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Financial Structure and Stability: An Empirical Exploration

Abstract: This paper attempts to investigate empirically whether financial and macroeconomic stability of economies are significantly affected by the structure of their financial systems, viz., bank-based and market-based structures. Using panel data estimations based on data from 82 countries for the period of 1996-2012, we find that in general, bank-based financial system contributes significantly to instability of the financial sectors and currency market. We also find some evidence that within the bank-based structure, higher presence of foreign banks is positively associated with currency market pressure. Additionally, the results show that the choice of bank-based versus market-based financial structure is important for low income countries. Banks in low income countries contribute to exchange market pressures whereas stock markets leads to reduction in such pressure. In high income countries, stock markets do not significantly affect banking and currency market instability.

Keywords: Financial structure, bank-based financial system, market-based financial system, stability

JEL Classification: G0, G21, G10

1. Introduction

Financial systems perform the important function of resource allocation for productive purposes and thus facilitate enhanced economic activities. Allocation of productive resources can happen through the efficient functioning of a stock market or through the efficient intermediation of the banking sector, or both. Stock markets provide a market mechanism for obtaining funds for productive activities

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of firms and an avenue for investors to invest their excess savings. Banks, on the other hand, act as an intermediary between savers and borrowers, by accepting deposits from savers and by lending these deposits to borrowers for their productive purposes. While both stock markets and banks may exist in parallel, many financial systems are found to have a dominant presence of one of the two. For example, Thakor (1996), Allen and Gale (2000) and Vitols (2001) observed that banks play a more predominant role in the financial systems in Germany and Japan while stock markets play a bigger role in the financial system of the United Kingdom (UK) and the United States of America (USA). Analysing data for many European countries, Langfield and Pagano (2016) commented that European countries' financial systems are strongly bank-based. Thus, depending on whether stock markets or banks play a more dominant role in allocation of financial resources, the structure of a financial system has been broadly classified as market-based and bank-based. Market-based financial system is the one where stock markets play a more prominent role in facilitating finances to the corporate sector compared to banks, while bank-based financial systems are the ones where banks are the major source of funds. Within a bank based system, we can further classify it into domestically dominated or foreign sector dominated. According to Lee (2012), banking sector and the stock markets are complementary in general, although they may be substitutes in some countries. Further, scholars have attributed the evolution of an economy's financial system into different structures to historical reasons (Allen and Gale, 2000; Vitols, 2001). The relative importance of bank-based and market-based financial systems on macro-economic outcomes has been studied by many scholars. Beck and Levine (2002) argue that neither market-based nor bank-based system matter for industrial growth. What matters, according to Beck and Levine (2002), is the legal system efficiency of the economy. Lee (2012) studied the relative merits of bank-based and market-based financial structures from the point of view of long term economic growth and observed differential role played by stock markets and banks in the economic growth of different countries. Further, according to Lee (2012), banking sector may play more important role than stock markets in the early years of growth in an economy.

In the aftermath of the global financial crisis of 2008, a recent literature has been growing on the issue of whether structure of the financial system has an implication for financial and macroeconomic stability. The theoretical debate on which structure – bank-based or market-based – lends an economy to be more vulnerable to financial and macroeconomic instability is difficult to resolve. The limited empirical literature has found evidence that in times of financial crisis, bank-based financial structure may exacerbate instability more than market-based structures (Langfield and Pagano, 2016; Bats and Houben, 2017). In terms of recovery, it has been found that market based economies recover faster than bank-based ones from economic crisis (Allard and Blavy, 2011).

In this paper, we attempt to augment the sparse literature on financial structure and stability by carrying out an empirical exercise on data comprising of a set of 82

countries covering the period of 1996 – 2012. The core research question addressed here is whether different financial structures contribute differently towards instability. Our study is closely related to Kim et al (2016) but differs from theirs and earlier analysis in two accounts. First, while earlier attempts were limited to developed OECD economies, our sample include both developed and developing economies. Second, while the earlier attempts specifically considered crisis events to investigate differential impact of bank-based and market-based structures, we use conventional measures of instability that cover both crisis events and non-crisis events. In spite of the differences in approach, our results are similar to the earlier results in the literature – bank-based financial structures are positively and significantly associated with financial sector or macroeconomic instability, after controlling for other factors. We find some evidence that this association is driven by dominance of foreign banks within bank-based financial structures. Thus, the primary contribution of our paper is to extend the literature to include developing as well as developed economy. In addition, it provides nuanced and fresh evidence on how financial structure may impact stability of developing and developed economies in differential manner. As earlier studies did not include low income economies in their analysis, earlier results were more specific to the high income countries whereas our results are more broad based, covering both low income and high income countries.

The rest of this paper is organised as follows. Section 2 discusses the literature on how the two types of financial structure may impact financial and macroeconomic instability as well as the literature on empirical characterization of financial structures into bank-based and market-based. Section 3 presents the empirical strategy adopted to investigate our core research question, followed by results and analysis in Section 4. Section 5 concludes the paper.

2. Review of literature

We organise the review of literature into two subsections. In Section 2.1, the literature linking instability and financial structure is reviewed, followed by empirical characterization of financial structure in section 2.2.

2.1. Financial Structure and systemic instability

The recent debate on whether the type of financial structure has a differential impact on financial sector stability is yet to be resolved. According to Langfield and Pagano (2016), the answer to this depends on the extent to which banks and markets enable efficient risk sharing that contributes in improved resilience of an economy to financial and macroeconomic shocks. The relative merits and demerits of the two types of financial structures have been discussed at length (see, for example, reviews of this literature in Levine, 2002; Schmidt and Hryckienics, 2006; Allard and Blavy,

2011 and Langfield and Pagan, 2016, among others). According to this literature, bank based financial structure derives its merit from effectively solving the problem of asymmetric information and moral hazard by careful screening of the borrowers and continuous monitoring of the projects funded by the banks. According to this view, the long-term relationship with the borrowers incentivises banks not to divulge borrowers' private information in public, thus leading to mitigation of panic driven instability. On the other hand, according to this literature, institutional relationship with clients is not important in stock markets. The shareholders may have myopic view of investments as they are interested in capital gains (Bhide, 1993, as cited in Levine, 2002). In the event of herd behaviour of stock market participants, there may be a massive withdrawal of funds due to speculative trading, leading to extreme volatility and possibility of an ensuing crash of the stock market. Thus, going by this literature, bank-based financial structures offer more stability than market based structure due to informational superiority of relationship banking.

However, as pointed out by Langfield and Pagano (2016), the stabilizing effect of relationship banking can be offset if bank lending is accompanied with firms' equity share as collateral towards loan. When stock markets rise, increase in the value of collateral and firms' equity allows banks to supply more credit. If banks also indulge in stock market investment as a strategy for earning revenue, then rising stock prices would add more value to banks' asset thus increasing funds and supply of credit. On the other hand, when stock prices fall, the opposite happens, leading to a reduction in credit supply. The reduction in credit supply when markets are falling may also be necessitated by regulatory compulsion for meeting minimum capital-to-risk weighted-asset ratio (CRAR) by banks (Adrian et al, 2013). Thus, banks tend to over supply credit during stock market boom and ration credit during bust. Another link between bank-based structure and financial instability, as pointed out by Bats and Houben (2017), stems from banks' asset-liability mismatches that makes banks vulnerable to liquidity and interest rate shocks, which, in extreme case may result in bank runs and systemic instability. Banks are also interconnected through inter-bank markets and hence prone to contagion of individual bank failure (Craig and von Peter, 2014). Contrary to this, stock markets have less systemic interconnectedness and involve more direct financing from savers to investors; this makes market-based structure less vulnerable to systemic financial instability (Bats and Houben, 2017).

The empirical literature on linking financial structure and stability is sparse and mainly confined to high income economies. Allard and Blavy (2011) study whether structure of the financial system matters for recovery from economic crisis of economies by studying a sample of 87 crises spread across 17 advanced economies during 1960 – 2007. The results of Allard and Blavy (2011) show that market based economies recover faster than bank-based economies from a crisis. Langfield and Pagano (2016) established that in the bank-based European economies, systemic risk at the level of banks increased during housing market and stock market crisis. In particular, they document that "an increase in the size of the banking system relative to equity

and private bond markets is associated with more systemic risk and lower economic growth, particularly during housing market crises" (Langfied and Pagano, 2016). In another paper, Bats and Houben (2017) carried out a cross country empirical analysis using data from 22 OECD countries over the period 2000 – 2015 to investigate the extent to which bank based and market based structures contribute to systemic risk. They found that for these countries, bank-based structure generates more systemic risk than market-based structure. Thus, the limited empirical evidence seem to indicate that bank-based economies tend to be more vulnerable to instability.[1]

2.2. Empirical characterization of financial structure

While the classification of financial systems into market-based and bank-based are conceptually quite clear, there has not been any well-accepted quantitative or empirical threshold to classify economies as belonging to these broad categories. Researchers have developed various quantitative indicators to measure the relative strength of markets and banking sector. There are various indicators for identification of financial structure of a country. The most widely used measure is the ratio of banking assets to equity market capitalisation. If the share of banking asset relative to GDP is greater than that of the capital market then the economy can be labelled as bank based economy. Another measure is portfolio allocation done by household sector between cash and cash equivalents, bank deposits, domestic bonds, domestic equity, foreign bonds, foreign equity and loan & mortgages (Allen and Gale, 2000). This indicator is a measure of the total financial assets held by household sector which will help in classifying countries into different financial systems as per the preference of the household sector.

Further, researchers have developed various quantitative indicators to measure the relative strength of markets and banking sector. Demirguc-Kunt and Levine (1999) and Levine (2002) used indicators based on size, activity and efficiency of banks and markets to classify financial structures. Many studies widely use these measures for empirical analysis. The size measure of markets i.e. stock market capitalisation is used by Ergungor (2004), Bats and Houben (2017) and Lee (2012) to cite a few. Demirguc-Kunt et. al (2011) uses stock market value of traded shares while Beck and Levine (2004), Demirguc-Kunt and Maksimovic (2000), Gambacorta et. al. (2014) uses turnover ratio as stock market indicator in their paper. Bank credit to private sector for banking sector is widely used for banking sector (Ergungor, 2004; Bats and Houben, 2017; Beck and Levine, 2004; Demirguc-Kunt and Maksimovic, 2000; Gambacorta et. al., 2014) while banking assets to GDP is used by Demirguc-Kunt and Maksimovic (2000).

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[1] See also Dienillah et al (2018), Karim et al (2016), Mulyaningsih et al (2016), Sunarmo (2018), Wang et al (2019),

3. Empirical Methodology

3.1. Empirical Model

To investigate whether the structure of a financial system significantly affects financial and macroeconomic stability, we estimate a set of panel data regression model. Our regression model has the following specification:

$$Y_{it} = constant + \alpha\, Bank_{it} + \beta Market_{it} + \gamma X_{it} + \tau_i + \varphi_t + \epsilon_{it} \tag{1}$$

where, the dependent variable Y_{it} is a measure of financial sector or macroeconomic stability/instability for country i at year t. The main explanatory variables are $Bank_{it}$ and $Market_{it}$, indicating the sizes of banking sector and stock markets respectively, in country i at year t. A vector of country specific control variables are included in X_{it}. Furthermore, the model controls for time-invariant country specific characteristics by τ_i which varies across countries. Additionally, the model captures country-invariant effects which change over time by including time effects given by φ_t. Lastly, ϵ_{it} is the random error term that follows a Gaussian distribution. Whether the unobserved time-invariant country specific constant τ_i is considered as a fixed constant or a random component give rise to either the Fixed-Effect (FE) model or the Random-Effect model (RE). The choice between FE or RE model is determined by the conventional Hausman test.

We estimate several specifications of regression model (1), by using various measures of instability as well as various measures of the explanatory variables for bank-based structure and market-based structure, based on size and activity indicators. For the dependent variable, we use three alternative measures, viz., Z-score (a measure of banking sector stability), stock market volatility (a measure of stock market instability) and exchange market pressure index (EMPI, a measure of currency market pressure). In the following subsection, we will discuss these measures in detail.

As for the main explanatory variables, we use indicators of banking sector size, activity and stock market size to indicate strength of the various structures of the financial system. Banking assets to GDP and stock market capitalisation are size indicators of banking sector and stock markets respectively. In an alternative specification, we use banking sector activity indicator, given by banking deposits plus credit and stock market capitalisation respectively as the main regressors.

In these specifications, the indicator for financial system structure enters the model quantitatively. It implies that a country can have high (low) levels of banking sector size/activity and high (low) stock market capitalisation simultaneously. When financial systems have both developed/underdeveloped banking sector and markets, this specification helps in finding out which type of financial intermediation contributes to stability/instability of the economy.

The model also includes a set of control variable given by *X*. The vector X includes log of GDP per capita, financial openness and trade openness. In some of the specifications of the model, we use share of foreign banks' asset in total banking sector asset as a control variable, to indicate extent of foreign banks presence in banking sector.

In order to investigate if the regressors impact differentially in low and high income economies, we estimate all specifications of the regression model thrice: for all countries (pooled regression), for a sample of only high income countries and for only low income countries. For the purpose of this paper, we define high income countries as those which are placed in high income and upper middle income categories of World Bank's country classification. Similarly, low income countries in our sample consist of those that belong to lower middle income and low income categories of World Bank's country classification.

In order to account for potential heteroscadasticity in the various models, we estimate heteroscadasticity-robust standard errors and use these for further testing of estimated coefficients.

In the following subsection, we discuss the variables used in our regression estimation.

3.2. Description of variables

Dependent variable: The dependent variable Y in equation (1) is a measure of stability or instability of the financial sector or the overall macro economy. The following alternative measures are used:

> z-score: z-score is a measure of banking sector stability. It is the ratio of banking sector's total capital plus average rate of return on assets to the standard deviation of the rate of return on asset. Higher the z-score, lower the probability of bank failure. Thus, high value of z-score indicates stability (see Guillen, 2016; Phan et al, 2020).
>
> Stock market volatility: Stock market volatility is measured by the standard deviation of a country's stock market index returns. Higher volatility of the stock market indicates higher instability.
>
> Exchange Market Pressure Index (EMPI): The EMPI is an index that measures pressure in the foreign exchange market (see Park et al, 2019). It is a weighted average of two components of currency market pressure: exchange rate and foreign exchange reserves. An increase in the value of EMPI indicates pressure on domestic currency to depreciate, which may not be actual deprecation, thereby signalling instability in foreign exchange markets. Likewise, a decrease in EMPI value implies a more stable economy.

Explanatory variables:

Bank Size: This is the ratio of banking sector assets to GDP.

Bank Activity: This is the ratio of total credit plus deposit to GDP (see also, Igan and Tan, 2017; Hou et al, 2018).

Stock market capitalization: An indicator of the stock market size, given by the ratio of stock market capitalization to GDP (Igan and Tan, 2017; Shen et al., 2018).

Control Variables:

GDP per capita (in natural log): Indicates the level of economic development of a country.

Foreign Banks' asset share: This variable is included to indicate the dominance of foreign banks in a country's banking sector. It is given by the proportion of foreign banks asset in total banking sector asset.

Financial Openness: This variable measures restrictions on cross border financial transactions which is given by Chinn-Ito index (Juhro et al., 2020).

Trade openness: It denotes importance of trade of goods and services for an economy. It is measured by total of exports and imports as a percentage of a country's GDP (see Iyke, 2017; Ho and Iyke, 2019).

3.3. Data

The empirical model is estimated for 82 countries for a period of 1996 to 2012. The choice of the sample countries and time period is driven by the availability of relevant data on all variables necessary for our analysis, especially for some of the stability measures used in this paper. The frequency of data is annual. Country level data on Z-score, stock market volatility, banking assets to GDP, bank deposits plus credit and stock market capitalisation are retrieved from Financial Structure Database of World Bank, available at *http://www.worldbank.org/en/publication/gfdr/ data/financial-structure-database*. The data on EMPI (exchange market pressure index) is from Patnaik et al (2017), since it is available for all countries and helps in cross country comparison. The EMPI data are available on a monthly basis at *http://macrofinance.nipfp.org.in/releases/exchange_market_pressure.html* which is then converted to annual data series using simple averages of monthly EMPI values. The data on GDP per capita and trade openness are taken from World Bank National Accounts Data available at *https://data.worldbank.org/indicator/NY.GDP.PCAP.KD* and *https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS* respectively. Chinn-Ito index (KAOPEN) of capital account openness which incorporates both capital account and current account controls is used for financial openness variable. The data are retrieved from *http://web.pdx.edu/~ito/Chinn-Ito_website.htm*.

Table 1: Summary Statistics of the variables for 82 countries over a period of 1996-2012

	Z-score	Stock Price Volatility	Exchange Market Pressure Index	Banking Assets	Bank Deposits plus Credit	Stock Market Capitalisation	Proportion of foreign banks	Financial Openness	Trade Openness	ln (GDP per capita)
All Countries										
Mean	-2.1	3.03	-0.37	68.52	113.41	50.74	36.26	0.94	88.19	9.12
Median	-2.03	3.04	-0.30	57.56	91.34	34.18	24	1.29	76.05	9
Std. Dev.	0.84	0.48	2.09	45.26	82.41	48.55	32.95	1.45	55.72	1.43
Min	-8.52	1.46	-16.17	3.38	5.72	0.03	0	-1.91	15.64	6
Max	3.01	4.95	19.09	263.94	568.28	263.75	100	2.36	441.6	12
Observations	1369	992	1321	1370	1331	1351	650	1376	1377	1394
High Income Countries										
Mean	-2.13	3.01	-0.40	78.73	130.66	58.60	36.34	1.18	94.54	9.68
Median	-2.04	3.03	-0.29	73.80	114.10	42.21	23.00	1.85	81.37	10.00
Std. Dev.	0.88	0.47	2.15	46.14	86.14	51.23	33.42	1.38	60.43	1.07
Min	-8.52	1.59	-16.17	5.78	8.41	0.03	0	-1.91	15.64	7.00
Max	3.01	4.60	19.09	263.94	568.28	263.75	100	2.36	441.60	12.00
Observations	1053	841	1011	1048	1009	1055	497	1053	1054	1071
Low Income Countries										
Mean	-2.00	3.12	-0.26	35.26	59.34	22.73	35.98	0.15	67.45	7.24
Median	-1.99	3.12	-0.36	33.47	55.29	16.71	25.00	0.01	61.60	7.00
Std. Dev.	0.68	0.52	1.89	18.52	31.09	20.11	31.48	1.36	27.60	0.69
Min	-3.68	1.46	-5.68	3.38	5.72	0.51	0	-1.91	22.17	6.00
Max	-0.30	4.95	11.44	89.54	156.09	113.33	100	2.36	143.02	8.00
Observations	316	151	310	322	322	296	153	323	323	323

Source: Authors' computation based on data from Financial Structure Database of World Bank, World Bank National Accounts Data, Patnaik et al (2017), Chinn-Ito website

Z-score is ratio of banking sector's total capital plus average rate of return on assets to the standard deviation of the rate of return on asset. Stock price volatility is measured by the standard deviation of a country's stock market index returns. Exchange market pressure index(EMPI) is weighted average of nominal exchange rate and foreign exchange reserves given by Patnaik et al(2017). Banking assets is ratio of banking sector assets to GDP. Bank Deposits plus Credit is ratio of total bank credit plus deposits to GDP. Stock Market Capitalisation is ratio of stock market capitalisation to GDP. Proportion of foreign banks is defined by proportion of foreign banks' assets in total banking sector asset. Financial Openness is a Chinn-Ito measure of restrictions on cross border financial transactions. Trade Openness is measured by total exports and imports as a percentage of country's GDP. GDP per capita measure of economic development of a country.
A high income country is defined as those countries belonging to high and upper middle income group of World Bank classification. Similarly, a low income country is defined as countries belonging to lower middle and low income groups of WB classification.

Table 1 presents summary statistics of all variables used in this study. The size and activity indicators of financial structure exhibit huge variations. Banking assets as a percentage of GDP for all countries has a mean of 68.52 and standard deviation of 45.26 with values ranging from 3.38 to 263.94. Stock market capitalisation also has similar statistics with mean of 50.74 and standard deviation of 48.55. Amongst all structure indicators, bank deposits plus credit shows the biggest variation with

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standard deviation of 82.41 ranging from 5.72 to 568.28. This indicates that financial structure varies enormously across countries and over years in our sample. It can also be seen in Table 1 that high income countries have greater size and activity levels of banking sector and markets in comparison to low income countries on an average. Also, the proportion of foreign banks in total banking assets exhibit similar pattern among different income groups in our sample.

4. Results and Analysis

Results of the estimated regression model for various specifications are presented in Tables 2, 3 and 4 respectively. In Table 2, we present the regression model estimated for z-score (logit transformation) as a dependent variable. Table 3 presents the results with stock market volatility (logarithmic terms) as dependent variable and Table 4 presents results for EMP index as dependent variable. In each of these three tables, we present four alternative specifications of our regression model, each being estimated separately for all countries, for high income countries and for low income countries. In specifications (1) and (2), we use size of the banking sector (banking sector asset to GDP) as the main indicator of strength of the banking sector, while in specifications (3) and (4), the indicator of the banking sector strength is measured by banking activity (volume of credit plus deposit as percentage of GDP). In all specifications, the strength of the stock market is measured by volume of stock market capitalisation as percentage of GDP. In specifications (2) and (4), an additional regressor, share of foreign banks' asset to total banking sector assets in also included to measure presence of foreign banks in an economy.

4.1. Regression with banking sector stability (Z-score) as dependent variable

Regression results presented in Table 2 indicate that the size of the banking sector is significantly and negatively associated with Z-score (specifications (1) and (2)) for all three sets of regressions, viz., the pooled regression (all countries), the regression for high income countries and the regression for low income countries. In these specifications, the size of the stock market is not significantly associated with Z-score. Thus, higher asset size of the banking sector seems to be associated with lower value of Z-score and lower banking sector size is associated with higher value of Z-score. This inverse and statistically significant impact of banking size on Z-score indicates that bank-based structure leads to more banking sector instability. On the other hand, the size of the stock market has no significant association with banking sector stability. This is not surprising, as the Z-score here is a measure of the banking sector stability and the only source of instability captured in Z-score is from the banks. Thus, higher banking sector size leading to higher instability in the banking sector is quite expected.

Table 2: Coefficient estimates of various specification of the Panel Regression with z-score as the dependent variable

	Dependent Variable: Z-score of the banking sector											
Independent Variables	All countries				High Income countries				Low Income countries			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Banking Asset (% of GDP)	-0.004** (0.002)	-0.009** (0.004)			-0.005** (0.002)	-0.009** (0.004)			-0.008*** (0.003)	-0.010** (0.005)		
Deposit+ Credit (% of GDP)			-0.004*** (0.001)	-0.005 (0.004)			-0.003 (0.002)	-0.005 (0.004)			-0.006*** (0.002)	-0.007 (0.004)
Stock Market Cap. (% of GDP)	0.003 (0.002)	0.003 (0.002)	0.002 (0.001)	0.002 (0.001)	0.003 (0.002)	0.002 (0.001)	0.002 (0.002)	0.002 (0.002)	0.002 (0.002)	0.002 (0.002)	0.002 (0.002)	0.003 (0.002)
Share of foreign banks asset		0.002 (0.002)		0.001 (0.002)		0.003 (0.004)		0.002 (0.004)		-0.001 (0.002)		-0.002 (0.002)
Financial Openness	-0.031 (0.032)	0.007 (0.042)	-0.026 (0.034)	0.021 (0.043)	-0.045 (0.038)	-0.012 (0.052)	-0.032 (0.040)	0.018 (0.054)	0.041 (0.049)	0.043 (0.054)	0.063 (0.049)	0.042 (0.052)
Exports and Imports (% of GDP)	0.002 (0.001)	-0.001 (0.002)	0.0004 (0.002)	-0.001 (0.002)	-0.0001 (0.002)	-0.001 (0.003)	-0.001 (0.002)	-0.001 (0.003)	0.002 (0.003)	0.001 (0.031)	0.03 (0.003)	0.002 (0.003)
In(GDP per capita)	-0.029 (0.062)	-0.027 (0.004)	-0.063 (0.070)	0.02 (0.040)	-0.029 (0.078)	-0.003 (0.046)	0.002 (0.084)	0.005 (0.044)	-0.262** (0.106)	-0.214 (0.120)	-0.27** (0.103)	-0.208** (0.089)
Intercept	-1.86*** (0.546)	-1.39*** (0.007)	-1.38*** (0.064)	-1.49*** (0.564)	-1.69** (0.761)	-1.61*** (0.620)	-1.96*** (0.826)	-1.75*** (0.707)	-0.148 (0.641)	-0.179 (0.881)	-0.005 (0.631)	-0.247 (0.650)
No. of Observations	1274	611	1235	596	985	470	945	455	289	141	289	141
No. of Countries	79	76	77	74	60	58	58	56	19	18	19	18
R-squared (overall)	0.017	0.026	0.017	0.012	0.002	0.02	0.001	0.09	0.0213	0.029	0.054	0.069
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Hausman test Results												
Chi2	14.24	23.64	17.22	21.59	14.32	21.36	13.09	21.12	10.3	21.59	42.45	20.21
Prob>Chi2	0.01	0.006	0.0041	0.001	0.013	0.002	0.02	0.002	0.07	0.001	0	0.002
Model Chosen	FE	FE	FE	FE	FE	FE	FE	FE	RE	FE	FE	FE

Source: Authors' computation based on data from Financial Structure Database of World Bank, World Bank National Accounts Data, Chinn-Ito website

Logit transformation of z-score is the dependent variable in this model. Specification (1) and (2) uses banking assets to GDP and stock market capitalisation as size indicators of banking sector and stock markets respectively. In specifications (3) and (4), activity indicator given by bank deposits plus credit for banking sector and stock market capitalisation for stock markets is used. Specifications (2) and (4) have an additional regressor which is share of foreign banks' assets in total banking sector.
Z-score is ratio of banking sector's total capital plus average rate of return on assets to the standard deviation of the rate of return on asset. Higher value of z-score indicates stability in financial sector. Banking assets is ratio of banking sector assets to GDP. Bank Deposits plus Credit is ratio of total bank credit plus deposits to GDP. Stock Market Capitalisation is ratio of stock market capitalisation to GDP. Proportion of foreign banks is defined by proportion of foreign banks' assets in total banking sector asset. Financial Openness is a Chinn-Ito measure of restrictions on cross border financial transactions. Trade Openness is measured by total exports and imports as a percentage of country's GDP. GDP per capita measure of economic development of a country.
Robust Standard Errors in parenthesis. Significance at 5% and 1% level are indicated by ** and *** respectively

In the specifications (3) and (4) of the regression model, the strength of the banking sector is measured by volume of credit and deposit instead of size banking asset. In these two specifications, we see that the negative association between Z-score and banking sector strength is not valid for high income economies. In these specifications, the coefficient of banking credit plus deposit (banking activity indicator) is found to be significant and negative for the regressions of all countries and low income countries but not significant for high income countries. Thus, the significant negative coefficient of the pooled regression seems to be due to that of the low income economies. Thus, in low income economies, higher level of banking sector activities seem to be associated with higher level of instability. The stock market size is not a significant factor for banking sector instability in these specifications as well.

Among other control variables, GDP per capita level is found to be negatively associated with stability in the regression of low income country group, in all the specifications. No other variable is found to be significant in explaining banking sector stability.

4.2. Regression with stock market instability (volatility of stock prices) as dependent variable

In Table 3, we present results of the regression of stock market volatility, measured by natural logarithm of standard deviation of the changes in major stock market index of a country. In specifications (1) and (2), we use banking sector asset relative to GDP as the explanatory variable that measures relative importance of banking sector, while in specifications (3) and (4), we use volume of credit plus deposit from banks to private sector (normalized by GDP) to measure relative importance of banking sector. In all specifications, the size of the stock market is measured by total stock market capitalization as percentage of GDP. Looking at the estimated coefficients of the explanatory variables, we find that for high income countries, banking sector asset and stock market capitalization are both significantly and positively associated with stock market volatility. However, this significant association vanishes when we include foreign banks' asset share as an additional explanatory variable in specification (2), which itself is not significant. Considering regression specifications (3) and (4), we observe a similar result – for high income countries, both banking sector activity (deposit plus credit) and stock market size are significant contributors to stock market volatility, but inclusion of foreign banks' asset share makes these financial structure variables insignificant. For the pooled regression and the regression for low income countries, none of the regressors measuring financial structure, viz., banking asset size, size of credit plus deposit and size of the stock market, have come out to be significant except for third specification in pooled regression.

Table 3: Coeffient estimates of various specification of the Panel Regression with stock price volatility as the dependent variable

Independent Variables	All countries				High Income countries				Low Income countries			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Banking Asset (% of GDP)	0.002	0.002			0.003***	0.002			-0.005	0.002		
	0.001	(0.002)			(0.001)	(0.002)			(0.006)	(0.005)		
Deposit+ Credit (% of GDP)			0.003***	0.003			0.002**	0.002			-0.001	0.0004
			0.001	(0.001)			(0.001)	(0.001)			(0.004)	(0.004)
Stock Market Cap. (% of GDP)	0.001	0.0002	0.002**	0.0001	0.002**	0.0005	0.002**	0.004	0.003	-0.004	0.002	-0.003
	0.008	(0.001)	0.001	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.005)	(0.003)	(0.005)
Share of foreign banks asset		0.004		0.006		0.007		0.007		-0.003		-0.003
		(0.004)		(0.003)		(0.004)		(0.003)		(0.005)		(0.006)
Financial Openness	-0.106***	-0.07	-0.110***	-0.093**	-0.111***	-0.07	-0.118***	-0.089	-0.085	0.047	-0.081	0.046
	0.032	(0.044)	0.031	(0.044)	(0.032)	(0.048)	(0.032)	(0.050)	(0.057)	(0.103)	(0.047)	(0.106)
Exports and Imports (% of GDP)	0.005***	0.006***	0.005***	0.006***	0.005***	0.006***	0.005***	0.006***	0.009**	0.005	0.008	0.005
	0.002	(0.002)	0.002	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.004)	(0.007)	(0.004)	(0.007)
ln(GDP per capita)	-0.021	-0.055	-0.019	-0.05	-0.025	-0.055	-0.027	-0.05	0.085	-0.076	0.067	-0.059
	0.067	(0.089)	0.072	(0.100)	(0.002)	(0.090)	(0.075)	(0.100)	(0.128)	(0.356)	(0.137)	(0.356)
Intercept	2.435***	2.646***	2.272***	2.469***	2.458***	2.55***	2.391***	2.39**	1.625	3.481	1.710	3.38
	0.643	(0.844)	0.668	(0.930)	(0.001)	(0.883)	(0.722)	(0.971)	(0.914)	(2.584)	(0.957)	(2.566)
No. of Observations	963	506	924	491	812	435	773	420	151	71	151	71
No. of Countries	67	66	65	64	56	55	54	53	11	11	11	11
R-squared (overall)	0.021	0.017	0.007	0.005	0.028	0.016	0.012	0.006	0.136	0.304	0.136	0.297
Year fixed effects	yes	yes	yes	yes	Yes	yes	yes	yes	yes	yes	yes	yes
Hausman test Results												
Chi2	27.92	42.7	38.06	76.39	34.65	43.58	43.29	77.31	0.67	7.91	0.59	6.31
Prob>Chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.984	0.161	0.988	0.276
Model Chosen	FE	FE	FE	FE	FE	FE	FE	FE	RE	RE	RE	RE

Dependent Variable: Stock Price Volatility of the stock markets

Source: Authors' computation based on data from Financial Structure Database of World Bank, World Bank National Accounts Data, Chinn-Ito website

Natural log of stock price volatility is the dependent variable in this version of the model. Specification (1) and (2) uses banking assets to GDP and stock market capitalisation as size indicators of banking sector and stock markets respectively. In specifications (3) and (4), activity indicator given by bank deposits plus credit for banking sector and stock market capitalisation for stock markets is used. Specifications (2) and (4) have an additional regressor which is share of foreign banks' assets in total banking sector.

Stock price volatility is measured by the standard deviation of a country's stock market index returns. Lower value of stock market volatility indicates stability in financial sector. Banking assets is ratio of banking sector assets to GDP. Bank Deposits plus Credit is ratio of total bank credit plus deposits to GDP. Stock Market Capitalisation is ratio of stock market capitalisation to GDP. Proportion of foreign banks is defined by proportion of foreign banks' assets in total banking sector asset. Financial Openness is a Chinn-Ito measure of restrictions on cross border financial transactions. Trade Openness is measured by total exports and imports as a percentage of country's GDP. GDP per capita measure of economic development of a country.

Robust Standard Errors in parenthesis. Significance at 5% and 1% level are indicated by ** and *** respectively

Among other control variables, financial openness variable is found to be negative and significant in all but second specification for the pooled (all country) and the high income country regressions, while it is not significant in any of the specifications for the low income country regressions. Thus, for high income countries, financial openness seems to curtail stock market instability. On the other hand, trade openness, measured by volume of net export, seems to increase stock market volatility in a significant manner for high income country groups.

4.3. Regression with exchange market pressure index (currency market instability) as dependent variable

In Table 4, we present our last set of regression results where the dependent variable is a measure of currency market pressure, thus indicating macroeconomic instability. Higher values of exchange market pressure index is associated with higher instability in the foreign currency market.

The coefficient of banking sector size in specification (1) is found to be positive and significant in all the three sets of regressions. For the pooled regression and the low income country regression this coefficient is highly significant, whereas for the high income country regression, it is significant at 10 per cent level. On the other hand, the coefficient of stock market size is found to be insignificant in all the cases. This seems to indicate that banking sector significantly contributes to currency market instability while the stock market has no significant impact on the instability in the currency market. Looking at the specification (3), where bank asset is replaced with volume of credit and deposit, we find similar results – in all three cases, volume of banking sector activity tend to contribute significantly to currency market pressure whereas the stock market size has no such significant impact on the currency market.

However, when we include the additional control variable of foreign banks' asset share in the regression models in specifications (2) and (4), we see a somewhat striking result. With the inclusion of this new variable, the significance of bank asset size and bank activity level diminishes for the pooled regression and the high income country regression. Instead, in these models, the coefficient corresponding to the new variable, foreign banks' asset share turns out to be significantly positive. In the regression for low income countries, the original banking sector variables remains positively significant as before, even after inclusion of foreign banks' asset share. Rather, we observe that in specifications (2) and (4), the stock market size variable becomes negatively significant, indicating that stock market activities seem to have a stabilizing effect on exchange market pressure in low income countries.

Table 4: Coefficient estimates of various specification of the Panel Regression with EMPI as the dependent variable

Independent Variables	All countries				High Income countries				Low Income countries			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Banking Asset (% of GDP)	0.010**	0.002			0.009*	-1.58E-04			0.041***	0.045**		
	(0.004)	(0.004)			(.005)	(0.005)			(0.008)	(0.021)		
Deposit+ Credit (% of GDP)			0.011***	0.004			0.010***	0.003			0.026***	0.017**
			(0.003)	(0.003)			(0.003)	(0.003)			(0.008)	(0.007)
Stock Market Cap. (% of GDP)	-8.58E-05	-0.004	6.42E-04	-0.005	-1.71E-04	-0.004	0.008	-0.004	-0.006	-0.030***	-0.008	-0.021**
	(0.004)	(0.003)	(0.004)	(0.003)	(0.005)	(0.003)	(0.004)	(0.003)	(0.011)	(0.009)	(0.011)	(0.009)
Share of foreign banks asset		0.010***		0.010***		0.010**		0.009**		0.009		0.017***
		(0.003)		(0.003)		(0.004)		(0.004)		(0.013)		(0.007)
Financial Openness	0.007	0.096	-0.063	0.039	0.013	0.156	-0.044	0.094	0.378	0.078	0.355	-0.094
	(0.146)	(0.080)	(0.131)	(0.067)	(0.153)	(0.108)	(0.139)	(0.097)	(0.270)	(0.286)	(0.266)	(0.101)
Exports and Imports (% of GDP)	0.001	-0.002	0.004	-0.002	1.09E-05	-0.001	0.004	-0.001	0.009	-0.004	0.006	-0.016
	(0.006)	(0.002)	(0.006)	(0.002)	(0.006)	(0.001)	(0.006)	(0.002)	(0.014)	(0.018)	(0.015)	(0.009)
ln(GDP per capita)	-1.616**	0.055	-1.602	-0.018	-2.081**	0.282	-2.256**	0.067	-1.97	3.15	-1.927	0.401
	(0.711)	(0.105)	(0.843)	(0.096)	(0.825)	(0.219)	(1.033)	(0.178)	(1.262)	(2.356)	(1.417)	(0.338)
Intercept	13.981***	-1.898**	13.264	-1.344**	19.462**	-4.25**	20.407	-2.318	12.119	-24.46	11.946	-3.603
	(6.294)	(0.760)	(7.367)	(0.621)	(7.715)	(2.031)	(9.574)	(1.574)	(9.137)	(17.500)	(10.243)	(2.021)
No. of Observations	1244	598	1205	583	957	457	918	442	287	141	287	141
No. of Countries	80	75	78	73	61	57	59	55	19	18	19	18
R-squared (overall)	0.038	0.188	0.045	0.192	0.037	0.195	0.052	0.192	0.121	0.054	0.103	0.302
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Hausman test Results												
Chi2	61.22	4.63	61.75	5.61	53.61	9.13	51.13	6.16	11.51	15.53	14.3	9.96
Prob>Chi2	0.000	0.592	0.000	0.468	0.000	0.167	0.000	0.405	0.042	0.017	0.014	0.126
Model Chosen	FE	RE	FE	RE	FE	RE	FE	RE	FE	FE	FE	RE

Source: Authors' computation based on data from Financial Structure Database of World Bank, World Bank National Accounts Data, Patnaik et al (2017), Chinn–Ito website

Exchange market pressure index given by Patnaik et al (2017) is the dependent variable in this version of the model. Specification (1) and (2) uses banking assets to GDP and stock market capitalisation as size indicators of banking sector and stock markets respectively. In specifications (3) and (4), activity indicator given by bank deposits plus credit for banking sector and stock market capitalisation for stock markets is used. Specifications (2) and (4) have an additional regressor which is share of foreign banks' assets in total banking sector.

Exchange market pressure index(EMPI) is weighted average of nominal exchange rate and foreign exchange reserves given by Patnaik et al(2017). A decrease in EMPI value implies stability in the currency markets. Banking assets is ratio of banking sector assets to GDP. Bank Deposits plus Credit is ratio of total bank credit plus deposits to GDP. Stock Market Capitalisation is ratio of stock market capitalisation to GDP. Proportion of foreign banks is defined by proportion of foreign banks' assets in total banking sector asset. Financial Openness is a Chinn–Ito measure of restrictions on cross border financial transactions. Trade Openness is measured by total exports and imports as a percentage of country's GDP. GDP per capita measure of economic development of a country.
Robust Standard Errors in parenthesis. Significance at 10%, 5% and 1% level are indicated by *, ** and *** respectively

Combining these observations, we conclude that banking sector size and activity exert a statistically significant impact on currency market pressure in high income as well as low income countries. However, the banking sector's contribution towards instability in the currency market seems to be attributable to presence of foreign banks in the banking sector, as indicated by the positive and significant coefficient of the variable measuring foreign banks' presence. As far as the stock market size is concerned, there is no significant impact on currency market pressure for high income countries, but in low income countries, stock market seems to contribute towards better stability of the currency market.

Among other control variables, only GDP is found to be negatively associated with exchange market pressure index. Thus, higher GDP leads to less stability in the currency market.

4.4. Robustness Check

As robustness check, we estimated a set of alternate regression models, where we consider the lagged values of all explanatory variables, instead of their contemporaneous values. The idea here is that the impact of all regressors, variables on financial structure in particular, on stability may be lagged and not contemporaneous. This transformation of the explanatory variables can also address the problem of endogeneity due to simultaneous determination of stability and structure. In Tables 5, 6 and 7, we present the result of robustness check.

Table 5, 6 and 7 have logit transformation of z-score, log of stock price volatility and exchange market pressure index respectively as dependent variables. Table 5 indicates a significant negative relationship between lagged banking size and z-score (specification (1)) for all countries, high income countries and low income countries. This suggests size of the banking sector leads to instability in the banking sector. In specification (3) for pooled and low income countries, banking activity causes instability. In case of low income group countries, there is some evidence of stability provided by markets in specification (3) which was not present in our earlier result.

In Table 3, the size and activity indicator of banking sector and stock markets were both significantly and positively related to stock market volatility for high income countries only. While in Table 6, we see that the lagged values of size/activity indicator of banking and market sector increases stock market volatility significantly in the pooled and the high-income group regressions.

Table 5: Coefficient estimates of various specification of the Panel Regression with z-score as the dependent variable

Independent Variables	Dependent Variable: Z-score of the banking sector											
	All countries				High Income countries				Low Income countries			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Banking Asset (-1)	-0.005**	-0.006*			-0.004**	-0.005			-0.007**	-0.004		
	(0.002)	(0.003)			(0.002)	(0.003)			(0.003)	(0.004)		
Deposit+ Credit (-1)			-0.003*	-0.004			-0.003	-0.003			-0.005**	-0.005
			(0.002)	(0.003)			(0.002)	(0.003)			(0.002)	(0.002)
Stock Market Cap. (-1)	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.001	0.002	0.002	0.003**	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Share of foreign banks asset (-1)		-0.0007		-0.001		-0.0002		-0.001		-0.003		-0.003
		(0.0022)		(0.002)		(0.004)		(0.004)		(0.002)		(0.002)
Financial Openness (-1)	-0.052	-0.011	-0.038	0.011	-0.053	-0.02	-0.04	0.009	0.039	0.027	0.044	0.012
	(0.032)	(0.050)	(0.035)	(0.055)	(0.036)	(0.062)	(0.039)	(0.068)	(0.050)	(0.045)	(0.048)	(0.052)
Exports and Imports (% of GDP) (-1)	0.002	0.001	0.0010	0.0002	0.002	0.001	0.001	0.0002	0.001	0.003	0.001	0.002
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
ln(GDP per capita) (-1)	-0.074	-0.102	-0.055	-0.103	-0.038	-0.092	-0.008	-0.091	-0.223*	-0.201*	-0.209*	-0.231**
	(0.065)	(0.071)	(0.070)	(0.076)	(0.077)	(0.083)	(0.084)	(0.092)	(0.113)	(0.119)	(0.114)	(0.106)
Intercept	-1.443**	-0.911	-1.588**	-0.834	-1.794	-0.985	-2.055	-0.92	-0.368	-0.467	-0.453	-0.098*
	(0.592)	(0.701)	(0.633)	(0.809)	(0.751)	(0.894)	(0.822)	(1.034)	(0.679)	(0.891)	(0.686)	(0.777)
No. of Observations	1202	543	1165	530	929	418	892	405	273	125	273	125
No. of Countries	79	76	77	74	60	58	58	56	19	18	19	18
R-squared (overall)	0.006	0.034	0.002	0.021	0.003	0.026	0.001	0.015	0.025	0.027	0.054	0.023
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Hausman test Results												
Chi2	16.28	16.48	14.89	17.97	14.92	14.41	13.82	16.88	12.27	11.33	19.87	15.35
Prob>Chi2	0.006	0.011	0.011	0.006	0.011	0.025	0.017	0.010	0.031	0.78	0.001	0.017
Model Chosen	FE	FE	FE	FE	FE	FE	FE	FE	FE	RE	FE	FE

Source: Authors' computation based on data from Financial Structure Database of World Bank, World Bank National Accounts Data, Chinn-Ito website

Logit transformation of z-score is the dependent variable in this version of the model. Specification (1) and (2) uses banking assets to GDP and stock market capitalisation as size indicators of banking sector and stock markets respectively. In specifications (3) and (4), activity indicator given by bank deposits plus credit for banking sector and stock market capitalisation for stock markets is used. Specifications (2) and (4) have an additional regressor which is share of foreign banks' assets in total banking sector.

Z-score is ratio of banking sector's total capital plus average rate of return on assets to the standard deviation of the rate of return on asset. Higher value of z-score indicates stability in financial sector. Banking assets is ratio of banking sector assets to GDP. Bank Deposits plus Credit is ratio of total bank credit plus deposits to GDP. Stock Market Capitalisation is ratio of stock market capitalisation to GDP. Proportion of foreign banks is defined by proportion of foreign banks' assets in total banking sector asset. Financial Openness is a Chinn-Ito measure of restrictions on cross border financial transactions. Trade Openness is measured by total exports and imports as a percentage of country's GDP. GDP per capita measure of economic development of a country.

Robust Standard Errors in parenthesis. Significance at 10%, 5% and 1% level are indicated by *, ** and *** respectively

Table 6 : Coefficient estimates of various specification of the Panel Regression with stock price volatility as the dependent variable

Independent Variables	All countries				High Income countries				Low Income countries			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Banking Asset (-1)	0.002***	0.003			0.003***	0.002			-0.006	0.003		
	(0.001)	(0.002)			(0.001)	(0.002)			(0.007)	(0.006)		
Deposit+ Credit (-1)			0.002***	0.003			0.002**	0.002			-0.001	0.00008
			(0.001)	(0.001)			(0.001)	(0.001)			(0.004)	(0.004)
Stock Market Cap. (-1)	0.002***	0.001	0.002***	0.001	0.003***	0.001	0.003***	0.002	0.006	-0.002	0.005	-0.0009
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.005)	(0.004)	(0.006)
Share of foreign banks asset (-1)		0.003		0.004		0.006*		0.007***		-0.001		-0.001
		(0.003)		(0.004)		(0.003)		(0.003)		(0.005)		(0.005)
Financial Openness (-1)	-0.086***	-0.066	-0.096***	-0.091**	-0.085***	-0.069	-0.095***	-0.094*	-0.038	0.048	-0.028	0.045
	(0.026)	(0.043)	(0.027)	(0.042)	(0.028)	(0.047)	(0.029)	(0.047)	(0.086)	(0.103)	(0.067)	(0.106)
Exports and Imports (% of GDP) (-1)	0.003*	0.005***	0.003**	0.005***	0.003*	0.005***	0.003*	0.005***	0.005	0.004	0.004	0.004
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.003)	(0.006)	(0.003)	(0.006)
ln(GDP per capita) (-1)	-0.025	-0.087	-0.034	-0.077	-0.004	-0.097	-0.017	-0.089	-0.042	-0.054	-0.054	-0.017
	(0.064)	(0.081)	(0.071)	(0.090)	(0.064)	(0.080)	(0.069)	(0.089)	(0.128)	(0.368)	(0.142)	(0.365)
Intercept	2.552***	2.845***	2.57***	2.66***	2.370***	2.814***	2.428***	2.641***	2.858***	3.218	2.86***	2.99
	(0.605)	(0.771)	(0.670)	(0.846)	(0.634)	(0.790)	(0.0696)	(0.0868)	(0.971)	(2.70)	(1.045)	(2.66)
No. of Observations	925	454	888	441	780	390	743	377	145	64	145	64
No. of Countries	67	66	65	64	56	55	54	53	11	11	11	11
R-squared (overall)	0.023	0.028	0.011	0.010	0.041	0.017	0.024	0.006	0.131	0.310	0.138	0.302
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Hausman test Results												
Chi2	47.02	64.26	52.68	81.06	51.85	64.16	56.81	79.83	0.85	2.7	0.41	1.72
Prob>Chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.75	0.99	0.88
Model Chosen	FE	FE	FE	FE	FE	FE	FE	FE	RE	RE	RE	RE

Source: Authors' computation based on data from Financial Structure Database of World Bank, World Bank National Accounts Data, Chinn-Ito website

Natural log of stock price volatility is the dependent variable in this version of the model. Specification (1) and (2) uses banking assets to GDP and stock market capitalisation as size indicators of banking sector and stock markets respectively. In specifications (3) and (4), activity indicator given by bank deposits plus credit for banking sector and stock market capitalisation for stock markets is used. Specifications (2) and (4) have an additional regressor which is share of foreign banks' assets in total banking sector.

Stock price volatility is measured by the standard deviation of a country's stock market index returns. Lower value of stock market volatility indicates stability in financial sector. Banking assets is ratio of banking sector assets to GDP. Bank Deposits plus Credit is ratio of total bank credit plus deposits to GDP. Stock Market Capitalisation is ratio of stock market capitalisation to GDP. Proportion of foreign banks is defined by proportion of foreign banks' assets in total banking sector asset. Financial Openness is a Chinn-Ito measure of restrictions on cross border financial transactions. Trade Openness is measured by total exports and imports as a percentage of country's GDP. GDP per capita measure of economic development of a country.

Robust Standard Errors in parenthesis. Significance at 5% and 1% level are indicated by ** and *** respectively

Table 7 : Coefficient estimates of various specification of the Panel Regression with EMPI as the dependent variable

Independent Variables	Dependent Variable: Exchange Market Pressure Index											
	All countries				High Income countries				Low Income countries			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Banking Asset (-1)	0.009***	-0.001			0.007***	-0.001			0.026***	-0.001		
	(0.002)	(0.004)			(0.002)	(0.004)			(0.007)	(0.011)		
Deposit+ Credit (-1)			0.008***	-0.002			0.006***	-0.002			0.017**	-0.003
			(0.002)	(0.004)			(0.001)	(0.004)			(0.006)	(0.007)
Stock Market Cap. (-1)	0.007	0.010	0.008**	0.0109	0.004	-0.001	0.005	0.009	0.037***	0.01	0.035***	0.013
	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.002)	(0.004)	(0.006)	(0.010)	(0.01)	(0.009)	(0.009)
Share of foreign banks asset (-1)		0.003		0.002		0.011***		-0.007		0.016**		0.015**
		(0.008)		(0.008)		(0.003)		(0.0129)		(0.008)		(0.007)
Financial Openness (-1)	0.158	0.088	0.102	0.094	0.167	0.115	0.117	0.160	0.124	-0.121	0.102	-0.123
	(0.125)	(0.146)	(0.117)	(0.153)	(0.132)	(0.090)	(0.124)	(0.175)	(0.464)	(0.113)	(0.450)	(0.113)
Exports and Imports (% of GDP) (-1)	-0.016***	-0.022*	-0.013**	-0.0206*	-0.018***	-0.001	-0.014**	-0.019	-0.013	-0.013	-0.0145	-0.012
	(0.006)	(0.012)	(0.005)	(0.012)	(0.006)	(0.001)	(0.05)	(0.127)	(0.013)	(0.013)	(0.013)	(0.013)
ln(GDP per capita) (-1)	-0.372		-0.425*	0.002	-0.136	0.322	-0.193	0.211	-0.624	0.220	-0.664	0.214
	(0.238)		(0.246)	(0.343)	(0.270)	(0.171)	(0.288)	(0.403)	(0.398)	(0.342)	(0.400)	(0.343)
Intercept	4.988**	-0.588	5.10**	1.334	3.338	-2.894	3.504	-0.062	4.851	-2.109	5.18**	-1.935
	(2.03)	(3.43)	(2.08)	(3.181)	(2.514)	(1.548)	(2.67)	(3.967)	(2.33)	(2.226)	(2.36)	(2.26)
No. of Observations	1179	534	1142	521	906	409	869	396	273	125	273	125
No. of Countries	80	75	78	73	61	57	59	55	19	18	19	18
R-squared (overall)	0.083	0.065	0.085	0.065	0.078	0.211	0.088	0.041	0.095	0.293	0.084	0.291
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Hausman test Results												
Chi2	52.08	16.6	44.5	17.55	33.51	12.08	23.96	12.72	28.34	6.2	29.67	5.56
Prob>Chi2	0.00	0.01	0.00	0.01	0.00	0.06	0.00	0.05	0.00	0.40	0.00	0.47
Model Chosen	FE	FE	FE	FE	FE	RE	FE	FE	FE	RE	FE	RE

Source: Authors' computation based on data from Financial Structure Database of World Bank, World Bank National Accounts Data, Patnaik et al (2017), Chinn-Ito website

Exchange market pressure index given by Patnaik et al (2017) is the dependent variable in this version of the model. Specification (1) and (2) uses banking assets to GDP and stock market capitalisation as size indicators of banking sector and stock markets respectively. In specifications (3) and (4), activity indicator given by bank deposits plus credit for banking sector and stock market capitalisation for stock markets is used. Specifications (2) and (4) have an additional regressor which is share of foreign banks' assets in total banking sector.

Exchange market pressure index(EMPI) is weighted average of nominal exchange rate and foreign exchange reserves given by Patnaik et al(2017). A decrease in EMPI value implies stability in the currency markets. Banking assets is ratio of banking sector assets to GDP. Bank Deposits plus Credit is ratio of total bank credit plus deposits to GDP. Stock Market Capitalisation is ratio of stock market capitalisation to GDP. Proportion of foreign banks is defined by proportion of foreign banks' assets in total banking sector asset. Financial Openness is a Chinn-Ito measure of restrictions on cross border financial transactions. Trade Openness is measured by total exports and imports as a percentage of country's GDP. GDP per capita measure of economic development of a country.

Robust Standard Errors in parenthesis. Significance at 5% and 1% level are indicated by ** and *** respectively

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Journal of Central Banking Theory and Practice · Special Issue Proceedings from 13ᵗʰ BMEB International Conference in Bali: *Maintaining Stability, Strengthening Momentum of Growth Amidst High Uncertainties*

In Table 7 where exchange market pressure index is the dependent variable, the coefficient of the size and activity indicators of the banking sector in specification (1) and (3) is positive and significant for all the three sets of regressions whereas the coefficient of stock market capitalisation is significantly positive for pooled regression and low income group countries regression. This indicates that both banking sector and stock markets lead to instability in the economy. For the low income group countries (specification (4)), it can be seen that the foreign banks in a country's banking system could be a factor generating instability. The results found are very similar to the main results presented earlier in Tables 2, 3 and 4.

5. Conclusion

The paper studies the association between financial structure, bank-based and market-based, and financial and macroeconomic stability using empirical panel model estimated on 82 countries for the period of 1996-2012. The results indicate that in general, bank-based financial system contributes significantly to instability of the financial sectors and currency market. Size and activity levels of the banking system not only increase banking instability, but also contribute to stock market volatility and exchange market pressure. On the other hand, size of the stock markets is found to affect only stock market volatility and has no significant impact on banking and exchange market instability. The impact of banking size and stock market size on financial and currency market instability is felt differently in high-income and low-income economies. While the banking sector instability (Z-score) is increased by higher levels of banking size/activity in all countries irrespective of income level, the positive impact of the banking size and activities on stock market volatility is observed only in high income countries. In high income countries, both bank-based and market-based systems contribute to stock market volatility, while in low-income countries, neither has a significant impact on stock market volatility. As far as currency market is concerned, bank size/activity increases currency market pressure in all countries irrespective of income level, while stock market size seems to reduce currency market pressure in low-income countries. Within the bank-based system, we find evidence that higher share of foreign banks can be attributed to higher currency market pressure. We conclude that banks' contribution to financial and macroeconomic instability is non-trivial and this could be due to the manner and extent to which banks are inter-linked to various segments of an economy – as intermediaries, as payment systems, as major participants in stock market and currency markets and so on. Globalization of banking systems and increased share of foreign banks in an economy may bring additional dimension to this complex inter-linkages of banking system.

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Appendix: List of Countries used for empirical analysis in this paper

S. No.	Country Name	Income Category	S. No.	Country Name	Income Category
1	Argentina	High Income	42	Kazakhstan	High Income
2	Armenia	High Income	43	Kenya	Low Income
3	Australia	High Income	44	Korea, Rep.	High Income
4	Austria	High Income	45	Kuwait	High Income
5	Bahrain	High Income	46	Lebanon	High Income
6	Bangladesh	Low Income	47	Lithuania	High Income
7	Barbados	High Income	48	Luxembourg	High Income
8	Belgium	High Income	49	Macedonia, FYR	High Income
9	Bolivia	Low Income	50	Malaysia	High Income
10	Botswana	High Income	51	Malta	High Income
11	Brazil	High Income	52	Mauritius	High Income
12	Bulgaria	High Income	53	Mexico	High Income
13	Canada	High Income	54	Moldova	Low Income
14	Chile	High Income	55	Mongolia	Low Income
15	China	High Income	56	Morocco	Low Income
16	Colombia	High Income	57	Nepal	Low Income
17	Costa Rica	High Income	58	Netherlands	High Income
18	Cote d'Ivoire	Low Income	59	New Zealand	High Income
19	Croatia	High Income	60	Norway	High Income
20	Cyprus	High Income	61	Oman	High Income
21	Czech Republic	High Income	62	Pakistan	Low Income
22	Denmark	High Income	63	Peru	High Income
23	Egypt, Arab Rep.	Low Income	64	Philippines	Low Income
24	El Salvador	Low Income	65	Poland	High Income
25	Estonia	High Income	66	Portugal	High Income
26	Fiji	High Income	67	Romania	High Income
27	Finland	High Income	68	Russian Federation	High Income
28	France	High Income	69	Saudi Arabia	High Income
29	Georgia	Low Income	70	Singapore	High Income
30	Germany	High Income	71	Slovenia	High Income
31	Greece	High Income	72	South Africa	High Income
32	Hungary	High Income	73	Sri Lanka	Low Income
33	Iceland	High Income	74	Sweden	High Income
34	India	Low Income	75	Switzerland	High Income
35	Indonesia	Low Income	76	Thailand	High Income
36	Ireland	High Income	77	Trinidad and Tobago	High Income
37	Israel	High Income	78	Turkey	High Income
38	Italy	High Income	79	Uganda	Low Income
39	Jamaica	High Income	80	Ukraine	Low Income
40	Japan	High Income	81	United Kingdom	High Income
41	Jordan	High Income	82	Zambia	Low Income

Note: A high income country is defined as those countries belonging to high and upper middle income group of World Bank classification. Similarly, a low income country is defined as countries belonging to lower middle and low income groups of WB classification.