The Effect of Capital Flows on Key Financial Stability Measures in Jamaica

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Capital inflows contribute to an economy's development by increasing the availability of funds for new projects, infrastructure development and productivity improvements, and can stimulate economic growth and job creation. However, the free flow of capital in and out of an open economy may also lead to economic destabilization, especially in politically and economically unstable emerging markets. Several small open economies, including Jamaica, have experienced economic crises largely attributable to capital flow movements. Against this background, the paper aims to examine whether sharp capital flow movements, specifically private capital inflow movements, are a significant risk factor for financial stability in Jamaica. A structural vector autoregressive (SVAR) model was used to assess the dynamic relationship between private capital inflows and financial stability, as well as the responsiveness of financial stability indicators to sudden changes in private capital flows. The findings confirm a significant relationship between private capital inflows and financial stability and underscores the need to develop macro-prudential measures to curb possible threats to financial stability.

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[1] The views expressed in this paper are not necessarily those of the Bank of Jamaica.

1.0 Introduction

Capital flows exist as a phenomenon more prevalent in open economies as they encourage economic activities and the exchange of resources between countries. Capital flows are an inherent characteristic of financial globalisation and liberalisation and refer to the cross-border movement of money, financial assets and more broadly, technical skills and expertise. According to Hoggarth, Jung and Reinhardt (2016), there are four main categories as it relates to the balance of payments accounting definition of capital flows: foreign direct investment (FDI), portfolio equity, portfolio debt and "other".[2] Capital inflows are beneficial to the recipient country/economy as they allow for the exchange of knowledge, technology and investments, which facilitate opportunities for economic growth and development that perhaps were unachievable otherwise. However, excessive capital inflows also referred to as capital inflow surges, are unsustainable as they raise the risk and probability of "sudden stops" and capital flow "reversal" , as well as, they pose a risk of credit and asset boom-bust cycles in economies, and hence threatens financial stability.[3]

Although not all surges lead to credit booms or asset price bubbles because of domestic policymakers and authorities initiatives to limit this adverse effect, in the case of Turkey and Colombia when experiencing a surge and lending boom simultaneously, it was found to increase the probability of a banking crisis. [4,5] Excessive inflows can also stretch an economy's ability to adjust macroeconomic policy, generally overwhelm domestic financial markets and distort money markets, cause rapid exchange rate appreciation, build-up in DTIs balance sheets, unsustainable drops in risk premia, as well as, disrupt monetary policy. This is especially an issue in small open economies due to their underdeveloped or developing economies and financial systems. The risk of boom-bust cycles, and more generally capital inflow surges, take about 6 years to manifest.[6]

Capital reversals and sudden stops, tend to contribute significantly to destabilising currency depreciation, and can contribute to credit crunches, an increase in loan defaults, upward pressure on interest rates and overall financial system stress. The potential for capital inflow surges and

[2] "Other" category mainly accounts for foreign loans and deposits.
[3] Papaika & Kosogov (2014) define financial stability as "a dynamic characteristic that manifests itself in the ability of the system to withstand endogenous and exogenous shocks". Essentially an environment where agents of the financial system operate efficiently, allowing the financial system to be able to withstand systemic risk.
[4] Amri et al (2016).
[5] Cabellero (2016).
[6] Korinek (2010).

therefore capital reversals and sudden stops along with the distinct herding behaviour often displayed by investors, increases the need for macro-prudential policies to mitigate the risks associated with them.

The objective of macro-prudential policies is to curtail and prevent systemic risk to the financial system using any tool or indicator based on macro-financial fundamentals, and can entail the use of existing micro-prudential tools to achieve financial stability. While prior research has recommended that macro-prudential policy be implemented after all viable macro-economic policy adjustments are made, research does support the use of macro-prudential policies such as limits on loan-to-value and debt-to-income ratios. These policies help to curb excessive lending since they help to build-up resilience to systemic risks from reversals of capital inflows or sudden stops, especially as it relates to domestic bank leverage and credit risks.[7,8]

Emerging market economies (EMEs) in the Latin American and Caribbean (LAC) region have historically profited from capital inflows, especially as it relates to FDIs, ODAs and remittances. Notably, Jara & Tovar (2008) provided evidence that the LAC entered a new phase of capital flows that began in 2003. This new phase which they alluded to was characterised by large gross FDI and portfolio inflows, incipient gross capital outflows in some countries, a reduced reliance on external financing in net terms, a reduction of external liabilities positions and improved net international positions in the region overall. Jamaica, a small open EME that enjoys a sizeable amount of remittance flow and FDI, among others, has had its share of capital inflow surge episodes. According to Langrin and Stennett (2011), Jamaica has experienced two financial crises, during 1996/1997 and 2007/2008, which they attribute to capital flow events. Prior research on Jamaica has found a significant relationship between capital flows and systemic risks.[9] The pace of capital inflows can exert upward pressure on currencies in EMEs and create "economic dislocation".

The presence of dollarization and a shallow capital market are country-specific characteristics that increase the riskiness of capital flows to Jamaica. FDIs are an important aspect of capital flows in Jamaica and although FDIs are thought to be one of the more stable forms of capital flows, Calvo (1998) believes that even when the majority of capital inflows take the form of FDIs, capital crises

[7] See IMF (2017), IMF (2012).
[8] Hoggarth, Jung and Reinhardt (2016)
[9] Langrin and Stennett (2011) and Rochester (2012).

are still conceivable as they can be temporary and can cause an increase in outflows through the repatriation of profits. Jamaica also has a sizeable remittance flow which has the potential to negatively impact the economy if it suddenly stops or reduces drastically, as remittances are thought to have "pro-growth effects… and enhance productive capacities of the economy".[10]

The above illustrates the potential risks posed on an economy by excessive capital inflows, and an evident link already existing between capital inflows and financial stability in Jamaica. As such, this paper will seek to add to the conversation of the impact of capital inflows on financial stability in Jamaica, as well as, postulate potential macro-prudential policy remedies to mitigate and address the systemic risks that occur due to inflow surges. Therefore, a Structural Vector Autoregressive (SVAR) model was conducted to illustrate the effect of an inflow shock on key measures of financial stability used in Jamaica. Based on the results, inflow surges to Jamaica did have an impact on the financial stability measures. Consequently, surveillance of capital inflows to Jamaica are crucial, and the use of macro-prudential policy to deepen the financial system may be appropriate in the future if marco-fundamentals begin to fall out of line or overheat as a result of excessive capital inflow pressures and to mitigate the risks associated with sudden stops and capital reversals.

The paper will continue as follows: Section 2 will give an analysis of current literature on capital flows and financial stability while Section 3 will present stylised facts on variables used in the analysis. Section 4 will describe the methodology used in the econometric model and Section 5 will display and analyse the empirical results of the model. The paper will conclude, along with some macro-prudential policy recommendations, in Section 6.

2.0 Literature Review

Capital Flows and the Financial System

Borén (2016) found that capital flows in the EU can potentially cause financial instability (as proxied by NPLs) as there was a significant and negative relationship between capital imports and NPLs. Kaminsky, Reinhardt & Vegh (2004) found the capital flow cycle to be tied to the business

[10] Kumar (2013), Buch and Kuckulenz (2010) and Ratha (2007).

cycle and often influence macroeconomic (and fiscal policy) policies.[11] Their definition of "cyclical properties of capital flows" mainly focused on whether these flows reinforced or stabilised the business cycle and concluded that net capital inflows are pro-cyclical in most OECD and developing countries.

The results of studies by Korinek (2007 & 2010) showed that capital inflow and outflow movements may lead to exchange rate appreciations and depreciations since foreign currency denominated liabilities create the risk of financial amplification, which leads to depreciating exchange rates, deteriorating balance sheets and a decline in aggregate demand. In other words, capital inflows and outflows can have an overall destabilizing effect on the system. Korinek (2010) also described the role capital inflows play in credit crises. He provided evidence that "private money market participants expand the stock of capital during booms and as the price of capital rises, this enables them to take on more credit. During busts, the stock of capital becomes less valuable and the ability to repay declines".[12] The IMF (2012) also agree that inflow surges can play a role in boom-bust cycles, as they believe surges often overwhelm the recipient country's financial market and their ability to adjust using macroeconomic policy. This financial and macroeconomic volatility often leads to asset price volatility and bubbles, rapid exchange rate appreciation, credit booms, unsustainable drops in risk premia and disruptions to monetary policy transmission.

As it relates to capital inflow surges Calvo (1998) believes that the ability to accommodate the change in current account deficit is essential to mitigate the risk of a sudden stop of inflows after a surge, and could be cushioned by international reserves as tight monetary policy often aggravates the credit "destruction problem". Korinek (2010) also believes capital inflow surges make recipient countries more vulnerable to adverse shocks. He posits that surges often create a boom in indebtedness, asset prices and consumption for a period and these booms in the market are inefficient as borrowers' behaviour increases financial instability at an aggregate level.

In regards to "sudden stops" or reversals of inflow surges, most researchers agree that this is where a majority of the risk to financial stability arise. Dornbusch et al (1995) noted, "it is not speed that kills, it is the sudden stop" as it relates to capital flow movement. A sudden stop of inflows may

[11] Talvi & Vegh (2000), Lane (2003) and Gavin and Perotti (1997).
[12] According to Korinek (2010), "investors cannot costlessly transform consumption goods into investment goods and vice versa."

cause a liquidity squeeze or an overall liquidity shortage, making it hard to service debts that will then cause pressure in the credit market.[13] Balwin & Giavazzi (2015) believe "the European sovereign debt crisis started as a classic sudden stop to cross border capital inflows". They posited that economies in the EU affected the worst by the sovereign debt crisis, were experiencing large capital account deficits and a surge of capital inflows. Rodrik & Velasco (1999) cited that economies with large short-term debt stock are more vulnerable to severe crises when a sudden stop of capital inflows occur.

Capital Flows and EMEs

The literature generally supports the strong relationship between capital inflows and developing countries/EMEs. Pradhan, Balakrishnan, Baqir et al (2011) found that cyclical and structural factors have influenced the increase in inflows to EMEs, however, these surges can threaten financial stability especially when they provoke drastic asset price movements. Kaminsky, Reinhardt & Vegh (2004) stated that the capital flows cycle in developing countries is pro-cyclical, thus moving in conjunction with the financial cycle and this is known as the "when it rains, it pours" phenomenon. They found that the root of most debt crises in EMEs were due to pro-cyclicality, high spending and borrowing when international capital is "plentiful", as macro-policies tend to be expansionary when inflows are high and contractionary when there are more outflows.

Two important EME crises attributed to capital inflow surges and their subsequent sudden stop or reversal are that of the Mexican Financial Crisis in 1994-95 and the East Asian Crisis of 1997. Musacchio (2012) noted that overenthusiastic foreign investors caused the Mexican Financial Crisis, rather than the country's fundamentals, which led to a drastic increase in different forms of capital inflows. This led to a lending boom, a boom in the Mexican stock market as well as FDI increase, and hence the crisis was triggered when the peso was devalued in December 1994. Consequently, there was herding behaviour of foreign investors, who then reversed the capital flows after extensive pressures on the economy. A weak regulated banking system, social crises and a change in the international monetary policy environment led to the economy being

[13] Gavin & Haussman (1996)

vulnerable to the eventual financial crisis that ensued. The crisis also had spillover/contagion effects to other countries in LAC and EMEs.

Montes (1998) believed the financial crisis in East Asia was caused by twin liberalization in the system while Radelet & Sachs (1999) and Yap (2009) posited that the crisis was a result of sudden capital reversals after an inflow surge to the region. Radelet & Sachs (1999) propose that these reversals may result in a BOP crisis, financial panic, bubble collapse, moral hazard crisis and disorderly workout of insolvent borrowers. [14] Yap (2009) state that a net private capital inflow surge in East Asia - more specifically Indonesia, Korea, Malaysia, Philippines and Thailand - in early 1997 was followed by a sudden reversal in flows, due to the withdrawal of foreign capital by panicked investors triggered by financial weakness in the Thai economy. This had negative spillover effects on investor perception in the region affecting the more financially fragile in East Asia. This reversal accounted for outflows of approximately 10% of pre-crisis gross domestic product (GDP) in 6 months.[15]

As it relates to the LAC, and specifically Jamaica, prior research supports the presence of an impact of capital flows on the financial system and the economy on a whole. Jara & Tovar (2008) stated that capital inflow surges might increase exchange rate risk when the recipient country has high currency mismatch and poses liquidity risks when short-term flows and short-term assets do not increase at the same pace. In addition, capital inflow surges contribute to credit and consumption booms, which results in increased credit exposure and increased susceptibility to international financial market spillover effects. However, they warned that while major financial progress has occurred in most economies of the LAC, financial stability implications of capital inflows are still a major concern for these economies, as their financial markets remain underdeveloped with banking systems being vulnerable and financial dollarization remains high. In the presence of high financial dollarization specifically, there is the potential to increase a fragile currency mismatch in the system as well as contribute to maturity risks.

In regards to the Jamaican experience, Langrin and Stennett (2011), Rochester (2012) and Spencer (2017) found that capital inflows have significant implications on the Jamaican economy. Langrin & Stennett (2011) stated that Jamaica had two major crises linked to capital flow movement and

[14] BOP crisis alluded to by Radelet and Sachs (1999) refer specifically to foreign exchange reserve depletion and currency depreciation.
[15] Radelet & Sachs (1999).

measured the difference and similarities in the capital inflow compositions during these financial crises. In the 1997 crisis, an on-going capital inflow surge culminated in an eventual asset price boom-bust cycle while the second crisis was due to external shocks from the Global Financial Crisis of 2008/9(GFC), where prior to the crisis there was also strong levels of private capital inflows made up of mainly FDIs. The Jamaican economy experienced a sudden stop of flows during the second crisis as levels of private capital inflows fell substantially. In addition, they found that the composition and volume of capital inflows into the economy were influenced by the stability of both the domestic and global financial and economic environment.

Rochester (2012) examined whether the components of net private flows resulted in pressures in the foreign exchange market. He found that in Jamaica there was a significant causal relationship between the two, with the exception of FDIs, which were found to have a statistically insignificant impact. Meanwhile, Spencer (2017) found that domestic factors play the most significant role in influencing capital flows to Jamaica, such as the domestic interest rate and exchange rate as it relates to attracting capital inflows.

Capital Flows and Macro-prudential Policy Measures(MPM)

Portfolio bond flows and short-term banking flows were found to be more likely to contribute to systemic risks. Post-GFC, the use of macro-prudential tools to alleviate or manage these risks to financial stability have become important, especially as it relates to capital flow movement.[16] IMF (2017) highlighted that post-GFC regulatory reforms have focused on building up resilience to shocks and that macro-prudential measures can help countries harness better the benefits of capital flows while managing the risk. Engel's (2015) proved that that there is reason to support the use of prudential measures on capital inflows in order to constrain over borrowing.

Darvas, Hüttl, Merler & Walsh (2015) found that some countries within the European Union (EU) used MPMs to manage the risks associated with capital flows, specifically to prevent the risks emanating from domestic imbalances that threaten financial stability and address cross-border issues that come as a consequence of their high levels of financial integration, making them highly susceptible to "cross-country spillovers". Some specific risks encountered by EU countries, such as Sweden and Croatia, in regards to capital flows, were credit and asset booms, sudden outflows,

[16] IMF (2012, 2017).

as well as, an increase in foreign exchange lending because of the ease of cross-border transactions. Macro-prudential tools such as the liquidity coverage ratio, net stable funding ratio, caps on loan-to-value (LTV) ratio, countercyclical capital buffer, credit ceilings and risk weights on foreign currency borrowing, were utilised in the EU to curb systemic risks resulting from capital flow volatility.

Pradhan, Balakrishnan, Baqir et al (2011) concluded that EMEs in Asia used reserve accumulation and currency appreciation to tackle risks from inflow surges, they also agreed that MPMs have become important in tackling the risks associated with asset price bubbles and excessive credit growth. They noted that MPMs were also used to mitigate other risks associated with capital flows and were typically used to meet specific objectives including: (i) to mitigate complications that stemmed from inflows to short-term instruments (ii) to limit inflows to local bond markets (iii) to reduce risks within the banking system and the real economy (iv) to limit vulnerabilities from private sector external borrowing and (v) to curb speculative activity in foreign exchange market contributing to exchange rate volatility.

However, Engel (2015) stated that when capital is mobile, countries that impose macro-prudential regulations on domestic financial institutions are subject to pressure arising from the global nature of international capital markets.[17] He opined that strong global cooperation on macro-prudential policy regulation, along with counter cyclical capital controls on specific elements of the credit market would reduce susceptibility to the risks of an open financial economy, especially as it relates to capital flows. Pradhan, Balakrishnan, Baqir et al (2011) encouraged policymakers to deepen their local financial capital markets to allow them to better absorb increases in capital inflows. Isakova (2016) finds that deeper capital markets are mainly used to create buffers for the financial system, especially against unanticipated reversals of flows, and this supports the need to have effective macro-economic policy, capital flow management measures (CFMs), as well as MPMs, in order to address the issues and vulnerabilities that result from capital inflows. Additionally, Ostry, Ghosh, Habermeier et al (2011) noted that both capital controls and MPMs are useful in managing financial stability risks associated with inflow surges, especially as it relates to vulnerabilities on domestic balance sheets.

[17] Capital flows entering and leaving domestic financial institutions are often required to meet additional regulations on flows, or sometimes less regulation, dependent on the country they are interacting with, hence, international cooperation and reciprocity is necessary for their effectiveness.

Based on the literature, excessive and unmanaged capital inflows - and the probability for inflows to stop and/or be reversed - into an economy can have a significant impact on an economy's financial system, and can be the catalyst of financial crises such as boom-bust cycles in the credit and asset market, as well as currency crises. Surges of capital inflows in the EMEs and LAC have been found to have significant and manifested risks to financial stability, along with the general benefits of capital inflows to these economies. The literature indicates that macro-prudential policy has been effective in addressing the systemic risks and vulnerabilities that can arise from capital flow movements. Jamaica has, according to previous studies, traditionally had a significant relationship with capital flows in its economy. Therefore, this study seeks to further delve into the known relationship between capital inflows and the Jamaican economy's financial stability by assessing the impact a surge may have on financial stability based on quantitative indicators, using the results to explore the feasibility of macro-prudential policies to address this relationship if found.

3.0 Stylised Facts

Within the Jamaican context, measures of capital inflows examined were gross private capital inflows, gross private capital inflows to nominal GDP, net private capital inflows and remittances. Upon examination, these measures exhibited a weak upward trend with the exception of remittances, which signalled a strong upward trend over the period of June 2006 to March 2018 (**Figures 1, 2, 3 and 4**). Quarterly gross private capital inflow showed significant reductions during the National Debt Exchange in 2013 – which could be indicative of a loss in investor confidence in Jamaica during this period, before returning to its upward trajectory in the latter part of 2015.[18] Quarterly remittances, however, only displayed a sustained fall during 2009, and was in line with the recession experienced in the countries where the remittances originated. Net private capital flows were consistently negative with the exception of mid-2009 and 2011, when net private capital inflows positively peaked before becoming negative.

[18] The National Debt Exchange (NDX) in Jamaica was part of a fiscal-structural reform that allowed for the exchange of bonds and notes issued by the Government of Jamaica for longer tenure notes and bonds to domestic holders.

Figure 1. Quarterly Gross Private Inflows June 2006 – March 2018

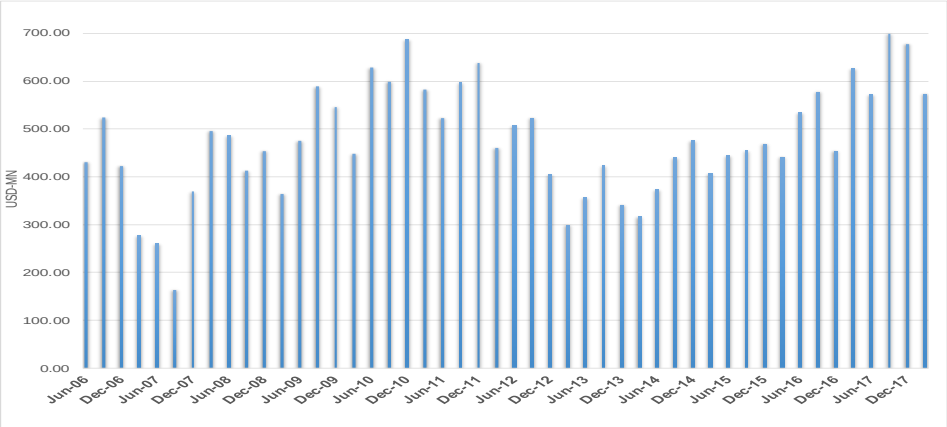


Figure 2. Quarterly Gross Private Inflows to Nominal GDP June 2006 – March 2018

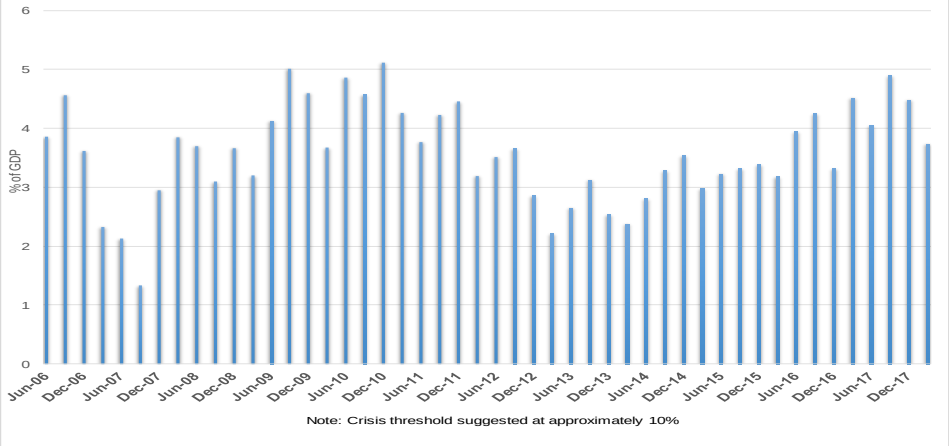


Figure 3. Net Private Capital Inflows June 2006 – March 2018

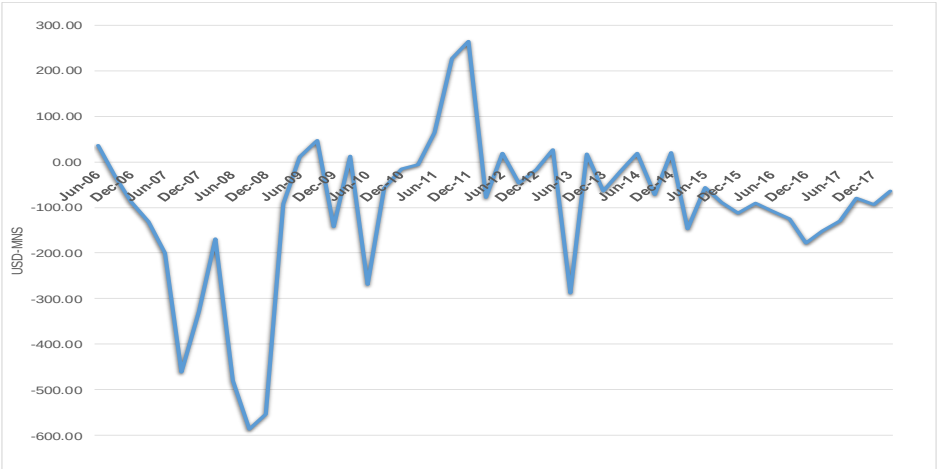
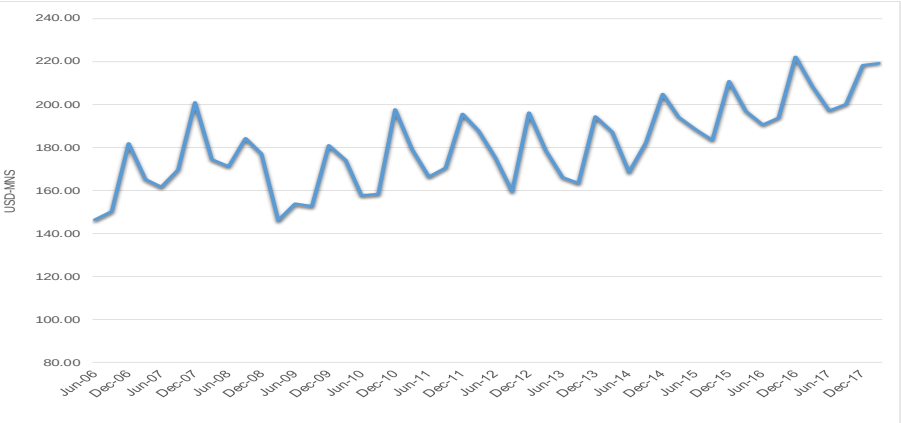


Figure 4. Quarterly Remittances June 2006 – March 2018



According to Langrin and Stennett (2011) and Spencer (2017), there are established relationships between capital inflows and the interest rate, asset prices and credit growth in Jamaica. Notably, the 90-day Treasury bill rate has been on a downward trajectory since 2006, with the exception of the period of the GFC where it peaked at 22.0 per cent for three consecutive quarters (**Figure 5**). In regards to asset price growth, the house price to income ratio and RREPI are used as proxies (**Figure 6**). Historically, based on RREPI, asset prices have been growing steadily. This is further supported by the house price to income ratio, which has been declining over time, signalling a larger increase in asset prices relative to income. DTI private sector credit has displayed volatility in its growth rates over the period of 2006 to 2017. However, credit growth experienced significant declines during the periods of the GFC and NDX. Recall that gross inflows also declined significantly during the same period, which supports that there is a relationship between credit growth and capital inflows.

Figure 5. Quarterly Jamaican 90-day Treasury Bill Rate June 2006 – March 2018

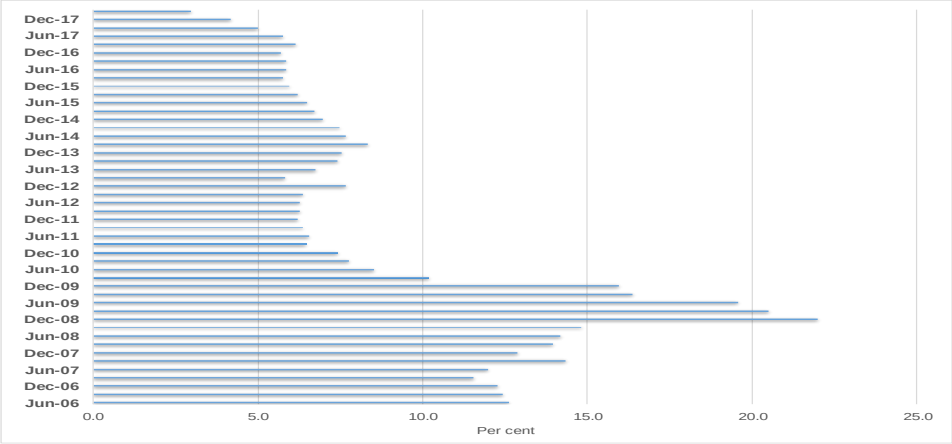
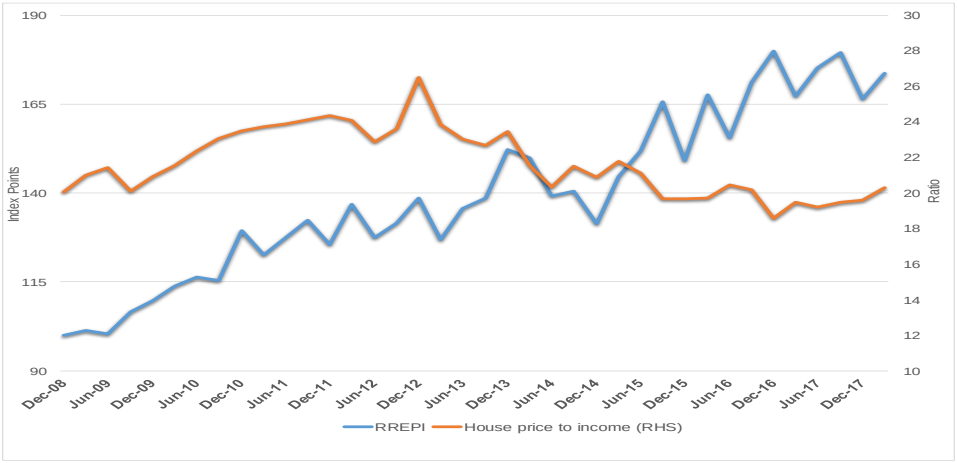
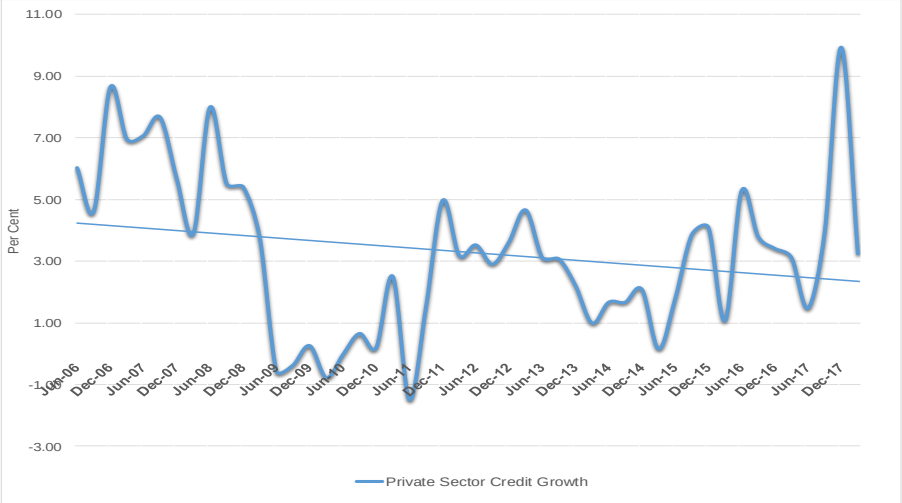


Figure 6. Quarterly Asset Price Growth December 2008 – March 2018



Given the strong economic relationship between Jamaica and the United States of America (US), it is also important to examine the impact of US GDP and policy rate on capital flows to Jamaica. US's quarterly GDP growth averaged 2.0 per cent a quarter between June 2006 and March 2018. During this same period, US GDP growth was volatile with significant negative growth during the recession of the GFC in 2009, which coincide with declines in remittances and gross capital inflows to Jamaica. Meanwhile, Jamaica's quarterly GDP growth was relatively stagnant, averaging 0.6 per cent during the same period, reflecting a negative impact from the GFC that was persistent up until late 2011.

Figure 7. Quarterly Credit Growth June 2006 – March 2018



Consistent GDP growth is a sign of a healthy economy, making a country more attractive to foreign investors. It has been observed that when US interest rates decrease, capital flows increase to outside of the US, with the reverse being true when US interest rates increase. Leading up to the GFC, the Fed rate steadily increased, peaking at 5.25 per cent, however, amid the crisis the Fed began to lower the interest rate and stabilised it at 0.25 per cent in December 2008. The Fed, since December 2015, slowly increased rates. Consequently, US interest rates exhibited an upward trend between the period June 2006 and March 2018.

Figure 8. Quarterly US and Jamaican Economic Growth June2006 – March 2018

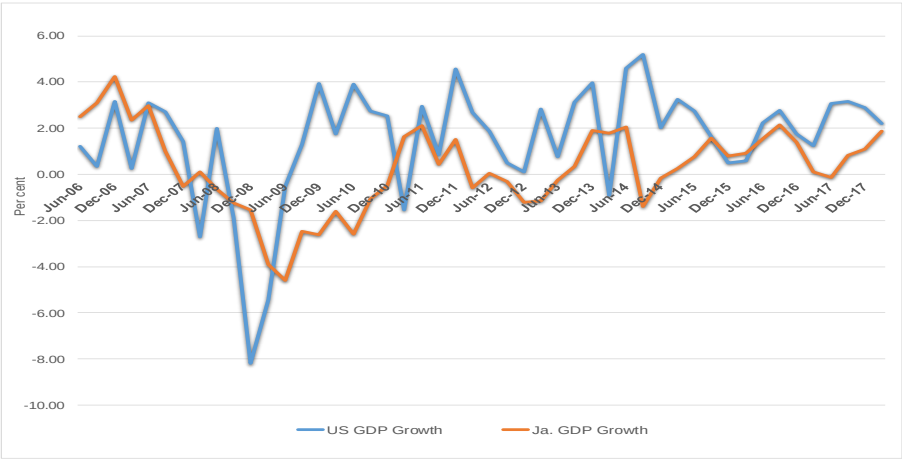
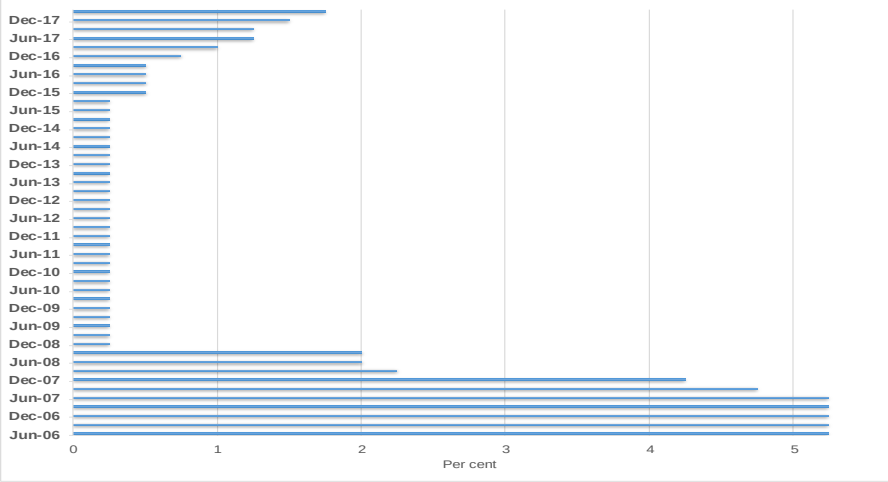


Figure 9. Quarterly Fed Interest Rate June 2008 – March 2018



The aforementioned shows that statistically trends have displayed a link between domestic performance and the performance of the external economy. This is specifically illustrated in the movement, or lack thereof, of capital into Jamaica during the period of the GFC, as well as a persistently low Fed interest rate saw an increase in inflows to Jamaica post-GFC. The importance of investor perception was also highlighted by the movements of Jamaican GDP growth and gross private capital inflows; as the country began recording positive growth there was an increase in inflows while during the NDX there was a short-lived reduction in inflows. Based on these stylised facts, a statistically significant relationship between capital inflows and financial stability in Jamaica is anticipated.

4.0 Methodology

In order to explore the impact of a capital flow shock on financial stability, a SVAR model was used to examine the dynamic relationship between private capital inflows and the Jamaican economy[19], as well as, other variables that may have an endogenous relationship between these two variables. The SVAR approach was selected over a traditional reduced form VAR because it is more suited for policy analysis and advice, as they help to quantify macro-economic relationships while reduced form VARs are better suited for forecasting. Therefore, it allowed

[19] Ying and Kim (2001), Culha (2006) and Korap (2010) also employed the use of SVAR model in their empirical studies on capital flows.

analysis of the economy's response to inflow shocks, as well as, the long run impact of capital inflows on financial stability. Data used in the model was quarterly, for the period 2006Q2 to 2018Q1.[20]

The model equation took the form:

$$F_t = \beta_0 + \beta_1 CI_t + \alpha' X_{i.t} + \varepsilon_{i,t} \qquad (1)$$

Where $X_{i,t}$ is a matrix representing the explanatory variables, with the exception of capital inflows denoted CI_t, and the dependent variable, F_t, represents a financial stability measure.

The explanatory variable of $X_{i,t}$ were:

- Chicago Board Options Exchange Volatility Index (VIX) – proxied global volatility;
- US GDP growth – used to proxy global GDP growth;
- Fed's interest rate – proxied global interest rates;
- private sector credit growth – representing the domestic credit cycle;
- house price to income ratio – representing domestic asset growth;
- domestic exchange rate vis-à-vis the US dollar – because of the presence of depreciation and foreign currency mismatch; and
- domestic interest rate and domestic GDP growth were also included along with the current account deficit because of the theoretical relationship with capital inflows.

Notably, however, the VIX, US GDP growth and the Fed's interest rate were specified as exogenous variables in the model, while the others were specified as endogenous. Although, the measure of global volatility used was different from that of Hoggarth, Jung and Reinhardt's (2016) model, this paper utilized measures such as domestic and global GDP growth, interest rates, domestic private sector credit growth and the domestic exchange rate vis-à-vis the US dollar, as explanatory variables.

As it relates to CI_t , the capital inflow measures, remittances, gross private capital inflows and net private capital inflows were used. [21] Gross private capital inflows and net private capital inflows were previously used in cited studies on the Jamaican economy, and data used is based on a cash

[20] Most variables used in the study were selected based on the work of Hoggarth, Jung and Reinhardt (2016).
[21] Remittances was used because of Jamaica's strong reliance on remittances as stated in BIS (2008).

accounting framework, capturing USD portfolio flows into the domestic foreign exchange market. Gross capital inflows was similarly used as the measure for capital inflows in the Hoggarth, Jung and Reinhardt (2016) model.

Non-performing loans (NPLs), the capital adequacy ratio (CAR), credit-to-GDP gap and DTI leverage[22] were used as a proxy to financial stability, F_t , in Jamaica. The method therefore, involved running the model multiple times, each time accounting for each specific financial stability and capital inflow measure.

Table 1. Variables used in SVAR and movements which result in increased risk in Jamaica

Financial Stability Measure	**Capital Flow Variable**	**Domestic Variable**	**Global Variable**
CAR ↓	Gross private capital inflow ↕	Private sector credit growth ↕	VIX ↑
DTI Leverage ↑	Net private capital inflow ↕	Exchange rate ↑	Fed interest rate ↑
NPL ↑	Remittances ↕	GDP growth ↓	US GDP growth ↓
Credit-to-GDP gap ↑		Interest rate ↕	
		Current account deficit ↑	
		House price to income ↑	

All variables were tested for non-stationarity using the Augmented Dickey Fuller (ADF)[23] test and the KPSS test. The exchange rate, house price to income, the Fed rate, remittances, CAR, NPL, leverage, credit-to-GDP gap and the domestic interest rate were found to be non-stationary but became stationary when the first difference was applied. The SVAR models were tested for stability and stationarity using the AR unit root circle analysis, and for no serial autocorrelation in the residuals using the LM test. All iterations of the model containing gross capital inflows as the capital inflow measure were both stable and contained no autocorrelation in the residuals, as well as the iteration with the first difference of NPL as the financial stability measure and the first difference of remittances as the capital inflow measure.

VAR lag order selection criteria were also assessed in order to estimate the SVAR using the appropriate lag length, and a lag length of one quarter was found to be optimal for all iterations of the model. Impulse response functions, using the Cholesky decomposition method with degree of freedom adjustments, were then carried out on the models over a two and a half years horizon to

[22] Leverage was calculated as DTI assets divided by DTI equities (ordinary shares in the system's capital account).
[23] Unit root tests results in Appendix, Table A.1.

examine the impact of a Cholesky one standard deviation private capital inflow surge/shock on the key financial stability measures.

5.0 Results

Overall, the results found echoed Hoggarth, Jung & Reinhardt (2016) analysis post and pre GFC that highlighted that gross capital inflows were a better indicator of systemic risk to financial stability, as the financial stability measures had a significant response to a gross inflow surge. The findings indicated a potential linkage - whether direct or indirect- of gross inflows and deposits and therefore by extension, credit availability in the financial system. This also highlights the increased probability of a credit boom-bust cycle as well as the risk of banks becoming more risk tolerant, in relation to their borrowers, in an inflow surge.

The relationship between the first difference of leverage and gross private capital inflows (GI) was significant based on the Student's t-distribution test. Subsequent to the application of a shock to GI, the inflow surge positively impacted leverage for the following three quarters before normalising. The surge resulted in an approximately 30.0 per cent increase in the difference of DTI leverage, which was larger than the average change in leverage of 2.0 per cent. This result supports economic intuition, as a capital inflow surge would lead to an increase in the availability and accessibility of financial assets in the system. The increase would lead to an increase in the DTIs' sector assets resulting in an increase of overall bank leverage.

The relationship between the first difference of CAR and GI was significant based on the Student's t-distribution test. A shock to gross inflows, resulted in a negative response by the CAR, with an approximately 0.15 per cent decrease in the change of the CAR, larger than the average change in CAR, which was -0.7 per cent. As was stated prior, this surge would be a catalyst for financial assets, leading to an increase in banking sector assets. This increase in assets would also translate to a decrease in the CAR, assuming tier 1 capital did not increase or not at the same or faster pace. The relationship between GI and the first difference of the CAR was found to be significant based on the Student's t-distribution test.

As it relates to the impact of a GI surge, even when not directly beneficial to the financial system, there is indication of an indirect impact through the depositor channel – especially on bank leverage and the CAR of banks. An increase of funds in the economy may be transmitted into an increase in bank deposits. This increase in bank deposits may be used by DTIs to issue more loans to borrowers/investors, resulting in an increase in DTIs' balance sheet assets, and more specifically their risk-weighted assets, which is paramount in the computation of these two financial stability measures.

The model iteration using the first difference of the financial stability measure, credit-to-GDP gap (DGAP) and GI resulted in DGAP having a lagged positive response to a shock on GI, increasing by 0.16 per cent in quarter two, post shock, and normalising after quarter three. As noted above, a GI surge would provide more funding in the economy, increasing DTIs' ability and willingness to issue loans. Therefore, this increase in credit available and issued would be reflected in an increase in the credit-to-GDP gap. Although positive credit-to-GDP gaps are favourable and indicative of a buoyant economy, there should be some caution, as too large a gap may be indicative of overheating in the financial cycle and unsustainable growth in credit markets. Notably, however, the relationship between the first difference of the credit-to-GDP gap and GI was insignificant based on the Student's t-distribution test.

There were two model iterations using the first difference of NPLs (DNPL) as the financial stability measure. Each model used as a measure private capital inflow, GI, and the first difference of remittances (DREM). The relationship between DNPL and GI was significant based on the Student's t-distribution test, while the relationship with DREM was insignificant. In the first iteration DNPL responded positively to a GI surge, increasing by approximately JM$ 0.1 billion which is less than the average DNPL for the series which was JM$ 0.3 billion. Conversely, DNPL had a negative to response to a shock on DREM, decreasing by approximately JM$ 0.4 billion when a DREM shock occurred. The positive response in NPLs when a GI surge occurs, although counterintuitive, could be reflective of the fact that banks tend to take on more risky customers in times of financial booms, which may result in an increase in NPLs as there is an increase in borrowers who are not creditworthy. This result highlights a key risk that may arise in financial boom events. While on the other hand, the reduction in NPLs when the economy experiences a

shock on DREM, is indicative of borrowers being better able to repay loans on time as result of the increase in funds and assets in the system.

6.0 Conclusion and Recommendation

In conclusion, the study set out to explore the impact, if any, that a capital inflow surge would have on Jamaica's financial stability indicators. Based on the results, inflow surges have a significant impact on financial stability indicators. Of note, a capital inflows transmission channel into the credit market in Jamaica was evident. This confirms a potentially strong positive relationship between capital inflows and credit growth, especially as it relates to loans and deposits. Therefore, this result solidifies the potential of increased risks or vulnerabilities to financial stability when a capital inflow surge occurs, and highlights the potential impact of a capital inflows stop or a capital flow reversal on the economy. Additionally, the presence of a shallow capital market, as well as, high levels of dollarization can exacerbate these risks. Caution must therefore be made not to fall into the trap of non-prudent behaviour when the economy is on the rise and there is a steady inflow of capital. Special attention to the importance of investor perception of the Jamaican economy, will also be critical going forward.

In order to mitigate these risks in a small open economy, macro-prudential policy measures may be applicable to Jamaica in the near future. These macro-prudential policies however, should be temporary - only implementing measures when necessary owing to the risk environment and the overheating of critical indicators such as credit and asset growth and the current account deficit. Furthermore, the effectiveness will depend on whether or not capital inflows primarily pass through the formal and regulated sections of the financial system. Jamaica could implement macro-prudential policies aimed at the pro-cyclicality in the financial system that often arise simultaneously with an inflow surge and lead to boom-bust events; for example, a CCyB, penalties for exceeding credit growth ceiling for DTIs, LTV limits, unremunerated reserve requirement and capital tax/surcharges. MPMs based on denomination of currency, whether local or foreign, may also play a role, for instance; limits on foreign currency loans as they restrict the exposure to a currency mismatch and to unhedged FX borrowers when there is surge in foreign currency inflows. Notably, there are some measures already in place in Jamaica that may be strengthened or given a

dual purpose to help minimise capital inflow risks such as the net open position limits on foreign currency for DTIs.

7.0 References

Amri, P. D., Richey, G. M. and Willet, T. D., 2016, Capital Surges and Credit Booms: How Tight is the Relationship?, Open Economies Review Vol. 27, pp. 637–670.

Baldwin, R. and Giavazzi, F. (eds.) (2015), The Eurozone Crisis: A Consensus View of the Causes and a Few Possible Rememdies, London CEPR Press.

Boren, E., 2016, Capital Flows and Non-Performing Loans: An Empirical Study of the European Debt Crisis, Lund University.

Buch, C. and Kuckulenz, A., 2010, Worker Remittances and Capital Flows to Developing Countries, International Migration Vol. 48(5) 2010, pp 89-117, International Organization for Migration

Caballero, J., 2016, Do Surges in International Capital Inflows Influence the Likelihood of Banking Crises?, Economic Journal 126(591), 281–316.

Calderon, C. and Kubota, M., 2012, Gross Inflows Gone Wild : Gross Capital Inflows, Credit Booms and Crises, Policy Research Working Paper No. 6270, World Bank.

Calvo, G., 1998, Capital Flows and Capital-Market Crises: The Simple Economics of Sudden Stops, University of Maryland, Journal of Applied Economics Vol. 1 No. 1, November 1998, pp. 35-54.

Calvo, S. and Reinhart, C.M., 1995, Capital Flows to Latin America: Is There Evidence of Contagion Effects?, Washington, DC : Institute for International Economics (1996).

Culha, A. A., 2006, A Structural VAR Analysis of the Determinants of Capital Flows into Turkey, Central Bank Review 2, pp. 11-35.

Darvas, Z., Huttl, P., Merler, S. and Walsh, T., 2015, Analysis of Developments in EU Capital Flows in the Global Context, Bruegel No. 2015.2574, European Commission.

Dornbusch, R., et al, 1995, Currency Crises and Collapses, Brookings Papers on Economic Activity 2, pp. 219-293.

ECLAC, 2017, Capital Flows to Latin America and the Caribbean; Recent Developments, ECLAC - Washington Office.

Engel, C., 2015, Macroprudential Policy in a World of High Capital Mobility: Policy Implications from an Acurrent account deficitemic Perspective, NBER Working Paper Series, Working Paper 20951, NBER.

Evans, O., Leone, A. M., Gill, M., et al, 2000, Macroprudential Indicators of Financial System Soundness, IMF Occasional Paper 192, IMF.

Fernandez-Arias, E. and Montiel, P. J., 1996, The Surge in Capital Inflows to Developing Countries: An Analytical Overview, The International Bank for Reconstruction and Development, The World Bank.

Gadanecz, B., and Jayaram, K., 2010, Measures of Financial Stability – a Review, IFC Bulletin No 31, BIS.

Gavin, Michael et al., 1997, The Macroeconomics of Capital Flows to Latin America: Experience and Policy Issues, Hausmann and Rojas-Suárez (Eds., 1996b), pp. 1–40.

Gavin, M. and Hausmann, R., 1996, The Roots of Banking Crises: The Macroeconomic Context, Hausmann and Rojas-Suárez (Eds., 1996a), pp. 27–63.

Ghosh, A., Ostry, J., and Qureshi, M., 2016, When do Capital Inflow Surges End in Tears?, American Economic Review Vol. 106 No. 5.

Hoggarth, G., Jung, C. and Reinhardt, D., 2016, Capital Inflows – the Good, the Bad and the Bubbly, Bank of England Financial Stability Paper No. 40 – October 2016.

Hoggarth, G., Mahadeva, L. and Martin, J., 2010, Understanding International Bank Capital Flows During the Recent Financial Crisis, Bank of England Financial Stability Paper No. 8 – September 2010, Bank of England.

IMF, 2017, Increasing Resilience to Large and Volatile Capital Flows – the Role of Macroprudential Policies, IMF Policy Paper, IMF.

IMF, 2012, The Liberalization and Management of Capital Flows: An Institutional View.

Isakova, A., 2016, Dealing with Capital Flows: the Role of Macroprudential Policy, Joint Vienna Institute.

Jara, A. and Tovar, C. E., 2008, Monetary and Financial Stability Implications of Capital Flows in Latin America and the Caribbean, BIS Papers No. 43, BIS.

Kaminsky, G., L., Reinhart, C. M., and Vegh, C. A., 2005, When it Rains, it Pours: Procyclical Capital Flows and Macroeconomic Policies, NBER.

Korap, L., 2010, Identification of Pull and Push Factors for Portfolio Flows: SVAR Evidence from the Turkish Economy, Dogus Universitesi Dergisi.

Korinek, A., 2007, Dollar Borrowing in Emerging Markets, Columbia University, New York.

Korinek, A., 2010, Hot Money and Serial Financial Crises, University of Maryland, 11th Jacques Polak Annual Research Conference November, 2010, IMF.

Kumar, R. R., 2013, Exploring the Nexus Between Capital Inflows and Growth in Latin America and the Caribbean: a Study of Clusters Led by Brazil and Mexico, University of the South Pacific, Springer Science + Business Media Dordrecht 2013.

Lane, P, 2003, Business Cycles and Macroeconomic Policy in Emerging Market Economies, Trinity College, Dublin. Mimeo.

Langrin, B. and Stennet, R., 2011, Capital Flows and Financial Instability: The Jamaican Experience, Bank of Jamaica Working Paper, Bank of Jamaica.

Montes, M. F., 1998, The Currency Crisis in Southeast Asia (Updated Edition), Singapore: Institute of Southeast Asian Studies.

Musacchio, A., 2012, Mexico's Financial Crisis of 1994-1995, Harvard Business School Working Paper No. 12-101, May 2012.

Ostry, J. D., Ghosh, A. R., Habermeier, K., et al, 2011, Managing Capital Inflows: What Tools to Use?, IMF.

Ostry, J. D., Ghosh, A. R., Habermeier, K., et al, 2010, Capital Inflows: The Role of Controls, IMF.

Pradhan, M., Balakrishnan, R., Baqir, R., et al, 2011, Policy Responses to Capital Flows in Emerging Markets, IMF.

Radelet, S. and Sachs, J., 1999, What Have We Learned, So Far, From the Asian Financial Crisis, Manuscript.

Ratha, D., 2007, Leveraging Remittances for Development, Global Economic Prospectus 2006: Economic Implications of Remittances and Migration, World Bank

Rochester, L., 2012, The Impact of Net Private Capital Flows on Foreign Exchange Market Pressures in Jamaica. Bank of Jamaica Working Paper, Bank of Jamaica.

Rodrik, D. and Velasco, A., 1999, Short-term capital flows, Annual Bank Conference on Development Economics, World Bank.

Sarno, L., and Taylor, M. P., 1996, Hot Money, Accounting Labels and the Permanence of Capital Flows to Developing Countries: an Empirical Investigation, Journal of Development Economics Vol. 59 (1999), pp. 337-364.

Spencer, S., 2017, Investigating the Drivers of Portfolio Inflows and Outflows for Jamaica, Bank of Jamaica Research Paper, Bank of Jamaica.

Talvi, E. and Végh, C.A., 2000, Tax Base Variability and Procyclical Fiscal Policy, NBER

Working Paper No. 7499 (2000), Journal of Development Economics.

Yap, J. T., 2009, The East Asian Financial Crisis: Causes, Impact and Policy Lessons, Asian Development Bank.

Ying, Y. H., and Kim, Y., 2001, An Empirical Analysis on Capital Flows: the Case of Korea and Mexico, Soutern Economic Journal Vol. 67 No. 4, pp. 954-968.

Zhang and Zoli, 2014, Macroprudential Policy and Capital Flow Measures in Asia: Use and Effectiveness, Regional Economic Outlook: Asia and Pacific.

8.0 Appendix

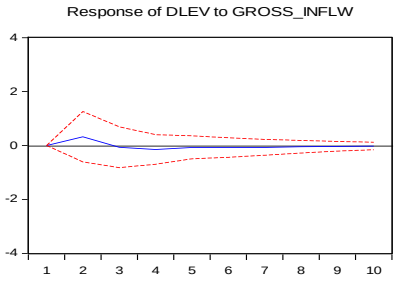
A.1 Unit Root Tests Results

	ADF	KPSS
NPLs	Non-Stationary	Non-Stationary
CAR	Non-Stationary	Non-Stationary
Leverage	Non-Stationary	Non-Stationary
Credit-to-GDP gap	Non-Stationary	Stationary**
Gross Private Inflows	Stationary*	Stationary**
Remittances	Non-Stationary	Non-Stationary
Net Private Inflows	Stationary**	Stationary**
Fed Funds Rate	Non-Stationary	Stationary**
US GDP Growth	Stationary**	Stationary**
VIX	Stationary**	Stationary**
Current Account Deficit	Stationary**	Stationary**
Exchange Rate	Non-Stationary	Non-Stationary
DTI Private Sector Quarterly Credit Growth	Stationary**	Stationary**
Domestic Interest Rate (90 day Treasury Bill Rate)	Non-Stationary	Non-Stationary
GDP Growth	Stationary*	Stationary**

Note: significant at 10% = *, significant at 5% = **, significant at 1% = ***

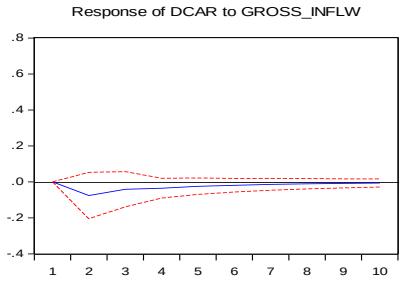
A.2

Response to Cholesky One S.D. Innovations ± 2 S.E.



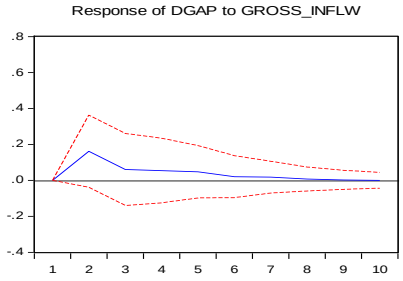
A.3

Response to Cholesky One S.D. Innovations ± 2 S.E.



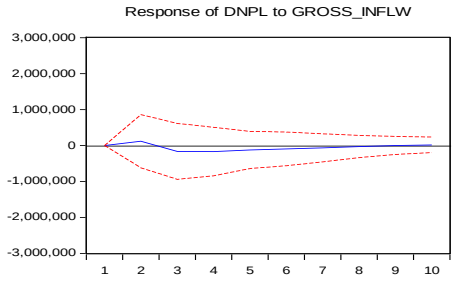
A.4

Response to Cholesky One S.D. Innovations ± 2 S.E.



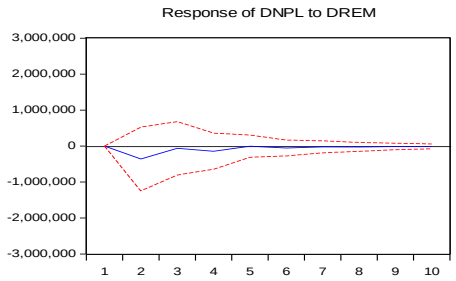
A.5

Response to Cholesky One S.D. Innovations ± 2 S.E.



A.6

Response to Cholesky One S.D. Innovations ± 2 S.E.



A.7

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 10/19/18 Time: 11:16
Sample: 2006Q2 2018Q1
Included observations: 35

Lags	LM-Stat	Prob
1	72.14317	0.2267
2	68.53290	0.3263

Probs from chi-square with 64 df.

A.8

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 10/19/18 Time: 11:17
Sample: 2006Q2 2018Q1
Included observations: 35

Lags	LM-Stat	Prob
1	63.52346	0.4933
2	86.47774	0.0322

Probs from chi-square with 64 df.

A.9

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 10/19/18 Time: 11:21
Sample: 2006Q2 2018Q1
Included observations: 35

Lags	LM-Stat	Prob
1	69.05460	0.3106
2	75.32679	0.1573

Probs from chi-square with 64 df.

A.10

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 10/19/18 Time: 11:25
Sample: 2006Q2 2018Q1
Included observations: 35

Lags	LM-Stat	Prob
1	66.64292	0.3862
2	80.16271	0.0836

Probs from chi-square with 64 df.

A.11

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 10/19/18 Time: 11:31
Sample: 2006Q2 2018Q1
Included observations: 35

Lags	LM-Stat	Prob
1	55.08271	0.7789
2	70.81433	0.2609

Probs from chi-square with 64 df.

A.12 Vector Autoregression Estimates

	D(Leverage)	D(CAR)	D(NPL)
D(Leverage)[-1]	-0.0834		
D(CAR)[-1]		0.2609	
D(NPL)[-1]			0.0676
Gross Inflows[-1]	0.0131**	-0.002*	9833.735**
D(Exchange Rate)[-1]	0.6872**	0.0416	507415.2**
Current Account Deficit[-1]	-0.0012	-0.0003	-1989.451
Credit Growth [-1]	-0.4648	-0.0106	-591495.1**
D(House Price to Income) [-1]	0.4164	0.1087	-375178.7
Domestic GDP Growth [-1]	0.5659*	-0.0254	-167309.1
D(TBILL)	-0.5716	-0.2395***	-171655.2
C	-5.0581	1.0518	-3814444
VIX	-0.0958	-0.0225	-44295.81
US GDP Growth	-0.1159	0.0146	-47019.31
D(Fed Fund Interest Rate)	4.0726	2.0943*	212501.0
R-squared	0.3614	0.5358	0.4067
Adjusted R-squared	0.0561	0.3138	0.123
Sum Sq. Residuals	134.6307	4.8084	6.73E+13
S.E. Equation	2.4194	0.4572	1710826
F-statistic	1.1835	2.4134	1.4334
Log Likelihood	-73.2386	-14.9258	-544.6524
Akaike AC	4.8708	1.5386	31.8087
Schwarz SC	5.404	2.0719	32.342
Mean Dependent	0.1002	-0.0173	212352.1
S.D. Dependent	2.4902	0.552	1826843
Determinant Residual Covariance (dof adj.)	1.07E+5	60850794	7.26E+20
Determinant Residual Covariance	37286914	2116141	253E+19
Log Likelihood	-702.4005	-652.1921	-1179.126
Akaike Information Criterion	45.6229	42.7538	72.8643
Schwarz Criterion	49.889	47.0199	77.1304

Note: significant at 10% = *, significant at 5% = **, significant at 1% = ***