



Munich Personal RePEc Archive

**Not the usual suspects: Critical
indicators in a dollarized country's
Financial Stress Index**

Mansour Ishrakieh, Layal and Dagher, Leila and El Hariri,
Sadika

2018

Online at <https://mpra.ub.uni-muenchen.de/116086/>
MPRA Paper No. 116086, posted 24 Jan 2023 08:02 UTC

Not the usual suspects: Critical indicators in a dollarized country's Financial Stress Index

Loyal Mansour Ishrakieh^a

Leila Dagher^b

Sadika El Hariri^c

December 2018

Abstract

In this paper we investigate the importance of the dollarization rate in heavily dollarized economies as one of the indicators in a Financial Stress Index. We use data on Lebanon, a middle-income developing country, considered to be one of the highest dollarized countries in the world to construct the first Financial Stress Index for Lebanon. Our findings indicate that the dollarization rate is the most important indicator for the FSI. This should be of relevance to many dollarized countries such as Bolivia, Peru, Uruguay, and others. Remarkably, none of the existing FSIs for dollarized countries has included the dollarization rate.

Keywords: Financial Stress Index; Financial Crisis; Dollarization Rate.

JEL: G01, G18, E58

a Research fellow at the Institute of Financial Economics, American University of Beirut.

b Director of the Institute of Financial Economics, American University of Beirut. Corresponding author.

c Research Assistant at the Institute of Financial Economics, American University of Beirut.

1. Introduction

Although the first country-level financial stress index (FSI hereafter) was built for Canada (Illing and Liu, 2003) in 2003, financial stress analyses only gained significant attention after the 2008 global recession; Oet et al. (2011) note that while no series representing financial stress in the US existed in 2008, 12 alternative series were available by 2010.

In a seminal paper by the IMF, Cardarelli et al. (2009) constructed an FSI for 17 developed countries concurrently. This was soon followed by Balakrishnan et al.'s (2009, 2011) influential work, who proposed a framework for developing FSIs for multiple emerging countries. Their index, known as the Emerging Markets FSI, adjusts the FSI proposed by the IMF (Cardarelli et al., 2009) for developed economies to account for the specificities of emerging economies.

Several developed countries and a few emerging countries have also constructed their own customized FSIs that include indicators distinctive to the country's economy. For a detailed literature review please see Mansour et al. (2018) and Kliesen et al. (2012). In spite of the increased interest in investigating financial shocks through FSIs globally, there is still an ongoing gap in the literature for developing and emerging countries, especially for highly dollarized economies and countries with fixed exchange rates, which this study aims to fill. Gulde et al. (2004) note that there is evidence suggesting that financial dollarization can potentially increase the vulnerability of financial systems. Hence, a detailed investigation of the construction of FSIs in such countries is warranted.

In this paper we demonstrate the importance of the dollarization rate as an indicator in the FSI, using data on Lebanon, one of the highest dollarized countries in the world. Lebanon employs a hard peg to the U.S. dollar since 1997. We construct a broad index that includes three different

market segments represented by a total of ten indicators. Our findings reveal that the three most important vulnerability indicators are: the dollarization rate followed by the EMPI and then the TED spread. While the last two indicators are included in almost every FSI, to the best of our knowledge, no study has accounted for the dollarization rate. This constitutes a major gap in the literature and weakens the usefulness of the FSI as a tool to help monitor, identify, and address any potential crisis.

These findings are relevant to heavily dollarized countries such as Bolivia, Cambodia, Peru, Uruguay, and others. Some of them have constructed FSIs but have omitted the dollarization rate. It is extremely important to revise these FSIs and include all important indicators to obtain an FSI that provides valuable, accurate, and timely information to macroprudential regulators whose aim is to maintain a smooth and resilient financial system. Further applications of FSIs such as identifying leading indicators of financial stress so that policymakers can focus on attempting to avoid increases in financial stress, can only be based on a flawless FSI.

2. Data and Description of Indicators

In our work, we extend the methodology of Balakrishnan et al. (2009, 2011), to better represent a developing heavily dollarized country such as Lebanon. Thus, the first Lebanese stress index the Institute of Financial Economics Financial Stress Index (IFEFSI), is tailored in such a way as to capture the particularities of the Lebanese financial sector. It is composed of three main sectors: (i) the banking sector, (ii) the equity market, and (iii) the foreign exchange and debt markets. Foreign exchange and debt markets are considered together in one sector because of their tight correlation in Lebanon.

Although data are available starting in 1990 (end of the civil war), we have chosen to consider the period January 1998 to January 2018. That way we would avoid the turbulent reconstruction period, and the problem of accounting for different exchange rate regimes.¹

The BLOM index (BMI) and six² listed banks' returns are provided on a daily basis by DataStream and the Beirut Stock Exchange. We convert them to a monthly frequency (last day of the month). U.S. data needed to construct the EMPI, foreign reserves, Fed Fund and broad money are sourced from the St. Louis Fed Fred economic data database. All remaining variables are taken from the Banque Du Liban (BDL) website and are available on a monthly basis.

All variables are included in a growth rate format or percentage change format, except for the interest rates. Given that indicators usually have different measurement units, normalization is required prior to aggregation (OECD, 2008). Each series is thus standardized by subtracting the mean and dividing by its standard deviation. For additional information on each indicator, please refer to our working paper Mansour et al. (2018). Descriptive statistics for each indicator and the resulting index can be found in Table 1.

¹ At the end of 1992, the Lebanese central bank adopted a *stabilization policy* based on the exchange rate regime where the US dollar was defined to be fixed and equal to 1,500-1,515 Lebanese Pound ($\pm 0.5\%$ change). This policy was officially implemented in 1997 and it took about one year for the Lebanese pound to be totally stabilized.

² AUDI, Bank of Beirut, BEMO, BLC, BLOM, and Byblos.

Table 1
Descriptive statistics for the indicators and the index.

Sample: 1998M01 2018M01

	INVY	LTED	BETA	LOAN	WACC	STKVOL	STKR	EMPI	EDTD	DOLL	IFEFSI VEW
Mean	-0.00	-0.00	0.00	-0.00	0.00	-0.00	-0.00	0.00	-0.00	-0.00	-0.00
Median	-0.08	0.00	0.01	-0.17	-0.04	-0.30	0.08	0.06	-0.25	-0.09	0.05
Maximum	1.11	10.89	1.97	10.69	3.63	8.07	3.21	3.87	10.35	7.79	13.83
Minimum	-2.31	-1.51	-5.14	-2.63	-9.40	-0.52	-7.19	-3.87	-1.20	-2.45	-9.83
Std. Dev.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.44
Skewness	-0.21	6.29	-2.03	5.92	-2.85	5.16	-1.97	0.06	5.74	2.87	0.66
Kurtosis	1.79	63.54	9.45	58.88	36.86	35.81	15.81	5.60	51.95	20.09	5.69
Observations	241	241	241	241	241	241	241	241	241	241	241

Notes: The indicators have been normalized so their mean is zero and their standard deviation is one.

2.1 Banking Sector

-Inverted Yield (INVY)

INVY is conventionally taken as the difference between 1 year or 2-year T-bills and the 10-year T-bonds. Since in Lebanon the long term T-bonds (more than 2 years) are uncommon, 3 months T-bills and 24 months T-bills are taken to represent respectively, the short term and the long term T-bills.

-Lebanese TED (LTED)

The traditional TED (Treasury-Euro Dollar) spread is measured as the difference between US Eurodollar deposits (three-month USD LIBOR) and US Treasury bills. We have extended this measure to tailor it to the Lebanese case; it measures the spread between the interbank rate (the interest rate that banks lend to other banks in the local currency) and the interest rate at which the government is able to borrow money for 3 months (also in LBP).

-Beta of Banking Sector (BETA)

For the IFEFSI, the beta of the banking sector is measured as the correlation (12 months rolling window) between the total returns of the banking-sector stocks and the BLOM market index (BMI) divided by the BMI's variance.

-Loans from Central Banks to Commercial Banks (LOAN)

Regardless of the source of funds (required reserves at the central bank or government and BDL securities as collateral for repo operations), BDL loans act to reinforce individual banks' liquidity positions in Lebanese pounds.

-Weighted Average Cost of Capital (WACC)

The cost of debt is obtained from the weighted interest rate on long term deposits (term and sight savings) in both local and foreign currencies for residents and non-residents, after deducting corporate taxes. Cost of equity is calculated using the CAPM model:

cost of equity = risk free rate + beta of banking sector * market risk premium

The risk free rate is assumed to be the yield on the three months Treasury Bills. The market premium is the difference between the returns of the BMI and the risk free rate.

2.2 Equity Market

The Beirut Stock Exchange, although being historically the second oldest market in the Middle East and North African region (established in 1920),³ is relatively small in terms of traded volume, number of listed companies, and liquidity.

-Stock Market Volatility (STKVOL)

In constructing the IFEFSI, we include the time-varying stock return volatility derived from a GARCH (1,1) specification.

-Stock Market Return (STKR)

The IFEFSI includes the stock market return growth rate multiplied by -1, such that a decline of stock price returns increases the stress index and vice versa.

³ The first one being the Egyptian stock market that was established in 1883.

2.3 The Foreign Exchange and Debt Markets

Since the early 90s, the dollarization rate in Lebanon has always been around 70%, one of the highest dollarization rates in the world after Angola, Armenia, Azerbaijan, Bolivia and Cambodia. It reflects preferences of economic agents to hold cash and/or to make deposits in foreign currencies rather than in the local currency because of a lack of trust and weak confidence (Catão and Terrones, 2016). Moreover, Lebanon is highly indebted and its debt in foreign currencies, also called partial dollarization, is relatively high; around fifty percent of its total debt. Dollarizing debt in a country that lacks confidence in its local currency improves trust since it disables the monetary authorities' ability to create money and devalue its local currency (Calvo and Mishkin, 2003).

However, dollarization makes the economy fragile and prone to severe financial crises if any devaluation occurs (Eichengreen and Hausmann, 1999; Eichengreen et al., 2007), unless the country adopts a fixed exchange rate regime to mitigate or to avoid probable currency crises (Devereux et al., 2003; Obstfeld, 2006). Indeed, in 1997, the BDL adopted a de facto fixed exchange rate regime to better match the economy's structural changes.

-Exchange Market Pressure Index (EMPI)

In order to measure the currency risk, we construct an Exchange Market Pressure Index (EMPI) following Eichengreen et al. (1995; 1996) and Pontines and Siregar (2008). The EMPI includes the accumulation of International Reserves (IR) that is crucial in maintaining fixed an exchange rate regime.

-Debt in foreign currencies over total debt (EDTD)

The External Debt to Total Debt ratio (EDTD) and more precisely the Short Term External Debt to Total Debt ratio (STEDTD) is considered in the literature to be one of the most informative vulnerability indicators in predicting future currency crises. Since STED data are unavailable on a monthly basis, IFEFSI includes the EDTD.

-Dollarization Rate (DOLL)

Several studies have found that money demand in foreign currencies in dollarized countries is highly correlated with sudden stop and systemic crises (Calvo et al., 2008; Durdu et al., 2009; Gonçalves, 2007) providing confirmation that the dollarization rate is a good financial vulnerability indicator.

The IFEFSI includes financial dollarization measured as the deposits in foreign currencies to the total deposit of residents and nonresidents. Since the US dollar has traditionally been more stable than the Lebanese pound in terms of currency value and purchasing power level, a higher value of the ratio reveals a higher stress period.

3. Methodology

Similarly to the IMF studies (Balakrishnan et al., 2009, 2011; Cardarelli et al., 2011), we adopt the Variance Equal Weight (VEW), which is the most frequently used weighting method in the literature. The IFEFSI shown in Figure 1 is a composite index that includes the simple sum of ten standardized indicators, each having an equal weight of one. Consequently, the resulting index has a mean of 0, a standard deviation of 3.44, and its values lie in the range between -9.83 and +13.83. As mentioned before, higher positive values of the stress index indicate stress periods, while negative values indicate calm periods.

The Principal Component Analysis (PCA) works better than the VEW in cases where indicators are highly correlated. Our indicators are all weakly correlated, so we only employ the PCA as a robustness check. We find that both series have very similar trends, and their correlation is high at 83.45 %.

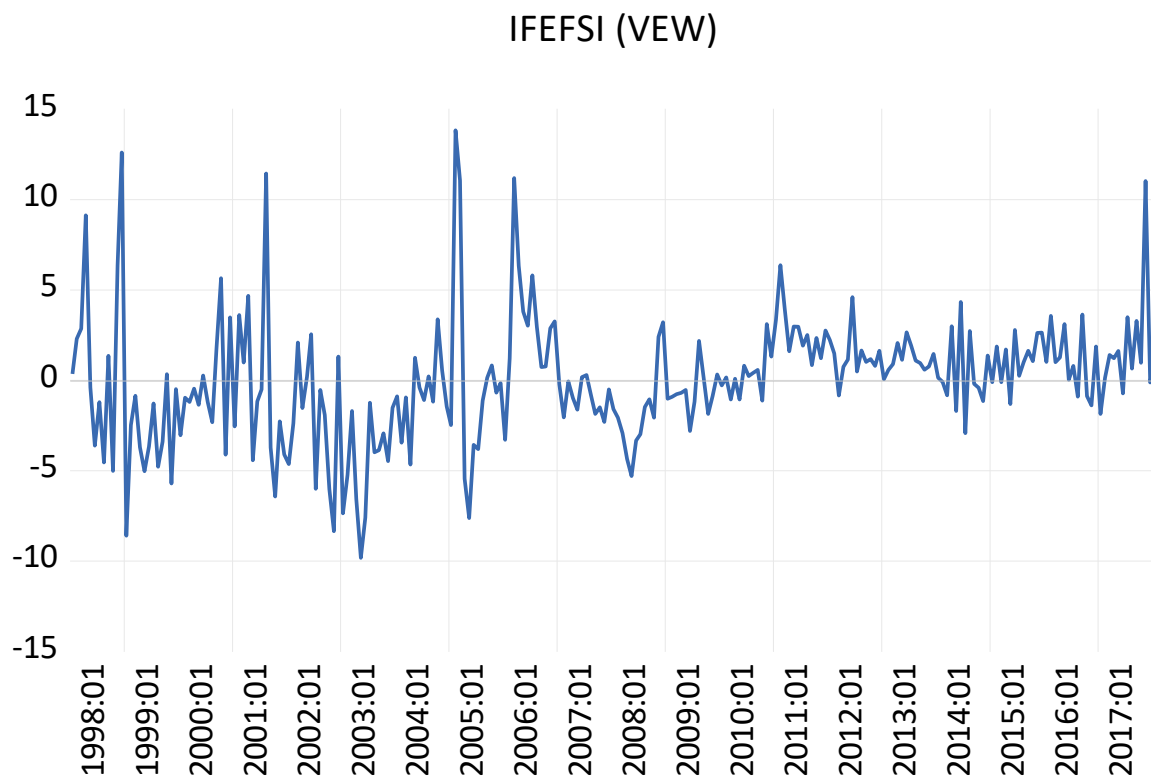


Fig. 1. IFEFSI (variance equal weighting method).

Notes: The IFEFSI is presented for the period January 1998 to January 2017. Higher positive values indicate more financial stress.

Source: Authors' calculation

4. IFEFSI Interpretation and the Role of Dollarization

Examining figure 1, we find 11 instances where the IFEFSI spikes above 1.5*standard deviation:

- April 1998: Lebanon rejects Israeli pullback plan (political)
- November/December 1998: prime minister declines to form a cabinet (political)
- August 2001: Moody's downgrade (economic)
- February/March 2005: the assassination of the prime minister (political)
- March/April 2006: Arabs disinvest in the Lebanese stock market (political)
- July 2006: Lebanon at war with Israel (political)

-February 2011: Lebanese government resigns (political)

-November 2017: an ambiguous incident during the prime minister's visit to Saudi Arabia (political)

Unlike most other FSIs in the literature, the IFEFSI does not detect international financial crises such as the dotcom crash (2000-2001) or the subprime crisis (2008-2009). This is not surprising given Lebanon's relatively isolated stock market, the fixed exchange rate regime, and the lack of speculation and absence of any sophisticated financial instruments. We find that the Lebanese financial markets are more vulnerable to domestic and perhaps regional instabilities, than to international ones. Moreover, political (or geopolitical) events seem to affect financial markets more than economic developments.

Deconstructing the index can help clarify its relationship with its components. We first investigate the correlations (see Table 2) of the different indicators with the IFEFSI and find that the dollarization rate has the highest correlation of 0.59. We then examine the behavior of the DOLL variable during the peaks as shown in Figure 2. DOLL is able to detect the vast majority of peaks with the exception of the one in early 2006 that was triggered by GCC investors selling their positions in listed Lebanese companies.

Table 2
Correlations between the indicators and the index.

	IFEFSIVEW
IFEFSIVEW	1.00
BETA	0.42
DOLL	0.59
EDTD	0.27
EMPI	0.56
INVY	0.24
LOAN	0.38
LTED	0.55
STKR	0.19
STKVOL	0.15
WACC	0.09

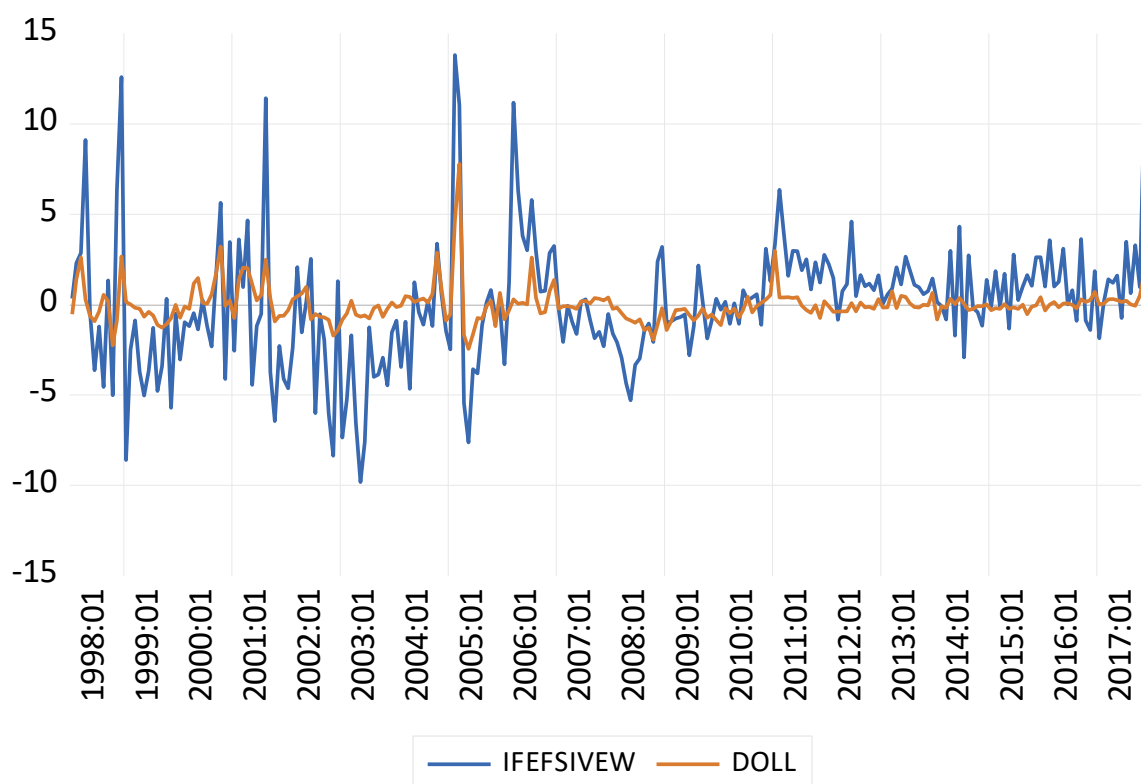


Fig. 2. The IFEFSI and the dollarization rate.

Notes: The IFEFSI is shown along with the dollarization rate (DOLL) for the period January 1998 to January 2017.

Source: Authors' calculations

5. Conclusions

All studies without exception stress the importance of selecting appropriate indicators to the particular country or region when constructing a Financial Stress Index. Park and Mercado (2014) note that: “Understanding the determinants of domestic FSI is important for policymakers to ensure financial stability.” It is hence of utmost importance that a country’s particularities be reflected in the index. In fact, indicators used for developed countries have differed from the indicators used for emerging countries. It is therefore expected that partially dollarized economies with high dollarization rates will have idiosyncratic vulnerability indicators for financial systems.

Following Gulde et al. (2004) who note that there is evidence suggesting that financial dollarization can potentially increase the vulnerability of financial systems, we include the dollarization rate in the construction of Lebanon's FSI. We develop Lebanon's first Financial Stress Index, broadly following the IMF methodology, while making sure to tailor the index to Lebanon. The IFEFSI starts in January 1998, has a monthly frequency, and is customized to include the relevant market segments and indicators.

The final IFEFSI is composed of three major market segments; the banking sector, the equities market, and the foreign exchange and debt markets, each including a selection of representative vulnerability indicators. We find that the Lebanese financial markets are more vulnerable to domestic and perhaps regional instabilities, than to international ones. Moreover, political (or geopolitical) events seem to affect financial markets more than economic developments.

An investigation of the components of the IFEFSI reveals that the dollarization rate is the single most important indicator with a correlation of 0.59 with the final index. We argue that other similar countries including Bolivia, Cambodia, Peru, and Uruguay, among others should include the dollarization rate as an indicator in order to obtain a sound and accurate FSI.

Acknowledgements

Insightful comments by participants at the ESCWA seminar (UN house, Beirut) and the World Bank seminar (World Bank, Washington DC) are greatly appreciated.

References

- Balakrishnan, R., Danninger, S., Elekdag, S., & Tytell, I. (2011). The transmission of financial stress from advanced to emerging economies. *Emerging Markets Finance and Trade*, 47(sup2), 40-68.
- Balakrishnan, R., Danninger, S., Elekdag, S., Tytell, I. (2009) The Transmission of Financial Stress from Advanced to Emerging Economies. International Monetary Fund Working Paper 133.
- Calvo, G. A., Izquierdo, A., & Mejía, L. F. (2008). Systemic sudden stops: the relevance of balance-sheet effects and financial integration (No. w14026). National Bureau of Economic Research.
- Calvo, G. A., & Reinhart, C. M. (2002). Fear of floating. *The Quarterly Journal of Economics*, 117(2), 379-408.
- Cardarelli, M. R., Elekdag, S., & Lall, M. S., (2009). Financial stress, downturns, and recoveries (No. 9-100). International Monetary Fund.
- Cardarelli, R., Elekdag, S., & Lall, S. (2011). Financial stress and economic contractions. *Journal of Financial Stability*, 7(2), 78-97.
- Catão, M. L., & Terrones, M. M. (2016). Financial de-dollarization: A global perspective and the Peruvian experience. International Monetary Fund.
- Durdu, C. B., Mendoza, E. G., & Terrones, M. E. (2009). Precautionary demand for foreign assets in Sudden Stop economies: An assessment of the New Mercantilism. *Journal of development Economics*, 89(2), 194-209.
- Eichengreen, B., & Hausmann, R. (1999). Exchange rates and financial fragility (No. w7418). National Bureau of Economic Research.
- Eichengreen, B., Hausmann, R., & Panizza, U. (2007). Currency mismatches, debt intolerance, and the original sin: Why they are not the same and why it matters. In *Capital controls and capital flows in emerging economies: Policies, practices and consequences*. University of Chicago Press. 121-170.
- Eichengreen, B., Rose, A. K., & Wyplosz, C. (1995). Exchange market mayhem: the antecedents and aftermath of speculative attacks. *Economic policy*, 10(21), 249-312.
- Eichengreen, B., Rose, A. K., & Wyplosz, C. (1996). Contagious currency crises (No. w5681). National Bureau of Economic Research.
- Gonçalves, F. M. (2007). The Optimal Level of Reserves in Financially Dollarized Economies: The Case of Uruguay. IMF Working Paper 07/625, Washington DC: International Monetary Fund.

- Gulde, A. M., Hoelscher, D., Ize, A., Marston, D., & De Nicoló, G. (2004). Financial stability in dollarized economies (Vol. 230). Washington, DC: International Monetary Fund
- Illing, M., & Liu, Y. (2003). An index of financial stress for Canada. Ottawa: Bank of Canada.
- Kliesen, K. L., Owyang, M. T., & Vermann, E. K. (2012). Disentangling diverse measures: A survey of financial stress indexes. *Federal Reserve Bank of St. Louis Review*, 94(5), 369-397.
- Mansour Ishrakieh, L., El Hariri, S., & Dagher, L. (2018). The Institute of Financial Economics Financial Stress Index (IFEFSI) for Lebanon. IFE Working Paper Series, 2018 (2).
- Mishkin, F. S., & Savastano, M. A. (2001). Monetary policy strategies for Latin America. The World Bank.
- OECD. (2008). Handbook on constructing composite indicators: Methodology and user guide. <http://www.oecd.org/sdd/42495745.pdf>
- Oet, M. V., Eiben, R., Bianco, T., Gramlich, D., & Ong, S. J. (2011). Financial stress index: Identification of systemic risk conditions. Federal Reserve Bank of Cleveland, 11-30.
- Park, C-Y., Mercado, R.V. (2014). Determinans of financial stress in emerging market economies. *Journal of Banking & Finance*, 45, 199-224.
- Pontines, V., & Siregar, R. (2008). Fundamental pitfalls of exchange market pressure-based approaches to identification of currency crises. *International Review of Economics & Finance*, 17(3), 345-365.