DRAFT

Measuring the level of Financial Stability in The Bahamas

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Abstract

In recent years, the need for countries to efficiently and consistently monitor and assess developments within their financial sectors has increased significantly, especially given the observed contagion effects of the recent global financial crisis. This is particularly important for Caribbean countries, where the financial sectors are typically dominated by a few large institutions. Accordingly, this paper seeks to create an Index of Financial Stability for The Bahamas, by utilising a variety of macroeconomic and macroprudential indicators.

Keywords: Financial stability, macroprudential indicators

[1] The views expressed in this paper are those of the authors and do not necessarily represent The Central Bank of The Bahamas. This paper should be considered a work in progress and as such the authors would welcome any comments on the written text.

DRAFT

Measuring the Level of Financial Stability[2] in The Bahamas

Introduction

Over the past decade, several developed and emerging markets have experienced serious economic dislocations and in some cases recessions, emanating from the collapse of a number of large financial institutions. In response, governments worldwide were forced to provide large-scale financial support "bailouts" to these entities, to allow them to either emerge from bankruptcy or merge with other financial firms, as the significant level of "interconnectedness" between institutions could have potentially led to a wide-scale financial crisis. These on-going challenges have brought to the forefront the need for policy makers to continuously monitor and analyse the health of the financial sectors in their various economies in order to prevent future financial crises.

In an attempt to address these issues globally, the International Monetary Fund (IMF) publishes a semi-annual report entitled "The Global Financial Stability Report". Likewise, several countries, including The Bahamas[3], produce their own financial stability reports, which track and analyse developments in their domestic financial sectors and assess the risks to the system.

On the regulatory front, policy makers have also recognised the growing need to consider the inter-linkages between the financial and real sectors when determining the appropriate

[2] A financial system is in a range of stability whenever it is capable of facilitating (rather than impeding) the performance of an economy, and of dissipating financial imbalances that arise endogenously or as a result of significant adverse and unanticipated events (See Schinasi, 2004).

[3] Copies of The Bahamas' Financial Stability Reports for 2012 and 2013 are available at: www.centralbankbahamas.com.

monetary policy stance. This need has ushered in a new era of macro-prudential policies[4]. Traditionally, in the Caribbean, these policies have focussed on domestic banks, which form the predominant part of most economies' financial sectors. However, as other non-bank institutions such as credit unions, insurance companies and building societies have grown in size and scale, these sectors must also be considered in creating an effective macro-prudential policy regime.

A major aspect of macro-prudential policy is the need to determine, in a timely basis, any potential stresses accumulating in the financial sector, in order to implement measures to prevent a crisis. In The Bahamas, the revisions to the Central Bank Act in 2010, made the Bank, *inter alia,* responsible for ensuring the stability of the financial system[5]. Consequently, policy makers need to analyse a variety of quantitative and qualitative macroeconomic and financial data in order to detect potential stressors. These so-called "early warning" indicators, are considered vital in allowing regulators to detect impending vulnerabilities in order to take pre-emptive action. In this regard, the construction of an index of financial stability should be beneficial, because it would combine the relevant variables and provide analysts with a simple and central indicator, which could be tracked and analysed over time.

This paper therefore seeks to create an index of financial stability for The Bahamas, using a variety of macroeconomic and financial data to compute the index. The remainder of this paper is structured as follows: section two highlights several studies which outline the development of financial stability indices for various countries, the subsequent section provides the theoretical framework for the development of a financial stability index for The

[4] These are policies aimed at limiting or minimizing the risk of incidences that would cause financial system instability, and that have high macroeconomic costs. (Galati and Moessner 2011)

[5] See Central Bank of the Bahamas Amendment Act 2010, page 2.

Bahamas, while section four tests the results of the model created. The final section summaries the major findings and concludes the study.

Literature Review

Given the renewed focus on avoiding a financial crisis and maintaining a resilient and stable financial sector, many countries have pursued the important task of constructing an apparatus for measuring and monitoring financial stability within their countries.

Jakubík and Slačík (2013) developed a financial instability index (FII) to assess financial market stress in nine key countries in Central, Eastern and Southeastern Europe. The motivation for the development of this index was the observed increase in importance of gauging financial stability in the wake of the recent financial crisis. Using quarterly market data, the authors constructed an index which comprised four (4) sub-indices, which were given varying weights; namely, the money market (40%), foreign exchange market (20%), equity market (20%) and bond market (20%), with the money market receiving a 'double weight' because the other markets were comparatively underdeveloped. Further, panel estimation was conducted to determine which macroprudential indicators explained financial stress over the preceding 10-16 years. A set of twenty-eight (28) macroprudential indicators were tested, categorized in five main groups: sovereign risk, contagion risk, vulnerability of the banking sector, vulnerability of the real sector, and macroeconomic indicators. The results of the analysis suggest that the level and changes in macroprudential indicators, as well as the interaction of different factors, influence financial stability. In particular, credit growth combined with private sector credit and public debt combined with the fiscal deficit, are effective leading indicators of financial instability.

Magdalena Petrovska and Elena Mucheva (2013), originally sought to construct an index of banking stability for Macedonia, which isolated key indicators of financial soundness, to provide a warning for financial system risk. However, given the complexity of interactions between various facets of financial and real sectors, the authors broadened the scope of their study to the creation of a financial conditions index, which signals financial stress within the system as a whole. Specifically, the banking stability index constructed for Macedonia utilized quantitative indicators of financial stability based on their relevance to the economy, as well as international practice. The index comprised indicators of insolvency risk, credit risk, profitability, liquidity risk and currency risk, for banks only. Each indicator was given a weight of 0.25, with the exception of profitability and currency risk, which were given weights of 0.20 and 0.05 respectively. The index was calculated by summating the weighted indicators, using quarterly data over a seven-year period, and normalizing the indicators so that they were all on a scale of 0 to 1. Increases in the index were interpreted as an improvement in banking stability, while the reverse was true for decreases. Based on the results, the index correctly tracked periods of crisis, through declines in the index, and periods of recovery were shown by increases in the index.

In contrast, when constructing a financial conditions index, the authors followed a slightly different methodology which involved calculating a weighted average of several financial sector indicators; whereby the individual weights were determined by principal component analysis (PCA). The results of the analysis showed that both methods measure financial conditions well "*post facto*", and allow for the monitoring of the extent of financial stability in order to project causes and sources of stress.

Similar to Petrovska and Mucheva, Cheag and Choy (2011), set out to construct an aggregate financial stability index for Macao's banking sector. The authors chose indicators based on their relevance and significance to the Macao financial sector, as well as practical considerations such as data availability and frequency. A total of nineteen indicators were used, which fell under three (3) sub index categories, namely; a financial soundness index, which included measures of capital adequacy, liquidity, and profitability; a financial vulnerability index, which included the external, financial and real sector indicators; and a regional economic climate index, which comprised weighted growth in China, Hong Kong & Taiwan. The calculation process included the normalization of quarterly data, which spanned the period 1996-2008. In this index, financial soundness indicators were given a weight of 60%, while the sum of financial vulnerability indicators and economic climate indicators were weighted at 40%—due to the presence of fewer indicators within those categories. The index was statistically normalized, whereby indicators were represented in terms of their standard deviation from the mean. Accordingly, index values above zero (0) were interpreted as periods of higher than average stability, while values below zero (0) were seen as having less than average stability. After the index was constructed, the authors found that it correctly went from positive to negative when the country was heading into a crisis period, indicating that it possessed some predictive power and could be used as a warning signal. Similarly, when the index was normalized empirically, by converting indicators to a range of 0 and 1, the results were comparable to the first test.

Albulescu (2008) aimed to develop an aggregate stability index for the Romanian financial system, in a bid to improve the Central Bank's analysis and assessment of financial stability in the country. Similar to previous studies, the author selected relevant indicators and sub-indices, and then normalized them, so that values ranged between a low of 0, which

represented total instability and a high of 1. The study utilized quarterly data on indicators which were prevalent in most financial stability literature, in addition to the "market capitalisation to GDP" in order to capture the impact of Romania's developing capital market. He then computed four composite indices: the Financial Development Index (FDI), the Financial Vulnerability Index (FVI), the Financial Soundness Index (FSI) and the World Economic Climate Index (WECI). The results of the study showed significant declines in the index, which coincided with periods of economic crisis (1998, 2001, and 2007). The author concluded by advising that the accuracy of the results could be improved upon by testing the relationship between the financial and the macroeconomic variables.

In terms of Latin America, Morales & Estrada (2010) constructed an index to measure stress levels within the Colombian financial system, following several instances of financial imbalance in the country. The authors utilized data, spanning the period 1995-2008, from 170 financial institutions, including commercial banks, mortgage lenders, finance companies and cooperatives. Although the study used higher frequency—monthly—data, the authors computed only eight (8) indicators. Morales & Estrada noted that the most difficult aspect of calculating the index was determining the weight for each indicator. Accordingly, the authors employed three different techniques to weight the variables, including the variance weighted method, which standardizes the indicators so they are presented in the same unit, and then aggregates them using the same weights. The two other methods utilised were the principal component method, based on the study by Cheag and Choy (2011), and the qualitative response approach, which employs econometric estimations to model the interaction between the dependent variable and the variables that may cause stress, based on either past bank failures or economic crises. The regression results of the latter were then used to estimate the

weight of each variable within the index. The authors found that all three indices yielded similar patterns and generally gave the highest weight to profitability and credit risk.

With regard to regional studies, Morris (2011) developed an aggregate financial stability index (AFSI) for Jamaica, to complement the existing framework which involves an Early Warning System Index and an Early Warning Bank Failure Model. By comparison, the AFSI provides a single quantitative measure and forecast of the stability of the financial system. To develop the index, quarterly data was utilized for the period March 1997 to March 2010. A total of nineteen (19) indicators were used to construct the index, with each indicator comprising a part of one of four sub-indices (subgroups): the financial development index, financial vulnerability index, financial soundness index and world climate index. For the variables, the method of equal weighting was used among subgroups and each indicator was normalized to allow for comparability across variables. The value for each indicator ranged between 0 and 1 with 0 being the weakest and 1 being the strongest. The index was found to have been successful in identifying the main periods of stability during the entire review period, in particular, during the late 1990s. In addition to this finding, an empirical test confirmed the responsiveness of the index to some macroeconomic variables, and a forecast was conducted using the Monte Carlo simulation, which showed a "sharp deterioration" in the index in the second half of 2010.

Methodology

In order to develop a quarterly financial stability index for The Bahamas over the period 2003 to 2012, it was first important to choose relevant indicators. The variables selected were based on the studies by Cheang and Choy, Morris, Morales and Estrada and Patrovska and Mihajlovska and the indicators used in the study over the sample period, along with the

associated signs, are shown in Table 1 (Appendix A). The next step involved dividing the variables to create four separate sub-indices: the Financial Soundness Index (fsi), the Financial Development Index (fdi), the Financial Vulnerability Index (fvi) and the Economic Climate Index (eci). These sub-indices were then aggregated using various weights to compute the Financial Stability Index (FSI).

The construction of the index was based mainly on the work of Cheang and Choy, Morris, Morales & Estrada and Patrovska & Mihajlovska. As noted in the literature review, these authors first normalised the indictors by placing them on a scale in the interval from 0 to 1. The empirical normalisation formula is shown in Equation 1:

$$I_{it}^{n} = \frac{I_{it} - Min(I_i)}{Max(I_i) - Min(I_i)} \times -1 \quad (1)$$

Where: I_{it} represents the value of indicator i during period t; Min (I_i) and Max (I_i) are the minimum and maximum respectively recorded by indicator i in the analysed period; I_{it}^{n} is the indicator's normalised value. The method uses the interval between the Max and Min as the scaling factor. This resulted in each indicator being compared to its limit values and the normalisation therefore represents the deviation from the limit values.

In order to ensure consistency in the direction of the indicators, i.e. that all indicators signalled an improvement in financial stability when they increased and a deterioration when they decreased, several of the variables underwent additional transformations prior to being standardised. For example, in the case of the fiscal and current account deficits to GDP, the values were inverted and multiplied by -1, which resulted in an increase in the transformed indicator i.e. a reduction in the actual current account to GDP, signalling an improvement in financial stability and vice versa. Similarly, the reciprocal of the ratios of the Direct Charge, National Debt and Central Government External Debt to GDP were utilised in the analysis.

The individual standardised indicators were averaged to form the sub-indices, which were then aggregated, based on their relative weights in the FSI. The weighs used in constructing the index were determined by the authors' perceived importance of each sub-index in determining financial stability. Although The Bahamas has never experienced a financial sector crisis, as a small open fixed exchange rate economy, dependent on its tourism sector and specifically on visitors from the United States market, economic conditions in the global market should have a significant influence on the state of the financial sector. As a result, the economic climate (eci) sub-index was given a weight of 25% (0.25). Similarly, the performance of the country's external reserves, which are needed to defend the fixed exchange rate regime and the Government sector—which has a significant impact on the financial sector—are expected to influence financial stability and are therefore allocated the largest weighting of 0.30. In addition, the state of the credit markets, which are a sign of financial development, are significant in determining financial stability, and this sub-index is therefore prescribed a weight of 0.25. Comparatively, the conservative nature of the banking sector—which is dominated by large Canadian banks—means that there has been very little variability in these institutions financial soundness indicators over time and hence this sub-index receives the lowest weight of 0.20.

The aggregate financial stability index (FSI) is equivalent to the weighted sum of the values for the individual sub-indices, as is shown in Equation 2.

$$FSI = 0.20 \times fsi + 0.25 \times fdi + 0.30 \times fvi + 0.25 \times eci \qquad (2)$$

In addition, given the influence of trends in nonperforming loans on credit extension and financial stability, as well as the importance of capital market development as an indicator of domestic sector development, two additional financial stability indices were calculated. For FSI_1, the *fsi* was augmented to include the non-performing loan ratio (*fsi_nonp)*, using data

spanning the QIII2002[6]-QIV2013. Similarly, the stock market capitalization to GDP was then included in the *fdi* index *(fdi_cap)*, which limited the resulting FSI_2 index to a span of QI2005-QIV2013. Equations 3 and 4 show the alternative forms of the Financial Stability Index.

$$FSI\_1 = 0.20 \times fsi\_nonp + 0.25 \times fdi + 0.30 \times fvi + 0.25 \times eci \quad (3)$$

$$FSI\_2 = 0.20 \times fsi\_nonp + 0.25 \times fdi\_cap + 0.30 \times fvi + 0.25 \times eci \quad (4)$$

Results

The results for the FSI, as shown in Chart 1 (Appendix B), indicate three distinct periods in the evolution of financial stability. The first stage, from Q1 2002 to Q3 2008, showed a period of relative stability with the overall index values averaging 0.53; however, amid the onset of the global financial recession in the latter half of the 2008, the index fell sharply over the next two quarters, but recovered quickly although it experienced significant volatility over the next four years, averaging 0.53 before surpassing its trend level in the final quarters of 2013.

A review of the four sub-indices (Chart 2) showed that a significant part of the variability of the FSI index was driven by movements in the eci, as global conditions changed relatively rapidly. Indeed the sharp fall in financial stability noted between the fourth quarter of 2008 and the first quarter of 2009, was due almost exclusively to a significant reduction in the eci, which recorded the lowest levels for two of its three indictors during these periods, and given the fact that the index is calculated based on the maximum and minimum values of each series, these two indicators recorded a value of zero over this timeframe. Among the other indicators, fvi showed a steady decline over time, before improving between 2009 and 2011, although the results indicate that the level of vulnerability has increased over the last two

[6] This is the earliest data available for non-performing loans

years of the sample period. Additionally, the fdi moved steadily higher over the 2003 to 2010 period, in line with the increase in access to loans and other forms of credit by the public. However, a slight reduction in the index was noted over the remaining years, as lending to the Government by the domestic banking sector increased. Further, the level of financial soundness has been steadily improving over the entire sample period, which illustrates the conservative nature of the domestic banking system.

Predictive Power of Model

One of the main areas of interest for policy makers relates to whether a financial stability index can be used as a predictor of impending financial and economic crises. In the case of the FSI developed for The Bahamas, a plot of the annual[7] FSI index against Real GDP over the sample period shows the limitations of the model in forecasting a downturn in the economy, as the indicator's trajectory does not vary significantly prior to the 2003 and 2008-09 recessions. This visual analysis is supported by the results of a simple Ordinary Least Squares (OLS) regression model, which analyses the link between Real GDP and the FSI, as shown by the relevant R^2 and p-values. This result is not surprising, given that over the review period, economic recessions were brought on by external shocks, rather than domestic factors.

FSI Annualised = 0.10503 + 0.004003 Real GDP Annual
(0.0000)** (0.3041)

R^2 = 0.105038 adj R^2 = 0.015542
** = indicates significance at 1% level

[7] Annual values of the FSI were obtained by averaging the quarterly values for each year.

Robustness of the Results

The next series of tests analysed the sensitivity of the FSI to the inclusion of additional variables to create the FSI_2 and FSI_3 indices. The results show that the inclusion of the new variables led to only slight deviations of the FSI indicator from its original path (Chart 5).

Conclusion

The study focussed on developing a financial stability index for The Bahamas, given the importance of financial stability in supporting economic growth and development. The FSI index generated was based on a series of variables which were identified by previous researchers as important in determining financial stability, as well as a few other indicators which the authors determined were relevant to the analysis.

The results showed that there were three distinct periods in the evolution of the financial sector, a stable period, followed by a short, sharp, decline in stability and then a period of relative volatility. However, on average, the final period represented the highest level of financial stability, due to improving economic conditions and steady gains in the level of financial soundness, given the conservative nature of the domestic banking system.

With regard to policy making, the results show that the index can be used as a guide in tracking the level of financial stability over time; however, it is important to analyse trends in the index over an expended period, as it cannot be used to forecast impending economic crises.

Going forward, there will be opportunities to add other variables to the index, as comprehensive historical data on the non-bank financial sector becomes more readily

available. This should also enhance the overall accuracy of the index and its relevance to policy makers in the non-bank sector.

Appendix A

Table 1
List of Individual Indicators Used in Financial Stability Index (FSI)
(2002 – 2013)

Category	Indicator	Average	Standard Deviation	Weighting
Financial Soundness Index (fsi)	Non-performing loan ratio*	7.73	3.81	***0.20***
	Ratio of Liquid Assets to Total Assets	15.66	3.23	
	Loan-to-Deposit Ratio	0.96	0.04	
	Return on Assets (ROA)	2.67	0.81	
	Interest Margin to Gross Income Ratio	93.96	1.79	
	Interest Rate Spread	6.81	0.61	
Financial Development Index (fdi)	Ratio of Credit to the Public Sector to GDP	17.47	5.63	***0.25***
	Ratio of Private Sector Credit to GDP	72.28	9.82	
	Change in Private Sector Credit	1.08	1.54	
	Ratio of Stock Market Capitalisation to GDP**			
Financial Vulnerability Index (fvi)	Current Account Deficit to GDP	-3.03	1.86	***0.30***
	Foreign Investment to GDP	4.41	1.48	
	Fiscal Deficit to GDP	-0.89	0.62	
	Direct Charge to GDP	36.77	10.34	
	National Debt to GDP	43.27	10.82	
	Central Government External Debt to GDP	6.02	3.73	
	Ratio of External Reserves to Base Money	53.35	8.83	
	Ratio of External Reserves to M2	12.86	2.09	
Economic Climate Index (eci)	US GDP Growth	1.94	2.61	***0.25***
	US Consumer Confidence Index	77.65	22.85	
	Growth in Air Arrivals	0.22	12.15	

Source: Central Bank of The Bahamas
* Used in computing FSI_2
** Used in computing FSI_3

Appendix B

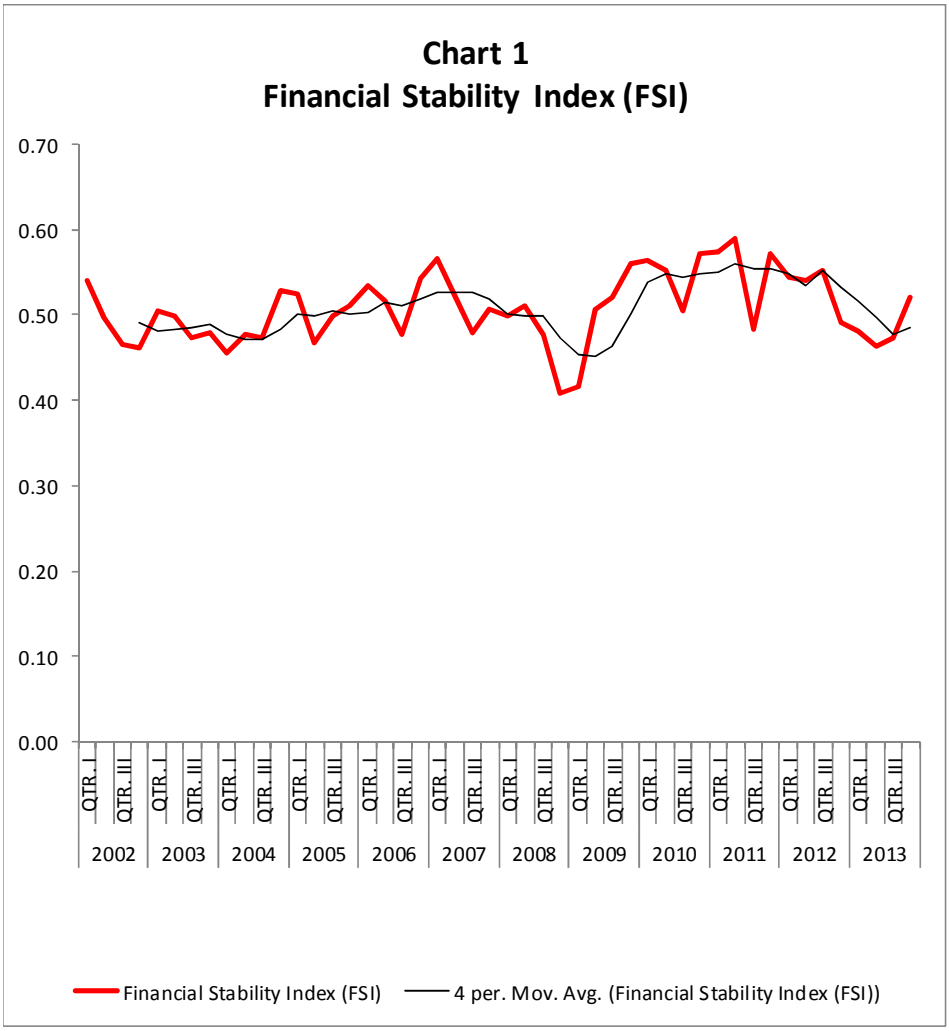
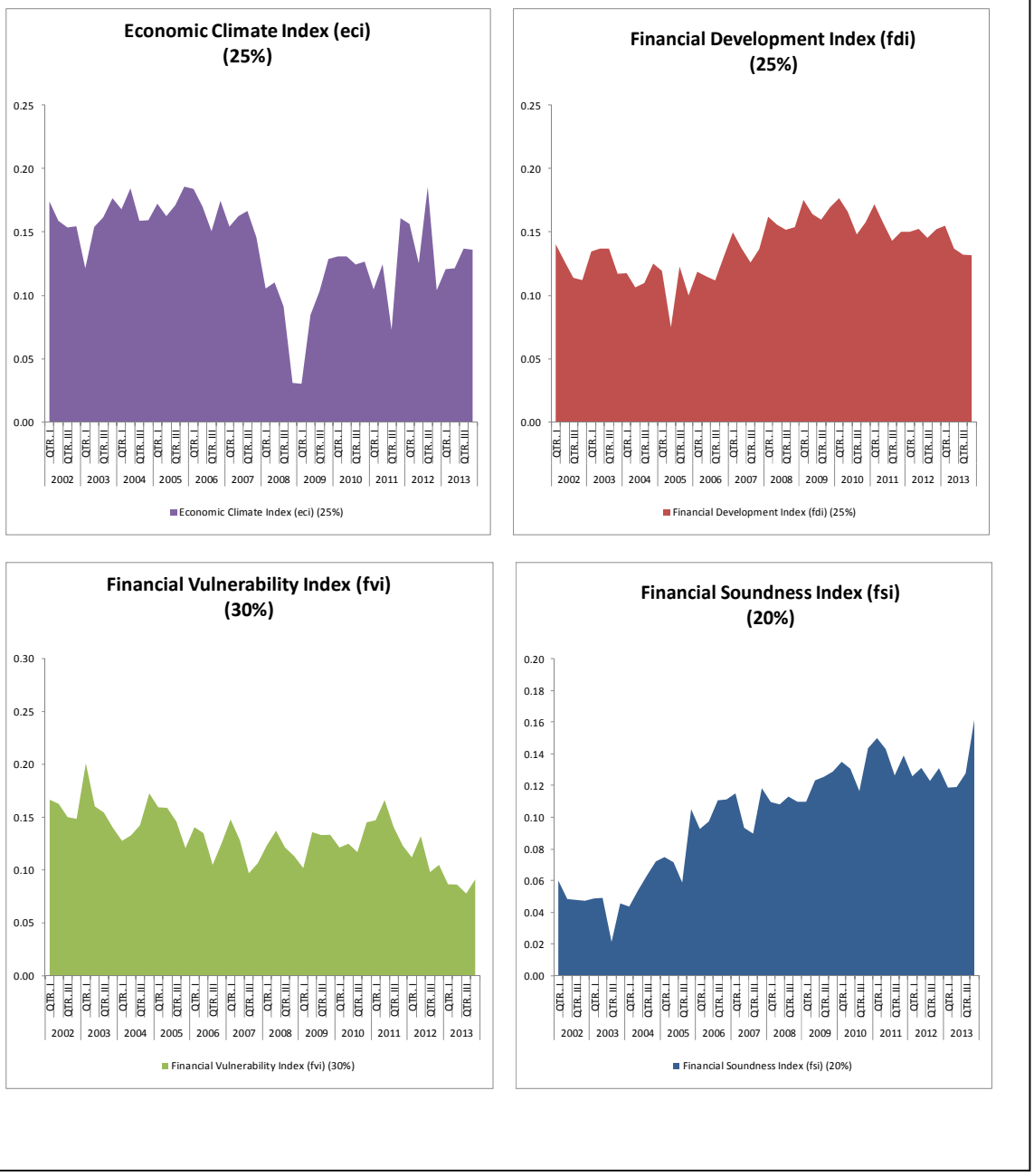


Chart 1
Financial Stability Index (FSI)
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
QTR.I
QTR.III
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Financial Stability Index (FSI)
4 per. Mov. Avg. (Financial Stability Index (FSI))

Chart 2

The FSI Sub-Indices



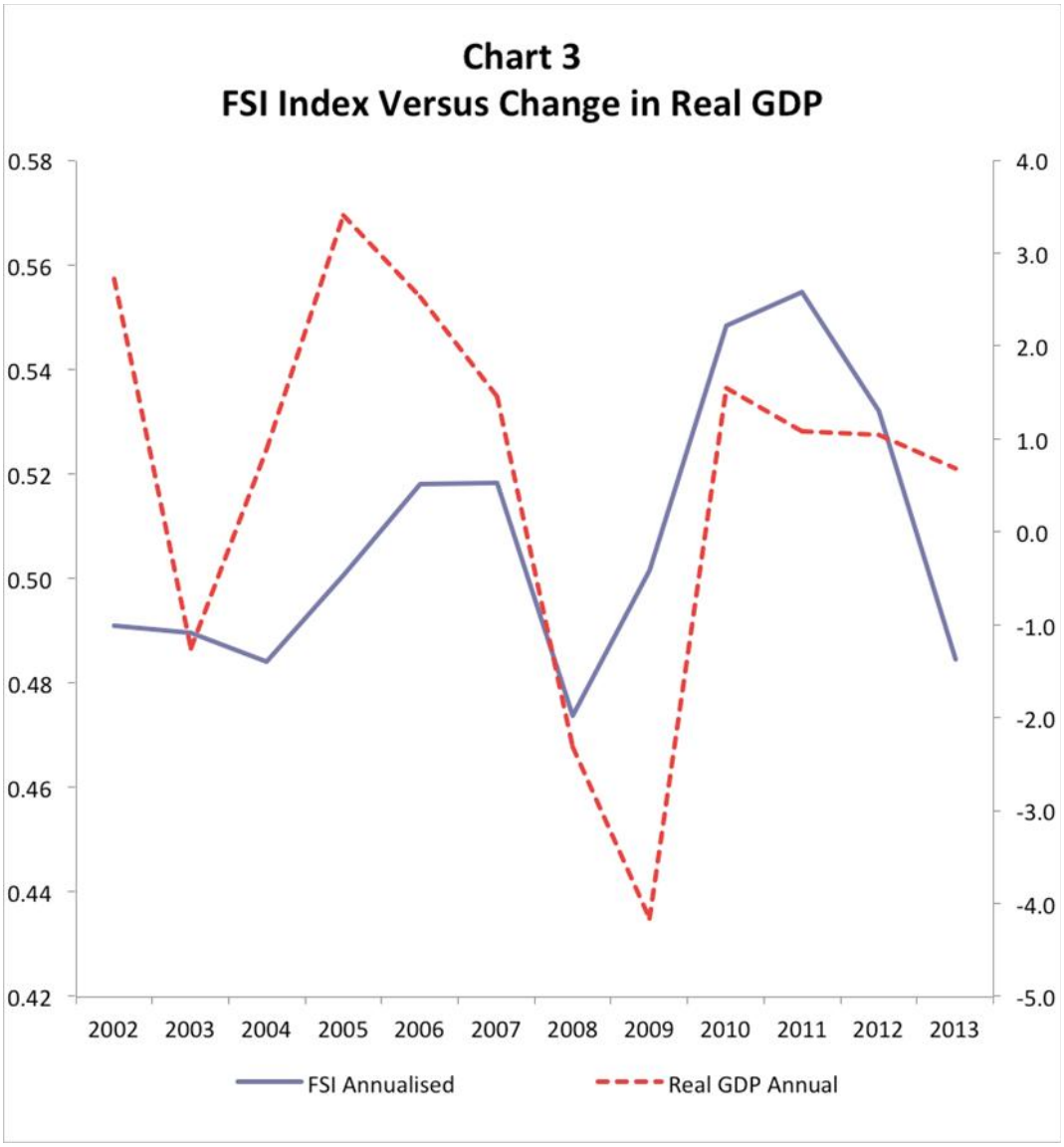


Chart 3
FSI Index Versus Change in Real GDP
0.58
0.56
0.54
0.52
0.50
0.48
0.46
0.44
0.42
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
FSI Annualised
Real GDP Annual

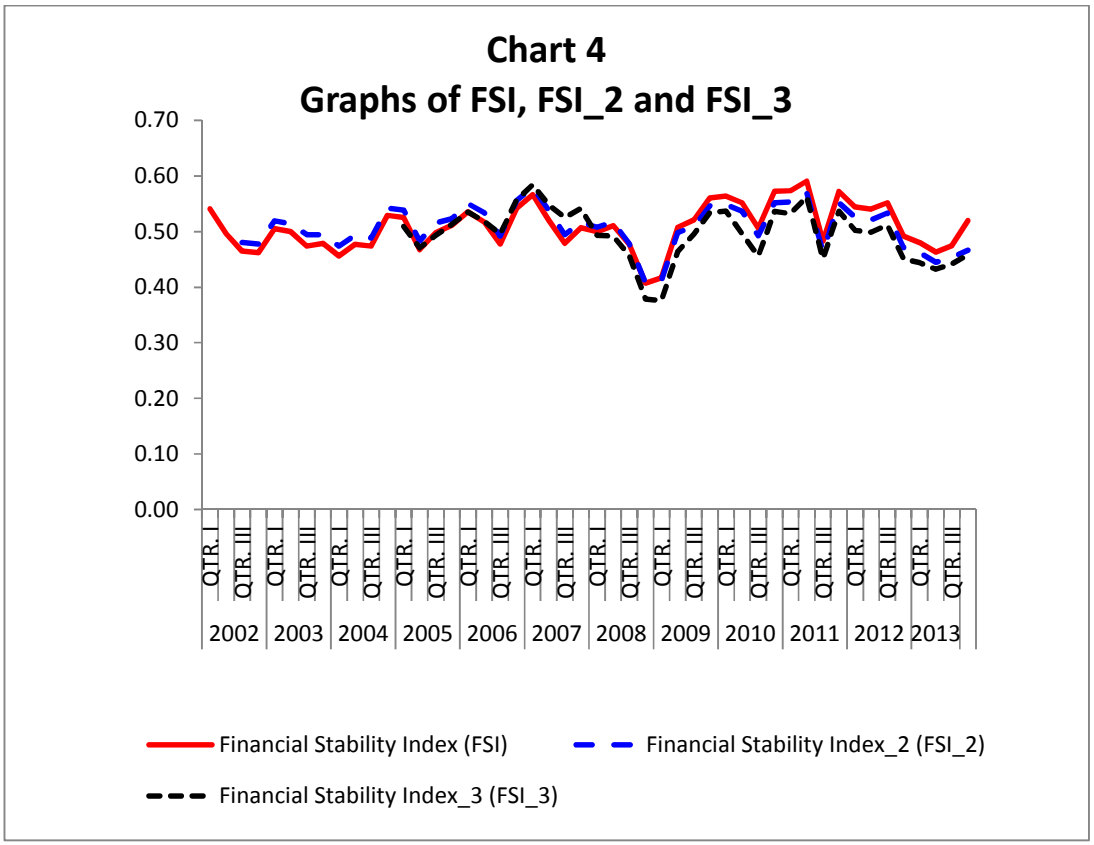


Chart 4
Graphs of FSI, FSI_2 and FSI_3
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
QTR. I
QTR. III
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Financial Stability Index (FSI)
Financial Stability Index_2 (FSI_2)
Financial Stability Index_3 (FSI_3)

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