 8, whilst FSD also Granger-causes CSI at lag 8. The study did not consider lags beyond 8 in this particular case.
(3) Variables included in the Granger-Causality Test are *ASI, CSI, DDI, FSD* and *INF*. Some of the test results are not reported in the Table due to their statistical insignificance.

The diagrammatical representation of the Granger-causality based on the results of lag one is illustrated in the Figure 4.2.1 below.

Figure 4.2.1: Tracing the Lines of Granger-Causality

FSD ⟶ INF ⟶ ASI ⟶ CSI
                                 ↓
                               DDI

The finding that asset substitution Granger-causes currency substitution is in sharp contrast with the work of Baliňo, *et al.* (1999) which provided implied empirical evidence that currency

substitution must precede asset substitution and not the reverse as is the case for Ghana. This finding is, however, in consistency with the proposition of monetary economists on sequencing of dollarisation. According monetary economists, a foreign currency may serve first be used as a unit of account and store of value before later being used as a medium of exchange in an economy where dollarisation is in response to hyperinflation, currency depreciation and a history of bank confiscation.

Thus, since the evidences strongly indicate that financial sector development is the fundamental cause of inflation, asset substitution, currency substitution, and *de facto* dollarisation, there is the need to critically examine at the sequencing of the implementation of financial sector reform programmes in Ghana.

4.3 Degree of Dollarisation and Selected Monetary Aggregates in Developing and Transition Countries

Table 4.3.1: Indicators of Dollarisation and Selected Monetary Aggregates (1996-2005)							
	DDI[*]	DDI[**]	ASI	CSI	FND	INT	VEL
Developing Economies	**37.21**	**2917.32**	**149.86**	**2767.46**	**22.38**	**17.86**	**31.80**
SSA Countries	**35.70**	**235.81**	**162.80**	**73.01**	**48.71**	**24.83**	**27.55**
Angola	56.2	444.26	289.62	154.64	20.91	48.26	19.86
Burundi	12.88	45.68	26.84	18.84	22.79	3.01	31.86
Congo, DR	37.82	395.82	337.57	58.25	3275.40	60.40	38.19
Ghana	27.65	126.42	84.09	42.33	21.72	13.31	37.53
São Tomé and Príncipe	38.11	157.68	91.04	66.65	32.71	16.49	19.61
Tanzania	22.55	105.47	44.87	60.60	21.26	14.25	26.93
Zambia	54.7	375.32	265.59	109.73	14.75	18.09	18.85
Other Developing Countries	**38.37**	**5002.94**	**139.79**	**4863.15**	**19.03**	**12.43**	**35.10**
Albania	21.04	98.21	42.97	55.24	0.06	3.58	29.67
Armenia	46.12	8750.35	-101.29	8851.64	12.75	17.41	43.49
Azerbaijan Republic	39.65	7928.96	-101.55	8030.51	13.73	9.46	43.29
Belarus	48.12	12480.28	-101.91	12582.20	18.04	15.19	17.03
Bosnia & Herzegovina	44.45	265.50	135.76	129.74	38.86	14.94	20.77
Cambodia	65.97	1905.90	1691.01	214.89	14.77	12.52	29.98
Kyrgyz Republic	24.01	3419.02	-101.77	3520.79	15.20	23.57	61.08
Latvia	31.62	5458.01	-102.24	5560.24	30.77	6.96	30.83
Moldova	24.38	4720.19	-102.91	4823.10	27.11	8.28	39.77
Transition Economies	**30.23**	**1765.57**	**53.84**	**1711.73**	**24595.45**	**13.71**	**27.33**
Bolivia	74.16	938.00	553.59	384.41	44.53	19.17	11.52
Egypt	18.96	107.56	28.39	79.17	84.40	4.54	13.86
Estonia	16.03	2524.31	-105.34	2629.64	36.04	4.91	18.32
Georgia	36.86	6617.99	-101.45	6719.44	10.90	23.71	50.39
Lithuania	25.23	98.54	55.86	42.68	25.87	6.21	27.89
Russian Federation	22.64	88.51	47.30	41.21	24.85	22.23	28.02
Ukraine	22.63	3639.10	-102.82	3741.92	24322.63	23.83	40.65
Vietnam	25.33	110.52	55.17	55.35	46.24	5.08	27.97
Overall Average	**34.88**	**2533.40**	**117.85**	**2415.55**	**1174.01**	**16.74**	**30.31**

Author's computation where values are in percentages

Notes: DDI[*] computed as FCD/M_2; DDI[**] computed as the sum *ASI* and *CSI*; *CSI* computed as FCD/M_1; *ASI* computed as $FCD/(M_2-LCC-FCD)$; *INT* is interest rate spread calculated as the difference lending rate between deposit rate of commercial banks; *VEL* represents velocity of money and measured as LCC/M_2.

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For most FSU, CIS and CEE countries asset substitution is negative with relatively high velocity of money, implying that for these countries, *de facto* dollarisation might not be principally due to high inflation rates at present or in the past, wide fluctuations of exchange rate, episode of bank confiscation, but probably as a consequence of their proximity to economic giants and high levels of international trade with neighbouring advanced economies. The study determined the extent of dollarisation and its components alongside some selected monetary aggregates for the 24 developing and transition economies under consideration. In general, it was found that countries with high interest rate risk as a result of wide interest rate spread and low financial depth are those that experience relatively high *CSI* and *DDI*[*]. Countries that fall under this category include Angola, Zambia, Armenia, Belarus, Kyrgyz Republic, and Georgia. Even though Bolivia has a high financial depth, its velocity of money quite low and as a result, it this has culminated in the high level of *CSI* and *DDI** the country experiences.

The findings from Table 4.3.1 show that, generally, *de facto* dollarisation (*DDI*[*] or *DDI*[**]) together with its components asset substitution and currency substitution is high in both developing and transition economies with developing economies experiencing a higher degree of severity. Among the 16 developing countries under consideration only five countries, namely Burundi (12.9%), Tanzania (22.6%), Albania (21.0%), Kyrgyz Republic (24.0%) and Moldova (24.4%) can be classified as experiencing relatively low and below 25 percent degree of dollarisation when traditionally measured as *DDI*[*]. For this same period among the transition economies under investigation, apart from Bolivia (74.2%) and Georgia (36.9%), *de facto* dollarisation is relatively low and ranges roughly between a low of 16.0% for Estonia to a high of 25.3% for Vietnam.

Currency substitution is very high in all countries under investigation resulting in an overall average of 2415.6% with SSA experiencing the least mean of 73.0% as against a high of 4863.2% for the nine other developing countries. Here again, Burundi experienced the lowest *CSI* of 18.4% while Belarus, another developing country experienced, the highest of 12,582.2% . With the exception of Ghana, there exists a negative correlation between velocity of money and at least a component of *de facto* dollarisation for all countries under study (see Appendix B for details).

4.4 Correlation Coefficients of De Facto Dollarisation and its Components for Developing and Transition Countries

The results of the correlation coefficients have shown that there is no significant difference between *CSI* and *DDI*[**] because across countries they are highly positively correlated. The correlation coefficients of *CSI-DDI*[**] is more perfect for FSU, CIS and CEE countries than for SSA countries. The high positive correlation between *DDI*[*] and *DDI*[**] is a clear testimony that the measurement dollarisation by the two procedures suggested do not really matter because they move very closely together across-nations.

Table 4.4.1: Country-Based Correlation Coefficients of ASI, CSI, and DDI (1996-2005)

	ASI-CSI	ASI-DDI*	ASI-DDI**	CSI-DDI*	CSI-DDI**	DDI*-DDI**
Developing Economies	**0.740**	**0.8559**	**0.8513**	**0.8964**	**0.9347**	**0.91455**
SSA Countries	**0.783**	**0.8845**	**0.9560**	**0.8493**	**0.8893**	**0.88402**
Angola	0.961	0.9219	0.9972	0.9444	0.9787	0.93519
Burundi	0.994	0.9903	0.9990	0.9784	0.9977	0.98703
Congo, DR	0.815	0.6398	0.9988	0.8935	0.8423	0.67031
Ghana	0.778	0.9639	0.9931	0.8681	0.8458	0.97928
São Tomé and Príncipe	0.807	0.7355	0.9720	0.9573	0.9231	0.85965
Tanzania	0.580	0.9906	0.7424	0.6441	0.9763	0.79271
Zambia	0.545	0.9495	0.9895	0.6592	0.6609	0.96396
Other Developing Countries	**0.707**	**0.8336**	**0.7698**	**0.9330**	**0.9700**	**0.93831**
Albania	0.479	0.9567	0.7866	0.6394	0.9188	0.87998
Armenia	0.898	0.9692	0.8976	0.9658	1.0000	0.96585
Azerbaijan Republic	0.868	0.9568	0.8681	0.9717	1.0000	0.97168
Belarus	0.947	0.9829	0.9472	0.9703	1.0000	0.97030
Bosnia & Herzegovina	0.942	0.9477	0.9777	0.9845	0.9916	0.98396
Cambodia	0.776	0.7500	0.9974	0.9867	0.8194	0.79405
Kyrgyz Republic	0.924	0.9750	0.9246	0.9836	1.0000	0.98368
Latvia	-0.354	0.0107	-0.3536	0.9260	1.0000	0.92603
Moldova	0.883	0.9534	0.8828	0.9692	1.0000	0.96922
Transition Economies	**0.848**	**0.9508**	**0.9226**	**0.9548**	**0.9710**	**0.98752**
Bolivia	0.944	0.9807	0.9904	0.9506	0.9804	0.98180
Egypt	0.987	0.9993	0.9929	0.9892	0.9991	0.99441
Estonia	0.930	0.9540	0.9302	0.9890	1.0000	0.98902
Georgia	0.796	0.9108	0.7964	0.9685	1.0000	0.96850
Lithuania	0.850	0.9583	0.9759	0.9630	0.9446	0.99670
Russian Federation	0.973	0.9904	0.9958	0.9832	0.9901	0.99398
Ukraine	0.838	0.9226	0.8384	0.9816	1.0000	0.98163
Vietnam	0.469	0.8900	0.8604	0.8133	0.8537	0.99414
Overall Average	**0.776**	**0.8875**	**0.8750**	**0.9159**	**0.9468**	0.93888

Authors' computation

4.5 Estimated Regression Results for Ghana

The empirical results as presented in Table 4.5.1 unearth the short-run and long-run macroeconomic determinants of asset substitution, currency substitution and *de facto* dollarisation with reference to Ghana.

The long-run performance of the models is above average given the reported value of R-squares and DW statistics. The par average performance of the Cointegrating models is appreciable given the quarterly time series data are used which under many circumstances might causes multicollinearity among the explanatory variables. Diagnostic results based on correlation coefficient matrix using the threshold of 0.90, does not suggest any severe presence of multicollinearity among the explanatory variables except in the case of in the case of FSD and FSD[2]. This is normal given the nature of the relationship between these two variables in the estimated regression model. It can, thus, be concluded that even though multicollinearity exists in the model it is not a serious threat to undermine the reliability of the estimated coefficients. Perhaps, the main limitation posed by this problem is the significant estimated coefficients. The F-statistics have also shown that the explanatory variables are jointly statistically significant in

explaining the long-run variations in asset substitution, currency substitution and *de facto* dollarisation. It can, therefore, be concluded that the empirical results of estimating the long-run equilibrium relationship is statistically efficient, unbiased and reliable.

Table 4.5.1: Estimated Results of Modelling ASI, CSI and DDI by OLS						
	The ASI Models		**The CSI Models**		**The DDI Models**	
Explanatory Variables	**LRERM**	*t*-statistic	**LRERM**	*t*-statistic	**LRERM**	*t*-statistic
CON	-0.809321	(-0.912)	0.131164	(0.666)	-1.161909	(-0.996)
DAB	-0.017801	(-2.967)***	-0.015305	(-1.149)	-0.205911	(-3.291)***
EXR	0.021632	(3.388)***	0.020714	(2.029)**	0.030941	(3.686)***
INF	0.094510	(2.577)**	-0.019846	(-2.433)**	0.061602	(2.180)**
INT	-0.008016	(-0.559)	0.075317	(2.361)**	0.165355	(0.876)
FSD	3.371426	(1.810)*	-0.085553	(-0.196)	4.227280	(1.937)*
FSD^2	-1.891718	(-1.886)*	0.173365	(0.659)	-2.051967	(-1.774)*
Summary Statistics						
R-squared	0.638850		0.524388		0.625736	
Adjusted R-squared	0.574868		0.468684		0.570162	
Durbin-Watson stat	1.808933		1.709143		1.803992	
F-statistic	5.296009	[0.000]***	7.618585	[0.000]***	7.660706	[0.000]***
Cointegration Test Stat	-6.417865	{-2.597}***	-3.453351	{-2.598}***	-5.201127	{-2.598}***
Explanatory Variables	**DECMM**		**DECMM**		**DECMM**	
CON	-0.036010	(-1.011)	0.010862	(1.516)	-0.031862	(-0.062)
$\Delta(\bullet(-1))$	0.273811	(2.579)**	0.312108	(2.880)***	0.286935	(2.547)**
$\Delta(DAB(-3))$			-6.59E-06	(-2.495)**		
$\Delta(INF)$	-0.020546	(-2.972)***	-0.030541	(-2.669)***	-0.158101	(-1.878)***
$\Delta(INF(-3))$			0.036374	(3.021)***		
$\Delta(INF(-4))$	-0.019580	(-3.342)***	-0.029474	(-2.238)**		
$\Delta(EXR(-1))$			0.001080	(3.584)***		
$\Delta(EXR(-3))$	0.022610	(1.675)	-8.08E-05	(-2.621)**	0.025506	(2.338)**
$\Delta(INT(-1))$					-0.027861	(-1.462)
$\Delta(INT(-2))$	0.029236	(2.031)**				
$\Delta(INT(-4))$	0.022551	(1.648)	0.005572	(2.378)**		
$\Delta(FSD)$	0.977778	(3.960)***			1.462865	(4.339)***
$\Delta(FSD(-2))$	2.883224	(2.233)**				
$\Delta(FSD(-3))$			0.533142	(2.420)**		
$\Delta(FSD(-4))$	-3.591278	(-2.637)**			-5.715296	(-2.965)***
$\Delta(FSD^2)$					0.761833	(3.448)***
$\Delta(FSD^2(-2))$	-2.433772	(-3.046)***			0.705139	(2.966)***
$\Delta(FSD^2(-3))$			-0.350564	(-2.569)**		
$\Delta(FSD^2(-4))$	-2.360448	(-2.795)***			-3.510130	(-2.929)***
RESID$_i$(-1)	-0.980593	(-7.11)***	-0.424960	(-4.511)***	-1.010729	(-6.378)***
Summary Statistics						
R-squared	0.717760		0.735226		0.630554	
Adjusted R-squared	0.658056		0.636909		0.568979	
BGSC LM Stat	0.067237	[0.935058]	0.444015	[0.643912]	0.458289	[0.634894]
RESET Stat	1.001423	[0.415886]	1.798938	[0.119808]	2.680644	[0.070768]*
F-statistic	12.02187	[0.0000]***	8.443853	[0.0000]***	10.24053	[0.0000]***
ARCH Test Stat	0.431773	[0.513592]	1.428058	[0.236950]	0.087075	[0.768931]

Authors' computations   **Notes:** *10% significance level; **5% significance level; ***1% significance level; Δ= first difference; F-probabilities in square parentheses; Critical Values in curly parentheses of the form {}. LRERM= Long-Run Equilibrium Regression Model; DECMM= Dynamic Equilibrium-Correction Mechanism Model

On the whole, in Ghana, the current level of financial sector development as well as the level which prevailed during the past-two or past-three quarter is singularly the most significant cause of asset substitution and *de facto* dollarisation in the short-run. For instance, for any one percent further improvement in financial sector development at any particular time, asset substitution increases by 98% whilst *de facto* dollarisation increases by 571%. Currency substitution increases by 53% when there is a mere one percent improvement in financial sector development by one percent in past-three quarter. The degree of financial sector development during the last-four quarter, however, has the tendency of reducing asset substitution and *de facto* dollarisation in the present quarter. There exists the probability that the extent to which continuous improvement in the development of the financial sector induces *de facto* dollarisation, asset substitution and currency substitution will terminate after some point even in the short-run.

It is worthy to note that any disequilibrium that occurs in the short-run can be corrected in the long-run given the negative sign of the residuals and the statistical levels of significance under all cases. The performance of the DECM models can be described as highly acceptable since the R-squares have shown that in all cases, between 50% and 70% of the variations in the dependent variables are caused by the explanatory variables in each model. None of the models suffered from specification errors, heteroskedasticity, autocorrelation or any of the fundamental assumptions underlying OLS.

5.0 THE EMPIRICAL FINDINGS

From the estimated results, the summary of the empirical findings are as follows:

- Across developing and transition economies *de facto* dollarisation is generally highly predominant, but the motives for holding foreign currencies as well as the motivation for depositing foreign currencies with banks vary widely especially between SSA and countries from CEE and FSU. The average *de facto* dollarisation in the sampled developing countries is 37% with SSA being 36% as against 30 for countries in transition. Similarly, asset substitution and currency substitution are higher in developing countries than their counterparts in transition. For developing countries, on the average, ASI and CSI are 150% and 2768% with SSA being 163% and 73% compared to 54% and 1712% for countries in transition.

- CSI is a better proxy for measuring comprehensive dollarisation index of the form $DDI^{**}=ASI+CSI$ given that the average coefficient for DDI^{*}-CSI is 95% compared to DDI^{*}-ASI of 88% and DDI^{*}-DDI^{**} of 94%.

- Broadly, countries that experience extremely high currency substitution of over 1000% also experience around -100% asset substitution. These countries, Armenia, Azerbaijan Republic, Belarus, Kyrgyz Republic, Latvia and Moldova are FSU countries with the remaining Estonia, Georgia and Ukraine being CEE countries. It is in only in Latvia that currency substitution and asset substitution appears to be substitutes to each other.

- Financial sector development programme is the undisputed genesis of *de facto* dollarisation in the form of asset substitution and currency substitution in Ghana in the short-run in particular. In fact, the results of the Granger-Causality were consistent with this finding by revealing that the root cause of *de facto* dollarisation is financial sector development. The line of Granger-causality is uni-directional running from financial sector development through inflation, asset substitution, to currency substitution. It is

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asset substitution that directly Granger-causes currency substitution and *de facto* dollarisation.

▪ Exchange rate depreciation is a propeller of higher *de facto* dollarisation in the form of asset substitution and currency substitution in the long-run. This makes exchange rate depreciation the most consistent prime maker of higher *de facto* dollarisation and its agents in Ghana in the long-run.

▪ The more developed the financial sector, the higher the incidence of *de facto* dollarisation and currency substitution within the Ghanaian economy in the long-run. The extent to which financial sector development induces *de facto* dollarisation and asset substitution will, however, terminate and become reversible in the long-run.

▪ Inflation has as usual produced a mixed result. In the long-run, even though higher levels of inflation are the genesis of asset substitution and *de facto* dollarisation, higher rates of inflation cannot be accused of being directly responsible for higher incidences the level of currency substitution. As revealed by the results of the Granger-causality, perhaps, higher rates of inflation can only be agent of currency substitution indirectly through asset substitution.

▪ The key and consistent macroeconomic determinants of asset substitution, currency substitution and *de facto* dollarisation in the short-run and long-run within the context of the Ghanaian economy are exchange rate, inflation and financial sector development. Interest rate spread is a relevant determinant of currency substitution in both the short-run and long-run and only short-run determinant of asset substitution with no impact on *de facto* dollarisation. In the short-run, domestic absorption determines currency substitution only but with long-run effects on asset substitution and *de facto* dollarisation.

6.0 POLICY IMPLICATIONS AND RECOMMENDATIONS

One of the implications from the empirical findings is that in extremely high dollarized countries, economic agents prefer to use foreign currencies for business transactions motives but would hold their local currency for speculative motives as opposed to relatively less dollarized countries. This might possibly be a consequence of improved efficiency and reliability of the domestic banking system in these economies which might limit in incidence of currency trade and rent seeking activities connected to foreign currencies. It must be pointed out that the high incidence of *de facto* dollarisation in the forms of currency substitution and asset substitution follow a consistent historical process. The severity of these *de facto* dollaraistion has the potential of impairing the effectiveness of fiscal policies particularly as far as tax revenue mobilisation is concerned. In an extremely highly dollarized country, for instance, tax evasion can be high because in such economies, underground economic activities including trading in illicit commodities and services, corruption, corporate fraud and rent-seeking activities are likely to be more convenient and enhanced.

In an economy where *de facto* dollarisation is extremely high, the quantum of effective or disguised money supply will definitely be higher than the size of reported domestic money supply. Naturally, this makes money and exchange rates control and management by the Central Bank a more daunting task. Thus, because of the high elasticity with which a foreign currency

can be substituted for a local currency, and vice versa, the implementation of monetary policy becomes less effective and associated with uncontrollable capital mobility across nations and riskier foreign exchange policy interventions, at least, in the very short-run. It is, therefore recommended that financial liberalisation for further development of the financial sector should be focussed on improved financial services such as off-shore banking, increasing access and decreasing cost of international money transfers through official routes especially to developing and transition countries.

The empirical finding that financial sector development promotes *de facto* dollarisation even though financial sector adjustment programme which was launched two decades ago might have a strong justification for improving the financial market performance, perhaps, its timing and sequencing might lack the right policy mix and direction. In connection with this finding, the study recommends that in order to reduce resultant financial fragility and risks and make the implementation of monetary policy more effective, there is the need for monetary authorities of Ghana to re-appraise the on-going financial reform programmes. This way a more prudent sequencing of financial reforms policy implementation would be identified and followed to minimize the current risk exposure within the financial system.

The results of this study also implies that extent to which Ghana can reduce its dependency on international economy and increase domestic absorption can, to a very large extent, minimise the high incidence of *de facto* dollarisation in the short-run, and to some extent the long-run. This is evidenced from the significant and consistent negative impact of domestic absorption on asset substitution, currency substitution and *de facto* dollarisation in Ghana. It is, therefore, suggested that expansionary economic policies such as a reduction in income tax, reduction in the rate of interest to boost domestic investment and the creation of job opportunities to reduce the rate of unemployment that would enhance domestic absorption should be implemented.

Both in the short-run and the long-run, the impact of inflation on *de facto* dollarisation, asset substitution and currency substitution is mix. This consistency violates the *a priori* expectations and suggests that the transmission mechanism of the effects of inflation on dollarisation and its components is complex and indirect. From the estimated results, for instance, in the long-run, a higher rate of inflation by one percent accounts for a 0.10% and 0.06% rise in asset substitution and *de facto* dollarisation respectively but a marginal fall of 0.02% in currency substitution. On the contrary, in any specific current quarter and the previous fourth-quarter, higher rates of inflation marginally reduce asset substitution and currency substitution in the short-run. This can possibly be attributed to the wrongful price expectations and money illusions, in the short-run, on the part of the household sector especially where a significant proportion of the population are not educated and, hence, suffer from telescopic analytical aptitude. Nonetheless, since the line of causality is traced from asset substitution through currency substitution to *de facto* dollarisation, it can be concluded that in the long-run, inflation promotes *de facto* dollarisation in Ghana.

Another probable explanation to this finding is that when price levels are high in a constrained low-income economy such as that of Ghana, the cost of living rises and fewer economic units would have the ability and willingness to hold money for any other purpose except for transactions motive directed at acquiring basic necessities of life such as food and clothing as a consequence of decreasing purchasing power. Under this circumstance, economic agents would rather be compelled to erode their savings and reserves which imply fewer deposits in local and

foreign currencies especially as a store of value[13], and hence lower levels of *de facto* dollarisation in the economy in the short-run. The study, therefore, recommends that inflation should be reduced in order to rates not exceeding the growth rate of real gross domestic product so that economic agents could have confidence in the local currency.

Higher interest rate spread suggests higher interest rate risks which exposes economic agents to higher financial risks and insecurity. This compels economic agents to diversify their investment portfolios in favour of foreign currency denominated assets. Therefore, the significant manner in which interest rate spread promotes currency substitution and *de facto* dollarisation especially in the long-run should inform Central Banks to design and implement monetary policies aimed at stabilizing the financial market by way of narrowing interest rate spread in the financial markets.

As the empirical findings reveal that depreciation of the Ghanaian cedi result in asset substitution currency substitution and *de facto* dollarisation in the long-run in particular, it is recommended that effective policies aimed at stabilizing the macroeconomy should be prudently designed and implemented in order to minimize the high incidence of *de facto* dollarisation. For instance, policy interventions for increasing domestic output in a sustainable manner that would in the long-run generate surpluses for exports of final and intermediate goods and subsequently reduce the dependency on imports of basic commodities should be rigorously pursued.

7.0 CONCLUDING REMARKS

This study was set out generally to find out if the massive financial liberalisation programmes embarked upon by developing and transition countries since the 1980s as way of promoting financial sector development is the principal cause of *de facto* dollarisation in the form of asset substitution and currency substitution using Ghana as a case study. The study also evaluated the extent as well as the cross-relations of asset substitution, currency substitution and *de facto* dollarisation in 24 sampled developing and transition economies. Overall, by narrow definition, *de facto* dollarisation is 35% across countries. By comprehensive measurement of *de facto* dollarisation averaged 2533% decomposed into asset substitution of 2416% and asset substitution of 118% for the 24 sampled countries. In effect, *de facto* dollarisation is more of a currency issue than an asset issue possibly because in developing and transition economies, incomes are relatively and close to the subsistence level, hence, economic agents find it difficult to save in any form of currency denomination.

Again, even though the degree of asset substitution, currency substitution and *de facto* dollarisation is high in both developing and transition countries, in the face of lower financial deepening and higher interest rate spread, the incidences of asset substitution, currency substitution and *de facto* dollarisation are relatively higher in developing countries than countries in transition.

The empirical results reveal that exchange rate, inflation and financial sector development are significant and consistent macroeconomic determinants of asset substitution, currency substitution and *de facto* dollarisation in the short-run and long-run. Though, financial sector development is the root cause of *de facto* dollarisation in Ghana both in the short-run and the

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[13] This connotes asset substitution which the study has identified as the component of dollarisation initially affected by higher inflation (refer to the results of Granger-Causality Test for details).

long-run, there is the opportunity for reversibility. Thus, further development of the financial sector after some time will no longer lead to *de facto* dollarisation or any of its components.

A policy recommendation for action is that monetary authorities in developing and transition countries should formulate and implement policies geared towards financial markets integration and transformation of the curb financial markets into the formal sector so as to reduce the tendency of using unapproved routes for international remittances into their economies. Again, it would be prudent and imperative for governments of developing countries, in particular, to ensure fiscal discipline and stabilization of the domestic currency against foreign currencies so that rent seeking activity in the form of currency trade does not look attractive to economic agents. Financial innovations and the development of the capital market in developing and transition economies should be accelerated to provide various investment options to potential investors. This way, *de facto* dollarisation in the form of asset substitution is likely to be minimized since there would be wider availability of higher interest-bearing financial assets than foreign currencies in these economies. Obviously, controlling inflation to rates not exceeding the real gross domestic product growth rate would be a sure way of making the public have confidence in the domestic currency to reduce *de facto* dollarisation in form of currency substitution emerging from loss of public confidence in the local currency.

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Appendix A: Structure of Money Supply (M$_2$) by Currency Macao

	Macao: Structure of Money Supply M$_2$, by Currency				
Year	M$_2$ (in 10^6 patacas)	MAP (%)	HKD (%)	OFC (%)	DDI=FCD/M$_2$
1985	9,250.10	26.6	60.1	13.2	2.75564
1986	11,092.70	25.6	54.5	19.9	2.90625
1987	14,281.60	22.5	51.8	25.8	3.44889
1988	19,990.30	19.2	56.4	24.4	4.20833
1989	24,264.90	20.8	55.3	23.9	3.80769
1990	30,658.80	22.8	49.1	28.1	3.38596
1991	41,944.30	22.7	51.3	26.0	3.40529
1992	50,800.60	24.2	50.7	25.1	3.13223
1993	54,312.10	26.3	51.0	22.7	2.80228
1994	61,213.30	27.1	55.6	17.3	2.69004
1995	69,443.60	29.0	56.3	14.7	2.44828
1996	74,332.70	29.9	55.4	14.6	2.34114
1997	78,182.90	30.5	53.4	16.1	2.27869
1998	80,627.60	30.6	53.3	16.1	2.26797
1999	86,096.30	32.5	51.2	16.3	2.07692
2000	84,917.90	27.3	52.4	20.2	2.65934
2001	91,550.00	28.5	51.2	20.2	2.50526
2002	98,959.60	27.8	51.8	20.4	2.59712
2003	111,090.00	26.9	54.0	19.1	2.60145
2004	120,947.00	24.6	53.8	21.6	3.01232
2005	135,659.80	26.3	56.4	20.3	2.88909

Source:
Computed by authors based on data obtained from Monetary Authority of Macao (AMCM) Annual Reports, various issues.

Note: MAP stands for Macao Patacas; HKD denotes the Hong Kong Dollar; whilst OFC represents other foreign currencies.

Appendix B

Country-Based Correlations of De Facto Dollarisation and Velocity of Money (1996-2005)

	ASI-VEL	CSI-VEL	DDI*-VEL	DDI**-VEL	FND-VEL	INT-VEL
Developing Economies	**-0.2629**	**-0.6312**	**-0.5578**	**-0.4773**	**-0.4375**	**0.1073**
SSA Countries	**0.0491**	**-0.3098**	**-0.2276**	**-0.0203**	**-0.3136**	**-0.0008**
Angola	-0.2152	-0.4404	-0.2909	-0.2777	0.3485	-0.7932
Burundi	-0.7391	-0.7196	-0.8078	-0.7324	-0.7182	-0.4499
Congo, DR	0.5745	0.0782	-0.1627	0.5410	0.6389	-0.3421
Ghana	0.6077	0.0573	0.3965	0.5263	-0.3096	-0.2949
Sao Tome and Principe	0.4876	-0.0661	-0.2298	0.2912	-0.5129	0.4619
Tanzania	-0.8459	-0.7765	-0.9094	-0.8631	-0.7252	0.8082
Zambia	0.4741	-0.3015	0.4106	0.3724	-0.9169	0.6042
Other Developing Countries	**-0.5055**	**-0.8812**	**-0.8145**	**-0.8327**	**-0.5338**	**0.1914**
Albania	-0.1412	-0.6587	-0.4208	-0.5268	-0.3439	-0.4357
Armenia	-0.8481	-0.9673	-0.9304	-0.9673	-0.7759	0.9107
Azerbaijan Republic	-0.6568	-0.9383	-0.8366	-0.9383	-0.8389	0.7264
Belarus	-0.8368	-0.8266	-0.8682	-0.8266	-0.6800	0.3955
Bosnia & Herzegovina	-0.7396	-0.8975	-0.9018	-0.8490	0.5104	-0.7266
Cambodia	-0.6686	-0.9748	-0.9930	-0.7187	-0.7458	-0.6600
Kyrgyz Republic	-0.6494	-0.8602	-0.7807	-0.8601	-0.0304	-0.2397
Latvia	0.6120	-0.9523	-0.7840	-0.9523	-0.9896	0.9056
Moldova	-0.6213	-0.8550	-0.8151	-0.8549	-0.9105	0.8460
Transition Economies	**-0.4796**	**-0.7637**	**-0.6564**	**-0.6640**	**-0.7564**	**0.3325**
Bolivia	-0.9444	-0.9747	-0.9746	-0.9703	-0.7748	-0.5513
Egypt	-0.8403	-0.8247	-0.8506	-0.8309	-0.8700	-0.7720
Estonia	-0.7519	-0.9086	-0.8701	-0.9085	-0.9279	0.9244
Georgia	-0.7131	-0.9780	-0.9131	-0.9780	-0.8958	0.7050
Lithuania	0.1715	-0.3617	-0.1061	-0.0431	-0.8651	0.4923
Russian Federation	-0.2446	-0.3562	-0.3589	-0.2905	0.1366	0.2878
Ukraine	-0.6395	-0.8989	-0.8391	-0.8989	-0.9259	0.7909
Vietnam	0.1256	-0.8071	-0.3386	-0.3917	-0.9287	0.7826
Overall Average	**-0.3351**	**-0.6754**	**-0.5906**	**-0.5395**	**-0.5438**	**0.1823**

Authors' computations

Appendix C: Results of Johansen Multivariate Likelihood Cointegration Tests

I(1) VARIABLES

Sample: 1988:4 2005:4; Included observations: 66; Lags interval: 1 to 2				
Test assumption: Linear deterministic trend in the data; Series: CSI INT INF FSD FSD^2				

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.437623	79.82996	68.52	76.07	None **
0.261210	41.84155	47.21	54.46	At most 1
0.180823	21.86061	29.68	35.65	At most 2
0.096902	8.696546	15.41	20.04	At most 3
0.029401	1.969584	3.76	6.65	At most 4

*(**) denotes rejection of the hypothesis at 5%(1%) significance level

L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

CSI	INT	INF	FSD	FSD^2
1.313376	-0.049920	0.015812	-2.955620	0.977648
-0.982965	0.030453	0.006405	5.836408	-3.564503
-1.518759	-0.016265	-0.001059	-5.022681	2.952242
0.407644	-0.012310	-0.000967	3.456035	-2.435066
-0.151153	0.003330	-0.000729	-1.145408	0.461827

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

CSI	INT	INF	FSD	FSD^2	C
1.000000	-0.038009	0.012039	-2.250399	0.744378	1.249041
	(0.00791)	(0.00274)	(1.09236)	(0.60590)	

Log likelihood   -37.43093

Normalized Cointegrating Coefficients: 2 Cointegrating Equation(s)

CSI	INT	INF	FSD	FSD^2	C
1.000000	0.000000	-0.088309	-22.19098	16.33003	8.433158
		(0.21947)	(58.7693)	(42.7261)	
0.000000	1.000000	-2.640123	-524.6259	410.0501	189.0102
		(5.98136)	(1601.68)	(1164.44)	

Log likelihood   -27.44045

Normalized Cointegrating Coefficients: 3 Cointegrating Equation(s)

CSI	INT	INF	FSD	FSD^2	C
1.000000	0.000000	0.000000	1.238947	-0.736334	-0.749315
			(0.75319)	(0.48898)	
0.000000	1.000000	0.000000	175.8416	-100.1706	-85.51150
			(27.3302)	(17.7431)	
0.000000	0.000000	1.000000	265.3162	-193.2564	-103.9806
			(75.5435)	(49.0438)	

Log likelihood   -20.85842

Normalized Cointegrating Coefficients: 4 Cointegrating Equation(s)

CSI	INT	INF	FSD	FSD^2	C
1.000000	0.000000	0.000000	0.000000	0.083506	-0.334877
				(0.05824)	
0.000000	1.000000	0.000000	0.000000	16.18795	-26.69103
				(4.54558)	
0.000000	0.000000	1.000000	0.000000	-17.69035	-15.23016
				(7.57163)	
0.000000	0.000000	0.000000	1.000000	-0.661724	-0.334508
				(0.02486)	

Log likelihood   -17.49494

I(2) VARIABLES

Sample: 1988:4 2005:4; Included observations: 66				
Test assumption: Linear deterministic trend in the data				
Series: EXR DAB				
Lags interval: 1 to 2				
Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.357115	29.57588	15.41	20.04	None **
0.006310	0.417758	3.76	6.65	At most 1
*(**) denotes rejection of the hypothesis at 5%(1%) significance level L.R. test indicates 1 cointegrating equation(s) at 5% significance level Unnormalized Cointegrating Coefficients:				
EXR	DAB			
0.000114	-7.40E-09			
-0.000123	1.67E-08			
Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)				
EXR	DAB	C		
1.000000	-6.50E-05	-1801.893		
	(1.3E-05)			
Log likelihood	-1463.208			

Appendix D: Graphical Representation of Residuals

RESID01

RESID02

RESID03