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COULD MACROPRUDENTIAL INDICATORS HAVE HELPED PREDICT A FINANCIAL CRISIS IN JAMAICA? A CASE STUDY OF THE CREDIT-TO-GDP GAP.

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Abstract: Whereas it is difficult to predict financial crises in advance, research pinpoints some key indicators of imbalances in the financial sector. The BIS' credit-to-GDP gap, which is seen as a key indicator of financial imbalances and predictor of financial crises, is accordingly recommended to trigger the Basel III countercyclical capital buffer (CCB). In addition, as the use of macroprudential instruments has been growing since the global financial crisis, there remains a need for verification of their overall and relative effectiveness, and, our research (Davis et al (2017)) has shown some macroprudential instruments to be effective in reducing the gap. Meanwhile, it is evident with hindsight that the 1996-8 financial crisis in Jamaica did not happen overnight but as a precursor, imbalances built up over a period of time. As such, the research focus in this paper is the Jamaican credit-to-GDP gap, both in aggregate and for subsectors, as a predictor of financial crisis and the build-up of imbalances in the credit market especially just prior to the financial crisis in Jamaica circa 1996–1998. Also, the paper seeks to assess over the period 2000-2013 which macroprudential instruments were effective in reducing the gap in Jamaica. Our work is distinctive not only in its focus on a Caribbean country but also in that most extant work has focused on the impact of macroprudential policy on house price rises and bank or household credit growth rather than the wider credit aggregate incorporated in the gap. The research in this paper should provide background for Caribbean² countries considering adopting or currently developing a macroprudential policy framework.

Keywords: Macroprudential policy, credit-to-GDP gap, financial liberalisation, deregulation, early warning indicators.

JEL Classification: F42, G15, G21, G28

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² The Caribbean is defined as countries that are full members of Caribbean Community (CARICOM). Established in 1973, CARICOM is an organization of fifteen Caribbean countries and dependencies. These member countries are: Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago. See CARICOM website, <http://caricom.org/about-caricom/who-we-are/our-governance/members-and-associate-members/>.

1. Introduction.

It has been ten years since the global financial crisis and many international organisations (IMF, FSB, and BIS, etc.), regional economic institutions (ECB, ESRB, etc.)³ and researchers have been recommending to countries' financial system regulators and policy-makers to develop a macroprudential policy framework.⁴ Supporting this, there have been numerous empirical studies on the use and effectiveness of macroprudential policy and its instruments, since there are robust arguments for the use of macroprudential policy as an essential tool to forestall crises or at least offer a buffer to soften the impact of financial crises (such as Carreras et al (2018), Cerutti et al (2017), Akinci and Olmstead-Rumsey (2015), Claessens et al (2014), Dell'Ariccia et al (2012), Lim et al (2011), Davis and Karim (2009), etc.). Yet, there remains a need for verification of the impact of macroprudential policy overall and relative effectiveness of the different tools. In addition, the literature on macroprudential policy is far from complete and continues to evolve, especially in the area of how to incorporate it in a country's monetary policy and financial system regulatory policy frameworks.

Meanwhile, well before the subprime crisis⁵, Borio and Lowe (2002a and b, 2007) suggested that, although it is difficult to predict financial instability before it happens, there are some circumstances where it is appropriate for policymakers to respond to certain imbalances. They saw that historically a combination of sustained rapid growth in aggregate credit and asset prices can indicate an impending financial crisis and contended that the gap between the aggregate credit-to-GDP ratio and its trend is a key indicator of financial imbalances. Also, they suggested that while low and stable inflation can promote financial stability, it can increase the likelihood of a surge in aggregate credit and asset price growth rather than the demand for goods and services.

There has to date been rather little work on macroprudential instruments and the credit-to-GDP gap focused on Caribbean countries. Accordingly, it is considered an important exercise in the Caribbean context to focus on the aggregate BIS' credit-to-GDP gap⁶ and that of subsectors in Jamaica, and the build-up of imbalances in the credit market especially just prior to their financial crisis in the period 1996–1998. This is of particular relevance since Basel III⁷ has given the gap a prominent role as a signal for policymakers in identifying looming build-up of imbalances in the financial market and in setting the countercyclical capital buffers (CCB).^{8,9} Although there is a substantial body of work supportive of the

³ See References, IMF-FSB-BIS (2011a) and (2011b), IMF (2011a), ESRB (2011) and (2014a), etc.

⁴ Most Caribbean countries have not yet adopted such a framework.

⁵ This crisis occurred in the US subprime mortgage lending market in the period 2007-2010 and played a central role in the global financial crisis around the same period.

⁶ BCBS (2010), see BIS website, <https://www.bis.org/publ/bcbs187.htm>.

⁷ See BIS website, <https://www.bis.org/bcbs/basel3.htm>.

⁸ The countercyclical capital buffer aims to ensure that banking sector capital requirements take account of the macro-financial environment in which banks operate. Its primary objective is to use a buffer of capital to achieve the broader macroprudential goal of protecting the banking sector from periods of excess aggregate credit growth that have often been associated with the build-up of system-wide risk. See BIS website, <https://www.bis.org/bcbs/ccyb/>.

⁹ However, the gap measure should be complemented with other indicators (Bank of England (2014), a point acknowledged in the Basel III Accord guidance and in EU legislation.

relevance of the credit gap, it has been subjected to significant critiques and this is highlighted in the paper.

The purpose of this paper is hence, firstly, to analyse whether the credit-to-GDP gap could have helped to predict the financial crisis in Jamaica by focusing especially on the period just prior to the crisis circa 1996-1998. Secondly, we evaluate over the period 2000-2013, which macroprudential instruments were effective in reducing the gap as the use of macroprudential instruments has been growing since the global financial crisis. The dataset in Cerutti et al (2015, 2017) suggested that Jamaica used two macroprudential instruments, Leverage and Taxes, during the period 2000-2013. The paper adds to the macroprudential policy research literature on the Caribbean and provides a review of the credit-to-GDP gap in context of the Caribbean, using Jamaica as a case study, which include focus on the subsectors and total gaps, as well as assessment of effectiveness of macroprudential instruments reducing the gap.

The rest of the paper is structured as follows. Section two provides an overview of the changing financial landscape in Jamaica in the early 1990s as well as discussing the financial crisis in the period 1996-1998. The third section looks at the work related to prudential indicators, notably the BIS' credit-to-GDP gap and its usefulness as an early warning indicator (EWI), identification of financial imbalances that may lead on to financial crises. Sector four discusses whether macroprudential indicators, especially the credit-to-GDP gap could have helped to predict the financial crisis in Jamaica. The fifth section presents empirical results on whether macroprudential instruments employed were effective in reducing the gap, the build-up of imbalances in the financial system, over the period 2000-2013 in Jamaica. The sixth section discussed lessons learned for Caribbean countries adopting or currently developing a macroprudential policy framework. Section seven concludes.

2 Jamaica's changing financial landscape and financial crisis.

2.1 The 1970s macroeconomic challenges.

The 1970s was characterised as a period of great economic challenges and changes in the financial landscape after a long period when no major financial crises took place since the end of World War II. The Bretton Woods system of managed exchange rates came to an end and many major world currencies started to float from 1973.¹⁰ Inflation and unemployment were rising and the oil shocks in 1973 and 1979, added to the economic slowdown in many countries and rapid inflation. In Jamaica, it was a period of macroeconomic deterioration, with increasing inflation, a widening of current account deficits, falling commodity (bauxite) prices, increasing unemployment and pressure on the foreign exchange reserves (Lim (1991)). Also, the regulation of the financial sector in Jamaica was suggested to be repressive, that is there was government involvement in the operation and development of financial institutions,

¹⁰ The system dissolved between 1968 and 1973. In August 1971, U.S. President Richard Nixon announced the "temporary" suspension of the dollar's convertibility into gold. While the dollar had struggled throughout most of the 1960s within the parity established at Bretton Woods, this crisis marked the breakdown of the system. An attempt to revive the fixed exchange rates failed, and by March 1973 the major currencies began to float against each other. See IMF website, <https://www.imf.org/external/about/histend.htm>.

control on domestic credit and interest rates, a highly government-regulated financial market and control of entry into the market, etc (Kirkpatrick and Tennant (2002)).

By 1981, with the continue worsening macroeconomic environment, the Jamaican government initiated a Structural Adjustment programme with assistance from the World Bank (WB) and the International Monetary Fund (IMF). This consisted of a number of structural adjustment loans and policies geared toward economic reform in Jamaica, aimed at achieving import and financial liberalisation, separation of monetary and fiscal policies, fiscal and tax reforms, adjustments to the real exchange rate and reduced government expenditures and involvement and control of certain industries (privatisation), etc (Behrman and Deolakikar (1991), McBain (1997)).

2.2 Financial liberalisation and deregulation.

In Jamaica, as part of the trade and financial reforms programme¹¹, the first stage of financial liberalisation started in 1986 and the principal objective of the programme was the created of environment that is conducive to efficient financial intermediation and which strengthened the central bank's ability to influence money and credit variables (Lim (1991)).¹² Peart (1995) indicated that the major objectives of the financial reforms programme was, firstly, the separation of monetary and fiscal policies¹³. Secondly, the creation of a fiscal and institutional environment which would strengthen the capital market and thirdly, reform of the interest rate policies.

Kirkpatrick and Tennant (2002) noted that this first attempt at financial liberalisation involved the removal of credit controls, the privatisation of the National Commercial Bank and the phasing out of reserve requirement for commercial banks, etc. They noted, however, by 1989 following the destruction caused by Hurricane Gilbert¹⁴, the financial reforms programme was interrupted and some policies were reintroduced such as statutory reserve requirement and credit ceilings. This was on account of increased bank liquidity, caused by reinsurance inflows and increased government expenditure associated with the recovery efforts.

By 1991, Jamaica implemented the second stage of financial liberalisation and deregulation with the removal of the ceilings placed on banking system credit and control of credit expansion and announced the unification of the cash reserve and liquid assets ratio. The setting of savings rates was totally deregulated, with the commercial banks now being authorised to set their own rates as well as the foreign exchange system being liberalised.

¹¹ The programme of trade and financial reforms was implemented by the Government of Jamaica and financed by the World Bank under the Trade and Financial Sector Adjustment Loan programme. This form part of the broader programme of Structural Adjustment and macroeconomic stabilization.

¹² The first stage of financial liberalisation was between 1986 and 1988.

¹³ High statutory reserve requirements applicable to deposit-taking institutions and the use of the Central Bank overdraft facility, served as funding sources for the government to finance the fiscal deficits, which affected the central bank's independence.

¹⁴ Hurricane Gilbert was formed during the 1988 Atlantic hurricane season and it was the most destructive storm to hit Jamaica.

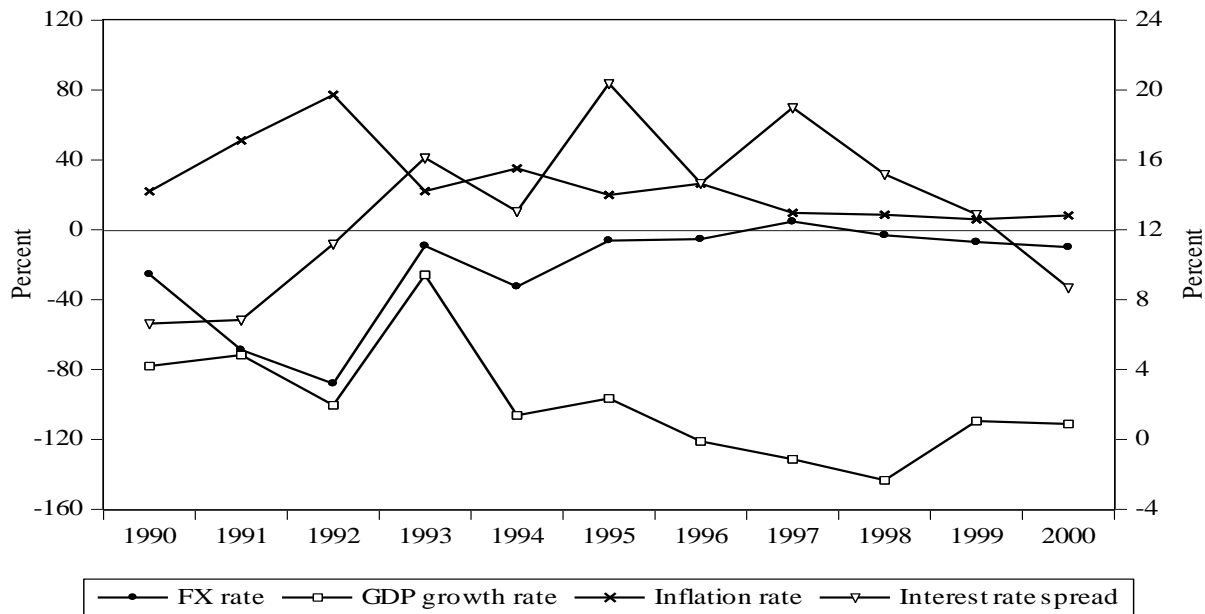
The government repealed the Exchange Control Act, which formally abolished capital account and foreign exchange controls in 1992 (Kirkpatrick and Tennant (2002)).

In addition, revisions in the financial legislation, which sought to update and strengthen the financial sector regulatory environment, were introduced (Bonnick 1998). These new measures included changes to the Bank of Jamaica (Amendment) Act, 1992, with provisions to make monetary policy more effective, regulate the management of foreign exchange and give statutory recognition to the Department of Bank Inspection. The Bank Act, 1992 and the Financial Institutions Act, 1992, provided for stricter prudential controls, provisioning for loan losses, and strengthening supervision and regulation and mechanisms for identifying and dealing with troubled institutions. Furthermore, the Financial Institutions Act, 1992, provided measures to regulate the operations of merchant banks and other near banks which take deposits from the public. However, while the legislation changes were necessary, the institutional framework took longer to develop.

2.3 The growth of the financial sector and growing risks.

Lim (1991) advised that the financial sector expansion in Jamaica on account of financial liberalisation must be viewed in the context of the prevailing macroeconomic environment, which at the time was characterised by high inflation, marginal GDP growth, high interest rates and a depreciating foreign exchange rate. He noted that high stock and real estate prices created by the high inflation environment provided expansionary opportunities for commercial banks through loans and via direct investment or acquisition of these assets. Chart 1 shows some macroeconomic variables for Jamaica over the period 1990 to 2000.

Chart 1 – Macroeconomic variables over the period 1990 – 2000.



Source: Bank of Jamaica, World Bank World Development Indicators Database and author calculation. Foreign exchange (FX) and inflation rates are on the left axis and GDP growth rate and interest rate spread are on the right axis. The FX rate is annual depreciation rate of one Jamaican dollar to one United States dollar.

Chart 1 above shows that there was a large increase in the inflation rate between the period 1990 and 1993, at the same time as there was a rapid depreciation of exchange rate for the Jamaica dollar to the US dollar, an annual decrease of approximately 60 percent in the period. There is a large increase in the GDP growth rate in 1993 which correspond to the rapid asset expansion of the financial sector especially in commercial banks credit (which is discussed further below). The interest rate spread¹⁵ widened during the period, reaching a high of 20 percent, which indicated increasing borrowing costs for borrowers.

With financial liberalisation in Jamaica, there was a rapid expansion of the assets of the financial sector, as in 1994, the financial sector's activities were equivalent to 16 percent of Jamaica Gross Domestic Product (GDP), up from 7 per cent in 1987. As well as the economic importance of the overall sector, the number, size and operations of deposit-taking institutions (DTIs) and non-deposit-taking financial institutions (NDTFIs) increased significantly. By 1995, the number of financial institutions had increased to 105 from 67 in 1989, with the majority of new institutions being building societies and merchant banks (Bonnick (1998)). This is also reflected in the rapid growth in commercial bank assets, especially in loans and advances¹⁶ and deposit liabilities, whereas there was an inflow of capital from abroad due to capital account liberalisation. By the end of 1995, the assets of the commercial banks represented about 175 percent of GDP, up from 75 percent at the end of 1991. Total commercial banks deposit liabilities accounted for 129 percent of GDP (1991: 26 percent). Meanwhile, there was a large increase in commercial banks foreign currency liabilities, 139 percent growth between 1991 and 1995, suggesting the inflow of capital from abroad.

Also, Kirkpatrick and Tennant (2002) indicated that the financial sector witnessed the growth of several financial conglomerates, linking insurance companies and commercial banks, therefore interrelated-party lending became pervasive. These new large financial conglomerates expanded aggressively, venturing not only into more innovative financial activities such as merchant banking and non-traditional financial services, in the form of commercial paper trading, etc., but also stretching beyond the boundaries of prudent financial practices into investment in real sector activities. They added that within these new large financial conglomerates, due to the interlocking nature of these so-called "One-Stop Financial Supermarkets", the risk of contagion was high, and the entire sector became vulnerable to financial instability.

Bonnick (1998) suggested that the emergence of these large financial conglomerates during the period, usually composed of commercial banks, merchant banks, credit unions, insurance companies etc., were mainly created to take advantage of the opportunities for minimizing the impact of regulation, supervision and taxations upon the group. Stennett et al. (1998) added that these large conglomerates often had complex structures of inter-company share holdings, interlocking boards of directors, common management and extensive inter-group transactions.

¹⁵ Interest rate spread is the interest rate charged by banks on loans to private sector customers minus the interest rate paid by commercial or similar banks for demand, time, or savings deposits.

¹⁶ Further analysis of the credit data will be undertaken in section 4.

It is clear that financial liberalisation and deregulation resulted in a sharp change in the financial landscape in Jamaica with the movement away from direct controls (removal of credit, foreign exchange, capital controls, etc.) toward a system of rules and a strengthened regulatory framework for monitoring and enforcing these rules. Yet, inherent risks were growing in the financial sector (Bonnick (1998)).

2.4 Macroeconomic policy changes and the financial crisis.

By 1994, the views of policy-makers changed as they decided that as a precondition for sustained economic growth, there needs to be a macroeconomic environment that is stable, predictable and favourable to long term investment (Stennett et al. 1998). Hence, policy-makers pursued tight demand management policies (high interest rates and reserve requirements) aimed at lowering the rate of inflation, stabilising the foreign exchange rate (see Chart 1) and dampening the demand for credit.¹⁷ These policies, notably high interest rates, had a harmful effect on borrowers' ability to repay loans and therefore contributed to the erosion in bank liquidity and solvency. Yet, Bonnick (1998) argued that foreign-owned and controlled institutions operating in the same environment fared much better, enjoying positive net income and returns on assets.

In 1995, problems started to appear in several financial institutions. Firstly, Century National Bank was provided with financial support (US\$112.8 million or about 4 percent of GDP) by the Bank of Jamaica (BOJ) and the term of reference of the Financial Institutions Services company, established to sort out the problems of Blaise Trust in 1994, was expanded to wind-up Century National Bank. By the first quarter of 1996, several insurance companies approached the Government of Jamaica for assistance in managing their liquidity problem, a mismatch of assets and liabilities. However, it was not a liquidity problem but a case of insolvency as these firms were over exposed to real estate investments which suffered a decrease in value. Also, it then became clear that many commercial banks, merchant banks and building societies in these large financial conglomerates were contaminated given the intercompany linkages with these insurance companies and they also approached the BOJ for support.

2.5 Managing and financing the cost of the crisis.

Of particular interest, the Government of Jamaica did not seek assistance or involvement of the IMF in managing the financial crisis because of the potential policies of the IMF, such as closing troubled institutions, raising interest rates and taxes and decreasing social spending, etc., which they felt may not have worked in the best interest of the financial sector and the country. Furthermore, after the Government met its outstanding loans repayment commitments to the IMF in the early 1990s, they decided to avoid any further engagements with the IMF (Kirkpatrick and Tennant (2002)).

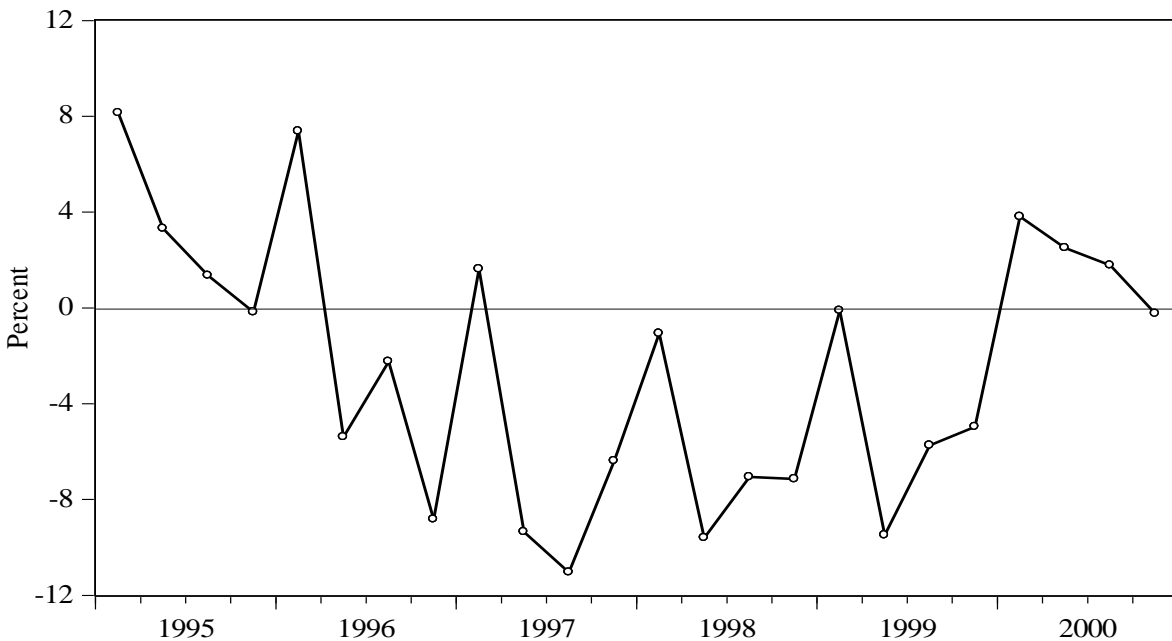
The approach adopted by the government was to, firstly, accept that a comprehensive (macroprudential) approach is needed to deal with the "*distressed*" institutions in the financial

¹⁷ Similar changes in the macroeconomic environment have been noted in advanced countries prior to the Latin American debt crisis in 1980s, the recession in the early 1990s and the subprime crisis in 2007/2008.

sector rather than doing it on an institution-by-institution basis (microprudential approach) (Bonnick (1998)). Secondly, Bonnick (1998) noted that the Government then created the Financial Sector Adjustment Company Limited (FINSAC), which subsequently assumed the operation of Financial Institutions Services company, to facilitate the resuscitation of the failed banks and to proceed with the restructuring and reorganisation of the financial sector. The extent of FINSAC intervention is reflected in the fact it had investments in over 150 companies such as banks, insurance companies, securities firms and hotels, etc.

Thirdly, to finance the cost of managing the crisis and to prevent further economic decline, the government engaged in short-term budget deficit financing as well as the BOJ providing liquidity support of an estimated US\$507.7 million, approximately 10 percent of GDP to commercial banks and affiliated insurance companies to meet the withdrawals demands by depositors (Bonnick (1998) and Kirkpatrick and Tennant (2002)). Chart 2 shows the government budget deficit or surplus as a percentage of GDP over the period 1995 to 2000. The government budget was allowed to move from surplus in 1995 to deficit during the crisis period of 1996 to 1998. In an effort of fiscal consolidation, measures aimed at strengthening tax administration, reduce current and capital expenditures, etc. were introduced in 1998-1999.

Chart 2 – Government of Jamaica Budget Deficit or Surplus to GDP.



Source: Bank of Jamaica, Ministry of Finance Debt Management Unit and author calculation.

Finally, regulatory weaknesses were identified as contributing factor to the financial crisis, and therefore FINSAC and Jamaica Ministry of Finance set up a committee to look at the regulatory framework. Special attention was paid to the strengthening of the Office of the Superintendent of Insurance, other regulatory agencies and banking institutions were required to take out deposit insurance in order to restore confidence in the financial sector. The Bank of Jamaica Act (1992), the Banking Act (1992) the Financial Institutions Act (1992) and the

Building Societies Act (1996) were amended in October 1997, giving the supervisory authorities more powers in respect of remedial and intervention actions. Some of the key regulatory changes in the 1997 amendments were.

1. Greater control and restrictions on related party lending and investment, prohibition of unsecured lending to connected parties and a more precise definition of non-performing loans was instituted.
2. There were specific regulations in respect of shareholdings, controlling interests, unsafe practices, termination of operations, amalgamations and transfers of assets as well as rules governing the licensing, capital and reserves and reporting requirements.
3. The computation of capital adequacy was made more stringent as banks were required to go above the Basel risk-based standard of eight per cent to ten per cent by December 1999.
4. Greater control was given to the supervisory authorities over changes in ownership and stricter definitions for 'fit and proper' managers, directors and financial institutions.
5. The amendments also specified the obligation and responsibility of banks' external auditors in the presentation of findings and reporting of problems and provided greater access to information by the regulators.
6. The Bank of Jamaica was given power to direct financial institutions to reverse transactions.
7. Legislation enabled the supervisory authority to request special audits as deemed necessary.

2.6 Summary of the financial crisis in Jamaica.

The fundamental causes of the Jamaican banking crisis have been discussed widely by researchers ((Bonnick (1998), Stennett et al (1998), Kirkpatrick and Tennant (2002), etc.) and the most commonly-cited causes for the financial crisis were (a) lack of proper financial sector governance; (b) ineffective and inadequate bank regulation and supervision; (c) domestic entrepreneurs' eagerness to get rich very quickly without the regards for the level of risks being undertaken; (d) poor quality managers being partly responsible for the management of these financial institutions; (e) changing stabilisation and macroeconomic policies of the BOJ and the government. However, Bonnick (1998) argued that foreign-owned and controlled financial institutions operating in the same environment using indigenous managers did not experience the same financial problems as with locally-owned or controlled institutions.

The evidence suggests that between 1993 and 1995, Jamaica was reaping the perceived benefits of financial liberalisation and deregulation. Yet, the strengthened regulatory framework and institutional development was not rigorous enough to prevent the financial crisis circa 1996-1998 as several vulnerabilities built up in the financial system as institutions ventured into riskier investments and there was an increase in moral hazard. Also, the Jamaican economy was facing economic headwinds both at home and abroad. Domestically, the economy was experiencing rising inflation and interest rates, a depreciating currency and slowing economic growth. Externally, in the early 1990s the fear of rising inflation in

advanced countries and consequent tightening of monetary policy (increases in interest rates) resulted in the end of the 1980s-economic boom (credit and assets prices prosperity) and a recession. Idiosyncratic shocks as such as the collapse of the Soviet Union, a spike in oil prices due to the Gulf War as well as the decline in borrowing played a role in lowering GDP growth (Davis (1995)).

Managing the financial crisis in Jamaica came with great expense to the government and the BOJ, which is estimated to cost about 10-15 percent of Jamaica's GDP. Yet, Hoggarth et al (2002) suggested that measuring the costs of financial crises are not in any way straightforward and most of the times there is a focus only on the fiscal cost of the crisis resolution. Costs should include as well as an assessment for the damages incurred to economy (Claessens et al (2012)). In Jamaica, the financial crisis resulted in a period of economic decline and a recession.

Before developing and outlining my empirical analysis on whether macroprudential indicators, notably the credit-to-GDP gap could have helped to predict the financial crisis in Jamaica and which instruments would have been most effective in closing the gap, I will provide a brief overview of empirical research on the credit-to-GDP gap as an early warning indicator.

3 Empirical research on the credit-to-GDP gap.

3.1 Early warning indicators.

Whereas it is difficult to predict financial crises in advance, Borio and Lowe (2002a and b, 2007) suggested that there are some circumstances where it is appropriate for policymakers to respond to financial imbalances. They saw that sustained rapid credit growth combined with large swings in assets prices have been precursors for many financial crises. It is evident with hindsight that the financial crisis in Jamaica did not happen overnight but as a precursor, financial imbalances built up over a period of time. The same can be said of the many financial and banking crises that have taken place throughout history (see Laeven and Valencia (2012)). Bordo (2000) noted that the frequency of financial crises has increased since 1973 since the end of the Bretton Woods period (1945 to 1971), and they show no sign of halting, despite the growing research on early warning indicators (EWIs) and on the reasons for crises.

As in the example of Jamaica, in a period of financial liberalisation and deregulation¹⁸, it is suggested that banking crises are more likely to occur in liberalised financial systems, although they may not be apparent immediately. Rather, they tend to appear a few years after the liberalisation process begins as the competition builds up, the market adjusts to the new environment and there is an appetite for greater risk taking with a lack of experience (Demirguc-Kunt and Detragiache (1998)). Also, Fry (1997) and Mehran and Laurens (1997) suggested rapid liberalisation in a country that lacked adequate prudential regulation and

¹⁸ Financial deregulation and excessive banks' lending also contributed to the banking crises and economic slowdown in Scandinavian countries in 1990-1991 (Sandel (2004)) and Japan 1991-1994 (Davis (1995)), etc.

supervision and whose enterprises and financial institutions lack experienced management could prove counterproductive to the liberalisation progress.

Davis and Karim (2008) saw that at the time, the practical use of early warning systems (EWSs) (early warning systems) by policy makers are limited, although with the changing nature of banking risks and ongoing financial liberalisation they are important for informing policies aimed at preventing crises. They noted as well, that an effective EWS, which highlights growing risks of a banking crisis, could facilitate policy action that could help head off a potential crisis or limit its effects (costs). Yet, for the EWS to be effective, they suggested that it is essential that the EWS gives advance warning as policy actions take time to be effective. This is a major drawback of some variables seen as EWS as advance warning is not always possible and the results may not be accurate and reliable, e.g. credit spreads to the global financial crisis. Davis and Karim (2009) preferred logit models which allow for multivariate signalling approach, as these models performed best, to signal extraction models.

3.2 Empirical tests of credit-to-GDP gaps as early warning indicators.

In their initial empirical test of early warning indicators using signal extraction techniques, Borio and Lowe (2002a, b) sought to determine whether the build-up of vulnerabilities can be spotted in time to take preventive action. They argued that large swings in asset prices and credit growth underlie many financial crises. In addition, while low and stable inflation promotes financial stability, it also increases the likelihood that excess demand pressures show up first in credit aggregates and asset prices, rather than in goods and services prices.

Borio and Lowe (2002b) suggested that a small set of variables should be sufficient to capture the build-up of vulnerabilities, because focusing on few variables can improve the reliability of indicators. As a result, they considered three core variables (indicators) that could contain useful information about the development of financial imbalances. The three variables were (1) credit-to-GDP; (2) equity prices (deflated by the price level); and (3) the real effective exchange rate. They suggested that in order to assess the build-up of imbalances or a boom, it is appropriate to employ a measure of the deviation (gap) of the variables (level) from its trend.

Therefore, the expectation is that if the credit-to-GDP gap, real equity prices and/or the real effective exchange rate move “sufficiently above” their trend (i.e. exceed some critical threshold), then financial imbalances are emerging, signalling the risk of subsequent financial distress. Tests were also performed on four different combinations of the variables, (1) credit and asset prices; (2) credit and the exchange rate; (3) credit and either asset prices or the exchange rate; and (4) credit and asset prices and the exchange rate. They noted that good early warning indicators have two important properties. These properties are, (1) the indicator should predict a high percentage of crises that do occur; and (2) the indicator should have a low false negative, meaning the indicator should not signal a crisis that does not materialise. The credit and exchange rate gaps tended on average to rise one period before and to peak in the crisis year, respectively. But the equity price gap was consistently positive until the crisis year yet peaks well before a crisis. The composite indicators performed well

also. Their empirical tests included 40 crises spread over 27 of the 34 countries, with 16 such episodes occurring in industrial countries and 24 in emerging market economies.

In an update to their earlier work, Drehmann and Juselius (2014) conducted empirical research on 10 indicators¹⁹ for 26 economies, covering quarterly time series starting in 1980, using criteria derived from the receiver operating characteristic (ROC) curve, (the ROC curve is a mapping of the false positive rate (Type II errors – a false signal of a crisis) to the true positive rate (the complement of Type I errors – signal of a crisis). They saw the area under the curve (AUC) as a summary measure. The credit-to-GDP gap performed well over long horizons and the debt service ratio is better in the shorter horizons.²⁰

Detken et al (2014) of the ESRB also found favourable results for the indicator properties of the credit-to-GDP gap in the EU-28. They found that in univariate signalling, the gap is the best single leading indicator for systemic banking crises associated with excessive credit growth. Meanwhile, multivariate analysis showed that when the gap is combined with other variables (such as debt service to income, the current account/GDP and real equity price growth) in a multivariate signalling approach, a discrete choice model or a decision tree, the overall signalling performance improves.

3.3 Critics of the credit-to-GDP gap.

In the light of these positive results, Basel III recommends to use the credit-to-GDP gap as a guide for setting the countercyclical capital buffer (CCB) (Basel Committee 2010a). Yet, it has faced criticism in context of its role as an early warning indicator in the countercyclical capital buffer framework and the identification of costly credit boom or banking crisis. Borgy et al (2014), of the Banque de France, for example, mentioned in their study of asset-price booms and banking crises, that existing macroprudential regulations may have given too strong a role to the credit-to-GDP gap ratio, as in their analysis it does not perform particularly well in the identification of costly asset-price booms or systemic banking crises relative to other indicators such as real interest rates and the real stock price.

Repullo and Saurina (2011) argued that the credit-to-GDP gap ratio could exacerbate the inherent procyclicality of risk-sensitive bank capital regulation. GDP growth is seen as a better indicator for these purposes. In addition, as the credit-to-GDP gap ratio corresponds to the deviation from a filtered trend, its real-time use depends mostly on the reliability of the end-of-sample estimates of credit and GDP. Some authors argue that subsequent revisions of macroeconomic statistics could be as large as the gap itself (Edge and Meisenzahl, 2011),

¹⁹ The 10 indicators were, the debt service ratio, credit growth, credit-to-GDP gap, non-core liabilities ratio, property price gap, property price growth, equity price gap, equity price growth, GDP growth and history (the total number of crises in a country between World War II and 2012).

²⁰ In recent related work, Grintzalis et al (2017) present estimates of finance-adjusted output gaps which incorporate the information on the domestic and global credit cycles for a sample of emerging market economies (EMEs), with a state-space representation of an HP filter augmented with a measure of the credit gap to estimate finance-adjusted output gaps. They measure the domestic and global credit gaps as the deviation of private-sector real credit growth and net capital flows to EMEs from long-term trends, using the asymmetric Band-Pass filter. They find financial cycle information is associated with cyclical movements in output.

which can raise concerns about the robustness of the credit-to-GDP gap if used as the sole indicator for CCB implementation.

Giese et al (2014) of the Bank of England, in looking at the performance of the credit-to-GDP gap in the UK, saw that it provided timely signals for policy tightening in past episodes of banking system distress. Yet, they were still cautious on performance of the gap in the future and they suggested complementary indicators such as household debt-to-income ratios, leverage ratio, etc. Similarly, Bennani et al (2014) saw that credit-to-GDP gap as well as real credit growth variables perform well in signalling a boom early in the case of France, but other indicators such as measures of property prices, of private sector debt sustainability or of bank balance sheets could also usefully complement the credit-to-GDP gap. As with the case of macroprudential policy, it is not a question of “one size fits all” and no single indicator can be used to identify asset-price booms and banking crises. As Bank of England (2014) suggested, it is therefore important to complement the credit-to-GDP gap measure with other indicators, a point acknowledged in the Basel III Accord guidance and in EU legislation.

Drehmann and Tsatsaronis (2014) from the BIS identified three areas of criticism of the credit-to-GDP gap. These areas are (i) the credit gap is not a good measure for setting the buffer, because it can lead to decisions that conflict with the countercyclical capital buffer (CCB) objective; (ii) the credit gap is not the best early warning indicator for banking crises, especially in the case of emerging market economies; and (iii) the credit gap has measurement problems.²¹ They acknowledged there are relevant measurement issues with the credit-to-GDP gap, particularly the starting point for the calculation and how to deal with structural breaks in the data series. Yet they suggested that the data should be properly adjusted to deal with structural breaks and the gap should be developed using at least ten years of data. Additionally, in their research, they saw that the credit-to-GDP gap performs better in providing policymakers with reliable signals about when to raise the buffer but this does not mean that the credit-to-GDP gap should solely be used, notably during a bust when more rapid release of buffers may be required. Indeed, Detken et al (2014) show that market-based indicators (such as overnight swaps or covered bond spreads) are the best indicators to be used to signal that the CCB should be reduced or released.

3.4 BIS’ credit-to-GDP gap.

As discussion above, the purpose of this paper is, firstly to analyse whether macroprudential indicators, notably the credit-to-GDP gap could have helped to predict the financial crisis in Jamaica in the period just prior to the crisis circa 1996-1998. Secondly, we seek to evaluate over the period 2000-2013, which macroprudential instruments were effective in reducing the gap as the use of macroprudential instruments has been growing since the global financial crisis. As an introduction, the following are some stylised facts on the BIS’ credit-to-GDP gap:

The credit-to-GDP gap (Gap_t) is defined as the difference between the credit-to-GDP ratio (c_t/y_t) and its long-term trend (t_t). The gap is calculated as follows.

²¹ BIS Quarterly Review (2014), March. See BIS website, https://www.bis.org/publ/qtrpdf/r_qt1403g.htm.

$$\text{Gap}_t = (c_t/y_t) - t_t \quad (1)$$

The measure of credit is a broad one of credit to the private, non-financial sector in the period, that is, it captures all sources of debt funds for the household and corporate sectors including funds raised abroad. Hence, it is a much broader measure of credit than is used in much of the work cited above, including credit to households and companies, from banks, money and bond markets as well as non-bank financial institutions. As such it would be less vulnerable to distortion by disintermediation and innovation than narrower measures such as bank credit (Detken et al 2014). Both variables, GDP and credit are in nominal terms and on a quarterly frequency. The ratio is calculated as follows.

$$\text{Credit-to-GDP ratio}_t = \text{credit}_t / \text{GDP}_t * 100\% \quad (2)$$

The trend t in the ratio is derived from using the Hodrick-Prescott (HP) filter.²² The HP filter is a mathematical tool used in macroeconomics to establish the trend of a variable over time. The HP filter is based on assumptions that the credit-to-GDP ratio: (c_t/y_t) can be decomposed into two components: the trend (t_t) and the cycle (c_t), which means $y_t = t_t + c_t$.

By using the Hodrick-Prescott (1997) technique, the BIS note that obtaining the trend involves solving the following optimisation problem:

$$\min_{\{g_t\}_{t=1}^T} \sum_{t=1}^T \left(\frac{c_t}{y_t} - t_t \right) + \lambda \sum_{t=1}^T (t_{t+1} - 2t_t + 2t_{t-1})^2 \quad (3)$$

where λ (lambda) is the smoothing parameter. The first term in the loss function penalises the variance of the cyclical component, while the second imposes a penalty on the lack of smoothness in the trend. Hence, the solution to the problem is a trade-off between the smoothness of the trend and how well it fits the original series.

There are three technical features that are important when calculating the BIS credit-to-GDP gap. Firstly, the trend (t_t) is calculated by means of a one-sided (backward-looking) filter. This means, the filter is run recursively for each period over an expanding sample. This is done to capture data constraints in day-to-day policymaking. Secondly, a larger smoothing parameter λ (lambda) of 400,000 is employed. It is assumed that the credit cycles are on average about four times longer than standard business cycles. Thirdly, the BIS credit-to-GDP gap required 10 years of data as the starting point for estimating the trend, which can have a measurement impact on the gap if there is a smaller data time series. The actual credit-to-GDP ratio is then compared to its long-term trend. If the credit-to-GDP ratio is significantly above its trend (that is, there is a large positive gap) then this is an indication that credit may have grown to excessive levels relative to GDP, implying financial imbalances.

²² See Hodrick and Prescott (1997).

In the Appendix, we show charts of the actual gaps in a number of countries over the period 2000-2016, as in September 2016, the BIS released time-series quarterly data on the credit-to-GDP gap covering 42 countries and one economic region²³, the Euro area, starting at the earliest in 1961. There were no Caribbean countries included, accordingly the paper provides a review of the credit-to-GDP gap in a Caribbean context, using Jamaica as a case study.

4 Analysis of the credit-to-GDP gap as a predictor of financial crises in Jamaica.

As discussed above, Borio and Lowe (2002a and b, 2007) indicated that financial crises do not happen overnight and as a forerunner, financial imbalances built up over a period of time. Furthermore, they suggested that certain financial imbalances such as sustained rapid credit growth combined with large swings in assets prices could be early warning indicators of impending financial crises. As also noted, Demirguc-Kunt and Detragiache (1998) suggested banking crises are more likely to occur in liberalised financial systems, it may not be apparent immediately but it tends to appear a few years after the liberalisation process begins as the competition builds up, the market adjusts to the new environment and there is an appetite for greater risk taking. Bonnicks (1998) noted with financial liberalisation in Jamaica during the period 1986-1993, there was a rapid asset expansion in the financial sector particularly in the credit markets prior to the financial crisis in 1996-1998. Therefore, before proceeding to discuss Jamaica's credit-to-GDP gap, I will review the financial conditions in the credit and housing markets.²⁴ The period of analysis, using quarterly data, will be from 1990q1 to 2014q4.

4.1 Credit and housing market conditions in Jamaica.

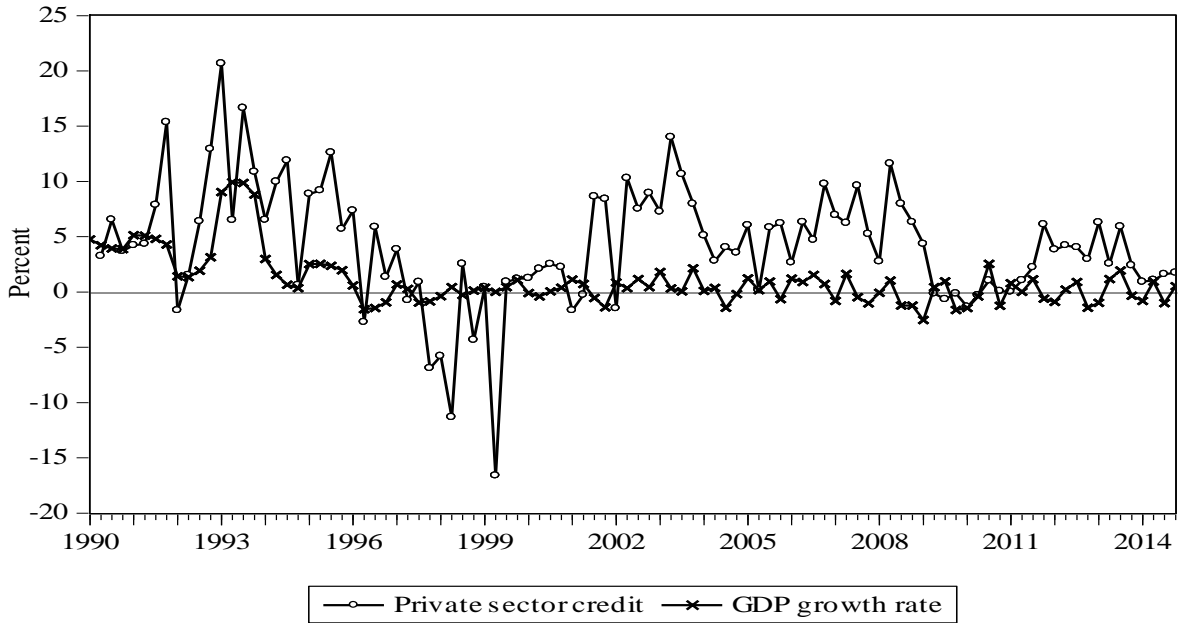
The following charts, using quarterly data, show the growth rates of various credit categories in Jamaica over the period 1990q1 to 2014q4. Chart 3 shows the growth rate of total private sector credit and GDP for the period under review. Total private sector credit equals total credit less credit to financial institutions and the public sector. There is increased growth in credit in the first half of the 1990s exceeding corresponding increases in GDP prior to the Jamaica financial sector crisis circa 1996-1998. The average rate of growth in total private sector credit during this period was 8 percent, with 1993 between the strongest year for growth, which averaged close to 14 percent. As expected there was a decline or slowing growth in total private sector credit during the crisis period (1996-1998), as in the second half of the decade, credit growth declined on average 2 percent from 1996 to 1999. As the BoJ and the Jamaican government introduced stability policies as a result of the financial sector crisis, there was a rebound in total private sector credit growth from 2002 to 2009 before the effects of the global financial crisis in 2007-2008 were felt²⁵, which is reflected in a slowdown of the domestic economy.

²³ BIS Quarterly Review pages 38-39, September, see https://www.bis.org/publ/qtrpdf/r_qt1609.pdf.

²⁴ Due to data limitation the focus of the analysis will be on the credit market as other indicators data such as sector leverage, debt-to-income ratio, capital adequacy ratio, etc., are not readily available for the period prior to the crisis.

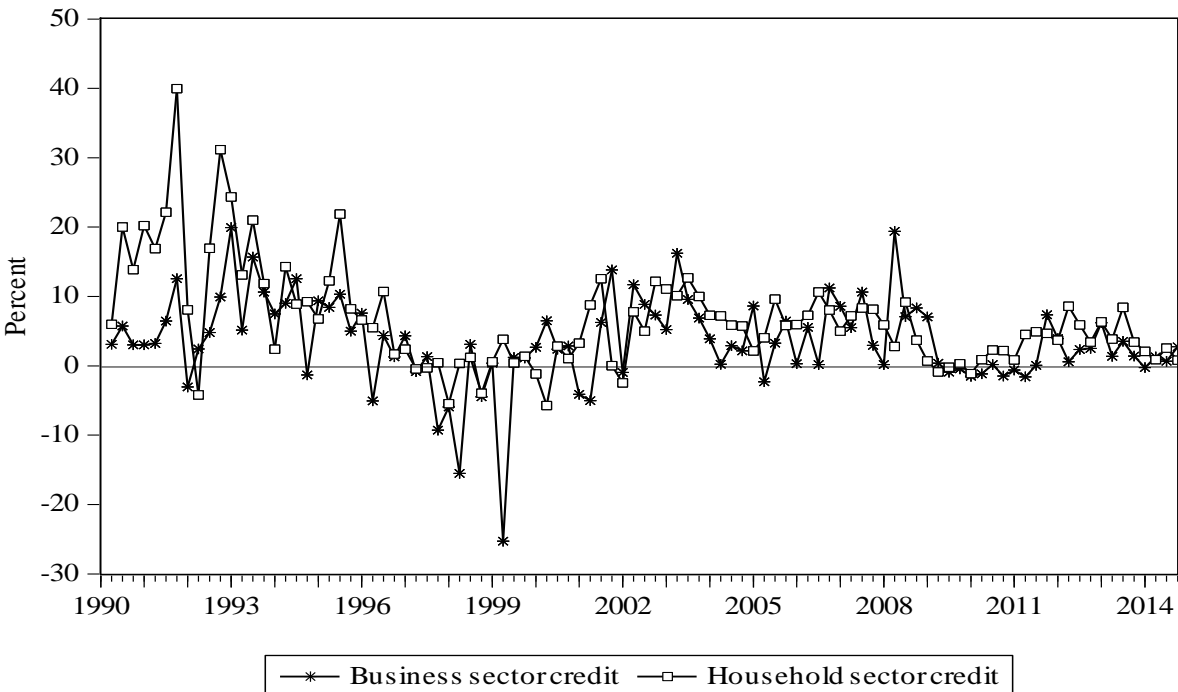
²⁵ In 2010, the IMF approves US\$1.27 billion loan to support Jamaica's plan to recover from government debt, weak economic growth and the effects of the global economic crisis. See IMF website, <https://www.imf.org/en/News/Articles/2015/09/28/04/53/sonew020410a>.

Chart 3 – Total private sector credit growth rate and real GDP growth rate.



Source: Bank of Jamaica, IMF International Financial Statistics and author calculation. Private sector credit is total private sector credit at market prices based on constant local currency. GDP growth rate is the quarterly percentage growth rate of GDP at market prices based on constant local currency.

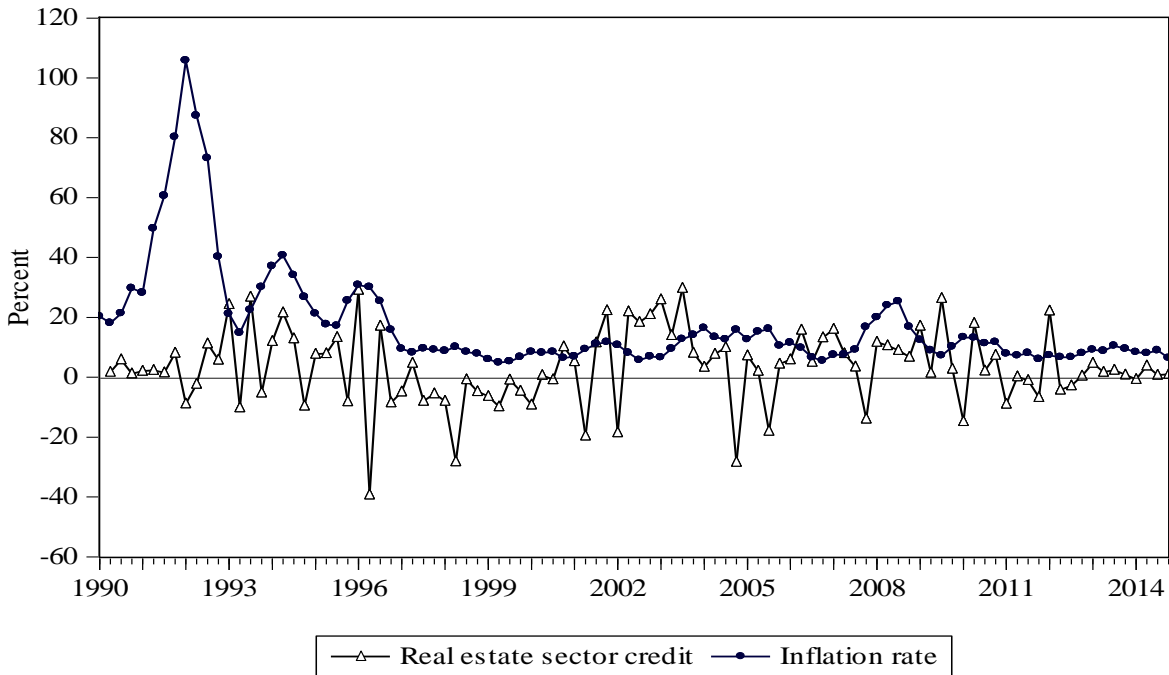
Chart 4 – Business and Household sectors credit growth rates.



Source: Bank of Jamaica, IMF International Financial Statistics and author calculation. Business and Household sectors credit are at market prices based on constant local currency.

Chart 4 above shows the growth rates of business and household sectors credit of the period under review. Both credit categories followed a similar growth pattern to total private sector credit over the period, yet most of the growth in total private sector credit happened in the business sector before declining as the contribution of household sector credit picked up. Kirkpatrick and Tennant (2002) noted with the growth of several financial conglomerates, linking insurance companies and commercial banks, interrelated-party lending became pervasive, which can be a reason for the large contribution of business credit to total private sector.

Chart 5 - Real estate sector credit growth rate and inflation rate.



Source: Bank of Jamaica, IMF International Financial Statistics and author calculation. Real estate sector credit is at market prices based on constant local currency. Real estate sector credit includes construction and land development loans.

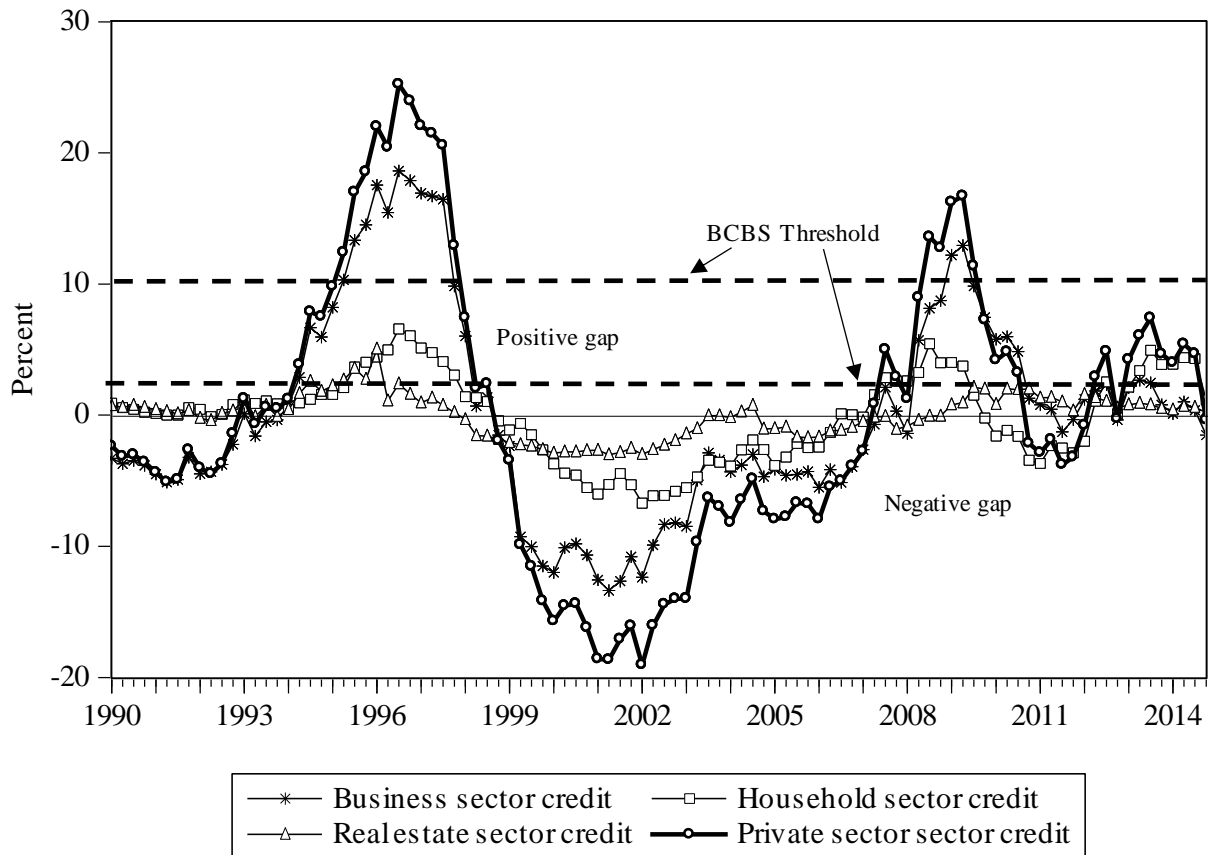
Chart 5 above shows the growth rate of real estate sector credit²⁶ and the rate of consumer price inflation over the period 1990-2014. There had been a gradual increase in the growth rate of real estate credit in Jamaica over the period. Prior to the financial sector crisis, in the period 1990-1995 the average growth rate was an estimated 5 percent. During the crisis period (1996-1998), as in the second half of the decade, the growth rate was negative 5 percent on average. There was a rebound in real estate sector credit growth in the 2000s and the average growth rate was estimated between 5 and 7 percent. The large increase in inflation during the period 1991 and 1993 may be due to the rapid depreciation in the foreign exchange rate for the Jamaica dollar, a decrease of approximately 77 percent over the period.

²⁶ Real estate sector credit includes construction and land development loans and hence includes liabilities of companies as well as households.

4.2 Jamaica's credit-to-GDP gap.

Against the background that Basel III has given the credit-to-GDP gap a prominent role in identifying looming build-up of imbalances in the financial market and in setting the countercyclical capital buffers, the focus of the gap in this paper to identify the build-up of financial market imbalances in Jamaica, and hence the effectiveness of the gap in the context of the financial crisis period. The gap for Jamaica is calculated using total private sector credit, which is total credit less credit to financial institutions and the public sector.²⁷ Large positive values in the gap can indicate excessive growth in total private sector credit relative to the growth in the economy. The lower and upper threshold of the gap as prescribed by the BCBS is 2 and 10 percentage points deviation from its trend.²⁸ GDP is gross domestic product at current prices. The gap is estimated by applying the one-sided (backward-looking) Hodrick-Prescott filter over the period 1990 to 2014 using quarterly data.

Chart 6 - Credit-to-GDP gaps for the period 1990-2014.



Source: Bank of Jamaica, IMF International Financial Statistics and author calculation. The lower and upper threshold of the gap as prescribed by the BCBS is 2 and 10 percentage. All the gaps are calculated in relation to its trend relative to their specific Hodrick-Prescott (HP) filter.

²⁷ The credit-to-GDP gaps in this paper should not be taken as representing the gaps published in the Financial Stability Reports for Jamaica.

²⁸ See BCBS (2010), see BIS website, <https://www.bis.org/publ/bcbs187.pdf>.

Chart 6 above shows the credit-to-GDP gaps for total private sector credit and the various credit subcategories.²⁹ The dotted lines show the BCBS percentage threshold of 2 and 10 percent that should trigger an early warning to policymakers about the potential build-up of financial sector imbalances and may warrant policymakers making a policy decision to reduce the imbalance. A positive gap indicates that credit growth may have grown to excessive levels relative to GDP growth in relation to its trend, implying financial imbalances and a negative gap suggests that credit growth has not grown in line with GDP growth and there is excess capacity in credit expansion. Also, the chart shows that there were two major periods where the total private sector gap deviated from its trend by more than 10 percent, the BCBS upper threshold. In the first period, 1995-1997, the total private sector credit gap deviated from its trend on average by 19 per cent, with it reaching a high of 25 percent in 1996q3. The build-up, where the gap deviated from its trend by 2 percent, the BCBS lower threshold, was first reached started in 1994q2.

The rapid expansion of financial sector credit especially to the business sector in Jamaica on account of financial liberalisation and deregulation, as discussed in section 2 above, is mostly responsible for the increase in the gap. Only business credit gap rose above the 10 percent threshold during the period, which shows the increasing influence of business credit in the total private sector credit gap, which suggest any potential financial sector imbalances most likely would happen in this sector. Household and real estate sectors credit gaps stayed within the lower and upper threshold during the period. In a second period of rapid credit growth, 2008-2009, there was a sharp increase in credit by an estimated 33 percent mostly to the business sector as the tourism industry was the primary recipient of credit lending. Investment in this industry accounted for the rapid increase in the private sector credit-to-GDP gap as well as the business sector gap. The private sector credit gap deviating from its trend on average of 14 percent and staying above the 10 percent threshold for 5 quarters between 2008 and 2009.

In comparing both periods, there was gradual increase in the gaps prior to the 1995-1997 period, as the financial sector imbalances built over 5 quarters before the 10 percent threshold was reached in 1995q2, while in the 2008-2009 period there was a sharp increase in the gaps over a quarter because of the large investment in the utility industry. This suggests that policymakers had some warning signs prior to the financial sector crisis in 1996-1998 but as suggested by critics of the credit-to-GDP gap, this may not always be the best early warning indicator for banking crises, especially in the case of emerging market economies on account of the time delays in the availability of the data and the slow response of the market to any new policy decision. In addition, by 1995 problems had already started to appear in several financial institutions in Jamaica, a financial sector crisis had taken roots and policymakers response was to stabilise the financial sector and limit overall cost of the crisis.

On account of the financial sector crisis circa 1996-1998, there was a long period of negative gaps from 1999 to 2007, which suggest that credit growth is not in line with their trends and GDP growth. Similarly, this can be seen in a number of countries after the global financial crisis in 2007/2008, see Appendix for countries credit-to-GDP gap.

²⁹ Statistical properties of the credit-to-GDP gaps are in the Appendix.

5 Baseline model for analysing the impact of macroprudential instruments.

5.1 Model specification.

The starting point for the empirical analysis of the effective of the macroprudential instruments on Jamaica credit-to-GDP gap is Davis et al (2017), who using quarterly data investigated macroprudential policies' effects on the credit-to-GDP gap using panel GMM specification. Also, important background is the work of Cerutti et al (2015, 2017), who looked at how the macroprudential index and its various sub-indexes, as shown in the Appendix relate to the growth in countries' credit and house prices. However, I use a simple Least Squares (LS) specification in this paper and the regression model used in the analysis is as follows.

$$PRIVSECGAP_{i,t} = \theta MaPP_{i,t-1} + \beta X_{i,t-1} + \varepsilon_{it} \quad (4)$$

where i denotes the country, t indicates time period. The dependant variable, $PRIVSECGAP_{i,t}$ denotes the quarterly private sector credit-to-GDP gap. The variable denoted by $MaPP$ is the macroprudential policy index, which captures the macroprudential effect on the credit-to-GDP gap from the beginning of the year they are actually in place and subsequently all quarters after that starting year until the period it is discontinued. I also include a vector of control variables, $X_{c,t}$.

The control variables used are as follows, real GDP growth rate (REALGDPGRW), inflation rate (INFLRATE), interest rate spread³⁰ (INTERSPRED), Government of Jamaica budgetary fiscal surplus/ deficit (FISCALGDP), unemployment rate (UNEMPLRATE), net foreign direct investments (FDIGDP) and personal remittances³¹ (REMGDP). FISCALGDP, FDIGDP and REMGDP were divided by GDP to normalise the data. The data for these variables are collected from the Bank of Jamaica, the IMF's International Financial Statistics and the World Bank's World Development Indicators. The control variables were tested for significance. The model estimation period is from 2000q1 to 2013q4.³² The model follows Davis et al (2017) but include net foreign direct investments, budgetary fiscal surplus/ deficit and personal remittances in order to capture specific effects in the Jamaican economy.

Peart (1995) suggested that prior to financial liberalisation in Jamaica, the entanglement of monetary and fiscal policies, which allow the financing of the fiscal deficit by using monetary policy instruments and through the commercial banking system served to restrict development and the availability of funds to the private sector. Also, Wilson (2012) examined the fiscal stimulus spending on job recreation in the USA. He saw that fiscal spending in the year tends to lead to higher job creation. Thus, with the separation of

³⁰ This is the difference between borrowing and lending rates of financial institutions (such as banks) in nominal terms.

³¹ Personal remittances comprise personal transfers and compensation of employees. Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from non-resident households. Compensation of employees refers to the income of border, seasonal, and other short-term workers who are employed in an economy where they are not resident and of residents employed by non-resident entities.

³² It is difficult to model the 1990-1999 period due to data limitation.

monetary and fiscal policy, which was an objective of financial liberalisation, the FISCALGDP variable is added to the model to examine the effect on private sector credit and the gap.

Craigwell (2006) saw that foreign direct investment (FDI) is an important contributor to economic growth and employment in the Caribbean as domestic saving is usually inadequate to meet local financing needs. As well, Wint et al (2005) examined the role of FDI in the stabilisation of financial sectors in Latin America and the Caribbean. They saw that FDI played an important role in assisting countries in the region emerging from financial sector crisis by improving prudential and operating standards. In addition, Wilson (2008) saw that Jamaica relies extensively on FDI to help spur economic growth as such FDIGDP variable is included in the model.

Ramocan (2010), using survey³³ data, saw that remittances are an essential source of financing for the household sector, which is used to supplement income. Stephenson and Wilsker (2016) using the Engel curve estimation approach and a two-part fractional response model, found that remittances have a significant effect on households' expenditure and the largest effects are in the areas of luxury purchases and home construction. In light of the important to the Jamaica household sector, REMGDP is included in the model.

Table 1: Control variables.³⁴

Variable	Source
Interest rate spread (INTERSPRED)	Bank of Jamaica
Real GDP growth rate (REALGDPGRW)	IMF International Financial Statistics
Inflation rate (INFLRATE)	Bank of Jamaica and IMF International Financial Statistics
Government Fiscal Surplus/ Deficit (FISCALGDP)	Bank of Jamaica
Net foreign direct investments (FDIGDP)	World Bank World Development Indicators
Personal remittances (REMGDP)	World Bank World Development Indicators
Unemployment rate (UNEMPLRATE)	IMF International Financial Statistics

Notes: The quarterly data for certain variables were derived by the author using linear interpolation method.

5.1.1 Macprudential instruments usage in Jamaica

Cerutti et al (2015, 2017), using the IMF's Global Macprudential Policy Instruments (GMPI) survey³⁵ database (2013-2014) describes the usage of macroprudential instruments and its effect on the credit and housing markets. The IMF dataset on macroprudential instruments cover 119 countries for the period 2000 to 2013.³⁶ Cerutti et al (2015, 2017)

³³ BOJ (2010), Remittances to Jamaica – Findings from a National Survey of Remittance Recipients.

³⁴ Statistical properties of the variables are in the Appendix.

³⁵ Analysis from the IMF Global Macro-Prudential Policy Instruments (GMPI) survey (2013-2014). The IMF surveys the central banks/national authorities of 125-member countries and the Central Bank of West African States (BCEAO) and respondents provided responses to more than 100 detailed questions on about 17 key macro-prudential policy tools.

³⁶ The survey covers 18 different instruments but the focus was on 12 specific instruments.

focused on 12 macroprudential survey instruments and 2 additional derived instruments and 3 groups summary instruments in the publicly available dataset.³⁷

The IMF database suggests that Jamaica used two macroprudential instruments³⁸ over the period 2000-2013. These instruments are leverage ratio and taxes. Leverage ratio limits banks from exceeding a fixed minimum leverage ratio, that is a how much capital comes in the form of debt and taxes is a levy on the revenues of financial institutions. These two instruments will be tested in the model for their effectiveness in lowering the credit-to-GDP gap for Jamaica. The tax was introduced in the 2002, while the leverage ratio was added in 2004. However, the reasons for using these instruments may not be macroprudential related.

The following is a table with the list of macroprudential instruments being tested in the model with two groups summary instruments.

Table 2: Macroprudential instruments dataset.

Macroprudential instruments	Abbreviation	Definition	Start date
<i>Survey Instruments</i>			
Leverage Ratio	LEV	Limits banks from exceeding a fixed minimum leverage ratio.	2004
Levy/Tax on Financial Institutions	TAX	Tax on revenues of financial institutions.	2002
<i>Groups of Instruments</i>			
Total macroprudential instruments used by the BoJ	MPIJ	Sum of LEV and TAX	2002

Source: Eugenio Cerutti, Stijn Claessens and Luc Laeven (2015) (Version February 24th, 2015) and author calculation. Notes: each variable is a dummy that takes on two values: 0 for no policy and 1 for policy in effect. The database covers a sample from 2000 to 2013 with annual data. The groups instruments are the aggregate of the survey instruments. MPIJ is a sum of LEV and TAX as such the start date will be 2002.

Reflecting the coverage of the dataset, the period for the analysis is from 2000q1 to 2013q4, with the IMF GMPI survey data being converted from yearly to quarterly data frequency. The measures were coded from the beginning of the year they are actually in place and subsequently all quarters after that starting year until the period they were discontinued. Quarterly data for the measures is the most appropriate approach since we are testing the macroprudential policies' effectiveness against the lowering of the credit-to-GDP gap, which is a quarterly measure, it is appropriate to have a quarterly frequency for the measures.

³⁷ See Appendix for the list of macroprudential instruments and its sub-indexes.

³⁸ See IMF GMPI database for the Caribbean countries that have used macroprudential instruments.

5.2 Baseline equation for Jamaica.

We undertook a simple least squares regression analysis to test the effectiveness of macroprudential policy instruments in closing the private sector credit-to-GDP gap in Jamaica. The sample begins in 2000q1 and ends in 2013q4. The independent variables were second lagged and the initial estimates for the baseline model are shown in the following table.

Table 3: Jamaica baseline model (Least squares estimated): Dependent variable Private Sector Credit-to-GDP gap (PRIVSECGAP).

Variables	Sample period estimate (2000q1-2013q4)
REALGDPGRW(-2)	-1.41** (-2.46)
FISCALGDP(-2)	-0.48*** (-6.06)
REMGDP(-2)	2.09*** (5.99)
FDIGDP(-2)	0.81** (2.66)
Constant	-42.00*** (-9.51)
Observations	54
R-squares	0.79
F-statistic (prob)	0.00

Notes: the coefficient values are reported and the t-statistics are reported in parenthesis below each estimated coefficient. *** significant at 1%, ** 5% and * 10%.

The control variables and model were tested using the t- and F- statistics and they show that REALGDPGRW, FISCALGDP, REMGDP and FDIGDP have significant effects on the private sector to credit-to-GDP gap. The baseline model coefficients' signs are correct and expected. Of particular, interest is the FISCALGDP and REMGDP variables. FISCALGDP variable measures government budget surplus or deficit, that is relationship between government fiscal expenditure and revenue collected. The FISCALGDP coefficient sign suggests that when there is fiscal deficit, this should have a positive effect on the gap and the opposite effect, a negative effect is expected when there is a fiscal surplus in the government budget.

REMGDP which measures remittances from non-residents (abroad) to resident (local) is a significant contributor to the economy in Jamaica. Remittances on average during the period account for 15 percent of GDP. As such, the positive coefficient sign suggests that as remittances increase, there is a positive effect on the gap and a negative effect on the gap is expected with a fall in remittances. The relative strong coefficient value suggests the important of remittances to the economy. A constant variable was added to the model, and its result suggests that when all the independent variables are zero, the dependent variable will be less than zero. This is expected as the means of the credit-to-GDP gaps over the

estimation period are negative³⁹ as well in looking at the graphical representation of the gap data (see above – Chart 6), during the period under review, the gaps values have mostly been negative (see Appendix for credit-to-GDP gap statistical measures).

5.3 Estimated results of the effectiveness of the macroprudential instruments.

The macroprudential instruments were tested one by one using the baseline model, and Table 4 outlines the results for each tool, entered one by one at the second lag, similar to the control variables.

Table 4: Macroprudential instruments results: Dependent variable Private sector credit-to-GDP gap (PRIVSECGAP).

Macroprudential instruments	Actual gap	Negative gap ⁴⁰
LEV(-2)	4.74 (1.60)	1.09 (0.58)
TAX(-2)	0.35 (0.01)	0.09 (0.05)
MPIJ(-2)	5.62* (1.81)	1.06 (0.60)

Note: For the macroprudential instruments definitions please see Table 2 and for baseline model estimates see Table 3. The instruments coefficient values are reported and the t-statistics are reported in parenthesis below each estimated coefficient. *** significant at 1%, ** significant at 5%, * significant at 10 %.

Overall the results suggest that the individual macroprudential instruments did not have a significant effect on the gap in Jamaica except for MPIJ, which has a positive and significant effect on the gap. The instruments are effective in reducing the gap when the coefficient sign is negative and significant. The instruments were then tested for the periods when there are positive and negative gaps. The model was unable to produce results for a positive gap due to the short data period, as over the period the gap has mostly been negative. The results for the negative gap show that the instruments have a positive effect on the gap, due to the positive coefficient signs but still insignificant. Davis et al (2017) suggested that macroprudential policy is more effective in reducing gaps during periods of positive gaps, as well Cerutti et al (2017) noted that these policies are effective but especially when there is an upturn in credit and house prices growth. In the case of Jamaica, this would require further analysis when there is an extended period of positive gaps.

5.4 Additional tests.

I ran robustness tests by examining the effectiveness of the instruments using sector specific credit-to-GDP gaps as the dependent variable for business credit, consumer credit and real

³⁹ Over the full period 1990-2014, the mean is zero.

⁴⁰ The model was unable to produce results for a positive gap due to the short data period.

estate credit⁴¹ (see Chart 5 for the credit-to-GDP gaps for business credit, consumer credit and real estate credit). Table 5 shows the baseline model for each sector.

Table 5: Baseline models for the subsector credit-to-GDP gaps.

Variables	Business sector credit-to-GDP gap	Consumer sector credit-to-GDP gap	Real estate sector credit-to-GDP gap
REALGDPGRW(-2)	-1.16** (-2.65)	-----	-0.26** (-2.09)
FISCALGDP(-2)	-0.30*** (-2.16)	-0.30*** (-8.26)	-----
REMGDP(-2)	1.48*** (5.57)	2.14*** (5.78)	0.49*** (7.58)
FDIGDP(-2)	0.46** (2.01)	1.06*** (6.31)	-0.25*** (-3.91)
INTERSPRED(-2)	-----	0.39** (2.15)	-----
INFLRATE(-2)	-----	-0.24*** (-3.67)	-----
UNEMPLRATE(-2)	-----	1.44*** (5.68)	-----
Constant	-28.80*** (-8.40)	-62.99*** (-7.94)	-6.07*** (-6.27)
Observations	54	45	54
R-squares	0.75	0.78	0.59
F-statistic (prob)	0.00	0.00	0.00

Notes: the coefficient values are reported and the t-statistics are reported in parenthesis below each estimated coefficient. *** significant at 1%, ** 5% and * 10%. ---- not applicable in the model.

Table 6 shows the macroprudential instruments results for the subsector credit-to-GDP gap.

Table 6: Macroprudential instruments results for subsector credit-to-GDP gaps.

Macroprudential instruments	Business sector credit-to-GDP gap	Consumer sector credit-to-GDP gap	Real estate sector credit-to-GDP gap
LEV(-2)	1.17 (0.51)	0.43 (0.26)	-0.59 (-0.88)
Tax(-2)	2.34 (0.89)	-----	1.48* (1.96)
MPIJ(-2)	3.29 (1.38)	0.43 (0.26)	0.55 (0.79)

Note: For the macroprudential instruments definitions please see Table 2 and for baseline model estimates see Table 5. The instruments coefficient values are reported and the t-statistics are reported in parenthesis below each estimated coefficient. *** significant at 1%, ** significant at 5%, * significant at 10%.

⁴¹ See Appendix for the statistical measures for the credit-to-GDP gaps.

Once again, the overall results suggest that the macroprudential instruments did not have a significant effect on the gap in Jamaica. TAX has a positive and has a significant effect on the real estate sector credit-to-GDP gap, yet the instruments are considered to be effective when they reduce financial sector imbalances, that is reducing a positive gap with the coefficient sign being negative and significant.

5.5 Summary of the results.

The objectives of the paper were to, firstly, analyse whether macroprudential indicators, notably the credit-to-GDP gap could have helped to predict the financial crisis in Jamaica, and secondly, to evaluate over the period 2000-2013, which macroprudential instruments were effective in reducing the gap. The results suggest that the credit-to-GDP is a potentially useful predictor of crises, as in the case of Jamaica. Also, the subsector gaps were useful in identifying the sector where there is greater potential for financial imbalances to most likely occur. Yet, as Giese et al (2014) suggested that other complementary indicators such as household debt-to-income ratios, leverage ratio, etc., should be used as well.

Jamaica's experience with macroprudential policy is insufficient to give a view of the effectiveness of its instruments in reducing the gap. The IMF GMPI database suggests that Jamaica used two macroprudential instruments over the period 2000-2013. The instruments were the leverage ratio and taxes. However, the motive for using these instruments may not have been for macroprudential reasons. Still, Davis et al (2017) results show macroprudential instruments are effective in reducing the gap in emerging market economies such as LTV, DTI, LEV and SIFI, etc.

6 Lessons learned for the Caribbean region.

In studying Jamaica's financial system development, its regulations and their experience in managing financial crisis and the most recent financial system disturbance in the Caribbean, the collapse of CL Financial Limited⁴², there are lessons the Caribbean can learn. Firstly, there is a well-established macroprudential policy framework in Jamaica, where policymakers have been given the legislative tools to assess financial system vulnerabilities in the financial system and to take corrective actions when required in the future. Currently, the legislative frameworks existing in many Caribbean countries may be inadequate for macroprudential policy and its tools, yet in the absence of legislation, countries can develop memorandum of understanding (MOU) between policymakers, setting out an operating framework and responsibilities.⁴³ Secondly, there is a need to address challenges of the availability of the appropriate data in a timely manner, information systems, and review current operating processes for the development of financial soundness and macroprudential indicators. The

⁴² In 2009, the collapse of CL Financial Limited (CLF), a Trinidad Tobago based conglomerate, represented the largest financial shock ever to hit Trinidad and Tobago and the Caribbean. CLF had a large presence in the Caribbean which created considerable systemic and contagion risks for the financial sector and the economy in region. The resolution costs of the collapse of CLF Limited is estimated to cost Trinidad and Tobago in excess of US\$3 billion or around 15% of GDP. The cost for the rest of the Caribbean region is difficult to assess. See IMF Country Report No. 11/74, Trinidad and Tobago: Selected Issues, March 2011, <https://www.imf.org/external/pubs/ft/scr/2011/cr1174.pdf>.

⁴³ In many instances financial legislative changes are not done in a timely manner in the Caribbean.

credit-to-GDP gap requires the use of quarterly data for credit and GDP and in some countries, quarterly data are not available.

Thirdly, policymakers need to address gaps in risk identification and assessment, disclosure and reporting. Jamaica has a well-established financial stability report (FSR), although it is only produced annually. There is a need to develop or improve on current FSRs in the region, which should contain substantial analysis of potential risks, macroprudential analysis, contagion and spill-over effects. The analysis should as well as include a Caribbean focus because there are financial firms in both the banking and insurance sectors that have large regional networks, emphasising the interconnectedness of the regional financial system. Ideally, it may be more useful especially in the larger Caribbean countries, if the FSR is produced semi-annually.

Fourthly, there needs to be an effective national crisis management and resolution frameworks as well as a regional framework because of the presence of cross-border financial institutions. There is a need to establish systems, process and clear line of responsibilities for any success in managing a crisis. In Jamaica, the experience from their financial crisis has shown that there needs to be close collaboration between policymakers in managing a crisis. The collapse of CL Financial has shown the difficulty in managing a regional financial system disturbance if the crisis management and resolution framework is inadequate as there was limited cross-border consultation and collaboration, etc.

Finally, the Caribbean region can explore whether there is a need for the formal establishment of a Caribbean Common Macroprudential Board (CCMB) similar to the ESRB⁴⁴, who will be responsible for macroprudential oversight in the region financial system and the prevention and mitigation of systemic risk. The most recent financial system disturbance, the collapse of CL Financial Limited, has shown that it would be beneficial for the Caribbean to develop macroprudential policy and tools that are specific for the Caribbean region, whose economies are structurally open and have heavy dependence on export earnings from either tourism-related services or primary commodities, thus vulnerable to external shocks.

7 Conclusion.

Although the literature and research are still developing, a number of countries' regulators, including Jamaica, have been given the legislative authority to formally develop a macroprudential policy framework as research has shown that it is useful in reducing financial sector imbalances. Specifically, Davis et al (2017) has shown macroprudential policy and its tools are effective in reducing the build-up of imbalances as measured by the credit-to-GDP gap. This paper adds to the literature as it focuses on the Caribbean region, where, to our knowledge, limited research has been completed.

The results suggest that Jamaica and more so the wider Caribbean experience with macroprudential policy is insufficient to give a view of its effectiveness, not least since the

⁴⁴ European Systemic Board is responsible for the macroprudential oversight of the European Union (EU) financial system and the prevention and mitigation of systemic risk. See ESRB website, <https://www.esrb.europa.eu/about/background/html/index.en.html>.

motive for using some of the instruments may not have been for macroprudential reasons. In this context, although there remains a need for verification of macroprudential policy overall and relative effectiveness, the Caribbean can benefit by developing and adopting macroprudential policy framework and its tools that are appropriate for each country situation and the region. It is important to note that the use of macroprudential policy can vary substantially among policymakers as a large number of macroprudential tools have been proposed and it is not a case where “one size fits all” (Darbar and Wu (2015)).

Finally, as regards further research, is there a need for certain large regional non-bank financial institutions especially large insurance conglomerates, who undertake deposit-taking activities to be treated as “commercial” banks where the more formal established banking regulation and macroprudential tools which can be used to assess their vulnerability. Currently, the focus of macroprudential policy has been mainly on imbalances emanating from the banking sector. Further assessment of macroprudential policies’ potential influence on non-bank financial institutions lending, money and bond markets, the commercial property sector, capital inflows, and regionally would be useful.

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9 Appendix

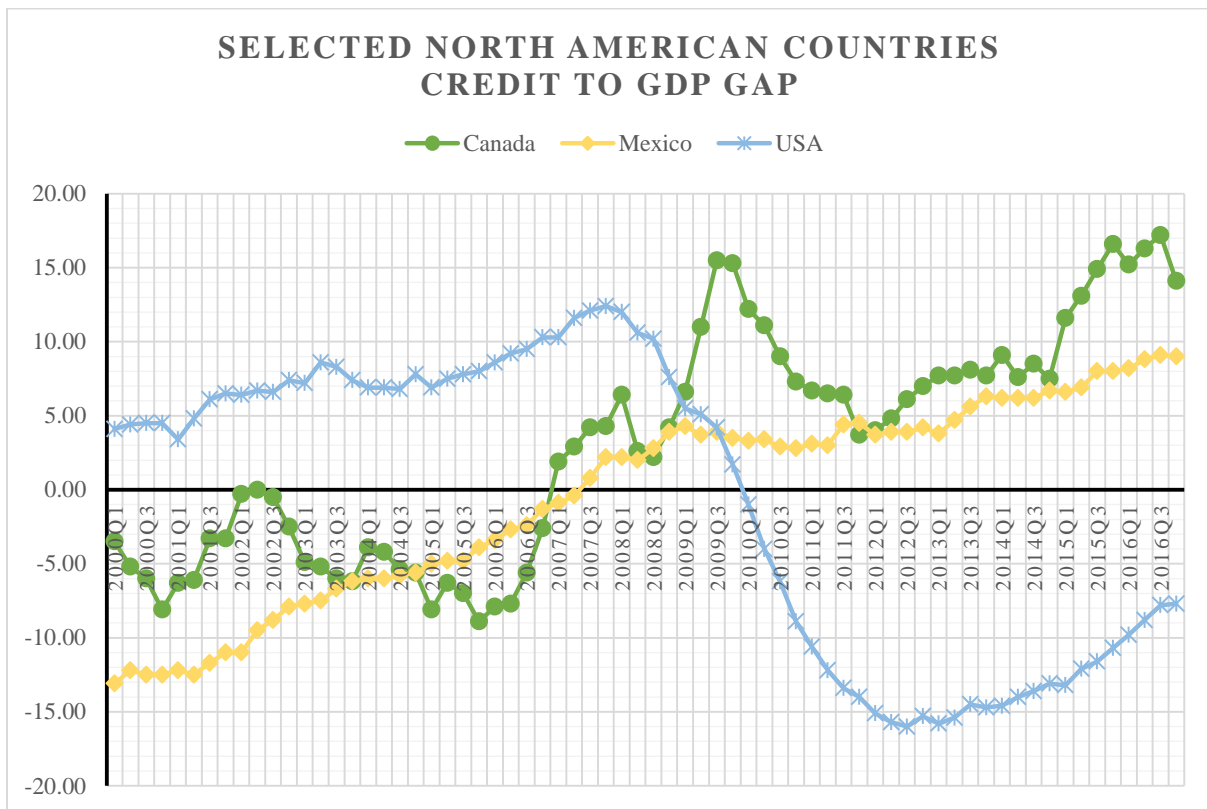
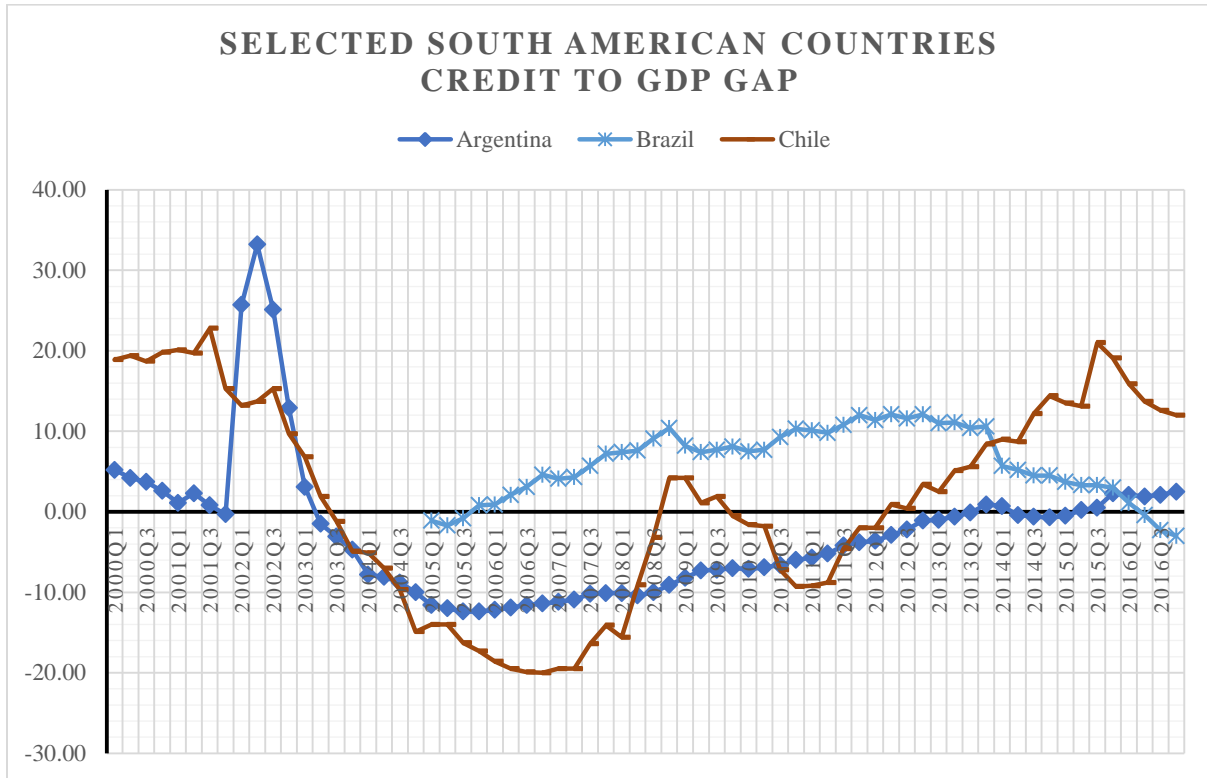
Table 1: Financial system in Jamaica with comparison to selected other Caribbean countries in 2016.

	Jamaica	Bahamas	Barbados	Trinidad and Tobago
Banks	6	8	5	8
Local	1	3	0	2
Foreign	5	5	6	6
Credit Unions	37	10	35	131
Insurance Companies	15	29	26	38
Other DTIs	35	10	13	22
Total	93	57	79	199

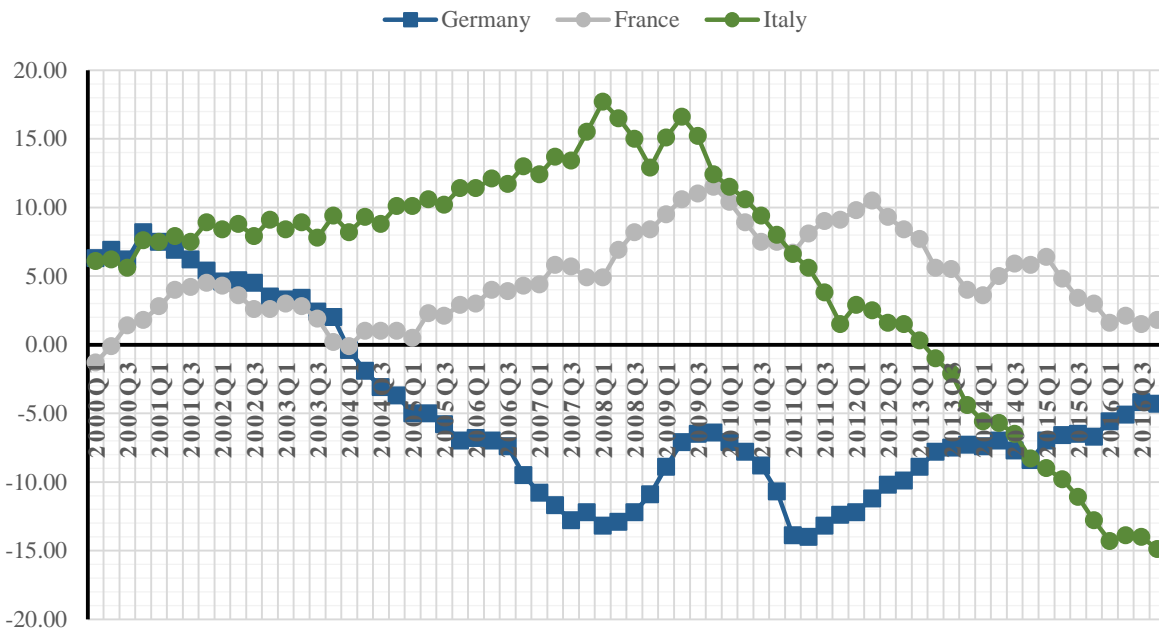
Source: CCMF (2015) and author calculation.

Note: The table does not include incorporate entities licensed to provide financial services to non-residents only such as off-shore banking entities.

Charts for BIS' Credit-to-GDP gaps over the period 2000-2016.



SELECTED EUROPEAN COUNTRIES CREDIT TO GDP GAP



SELECTED EUROPEAN COUNTRIES CREDIT TO GDP GAP

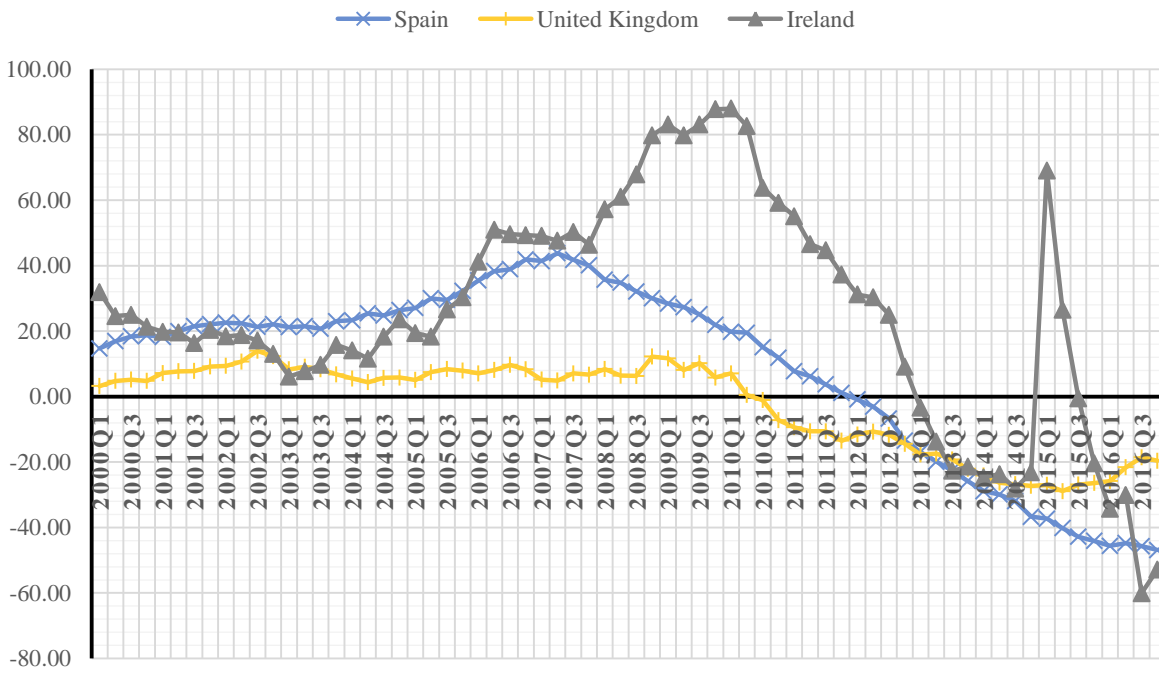


Table 2: The statistical properties of credit-to-GDP gaps over the period 2000-2013.

	Private sector Credit-to-GDP Gap	Business credit- to-GDP gap	Consumer credit-to-GDP gap	Real estate credit-to-GDP gap
Mean	-3.36	-1.95	-1.42	-0.43
Median	-3.83	-2.75	-2.24	-0.16
Maximum	16.70	12.95	5.43	2.12
Minimum	-19.05	-13.38	-6.70	-3.03
Std. Dev.	9.46	6.57	3.36	1.55
Observations	56	56	56	56

Table 3: The statistical properties of model variables over the period 2000-2013.

	Net FDI to GDP	Personal Remitt- ances to GDP	Interest Rate Spread	Unemp- loyment rate	Real GDP Growth Rate	Inflation Rate	Gov't Fiscal Surplus/ Deficit to GDP
Mean	5.11	14.41	15.82	12.13	0.15	10.75	-12.40
Median	5.55	15.19	16.41	12.00	0.19	9.48	-10.05
Max.	10.06	16.55	18.77	16.30	2.54	25.30	0.045
Min.	1.20	9.01	10.98	8.90	-2.53	5.49	-36.34
Std. Dev.	2.11	2.08	2.00	1.72	1.09	4.29	9.46
Obsers.	56	56	56	47	56	56	56

Table 4: IMF macroprudential instruments dataset.

Instrument	Abbreviation	Definition
<i>Survey Instruments</i>		
Loan-to-Value Ratio	LTV	Constrains highly levered mortgage down payments by enforcing or encouraging a limit or by determining regulatory risk weights.
Debt-to-Income Ratio	DTI	Constrains household indebtedness by enforcing or encouraging a limit.
Time-Varying/Dynamic Loan-Loss Provisioning	DP	Requires banks to hold more loan-loss provisions during upturns.

General Countercyclical Capital Buffer/Requirement	CTC	Requires banks to hold more capital during upturns.
Leverage Ratio	LEV	Limits banks from exceeding a fixed minimum leverage ratio.
Capital Surcharges on SIFIs	SIFI	Requires Systemically Important Financial Institutions to hold a higher capital level than other financial institutions.
Limits on Interbank Exposures	INTER	Limits the fraction of liabilities held by the banking sector or by individual banks.
Concentration Limits	CONC	Limits the fraction of assets held by a limited number of borrowers.
Limits on Foreign Currency Loans	FC	Reduces vulnerability to foreign-currency risks.
Reserve Requirement Ratios	RR	Limits credit growth; can also be targeted to limit foreign-currency credit growth.
Limits on Domestic Currency Loans	CG	Limits credit growth directly.
Levy/Tax on Financial Institutions	TAX	Tax on revenues of financial institutions.
<i>Derived Instruments</i>		
Loan-to-Value Ratio Caps	LTV_CAP	Restricts to LTV used as a strictly enforced cap on new loans, as opposed to a supervisory guideline or merely a determinant of risk weights.
FX and/or Countercyclical Reserve Requirements	RR_REV	Restricts to RR which i) imposes a wedge of on foreign currency deposits or ii) is adjusted countercyclically
<i>Groups of Instruments</i>		
Total macroprudential instruments	MPI	Sum of MPIF and MPIB
Macroprudential instruments focused on the borrower	MPIB	Sum of LTV_CAP and DTI
Macroprudential instruments focused on the financial institution	MPIF	Sum of other instruments, including RR_REV rather than RR (DP + CTC + LEV + SIFI + INTER + CONC + FC + RR_REV + CG + TAX)

Source: Eugenio Cerutti, Stijn Claessens and Luc Laeven (2015) (Version February 24th, 2015) and author extension. Notes: each variable is a dummy that takes on two values: 0 for no policy and 1 for policy in effect. The database covers a sample from 2000 to 2013 with annual data. The groups instruments are the aggregate of the survey instruments.