



Financial Stability Report 2016

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Abbreviations

ABM	Automated Banking Machine	JDX	Jamaica Debt Exchange
ACH	Automated Clearing House	JSE	Jamaica Stock Exchange
AFSI	Aggregate Financial Stability Index	LSCRI	Large-Value System Concentration Risk Index
BOJ	Bank of Jamaica	MaFI	Macro-Financial Index
BPS	Basis Points	MCCSR	Minimum Continuing Capital and Surplus Requirements
CAR	Capital Adequacy Ratio	MCT	Minimum Capital Test
CD	Certificate of Deposit	MiPI	Micro-Prudential Index
CIS	Collective Investment Schemes	NDTFI	Non-Deposit-Taking Financial Institution
CISS	Composite Indicator of Systemic Stress	NDX	National Debt Exchange
CRE	Credit Risk Exposure	NIR	Net International Reserves
CSD	Central Securities Depository	NOP	Net Open Position
D-SIB	Domestic Systemically Important Bank	NPL	Non-Performing Loan
DTI	Deposit-Taking Institution	POS	Point-of-Sale
DVBP	Dollar Value of a Basis Point	RAI	Risk Appetite Index
FIA	Licensee under the Financial Institutions Act	REER	Real Effective Exchange Rate
FSC	Financial Services Commission	ROA	Return on Asset
FSI	Financial Soundness Index	ROE	Return of Equity
FSR	Fiscal Stability Ratio	RTGS	Real-Time Gross Settlement System
FUM	Funds Under Management	RWA	Risk-Weighted Assets
GDP	Gross Domestic Product	SD	Securities Dealer
GOJ	Government of Jamaica	SIFI	Systemically Important Financial Institution
GWP	Gross Written Premium	VIX	Volatility Index
HHI	Herfindahl-Hirschman Index		
IC	Insurance Company		

Preface

The maintenance of financial stability by the Bank of Jamaica (BOJ) primarily concerns the safeguard of conditions which ensure the proper and efficient functioning of the financial system and, consequently, the promotion of real economic activity. The financial system consists directly of three basic financial components: institutions, markets and infrastructure.¹ These components interact with each other as well as with other indirect participants in the system – such as households, nonfinancial corporations and the public sector – to allocate economic resources and redistribute financial risks.

Aside from the supervision of deposit-taking institutions, the BOJ is charged with the responsibility of ensuring that the overall financial system is robust to shocks and that participants are assured of its robustness. This entails making sure that financial institutions, in particular banks, are sound. The maintenance of financial stability by the Bank also involves overseeing the efficient and smooth determination of asset prices, making certain that participants are able to honour promises to settle market transactions and preventing the emergence of systemic settlement risk arising from various financial imbalances that may develop within individual institutions or the system.

The Financial Stability Report 2016 provides an assessment of the main financial developments, trends and vulnerabilities influencing the stability of Jamaica's financial system during the year. The Report covers:

- i) an overall assessment of financial stability;
- ii) macro-financial risks;
- iii) financial system developments;
- iv) financial system sectoral exposures;

- v) risk assessment of the financial system; and
- vi) payment system developments.

Comments and suggestions from readers are welcomed. Please email your feedback on this report to library@boj.org.jm.

¹ Financial institutions include inter alia banks, securities dealers and insurance companies. Financial markets include inter alia foreign exchange, money and capital markets. Financial market infrastructure refers to payment and securities settlement systems.

1. Financial Stability Overview

The financial system in 2016 was characterized by balance sheet expansion which was supported by a stable macroeconomic environment. The expansion reflected strong credit growth which contributed to increasing debt burdens of households and corporates. Stability concerns were also rooted in the continued trend of financial system dollarization and the estimated reduced resilience to interest rate shocks by both the deposit-taking institutions (DTIs) and securities dealers (SDs) sectors.

For the review year, the Jamaican economy demonstrated sustained macroeconomic stability reflected by improvements in GDP growth, low and stable inflation, a reduced current account deficit and the accumulation of net international reserves.

Supported by this sound economic performance the financial sector deepened. The balance sheets of both deposit-taking and non-deposit taking financial institutions (NDTFIs) showed strong rates of growth over the year. Banks' loan portfolios showed reduced concentration with personal loans still accounting for the largest share of issued credit. The local currency lending and deposit rate spread also narrowed over the year reflecting a move towards increased banking sector efficiency.

Despite the strong growth in loans and advances, credit growth is not yet at the point that warrants consideration for counter-cyclical macro-prudential policies. The growth in credit is however increasing the financial system vulnerabilities that emanate from increased corporate sector and household debt. As a result of credit expansion, the debt servicing capacity of both sectors deteriorated for 2016.

The trend of financial dollarization also embodied financial system stability concerns. Foreign currency deposit liabilities and foreign currency investment holdings continued to trend upwards. Given the heightened levels of financial dollarization for DTIs and SDs, the financial sector was more exposed to risks associated with currency mismatch risk and credit risk from currency lending to un-hedged borrowers.

Portfolio duration gaps increased for both DTIs and SDs over the review year. Notably the portfolio duration gap of SDs exceeded that of DTIs by 3 times. The increased net portfolio duration of SDs' was largely reflective of longer asset portfolio duration, but were also driven to a lesser extent by shorter liability portfolio durations.

Despite these potential areas of vulnerability the BOJ's stress testing assessments in 2016 show that the financial system remains robust to hypothetical but plausible shocks. This resilience was due to strong capital positions for DTIs and NDTFIs as well as improvements in DTIs' loan quality.

Macro-Financial Environment

Despite a downturn in global growth that reflected economic challenges across several advanced and emerging economies, domestic economic conditions showed a stable macro-financial environment and reversion to expansion of the financial cycle.

The Jamaican economy grew at a faster pace in 2016 compared to 2015. Economic growth was accompanied by growth in DTI loans, advances and discounts loans of 16.8 per cent, approximately twice the growth rate in 2015.

The performance in credit was partly driven by the lower cost of capital. The BOJ reduced interest rates on both its benchmark 30-day Certificates of Deposit and the Standing Liquidity Facility by 25 bps in the review year. In addition, the weighted average lending rates on commercial loans fell by 73 bps at end-2016 relative to end-2015. Furthermore, the weighted average yields on GOJ Treasury bills generally declined during the year.

Despite significant credit expansion, the BOJ's assessment of stability risks due to excessive credit growth showed that the observed trends demonstrate a reversion to an expansionary financial cycle but remains at a level below systemic concern.

The macro-financial environment was also characterized by continued dollarization in part influenced by depreciation in the value of the Jamaica Dollar relative to its US Dollar predominantly due to investor demand for foreign currency denominated instruments.

Financial System Developments

The financial system showed significant balance sheet growth for 2016 in which total assets of the DTI sector, including credit unions, increased by 14.3 per cent. Securities dealers, general insurance companies and life insurance companies showed similar annual asset growth of 8.4 per cent, 8.5 per cent and 11.8 per cent, respectively, at end-September 2016 relative to end-2015.

Balance sheet expansion coupled with improved asset quality, reflected by contracting stock of non-performing loans, helped to increase the profitability of the DTI sector in 2016. Asset quality for the system improved significantly during the year, as the stock of non-performing

loans contracted by 16.8 per cent or \$3.7 billion to \$18.4 billion, similar to the reduction of 11.6 per cent or \$2.9 billion in 2015.

The sector's return on equity increased by 5.3 percentage points to 18.0 per cent for the year in which non-interest income was the most significant contributor to the increase in revenue. The SDs showed marginal improvement in profitability. For the calendar year to September 2016, SDs reflected a ROE of 11.4 per cent compared 11.3 per cent for the calendar year to September 2015.

Financial system dollarization continued for both DTI and SD sectors. The annual growth in foreign currency denominated assets of 15.1 per cent or US\$618.9 million compared to 5.6 per cent during 2015. The increase in foreign currency assets was concentrated in loans and advances of US\$281.1 million, cash and placements of US\$187.7 million and investments of US\$136.5 million (primarily instruments issued by the Government of Jamaica and new reverse repurchase transactions). Similarly, foreign currency denominated liabilities expanded by 17.2 per cent or US\$674.3 million compared to 10.6 per cent in 2015 resulting in an increase in the average share of DTIs' foreign currency deposits to total deposits to 47.0 per cent for 2016 relative to 45.0 per cent for 2015.

Financial System Exposures

Against the background of government crowding-in, DTIs and NDTFIs recorded lower exposures to sovereign debt for 2016 relative to 2015, increased exposures to the corporate sector and private sector debt while exposure to households remained relatively unchanged. At end-September 2016, the pension industry continued to have the highest exposure to investments in Governments securities, relative to other investment classes.

In terms of financial system interconnectedness, an assessment of bilateral balance sheet exposures at end-September 2016, showed that building societies continued to have significant gross credit exposures to the SDs and commercial bank sectors. As a result, building societies showed increased susceptibility to hypothetical counter-party shocks at end-September 2016 relative to end-2015.

Risk Assessment of the Financial System

In light of the strong credit expansion, stress test results for the DTI sector at end-2016 showed that each sub-sector was adequately capitalized to absorb hypothetical increases in NPLs. Despite continued dollarization on the investment portfolios, DTIs continued to show robustness to the foreign exchange and liquidity stress test assessments. This resilience mainly reflected the sectors' strong capital positions as well as reduced net open position to capital ratios and higher levels of liquid assets for the review period.

Interest rate risks increased in the financial system. At end-September 2016, interest rate risk stress tests results showed that DTIs demonstrated reduced resilience to interest rate shocks. This performance is mainly due to the lengthened portfolio duration gap relative to end-2015 which contributed to higher fair value losses in each shock scenario.

At end-September 2016, risk exposures for the twelve largest SDs showed deterioration in the exposure of these institutions to interest rate risks, foreign exchange risks and counterparty risks relative to end-2015. SDs showed greater susceptibility to interest rate shocks at end-September 2016 relative to end-2015.

Payment System Developments

The review period demonstrated increases in electronic payment activity. During 2016, transaction activity in the JamClear-RTGS system increased by 17.7 per cent. Additionally, total volume of JamClear-RTGS transactions for the period increased to 488 678 transactions for 2016 relative to 301 371 transactions for 2015. The JamClear-CSD also showed an increase in transactional value amounting to 12.6 times GDP but a reduction in the number of transactions.

There was continued growth in the value and usage of electronic payment instruments offered by commercial banks during 2016. The value of electronic payments increased by 22.6 per cent to J\$619.3 million per 1000 persons.

Outlook

The global economy is projected to show increased growth in 2017 relative to 2016 mainly due to expansionary fiscal policies in major economies. As well, Jamaica's economy is projected to grow in 2017 at a faster rate than that recorded in 2016 predominantly due to on-going structural reforms, improved confidence and increased external and domestic demand.

The domestic financial system should see continued expansion and increased competition in commercial banking due to continued macroeconomic growth and the addition of two new Commercial Banks bank licences. System expansion will also be driven by national policy to increase financial inclusion which includes better financing for smaller enterprises and borrowers in rural locations. An expanded financial sector with widened access to financial services by the public should also be facilitated by provisions for agent

banking which allows for the offering of certain banking services through agent operations.

The outlook for 2017 will as well include continued regulatory strengthening. The calendar year should see full operationalization of the Financial System Stability Committee that will contribute to the development and implementation of macro-prudential policies and instruments.

The BOJ's supervisory department also plans to take additional measures in 2017 for ensuring resilience of the system. Some of which include, consolidated capital adequacy requirements and a Financial Holding Company oversight regime and preparation for the assumption of supervisory oversight of the credit union sector.

During 2016, there were also amendments to the insurance legislation for Jamaica. This was in an effort to strengthen the regulatory framework and risk management practices within the insurance industry. There is also expected to be prudential strengthening for SDs. This will include the development of retail repo indicators, the implementation of industry submitted stress testing and prudential guidelines for limiting SDs' counterparty exposure.

2. Macro-financial risks

2.1 Overview

The domestic macro-economic environment was characterized by improvements in key areas despite the slowdown in the global economy for 2016. The improvement in the macroeconomy was largely reflected in domestic financial system stability as evidenced by the financial stability cobweb. In addition, the risk of excessive leverage as indicated by credit-to-GDP gap measures remained low. There was also a reduction in systemic risk in relation to institutions' common exposures as shown by the Composite Indicator of Systemic Stress (CISS) for 2016 relative to 2015. Furthermore, there was mixed outturn in default risk, as measured by the distance-to-default whereby DTIs improved while there was deterioration for SDs. In general, the financial system was more resilient to the contemplated range of shocks for several risk categories.

Notwithstanding the positive developments, the core indicators of systemic risk signalled exposures stemming from a build-up in leverage, concentration in financial system assets and the continued increase in financial dollarization. Continued deterioration in these growing areas of risk exposures may ultimately warrant an assessment of the application of relevant macro-prudential measures to minimize the build-up of systemic risk within the sector.

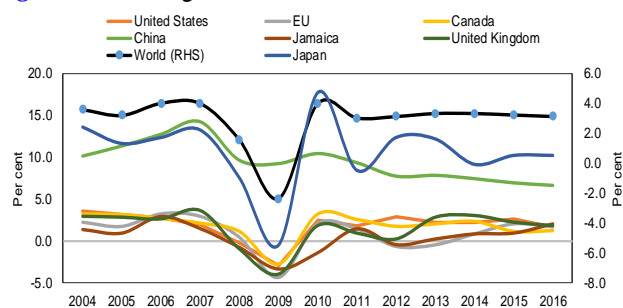
2.2 Global developments

Global growth was estimated at 3.1 per cent for the year relative to growth of 3.2 per cent for 2015. The slight downturn reflected economic challenges across several advanced and emerging economies (see **Figure 2.1**).¹ The deceleration in growth was evidenced in the USA, U.K., Euro area and China while Canada continued to progress marginally.² Additionally, the lower growth outturn for

¹ See IMF World Economic Outlook Update January 2016.

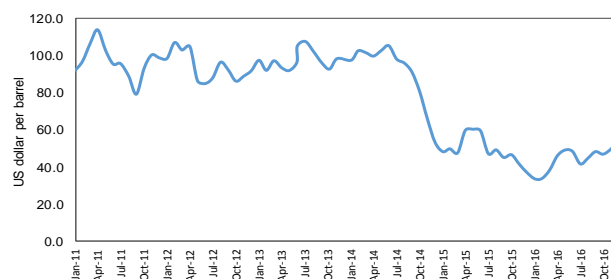
² Growth in the USA mainly reflected weaker than expected demand coupled with the economic tensions leading up to the US general elections on 08 November 2016. However, in December 2016 the Federal Open Market Committee (FOMC) decided to raise the target range for the federal funds rate

Figure 2.1 GDP growth rates of selected countries



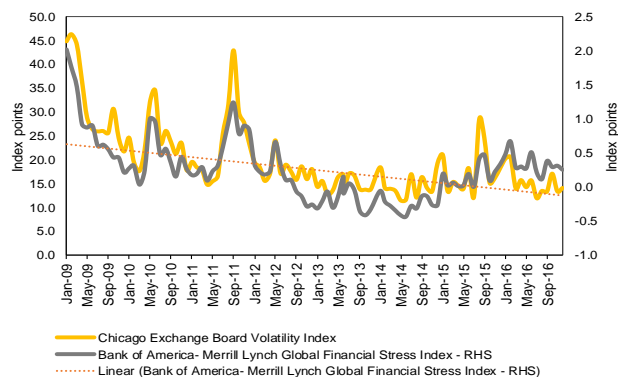
Source: Bloomberg, Bank of Jamaica, IMF World Economic Outlook

Figure 2.2 West Texas Intermediate oil prices



Source: Bloomberg

Figure 2.3 International financial market indicators



Source: Bloomberg

Note: The BAML-GFSI is a calculated, cross market measure of risk, hedging demand and investor flows in the global financial system. Values greater than 0 indicate more financial market stress than normal while values less than 0 indicate less financial stress than normal. The VIX reflects a market estimate of future volatility, based on the weighted average of the implied volatilities for a wide range of strikes. An increase in the VIX index indicates increased volatility.

from 0.50 to 0.75 per cent in the context of improved labour market conditions and a return to 2.0 per cent inflation. Lower than expected growth outturn in the U.K. and Euro area mainly reflected the unexpected outturn of the U.K. referendum on leaving the European Union. Growth in China echoed spillovers from persistently weak demand in advanced economies, political discord and geopolitical tensions in several countries. On the other hand, growth in Canada reflected the firming of global oil and metal prices for most of 2016.

Figure 2.4 Selected domestic macroeconomic indicators

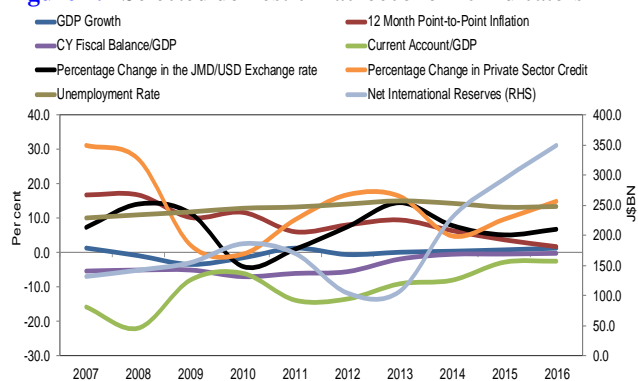
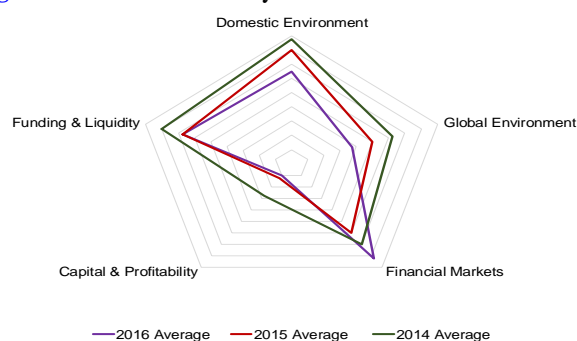
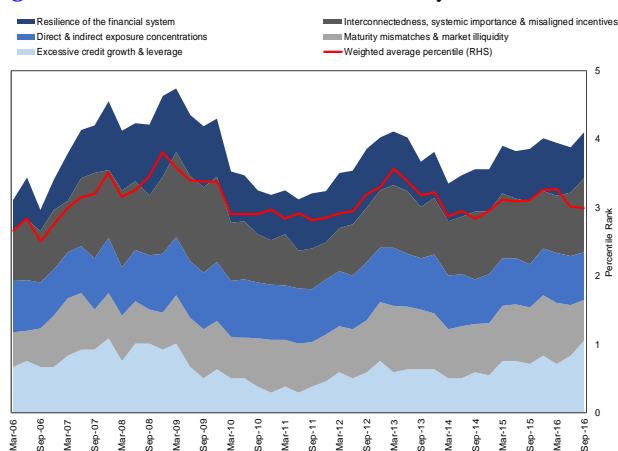


Figure 2.5 Financial stability cobweb



Note: The domestic macroeconomic environment, financial market conditions and the global environment indicators identify the systemic shocks that would trigger major difficulties for financial institutions. The capital & profitability and the funding & liquidity indicators reflect the capacity of financial institutions to absorb a shock to either side of their balance sheets. Movements away from the centre of the diagram represent an increase in financial stability risks. Movements towards the centre of the diagram represent a reduction in financial stability risks.

Figure 2.6 Evolution of core indicators of systemic risk



Note: The cyclogram is an aggregation of core variables that illustrate the build-up of macro-economic imbalances and financial cycles. The evolution of core indicators of systemic risk is measured by comparing each of the various macro-prudential risk indicators to its historical empirical cumulative distribution function. A number between 1 and 5 is assigned to the actual value of the variable depending on its position in respective quantiles of its historical distribution. The simple average of the ranks for each variable is used to find the aggregate values for the cyclogram. The weighted average percentile rank takes into account the contribution of each risk category to overall systemic risk.

2016, occurred within the context of some moderation in the declining oil price trend throughout the review year. Specifically, West Texas Intermediate (WTI) oil prices declined by 11.3 per cent to US\$44.5 per barrel for 2016 (see **Figure 2.2**). The moderation in the oil price trend reflected the anticipated signed agreement among OPEC members and other major producers to limit supply.

Volatility in global financial markets moderated for 2016. Relative to the upward trend observed since 2014, fluctuation in asset prices showed signs of improvement for the year. This performance was reflected in decreases in the Bank of America Merrill Lynch Global Financial Stress Index (BAML-GFSI) as well as the Chicago Board Options Exchange Volatility Index (VIX) (see **Figure 2.3**). However, there were bouts of financial market uncertainty during June and November 2016 due to the unexpected U.K. referendum results as well as the U.S. general election, respectively.³

2.3 Domestic environment

During 2016, the domestic macroeconomic environment was generally characterized by improvements in key macroeconomic variables as well as the successful completion of the IMF’s Extended Fund Facility programme. Specifically, there were continued improvements in GDP growth, inflation, current account, fiscal position and the net international reserves (NIR) (see **Figure 2.4**). In particular, the economy is estimated to have grown by 1.4 per cent for 2016 relative to growth of 0.9 per cent for the previous year, largely reflecting increases in both external and domestic demand.

Additionally, the outturn in inflation rate for the review period was at a record low since 1964. The annual point-to-point change in the CPI was 1.7 per cent relative to 3.7 for 2015, largely indicative of declining inflation expectations and favourable weather conditions. These improvements

³ On 24 June 2016, the U.K. referendum results pointed to nationals voting in favour of leaving the European Union (Brexit). This outturn may have implications for the London market as well as economic integration of the U.K. with the rest of Euro area.

were offset by the depreciation of the Jamaica Dollar vis-à-vis the United States dollar was 6.3 per cent for 2016 relative to 4.8 per cent for the prior year. This outturn partially reflected heightened demand conditions emanating from the redemption of a GOJ BMI Note as well as the uncertainty among investors regarding the outcome of the scheduled General Elections in February 2016.^{4,5}

2.3.1 Cobweb measure of financial stability

The financial stability cobweb showed a general improvement across all dimensions of risks with the exception of the financial market for 2016 (see **Figure 2.5**). Of note, increased vulnerabilities within the financial market dimension of the cobweb reflected increases in the foreign exchange bid-ask spread along with larger percentage changes in the GOJ 180-day Treasury bill rate on average. Improvement in the global environment on the other hand, reflected a narrowing of the spread between the EMBI and the US treasury rate as well as lower global unemployment rate. Concurrently, the decline in risk in the domestic environment dimension was due to higher current account balance and lower unemployment rate.

2.3.2 Cyclogram of macro-prudential risks

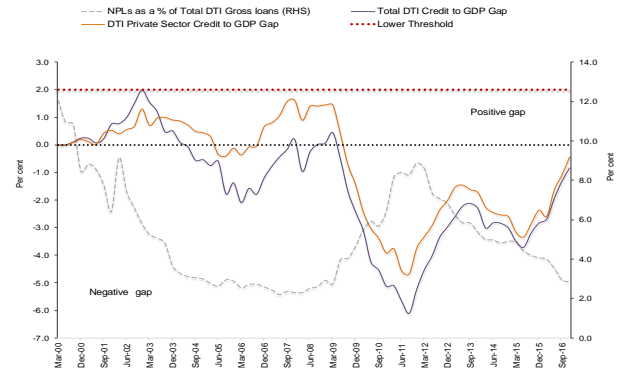
Within the context of the macro-economic developments highlighted and the Bank’s expanded mandate for financial stability, there was an improvement in the overall indicator of systemic risk for 2016 (see **Figure 2.6**). This was evidenced by a decrease in the average percentile rank of macro-prudential risk areas for end-September 2016 relative to end-September 2015.⁶ A further examination of the sub-components of the cyclogram showed that this outturn

⁴ The accelerated pace of depreciation also reflected the impact of large value subscriptions for foreign currency denominated investments that were on offer during the June 2016 quarter.

⁵ To curb the demand pressures within the foreign exchange market during 2016, the Bank increased its intervention sales. Furthermore, the Bank increased the cash and liquid asset reserve requirement for foreign currency liability as well as discontinued remuneration on foreign currency reserve holdings, aimed at dampening the growing trend in dollarization.

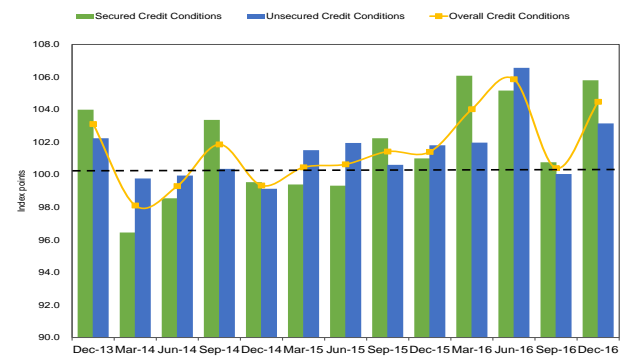
⁶ Macro-prudential intermediate objectives for systemic risk include: (i) mitigating and preventing excessive credit growth & leverage; (ii) mitigating and preventing excessive maturity mismatches & market illiquidity; (iii) limiting the impact of direct & indirect exposure concentrations; (iv) limiting the impact of

Figure 2.7 Credit to GDP Gap



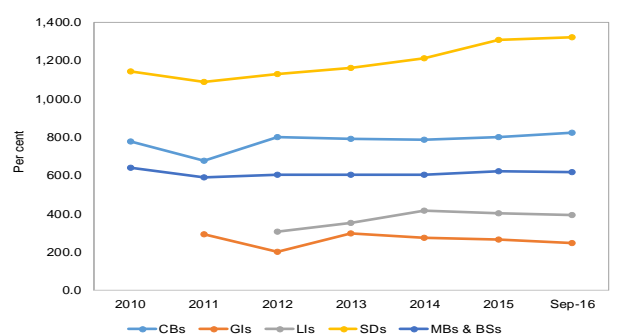
Note: (i) Credit-to-GDP gaps were estimated by applying the one-sided Hodrick Prescott (HP) filter to quarterly data spanning the period 2000 to 2015 for all DTIs and (ii) The lower and upper threshold values prescribed by the Basel Committee on Banking Supervision are 2.0 per cent and 10.0 per cent, respectively.

Figure 2.8 Credit standards and credit conditions survey indices



Note: The index is the average responses for changes in selected credit terms reported in the Credit Conditions Survey.⁷ Index values above 100 indicate an increase in the variable while values below 100 indicate a decline.

Figure 2.9 Leverage metric – DTIs, SDs and insurance companies



Note: Leverage is calculated as total financial system assets plus total off balance sheet exposures relative to equity.

interconnectedness, systemic importance and misaligned incentives; and (v) strengthening the resilience of the financial system.

⁷ See BOJ Quarterly Credit Conditions Survey.

Figure 2.10 Daily annualized zero-coupon GOJ domestic bond yields

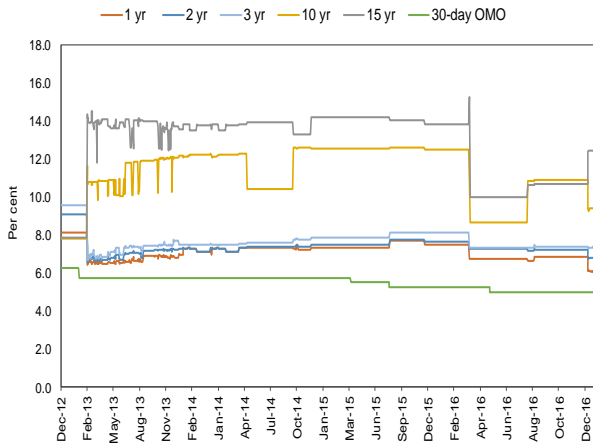
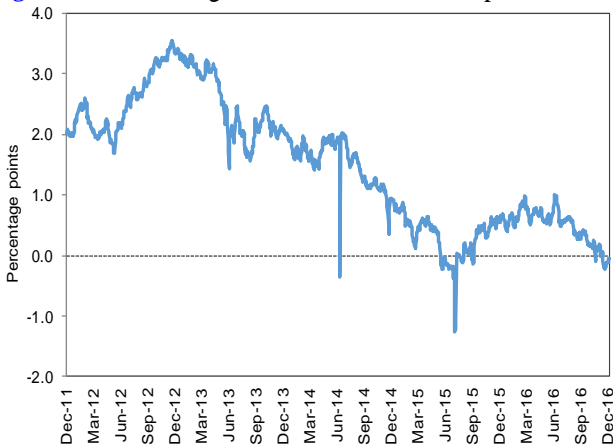
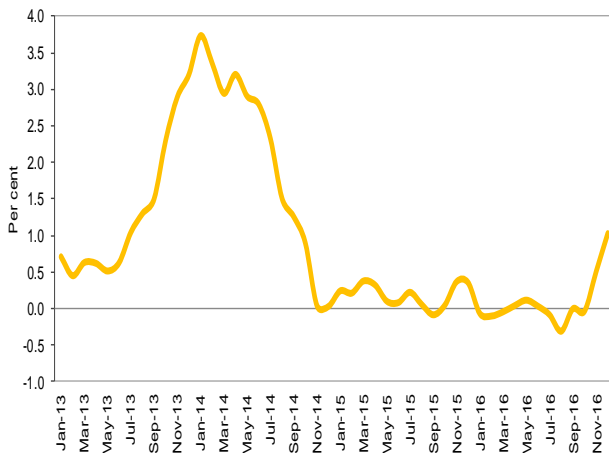


Figure 2.11 Jamaica global bonds and EMBI+ spread



Source: Bloomberg

Figure 2.12 TRE spread



stemmed from improvements in both the structural and cyclical dimensions of macro-prudential assessment.⁸ Specifically, there were improvements in the risk areas of maturity mismatches & market illiquidity, direct & indirect exposure concentrations and resilience in the financial system.

This improvement was, however, partially offset by deterioration in the risk areas of interconnectedness & systemic importance, and excessive credit growth & leverage. As it relates to interconnectedness & systemic importance, DTIs’ gross exposures to SDs and total SIFI group assets to total system assets as well as dollarization indicators deteriorated over the review period. The outturn for the area of excessive credit growth and leverage primarily reflected deterioration in leverage indicators for the period relative to end-2015.

2.4 Measures of excessive credit growth and leverage

2.4.1 Credit-to-GDP Gap

Domestic credit grew by 13.3 per cent for 2016 which was 4.5 percentage points above the recorded growth for 2015. This occurred against the background of favourable domestic credit conditions, partly reflecting the BOJ’s continued easing of monetary policy.⁹ The expansion in private sector credit of 14.4 per cent outweighed the impact of the continued contraction of public sector credit of 6.4 per cent for the reporting period. The downward trajectory of public sector credit was reflective of the fiscal stance by the government.¹⁰

Despite the credit expansion, risks associated with excessive lending within the domestic economy remains contained (see **Figure 2.7**). Of note, the private sector credit to GDP gap remained negative but showed an upward reversion of the credit cycle. Additionally, the perceived risk of the

⁸ See Box 2.1: Operational Aspects of Macro-prudential Assessment in Jamaica.

⁹ Domestic credit includes domestic loans and advances as well as corporate and government issues held by deposit taking institutions.

¹⁰ Since 2012, the government of Jamaica (GOJ) has embarked upon fiscal tightening as reflected by the smaller deficit balance, in an effort to reduce the country’s debt to GDP levels.

accelerated growth in private credit was dampened by the downward trajectory in the build-up of the share non-performing loans to total loans. This outturn reflected continued improvement in the loan quality of the private sector.

2.4.2 Credit standards and credit conditions¹¹

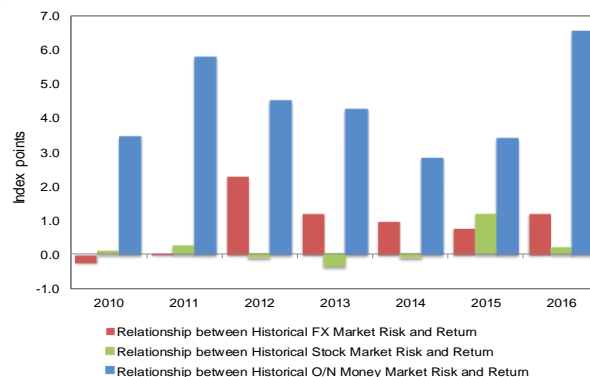
During 2016, the domestic credit market continued to show signs of credit easing as evidenced by the results of the BOJ's Quarterly Credit Conditions Survey (QCCS) (see **Figure 2.8**). Of note, the index of overall credit conditions remained above the benchmark level for the review period. Further disaggregation of credit conditions into secured and unsecured components indicated that secured credit conditions had the largest improvement when compared to 2015. The outturn in credit conditions was bolstered by the increase in demand and supply for credit during the review period. This improvement in supply and demand was largely influenced by increased loan promotion activities by institutions, lower market interest rates, as well as improved macro-economic conditions.

2.4.3 Financial sector leverage

Leverage metrics for SDs and commercial banks showed increased leverage for the calendar year to end-September 2016 compared to end-2015 (see **Figure 2.9**). While that of insurance companies, merchant banks and building societies showed marginal decrease, which was largely attributable to a greater percentage increase in equity over the review period relative to total financial assets and off-balance sheet exposures. The increase in the leverage for SDs and commercial banks was attributable to a greater percentage increase in to total financial assets and off-balance sheet exposures relative to their equity.

¹¹ The credit conditions survey is an online survey conducted by the BOJ to elicit qualitative information on changes in the demand and supply of credit to businesses and individuals.

Figure 2.13 Jamaica money market, stock market and foreign exchange risk appetite indices (RAI)



Note: The RAI is a measure of the responsiveness of market returns to market volatility and/or uncertainty.

Figure 2.14 Amihud index of foreign exchange market depth

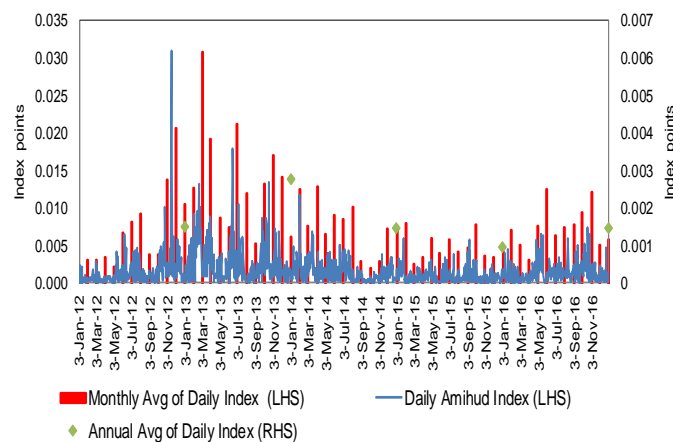


Figure 2.15 Amihud index of stock market depth

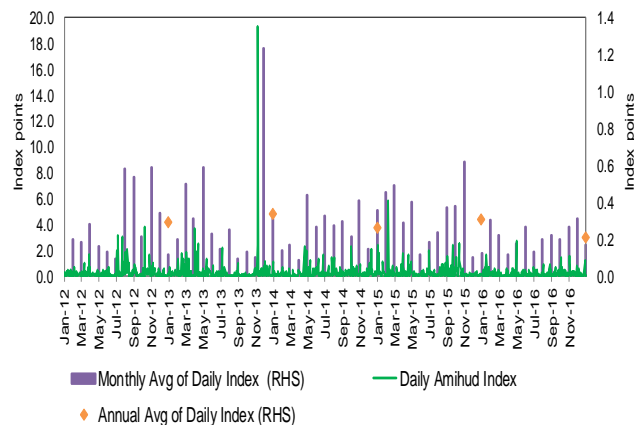
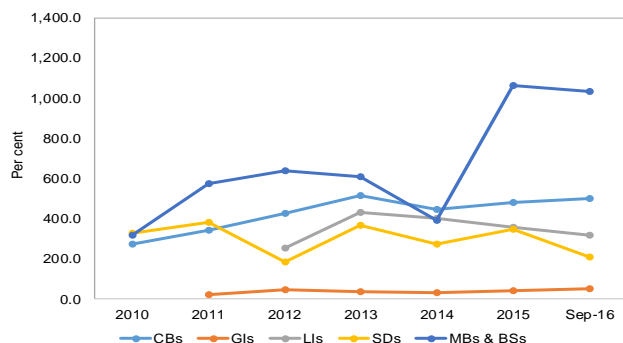
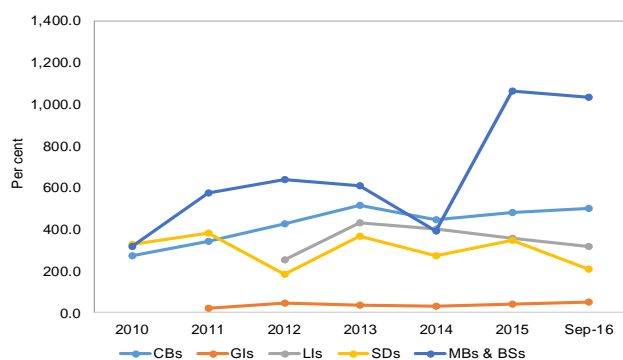


Figure 2.16 Maturity transformation (short-term) – DTIs, SDs and insurance companies



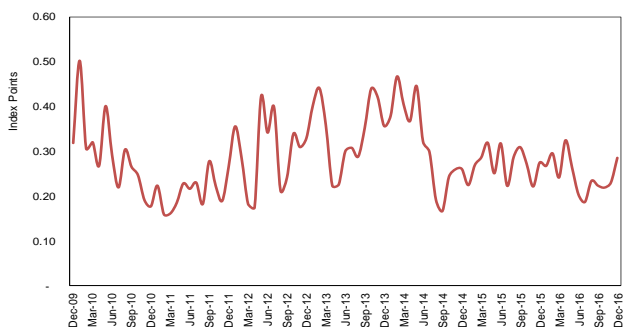
Note: This is calculated as short term liabilities [≤ 30 days] plus redeemable equity [≤ 30 days]) to short term assets [≤ 3 months].

Figure 2.17 Liquidity transformation – DTIs, SDs and insurance companies



Note: This is calculated as short term liabilities [≤ 30 days] to liquid assets [broad]. Liquid assets are considered all assets that can be easily and immediately converted into cash at little or no loss of value. In Jamaica’s case, the broad liquid asset measure cover cash and equivalents, GOJ/US/CAN/EURO government securities due in less than 3 months and equities listed in stock exchanges of developed countries.

Figure 2.18 Composite indicator of systemic stress (CISS) in financial markets



Note: The CISS measures the joint impact of activity in the money market, equity market, bond market and foreign exchange market. An increase in the CISS indicates a high degree of correlation between markets which aggravates systemic risk. When the correlation between markets is low the risk is reduced.

2.5 Measures of excessive maturity mismatches and market illiquidity

2.5.1 Market liquidity and risks appetite

During 2016, the GOJ introduced five issues with varying tenures. These issues occurred over the following periods: February 2016 – three issues: 2018, 2022 and 2046; August 2016 – one issue: 2026 and November 2016 – one issue: 2031. Within this context, yields on the GOJ zero-coupon bonds decreased in comparison to last year, predominantly at the longer tenures (see **Figure 2.10**). Of note, there was significant decline in the 10 year and 15 year yields by 2.9 and 1.5 percentage points relative to declines of 0.1 and 0.5 percentage point for 2015, respectively. The reduction in yields across varying tenures during 2016 to some extent reflected an improvement in investor confidence in the Government’s fiscal stance.

Against the backdrop of improved economic and financial conditions across emerging markets, investors’ confidence in GOJ global bonds has risen during 2016. Of note, the spread between GOJGB and the Emerging Market Bond Index (EMBI+) trended downwards in 2016 which compares favourably to the upward trend that was observed in 2015 (see **Figure 2.11**). This improvement in investor confidence was also reflected in the government’s intervention in the global bond market in August, for which the reopening of an existing 2039 issue had a complete subscription.

Liquidity conditions in the money market continued to improve during 2016 as depicted by the narrowed TRE spread for most of the year (see **Figure 2.12**). The average monthly TRE spread was 0.1 per cent which compared favourably to 0.2 per cent for 2015. Of note, tighter liquidity conditions were observed for the last quarter of 2016 and reflected the change in policy stance by the Bank.

During 2016, the Bank started the process of transitioning from the 30-day CD rate to the rate on its overnight CD as the policy rate. Against this background, the rate on the overnight CD increase by 2.8 percentage points to 3.0 per

cent and reduced the frequency with which it offered its 30-day CD issues to twice per week. Additionally, the Bank raised the cash reserve and liquid asset reserve requirements for foreign currency liabilities in incremental steps to 12.0 per cent and 26.0 per cent, respectively, equal to those for domestic currency liabilities.¹²

In addition, Risk Appetite Indices (RAIs) across the Money, Foreign Exchange and Stock markets continued to be jointly positive during 2016 (see **Figure 2.13**). Thus reflecting the willingness of investors to bear risks across these market.¹³ The outturn in the RAIs may be attributed to improvement in the level of investors' confidence in the domestic macro-economic environment.

During the review period, liquidity conditions within the foreign exchange market deteriorated as reflected in the Amihud Index, which increased for the review period (see **Figure 2.14**). Of note, there was a faster pace of depreciation in the value of the Jamaica Dollar relative to its US Dollar counterpart. The Jamaica dollar depreciated by 6.3 per cent vis-à-vis its US counterpart during the year in comparison to 4.8 per cent in 2015. This was evidenced by a widening of the monthly average bid-ask spread to \$0.7 for 2016 relative to \$0.6 for 2015.

In contrast to the performance of the FX Amihud index, the index for the stock market improved for 2016. More specifically, the index decreased on average by 31.1 per cent to a value of 0.2 for the review year (see **Figure 2.15**). This was mainly attributable to the impact of lower price movements for 2016. The improvement in stock market depth occurred within a context of favourable stock market returns. For 2016, the Jamaica Stock Exchange Main Index showed a strong increase of 27.6 per cent albeit lower than the increase of 97.4 per cent recorded for the previous year. The outturn in the stock market largely reflected improved

Figure 2.19 Quarterly distance-to-default for DTIs and non-deposit taking financial institutions

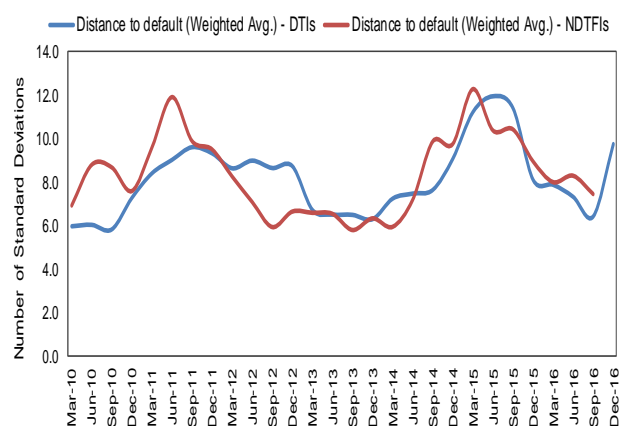


Figure 2.20 Ratio of holdings of total GOJ debt by DTIs, SDs and life insurance companies to capital

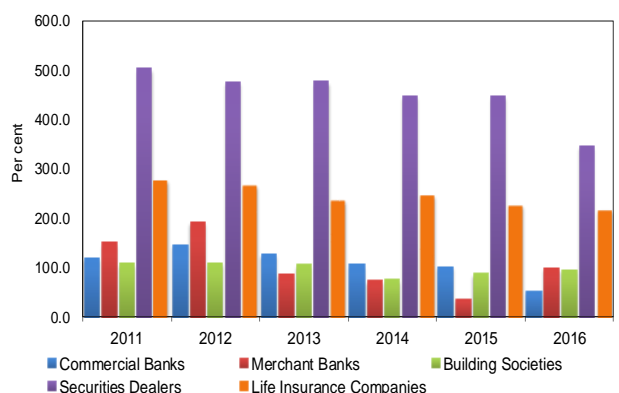
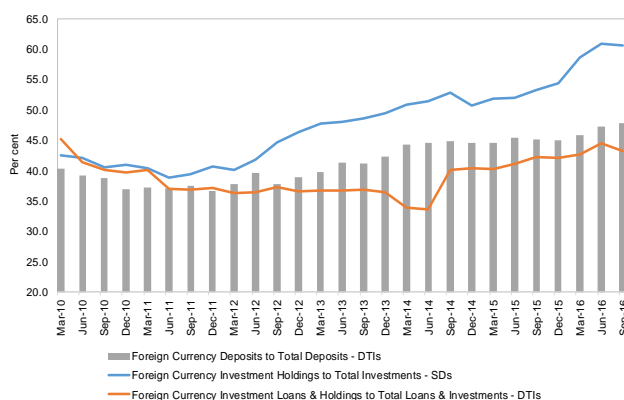


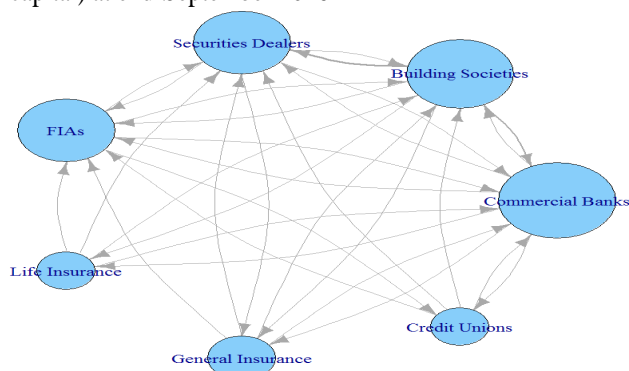
Figure 2.21 Dollarization Trends



¹² See Bank of Jamaica 2016 Annual Report.

¹³ An increasing RAI depicts a reduction in risk aversion of investors, and vice versa.

Figure 2.22 Network of gross credit exposure between financial institutions (unsecured gross credit exposure to capital) at end-September 2016



Note: Nodes represent the financial sub-sectors and links represent the weighted gross credit exposures between sectors. Arrows directed towards a node indicate that the node is a gross borrower while arrows directed outwards indicate that the node is a gross lender. Nodes are weighted based on the level of connectedness of the sector. Links are weighted by the size of the gross credit exposure to sector capital. Larger nodes indicate a greater level of importance while thicker links indicate larger exposures.

Figure 2.23 Network of gross credit exposures between financial institutions (unsecured gross credit exposures to capital) at end-2015

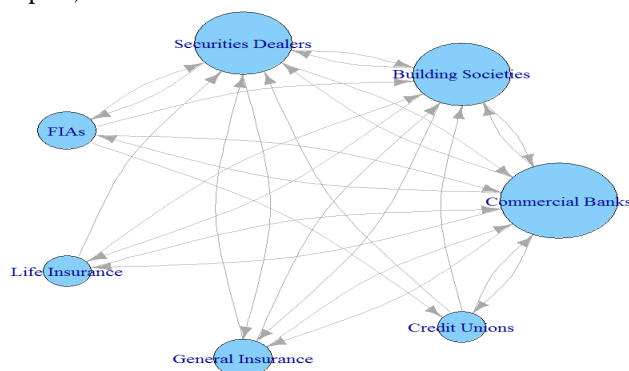
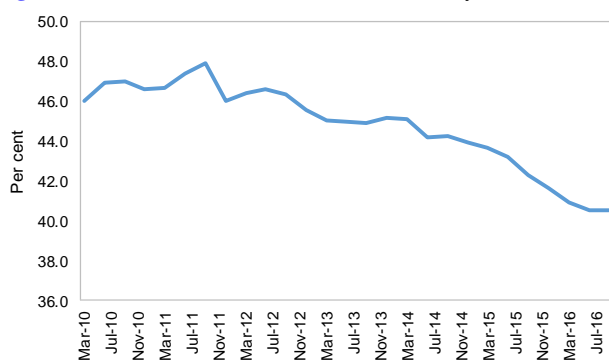


Figure 2.24 NDTFIs assets to total financial system assets



macroeconomic conditions and favourable investor sentiment as measured by the stock market RAI.

2.5.2 Maturity and liquidity transformation risk exposures

Risks emanating from the mismatch of the maturity of short-term assets and liabilities increased for commercial banks and insurance companies for the calendar year to end-September 2016 relative to end-2015 (see **Figure 2.16**). The deterioration in the maturity transformation metrics for these subsectors reflected a greater percentage increase in their short-term liabilities relative to their short-term assets.¹⁴ As it relates to the maturity of long-term assets and liabilities, the maturity transformation for commercial banks and insurance companies broadly reflected improvements for the period.

Exposures in the use of short term debt to finance short-term investments was generally lower for the calendar year to end-September 2016 relative to end-2015, with the exception of commercial banks and general insurance companies (see **Figure 2.17**). The increased exposures for commercial banks and general insurance companies were attributable to the faster pace of growth in short-term liabilities relative to liquid assets.¹⁵ Furthermore, the risk metrics for merchant banks and building societies continued to trend above the other sub-sectors.

2.6 Measures of direct and indirect exposure concentration

2.6.1 Exposure to financial markets

There were lower common exposures across the domestic financial market for 2016 as measured by the Composite Indicator of Systemic Stress (CISS). The index decline to a monthly average of 0.25 for the review year relative to a

¹⁴ Growth in short-term liabilities for commercial banks, general insurance companies and life insurance companies was 12.4 per cent, 46.6 per cent and 39.2 per cent while growth in short-term assets was 6.5 per cent, -5.2 per cent and -10.4 per cent, respectively.

¹⁵ Growth in short-term liabilities for commercial banks and general insurance companies was 12.4 per cent and 46.6 per cent while growth in liquid assets was 8.3 per cent, 15.9 per cent, respectively.

monthly average of .027 for 2015 (see **Figure 18**).¹⁶ This was primarily due to the reduction in exposures from the bond and equity markets, which outweighed the deterioration in exposures from the foreign exchange and money markets.

2.6.2 Exposure to financial institutions default risk

The distance-to-default for DTIs increased relative to 2015 and was largely due to the sharp improvement observed during the final quarter of 2016 (see **Figure 2.19**). The improvement observed for 2016 was associated with the larger growth in the market value of assets and lower volatility in returns for DTIs. The reduction in default risk reflected the increased spread between the value of assets and debt obligations that fall due in one year for the sector.

Conversely, the distance-to-default for the NDTFIs continued to decline over the review period, reflecting an increase in default risk across the sector. Of note, the distance-to-default for NDTFIs decreased to a quarterly average of 7.9 standard deviations for the calendar year to September 2016 relative to 10.5 standard deviations for 2015.¹⁷ This outturn was mainly driven by a greater than proportional increase in the volatility of returns and liability holdings relative to the increase in market value of assets for the review period.

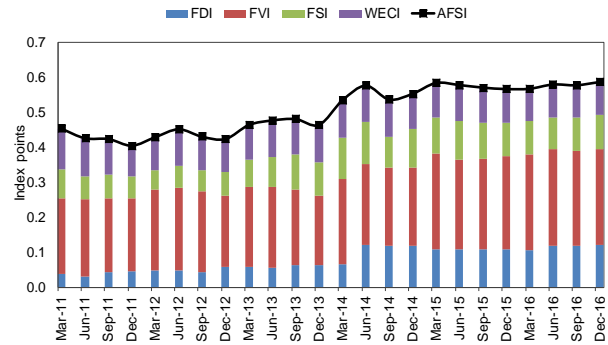
2.6.3 Exposure to sovereign debt default risk

For 2016, there were mixed performances related to the exposure of the banking system to sovereign debt default, as measured by the ratio of holdings of GOJ total debt to capital (see **Figure 2.20**). Specifically, the ratios for SDs, commercial banks and life insurance companies decreased to 345.4 per cent, 93.6 per cent and 217.2 per cent relative to 446.6 per cent, 100.8 per cent and 225.1 per cent for 2015, respectively. On the other hand, the increased sovereign debt default risk for building societies and

¹⁶ This outturn represented improvement in the equity and bond markets, however, these improvements were partially offset by deterioration in foreign exchange and money market conditions.

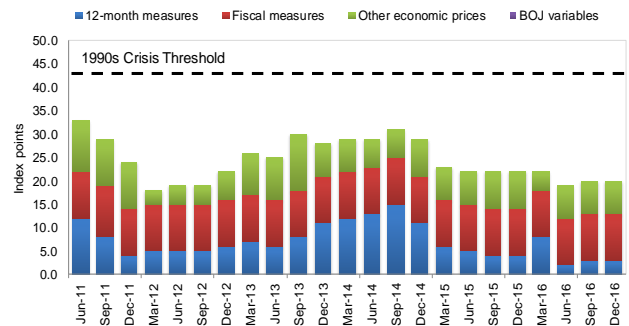
¹⁷ The distance-to-default measures the distance (in standard deviation) of an institution’s contingent assets to its default barrier (which is define as the sum of short-term liabilities and one-half long-term liabilities).

Figure 2.25 Aggregate financial stability index



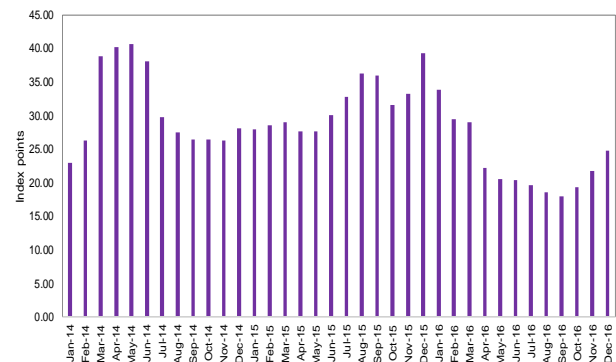
Note: The AFSI aggregates microeconomic, macroeconomic and international factors to form a single measure of financial stability. A higher value indicates increased financial stability while a lower value indicates deterioration in financial sector stability. Of importance microeconomic data captures information for DTIs. FDI - Financial Development Index, FVI - Financial Vulnerability Index, FSI - Financial Soundness Index, WECI - World Economic Climate Index.

Figure 2.26 Macro-financial index



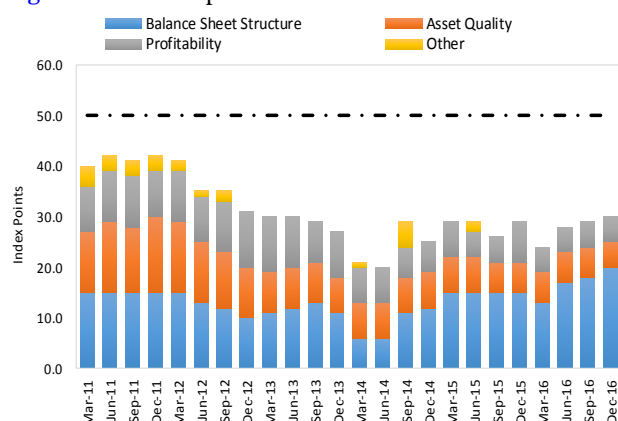
Note: The MaFI & MiPI are signal-based indices computed using scores for indicators based on the number of standard deviations of each indicator from its ‘tranquil period’ mean value. The tranquil period for both indices spans the period March 2002 to March 2003. The scores range from 0 to 5 with a score of 5 representing the most severe signal. The higher the aggregate score, the more severe the signal.

Figure 2.27 Z-score index for the DTIs



Note: The Z-score (insolvency risk) index is used as a measure of a bank’s financial soundness. The Z-score is used to capture the likelihood of a bank’s earnings in a given year becoming low enough to eliminate the bank’s capital base and thus, the likelihood of the bank becoming insolvent. A higher Z-score implies a lower probability.

Figure 2.28 Micro-prudential index for DTIs



merchant banks for 2016 reflected a faster pace of growth in holdings of foreign currency denominated GOJ debt relative to the growth in capital.

2.7 Measures of interconnectedness & systemic importance

2.7.1 Misaligned incentives

The trend of financial dollarization continued to dominate financial stability concerns for 2016. Notably, foreign currency deposits and foreign currency investments holdings continued to trend upwards for the DTI and SD sectors, respectively (see **Figure 2.21**). Specifically, there was an increase in the average share of DTIs' foreign currency deposits to total deposits to 47.0 per cent for 2016 relative to 45.0 per cent for 2015. This outturn was reflective of an increase in the perceived currency risk of saving in the Jamaican dollars by households and corporates. Similarly, there was a 7.2 percentage points increase in the ratio of foreign currency investments holdings to total investments to 60.0 per cent for SDs in 2016. During the latter part of 2016, there was moderation in the growth of the foreign currency investments to total investments and foreign currency investments plus foreign currency loans to total investments for SDs and DTIs, respectively. This occurred within the context of a strengthening in the domestic currency as well as the increase in DTIs foreign currency reserve requirements.

Given the heightened levels of financial dollarization for DTIs and SDs, the financial sector is more exposed to, *inter alia*, currency mismatch risk and credit risk from currency lending to un-hedged borrowers. The developments related to financial dollarization present additional sources of systemic risk, however, raising foreign currency reserve requirements will not address these additional sources of risk. As such, macro-prudential measures have to be implemented in order to stem dollarization until public confidence has been restored in the value of the currency.¹⁸ Broadly, the applied measures should form part of a risk

¹⁸ These measures should remain in place until the inflation targeting framework is implemented, which will anchor inflation to the level of advanced economies.

management framework that incorporates the capital adequacy position of these sectors on an institution-specific level.

2.7.2 Interconnectedness within interbank market

The building societies sector continued to show significant gross exposure to SDs and commercial banks. Gross exposures to SDs and commercial banks were three times and two times the capital level for that of the building societies, respectively (see **Figure 2.22** and **Figure 2.23**). While the exposure of the building societies sector increased for 2016, it should be noted that the exposure was spread across several institutions within the commercial bank and SDs sectors. Overall, this outturn is indicative of increase susceptibility of the building societies sector to credit default risk.

2.7.3 Systemic importance

As it relates to the systemic importance of institutions within the financial system, there was an increase in the number of systemically important financial institutions (SIFIs) to three at end-September 2016 relative to two at end-2015.¹⁹ Consequently, total SIFI group assets as a share of total financial system assets increased to 64.0 per cent at end-September 2016 relative to 47.8 per cent for end-2015. This outturn not only highlighted growth in the degree of concentration and the potential for contagion risks within the system but also the need to effectively monitor the developments related to these groups.²⁰ Furthermore,

¹⁹ The D-SIB framework currently used by the Bank follows the methodology outlined in Brämer and Gischer (2012), which assesses the significance of banks based on several key categories, which are: size interconnectedness, non-substitutability and complexity. The framework is used to analyze the systemic importance of consolidated banking groups. The score for banking group *i* for period *j* is computed as follows:

$$SCORE_{ij} = \frac{A_{ij}}{\sum_i^n A_{ij}} + \left(\frac{(LFC_{ij} + DFC_{ij})}{(\sum_i^n LFC_{ij} + \sum_i^n DFC_{ij})} \right) + \left(\frac{(LH_{ij} + LNFC_{ij} + LGG_{ij} + LCS_{ij})}{(\sum_i^n LH_{ij} + \sum_i^n LNFC_{ij} + \sum_i^n LGG_{ij} + \sum_i^n LCS_{ij})} \right) + \left(\frac{(TS_{ij} + IS_{ij})}{(\sum_i^n TS_{ij} + \sum_i^n IS_{ij})} \right)$$

where, A represents total resident assets, LFC represents loans to financial corporations, DFC represents deposits from financial corporations, LH represents loans to households, LNFC represents loans to non-financial corporations, LGG represents loans to the general government, LCS represents loans to community service and non-profit organizations, TS represents trading securities and IS represents investment securities.

²⁰ Refer to Bank of Jamaica 2016 Annual Report. A framework for consolidated supervision was introduced by the Banking Services Act such that each financial

continued growth in SIFI activity will ultimately warrant an assessment of the application of macro-prudential measures, in keeping with international best practices, to offset the potential contagion effects.

At end-September 2016, shadow banking, as measured by the ratio of NDTFIs assets to total financial system assets contracted marginally, signaling lesser exposure of the financial system to the institutions. Specifically, the ratio declined to 40.5 per cent relative to 41.7 per cent at end-2015. This outturn was largely due to larger growth in total financial system assets relative to growth in the NDTFIs' total assets (see **Figure 2.24**). While the growth in NDTFIs assets recorded on the balance sheet did not grow significantly, total off-balance sheet assets have been growing.

2.8 Resilience of Financial System

2.8.1 Aggregate Financial Stability Index (AFSI)

Domestic financial conditions, as measured by the ASFI, displayed signs of continued stability for the review period. Specifically, the AFSI grew by 4.0 per cent to a quarterly average of 0.6 relative to 2015 (see **Figure 2.25**). Growth in the index was mainly driven by improvements in financial vulnerability and financial development sub-components of the AFSI. Specifically the favourable outturn in the financial vulnerability sub-component was attributed to positive developments in key macroeconomic variables such as the inflation rate and the real effective exchange rate (REER), which is a measure of trade competitiveness. Additionally, improvements in the credit to GDP ratio, stock market capitalization and the Herfindahl-Hirschman Index asset concentration for the DTI sector contributed to the stronger performance of the financial development sub-index. The improvement in the index, however, was partly offset by weaker global economic climate conditions which was influenced by an increase in the quarterly average world inflation rate for 2016 relative to 2015.²¹

group to which a DTI belongs, is structured in a way which facilitates effective consolidated supervision.

²¹ Source: Bloomberg database.

2.8.2 Macro-Financial Index (MaFI)

The MaFI showed improvements for 2016 with a reduction in the quarterly average value of the index to 20.0 points relative to 22.0 points for 2015 and remained well below the 1996-1998 financial crisis threshold value of 44.0 points (see **Figure 2.26**). This outturn reflected improvements in the quarterly average value of indicators related to the 12-month measures and the other economic prices categories. In particular, the signal from the 12-month growth in the stock market index improved to 3.0 points for end-2016 relative to 5.0 point for end-2015. The volatility in inflation indicator also improved to no signal for end-2016 relative to 5.0 points for end-2015. Improvements were, however, partially offset by deteriorations in the 12-month GDP growth and the volatility in the exchange rate indicators to 1.0 point and 4.0 points, respectively, for end-2016 relative to no signal and 1.0 for end-2015.

2.8.3 Z-score Index of insolvency risk

Notwithstanding the macro-financial improvements, the vulnerability of the DTI sector to insolvency risk deteriorated over the review period. Specifically, the Z-score index decreased by 3.7 per cent to an average monthly value of 23.0 points for 2016 which compares to a 4.0 per cent improvement to an average monthly value of 31.6 points for 2015 (see **Figure 2.27**).²² The outturn in the Z-score was largely a result of the deterioration of the volatility in the average monthly risk adjusted return on capital.

2.8.4 Micro-prudential Index (MiPI)

The average value of the MiPI remained unchanged for 2016 relative to 2015 and was below the 1996-1998 financial crisis threshold value of 50.0 points (see **Figure 2.28**).²³ This outturn reflected improvements in indicators in the asset quality, profitability and ‘other’ categories.

Particularly, the average quarterly value of non-performing loans to total assets decreased to 1.0 point for end-2016 relative to 2.0 points for end-2015. Similarly the average quarterly value for both employee’s salaries to total assets and net income total assets decreased to no signal for end-2016 relative to 1.0 point for end-2015. In addition, the 12-month growth in deposits indicator also improved to no signal for end-2016 relative 1.0 point for end-2015. Improvements in the index were, however, offset by increases in the average quarterly signals for indicators from the balance sheet structure category. Specifically, financial institution loans to total loans deteriorated to 4.0 points for end-2016 relative to no signal for end-2015.

2.8.5 Stress testing results

With regards to stress testing the financial system, the Bank’s stress testing results indicated that at end-September 2016, there were lower credit risk exposures emanating from DTIs and SDs. However, both sectors experienced deterioration in counterparty, foreign exchange rate and liquidity risks relative to end-December 2015. For 2016, DTIs and SDs showed increased susceptibility to interest rate shocks with SDs showing greater vulnerability to this stress test. Life insurance and general insurance companies showed increased resilience to liquidity shocks. However, life insurance companies showed reduced resilience to interest rate shocks, nonetheless, the sector remained above the prudential capital benchmark following these shocks (see **Chapter 5: Risk Assessment of the Financial Sector**).

²² The Z-score (insolvency risk) index is calculated as:
$$z = \frac{RORAC + C/A}{STD\ DEV(RORAC)}$$
 where RORAC is the bank’s return on risk adjusted capital, C/A is its regulatory capital to asset ratio and STDDEV(RORAC) is its standard deviation of return on assets computed over the sampling period. The Z-Scores are weighted based on the relative total assets of the sectors.

²³ Indicators included in the micro-prudential index are weighted by asset size.

Box 2.1 Operational Aspects of Macro-prudential Assessment in Jamaica

Subsequent to the passing of The Bank of Jamaica (Amendment) Act 2015, the Financial System Stability Committee (FSSC) was established and held its first meeting in December 2016.¹ During this meeting, the operational framework for macro-prudential assessment was introduced. The framework outlined six elements that would guide the operation of the FSSC. These included:

1. Establishing the goal for financial stability;
2. Defining intermediate objectives which would allow for the easier measurement of systemic risk;
3. Setting of legal powers that affords the committee and the Bank of Jamaica (BOJ) effective governance and operational independence;
4. Assessment of the transmission mechanism of macro-prudential policy;
5. Accountability and communication on macro-prudential issues; and
6. Crisis planning, management and resolution procedures.

Policy-making Process of the FSSC

It is the intention of the BOJ to establish a set of intermediate objectives which reflect the root causes of financial crises. Following this, operational targets and macro-prudential tools would be put in place to correct deviations from these intermediate objects in terms of what was required for the smooth operation of the system.² Essentially the FSSC will:

- (i) identify and assess systemic risk based on BOJ's suite of macro-prudential indicators;
- (ii) select appropriate tools which are accurately calibrated while ensuring that the transmission mechanism is understood;

- (iii) monitor the implementation and transmission of macro-prudential instruments; and
- (iv) communicate with the public on the use and impact of tools on the system.

The FSSC will fulfill its functions through the guidance of quarterly reports on keys aspects of BOJ's financial system stability assessments. The committee will meet at least six times per year where they will evaluate the presence of systemic threats to the financial system and make applicable policy recommendations to address the identified risk exposures. The potential sources of systemic threats have been grouped into two broad dimensions, namely systemic risks emanating from financial cycles and systemic risks emanating from the structure of the financial system in order to allow for the easier measurement of systemic risk (see **Figure 1.0**).

More specifically, the cyclical dimension deals with the evolution of aggregate risk in the financial system over time, referred to as "procyclicality". It concerns the collective tendency of financial agents to assume excessive risk in the financial upswing due to over-optimism ("risk illusion"), reflected in excessive leverage or maturity.

On the other hand, the structural dimension is related to the distribution of risk across the financial system at a given point in time and is based on monitoring common exposures, systemic importance, misaligned incentives and interconnectedness of financial institutions, and enhancing its capacity to weather shocks including contagion while continuing to provide essential financial services.

¹ The FSSC is tasked to perform macro-prudential assessment, promoting the regular exchange of information, international cooperation in support of financial system stability objectives, providing periodic and exceptional reports to the Minister of Finance and Planning on financial stability oversight, as well as making recommendations to the BOJ for the carrying out of the financial stability mandate.

² To determine the tools to be used, the BOJ will rely on a set of macro-prudential indicators in conjunction with empirical evidence as well as judgement to trigger the tools. The BOJ will consider several macro-prudential indicators that are linked to these macro-prudential tools and further linked to the intermediate objectives in order to determine whether action is warranted.

Macro-prudential Assessment Objectives³

In order to effectively monitor systemic risk, the cyclical and structural dimensions were apportioned across five quantifiable ‘macro-prudential’ objectives.

Cyclical Dimensions

Objective 1: *Mitigate and prevent excessive credit growth and leverage across the entire financial system or a major component*

- Aimed at signaling whether the financial system is susceptible to asset price and credit boom-bust cycles, both of which are monitored by measures of asset price and credit markets as well as financial institutions’ leverage.

Objective 2: *Mitigate and prevent excessive maturity mismatches and market illiquidity across the entire financial system or a major component*

- Thin market liquidity as reflected in widening market spreads creates difficulty for the financial system’s stable and efficient intermediation of funds.

Structural Dimension

Objective 3: *Limit the impact of direct and indirect exposure concentrations*

- Risks to the system could stem from a lack of diversification due to financial concentration in a particular sector or asset type.

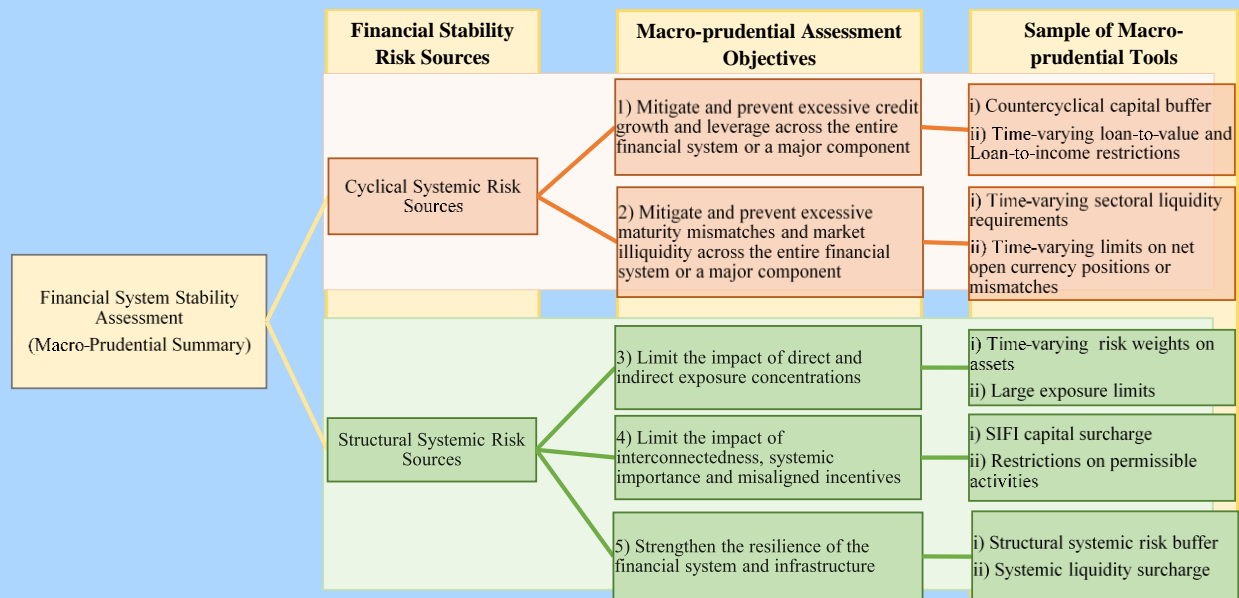
Objective 4: *Limit the impact of interconnectedness, systemic importance and misaligned incentives*

- Increases in interbank exposures, the number of institutions deemed systemically important and the size of the shadow banking sector will lead to increased susceptibility to narrow-based shocks to the system.

Objective 5: *Strengthen resilience of financial system*

- Low resilience to stress testing will indicate fragility in the sector. Stress testing is important in determining the degree of resilience of the system to changes in both macroeconomic, and microeconomic factors by measuring the impact on capital.

Figure 1.0: Schematic of macro-prudential assessment



³ There are several targeted macro-prudential indicators associated with each objective whose selection are guided by international best practices. Each indicator is compared over time to critical thresholds of its historical

empirical cumulative distribution. Observations in the indicator time series are then ranked in the empirical distribution and compared to critical thresholds to produce a heat map which guides an assessment of systemic risk.

3. Financial System Developments

3.1 Overview

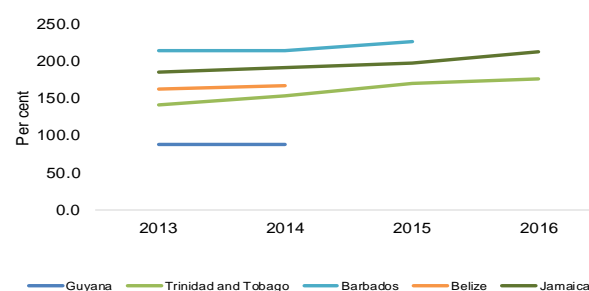
For 2016, the asset base of the Jamaican financial sector expanded, primarily influenced by the performance of the commercial banks. Moreover, financial soundness indicators signaled improved conditions within the DTI sector, particularly as it relates to the return on assets (ROA) and return on equity (ROE) indicators. Furthermore, institutions within the DTI sector continued to maintain adequate levels of capital and liquidity while there was continued improvement in asset quality during the review period.

Similarly, there was growth in asset base of the NDTFI sector for the review period, which was influenced by all NDTFI sub-sectors.¹ The performance of the securities dealers' industry was influenced by growth in funds under management (FUM) of these institutions.² There was a slight deterioration of the capital adequacy ratio for the sector and increased sensitivity to foreign exchange risk. The asset base of the insurance sector expanded while the sector maintained satisfactory levels of solvency and capital adequacy. The profitability metrics for the sector showed improvements, however, the insurance penetration remained flat.

3.2 The Financial System

There was improvement in the depth of financial intermediation in Jamaica during 2016, as measured by total financial institutions' assets as a share of GDP. The ratio increased to 212.6 per cent at end-2016 relative to 196.5 per cent at end-2015. This positive performance was primarily due to faster growth in the financial system's asset base relative to growth in GDP. Regionally, this indicator increased for Trinidad and

Figure 3.1 Depth of financial intermediation (*assets of financial corporations as % of GDP*)³



Source: Regional Central Banks

Figure 3.2 Growth in market shares in DTI and credit union assets (*growth between end-2015 and end-2016*)⁴

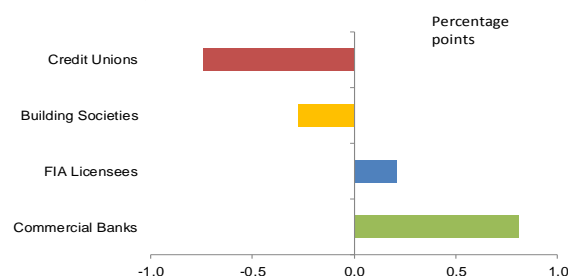
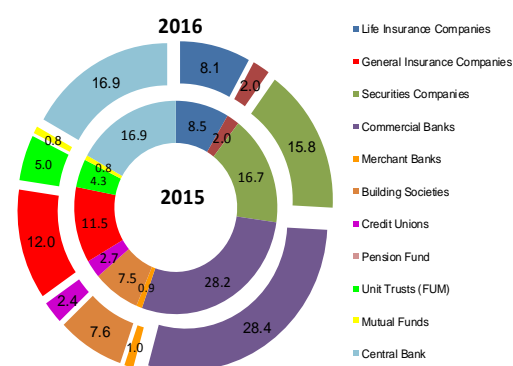


Figure 3.3 Market share in financial system assets⁵



¹ Non-Deposit Taking Financial Institutions (NDTFIs) include pension funds, collective investment schemes, securities dealers, life insurance companies and general insurance companies.

² FUM assets of the securities dealers are largely managed off balance sheet.

³ Data for the following countries were not available as at end-December 2015: Belize, Barbados, Guyana and Trinidad.

⁴ DTIs include commercial banks, building societies and FIA licensees.

⁵ Assets are defined as total balance sheet assets. Also, NDTFIs data is at end-September 2016.

Figure 3.4 Distribution of major asset categories as a share of total DTIs’ assets

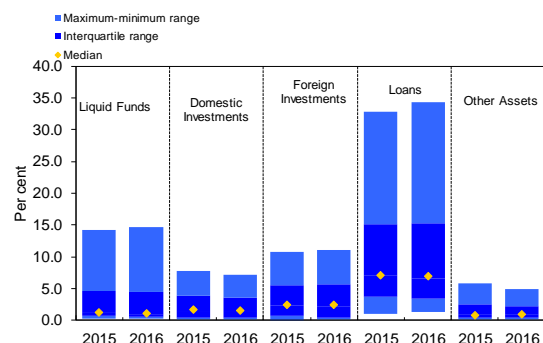


Figure 3.5 Major components of DTIs’ aggregate balance sheet as end-2015 and end-2016

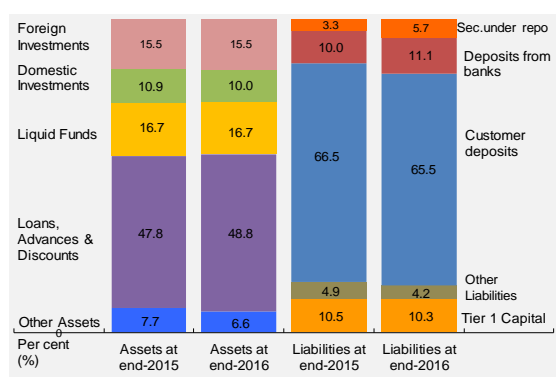
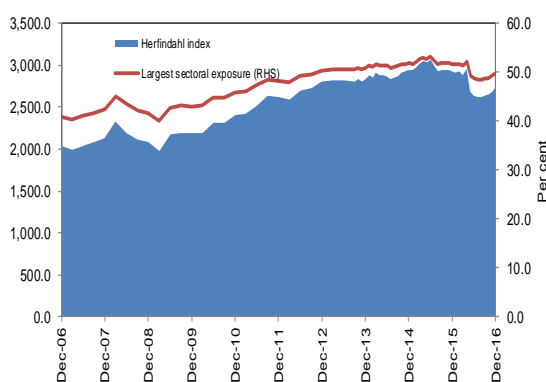


Figure 3.6 Concentration of DTIs’ loan portfolio to private sector (HHI 0-10,000)



Tobago to 176.4 per cent at end-2015. This compares to 169.0 per cent at end the previous year. The outturn for Trinidad and Tobago was primarily due to an expansion in financial institutions assets (see **Figure 3.1**).

3.3 DTIs and Credit Unions

3.3.1 Market share of DTIs and Credit Unions

Commercial banks remained the dominant subsector within the DTI sector. The market share of commercial banks and FIA licensees, in terms of asset base, increased to 71.9 per cent and 2.6 per cent at end 2016, relative to 71.2 per cent and 2.4 per cent respectively at-end 2015. Conversely, the market share of building societies and credit unions declined by 0.3 and 0.7 percentage points to 19.3 per cent, and 6.2 per cent, respectively (see **Figure 3.2**). Moreover, commercial bank assets as a percentage of overall financial system assets increased to 28.4 per cent at end-2016 (see **Figure 3.3**).

3.3.2 DTIs’ balance sheet position

All DTI subsectors recorded growth in their asset base for 2016. DTIs’ total assets grew by 14.4 per cent to 1 443.8 billion at end-2016 relative to growth of 9.6 per cent the previous year. The asset growth for the review period was due primarily to a 16.8 per cent increase in loans, advances and discounts. More specifically, loans, advances & discounts reflected an increase of 12.6 per cent in domestic loans and an increase of 32.5 per cent in foreign currency loans. At the same time, the holdings of investments grew by 10.6 per cent relative to the review period. This reflected growth in domestic investments and foreign investments of 5.1 per cent and 14.4 per cent respectively (see **Figure 3.4** and **Figure 3.5**). Moreover, DTIs’ net open position to capital ratio decreased by 1.2 percentage points to 2.3 per cent at-end 2016.

The Herfindahl-Hirschman Index (HHI), used to measure concentration in private sector lending, decreased by 6.3 per cent to 2 745.0 at end-2016 (see

Figure 3.6).⁶ The improvements in concentration risk was due to the more diversified loan portfolio of the DTIs' sector. Moreover, DTIs continued to have considerable exposure to the domestic household sector and this sector represented the DTIs' largest exposure to the private sector during 2016. More specifically, household sector loans as a proportion of total loans decreased by 1.9 percentage points to 49.86 per cent at end-2016. Furthermore, the DTIs' other significant exposures in the lending market were to *Distribution* (8.6 per cent), *Tourism* (7.1 per cent), *Financial Institutions* (5.8 per cent) and *Professional Services* (5.2 per cent) at end-2016 (see **Table 3.1**).

The credit portfolio of DTIs in Jamaica continued to reflect high concentration levels at-end 2016 with 73.0 per cent of credit extended to the private sector being channeled to three main economic sectors, namely *Distribution*, *Tourism* and *Household sector* (see **Figure 3.7**). Further, a Lorenz curve analysis was utilized, which showed that 30 per cent of the DTIs (three institutions) continue to account for over 60.0 per cent of loans extended to the sectors which are the most concentrated in loans. In regards to the personal loans and distribution sectors, there was a slight improvement in the number of DTIs that extended credit to these categories for the 2010 to 2016 post global crisis period (See **Figure 3.8**).

For the review period, loans of the three DTIs accounted for the largest share of private sector credit as a proportion of total private sector credit increased to 75.1 per cent at-end 2016. This increase was largely influenced by stronger credit growth to the distribution sector which grew by 13.0 per cent. However, the share

Figure 3.7 Share of Private Sector Credit by top three (3) DTIs

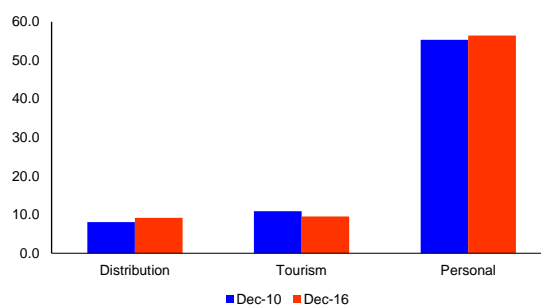
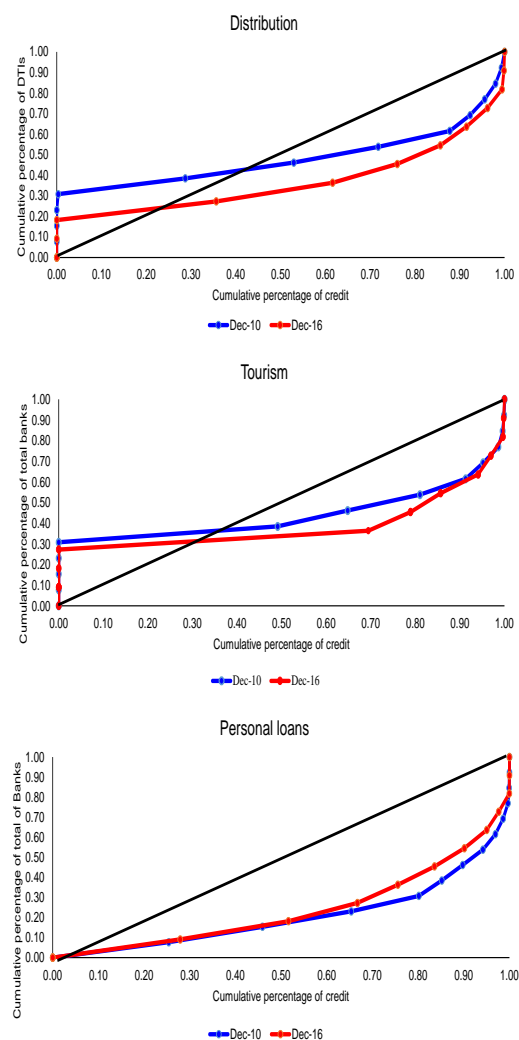


Figure 3.8 Distribution of credit by DTIs



⁶ The Herfindahl-Hirschman Index (HHI) is calculated by squaring the loan share of each sub-sector within the private sector loan market, and then summing the resulting numbers. The HHI index can range from close to zero to 10 000.

Table 3.1 Concentration of DTIs loan portfolio

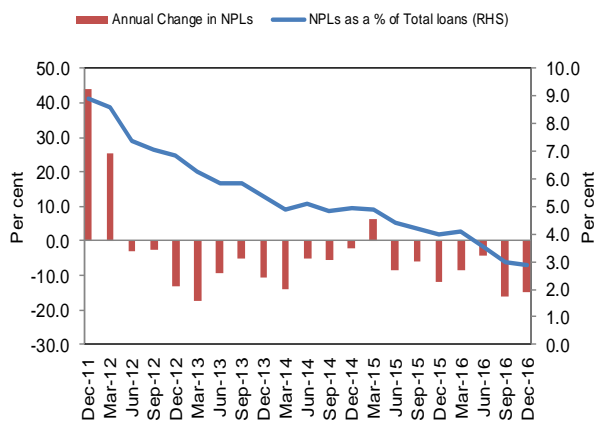
Per cent	2012	2013	2014	2015	2016
AGRICULTURE & FISHING					
CONSTRUCTION & LAND DEV.					
DISTRIBUTION					
ELECTRICITY					
ENTERTAINMENT					
FINANCIAL INSTITUTIONS					
MANUFACTURING					
MINING, QUARRYING & PROC.					
PERSONAL NON BUS. LOANS TO INDIVS.					
PROFESSIONAL & OTHER SERVICES					
OVERSEAS RESIDENTS					
TOURISM					
TRANSPORT, STORAGE & COMM.					
PUBLIC SECTOR					

Note: Darker shades signify increased concentration

of loans that these DTIs extend to the tourism sector decreased by 12.7 per cent.

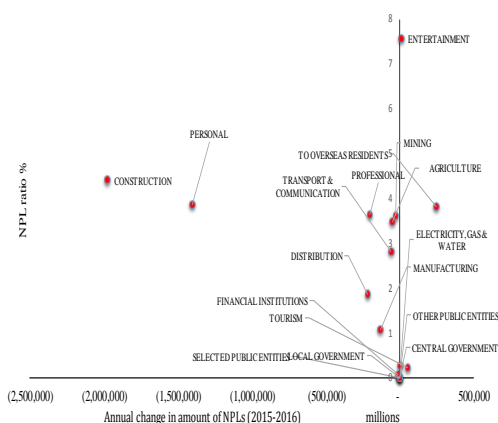
DTIs' asset quality, as measured by NPLs as a share of total loans, continued to improve during 2016. This development was largely due to a 14.6 per cent decline in NPLs relative to a decline of 11.9 per cent for the previous year (see **Figure 3.9**)⁷. Similarly, there were improvements in sectoral asset quality across most sectors. The entertainment sector accounted for the highest NPL ratio while the construction sector had the most significant dollar value decline in NPLs (see **Figure 3.10**).

Figure 3.9 NPLs in the DTI sector



The NPL coverage ratio increased to 116.6 per cent at end-2016 from 106.4 per cent at end-2015 and continued to remain well above the full coverage of 100 per cent.⁸ Correspondingly, there was an increase in the median NPL coverage ratio to 128 per cent at end-2016 relative to 118.0 per cent at end-2015 (see **Figure 3.11** & **Figure 3.12**). Loan loss provisions as a percentage of total loans decreased to 3.4 per cent at end-2016, relative to 4.4 per cent at end-2015. The reduction in loan loss provision was due to a pay-out of a major facility in the construction sector by the commercial banking sub-sector as well as lower NPLs reflecting improvements in borrowers' capacity to repay their obligations over the review period (see **Figure 3.11**)⁹.

Figure 3.10 Sectoral asset quality of DTIs



The DTI sector continued to maintain adequate levels of liquidity for 2016 consistent with an increase in liquid asset reserves in excess of the minimum

⁷ Some improvements in assets quality may be due to the increased usage of credit bureau by DTIs.

⁸ NPL coverage ratio measures a bank's ability to absorb potential losses from its non-performing loans. It is calculated as provisions for impairment under the International Financial Reporting Standards plus prudential provisions for expected losses based on regulatory criteria as a ratio to NPLs.

⁹ Loan loss provisions are net new allowances that DTIs make in the period against bad or impaired loans. This is done based on their judgement as to the likelihood of losses. It is calculated as provisions of impairment under the International Financial Reporting Standards plus prudential provisions as a percentage of total loans.

statutory.¹⁰ Notwithstanding, the ratio of liquid assets to total assets decreased marginally to 25.3 per cent at end-2016 relative 25.8 per cent at the close of the previous year. The decrease in the ratio was due mainly to DTIs’ slower pace of growth in liquid assets relative to the asset base, particularly within the building societies sub-sector (see **Figure 3.13**).

There was relative stability in funding risk over the review period, as funding from deposits continued to represent DTIs’ main source of asset financing. Total deposits increased by 13.8 per cent to \$877.9 billion, representing 71.4 per cent of total liabilities at end-2016 relative to 72.4 per cent at end-2015. In addition, total loans as a share of deposits which is a measure of financial intermediation increased to 80.2 per cent at end-2016 relative to 78.0 per cent at end-2015 (see **Figures 3.14** and **3.15**).

The CAR for DTIs decreased during 2016. Of note, the mean CAR declined to 16.8 per cent at end-2016 relative to 18.1 per cent at end-2015 (see **Figure 3.16**).¹¹ The quality of regulatory capital, as measured by the ratio of Tier 1 capital to total regulatory capital, declined marginally to 99.6 per cent at end 2016 relative to 100.7 per cent at end 2015. This performance largely reflected a reduction of non-distributable retained earnings which remained the largest component of Tier 1 capital, totaling 69.1 per cent at end-2016 relative to 55.0 per cent at end 2015. Similarly, the Tier 1 capital to risk weighted assets ratio decreased to 15.1 per cent from 15.5 per cent the previous year.

Figure 3.11 Loan loss provisioning rate and NPL coverage DTIs

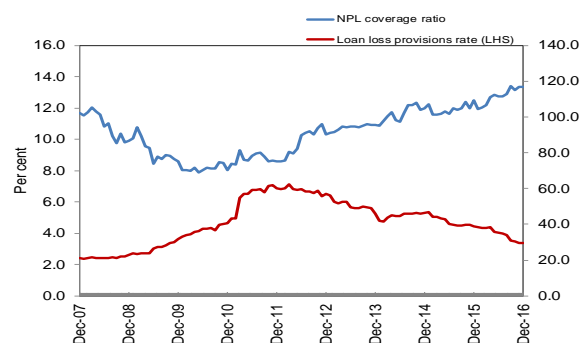


Figure 3.12 Distribution of NPL coverage ratio in the domestic DTI sector (min, max and median)

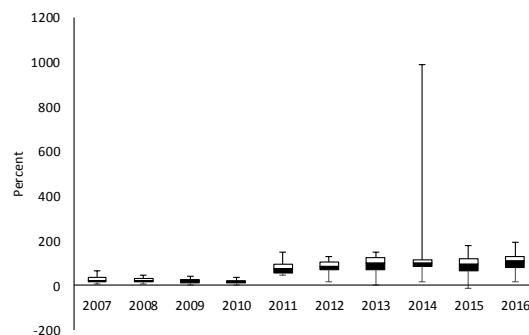
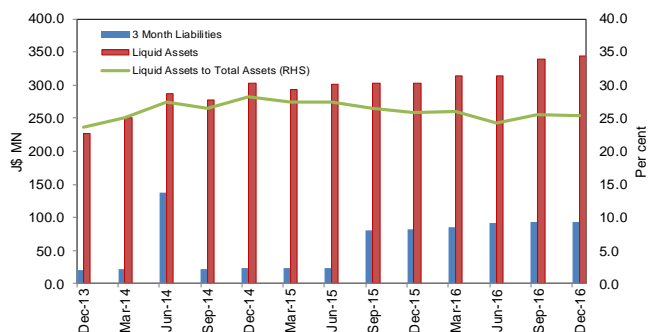


Figure 3.13 Liquidity conditions in the DTI sector



¹⁰ DTIs are required to hold reserves amounting to 26.0 per cent of their average liabilities in the form of liquid assets at the Bank of Jamaica.

¹¹ Note that the prudential minimum of 10.0 per cent is higher relative to the international benchmark which is 8.0 per cent.

3.3.3 DTIs' earnings and profitability

For 2016, the DTIs recorded net profits of \$37.6 billion reflecting an increase of 59.0 per cent relative to 2015. Furthermore, operating profits increased during 2016 to \$34.4 billion relative to \$20.9 billion for 2015. This increase was primarily due to an increase in operating income (see **Figure 3.17**).¹² Similarly, the sector's return on equity (ROE) increased by 5.3 percentage points to 18.0 per cent for the year. A decomposition of the ROE showed increases in the operating margin, gross income and the risk weighted assets density ratio (see **Figure 3.18**).¹³ Importantly, DTIs leverage ratio as measured by tier 1 capital as a percentage of total assets decreased during 2016. Notably, the median leverage ratio decreased to 10.3 per cent relative to 10.9 per cent at end-2015 (see **Figure 3.19**).

In addition, DTIs' ROA increased to 2.7 per cent as at end-2016. Moreover, the median ROA increased to 1.8 per cent in 2016 relative to 1.2 per cent as at the close of the previous year (see **Figure 3.20**). This reflected an increase in net interest income of 9.0 per cent for DTIs during 2016, which was largely due to increases in *Loans Advances & Discounts*. At the same time, interest expenses increased by 4.7 per cent for 2016, primarily as a result of an increase in borrowing expenses. Moreover, net interest margin for DTIs was 3.9 per cent at end 2016 relative to 4.12 per cent at end 2015 primarily due to growth in average earning assets (see **Figures 3.21 to 3.23**).¹⁴

¹² Operating profits excludes non-interest income and expenses

¹³ Operating margin is equal to net profit as a percentage of gross income. The risk weighted assets density ratio is calculated as risk weighted assets as a percentage of total assets. Equity multiplier is equal to total assets as a proportion of capital & reserves.

¹⁴ Net interest margin is equal to net interest income/average earning assets.

Figure 3.14 Distribution of DTIs' funding sources as a share of total liabilities as at end-2015 and end-2014

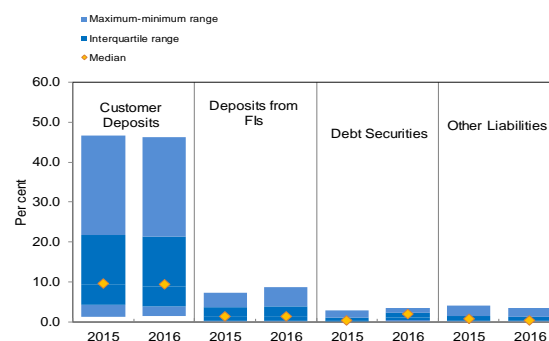


Figure 3.15 Trends in loans and deposits of the DTI sector

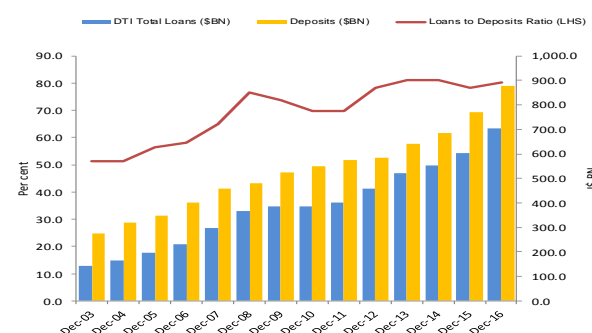


Figure 3.16 Distribution and average of capital adequacy ratio

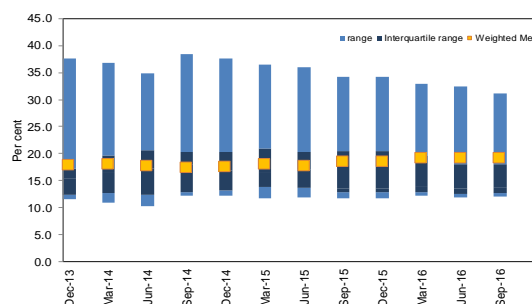


Figure 3.17 Operating profit and impairment losses for DTIs

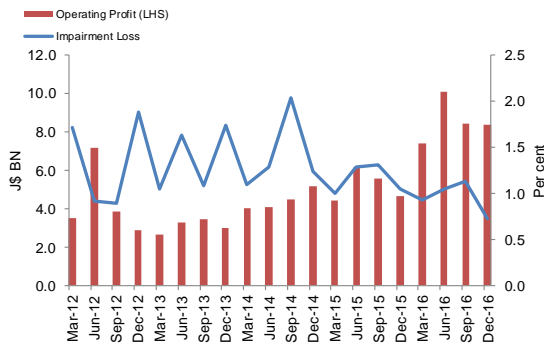


Figure 3.18 Decomposition of DTIs' ROE

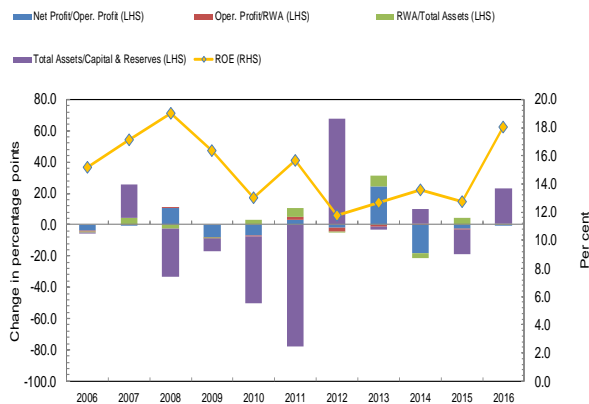
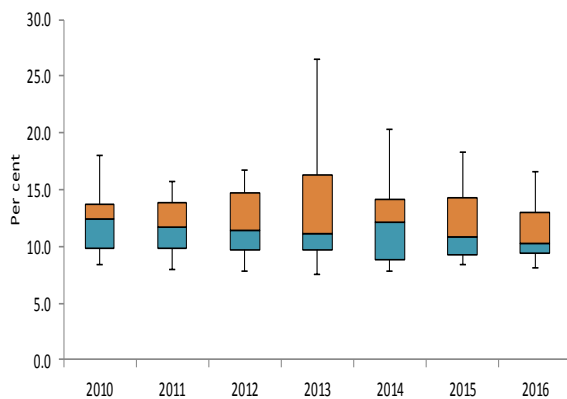


Figure 3.19 Distribution of DTIs' leverage



3.4 Non-Deposit-Taking Financial Institutions (NDFIs)

The asset base of the NDTFI sector increased by 10.7 per cent to \$1 592.0 billion as at end-September 2016 compared to \$1 438.5 billion at end-2015. The expansion in the sector's total assets was influenced by increases in assets of all NDTFI sub-sectors. Within the NDTFI sector, the asset base of securities dealers improved by 8.6 per cent at end-September 2016 relative to the close of 2015. The asset base of life insurance companies and general insurance companies grew by 5.7 per cent and 12.1 per cent, respectively. Furthermore, collective investment schemes (CIS) reflected the most significant growth for the review period. The asset base of CIS increased by 25.5 per cent for the review period relative to end-2015. At end-September 2016, assets of securities dealers, pension funds and life insurance companies accounted for 36.3 per cent, 27.5 per cent, and 18.5 per cent, respectively, of NDTFI total assets. However, securities dealers, pension funds and life insurers recorded a lower share of the market relative to end-2015 (see **Figure 3.25**). Securities dealers have lower asset growth relative to the previous review period due to the continued phasing down of the retail repurchase business model.

3.4.1 Securities Dealers

Securities dealers' asset base was \$577.1 billion as at end-September 2016, relative to \$531.2 billion for end-2015. SDs' off-balance sheet assets continued to be twice that of the on-balance sheet items. Of note, due to the on-going reforms in the securities dealers sector, these institutions have been expanding their product offerings to include CIS. The value of the CIS managed by these dealers are a part of the total FUM assets reported by the securities dealers. The FUM assets of the major securities dealers increased to \$1 094.1 billion at end-September 2016 relative to \$855.3 billion

at end-2015 (see **Figure 3.26**).¹⁵ The increase in FUM for the review period was driven by an increase in holdings of assets classified as *Other Assets*.¹⁶

Risk weighted assets (RWA) of the securities dealers rose by 11.9 per cent to \$346.5 billion at end-September 2016 (see **Figure 3.24**). Furthermore, the sector's CAR by 1.0 percentage point (pp) to 20.5 per cent at end-September 2016 which was largely influenced by the increase in RWA, despite a marginal increase in regulatory capital (see **Figure 3.27**). Similarly, the sector's primary ratio, measured as regulatory capital to total assets, increased by 0.4 pp to 13.2 per cent at end-September 2016. Regulatory capital increased by 12.2 per cent to \$71.1 billion. Nonetheless, the CAR and primary ratio remained over the prudential benchmark of 10.0 per cent and 6.0 per cent, respectively.

Securities dealers were more susceptible to foreign exchange risk at end-September 2016 compared to end-2015. The sector's foreign currency net open position to capital ratio increased to 23.6 per cent at end-September 2016, relative to 19.1 per cent at the close of 2015 (see **Figure 3.28** and **Table 3.3A**). This increased foreign exchange exposure is consistent with trend increase in dollarization in the sector since end-2015. As at end-September 2016, foreign currency investment holdings to total investment was 60.6 per cent.

The SDs showed marginal improvement in profitability. For the calendar year to September 2016, the securities dealers reflected a ROA of 1.6 per cent and ROE of 11.4 per cent compared to a ROA and ROE of 1.5 per cent and 11.3 per cent, respectively, for the calendar year to September 2015 (see **Figure 3.29** and **Table 3.3A**). Furthermore, total liabilities as a share of total assets, which is one measure of leverage, declined by

¹⁵The twelve securities dealers referred to are essentially core dealers whose business model is predominantly securities dealing activities. The sample includes the five largest SDs.

¹⁶*Other Assets* category includes, but is not limited to: CIS, corporate bonds, equities and reverse repurchase agreements.

Figure 3.20 Distribution of DTIs' return on assets (ROA)

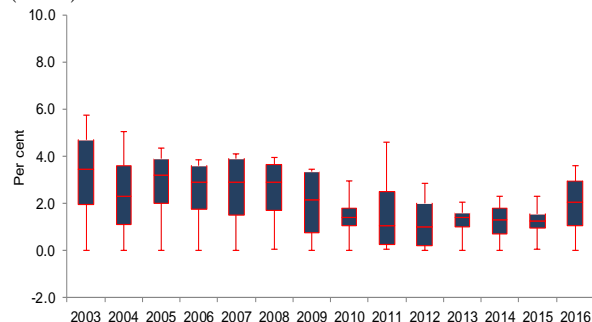


Figure 3.21 DTIs' sources of revenue, charges for provisions and net profit (JMD billions)

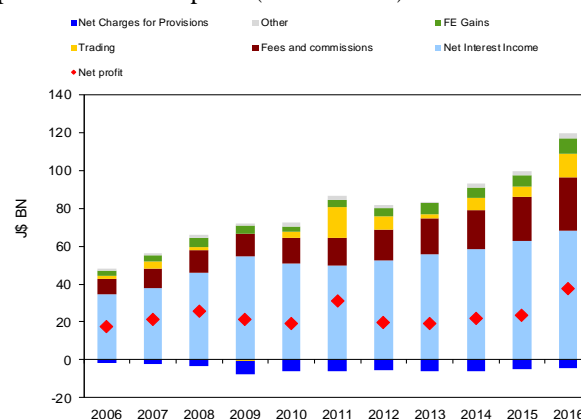


Figure 3.22 Interest margin for retail operations of DTIs

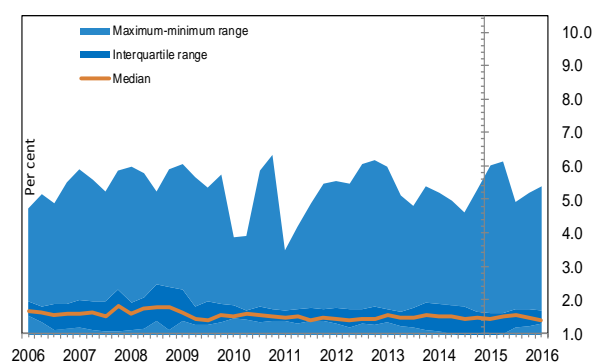


Figure 3.23 DTIs' sources of interest income

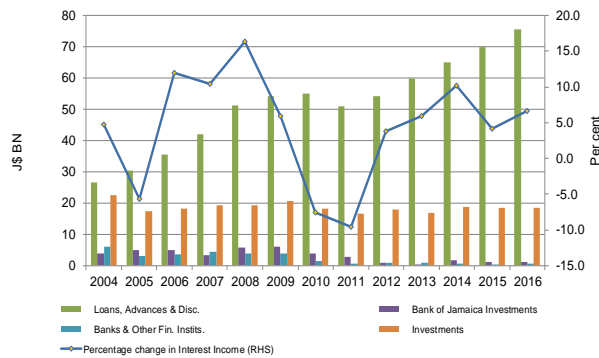


Figure 3.24 Risk-weighted assets (Two largest banks vs banking sector; securities dealers (SDs))

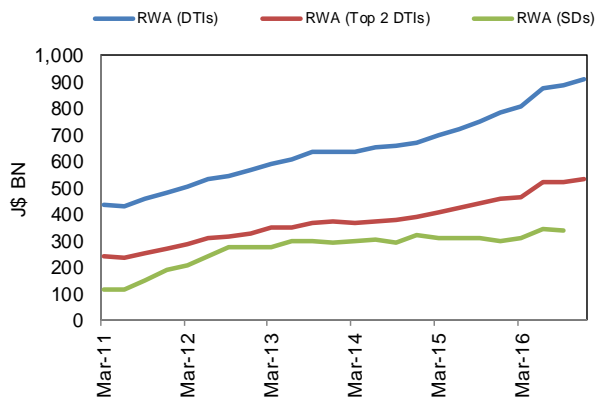
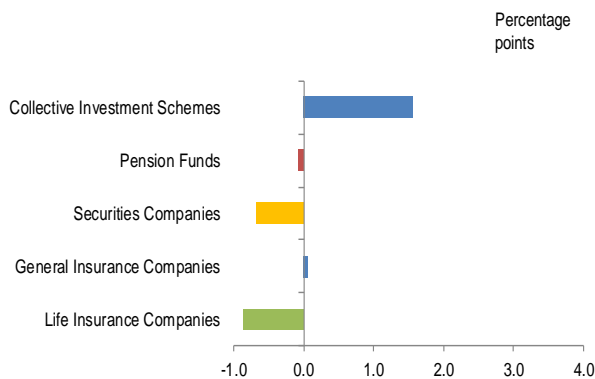


Figure 3.25 Change in market share in NDTFIs assets (change between end-2015 and end-September 2016)



0.28 pp relative to 86.0 per cent at end-September 2016, which represents an improvement relative to end-2015.

3.4.2 Insurance Companies

The number of companies in the insurance sector increased to seventeen at end-September 2016 from sixteen at end-2015, reflecting an additional company in the general insurance sub-sector. Life insurance companies continued to be the dominant sub-sector, accounting for 80.3 per cent of the sector's total assets. Furthermore, the two largest life insurance companies accounted for 65.7 per cent of the sub-sector's total assets as at end-September 2016. However, the three largest companies of the general insurance sub-sector accounted for 51.2 per cent of the sub-sector's asset base.

There was growth of 6.9 per cent in the insurance sector's asset base as at end-September 2016 relative to the close of 2015 (see **Figure 3.30**). More specifically, the respective asset bases for life and general insurance companies were \$294.6 billion and \$72.4 billion at end-September 2016 compared to \$278.7 billion and \$64.6 billion at end-2015. For life insurance companies, asset growth was driven predominantly by an increase in *Total Equity Investments* of 52.5 per cent. The increase in the asset base of general insurance companies was influenced by growth of 10.6 per cent in *Total Investments*.

Government securities accounted for 56.3 per cent and 33.4 per cent of life insurance assets and general insurance assets, respectively, at end-September 2016, relative to 58.4 per cent and 32.7 per cent at end-2015 (see **Figures 3.31** and **3.32**). As at end-September 2016, the share of real estate, unquoted equities and debtors in total assets for the life insurance and general insurance sub-sectors accounted for 3.3 and 7.0 per cent, respectively, relative to 3.0 per cent and 8.2 per cent, the previous year. Thus, the asset quality deteriorated

for the life insurance sub-sector and improved for the general insurance sub-sector.¹⁷

The market for insurance continues to be relatively underdeveloped. Despite growth in the sector's asset base, insurance penetration continued to be low as at end-September 2016 (see **Figure 3.33** and **Table 3.4**).¹⁸ Insurance penetration for life insurance companies decreased to 2.0 per cent of GDP relative to 2.8 per cent of GDP as at end-2015. Furthermore, insurance penetration for general insurance companies decreased by 0.55 pp to 1.83 per cent of GDP at end-September 2016 relative to end-2015. Against this background, the insurance density remained flat at 0.001 per cent for the past three years.¹⁹

The total gross written premium (GWP) income of insurance companies was \$87.7 billion for the twelve-month period ended September 2016 relative to \$79.1 billion for the previous twelve-month period ended September 2015. Notably, the increase in GWP in the insurance sector was supported by both sub-sectors (see **Figure 3.34**). Notwithstanding the increase in GWP, there was a 27.5 per cent increase in claims incurred by the sector for the twelve-month period ended September 2016 relative to the previous twelve-month period ended September 2015 (see **Figure 3.35**). In addition, the claims ratio, which is the ratio of claims incurred to earned premiums for insurance sector, was 29.9 per cent for year ended September 2016 compared to 27.1

Figure 3.26 Securities dealers' funds under management (FUM) (J\$ billions)



Figure 3.27 Securities dealers' regulatory capital, capital adequacy and primary ratios

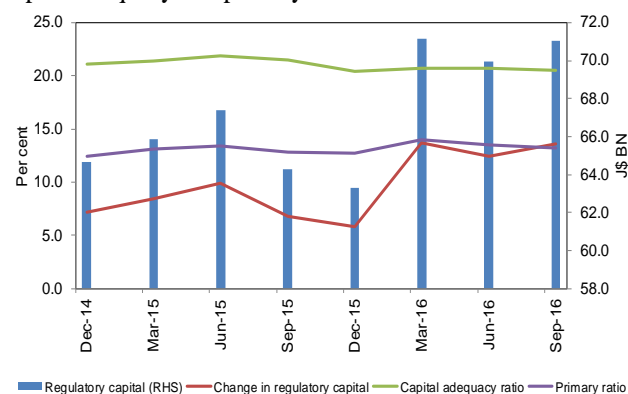
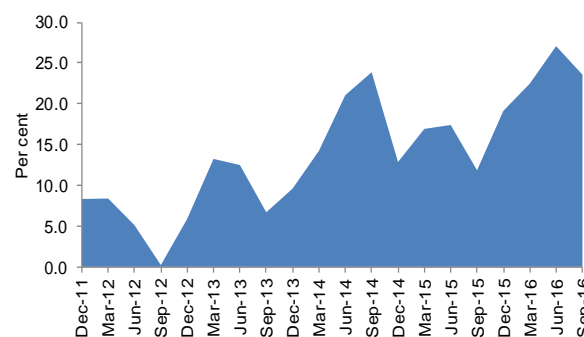


Figure 3.28 Securities dealers' net open position to capital



¹⁷ Real estate, unquoted equities and debtors are asset classes within the insurance sector which have the largest probability of being impaired. This is largely due to the fact that real estate and unquoted equities are illiquid assets, while debtors (accounts receivables) exposes the sector to credit risk.

¹⁸ Insurance penetration is defined as ratio of premium volume to GDP. It measures the importance of insurance activity relative to the size of the economy.

¹⁹ Insurance density is the ratio of total gross premiums to total population.

Figure 3.29 Securities dealers’ return on assets and return on equity

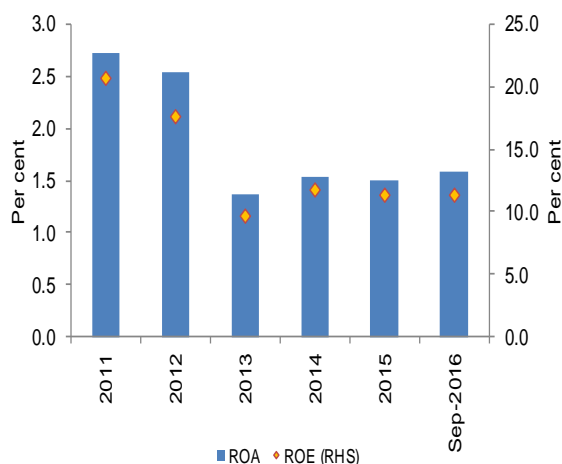


Figure 3.30 Total assets of insurance companies

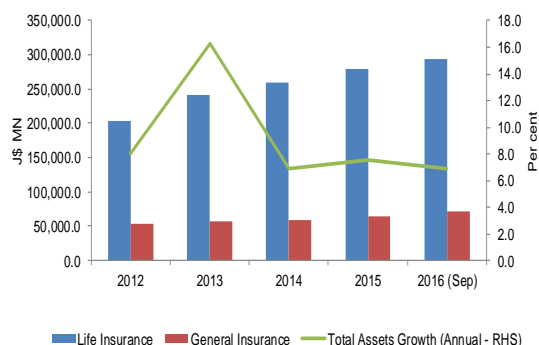
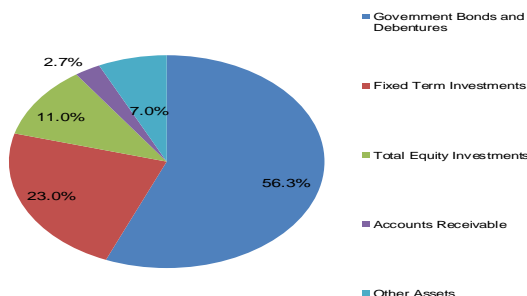


Figure 3.31 Distribution of assets of life insurance companies



per cent for year ended September 2015.^{20,21}

The five year average of the insurance claims ratio was 28.9 per cent. This increase in the claims ratio is driven by claims incurred growing at a faster rate than earned premiums.

The insurance sector’s profitability reflected an improvement for the review period. Total income grew by 11.3 per cent for the year ended September 2016 relative to the prior review period (see **Figure 3.36**). Additionally, profit before tax and extraordinary expense for the insurance sector was \$27.4 billion for the year ended September 2016. An increase in life insurance profits before taxes of 34.1 per cent to \$22.2 billion for year end-September 2016 largely influenced the profit performance for the insurance sector (see **Figure 3.37**). The ROA and ROE of the life insurance sector both increased by 0.2 pp to respective values of 4.9 per cent and 20.9 per cent at year end-September 2016, relative to the year ended September 2015. Similarly, the ROA for the general insurance sector increased to 5.7 per cent while the ROE increased to 16.1 per cent for the year ended September 2016, relative to 4.7 per cent and 13.2 per cent, for the year ended September 2015. The increase in the general insurance sector’s profitability resulted from an increase in net premium earned.

The capital adequacy and solvency of the insurance companies remained at sufficient levels up to end-September 2016. In particular, the sector’s median solvency ratio, as measured by available capital to total liabilities, increased to 153.7 per cent relative to 150.1 per cent at the close of 2015 (see **Figure 3.38**). However, there was a decrease in the ratio of capital to total assets to 22.4 per cent at end-September 2016

²⁰ Earned premium is GWP adjusted by the unearned premium provisions at the beginning and end of the accounting period.

²¹ The breakdown of data required for the calculation of this ratio is not available for life insurance companies.

from 22.9 per cent at end-2015 (see **Figure 3.39**). All life insurance companies surpassed the minimum regulatory capital requirements with respect to the Minimum Continuing Capital and Surplus Requirements (MCCSR) ratio.²² The MCCSR ratio for the life insurance sub-sector was 259.3 per cent in comparison to the minimum requirement of 150.0 per cent. Similarly, all general insurance companies exceeded their minimum capital regulatory requirement of a Minimum Capital Test (MCT) ratio of 250.0 per cent.²³ The MCT ratio for the general insurance sub-sector was 309.0 per cent. At end-September 2016, the retention ratio for life insurance companies increased marginally to 98.6 per cent relative to 98.1 per cent at end-2015 period.²⁴ However, general insurance companies' retention ratio increased to 70.3 per cent at end-September 2016 from 57.1 per cent at the end of 2015 (see **Figures 3.40 & 3.41**).

Figure 3.32 Distribution of assets of general insurance companies

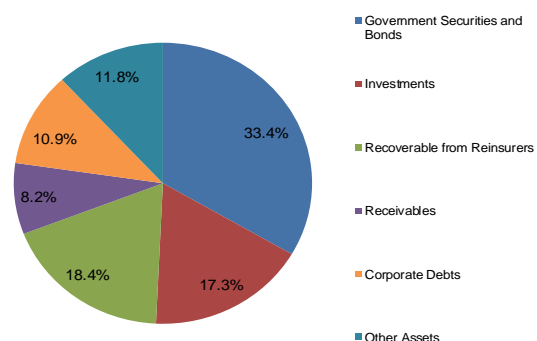


Figure 3.33 Insurance penetration (% of GDP)

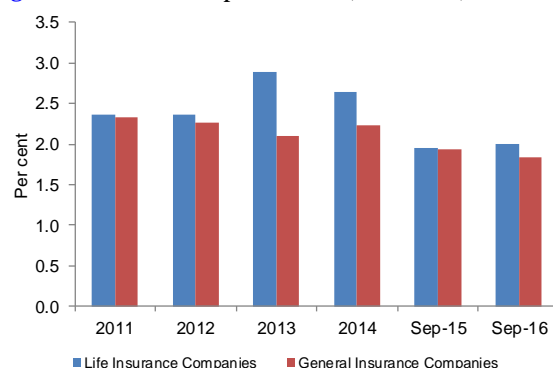
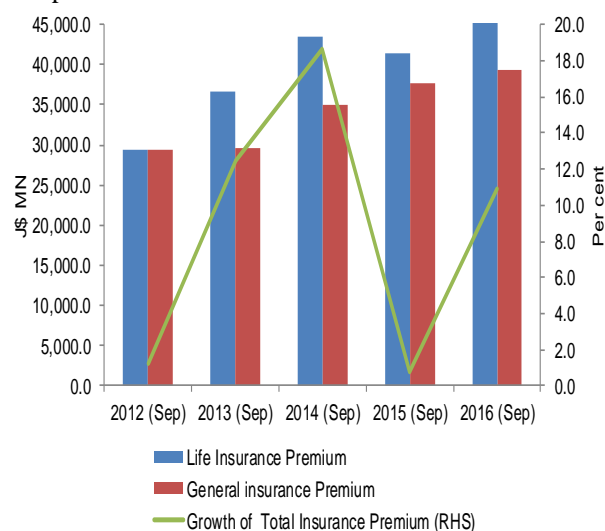


Figure 3.34 Premium income and growth of insurance companies



²² The Minimum Continuing Capital and Surplus Requirements (MCCSR) uses the actuarial liabilities and asset mix to measure an insurer's capital adequacy to meet its obligations to policyholders.

²³ The MCT Prescribed Capital Required ("PCR") assesses the riskiness of assets and policy liabilities and compares capital available to capital required. It was initially set at 200.0 per cent and was increased to 225.0 per cent in the first quarter of 2012 and increased to 250.0 per cent in 2013.

²⁴ Reinsurance retention ratio measures the amount of risk being absorbed by an insurer rather than passing it on to a reinsurer. Measured as the ratio of net premiums written to gross premiums, the ratio captures the net amount of risk which the reinsurer keeps for his own account.

Figure 3.35 Earned premium, claims incurred and claims ratio of general insurance

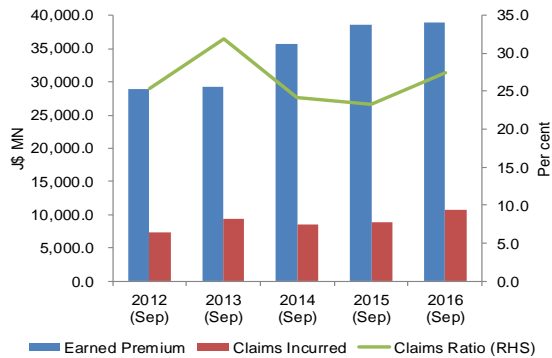


Figure 3.38 Distribution of the solvency of insurance companies (available to required solvency ratio; %)

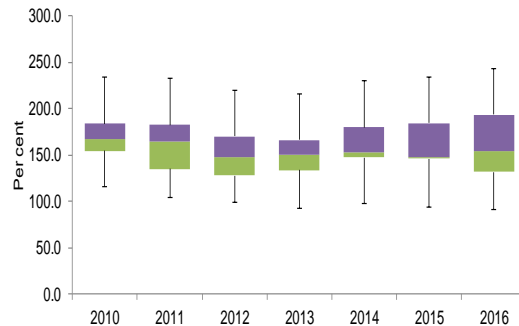


Figure 3.36 Total income (GWP + investment income) of the insurance sector

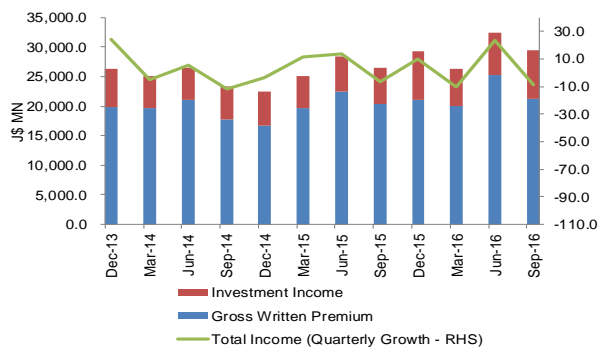


Figure 3.39 Capitalization of the insurance sector (JMD billions; %)

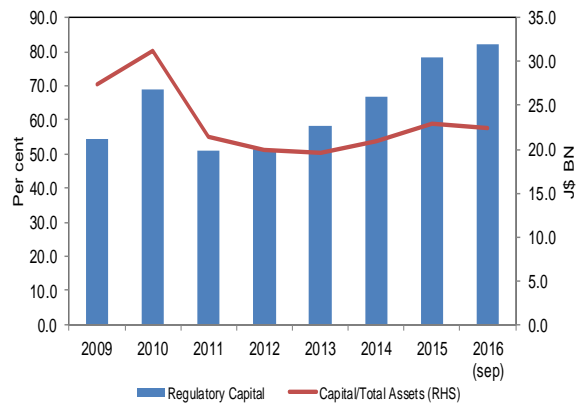


Figure 3.37 Profit before tax and growth of insurance companies

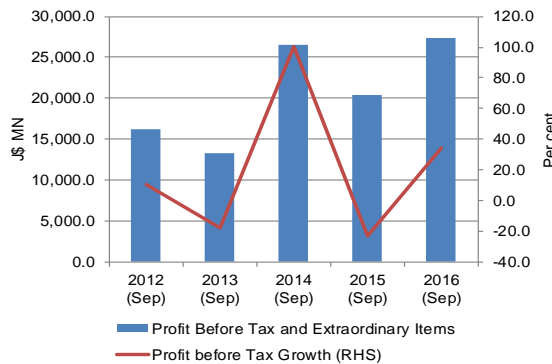


Figure 3.40 Life insurance retention ratio; %

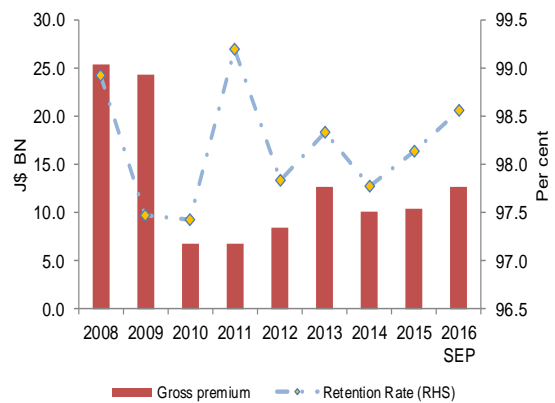


Figure 3.41 General insurance retention ratio; %

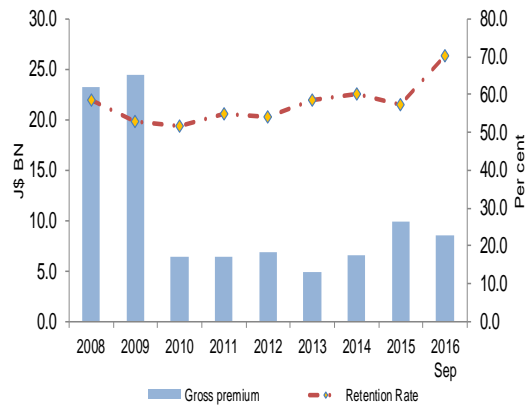


Table 3.2 Financial Soundness Indicators for Deposit-Taking Institutions^{1/}

Indicator (%)	Categories	Mar-15	Jun-15	Sep-15	Dec-15	Mar-16	Jun-16	Sep-16	Dec-16
Core Indicators									
Regulatory capital to risk-weighted assets	Capital adequacy	15.7	15.6	15.1	14.9	14.8	14.5	14.7	14.7
Tier 1 capital to risk-weighted assets	Capital adequacy	15.8	15.7	15.2	15.0	14.9	14.5	14.6	14.2
Non-performing loans (net) to capital	Capital adequacy	-0.3	-0.4	-1.0	-1.2	-1.2	-1.9	-2.4	-2.2
Non-performing loans to total loans	Assets quality	4.9	4.4	4.2	4.1	4.0	3.5	3.0	2.9
Return on assets	Earnings & Profitability	0.5	0.6	0.6	0.5	0.7	0.9	0.7	0.7
Return on equity	Earnings & Profitability	3.3	4.1	3.7	3.0	4.3	6.0	4.9	4.6
Interest margin to income	Earnings & Profitability	51.4	53.6	52.9	51.9	50.7	45.5	48.9	48.7
Non-interest expenses to income	Earnings & Profitability	25.8	25.0	24.3	27.6	24.3	21.9	22.8	23.0
Liquid assets to total assets	Liquidity	27.4	27.4	26.5	25.8	26.0	24.3	25.5	25.3
Duration on assets - Domestic Bonds	Sensitivity to Market Risk	1.1	1.3	0.8	0.9	1.1	1.0	1.3	N/A
Duration on assets - Global Bonds	Sensitivity to Market Risk	2.7	2.8	2.8	2.9	3.5	3.3	3.0	N/A
NOP to capital	Sensitivity to Market Risk	1.1	0.5	4.7	3.5	13.6	13.9	7.0	3.5
Encouraged Indicators									
Capital to assets	Capital adequacy	15.4	15.4	15.3	15.1	15.2	14.8	14.9	14.6
Trading income to total income	Earnings & Profitability	11.0	9.4	9.8	10.5	13.2	19.4	15.7	18.1
Personnel expenses to non-interest expenses	Earnings & Profitability	38.5	40.2	38.3	38.4	39.3	38.3	37.5	34.2
Spread between lending & deposits rates ^{2/}	Earnings & Profitability	13.7	14.0	13.9	13.9	13.3	13.2	13.0	13.0
Deposits to total (non-interbank) loans	Liquidity	137.0	141.9	141.6	142.5	145.1	138.7	138.1	137.0
Foreign-currency-denominated loans to total loans	Foreign Exchange risk	23.0	23.2	24.3	23.6	23.1	27.4	27.2	26.4
Foreign-currency-denominated liabilities to total liabilities	Foreign Exchange risk	38.0	41.6	41.2	41.2	42.1	42.7	43.1	42.8
Net open position in equities to capital	Foreign Exchange risk	19.9	21.7	21.1	18.0	17.4	16.7	16.1	16.1
Household debt to GDP	Household sector leverage	16.6	16.7	17.1	17.3	17.0	17.3	17.7	18.3
Residential real estate loans to total loans	Exposure to real estate	24.5	24.9	24.3	24.5	24.6	23.3	22.9	22.7
Commercial real estate loans to total loans ^{3/}	Exposure to real estate	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Notes:

^{1/} Deposit-taking Institutions (DTIs) include commercial banks FIA licensees and building societies.

^{2/} Weighted by assets size.

^{3/} Represents data for building societies only.

Table 3.3 Financial Soundness Indicators for Securities Dealers and Insurance Companies

Indicator (%)	Categories	Jun-15	Sep-15	Dec-15	Mar-16	Jun-16	Sep-16
A. Securities Dealers ^{1/}							
Regulatory capital to risk-weighted assets	Capital adequacy	21.9	21.5	20.5	20.7	20.7	20.5
Tier 1 capital to risk-weighted assets	Capital adequacy	19.4	19.3	19.1	18.3	18.0	16.9
Non-performing loans (net) to capital	Capital adequacy	1.3	0.6	0.3	0.1	0.1	0.1
Non-performing loans to total loans	Assets quality	22.1	21.2	7.3	6.6	5.4	4.5
Return on assets	Earnings & Profitability	0.6	0.4	0.3	0.3	0.8	0.6
Return on equity	Earnings & Profitability	4.7	2.8	1.9	2.6	6.3	4.5
Interest margin to income	Earnings & Profitability	29.8	30.9	29.9	30.2	23.6	25.8
Non-interest expenses to income	Earnings & Profitability	26.2	29.4	35.4	33.5	26.2	32.1
Liquid assets to total assets	Liquidity	12.4	12.4	10.8	9.3	10.8	12.3
Duration on assets -Domestic Bonds	Sensitivity to Market Risk	1.4	1.4	1.4	2.2	3.0	2.6
Duration on assets- Global Bonds	Sensitivity to Market Risk	5.3	5.1	6.1	6.3	8.3	8.1
NOP to capital	Sensitivity to Market Risk	17.4	11.8	19.1	22.5	27.1	23.6
B. General Insurance							
Net premium to Capital	Capital adequacy	22.1	20.6	21.4	21.1	21.0	28.0
Capital to Assets	Capital adequacy	28.0	29.6	31.1	30.2	27.8	29.7
(Real estate + unquoted equities + debtors) to total assets	Assets quality	10.3	6.9	8.2	9.6	11.0	7.0
Receivables to gross premiums	Assets quality	47.6	32.9	52.3	58.0	49.9	46.3
Equities to total assets	Assets quality	1.9	1.9	2.5	2.4	2.3	2.5
Net technical reserves to net claims paid in last 3 years	Reinsurance & actuarial issues	463.9	450.7	469.7	457.6	378.8	346.0
Risk retention ratio (net premium to gross premium)	Reinsurance & actuarial issues	34.6	39.7	57.1	47.1	31.0	70.3
Gross premium to number of employees J\$(000)	Management Soundness	10.1	8.4	6.4	7.7	12.2	7.3
Assets per employee J\$(000)	Management Soundness	56.1	54.9	54.8	56.8	64.4	61.4
Net Claims to net premium (loss ratio)	Earnings & Profitability	52.7	53.7	48.6	63.1	64.4	56.2
Total expenses to net premium (expense ratio)	Earnings & Profitability	91.4	98.3	87.4	100.7	98.4	97.1
Combined ratio (loss + expense ratio)	Earnings & Profitability	144.2	152.0	136.1	163.8	162.8	153.4
Investment Income to net premium	Earnings & Profitability	17.8	16.0	21.5	16.5	20.9	22.7
Return on Equity	Earnings & Profitability	6.3	5.9	6.5	3.4	5.5	9.8
Liquid assets to total liabilities	Liquidity	85.5	84.5	85.8	86.3	77.9	83.4
C. Life Insurance							
Capital to technical reserves	Capital adequacy	77.0	81.5	87.3	93.7	84.5	84.6
(Real estate + unquoted equities + debtors) to total assets	Assets quality	2.7	2.9	3.0	2.3	3.5	3.3
Receivables to gross premiums	Assets quality	56.3	62.5	50.8	39.6	77.0	61.7
Equities to total assets	Assets quality	2.1	1.9	2.7	2.7	2.7	2.6
Net technical reserves to net premium paid in last 3 years	Reinsurance & actuarial issues	808.3	774.7	744.3	668.0	754.9	776.8
Risk retention ratio (net premium to gross premium)	Reinsurance & actuarial issues	98.0	98.0	98.1	98.2	98.0	98.6
Gross premium to number of employees J\$(000)	Management Soundness	5.5	5.4	7.0	5.7	5.7	6.6
Assets per employee J\$(000)	Management Soundness	139.6	140.7	144.4	135.3	148.8	152.7
Expenses to net premium (expense ratio)	Earnings & Profitability	52.6	50.0	53.4	51.9	53.5	42.8
Investment Income to investment assets	Earnings & Profitability	2.2	2.2	2.9	2.5	2.4	2.6
Return on Equity	Earnings & Profitability	4.4	12.0	12.2	5.9	6.4	8.2
Liquid assets to total liabilities	Liquidity	29.2	29.3	27.6	15.7	29.1	33.0
Duration on assets -Domestic Bonds	Sensitivity to market risk	1.1	1.1	1.2	1.3	1.3	1.3
Duration on assets- Global Bonds	Sensitivity to market risk	7.5	7.4	8.8	8.8	5.5	5.5

Notes:

^{1/} Includes the top-12 securities dealers.

Table 3.4 Sectoral Indicators of Financial Development

Sub-sector	Indicator	2011	2012	2013	2014	2015	2016
Banking	Total number of DTIs	13	13	12	11	11	11
	Number of branches and outlets	173	173	166	165	165	165
	Number of branches/thousands population	0.06	0.06	0.06	0.06	0.06	0.06
	Bank deposits/GDP (%)	41.7	44.5	45.1	44.3	47.1	50.4
	Bank assets/total financial assets (%) ^{1/}	34.9	36.6	37.2	35.7	36.8	37.1
	Bank assets/GDP (%)	63.8	66.2	67.8	69.3	71.8	77.9
Insurance	Number of insurance companies	14	14	14	15	16	17
	Gross premiums/GDP (%)	4.5	4.6	5.0	4.9	4.8	5.0
	Gross life premiums/GDP (%)	2.3	2.4	2.9	2.6	2.5	2.8
	Gross non-life premiums/GDP (%)	2.2	2.3	2.1	2.2	2.3	2.3
	Insurance assets/GDP (%)	18.8	19.6	21.0	20.7	21.2	21.1
	Insurance assets/total financial assets (%)	10.0	10.3	10.8	11.0	10.7	10.5
Pensions	Types of pension plans						
	# Defined Benefit plan	116	116	111	110	107	106
	# Defined Contribution plan	347	347	333	319	308	304
	Pension fund assets/total financial assets (%)	12.2	12.4	11.9	11.4	11.5	12.0
	Pension fund assets/GDP (%)	22.3	22.4	21.6	22.1	22.4	25.2
Mortgage	Mortgage assets/total financial assets (%) ^{2/}	4.1	8.0	8.3	7.9	8.4	8.4
	Mortgage assets/GDP (%)	8.7	14.4	15.1	15.4	16.4	17.6
Securities Dealers	Total number of securities dealers	31	29	29	30	29	29
	Securities dealer's/total financial assets (%)	21.7	21.5	20.2	18.2	16.6	15.8
	Securities dealer's assets/GDP (%)	39.6	39.0	36.8	35.3	32.5	33.2
Credit Union	Total number of credit unions	43	43	38	37	37	37
	Credit union's assets/total financial assets (%)	3.2	3.0	3.0	2.7	2.7	2.4
	Credit union's assets/GDP (%)	4.8	5.4	5.4	5.3	5.3	5.1
Foreign exchange markets	Adequacy of foreign exchange (reserves in months of imports)	4.7	3.3	3.2	4.4	5.6	6.1
	Foreign exchange reserves as ratio to short-term external debt (%)	196.8	281.0	139.3	279.8	529.6	486.6
Capital markets	Number of listed securities (equities) ^{3/}	55	50	56	54	64	68
	Number of new issues (equities) ^{4/}	6	4	14	7	1	7
	Number of new issues (bonds) ^{5/}	19	24	2	0	0	5
	Value of new issues (equities) J\$Bn	3.0	0.4	45.0	1.4	0.3	1.8
	Value of new issues (bonds) J\$Bn	105.1	77.8	1.7	0	0.0	41.8
	Market capitalization/GDP (%)	48.9	44.7	34.6	19.0	36.9	45.7
	Value traded/market capitalization (%)	3.4	3.1	2.9	4.4	3.4	3.2
Collective investment funds	Unit trust funds under management (J\$BN) ^{6/}	32.4	49.7	58.0	111.0	136.4	181.2
	Number of unit trusts	4	9	10	11	12	13
	Unit trust FUM/total financial assets (%)	1.4	2.1	2.2	3.7	4.3	5.0
	Mutual funds (value of units held by Jamaicans)US\$MN	164.5	122.0	165.0	177.0	200.9	223.0
	Mutual funds/total financial assets(%)	0.6	0.5	0.7	0.7	0.7	0.8

Notes:

^{1/} Financial system assets include assets for banks, insurance companies, credit unions, securities dealers, pension funds, unit trust FUM and mutual funds.

^{2/} Includes data for building societies, commercial banks & National Housing Trust

^{3/} Includes Junior market listings

^{4/} Includes preference shares

^{5/} Government of Jamaica bonds

^{6/} Unit trust portfolios are composed mainly of fixed income securities, equities and real estate investments

Box 3.1 International and Local Measures Regarding Correspondent Bank De-Risking

The financial and economic system depends on the global network of banks that enables international business activity. Over the past few years there has been a general tightening of international regulatory standards for international finance which include principles related to understanding and mitigating risks, illicit financing and tax transparency. During 2016, several actions to confront correspondent bank de-risking were taken by the regional and international communities.

Efforts by Regional and International Financial Institutions

CARICOM Committee of Central Bank Governors have voiced the intention to take a regional approach by, among other things:

- i. improving efforts to achieve full compliance with international AML/CFT and tax transparency standards.
- ii. harmonizing legislation across the region and increasing resources dedicated to financial intelligence units.
- iii. establishing frameworks for National Risk Assessments, National Action Plans and National AML/CTF committees.
- iv. engage and work with international rule setting such as the IMF and World Bank.

The Caribbean Development Bank (CDB) as well has been engaging with regional stakeholders by means of advocacy. The development bank further reports the willingness to ‘offer technical assistance (TA) to fund appropriate proposals and studies focused on finding solutions aimed at reversing the decline in CBRs and mechanisms to mitigate its impact on the Region CDB is willing to mobilize and provide TA to its BMCs, including to develop their institutional capacity for Anti-Money Laundering and Countering the Financing of Terrorism (AML/CFT) and financial sanctions compliance’.¹

U.S Department of the Treasury has made a number of statements on their commitment to continue cooperation and dialogue on de-risking and plans to enhance the effectiveness of AML/CFT measures across the globe. The Treasury is working both bilaterally and through engagement with FATF

to promote more consistent implementation of AML/CFT regimes. In 2016 the Treasury, through the Office of the Comptroller of the Currency (OCC), issued guidance on the reevaluation of foreign correspondent banking.² The guidance encouraged licensees to engage in corporate governance best practices when making account retention or termination decisions in relation to their correspondent banks.

- i. The OCC reiterated its supervisory expectation that banks should have established policies and procedures for conducting risk assessments for foreign correspondent accounts and that risk assessments are re-evaluated periodically as part of banks’ ongoing risk management and due diligence.
- ii. The Guidance states that banks should establish and maintain an effective corporate governance function to review the method for risk re-evaluation and to monitor the appropriateness of recommendations regarding foreign correspondent account retention or termination. When conducting re-evaluations, banks should confirm that procedures are implemented for reassessing the risk associated with foreign correspondent and the related decisions re retention or termination are considered by senior management.
- iii. Further, banks should ensure that decisions to terminate foreign correspondent accounts which result from re-evaluations are based on analysis of the risks presented by individual financial institutions and the bank’s ability to manage the associated risks.
- iv. The OCC is also encouraging banks to ensure that they have mechanisms in place to clearly communicate decisions to place restrictions on accounts or terminate relationships; provide sufficient time for the foreign correspondent to establish new relationship(s); and ensure a clear audit trail of the reasons and method used for account closure.

The Financial Action Task Force (FATF) has published a number of guidance papers and public statements for use by financial institutions and regulators to raise awareness of the “de-risking” issue and clarify the importance of the appropriate implementation of the risk-based approach. The guidance reiterated the existing expectation that regulators and

¹ Caribbean Development Bank (2016). Policy Brief- Decline in Correspondent Banking Relationships. http://www.caribank.org/wp-content/uploads/2016/05/CorrespondentBanking_May6-1.pdf

² U.S Department of the Treasury. 2016. “Risk Management Guidance on Periodic Risk Reevaluation of Foreign Correspondent Banking.” OCC Bulletin 2016-32. <https://www.occ.gov/news-issuances/bulletins/2016/bulletin-2016-32.html>

supervisors should use a risk-based approach when supervising financial institutions for compliance with AML/CFT measures. The FATF issued a guidance document entitled 'Guidance on Correspondent Banking Services'.³

The Bank of International Settlements, through the Committee on Payments and Market Infrastructures (CPMI), presented an analysis on the use of tools for AML/CFT due diligence.⁴ CPMI has recommended a number of technical measures for the possible reduction in costs associated with due diligence. These measures are based on greater information sharing and include the increased use of KYC utilities and Legal Entity Identifiers.

The CPMI called on industry bodies to review the multiplicity of templates and procedures used by the different utilities in efforts to identify the most appropriate data fields that all utilities should collect as best practice and that all banks should be ready to provide to other banks. The CPMI further called for mapping facilities between the Business Identifier Code (BIC), which is the code used for routing payment messages to the right bank, and the LEI, to help overcome the existence of multiple BIC codes for the same bank and help match the information that will have been gathered on these banks in KYC utilities.

The Financial Stability Board (FSB) established in March 2016 the Correspondent Banking Coordination Group to coordinate and drive the implementation of the FSB's action plan. The FSB agreed to coordinate work to examine the extent and causes of banks' withdrawal from correspondent banking, the implications for affected jurisdictions including financial exclusion and identify possible policy responses to address this issue.⁵

Aspects of Jamaica's Action Plan

Jamaica has taken a number of measures to curtail the trends of de-risking. These policy changes are largely aimed at strengthening Jamaica's supervisory capacity and regulatory frameworks. Some of which are targeted to reduce the potential for money laundering and the financing of terrorism. Some of the efforts made to date include:

- i. Progressive implementation of necessary FATF Recommendations against money laundering and terrorist financing which are aimed at increasing the transparency of the financial sector;
- ii. Amendments to the Proceeds of Crime Act and its Regulations to improve money laundering prevention;
- iii. Amendments to the Terrorism Prevention Act and its Regulations to strengthen the combatting of terrorism financing;
- iv. Establishment of the United Nations Security Council Resolutions Implementation Act to counter the proliferation of weapons of mass destruction and improve the sanctions framework;
- v. Revision of the Bank of Jamaica AML/CFT Guidance Notes for financial institutions to reflect changes in the FATF methodology;
- vi. Assessing Jamaica's AML/CFT risk level by undertaking the National Risk Assessment that will be subject to ongoing reviews and updates;
- vii. Ensuring that all Designated Non-Financial Businesses and Professions are brought under the AML/CFT Framework at earliest.

A number of capacity building efforts have also been undertaken. These efforts include:

- i. Training for all examiners responsible for AML/CFT supervision is set as a next priority. The development of structured training programmes as well as exposure to international training courses by AML/CFT experts for both supervisors and compliance officers across the industry;
- ii. Requirements that local institutions have on staff an AML officer, provide AML training, conduct independent self-testing and apply internal controls for compliance;
- iii. Development of a national identification system which will allow for a centralized database from which information can be retrieved and shared.

³ Financial Action Task Force. 2016, "Guidance on correspondent banking services," FATF, Paris. www.fatf-gafi.org/publications/fatfrecommendations/documents/correspondent-banking-services.html

⁴ Bank of International Settlements. 2016. "Correspondent Banking," CPMI Papers Number 147. <http://www.bis.org/cpmi/publ/d147.pdf>

⁵ FSB (2016). Action plan to assess and address the decline in correspondent banking. <http://www.fsb.org/wp-content/uploads/FSB-action-plan-to-assess-and-address-the-decline-in-correspondent-banking.pdf>

4. Financial System Sectoral Exposures

4.1 Overview

Deposit-taking institutions' (DTIs) and non-deposit-taking financial institutions' (NDFIs) exposure to household and corporate sector debt, as measured by debt to assets was mixed for 2016. Notably, DTIs' exposure to the household sector remained virtually unchanged while DTIs and NDFIs exposure to the corporate sector and private sector loans, respectively, increased relative to 2015. Furthermore, with the exception of corporate sector debt, real annual growth in household, and public sector debt remained below pre-global financial crisis average levels, reflecting no imminent threat to macro-prudential stability. Additionally, DTIs and NDFIs continued to record improvements in loan quality ratios.

DTIs and NDFIs recorded lower exposures to sovereign risk for 2016 relative to 2015. The decline in exposure primarily reflected the repayment of approximately \$83.5 billion from maturing BMI notes during the year. Furthermore, there was a decline in public sector debt relative to GDP for 2016 relative to 2015.

4.2 Household debt and DTIs' exposure

Household sector debt incurred with DTIs continued to expand for 2016.¹ This expansion occurred within a context of relatively stable macroeconomic environment supported by the Bank's accommodative monetary stance, real GDP growth as well as decreased unemployment levels. For 2016 household sector debt grew by 12.0 per cent in real terms, twice the rate of increase for the prior year. However, the growth for 2016 was below the pre-global financial crisis levels (see **Figure 4.1**).² The increase in real household sector credit was driven by both consumer and mortgage loans. The performance in household sector credit was partly driven by lower interest rates on personal and mortgage credit due to increased competition by institutions in an effort to grow market share (see **Table 4.1**).³

¹ Household debt incurred with DTIs is proxied by the sum of residential mortgage loans and consumer loans (which includes credit card receivables).

² Prior to the global financial crisis in 2008, growth in household sector debt averaged 13.7 per cent for the period 2003-2007.

³ While there were declines in the nominal mortgage rates, real mortgage rates increased for 2016 relative to 2015, reflective of the faster pace of decline in the annual inflation rate relative to nominal mortgage rates.

Figure 4.1 Real growth in household debt and its sub-components for DTIs

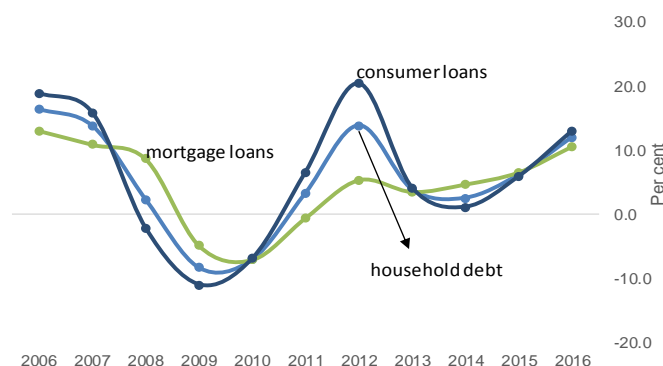


Table 4.1 Selected interest rates & housing data

	2013	2014	2015	2016	Graphs
Sectoral Interest Rates (per cent)					
Building Societies					
Real Mortgage Loans Rate*	0.6	3.1	5.6	7.1	
Mortgage Loans Rate	10.0	9.7	9.5	8.9	
Average Weighted Loan Rate	9.9	9.7	9.5	9.0	
Commercial bank					
Real Mortgage Loans Rate*	0.5	3.1	5.7	7.6	
Mortgage Loans Rate	9.9	9.7	9.6	9.4	
Installment Credit Rate	16.8	16.1	15.2	13.8	
Personal Credit Rate	24.8	25.6	26.2	25.5	
Commercial Credit Rate	12.8	12.9	12.9	12.3	
Average Weighted Loan Rate	17.5	17.2	16.9	16.2	
FIA**					
Installment Credit Rate	11.8	12.0	11.7	11.6	
Personal Credit Rate	13.8	17.4	14.7	10.7	
Commercial Credit Rate	10.1	11.3	11.6	11.7	
Average Weighted Loan Rate	11.4	11.9	11.7	11.6	
Housing Data					
# of Mortgages ^{1/p/}	17 308	13 428	15 054	-	
Value of Mortgages \$Bn ^{1/p/}	37.7	34.2	34.7	-	
Housing Completion ^{2/p/}	5 560.0	2 283	2 382	-	
Housing Starts ^{2/p/}	2 896.0	2 039	1 467	-	

* Annual Average Inflation rate used to compute the real mortgage rate.

^{1/} Includes NHT, building societies and non-specialized

^{2/} Includes public sector & private sector

Figure 4.2 Household debt as a share of DTIs loans & assets

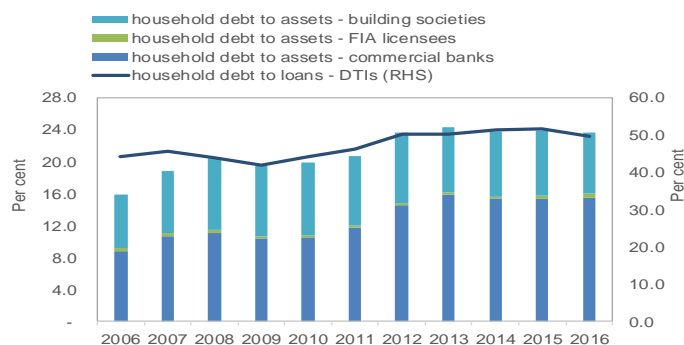


Figure 4.3 DTIs' household sector loan quality & loan loss provisioning to household sector NPLs

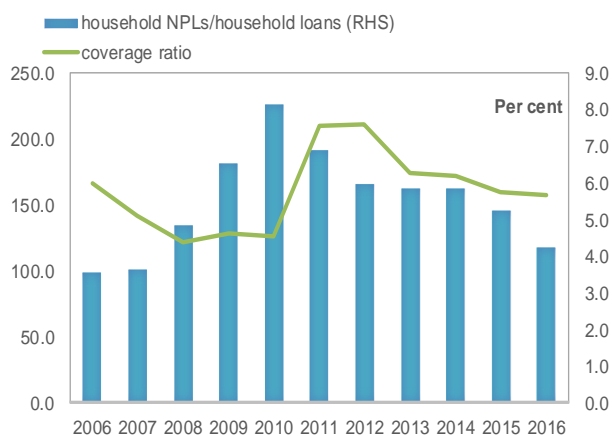


Figure 4.4 Household debt servicing capacity

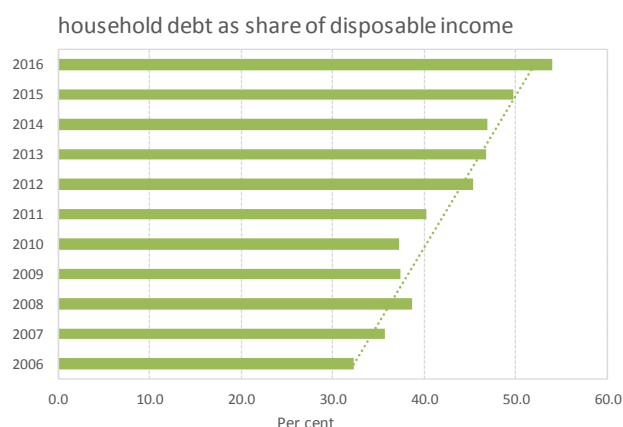
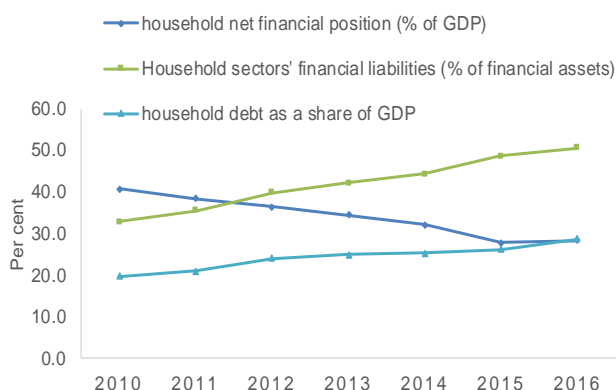


Figure 4.5 Other household sector indebtedness indicators



Specifically, real consumer and mortgage loans grew by 12.9 per cent and 10.6 per cent for 2016 relative to 5.8 per cent and 6.2 per cent, respectively for the prior year.

For 2016, DTIs' exposure to the household sector as measured by household debt to assets remained virtually unchanged at 23.6 per cent (see **Figure 4.2**). Nonetheless, the household sector loan quality ratio continued to improve for 2016. Specifically, household non-performing loans (NPLs) as a share of total household loans for DTIs decreased to 4.3 per cent at end-2016 relative to 5.3 per cent at end-2015 (see **Figure 4.3**). The improvement in the ratio was largely influenced by net loan write-offs.⁴ Specifically, for 2016, net loan write-offs amounted to \$3.3 billion relative to \$3.7 billion for 2015. Additionally, DTIs' continued to maintain relatively high coverage ratios. The household coverage ratio for the DTI sector declined marginally to 158.0 per cent at end-2016 relative to 159.8 per cent the prior year (see **Figure 4.3**).⁵ Notwithstanding this, the DTIs' capacity to absorb potential losses arising from NPLs remained strong.

4.2.1 Household sector indebtedness

The debt servicing capacity of households as measured by total real household debt to real disposable income has generally trended upward since 2011 reflecting increasing indebtedness. In particular, the ratio deteriorated by 4.3 percentage points to 54.0 per cent at end-2016 and was well above the ten year annual average of 41.0 per cent for the past ten years, reflecting increasing indebtedness (see **Figure 4.4**).^{6,7} This outturn was primarily as a result of the faster pace of increase in household debt of 12.3 per cent relative to growth in disposable income of 3.3 per cent for

⁴ Net loan write-offs is computed as charge-off loans less bad loans recovered.

⁵ Coverage ratio is measured as the ratio of loan loss provisions plus prudential provisioning to non-performing household loans.

⁶ Total household debt is proxied by the sum of residential mortgage loans, consumer loans (which includes credit card receivables) and National Housing Trust loans.

⁷ BOJ's projection for disposable income was revised. It is computed as gross personal income less statutory deductions. Gross personal income is proxied as the sum of compensation to employees domestically and from the rest of the world as well as current transfers from rest of the world (which primarily includes remittances). Operating surplus of the household sector is excluded from personal income due to data availability.

the review period. Similarly, household debt continued to account for an increasing share of GDP although the ratio remained low and relatively stable over time (see **Figure 4.5**). Concurrently, the financial liabilities to financial assets ratio for the household sector increased to 50.3 per cent relative to 48.5 per cent as at end-2015, partly reflected increasing levels of debt.⁸ Notably, Pension fund deposits continued to account for the largest share of households' financial assets (44.6%) while mortgage loans accounted for the largest share of financial liabilities (61.8%). On the other hand, household sector's net financial assets as a percentage of GDP improved marginally to 28.1 per cent relative to 27.6 per cent the prior year.

4.3 Corporate sector debt and DTIs' exposure

DTIs' exposure to the corporate sector as measured by corporate sector debt to DTIs' assets increased to 20.1 per cent at end-2016 from 17.8 per cent at end-2015 mainly reflecting a faster pace of growth in debt relative to assets (see **Figure 4.6**).⁹ Real growth in corporate sector debt held by DTIs increased sharply to 28.0 per cent for the review period relative to growth of 6.6 per cent for 2015 and an average real growth of 8.9 per cent for the 5-year pre-global financial crisis period (see **Figure 4.6**).¹⁰ This was partially due to reductions in rates on loans for commercial purposes particularly for commercial banks as well as improved macroeconomic stability. Notably, the stronger pace of growth in corporate sector lending was reflected in all economic sectors with the exception of *Agriculture, Mining and Construction*. Of note, *Electricity, Gas & Water, Entertainment, Manufacturing and Tourism* recorded the highest increases ranging between 29.6 per cent and 50.4 per cent (see **Figure 4.7**).

4.3.1 Corporate sector loan quality

There was continued improvement in the loan quality ratio for the corporate sector for 2016. The ratio of corporate sector

Figure 4.6 Real growth in corporate sector debt held by DTIs & corporate sector debt as a share of DTIs' assets

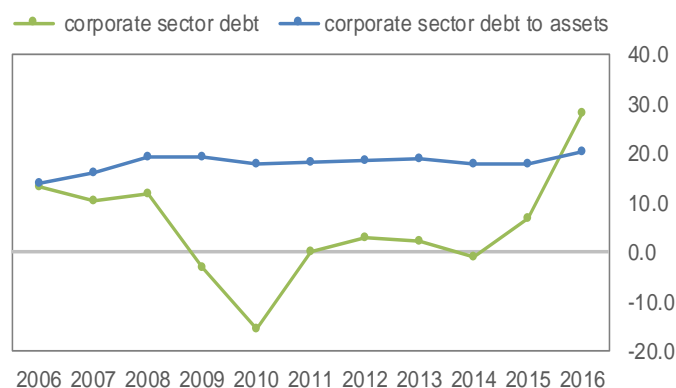


Figure 4.7 DTIs' exposure to corporate sector loans with the highest growth rates for the year

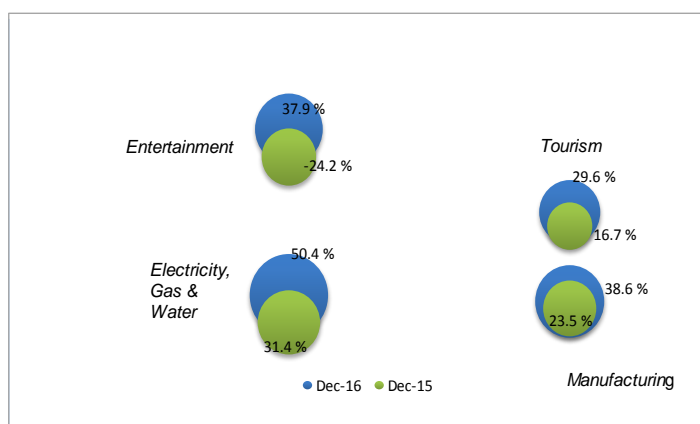
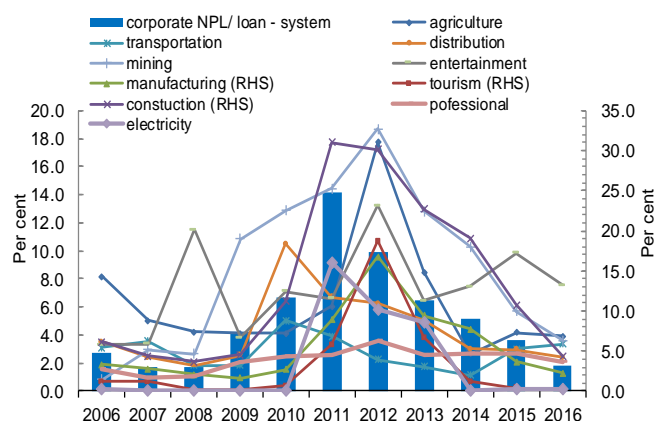


Figure 4.8 Ratio of corporate sector NPLs to corporate sector loans-DTIs



⁸ Financial assets of households include: pensions, deposits, on balance sheet retail repos, life assurance and annuity contracts and policyholder funds on deposit. Financial liabilities on the other hand include: consumer loans and mortgage loans.
⁹ Vulnerability is measured as the ratio of corporate sector debt to DTIs' assets.
¹⁰ Corporate sector debt includes loans for commercial purposes and notes & debenture holdings of DTIs.

Figure 4.9 Corporate sector debt to corporate operating surplus

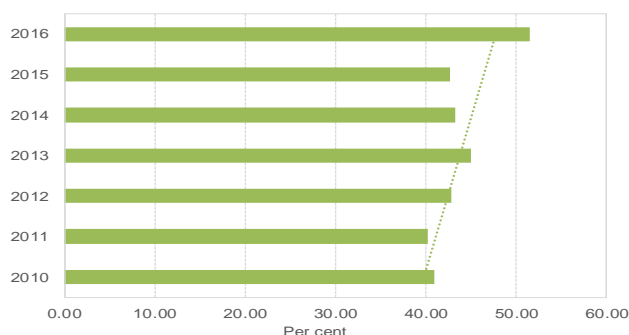


Figure 4.10 Other corporate sector indebtedness indicators

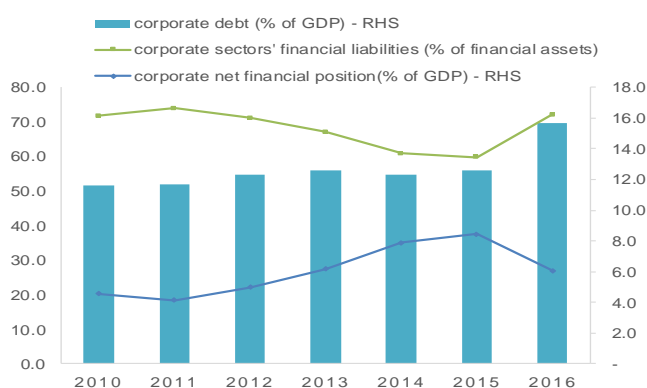
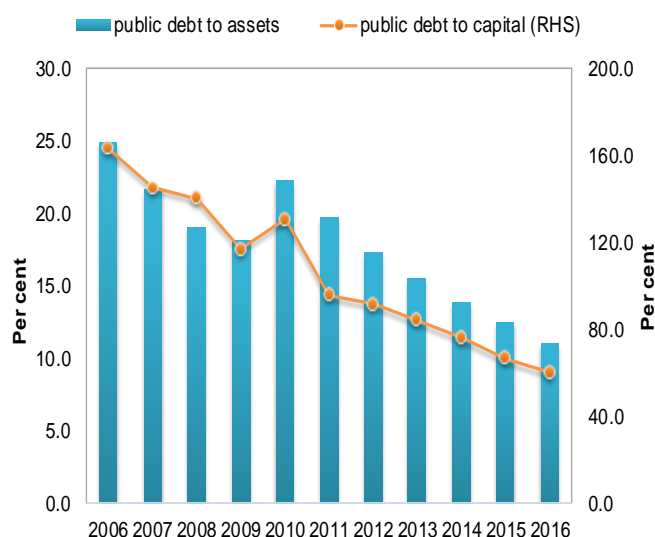


Figure 4.11 Public sector loans and securities to assets & capital - DTIs



NPLs to total corporate sector loans declined to 1.8 per cent at end-2016, relative to 3.6 per cent at end-2015 (see **Figure 4.8**). The improvement in the asset quality ratio was mainly reflected in the loan portfolio of the commercial banking sector and across all economic sectors except for *Transport, Storage & Communications*.

4.3.2 Corporate sector indebtedness

The debt servicing capacity of the corporate sector as measured by the share of corporate sector debt to corporate sector operating surplus deteriorated for 2016 (see **Figure 4.9**). This performance contributed to increased vulnerability of the DTI sector to the corporates. Likewise, corporate sector net financial position as a share of GDP deteriorated which is consistent with a stronger increase in financial liabilities relative to the growth in assets.¹¹ For 2016, corporate sector financial liabilities as a share of corporate sector assets stood at 72.1 per cent relative to 59.8 per cent for 2015 (see **Figure 4.10**).

4.4. Public sector debt & DTIs' exposure

DTIs' exposure to public sector debt declined for 2016 relative to 2015. The decline was partly due to DTIs focusing on its core business function of issuing loans. Furthermore, the reduction in DTIs' exposure to public debt was reflected in a decline in the ratio of public sector loans and securities to DTIs' assets to 11.0 per cent at end-2016, relative to 12.5 per cent at end-2015 (see **Figure 4.11**).¹² The performance for 2015 was mainly influenced by a 15.3 per cent increase in DTIs' assets as well as a 6.4 per cent decline in public sector loans for the review period.

4.4.1 Public sector performance & indebtedness

Fiscal vulnerability, based on government debt as a share of GDP continued to be very high. Nonetheless, consistent with the Governments' efforts to reduce its debt, public sector debt as a share of GDP declined to 124.3 per cent at end-

¹¹ The Financial assets of corporates include: deposits and retail repos. Corporate financial liabilities on the other hand include: loans for commercial purposes as well as notes & debenture holdings of DTIs.

¹² Exposure to public sector debt is measured by public sector loans and securities as a share of DTIs' assets. The public sector comprises public entities and central government.

2016 from 126.1 per cent at end-2015. This mainly reflected a slower pace of growth in public sector debt stock relative to the growth in GDP (see **Figure 4.12**). For 2016, the domestic debt stock declined by 3.0 per cent, while external debt grew by 5.9 per cent (see **Figure 4.13**). The reduction in the domestic debt stock for 2016 primarily reflected the repayment of approximately \$83.5 billion from maturing BMI notes. On the other hand the increase in the external debt stock was mainly attributed revaluation due to depreciation of the domestic currency vis-à-vis the US dollar.

The fiscal stability ratio (FSR) which captures the stability of government finances remained flat for 2016. Specifically, the FSR stood at 1.0 at the close of the review period.¹³ This performance occurred against the background of higher revenues and grants relative to expenditure which resulted in a lower fiscal deficit relative to the previous year. Regarding other debt sustainability indicators, there were mixed results for 2016. In particular, interest payment to GDP deteriorated. However, debt servicing to budgetary revenues and external debt to exports of goods and services improved (see **Figure 4.14**).

There was a lengthening of the maturity profile of domestic debt for 2016 relative to 2015. More specifically, the proportion of domestic debt due to mature in 5 years or less decreased to 42.6 per cent at end-2016 from 48.2 per cent at end-2015, reflecting a marginal reduction in refinancing risk for the Government (see **Figure 4.15**). Additionally, domestic fixed rate instruments continued to account for the largest share of the total debt stock. In particular, for 2016, the domestic fixed rate instruments as a share of the total debt stock declined marginally by 1.2 percentage points while variable rate instruments as a share of total debt remained relatively flat at 40.4 per cent (see **Table 4.2**).

Figure 4.12 Debt to GDP ratios

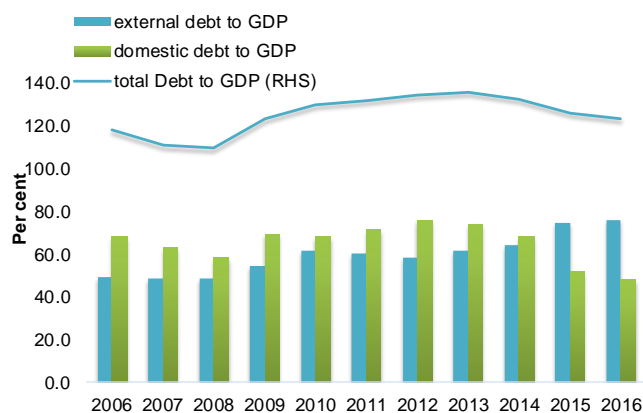


Figure 4.13 Growth in public sector debt stock

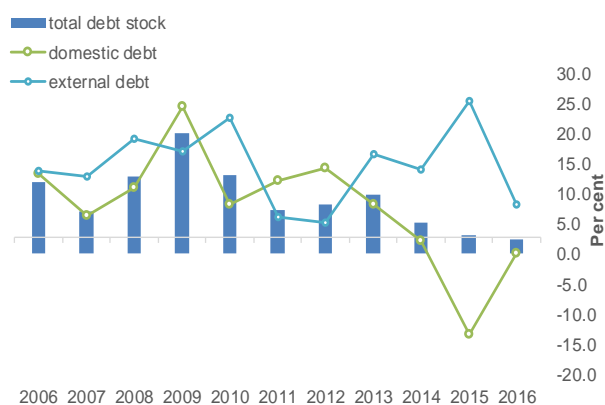
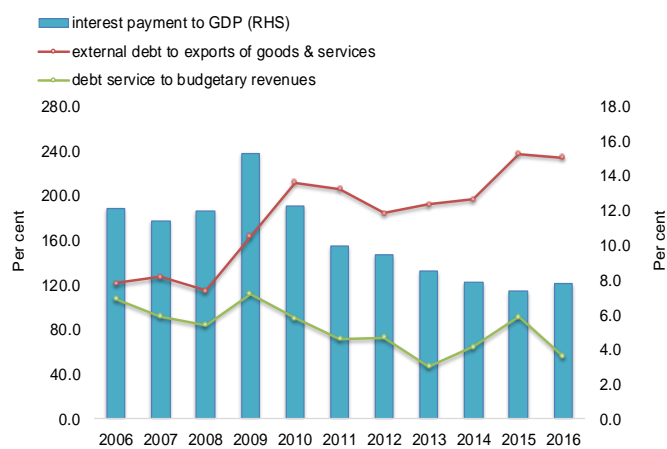


Figure 4.14 Debt sustainability indicators



¹³ The FSR is computed as the ratio of the overall fiscal balance as a per cent of total revenue less 1 (one). The closer the FSR is to zero indicates more stable government finances.

Figure 4.15 Domestic debt by maturity

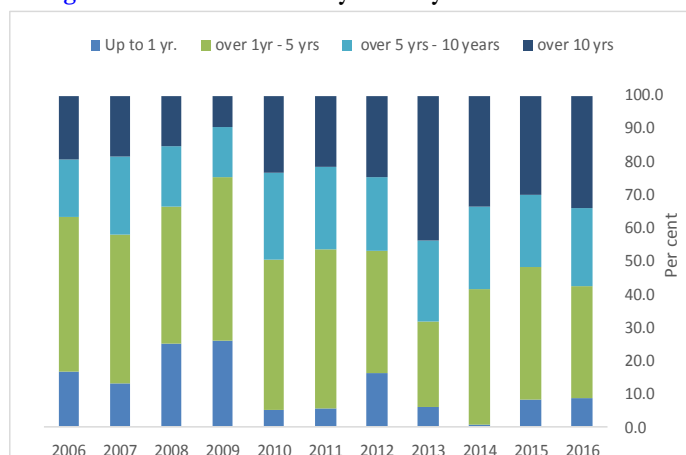
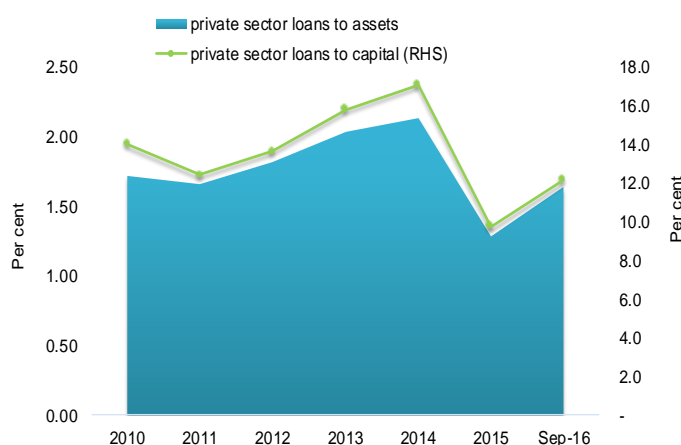


Table 4.2 Share of domestic debt by instrument type

	Fixed rate	Variable rate	Non Interest Bearing Debt
2006	44.0	56.0	0.0
2007	37.9	62.0	0.1
2008	38.0	62.0	0.0
2009	48.9	51.1	0.0
2010	59.3	40.7	0.0
2011	56.5	43.4	0.1
2012	56.0	43.9	0.1
2013	67.9	32.0	0.1
2014	67.7	32.2	0.1
2015	60.8	39.2	0.1
2016	59.6	40.4	0.1

Figure 4.16 Private sector loans to assets & capital for the 12 largest securities dealers



4.5. Non-deposit-taking financial sector exposure

4.5.1 Securities dealers' exposure to private sector debt

The exposure of the twelve core SDs to private sector debt continued to be low as at end-September 2016.¹⁴ The ratio of private sector debt to assets for the SDs increased marginally to 1.6 per cent at end-September 2016 relative to a ratio of 1.3 per cent at end-2015 (see **Figure 4.16**). Furthermore, private sector debt held by SDs as a proportion of capital was 12.2 per cent at end-September 2016 which represented an increase of 2.4 percentage points, relative to end-2015. This was largely attributable to a faster increase in private sector debt relative to the increase in capital. Notably, of the twelve SDs, only seven institutions had exposure to private sector debt.

SDs' loan quality ratio, as measured by private sector NPLs to private sector loans, decreased to 4.5 per cent at end-September 2016, relative to 7.3 per cent at end-2015 (see **Figure 4.17**). This improvement was well below the 12.5 per cent average for the past five years and largely reflected the operations of one institution. Similarly, the coverage ratio for SDs improved to 75.7 per cent at end-September 2016 relative to 61.9 per cent at end-2015 implying reduced vulnerability to loans losses. This increase was due to a faster pace of decrease in NPLs relative to the increase in loan loss provisions.

4.5.2 Public sector debt & securities dealers' exposure

Within the context of the retail-repo phase-down, net repayment on four maturing BMI bonds during 2016 as well as liberalization of foreign currency investments, SDs' exposure to public sector debt declined.¹⁶ The ratio of public sector debt to SDs' assets declined to 26.8 per cent at end-September 2016 from 34.1 per cent at end-2015 (see **Figure 4.18**). Furthermore, this outturn was largely in keeping with the reforms in the sector aimed at reducing risks emanating

¹⁴ Private sector loans include loans to corporate sector entities and personal (household) loans.

¹⁵ Core SDs include dealers whose business model is predominantly securities dealing activities and include the top 5 largest SDs.

¹⁶ Public sector debt is measured as the sum of public sector loans and public sector securities, while exposure is defined as public sector debt as a proportion of assets.

from SDs to the wider financial system. Similarly, public sector debt holdings to capital declined to 198.7 per cent at end-September 2016 from 260.2 per cent at end-2015.

4.5.3 Public sector debt & insurance sector exposure

Similar to the SDs, exposure to public sector debt declined for the insurance sector as at end-September 2016 relative to end-2015. The ratio of public sector debt holdings to insurance assets declined marginally to 44.4 per cent at end-September 2016 relative to 46.9 per cent at end-2015 (see **Figure 4.19**). In particular, this ratio was 48.3 per cent and 28.6 per cent for the life and general insurance companies, respectively, at end-September 2016 relative to respective ratios of 49.9 per cent and 33.5 per cent at end-2015. As a proportion of capital, public sector debt holdings for the insurance sector declined to 180.2 per cent at end-September 2016 relative to a ratio of 189.4 per cent at end-2015, consistent with a decline in public sector debt (see **Figure 4.20**).

4.6 Other asset exposure

Exposure to other asset categories including equities and real estate remained relatively low across the financial system for 2016. With the exception of DTIs, there was a marginal increase in exposure to equity investments. Specifically, the ratio of equity investments as a proportion of assets increased to 9.3 per cent and 1.7 per cent as at end-September 2016 relative to 6.6 per cent and 1.2 per cent for SDs and insurance companies, respectively. On the other hand, the DTIs maintained the same level of investment in equities, recording a ratio of 0.5 per cent, similar to that obtained at end-2015. Regarding real estate investments, there was an increase in exposure for the insurance sector as at end-September 2016. Notably, the ratio of real estate investments to assets for the sector increased marginally to 0.8 per cent relative to 0.9 per cent at end-2015, largely reflecting activities within the life insurance sub-sector (see **Figure 4.22**).

Figure 4.17 Private sector NPLs to total private sector loans & coverage ratio for the 12 largest securities dealers



Figure 4.18 Public sector debt holdings to assets & capital for the 12 largest securities dealers

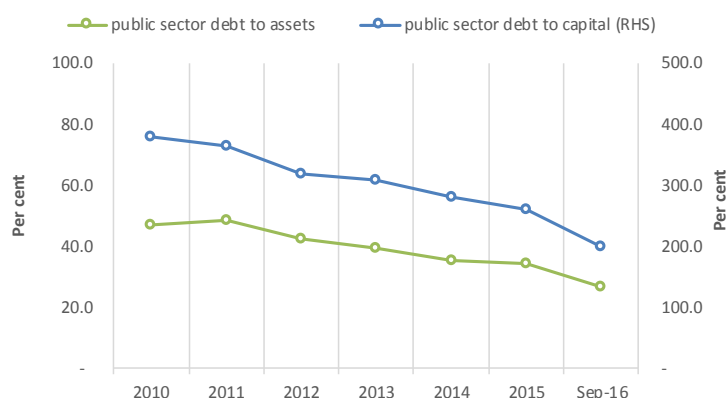


Figure 4.19 Public sector debt holdings to assets for insurance companies

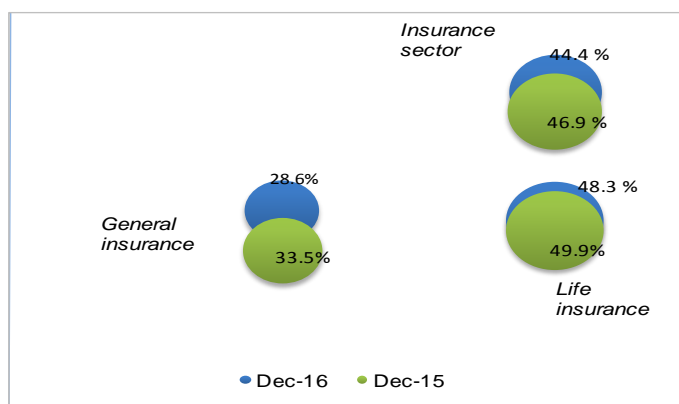
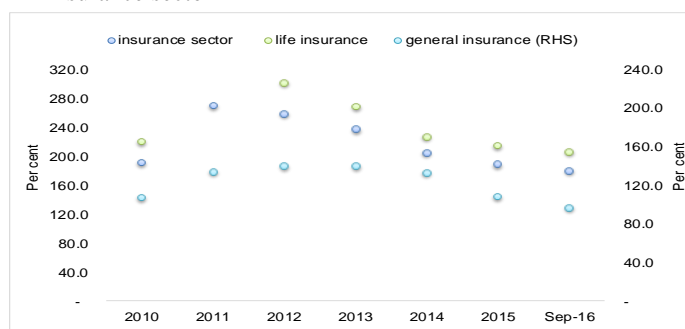
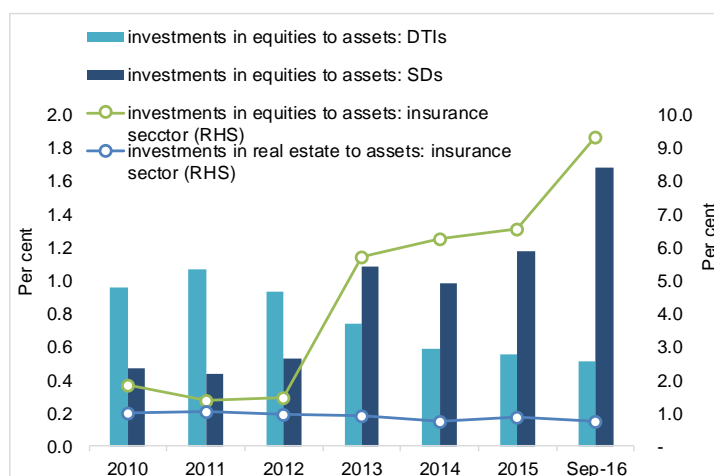


Figure 4.20 Public sector debt holdings to capital for the insurance sector**Figure 4.22** Investments in other assets for the DTIs, SDs & insurance sector**Table 4.2** Investment classes as a per cent of total assets pensions industry

	2012	2013	2014	2015	Sep-16
Investments in Governments Securities to Assets (%) ^{1/}	43.9	42.5	40.5	33.6	31.0
Investments in Equities to Assets (%)	10.3	9.8	9.3	14.6	16.0
Investments in Real Estate to Assets (%)	6.0	5.9	5.8	5.4	4.9
Investment Arrangements to Assets (%) ^{2/}	26.9	29.0	29.5	32.8	36.6
Other Investments to Assets (%)	11.8	12.1	14.1	13.2	11.2
Total Asset values (J\$BN)	294.1	307.1	341.4	396.9	438.1

Notes

^{1/} Government securities includes Government of Jamaica securities and other sovereign securities from the US, UK and Canada.

^{2/} An investment arrangement describes investments in deposit administration contracts and pooled funds.

4.7 Pension industry exposure to government's securities, equities & real estate¹⁷

At end-September 2016, the pension industry continued to have the highest exposure to Investment Arrangements as well as Investments in Governments Securities, relative to other investment classes (see **Table 4.2**).^{18,19} For the review period, exposure to Investment Arrangements and Investments in Governments Securities was 36.6 per cent and 31.0 per cent, respectively. This compares to values of 32.8 per cent and 33.6 per cent, respectively, recorded at end-2015, reflecting a shift away from investment in Government securities. For the same period, there was an increase in exposure to equities investments to 16.0 per cent from 14.6 per cent at the end-2015. However, pension fund exposure to real estate continued to decline in 2016.

¹⁷ The data for the industry represents data for the pension fund as at end-September 2016.

¹⁸ Pension industry refers to private pension plans within the regulatory oversight of the Financial Services Commission.

¹⁹ Exposure is computed as a per cent of total assets.

Box 4.1 An Early Warning System (EWS) for Economic and Financial Risk in Jamaica

In recent times, several countries have experienced periods of financial distress which have destabilized their domestic economies. Excessive credit growth and inflated asset prices, can result in maturity mismatches, large exchange rate as well as interest rate exposures. The buildup these risks within the financial system can result in severe consequences for the real economy.

As such, the coordinated monitoring of all sectors within the Jamaican economy is of great importance given the strong likelihood that spillover effects from one sector to another can pose systemic risks to financial and economic stability. Against this background, composite indicators have been designed to capture six sectors within the Jamaican economy, which include the real economy, household and corporate sectors, financial institutions, financial markets and the international economic environment.

Development of composite indices for Jamaica¹

The method employed to transform the series into the composite indicators closely follows the approaches proposed by Bhattacharyay et al. (2009) and Galaso et al. (2014). Furthermore, each composite indicator was constructed using two steps which have been outlined below.

- All variables selected were adjusted for seasonality using the X12-ARIMA method along with the removal of trends by employing a one-sided Hodrick-Prescott Filter technique.
- The data was transformed into a stationary series by finding the first difference.

Data and Methodology for Establishing Composite Indicators

- The series that were not expressed in percentage form were differenced using a symmetric percentage formula (p_i)

$$p_i = 200 * \frac{x_{i,t} - x_{i,t-1}}{x_{i,t} + x_{i,t-1}} \quad [1]$$

Where $x_{i,t}$ is the variable in time period t.

Composites were weighted and aggregate based on equations 2 to 5:

Firstly, composite indicators are weighted by employing a standardization factor that measures its volatility (w_i) which gives more weights to those components that are less volatile.

$$w_i = \frac{1}{\sum_i sd_i} \quad [2]$$

Secondly, the quarterly contributions of each component of the composite indicator ($c_{i,t}$) is obtained. These quarterly contributions were calculated by finding the product of the quarterly variations ($v_{i,t}$) and the weights.

$$c_{i,t} = v_{i,t} \cdot w_i \quad [3]$$

Thirdly, (s_t) is derived and represents the aggregation of the adjusted contributions computed above. This is calculated as follows:

$$s_t = \sum_i c_{i,t} \quad [4]$$

Finally, the composite is computed using a recursive formula which has an initial value of $I_0 = 100$. Succeeding values are derived by utilizing equation 5

$$I_t = I_{t-1} * \frac{200+s_t}{200-s_t} \quad [5]$$

Components of the Jamaican Composite Indicators

The approach established composite indicators for the real economy (leading and coincident composite indicators), the household sector (composite household sector indicator), the corporate sector (composite corporate sector indicator), financial institutions (composite financial institutions indicator), financial markets (composite financial markets indicator) and the international economic environment (composite international economic environment indicator).

Leading Composite Indicator for the Real Economy (CLI)

The CLI changes prior to the reference cycle and the movement in economic activity.

- Inverse of the growth in West Texas Intermediate (WTI) average oil price.
- Growth in US Consumer Confidence Index.
- Growth in Consumer Expectations on Business Conditions Index.
- Growth in Consumer Income Expectations Index.

¹ Samuels, J. 2016. "An Early Warning System for Economic and Financial Risks in Jamaica", Bank of Jamaica Working Paper.

- Growth in Jamaica Stock Exchange (JSE) Main Index.

Coincident Composite Indicator for the Real Economy (CCI)

This composite reflects the current changes in economic activity and includes five (5) individual components which are listed below.

- Real wages.
- Total production of goods.
- Inverse of unemployment rate.
- Bauxite exports.
- Real GDP.

Composite Indicator for the Household Sector (CHS)

The CHS measures the vulnerability arising from excessive credit to the household sector. The variables included in the CHS are:

- Households’ NPLs to total DTI household sector loans.
- Households’ debt to total loans.
- Household’s debt to nominal GDP.

Composite Indicator for the Corporate Sector (CCS)

The CCS measures the significance of DTIs exposure to corporate sector debt to the financial system and economy as a whole. These indicators include:

- Real growth in corporate sector debt.
- Corporate sector’s NPLs to total loans for the corporate sector.
- Corporate sector’s debt to DTI assets.

Composite Indicator for Financial Institutions (CFI)

The CFI is a comprehensive indicator that is used to monitor financial system health.

- Total DTI loan growth.
- Inverse of the weighted average lending and deposit rates spread.
- Financial Institutions Stability Index.

Composite Indicator for the Financial Markets (CFM)

This composite is useful in gauging the degree of risk in the domestic financial markets.

- M2 to Foreign International Reserves.
- TRE Spread.
- US interest rate differential.
- JGBI and EMBI Spread.

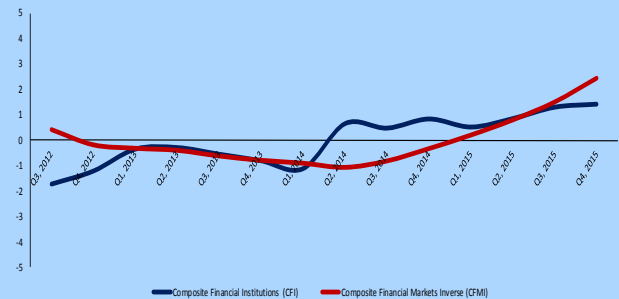
Composite Indicator for the International Economic Environment (CIEE)

This composite captures potential vulnerabilities emanating from the international environment.

- Growth in real effective exchange rate (REER).
- Terms of trade.
- External current account balance to GDP.

Analysis of the signaling capabilities and the interrelationship between Composite Indicators

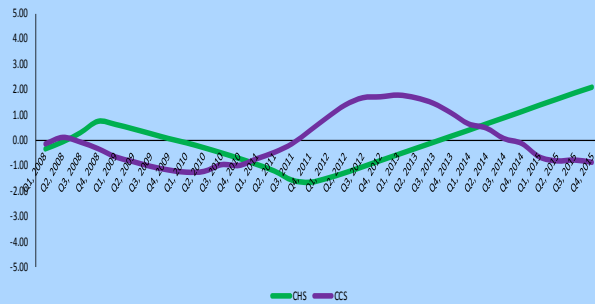
Figure 1: The relationship between the Composite Financial Institutions and the Composite for the Financial Markets



In reference to the Composite Financial Markets Index (Inverse), an increase in this indicator indicates a reduction in financial market risk. Figure 1 shows that the CFMI declined after a period of volatility in the financial markets consequent to the global financial crises of 2009. A decline in the CMFI may be due to speculative attacks on the domestic currency, inefficiencies in the money market, widening in interest rate differentials and higher risk premiums on government securities. Therefore, it is important to monitor the financial markets as sudden movements in these markets may have a significant impact on the operations of domestic financial institutions.

In a similar manner, an increase in the composite indicator for financial institutions (CFI) signals an improvement in the conditions of financial institutions. Subsequent to the National Debt Exchange (NDX) in February of 2013, the CFI declined as there was initial deterioration in key profitability indicators for financial institutions, however the index showed improvement by the second quarter of 2014, as financial institutions actively restructured their asset portfolios. Notably, the CFMI has a lead of 12 months between peak periods when compared to the CFI, where these two indicators reach the highest degree of correlation at 0.73.

Figure 2: Comparison of the Composite Household Sector and the Composite Corporate Sector (both Standardized)

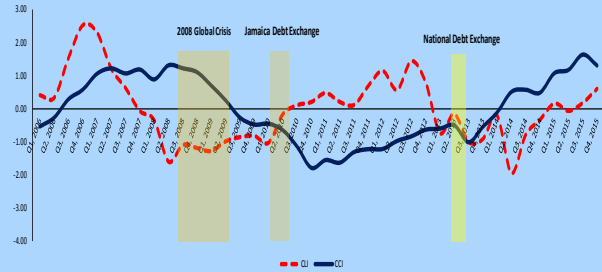


An increase in the CHS indicates an increasing risk exposure of DTIs to household debt. The CHS peaked during the fourth quarter of 2008 without a strong reaction of the CCS (see Figure 2). This may be a result of the CHS lagged effect on the CCS. More specifically, increased credit to the household sector may improve the balance sheets of the corporate sector. In turn, this will result in more credit being extended to the corporate sector in subsequent periods.

Of note is that sharp increases of these two composites can indicate excessive lending by banks which can pose a systemic threat to financial system stability. In this case, contractionary monetary policy and macro prudential tools such as, caps on credit and debt to income (DTI) and loan to value (LTV) ratios can be used mitigate inflated asset prices in the housing and stock markets.

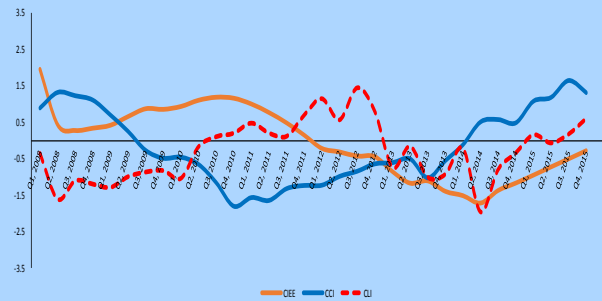
Additionally, the CHS has a clear lead on the CCS. Although the reaction time of the CCS to the growing exposure in the CHS varied between 39 and 48 months, there is a lag of forty five (45) months between the first peaks. Similarly, the slowing down of the CHS and the CCS in March 2012 and December 2015 respectively, also showed a lag of 45 months). Therefore it can be stated, that increased exposure to the household sector will eventually be followed by increased exposure to the corporate sector.

Figure 3: Comparison of the Composite Leading indicator and the Composite Coincident Indicator (both Standardized)



As it regards to the leading composite index for real economic activity (CLI), an increase in this composite signals an uptick in the real economy. Furthermore, the analysis of the relationship between the CLI and the CCI reveals a lead of the leading indicator of about 2 ½ years (see Figure 11). This is the estimated number of months that it takes for the peaks to reach their highest degree of correlation which is 0.54 when assessing different lag lengths.

Figure 4: The relationship between the Composite Coincident Indicator and the Composite for the International Economic Environment (both Standardized)



The composite indicator for the international economic environment measures Jamaica’s performance relative to its international trading partners. A comparison of the CIEE, CCI and the CLI between the period 2008 and 2015 showed that starting from Q3 2008 the world economy accelerated faster than Jamaica’s economy (see Figure 4). Conversely, while the CIEE declined rapidly during the Q3 of 2010, the leading composite for the Jamaican economy increased significantly until the second quarter of 2013. This indicated that as the world economy contracted during this period, the CLI forecasted economic improvement approximately two and a half years after. As, such the CIEE has a clear lag on the CCI.

Vector Error Correction Model (VEC)

This model was utilized to assess the impact of positive shocks to the CHS, CCS and the CCI composites on the following fragility measures.

1. $Z\text{-score} = \frac{RORAC + \frac{C}{A}}{\sigma RORAC}$
2. Total NPL/Total loans

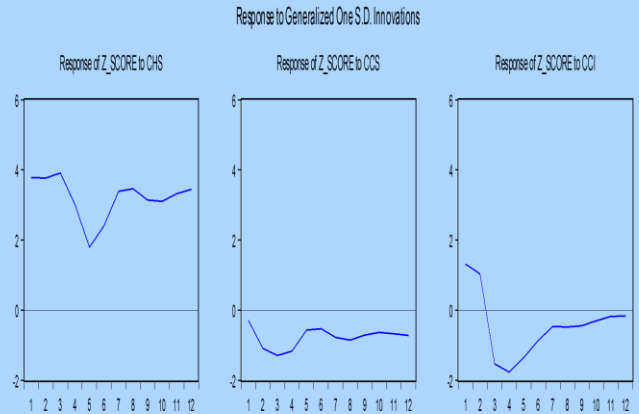
Diagnostic Tests/ Estimation

- Serial correlation tests were examined prior to estimating the model. There was no presence of auto correlation.
- Based on the estimated results, at least one co-integrated equation exist at the 5.0% level. As such, there is a long run relationship.
- Generalized Impulse response functions were estimated for 12 quarters and are shown in the two graphs below.

Findings

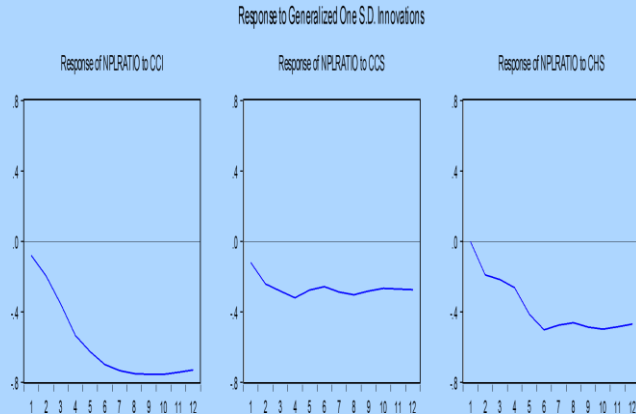
- Correlation results revealed that the CHS was a leading indicator for the CCS for known periods of vulnerability such as the global crisis, JDX and NDX periods.
- The FMI was a leading indicator for the CFI for the JDX and NDX periods.
- The VEC approach determined that there is pro-cyclicality as evidenced by the response of the Z-score and NPL ratio to a shock in the CCI and the CHS.

Z-Score Model



Based on these findings, it may be useful for policymakers to employ tools such as debt to income (DTI) ratios and loan to value (LTV) ratios to limit the impact of the buildup of DTI’s exposure to the household and corporate sectors, in order to mitigate systemic events.

NPL/Total loans ratio model



5. Risks Assessment of the Financial Sector

5.1 Overview

Stress tests conducted during 2016 showed that DTIs generally remained robust to hypothetical liquidity, market, and credit shocks, notwithstanding, marginally lower capital positions. However, on average, exposures to foreign exchange, liquidity and counterparty risks increased for 2016, while average exposures to credit and interest rate risks declined relative to the previous year. Notwithstanding a reduction in average interest rate exposure, there was a decline in DTIs’ median post-shock CAR due to a hypothetical increase in interest rates. The results of these stress tests were partly reflective of increases in domestic bond duration factors during the review period.

NDTFIs generally remained resilient to a wide range of foreign exchange and liquidity shocks during the first three quarters of 2016. However, the securities dealers and life insurance sub-sectors showed increased vulnerability to hypothetical interest rate shocks largely due to higher fair value losses relative to 2015. Furthermore, stress test results based on counter-party exposures showed that at end-September 2016, commercial banks and SDs showed reduced susceptibility, while building societies showed increased susceptibility to these shocks relative to end-2015.

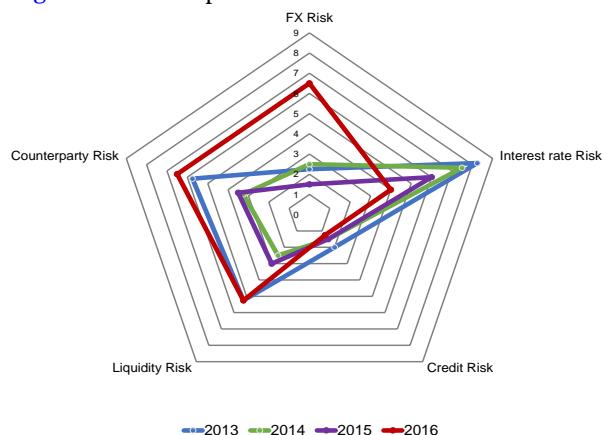
5.2 Risk exposure assessment for DTIs

DTIs’ average exposure to financial risks were largely increased for 2016 relative to 2015. In particular, the financial risk exposure “cobweb” diagram reflected increases in foreign exchange, counterparty and liquidity risks (see **Figure 5.1**).

However, DTIs’ aggregate stress tests as at end-September 2016 largely showed improved results mainly due to improvements in credit quality as well as a slower pace of depreciation of the domestic currency, particularly in the latter half of the review period (see **Figure 5.2**).¹

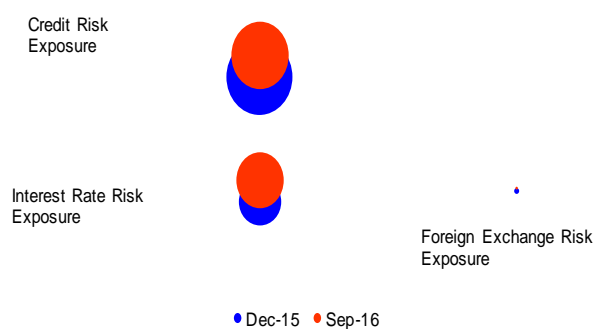
¹ Due to the unavailability of data for December 2016, the most recent results for the aggregate stress tests and interest stress tests are as at end-September 2016.

Figure 5.1 Risk exposures of DTIs



Note: Movements away from the centre of the diagram represent an increase in DTIs risk exposures. Movements towards the centre of the diagram represent a reduction in DTIs risk exposures. The credit, interest rate foreign exchange, liquidity and counterparty risk dimensions reflects the major classes of risks faced by DTIs. Risk exposure indicators are: (i) Foreign exchange risks – Net open position/Capital; Loans to Non-FX earners/Total FX loans (ii) Interest rate risks - Cumulative maturity gap of up to 30 days/Assets; Cumulative maturity gap of up to 90 days/Assets; Cumulative maturity gap of up to 365 days/Assets; DVBP/Capital (iii) Credit Risks – NPL/Total loans (iv) Liquidity risks – Liquid assets/Total assets; Liquid assets/Short-term liabilities (v) DTIs gross interbank exposures to DTIs/DTI capital base; DTIs gross interbank exposures to SDs/DTI capital base

Figure 5.2 Relative exposures of DTIs based on scenarios examined in aggregate stress test analysis



Note: The larger the bubble, the greater the exposure to risk factors. Aggregate stress tests assess the simultaneous impact of increases in interest rates, currency depreciation, credit quality deterioration as well as deposit outflows on institutions’ CARs. The size of each node is scaled in proportion to the total value of exposure arising from scenarios involving credit risk (100.0 per cent of past due performing loans (0-3 months) becoming non-performing), foreign exchange risk (10.0 per cent depreciation in the JMD/USD exchange rate) and interest rate risk (1100 bps/100 bps & 100 bps/10 bps increase in interest rates on domestic/foreign rate sensitive assets and liabilities, respectively).

Figure 5.3 Trends in the liquidity ratio and excess reserves

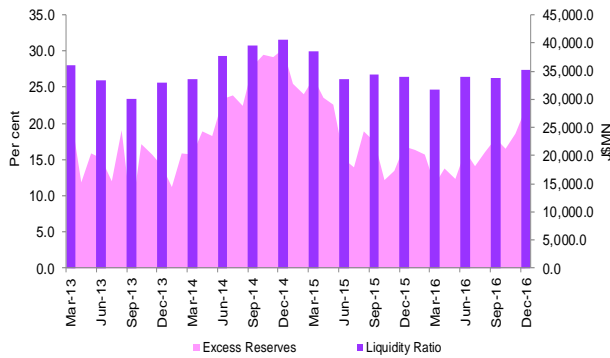


Figure 5.4 The ratio of assets maturing within 3 –months to liabilities maturing within 3 - months for DTIs

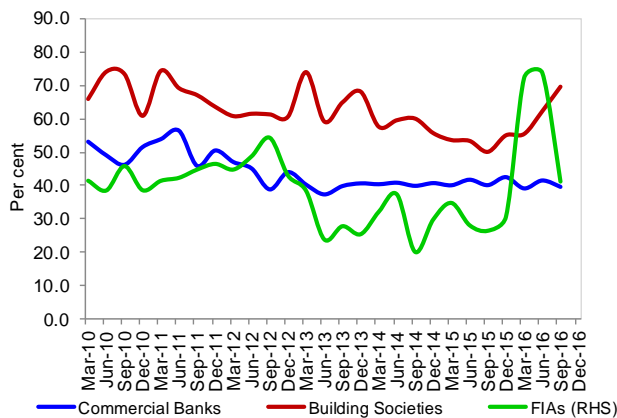
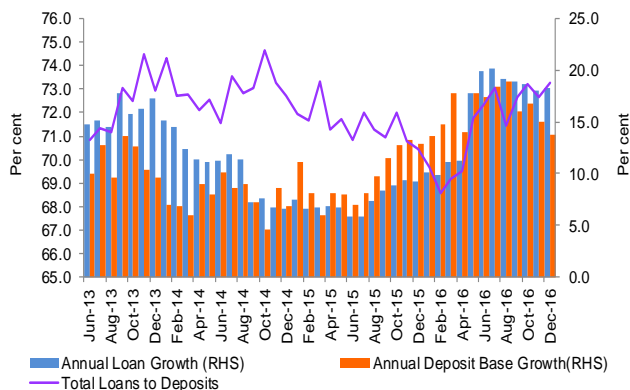


Figure 5.5 Loans to deposit ratio – DTI Sector



In particular, there were positive developments in key indicators, namely, NPL to total loans and NOP to capital. Conversely, DTIs’ aggregate stress test showed increased exposure to an increase in interest rates. Nonetheless, DTIs remained resilient to hypothetical interest rate, liquidity, foreign exchange and credit shocks during the year.

5.3 Liquidity funding risk assessment for DTIs

Against the background of improved Jamaica Dollar liquidity conditions during most of 2016, domestic currency liquidity risk exposure of DTIs declined during the year. This performance reflected improvements in some key measures of liquidity risk during the year. In particular, the statutory liquidity ratio of the sector increased steadily during the year to 27.4 per cent at end-2016 relative to 26.4 per cent at end-2015. Of note, the dollar value of DTIs’ reserves of liquidity in excess of those prescribed by the Bank were above the level recorded at the end of the previous year (see **Figure 5.3**).²

Concurrently, there was improvement in the ratio of short-term assets to short-term liabilities for the building societies and merchant bank sub-sectors during the calendar year to September 2016 relative to the previous year (see **Figure 5.4**). The ratio for the building societies sub-sector increased by 14.6 percentage points to 69.6 per cent. However, the ratio for commercial banks declined by 2.9 percentage points to 39.5 per cent at end-2016, relative to the close of the previous year. In addition, the loans-to-deposit ratio for the DTI sector increased by 2.8 percentage points to 73.3 per cent at end-2016 relative to end-2015 (see **Figure 5.5**). At the same time, this ratio remained below 100.0 per cent, indicative of continued viability in meeting short-term liquidity needs.

Regarding funding sources, deposits continued to account for the dominant share of DTIs’ funding base. However, deposits as a proportion of total funding declined to 67.8 per cent at

² During 2015, the BOJ introduced the Occasional Term Repo Operations which provided liquidity to DTIs for 90 days at a rate of 9.15 per cent. In addition, the Bank implemented the weekly fixed volume competitive bid auction repo facility in October 2015.

end-2016 relative to 69.0 per cent at end-2015. In contrast, ‘repos’ as a source of total funding increased to 4.8 per cent relative to 3.6 per cent at the close of the previous year while ‘other funding’ liabilities as a share of total funding decreased to 4.5 per cent relative to 5.4 per cent at end-2015.

As it relates to funding risk stress tests results, all DTIs were adequately capitalised to absorb losses associated with hypothetical declines in deposits during 2016. For example, following a hypothetical 10.0 per cent decline in average deposits, the post-shock CARs for all DTIs remained above the regulatory benchmark of 10.0 per cent.³ However, there was a decline in the interquartile range of post-shock CARs for the system during 2016. It would take a 64.0 per cent reduction in deposits as at end-2016, for the CAR of the DTI sector to breach the statutory benchmark of 10.0 per cent, which is similar to the result obtained at end-2015. These results are indicative of insignificant changes in vulnerability of DTIs to liquidity funding risk during the review period, due to strong capital and liquidity positions (see **Figures 5.6 & 5.7**).

5.4 Market risk assessment of DTIs

The commercial banking and building societies sub-sectors reflected an increase in the Jamaica Dollar value of foreign currency securities held during 2016. This increase mainly reflected increased holdings in foreign currency investments as DTIs adjusted portfolios within the context of continued depreciation of the domestic currency (see **Figure 5.8**). Against this background, foreign currency securities as a share of the total investment portfolio increased to 61.0 per cent and 61.6 per cent at end-2016 for the commercial banks and building societies, respectively, relative to 58.0 per cent and 59.0 per cent at end-2015. However, during 2016, the

Figure 5.6 Distribution of liquidity funding risk stress test results for DTIs (10.0 per cent decline in average deposits)

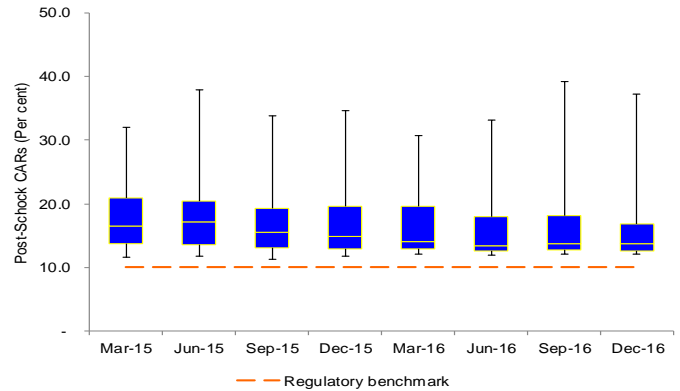


Figure 5.7 Liquidity funding risk stress test results for DTIs

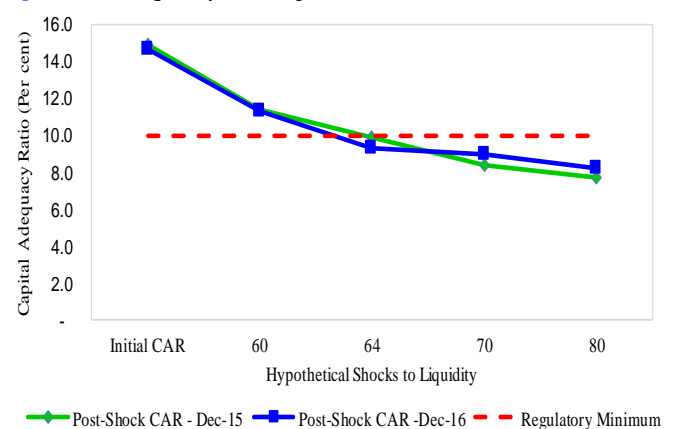
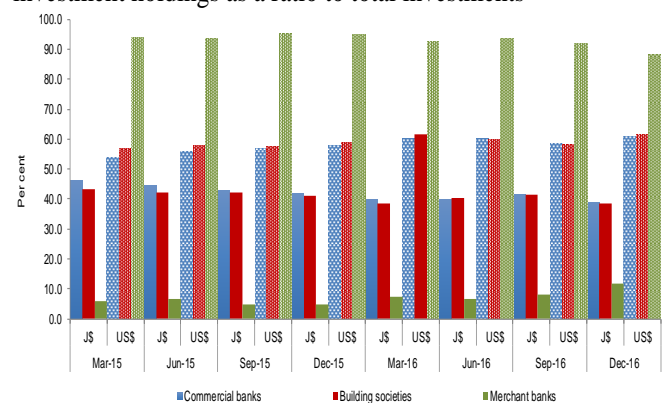


Figure 5.8 DTIs’ domestic currency and foreign currency investment holdings as a ratio to total investments



³ The ‘hair cuts’ (per cent loss in value) applied in the stress testing framework on liquidating each category of assets are items in course of collection (10.0 per cent), non-liquid investments (25.0 per cent), accounts receivables (25.0 per cent), loans & advances (25.0 per cent), fixed assets (50.0 per cent) and other assets (50.0 per cent). The resultant hypothetical losses are written off against the capital buffers first and then statutory capital.

Figure 5.9 Evolution of duration measures for DTIs

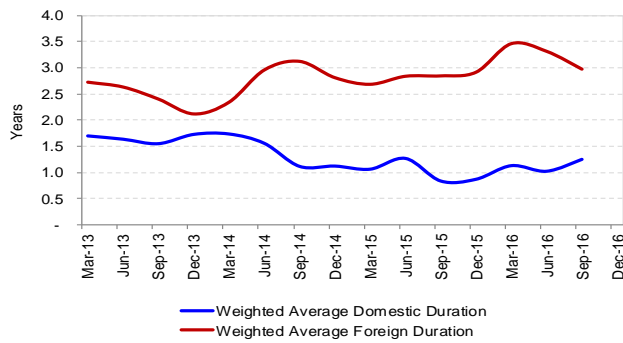


Figure 5.10 The evolution of monthly volatility in the Jamaica Dollar to US dollar exchange rate⁴

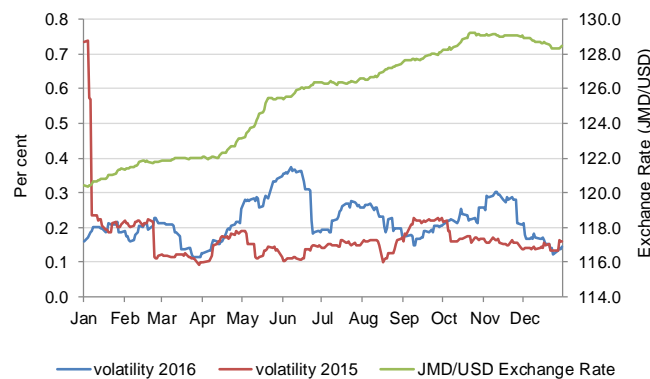
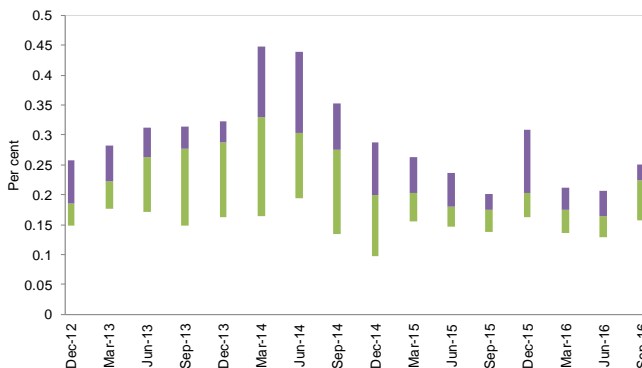


Figure 5.11 The evolution of inter-quartile ranges for the value at risk (VaR) for DTIs



⁴ The daily volatility is calculated using the daily percentage change in the foreign exchange rate. The monthly volatility is calculated by multiplying the daily volatility by the square root of 21, where it is assumed that each month has 21 trading days.

merchant bank sub-sector showed a decline in the Jamaica Dollar value and share of foreign currency investments to total investments. Notwithstanding, the merchant banks sector continued to hold the largest proportion of their portfolio in foreign currency securities. At end-2016, foreign currency securities accounted for 88.4 per cent of the investment portfolio of the merchant bank sub-sector.

Duration on domestic bonds increased during the calendar year to end-September 2016, underscoring increased DTI exposure to interest rate risk on these securities relative to 2015. The duration of domestic bonds held by DTIs increased to 1.24 at end-September 2016 relative to 0.86 at end-2015 reflecting the impact of increased holdings of longer tenured domestic securities by merchant banks and building societies. Similarly, there was a trend increase in the duration on foreign bonds. The duration on foreign currency securities increased to 2.98 at end-September 2016 relative to 2.92 at end-2015 (see **Figure 5.9**). Additionally, there was increased volatility in the foreign exchange market during 2016 (see **Figure 5.10**). Notwithstanding, the increased volatility and higher duration of domestic currency securities, the VaR outturns for DTIs were generally lower, resulting in lower inter-quartile range of DTIs' VaR estimates relative to 2015 (see **Figure 5.11**).

5.5 Interest rate risk assessment for DTIs

At end-September 2016, interest rate risk stress tests results showed that DTIs were more vulnerable to interest rate shocks. The median quarterly post-shock CAR of DTIs declined during 2016 relative to the previous year following a hypothetical increase in interest rates (see **Figure 5.12**). Furthermore, as at end-September 2016, not all DTIs were adequately capitalised to absorb losses associated with large but plausible hypothetical increases in interest rates, with the CAR of one DTI falling below the 10.0 per cent CAR prudential benchmark. However, all DTIs were robust to hypothetical interest rate declines during 2016.

5.6 Foreign exchange risk assessment for DTIs

DTIs’ NOP increased by 14.0 per cent for 2016, to close the year at \$4.8 billion (see **Figure 5.13**).⁵ However, the NOP to capital ratio for the DTI sector remained at 3.5 per cent at end-2016, relative to end-2015, reflective of reduced foreign currency risks, particularly during the second half of the year. The increase in DTI’s aggregate NOP for 2016 was due to the increased long position for commercial banks.

However, DTIs’ foreign currency exposure to non-foreign currency earners increased during the review period relative to the previous year. In particular, loans to non-foreign exchange earners as a proportion of total foreign currency loans increased to a quarterly average of 27.7 per cent for 2016 compared to an average of 15.1 per cent for 2015 (see **Figure 5.14**).⁶

DTIs remained generally resilient to hypothetical depreciation of the Jamaica Dollar vis-à-vis the U.S. dollar during 2016, as institutions were adequately capitalized to absorb losses associated with these shocks. However, subsequent to a hypothetical 30.0 per cent depreciation, the average median post-shock CARs across all DTIs were lower during 2016, relative to 2015 (see **Figure 5.15**).⁷ The increased susceptibility of the DTI sector to the hypothetical depreciation shock for 2016 largely reflected the impact of weaker capital positions for a number of institutions during the year. Building societies remained most resilient to the shocks applied for 2016, despite a marginally lower quarterly average post-shock CAR for the sub-sector relative to 2015. Commercial banks and merchant banks also showed a marginal increase in exposure to the exchange rate

⁵ Long position in foreign currency assets include all currencies converted to US dollars.

⁶ Of note, foreign exchange stress test assessments include an increase in NPLs and the associated 100.0 per cent provisioning for foreign currency loans to non-FX earners.

⁷ Shocks are applied first to the exchange rate between the Jamaica Dollar and the US dollar. The corresponding exchange rates of the Jamaica Dollar vis-à-vis the Euro, the Canadian dollar, and the Pound Sterling are then incorporated based on historical correlations with the selling rate for the US dollar between the January and May 2003 foreign exchange crisis period.

Figure 5.12 Interquartile range for post-shock CARs due to interest rate risk stress tests of DTIs (impact on CAR of 1100 bps/ 100 bps & 275 bps/ 15 bps shock to interest rates)⁸

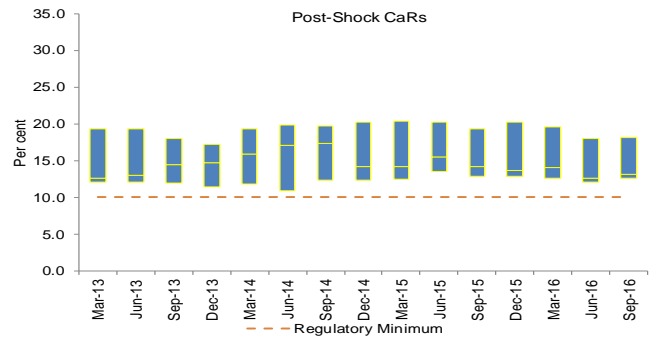


Figure 5.13 Quarterly ratio of DTI net open position to tiered capital

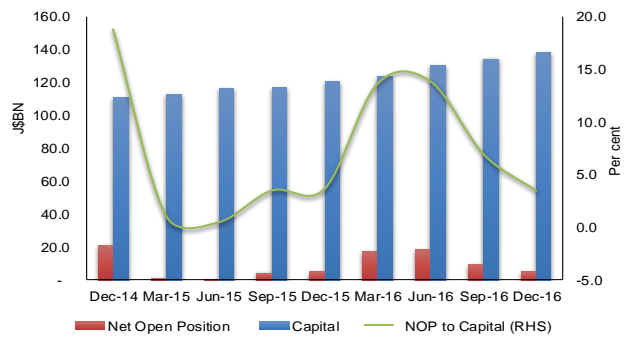
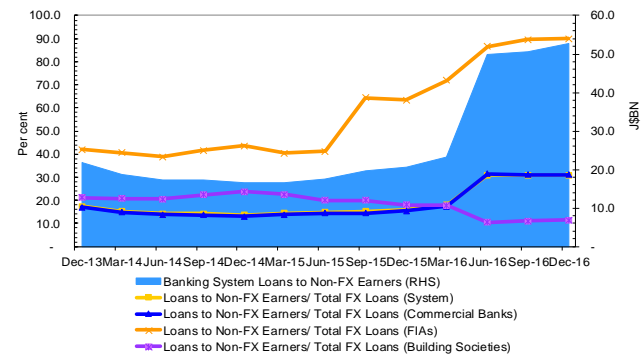


Figure 5.14 Analysis of foreign loans to non-foreign currency earners for DTIs



⁸ A shock of 1100 bps and 100 bps was applied to the domestic securities portfolio and the domestic deposits & loan portfolio, respectively. A shock of 275 bps and 15 bps was applied to the foreign securities portfolio and the foreign deposits & loan portfolio, respectively.

Figure 5.15 Distribution of foreign exchange risk stress test results for DTIs (impact on CAR of 30.0 per cent depreciation)

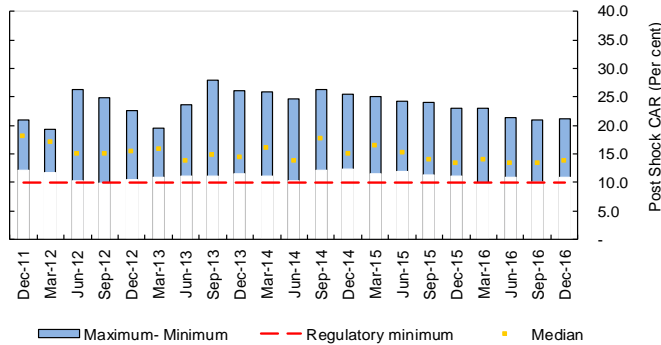


Figure 5.16 Credit risk exposure for DTIs at end-2015 (scenario: 100.0 per cent write-off of past due loans less than 3 months)

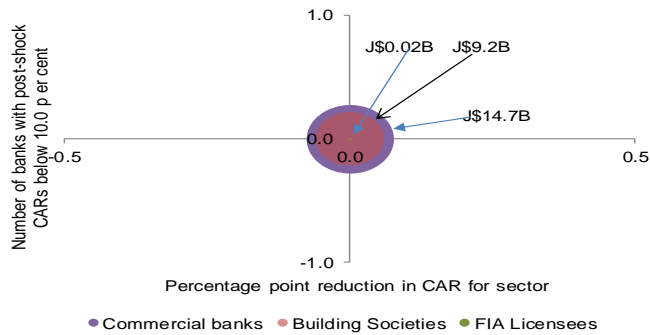
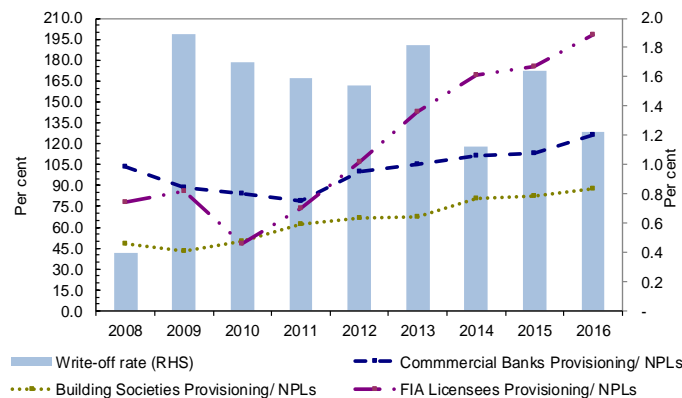


Figure 5.17 NPL coverage ratios for DTIs and write-off rates for NPLs for commercial banks



depreciation shocks, with the quarterly average post-shock CARs of these institutions decreasing relative to 2015. The post-shock CARs of these institutions remained above the 10.0 per cent prudential benchmark for the review period. In addition, DTIs remained resilient to the range of hypothetical appreciation shocks considered for the review period.

5.7 Credit risk assessment of DTIs

DTIs’ exposure to credit risk declined during 2016. The loan quality ratio, as measured by the ratio of NPLs to total loans for the sector, declined to 2.9 per cent at end-2016 relative to 4.1 per cent at end-2015 and reflected improvement in the ratios for all DTI sub-sectors. The commercial bank sub-sector reflected the most pronounced improvement in loan quality, driven by a substantial decline in NPLs, with the NPLs to total loan ratio declining to 2.7 per cent at end-2016 relative to a ratio of 4.1 per cent at end-2015. For the building societies sub-sector, the ratio declined to 3.7 per cent at end-2016 relative to 4.4 per cent at end-2015. This occurred alongside a decline in the write-off ratio, measured as loan write-offs as a per cent of total loans, to 1.2 per cent at end-2016 relative to 1.6 per cent at end-2015 and was below the five-year historical average. In addition, the loan quality ratio for the FIA licensees sub-sector declined marginally for the year, totalling 0.8 at end-2016 relative to 0.9 at end-2015 (see **Figure 5.16**).⁹

Against the background of strong declines in NPLs for the commercial banks and building societies for 2016, the NPL coverage ratios for both sub-sectors increased to respective values of 126.1 per cent and 87.5 per cent at end-2016 relative to 113.2 per cent and 82.6 per cent at end-2015. The NPL coverage ratio for the merchant banks also increased to 197.9 per cent at end-2016 relative to 175.5 per cent at end-2015. In addition, the maximum ratio of NPLs to capital recorded across all DTIs decreased to 18.7 per cent at end-2015 from 27.5 per cent at end-2015 (see **Figure 5.17**). Furthermore, there was a narrowing of the inter-quartile range

⁹ Write-off rate is computed as the ratio of “charged off assets” for the year to “loans, advances & discounts (net of provisions)”.

of NPLs to capital for DTIs, which underscored a lower exposure to credit risk. This ratio fell within an inter-quartile range of 9.6 per cent to 16.4 per cent at end-2016 relative to values of 12.0 per cent to 21.4 per cent at end-2015 (see **Figure 5.18**).

Stress test results at end-2016 showed that each sub-sector was adequately capitalized to absorb a hypothetical 30.0 per cent increase in NPLs (see **Figure 5.19**). In particular, there was an improvement in commercial banks’ resilience to this hypothetical increase in NPLs during 2016. This was largely due to improved loan quality during the year. Further, the merchant banks and building societies sub-sectors also remained resilient to large but plausible hypothetical shocks to NPLs over the review year.

Reverse stress testing exercises showed that within the merchant banks sub-sector, it would take an increase in NPLs of 5178.0 per cent at end-2016 for the first merchant bank to breach the CAR benchmark relative to an increase of 2 985.0 per cent at end-2015 (see **Figure 5.20**). The commercial bank sub-sector also showed reduced susceptibility to reverse stress testing assessments. It would take a larger increase in NPLs of 182.0 per cent to cause the most vulnerable institution to have its CAR fall below 10.0 per cent, relative to an increase of 150.0 per cent in NPLs at end-2015. In addition, a hypothetical increase of in NPLs of 370.0 per cent would result in the most susceptible building society breaching the prudential minimum CAR benchmark. This result was similar to that which was obtained at end-2015.¹⁰ In terms of the overall DTI sector, it would take a higher hypothetical 450.0 per cent increase in NPLs at end-2016 for the CAR of the DTI sector to breach the prudential minimum, relative to an increase of 307.0 per cent at end-2015 (see **Figure 5.21**).

Figure 5.18 Distribution of NPLs to capital base for DTIs

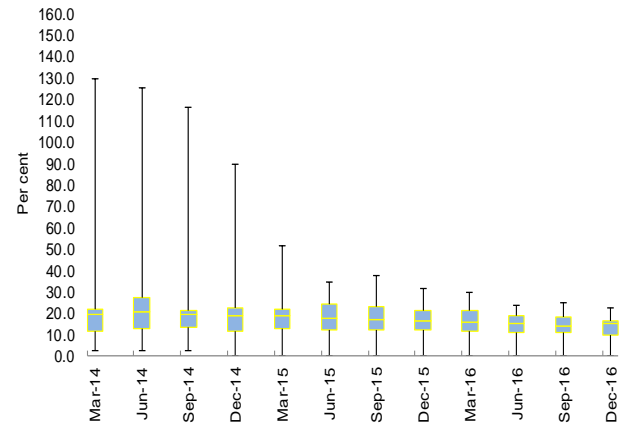


Figure 5.19 Credit risk stress test results for DTIs (Scenario: Impact on CAR of a 30% increase in NPLs)

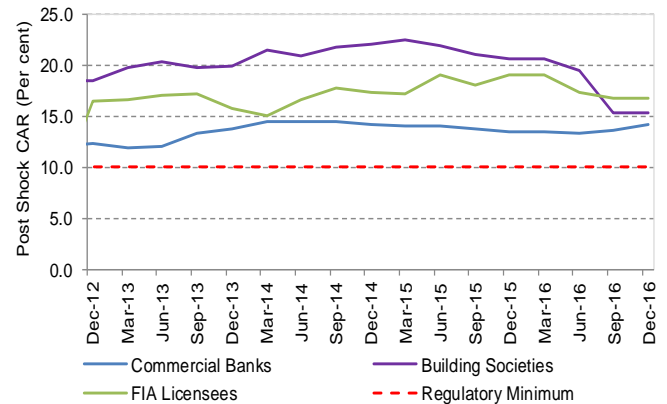
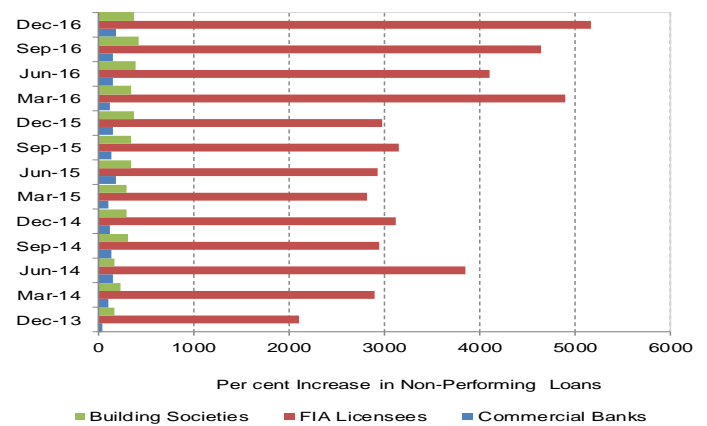


Figure 5.20 Reverse stress testing the credit risk exposure of DTIs



¹⁰ Reverse stress testing involves identifying the increase in NPLs required to bring the weakest institution’s CAR below the 10.0 per cent minimum benchmark.

Figure 5.21 Impact on DTIs’ CAR from an increase in NPLs

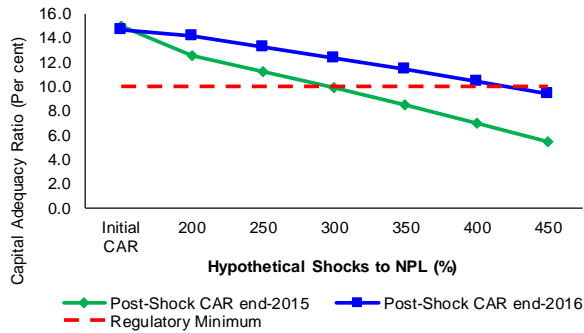
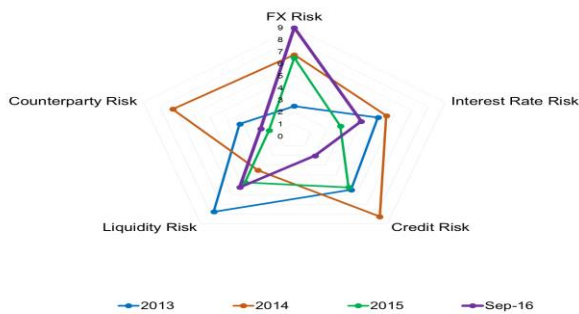
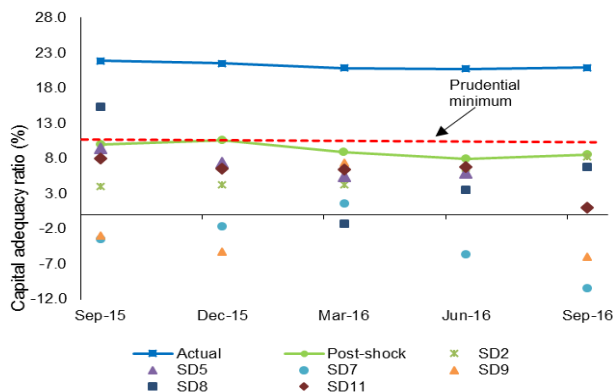


Figure 5.22 Evolution of risk exposure indicators for the 12 largest SDs



Risk exposure indicators: (i) Credit Risk - NPLs/Loans (ii) Interest Rate Risk - Cumulative maturity gap < 30 days, < 90 days, < 360 days/Assets, DVBP/Capital (iii) Foreign Exchange Risk - NOP/Capital (iv) Counterparty Risk - Gross exposures to DTIs/Capital (v) Liquidity Risk – Liquid assets/total assets, liquid assets to short-term liabilities

Figure 5.23 Impact of Scenario based aggregate stress tests on SDs’ CARs



5.8 Overall Risk Exposures of SDs

At end-September 2016, the cobweb map of risk exposures for a representative sample of twelve SDs showed deterioration in the exposure of these institutions to interest rate risks, foreign exchange risks and counterparty risks relative to end-2015 (see **Figure 5.22**).¹¹

SDs’ stronger exposure to interest rate risks was mainly driven by a widening in the negative cumulative maturity gap position to asset ratio for periods up to 30-days and 90-days as well as deterioration in the dollar value of a basis point to capital ratio.¹² The performance of the foreign exchange risk dimension was impacted by increases in the NOP to capital ratio, while the deterioration in counterparty risk exposures reflected increases in SDs’ gross exposures to DTIs as a share of capital. On the other hand, credit risk exposure improved substantially while the liquidity risk dimension remained unchanged relative to the previous period. The fall in credit risk exposure was due to declines in SDs’ NPLs to total loans ratio. Furthermore, at end-September 2016, the sector’s exposure to the cumulative hypothetical shocks examined also deteriorated relative to its performance at the close of 2015.¹³ This performance was largely reflective of increased exposure to interest rate and foreign exchange risks (see **Figure 5.23**).

¹¹ The sample includes the five largest SDs.

¹² DVBP is the loss in net interest income generated from 100 bps shocks to the system’s foreign and domestic securities portfolio and reported as a percentage of the system’s capital base.

¹³ Aggregate stress test assumptions include: i/ 1100 bps and 100 bps increases in domestic interest rates on investment assets & liabilities and other assets & liabilities, respectively. ii/ 100 bps and 10 bps increases in foreign currency interest rates on investment assets & liabilities and other assets & liabilities, respectively. iii/ 10.0 per cent depreciation in the JMD/USD exchange rate. iv/ 100.0 per cent of past due performing loans (0 - 3 months) becoming non-performing. v/ 10.0 per cent reduction in deposits or repurchase liabilities.

5.9 Liquidity Funding Risk Assessment of SDs

At end-September 2016, stress test results showed that there was continued resilience of the SDs sector to hypothetical reductions in retail repo liabilities.¹⁴ In particular, it would take a more than 50.0 per cent reduction in retail repo liabilities for the CAR of the SD sector to fall below the 10.0 per cent benchmark, representing an improvement relative to end-2015, when a lower shock of below 50.0 per cent would bring the sector CAR below 10.0 per cent (see **Figure 5.24**). The increased resilience occurred in a context of further declines in securities dealers’ holdings of repo liabilities during 2015, due to the continued phasing down of the retail repo business model. Retail repos as a share of total liabilities declined to 18.4 per cent at end-September 2016 relative to 24.8 per cent at end-2015.¹⁵ Nonetheless, despite these ongoing reforms, the sector has remained highly capitalized. In addition, there were mixed performances as it relates to key liquidity indicators for the SD sector during the first nine months of 2016. The ratio of short-term assets (less than three months) to short-term liabilities increased to a quarterly average of 39.7 per cent from 28.2 per cent for the previous year (see **Figure 5.25**). However, the ratio of liquid assets to total assets decreased to an average of 10.8 per cent for the first three quarters of 2016 from an average of 11.0 per cent for 2015.

5.10 Market risk assessment of SDs

VaR estimates at end-September 2016, for the 12 largest SDs were generally higher relative to end-2015 (see **Figure 5.27**). This weaker performance was also evidenced in a higher inter-quartile range of VaR results for these institutions. The VaR outturn of the SDs was influenced by stronger investment in foreign currency denominated securities as well as a marked increase in the average duration on SDs’ foreign currency bond portfolios to 8.1 relative to 6.1 at end-2015 (see **Figure 5.28**). Furthermore, foreign currency securities

¹⁴ The current definition of retail repos in the liquidity funding risk assessment is a proxy as it is a much broader measure than actual retail repos.

¹⁵ To address potential systemic risks from the retail repo business model, the GOJ committed to reform the broker-dealer industry, which included the phasedown of the “retail repo” business model.

Figure 5.24 Liquidity funding risk stress test results for - SDs (Scenarios: 10.0 per cent to 50.0 per cent decline in Retail Repo-liabilities)

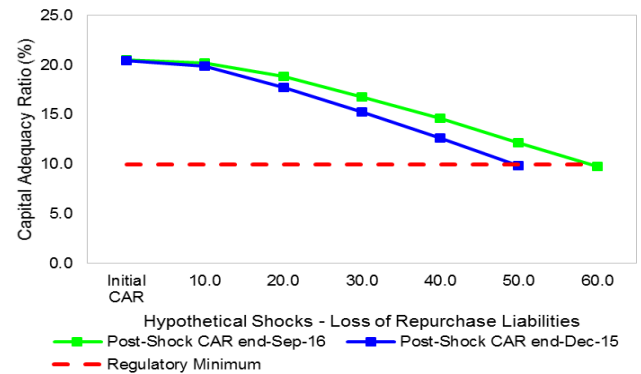


Figure 5.25 The ratio of assets maturing within 3-months to liabilities maturing within 3-months for SDs

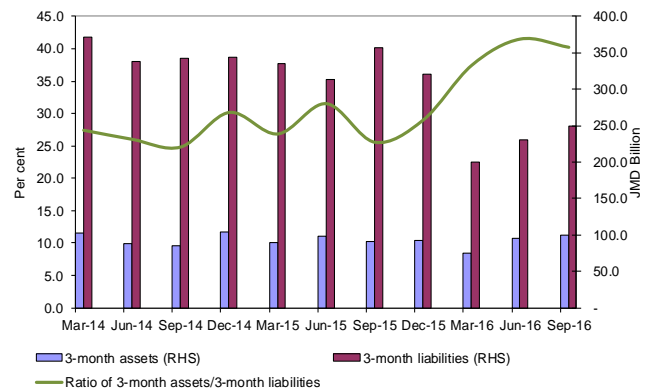


Figure 5.26 Cumulative gap to asset positions – SDs

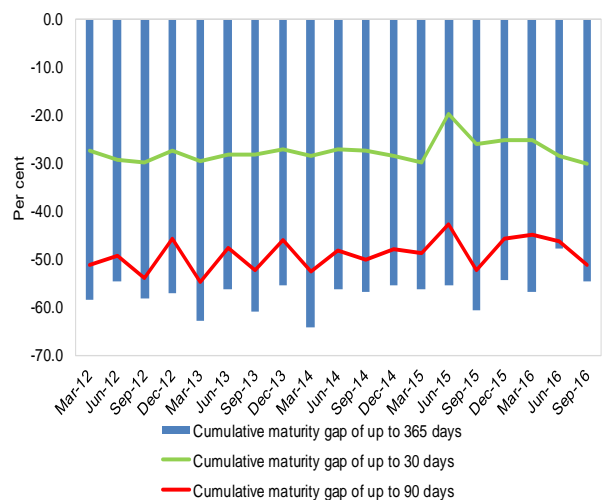


Figure 5.27 Evolution of box and whisker plots for the value at risk for the 12 largest securities dealers

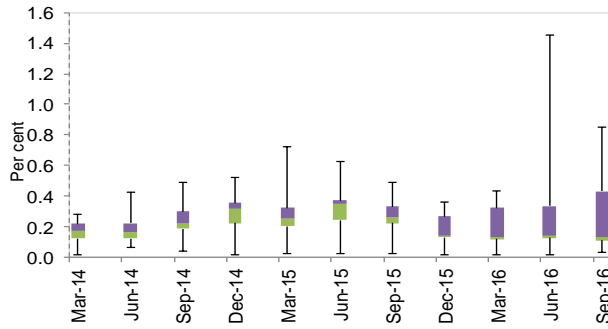


Figure 5.28 Evolution of duration for domestic and foreign securities for top 12 largest securities dealers

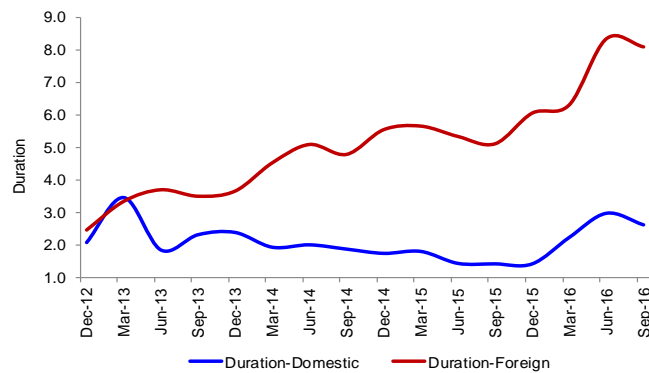
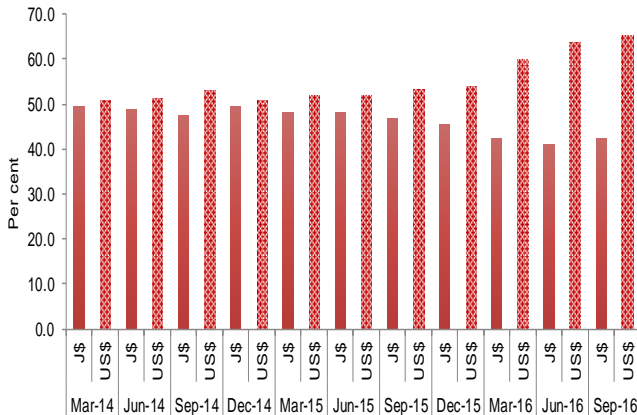


Figure 5.29 Investment holdings as a ratio to total investments - SDs



as a share of total investments increased to a quarterly average of 62.9 per cent relative to an average ratio of 52.9 per cent for 2015 (see **Figure 5.29**). This continued increase in dollarization on the investment portfolio of the SDs is largely reflective of greater portfolio diversification as well as currency revaluations due to the depreciation in the domestic currency.

5.11 Interest rate risk assessment of SDs

SDs showed greater susceptibility to interest rate shocks at end-September 2016 relative to end-2015. As a result of a shock involving a 1100 bps/100 bps & 275 bps/15 bps increase in interest rates on domestic and foreign rate sensitive assets and liabilities, the sector’s CAR declined to 8.0 per cent at end-September 2016 relative to 11.8 per cent at end-2015, following the same shock (see **Figure 5.30**). Furthermore, subsequent to the shock, the CARs of 5 securities dealers fell below the prudential 10.0 per cent requirement relative 3 institutions at end-2015. A scatter plot of the largest nine SDs’ duration against their percentage point change in CAR following a hypothetical 1100 bps/100 bps interest rate shock also illustrates the SDs’ strong vulnerability to interest rate risk at end-September 2016.¹⁶ This performance is mainly due to large gap between the duration on the asset and liability portfolio duration and liability duration relative to end-2015 (see **Figure 5.31**). In addition, the sector’s CAR fell to 9.4 per cent when a more severe hypothetical shock involving a 1300 bps/300 bps & 325 bps/50 bps in interest rates on domestic and foreign rate sensitive assets and liabilities was examined relative to 4.4 per cent at end-2015. Against this background, the weaker performance during 2016 was largely due to higher fair value losses for these institutions relative to end-2015.

5.12 Foreign risk assessment of SDs

Despite increased dollarization of the securities dealers’ asset portfolio during 2016, these institutions continued to be resilient to a 10.0 per cent to 50.0 per cent range of shocks involving hypothetical depreciations and appreciations in the

¹⁶ Of note, the FSC has commenced bottom up stress testing as well as prudential tightening measures for the industry.

exchange rate (see **Figure 5.32**). The sector CAR remained unchanged following both a 50.0 per cent depreciation and a 50.0 per cent appreciation in the exchange rate. The continued resilience of the SDs was primarily due to strong levels of capital. However, the sector showed increased susceptibility to appreciation shocks due to the general increase in the net open position of these institutions during 2016 (see **Chapter 2**).

5.13 Evolution of risk indicators – Life and General Insurance Companies (ICs)

There was deterioration in the asset quality and liquidity dimensions of risk for general insurance companies at end-September 2016 relative to end-2015 (see **Figure 5.33**). The performance of the asset quality dimension was largely influenced by the increases in the equities to total assets and receivables to gross premiums ratios while the worsening in the liquidity risk dimension reflected the impact of weakening in the liquid assets to total liabilities ratio.

Nonetheless, there was improvement in both the reinsurance and actuarial risk dimension as well as the earnings and profitability dimension for the review period. The improvement in the reinsurance and actuarial risk dimension was largely influenced by the performance in the net premium to gross premium ratio.

Regarding the life insurance sector, there were improvements across all dimensions for the review period, with the exception of the liquidity risk dimension while the performance in the asset quality dimension was unchanged (see **Figure 5.34**). The strongest improvement was evidenced in the capital adequacy dimension and was driven by increases in the capital to technical reserves ratio. The deterioration in the liquidity dimension was due to a decline in the ratio of liquid assets to total assets.

Figure 5.30 Interest rate stress test results - SDs¹⁷

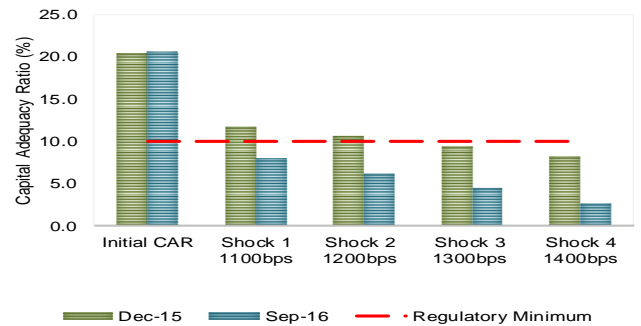


Figure 5.31 Duration gap vs. percentage point change in CAR after a 1100bps/100bps interest rate shock at end-September 2016

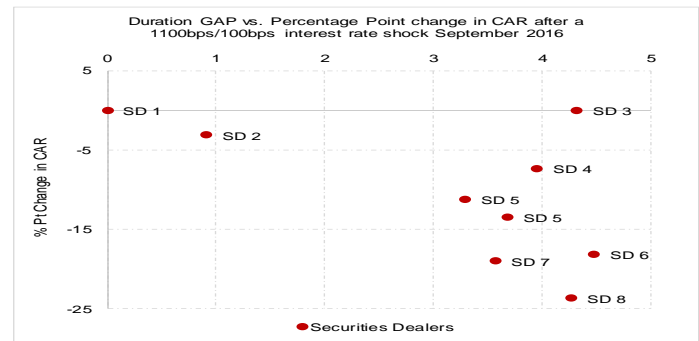
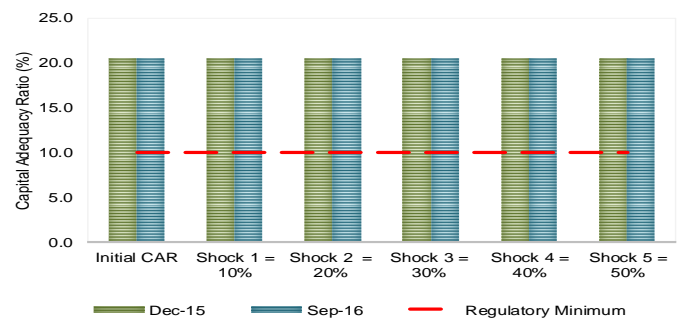
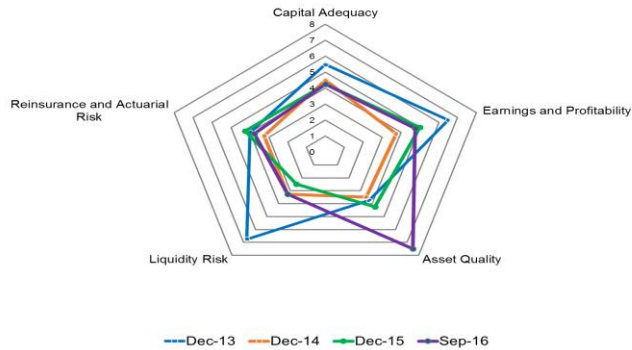


Figure 5.32 Foreign exchange risk stress test results - SDs (Scenarios: Impact on CAR of 10.0 per cent to 50.0 per cent depreciation)



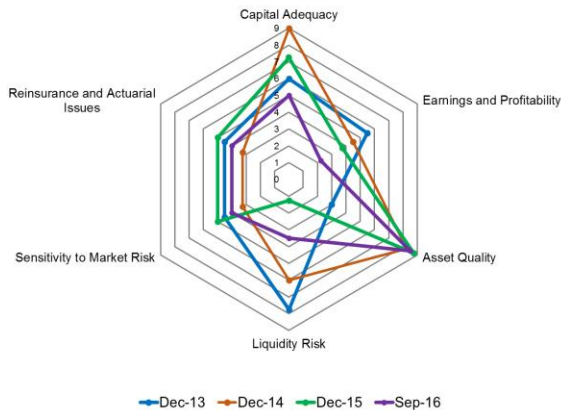
¹⁷ The scenarios examined include: Increases of 1100 bps/100 bps & 275 bps/15 bps, 1200 bps/200 bps & 300 bps/30 bps, 1300 bps/300 bps & 325 bps/50 and 1400 bps/400 bps & 350 bps/70 bps in interest rates on domestic/foreign rate sensitive assets and liabilities.

Figure 5.34 Evolution of Risk Exposures – General Insurance



Core FSI indicators: (i) Asset Quality – Receivables to gross premiums, equities to TA, real estate + accounts receivables to TA (ii) Capital Adequacy – MCT, net premium to capital, capital to assets (iii) Earnings & Profitability - ROE, ROA, net claims to net premiums, total expenses to net premium, investment income to net premium (iv) Liquidity – Liquid assets/total liabilities (v) Reinsurance & Actuarial Issues – net premium to gross premium, net tech. reserves to net claims (v) Liquidity Risk – Liquid assets/total assets, liquid assets to short-term liabilities

Figure 5.34 Evolution of Risk Exposures – Life Insurance



Core FSI indicators: (i) Capital Adequacy – MCCR, Capital/Assets, Capital/Technical Reserves (ii) Earnings & Profitability - ROE, Operating expenses/Net premium, Investment income/Investment Assets (iii) Asset Quality – Receivables to gross premiums, Equities/Total Assets, real estate + accs receivables to TA (iv) Liquidity – Liquid assets/Total Assets (v) Sensitivity to market risks – Duration of assets and liabilities (domestic bonds), Duration of assets and liabilities (global bonds) (vi) Reinsurance & Actuarial Issues – net premium to gross premium, net tech. reserves to net claims

5.14 Market and interest rate risk assessment of ICs

There was reduced resilience of the life insurance sector to hypothetical interest rate shocks at end-September 2016 relative to the close of 2015. The performance of the sector was influenced by an increase in the positive repricing gap position as well as the average duration on the domestic bond portfolio which contributed to higher fair value losses for these institutions relative to end-2015 (see **Figure 5.35**).

Nonetheless, following the most severe shock which was applied, involving a 1400 bps/400 bps & 350 bps/70, the post-shock CARs of all institutions, except one life insurance company, remained above the statutory benchmark following the hypothetical interest rate shock (see **Figure 5.36**).

The higher duration outturn for the domestic bond portfolio also contributed to an increase in the average quarterly VaR estimate for the sector. The VaR for life insurance companies increased to an average of 0.20 per cent of total investments for the first three quarters of 2016 relative to 0.14 per cent for 2015 (see **Figure 5.37**).

5.15 Liquidity funding risk assessment of ICs

Life insurance and general insurance showed increased robustness to hypothetical shocks involving declines in liquid liabilities during 2016. More specifically, following a shock involving a 10.0 per cent loss of liquid liabilities, the post-shock minimum continuing capital surplus requirements (MCCSRs) of the life insurance companies increased to a quarterly average of 265.5 per cent for the first three quarters of 2016 relative to an average of 261.2 per cent for 2015 (see **Figure 5.35**). The stronger performance was attributable to general improvements in the capital and liquid position of these institutions during the review period. Similarly, the quarterly average post-shock MCT for general insurance companies rose to 295.8 per cent for the same period in 2016 relative to a quarterly average of 293.5 per cent for 2015. The improved performance relative to 2015 was largely due to increases in the capital position of these institutions.

5.16 Contagion risk assessment of the domestic financial system

An assessment of bilateral balance sheet exposures at end-September 2016, which is a useful measure of interconnectedness, showed that the building societies sector continued to have significant gross credit exposures to the SDs and commercial bank sectors. Moreover, stress testing of counter-party risk exposures for the financial system revealed that at end-September 2016, building societies showed increased susceptibility to these shocks relative to end-2015 (see **Figures 5.38 & 5.39**).¹⁸ However, regarding the commercial banks and SDs, these sectors showed reduced susceptibility to credit exposure shocks relative to the close of the previous year.

Figure 5.35 Liquidity funding rate risk stress test results for the insurance sector (Scenario: Impact on CAR of 10.0 per cent decline in liquid liabilities)

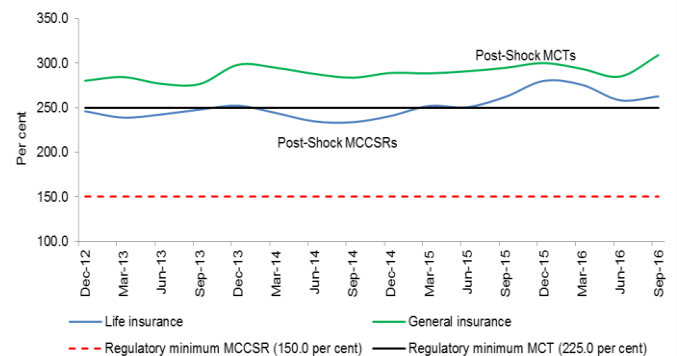


Figure 5.36 Interest rate risk stress tests for the life insurance sector¹⁹

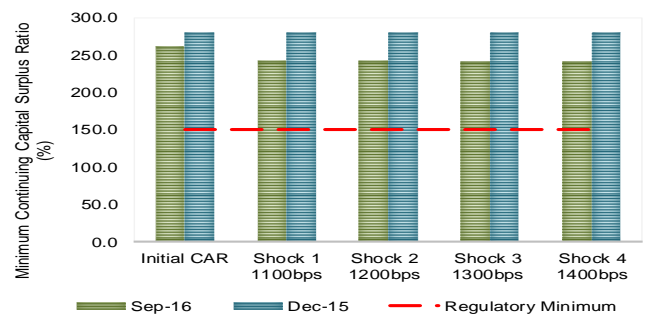
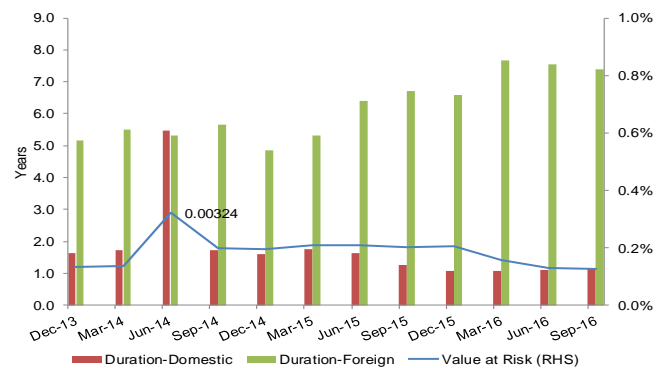


Figure 5.37 Value at risk and durations for the life insurance sector



¹⁸ Stress testing of counter-party risk exposures for the financial system involved the assessment of the hypothetical failure of a financial entity which exposed the financial system to the largest counter-party credit risk.

¹⁹ The scenarios examined include: Increases of 1100 bps/100 bps & 275 bps/15 bps, 1200 bps/200 bps & 300 bps/30 bps, 1300 bps/300 bps & 325 bps/50 bps and 1400 bps/400 bps & 350 bps/70 bps in interest rates on domestic/foreign rate sensitive assets and liabilities

Figure 5.38 Counterparty risk exposures – Impact on CAR due to large net credit exposures at end-December 2015 (%)

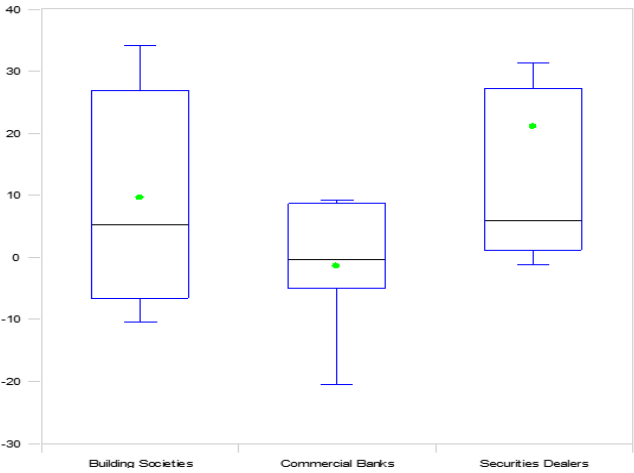
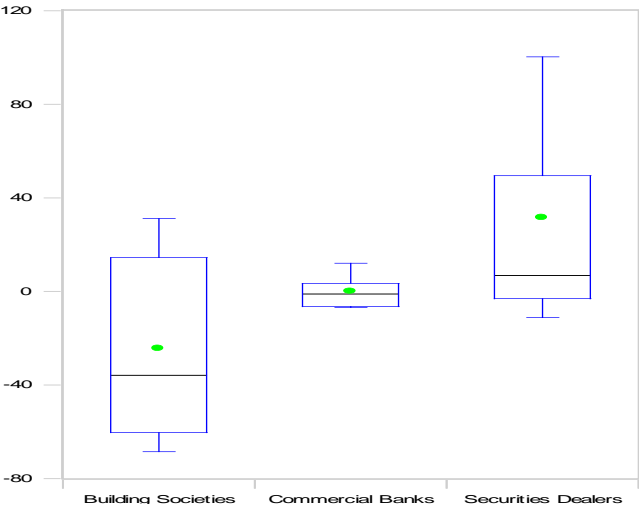


Figure 5.39 Counterparty risk exposures – Impact on CAR due to large net credit exposures at end-September 2016 (%)



6. Payment System Developments

6.1 Overview

Overall, the payment and settlement systems remained vibrant during 2016 in spite of tightened liquidity conditions experienced for the second half of the year. Activities in the JamClear-Real-Time Gross Settlement System (RTGS) increased with the overall value of transactions amounting to 10.4 times the size of the economy. The JamClear-Central Securities Depository (CSD) continued to exhibit mixed performance over the review period with an increase in transaction value amounting to a system turnover of 12.6 times GDP and a reduction in the number of transactions. Despite increases in electronic payments, there still remains a strong preference for cash payments. The number of cheque transactions, however, declined in line with the ACH threshold requirements.

In relation to the financial sector's exposure to financial market infrastructure, there was a continued susceptibility to concentration risk, emanating from concentration of liquidity in the large-value transfer system. Regarding interconnectedness and systemic importance, commercial banks significantly influence the flow of liquidity within the network with other DTIs as well as primary dealers demonstrating greater significance as intermediaries within the network. Heightened contagion risk was also observed at end-2016 relative to end-2015 indicating the higher susceptibility of the large-value system to systemic risk brought on in the event that participants experience liquidity constraints.

Figure 6.1 JamClear systems monthly turnover

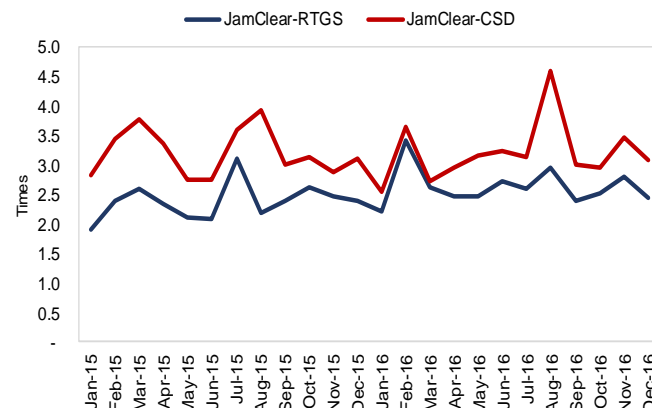


Figure 6.2 JamClear-RTGS monthly transaction values and volumes

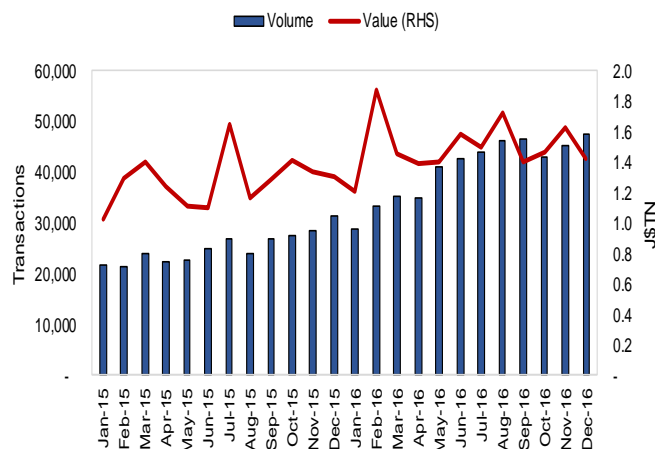


Figure 6.3 JamClear-CSD monthly transaction values and volumes

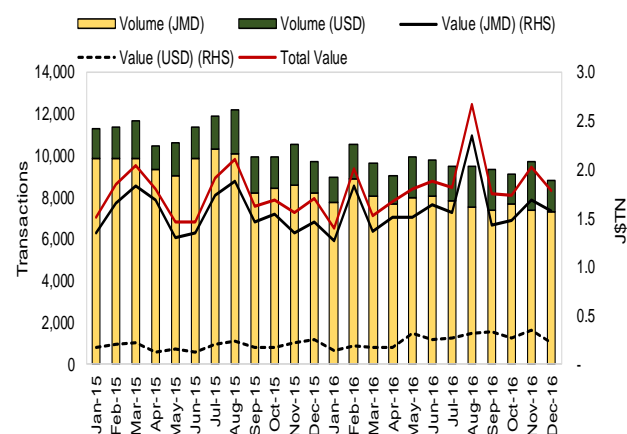


Figure 6.4 Automated Clearing House monthly transaction values and volumes

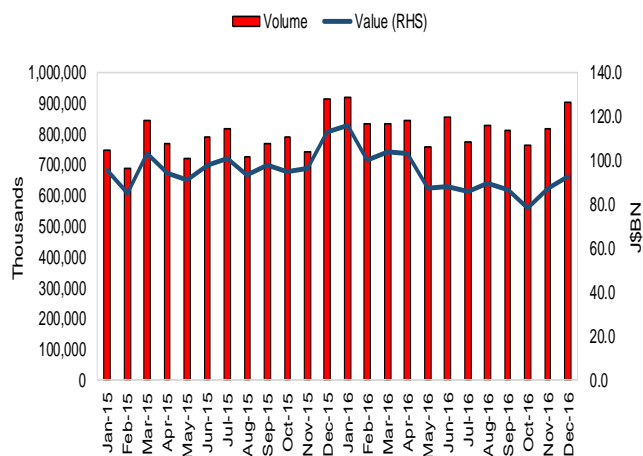


Figure 6.5 MultiLink monthly transaction values and volumes

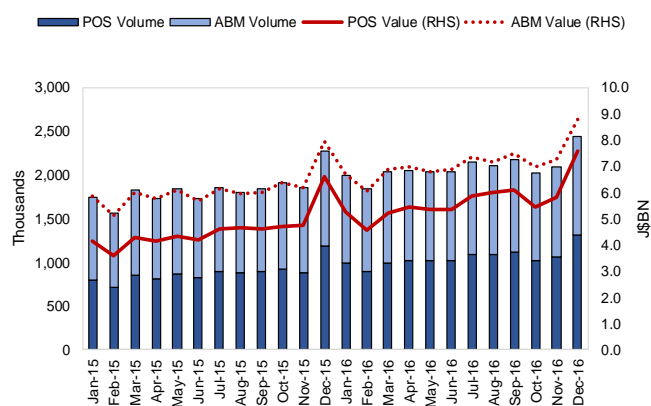


Table 6.1 Percentage proportion of average monthly retail payment transactions

	2015		2016	
	Value	Volume	Value	Volume
Cheques	64.8	14.1	58.1	12.5
Card Payments				
<i>Debit</i>	22.3	65.5	27.0	69.4
<i>Credit</i>	9.6	15.9	11.1	16
Other Electronic Payments	3.3	4.5	3.8	2.1

6.2 Key developments in Payment Systems

6.2.1 JamClear-Real-Time Gross Settlement (RTGS) System^{1,2}

During 2016, there was an increase in activity in the JamClear-RTGS system. In particular, the total value of JamClear-RTGS transactions increased by 17.7 per cent to J\$18.0 trillion for 2016 and a system turnover of 10.4 times GDP. The average monthly transaction value increased to J\$1.5 trillion for 2016 relative to J\$1.2 trillion for 2015. This transactional value represented an average monthly turnover of 2.6 times monthly GDP (see **Figure 6.1**).³ Payments related to securities transactions from the JamClear-CSD accounted for the largest portion of the total transaction value, approximately 59.2 per cent.

Additionally, total volume of JamClear-RTGS transactions for the period increased to 488 678 transactions for 2016 relative to 301 371 transactions for 2015. Similarly, the average monthly transaction volume increased by 62.2 per cent to 40 732 transactions (see **Figure 6.2**). Customer credit transfers (single and multiple) accounted for approximately 80.3 per cent of the transaction volumes.⁴ Over the review period, all customer credit transfers were settled within the two hour rule with a maximum settlement time of 21.0 seconds.

6.2.2 JamClear- CSD⁵

The JamClear-CSD system continued to show mixed performance for 2016 with increases in transactional value and decreases in transaction volume. The overall value increased by 6.6 per cent to J\$22.0 trillion in 2016 which represented a system turnover of 12.6 times GDP. The average monthly value of JamClear-CSD transactions

¹ JamClear-RTGS statistics include both JMD and USD denominated transactions.

² Currently, the JamClear-RTGS system has 22 full members: six commercial banks, two merchant banks, two building societies, eight primary dealers (broker dealers), the Jamaica Central Securities Depository (JCSD), the JCSD Retail Repo Trustee Arrangement, Accountant General Department (AGD) and Bank of Jamaica (BOJ).

³ Turnover is a ratio of the total transaction value as percentage of GDP.

⁴ These payments are considered time critical and as such have been given a required time within the system rules of a maximum of two hours to be settled.

⁵ JamClear-CSD statistics include both JMD and USD denominated transactions.

increased to J\$1.8 trillion for 2016 relative to J\$1.7 trillion for 2015, an average monthly turnover of 3.2 times monthly GDP (see **Figure 6.1**).

The overall volume of transactions however, declined to 113 597 transactions for 2016 relative to 130 834 transactions for 2015. The average monthly volume of transactions also decreased by 13.2 per cent to 9 466 transactions for 2016 (see **Figure 6.3**).

6.2.3 Retail Payment Systems

Automated Clearing House (ACH)

Within the context of the final phase of the lowering of the ACH value threshold, total value of transaction for 2016 decreased to J\$1.1 trillion relative to J\$1.2 trillion for 2015. Of the total ACH transaction value for 2016, cheques processed accounted for J\$9.2 billion, a decrease of 10.6 per cent relative to 2015. The average monthly value of cheques also decreased to J\$134 590 per transaction relative to J\$144 045 per transaction. This outturn was in keeping with BOJ's continued objective of minimizing the Bank's net settlement risks emanating from the ACH. The average monthly transaction value also decreased to J\$93.0 billion for the review period relative to J\$96.7 billion for 2015.

On the other hand, total volume of ACH transactions increased to 9.7 million for 2016 relative to 9.3 million for 2015. This was primarily due to increases in both direct credit and debit transactions by 30.4 per cent and 14.3 per cent, respectively. The number of processed cheques, however, decreased 4.3 per cent. Average monthly transaction volume also increased to 827 454 for the review period relative to 774 678 for 2015 (see **Figure 6.4**).

MultiLink

Activity within the MultiLink card network increased for 2016. The total value of MultiLink transactions increased by 20.1 per cent to J\$152.9 billion, for 2016. The average monthly transactional value also increased J\$12.7 billion for 2016 relative to J\$10.6 billion for 2015. Additionally, transactional volumes increased to 25.0 million for 2016 relative 22.0 million for 2015. The average monthly volume

Figure 6.6 Currency in circulation

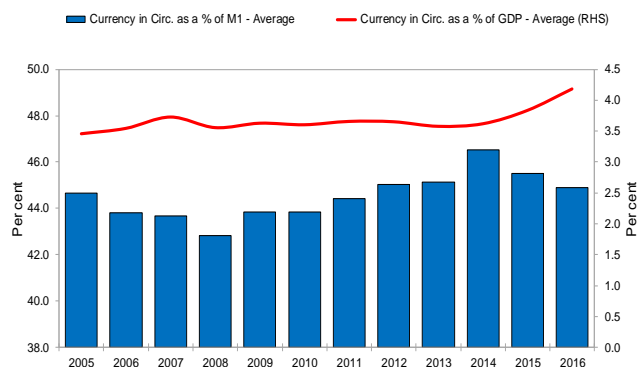


Figure 6.7 Inter-bank and intra-bank cheque volumes and values per 1000 persons

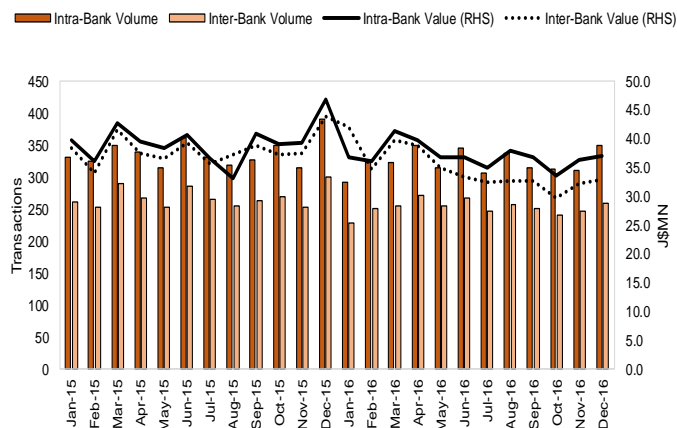


Figure 6.8 E-payment volumes and values per 1000 persons

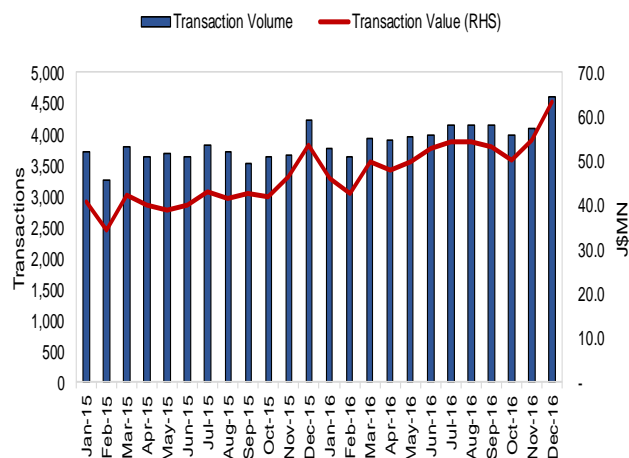


Figure 6.9 Debit & credit card volumes and values per 1000 persons

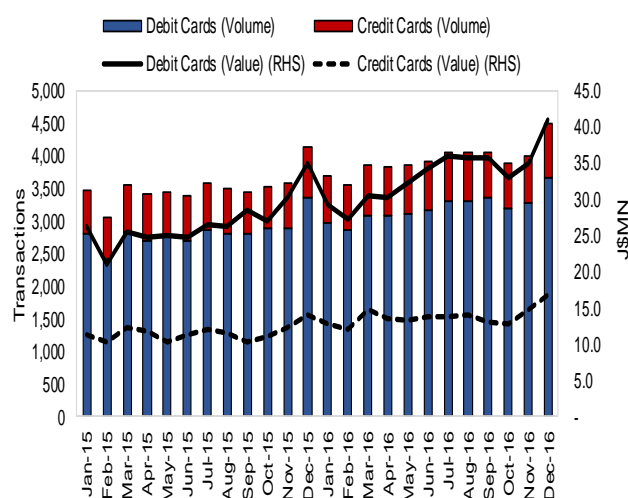


Figure 6.10 Monthly payment card penetration

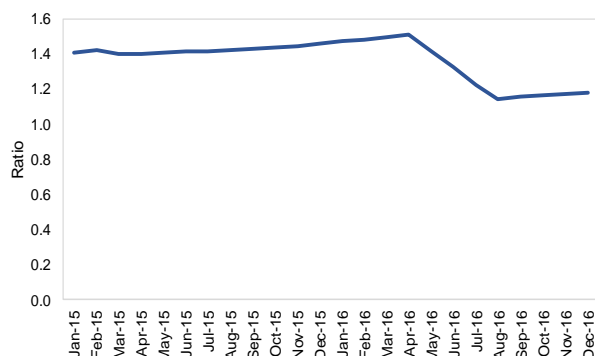
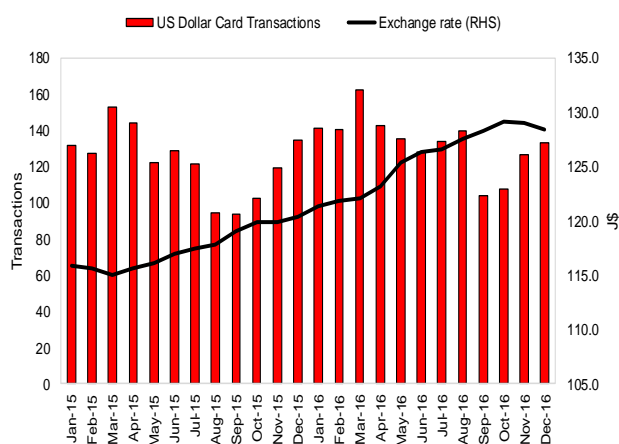


Figure 6.11 US dollar card transaction per 1000 persons and exchange rate



also increased to 2.1 million transactions for 2016 relative to 1.8 million transactions for 2015.

The increase in average monthly transactional activity was influenced by growth in both point-of-sale (POS) and automated bank machine (ABM) transactions. The average monthly volume of POS transactions increased to 1.0 million, an increase of 20.1 per cent, amounting to J\$5.7 billion while the number of ABM transactions increased to 1.0 million, an increase of 7.6 per cent, amounting to J\$7.1 billion (see Figure 6.5)

6.2.4 Key trends & developments in retail payments⁶

Total retail payment transaction increased in 2016 by approximately 3.1 per cent to J\$1.5 billion per 1000 persons.⁷ The average monthly transactional value also increased to J\$123.2 million per 1000 persons for the period. The total number of retail transactions increased by 3.6 per cent to 55 246 per 1000 persons with average monthly transaction volumes increasing to 4 604 transactions per 1000 persons. Debit cards continued to be the most utilized retail payment instrument in 2016 accounting for 69.4 per cent of the total number of retail payment transactions, an increase of 4.1 percentage points. Cheques accounted for 58.1 per cent of the total value of retail transactions for 2016. This was indicative of migration from paper-based forms of payments to electronic forms (see Table 6.1).

Paper-based instruments

Cash

There was stronger growth in currency in circulation during 2016 relative to 2015. For the year, currency in circulation increased by 17.8 per cent to J\$86.4 billion relative to growth of 15.3 per cent for 2015. The average monthly level of currency in circulation as a share of GDP, increased to 4.2 per cent for 2016 relative to 3.8 per cent for 2015. Average currency in circulation as a share of M1, however decreased

⁶ All retail payments figures except cash data are per 1000 persons of working age (age 14 and older).

⁷ Retail payments include cheque payments, debit and credit card payments and other electronic forms of payment.

to 44.9 percent for 2016 relative to 46.5 per cent for 2015 (see **Figure 6.6**).⁸

Commercial bank cheques

Cheque payments continued to decline in 2016 with the average monthly cheque transactions decreasing by 7.6 per cent to J\$71.6 million per 1000 persons. A further disaggregation of the cheque transactions revealed that the value of intra-bank cheques decreased by 6.1 per cent to J\$37.0 million per 1000 person with the value of inter-bank transactions decreasing by 9.0 per cent to J\$34.6 million per 1000 persons.

Similarly, average monthly cheque transaction volume decreased by 5.0 per cent to 575 transaction per 1000 persons. Consistent with the change in transactional value, intra-bank cheque volumes declined by 4.3 per cent to 323 transactions per 1000 persons with inter-bank transaction decreasing by 5.8 per cent to 252 transactions per 1000 persons (see **Figure 6.7**).

Commercial bank electronic payment instruments⁹

There was continued growth in the value and usage of electronic payment instruments offered by commercial banks during 2016. The value of electronic payments increased by 22.6 per cent to J\$619.3 million per 1000 persons with the average monthly value increasing to J\$51.6 million per 1000 persons. The total number of electronic transactions for 2016 increased by 9.1 per cent to 48 350 transactions per 1000 persons with average monthly electronic transactions increasing to 4 029 transactions per 1000 persons (see **Figure 6.8**).

Card payments

Card payment activities continued to increase in 2016 with growth in both credit and debit card value and volume. The value of credit card transactions increased by 19.2 per cent to J\$164.3 million per 1000 person for 2016 with average monthly transactional value increasing to J\$12.7 million per

Figure 6.12 Number of active POS and ABM terminals

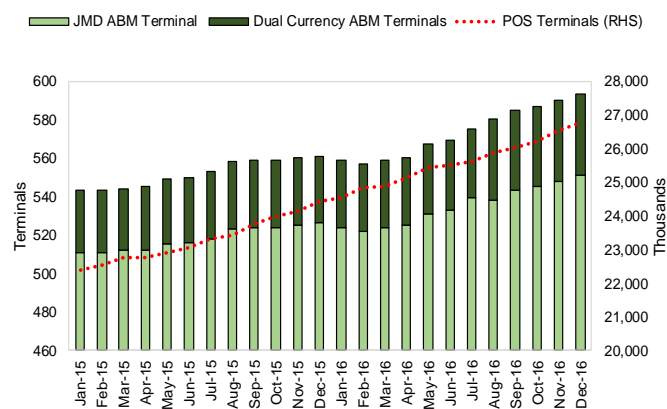


Figure 6.13 POS transactions to ABM withdrawals

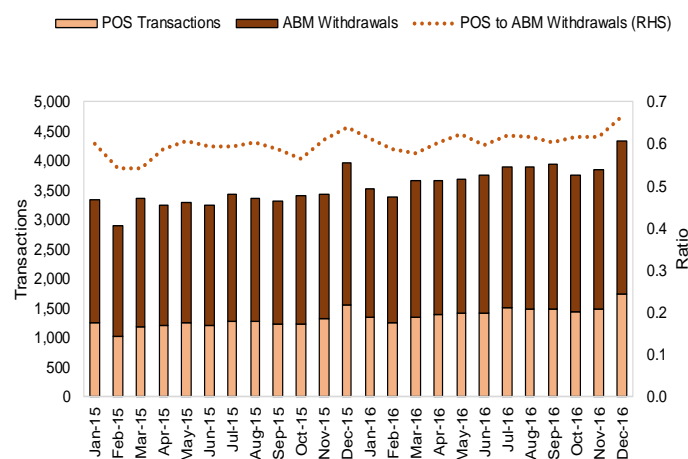
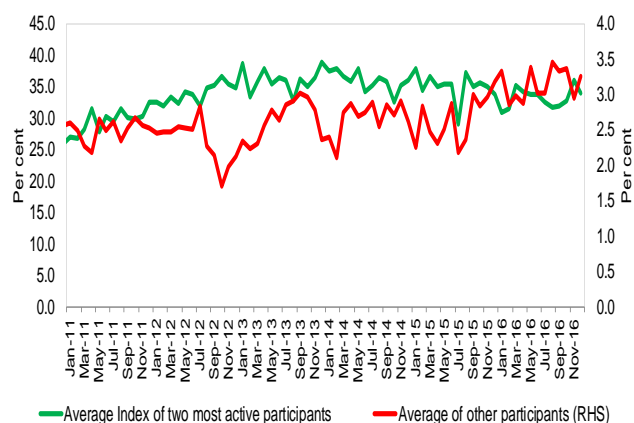


Figure 6.14 Large-value system concentration risk index



⁸ M1 is defined as currency in circulation plus demand deposits in local currency.

⁹ Electronic payments include debit card, credit card and other electronic payments.

Figure 6.15 Herfindahl index of JamClear-RTGS payment activity

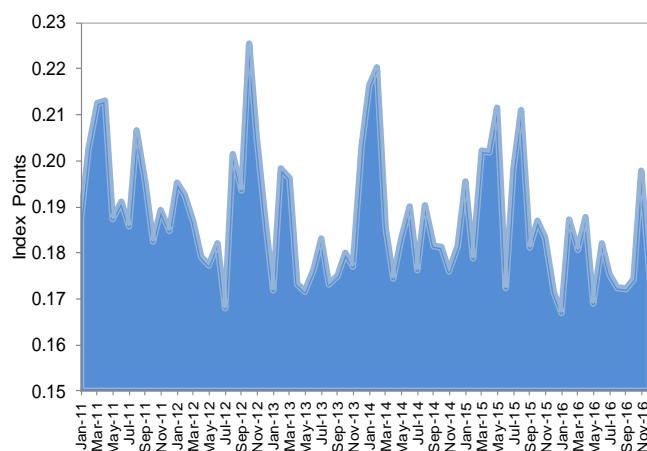
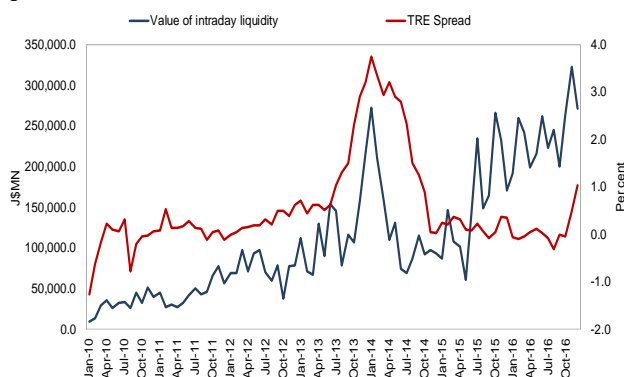
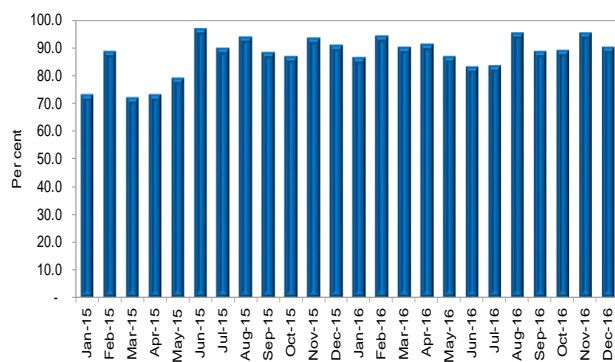


Figure 6.16 Value of intraday liquidity transactions and TRE Spread



Note: The TRE spread measures the premium priced in the repo rate for default risk and is computed as the difference between the 30-day private money market rate and the 30-day T-bill rate.

Figure 6.17 Share of BOJ intraday repos (values) demanded by the top four subscribers during 2015 & 2016



1000 persons. Debit card transactional values also increased in 2016 by 24.9 per cent to J\$399.5 million per 1000 persons with average monthly transactional value increasing to J\$33.3 million per 1000 persons. Accordingly, credit card volume increased in 2016 by 7.3 per cent to 8 825 transactions per 1000 persons with average monthly volumes increasing to 735 transactions per 1000 persons. In addition, debit card volumes increased in 2016 by 13.6 per cent to 38 346 transactions per 1000 persons with average monthly volume increasing to 3 195 transactions per 1000 persons (see **Figure 6.9**). Though card activities increased over the review period, payment cards in circulation decreased by 7.6 per cent to 2.7 million in 2016. Consequently, card penetration decreased to 1.2 cards per person at end-2016 (see **Figure 6.10**).¹⁰

The average monthly volume of US dollar card transactions continued to grow in 2016 despite the continued depreciation in the Jamaican dollar vis-à-vis the US dollar. For 2016, average monthly volume of US dollar card transactions increased by 8.3 per cent to 133 transactions per 1000 persons (see **Figure 6.11**). The volume of Jamaica dollar-denominated card transactions also increased relative to 2015.

Electronic payment channels offered by commercial banks

There was an increase in the number of active ABM and POS terminals operated by commercial banks. Specifically, ABM active terminals increased by 5.7 per cent at end-2016 to 593 terminals. The number of active POS terminals also increased by 9.5 per cent at end-2016 to 26 750 terminals (see **Figure 6.12**).

In light of the continued increase in electronic payment usage, the ratio of POS transactions to ABM withdrawals also increased in 2016. Though the number of ABM withdrawals continued to be greater than the number POS transactions, growth in the average monthly number of POS

¹⁰ Cards penetration is total credit and debit cards (JMD, USD and dual currency) to the working population (14 years and older).

transactions for 2016 surpassed that of ABMs withdrawals, increasing by 15.2 per cent to 1 432 transactions per 1000 persons. Average monthly ABM withdrawals grew by 11.0 per cent to 2 340 transaction per 1000 persons. In the context of larger growth in average monthly POS transactions to ABM withdrawals, the ratio of POS transactions to ABM withdrawals increased to 0.7 POS transactions for every ABM withdrawal (more than one ABM withdrawal to POS transaction). This outturn illustrates the continued prevalence of cash as a medium of payment even in the presence of increasing usage of electronic payments (see **Figure 6.13**).

6.3 Assessing financial sector exposure to financial market infrastructures (FMIs)

6.3.1 Concentration Risk

Large-value System Concentration Risk Index (LSCRI)¹¹

An examination of the index showed that liquidity concentration remained high for the review period.¹² This was reflected by the share of payment activity being dominated by the two most active participants. The average share of activity for other participants within the system increased to 3.3 per cent in 2016 relative to 3.2 per cent in 2015. This was, however, offset by an increase in the average share of payment activity for the two most active participants to 34.0 per cent for 2016 relative to 33.7 for 2015 (see **Figure 6.14**).

Herfindahl Index of JamClear-RTGS Liquidity Concentration

The level of concentration risk within the system was also reflected in the Herfindahl index of payment activity.¹³ This index averaged 0.2, in line with the annual average over the last five years, thereby signalling persistence in the level of

¹¹ This measure is computed based on payments made and received by each bank as a share of overall payments for the system.

¹² The LSCRI records the share of payment activity between:

- (i) the two most active participants in relation to all other participants; and
- (ii) all other participants in relation to the two most active participants.

The calculation excludes the activities of the Accountant's General Department, BOJ and Clearing Houses who are also participants in the RTGS system.

¹³ The Herfindahl index is a measure of the extent of a financial institution's payment activity in relation to the other participants in the system. It is also an indicator of the level of concentration of liquidity with the system.

Figure 6.18 BOJ intraday repo facility monthly transaction value

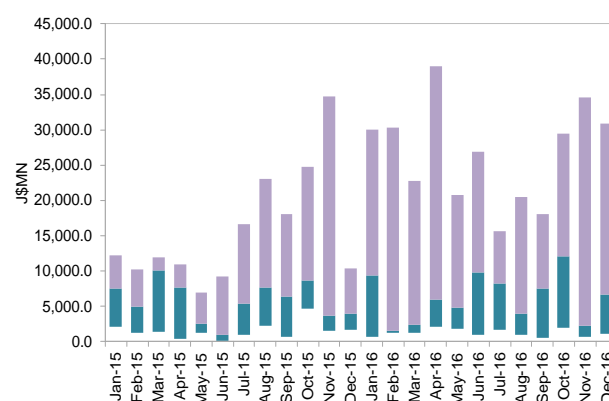


Figure 6.19a JamClear-RTGS network (end-2015)

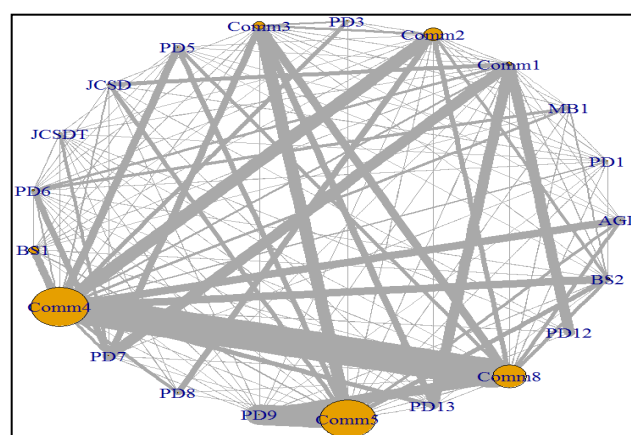


Figure 6.19b JamClear-RTGS network (end-2016)

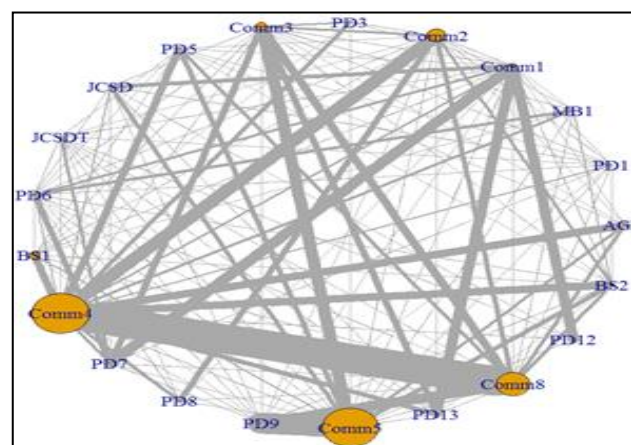


Table 6.2 Core payment network statistics

	Dec 2015	Dec 2016
Network Size		
Nodes	21	21
Links	243	237
Connectivity Measures		
Density (%) - Connectivity	57.9	56.4
Distance Measures		
Average Path Length ¹⁴	1.4	1.4
Diameter ¹⁵	7	6
Systemically Important Payment Institution Concentration		
Size of Giant Strongly Connected Components (GSCC) - Number of Institutions	11	10

¹⁴ An average path length of one indicates that all participants have sent a payment to all others. A longer path length indicates that activity is concentrated among fewer pairs of participants.

¹⁵ The diameter indicates the maximum distance between any two participants in the network. The diameter can provide an indication of how easily or quickly an event affecting a participant could potentially affect the others in the network. A shorter diameter indicates a faster speed of contagion within the network.

liquidity concentration within the large value transfer system in Jamaica (see **Figure 6.15**).

6.3.2 Liquidity risk

Liquidity conditions tightened in the second half of the year relative to conditions for the first six months of 2016. This was reflected by the average monthly value of intraday liquidity usage being 11.4 per cent higher in the second half of 2016 amounting to J\$254.5 billion relative to J\$228.5 billion for the first six months (see **Figure 6.16**). Similar liquidity conditions were observed the money market. Specifically, during the first half of the review period, favourable liquidity conditions were experienced as reflected by a narrowing of the TRE spread. Some tightening of liquidity was, however, observed in the second half of the year as reflected by the uptick of the TRE spread (see **Figure 6.16**). The average monthly TRE spread was 0.01 per cent, 0.2 percentage points lower than 2015.

Usage of BOJ's intraday liquidity facility¹⁶

The value of the BOJ's intraday liquidity facility usage increased for 2016 by 55.3 per cent to J\$2.9 trillion relative to growth of 23.4 per cent for 2015. The number of the intraday liquidity transactions, also increased by 51.1 per cent in 2016 relative to 2015. Of the participating institutions utilizing the BOJ intra-day repo facility, the percentage of funds demanded by four institutions remained consistently over 80.0 per cent for most of the review period, an indication of concentration of liquidity risks in the payment system (see **Figure 6.17**). The Bank's provision of intra-day repos totalled \$2.9 trillion for 2016 relative to \$1.9 trillion for 2015. The amount of funds demanded during the second half of the year totalled J\$1.5 trillion relative to a total of J\$1.4 trillion up to end-June 2016 (see **Figure 6.18**).

The bank continued provision of the standing liquidity facility (SLF), the bi-monthly repurchase operations (BRO) and the excess funds rate (EFR) over the year. Within the context of growing trend in dollarization as well as to curtail

¹⁶ The BOJ's intraday liquidity facility provides funds to system participants to minimize their liquidity exposure brought about by timing mismatches between incoming and outgoing payment activities.

volatility within foreign exchange market, the Bank tightened liquidity through the reduction in loan amounts via BOJ's weekly repurchase operations and lower placements on the Bank's overnight Certificate of Deposit (CD).

6.4 Evaluating interconnectedness & systemic importance

JamClear-RTGS network topology

The commercial banking sector remained the most influential sector within the network as reflected by the larger nodes. Commercial banks also significantly influence the flow of liquidity within the network, evidenced by the thicker links (see **Figure 6.19a & 6.19b**). Notwithstanding, building societies and primary dealers continued to show a high level of importance within the payment network.

Network Statistics

Network connectivity decreased slightly to 56.4 per cent at end-2016 relative to 57.9 per cent at end-2015. This decline reflected lower potential contagion paths within the system. In addition, there was an increase in the speed of contagion measure where the "diameter" decreased to six participants at end-2016 relative to seven participants at end-2015. This result reflects relatively higher susceptibility of the JamClear-RTGS to systemic risk brought on by participants experiencing liquidity constraints (see **Table 6.2**).

BOX 6.1: Structure & Stability of the Jamaican Payment System: Assessing Systemic Risk in the JamClear-RTGS System through Network Analysis & Simulations¹

Introduction

The most recent global financial crisis experienced in 2008 has raised concerns on the adverse consequences related to externalities intrinsic to financial systems. One particular association with the increased pace of globalization and financial integration, is interconnectedness risk or the concept of too-connected-to-fail (Chan-Lau, 2010). With increased interconnectedness in financial markets, systemic risk has become a key concern for central banks, especially as it relates to their responsibility for financial stability.

Network analysis has emerged as a method tackling the issue of interconnectedness and it involves the mapping and measuring of relationships and flows within a group of agents. The main advantage of network analysis is that it provides both a visual and a mathematical analysis of relationships from which the answers to key questions about the characteristics and performance of the network can be obtained (Espinosa-Vega and Solé, 2011a). Network analysis also allows for the design of simple metrics for measuring contagion that can be used to augment contemporary stress testing and simulation techniques.

Several studies have explored networks from a balance sheet perspective, focusing on the generation of matrices of interbank exposures that identify gross lending and borrowing among institutions in an effort to facilitate the simulation of plausible stresses to specific institutions and assess the systemic impact on other institutions within the financial system.¹ In recent times, there has been some growth in the literature examining financial networks from a payment systems perspective.² These studies use the actual transfer of funds between participants to construct matrices of interbank/inter-institution connections.

This study attempts to examine the network topology and stability of the Jamaican payment system. The operational resilience of payment infrastructures is important to maintain financial stability as a disruption in routine payment flows can result in unwanted risk exposures. Therefore, this paper seeks to assess the payment system network topology under stressed

conditions so as to gauge the target areas for liquidity management policies.

The large-value payment system, JamClear-RTGS was used to construct a payments network for Jamaica. Further, several network statistics were used to identify systemically important payment institutions (SIPIs). Following this, simulation techniques were used to assess the stability of the JamClear-RTGS system.

Data

Given the potential impact of tight liquidity conditions on financial market flows, it was important to examine the network structure during periods of tight liquidity. The BOJ's TRE spread and the value of intra-day liquidity usage were used to identify periods of tight liquidity. Based on the examination of both measures over the period spanning 2010 to 2015, it was found that January 2014 was a period of tight liquidity. This period was juxtaposed to a period of relatively normal liquidity conditions, December 2015. A dataset of actual daily payments for both months was collected from the JamClear-RTGS database and included all transaction types within the JamClear-RTGS system except system charges and other transactions denoted as general ledger. The data included information on the sender, receiver and the value of each individual payment. The central bank was removed from the dataset as their influence on the network is understandably significant and therefore they were not necessary for inclusion in the study.

Network Statistics

Network statistics provide a mathematical representation of complex systems such as that of payment networks. These measures simplify the payment flows to unweighted links, allowing for ease of analysis. There is a wide variety of network statistics that could possibly be used, however, the focus in this piece was limited to centrality measures as this is used to inform the simulations.

Centrality measures assign scores to nodes, allowing for the ranking of participants based on their level of influence or importance within the network. Having different centrality

¹ See: Eisenberg and Noe, 2001; Demange, 2012; Elliot et al., 2013; Glasserman and Young, 2015.

² See: Boss et al., 2004; Soramäki et al., 2006; Roberts, 2011.

measures allow for the observation of different patterns within the network that can be used to assess stress points or the emergence of risks.

Degree Centrality

Degree refers to the number of edges connected to a node. Degree centrality equates centrality/influence directly to the degree of a node and hence does not consider indirect relationships. Therefore, the most central/influential participant in the system is the one with the most direct relationships. Directed networks allow for both an in-degree and an out-degree. For payments systems, in-degree centrality highlights participants that are net-debtors while out-degree centrality identifies net-creditors. The important point to note is that those participants connected to many others might have more influence on and/or have more access to liquidity. Based on degree centrality, commercial banks are the most influential nodes within the network. This is highlighted by commercial banks having the higher levels of both in-degree and out-degree centrality in both periods examined (see **Figure 1**).

*Closeness Centrality*³

Closeness centrality measures how many steps are required to access every other node from a given node. This measure shows the importance of participant as it relates to the ease of providing liquidity. Furthermore, it can be used as an indicator to identify the more systemically important participants in the event of liquidity crises. As it relates to closeness centrality for both periods examined, it was observed that primary dealers followed by commercial banks were the most influential nodes within the network. Given that closer nodes allow for ease of liquidity flow, it can be said that primary dealers are important in the transfer of liquidity throughout the network (see **Figure 2**).

³ The closeness centrality of a node is defined by the inverse of the average length of the shortest paths to/from all the other nodes in the graph:

$$C_i = \frac{1}{\frac{1}{n} \sum_j d_{ij}}$$

Here d_{ij} is the length of the geodesic (shortest) path from i to j . This simplifies to:

$$C_i = \frac{n}{\sum_j d_{ij}}$$

*Betweenness Centrality*⁴

The betweenness centrality measures the extent to which a node lies on paths between other nodes. Nodes with high betweenness centrality may have considerable influence within a network by virtue of their control over information passing between others (Newman, 2010). This measure highlights the importance of a participant with regards to their impact on the flow of payments between other participants in the system that may not be directly connected. Primary dealers were generally observed to have the largest betweenness centrality values in both periods. This indicates that primary dealers have a greater probability of being an intermediary on the shortest path between any two other participants. This underscores the importance of primary dealers in linking payments flows between other participants within the network that would have otherwise not been connected (see **Figure 3**).

Counterfactual Simulations

In the evaluation of payment system stability we employ counterfactual simulations, using the method of unwinding first explored by Humphrey (1986) and later Angelini et al. (1993). The multilateral net positions of all participants within the network were calculated and then used to simulate the failure of major participants by removing all transactions sent and received by those participants for a particular period.⁵ The net balances of the remaining participants were then recalculated, highlighting those with a negative balance. The change in the net balances of these institutions were then compared to the contingent liquid indicators. A participant who experienced an increased level of exposure greater than or equal to their ability to withstand/absorb the shock were assumed to ‘have failed’ due to systemic effect. The payment activity of this participant was then removed from the network and new settlement positions calculated. Several iterations of this process was conducted until all participants were able to settle their transactions.

⁴ The node betweenness of node i is defined by:

$$B_i = \sum_{s \neq i \neq t} \frac{\sigma_{st}(i)}{\sigma_{st}}$$

Where s and t are nodes in the network different from i , σ_{st} denotes the number of shortest paths from s to t , and $\sigma_{st}(i)$ is the number of shortest paths from s to t that i lies on.

⁵ Multilateral net positions are calculated as the sum of all payments received by an institution minus the sum of all payments sent by the institution.

In this study, simulations were geared towards assessing the JamClear-RTGS system's susceptibility to liquidity shocks based on idiosyncratic issues impacting participants' ability to meet their payment obligations and thereby pose systemic risk concerns for the financial system. As a measure of the ability to withstand liquidity shocks, the change in the net balance of participants with negative net balances were compared to the participants' JamClear-RTGS transaction account closing balance, cash reserves and stock of liquid assets.

For the purpose of this study, tiers of contingent liquidity were established based on their ease of accessibility in the event of shocks to payment flows. Participants' average transaction account closing balances over the periods examined were deemed as Tier 1 contingent liquidity, as this is where all transactions originate and funds can easily be reallocated if necessary. Cash reserves are deemed Tier 2 contingent liquidity, as this is the most liquid form of assets in the event that the transaction account closing balance was insufficient to absorb the shock. Additionally, Tier 3 contingent liquidity are participants' liquid asset with a maturity time of up to 90 days.

Unlike previous studies, we adjusted contingent liquidity measures by accounting for the absorption of shocks in each iteration. This was done by reducing the stock of contingent liquidity by the proportion of the change in the participant's net balance for each iteration of the simulation.

As an augmentation to the unwinding methodology employed in Humphrey (1986) and Angelini et al., (1993), this research incorporates network topology in the counterfactual simulations. Systemically important payment institutions (based on participants being too-connected-to-fail) were identified through their presence in the giant strongly connected component (GSCC) as well as their degree centrality scores. Out-degree centrality is used to identify and rank the top four (4) systemically important payment institutions (SIPIs) within the GSCC which are then used as troubled participants within various scenarios. Out-degree centrality was used as opposed to in-degree centrality since these participants are net creditors and are expected to have a greater impact on the network.

This paper also employs proportional payment defaults where a percentage of a participant's overall sent payments are removed and the impact on the GSCC is examined.

Participants that are deemed to have failed then have their ability to make payments restricted. This iterative process is continued until all remaining participants are able to meet their payment obligations either through settlement or using their contingent liquidity. This augmentation to the unwinding process was seen as more realistic than a participant failing to meet all of its obligations over a given period of time.

The GSCC of a network can be used as an indicator of the level of concentration within the network. We propose that the smaller the size of the GSCC, the greater the concentration risk as a smaller subset of participants are totally connected thus increasing the likelihood of failure of the network in the event of severe liquidity constraints. Concentration risk, measured by the size of the GSCC within the JamClear-RTGS was observed to be the same in both periods with 11 participants being deemed SIPIs. The structure of the GSCC changed significantly in December 2015 relative to January 2014 with only commercial banks and primary dealers making up the SIPI group. Of significance as well, was the increase in the number of primary dealers within the GSCC, underscoring the increasing importance of these institutions within the financial sector (see **Figure 4**).

Simulation Results

Firstly, we examined the impact of the total failure of the most influential participant on the JamClear-RTGS network. Following this, we then executed a more realistic shock of a proportional failure where the most influential participant was unable to make out-going payments by proportionally cancelling outgoing payments from this participant. These simulations were conducted in both the tight and normal liquidity periods.

Failure of Most Central Participant

For January 2014, following the removal of the most central participant within the JamClear-RTGS network, it was observed that five participants had negative net balances. The system was observed to be stable based on the Tier 3 liquidity measure. Using Tier 1 liquidity, however, it was observed that one participant failed. The system was observed to be stable after two iterations with five participants having negative net balances which were sufficiently covered by their Tier 1 liquidity. Using Tier 2 liquidity, it was observed that three participants failed. The system was observed to be stable after three iterations with three participants having negative net balances but holding sufficient Tier 2 liquidity to offset negative net balances.

An examination of the failure of the most central participant during a period of normal liquidity revealed a more resilient network with only two participants having negative net balances. Based on all three liquidity measures, no participant failed and the system was observed to be stable after one iteration.

Proportional Settlement Failure of Central Participants

The most central participant was subject to failure of various proportions of their outgoing transactions starting with 100 per cent failure then 10 per cent reductions in the proportion of failure payments until the system was observed to be stable. This assessment was conducted on the peak days (based on the day with the highest transactional activity) of both the period of tight and normal liquidity. Proportional settlement failures were considered to be more realistic as they relate to payment defaults or transactional delays of participants. With these simulations being conducted on daily data, only the Tier 1 liquidity measure, the transactional account closing balance of the previous day was used to evaluate the stability of the network.⁶

An examination of the system in a period of tight liquidity revealed that five participants had negative net balances. All outgoing payments from the most central participant were restricted and it was observed that one other participant failed. The system was observed to be stable after two iterations with eight participants having negative net balances. However, they had sufficient levels of Tier 1 liquidity to offset by the negative balances.

Examining the network on a peak day during normal liquidity conditions revealed that four participants had negative net balances. On the restriction of all outgoing payments from the most central participant, one participant failed. The system was observed to be stable after two iterations with six participants having negative net balances but sufficient Tier 1 liquidity to offset the negative net balances.

The system was also observed to be stable following proportional defaults by the second, third and fourth most central participants. Several iterations were carried out and it was found that the system remained stable during both periods based on the levels of Tier 1 liquidity.

Concluding Remarks

The simulations results presented demonstrate that the JamClear-RTGS network is robust to significant distress, thereby signaling a stable and resilient network to systemic risk. Notwithstanding, the large value system simulation of systemic stress using proportional defaults proposed in this research paper, proves to be an essential tool regulators can utilize for the continued assessment of the stability of payment system.

This study employed augmented simulations based on the method of unwinding from existing literature as well as proposed a more realistic method wherein the defaults of the most central participants' outgoing payments were explored. Results revealed a relatively resilient network in both periods examined with the largest number of failed institutions being three participants. This was, however, in two instances where cash reserves (Tier 2 liquidity) were used as the participants' contingent liquidity. As expected, the JamClear-RTGS network was observed to be more resilience in the period of normal liquidity.

Based on the proportional counterfactual simulations of outgoing payment defaults proposed in this paper, the system was observed to be very resilient with only one participant failing in both periods examined when all outgoing payments were restricted from the most influential participant in both periods. Results also suggest that the system was able to withstand 100 per cent of individual outgoing defaults from the second, third and fourth most influential participants within the network in both periods. This was due to the significant level of opening balances in their transactional accounts that can be used as contingent liquidity.

The network topology analysis presented here highlights the need for more focus on primary dealers in the Jamaican financial system given their increasing importance for financial intermediation. This, coupled with increased concentration risk emanating from the group, accentuates the importance of the implementation of macro-prudential tools to target concentration of systemically important institutions in a relatively small and concentrated financial sector.

⁶ Peak day for period of tight liquidity: January 31, 2014. Peak day for normal liquidity period: December 18, 2015.

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Figure 1: Degree Centrality of Participants

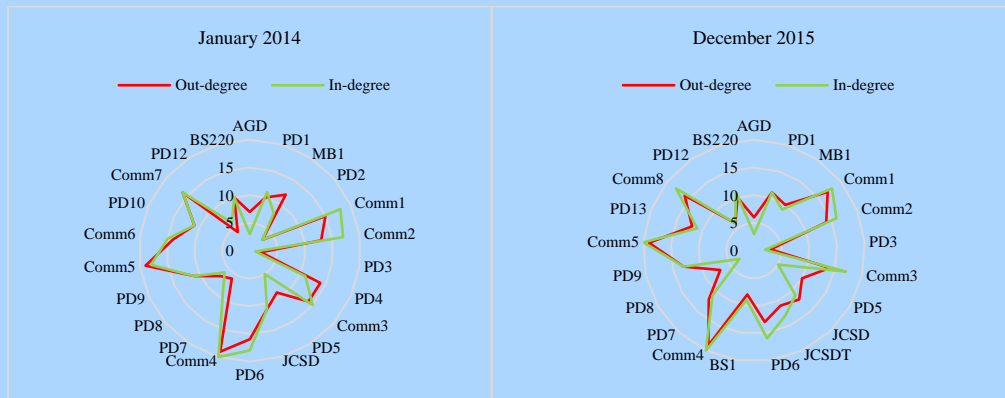


Figure 2: Closeness Centrality of Participants

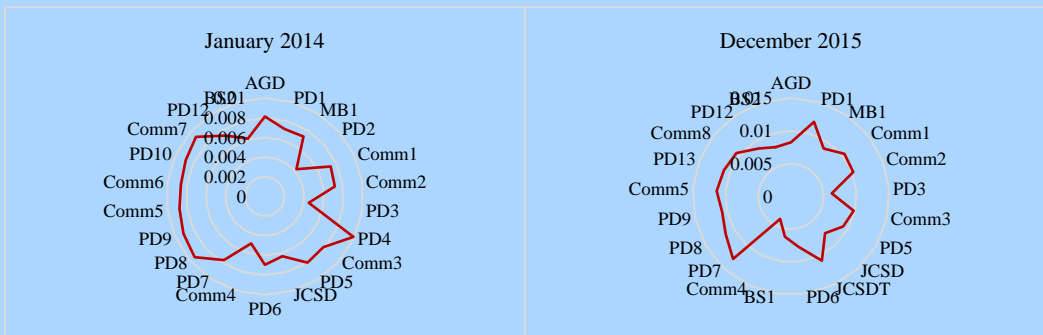


Figure 3: Betweenness Centrality of Participants

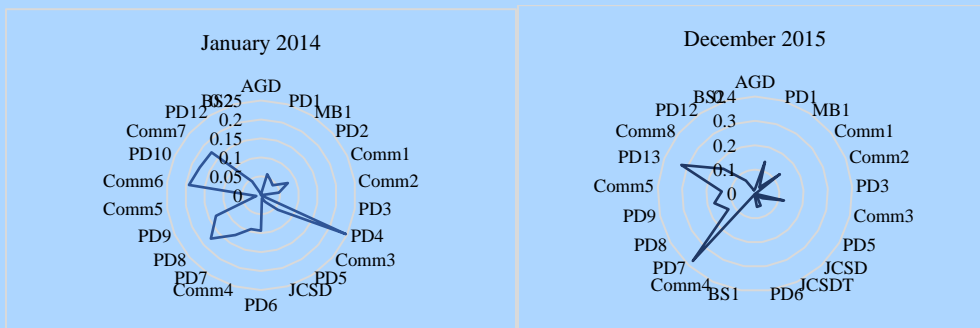
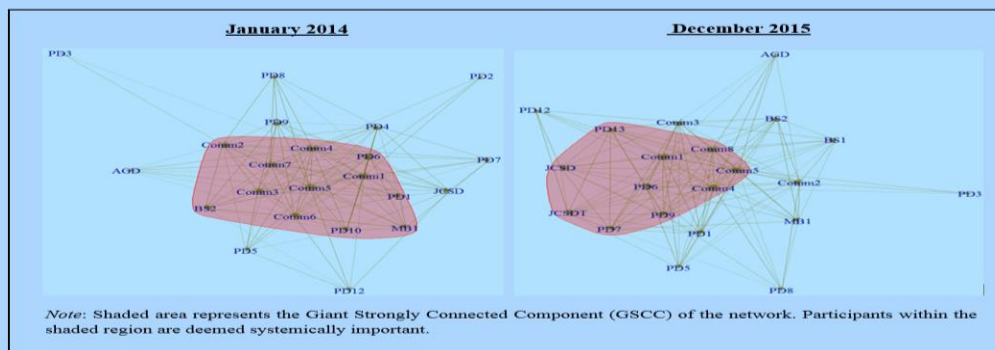


Figure 4: JamClear-RTGS Giant Strongly Connected Component



Glossary

Automated Clearing House	A facility that computes the payment obligations of participants, vis-à-vis each other based on payment messages transferred over an electronic system.
Bid-ask Spread	The difference between the highest price that a buyer is willing to pay for an asset and the lowest price that a seller is willing to accept to sell it.
Central Securities Depository	An institution which provides the service of holding securities and facilitating the processing of securities transactions in a book entry (electronic) form.
Concentration Risk	The risk associated with the possibility that any single exposure produces losses large enough to adversely affect an institution's ability to carry out their core operations.
Consumer Confidence Index	An indicator of consumers' sentiments regarding their current situation and expectations of the future.
Counter-party Risk	The risk to each party of a contract that the counterparty will not live up to its contractual obligations. Counterparty risk is a risk to both parties and should be considered when evaluating a contract.
Credit Risk	The risk that a counterparty will be unable to settle payment of all obligations when due or in the future.
Disposable Income	The remaining income after taxes has been paid which is available for spending and saving.
Dollarization	Dollarization is the official or unofficial use of another country's currency as legal tender for conducting transactions.
Financial Intermediation	The process of channelling funds between lenders and borrowers. Financial institutions, by transforming short-term deposits or savings into long-term lending or investments engage in the process of financial intermediation.
Fiscal Deficit	The excess of government expenditure over revenue for a given period of time.

Foreign Exchange Risk	The risk of potential losses which arise from adverse movements in the exchange rate incurred by an institution holding foreign currency-denominated instruments.
Funds Under Management/ Managed Funds	The management of various forms of client investments by a financial institution.
Hedging	Strategy designed to reduce investment risk or financial risk. For example, taking positions that offset each other in case of market price movements.
Interest Margin	The dollar amount of interest earned on assets (interest income) minus the dollar amount of interest paid on liabilities (interest expense), expressed as a percent of total assets.
Interest Rate Risk	The risk associated with potential losses incurred on various financial instruments due to interest rate movements.
Intraday Liquidity	Credit extended to a payment system participant that is to be repaid within the same day.
Large Value Transfer System	A payment system designated for the transfer of large value and time-critical funds.
Liquidity Risk	The risk that a counterparty will be unable to settle payment of all obligations when due.
Net Open Position	The difference between long positions and short positions in various financial instruments.
Non-Performing Loans	Loans whose payments of interest and principal are past due by 90 days or more.
Off-Balance Sheet Items	Contingent assets and debts that are not recorded on the balance sheet of a company. They are usually noteworthy as these items could significantly affect profitability if realized.
Payment System	A payment system consist of the mechanisms - including payment instruments, institutions, procedures, and technologies - used to communicate information from payer to payee to settle payment obligations.

Real-Time Gross Settlement System

A gross settlement system in which payment transfers are settled continuously on a transaction-by-transaction basis at the time they are received (that is, in real-time).

Repurchase Agreement (Repo)

A contract between a seller and a buyer whereby the seller agrees to repurchase securities sold at an agreed price and at a stated time. Repos are used as a vehicle for money market investments as well as a monetary policy instrument of BOJ.

Retail Payment System

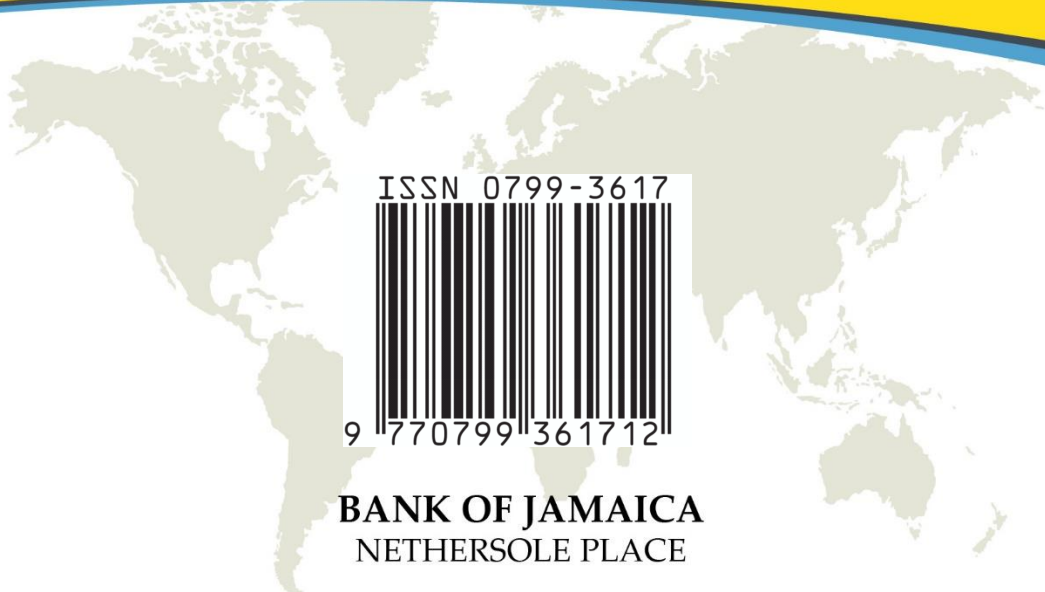
An interbank payment system designated for small value payments including cheques, direct debits, credit transfers, ABM and POS transactions.

Stress Test

A quantitative test to determine the loss exposure of an institution using assumptions of abnormal but plausible shocks to market conditions.

Systemic Risk

The risk of insolvency of a participant or a group of participants in a system due to spillover effects from the failure of another participant to honour its payment obligations in a timely fashion.



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