The relationship between Financial liberalization, Financial Stability and Capital Control: Evidence from a multivariate framework for developing countries

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2015

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Abstract

We analyze the dynamic relationship between financial liberalization and financial stability for a panel of 25 developing countries during the period 1986-2010. The empirical study employs the Toda and Yamamoto's (1995) procedure to test for the Granger no-causality between six variables of our study including: credit-to-GDP gap, deposit to credit ratio, net interest margin , bank supervision, Liberalization measured by kaopen and capital control proxied by the Quinn index (2007) . The results show a first bidirectional causal relationship between financial stability and deposit to credit ratio, a second one between financial stability and capital control and a third one between financial stability and liberalization.

Keyword: Liberalization, capital control, Developing countries, Toda and Yamamoto

1. Introduction

During the past few years, emerging market economies have witnessed a substantial increase in international capital inflows reaching a historical level of $660 billion in 2007. After a sharp decline in 2007, the pattern intensified in early 2009 averaging nearly $112 billion per quarter in inflows between the second quarter of 2009 and the fourth quarter of 2013 (Lavigne *et al*.2014). The monetary stimulus and the various quantitative programs launched by most central banks in developed countries have spurred capital inflows and make it more difficult for emerging market policymakers to pursue their internal stabilization objectives.

However, managing massive capital is not an easy task as they put soaring pressure and could even generate crisis. This shows that beyond positive spillover effects of massive capital inflows, they could also raise some challenges for policy makers such as their inherent volatility and the risk of a disruptive capital withdrawal from EMEs once the process of monetary policy normalization in advanced economies commences. To avoid a scenario similar to the 1997 Asia crisis, regulators and policymakers have given a special consideration to improve regulation and increase supervision to the banking sector in order to ensure its safety. In this sense, Macroprudential policies including monetary, fiscal and exchange policies and other variety of actions have been introduced to strengthen the current regulatory framework and to preserve the financial sector sound and resilient.

In this study, we aim at analyzing the dynamic relationship between financial liberalization and financial stability for a panel of 25 developing countries during the period 1986-2010. This article pays particular attention to the role of capital control since it was perceived as an effective policy tool to limit the harmful effects of sudden-stop. It also pays a specific attention to the credit boom as it is considered as an important indicator of financial stability (Borio *et al.* (2002 et 2009) Mendoza et Terrones (2008) Dell'Ariccia *et al.* (2012)).

This study is important for developed countries since bank credit has a crucial role in financing their short-term investment activity. In this case, a rule that constrains the growth in overall credit could entail a welfare cost (Agenor et al, 2013). The empirical stud utilizes a multivariate procedure by employing six variables. We employ the Toda and Yamamoto's (1995) procedure

which is a different causality testing to the commonly used methods; i.e. Granger Causality. Overall results reveal the existence of three bidirectional relationships: the first one is between financial stability and deposit to credit ratio, the second one between financial stability and capital control and the third one between financial stability and liberalization.

The remainder of the paper is organized as follows: section two describes the methodology and data, section three presents the empirical results and section four concludes.

2. Data and methodology

2.1. Data

We consider the following six variables: credit-to-GDP (FS), deposit to credit ratio (Dep), net interest margin (NIM), bank supervision (Sup), Liberalization (LiB) measured by kaopen and capital control proxied by the Quinn index (2007). The definitions of the variables as well as their sources are presented in Table 1.

Table1. Definition and sources of the variables

Variables	Definition	Source
FS	We use the Basel III credit-to-GDP gap to refer to financial stability. Credit gap is defined as the difference between the credit-to-GDP ratio and its long-term trend (Mendoza et Terrones (2008) Gournichas *et al.* (2001)). Following the Basel Committee on Banking Supervision, the long-run trend be calculated by a one-sided, or 'real-time', Hodrick-Prescott (HP) filter with a smoothing parameter of 400,000. $FS = (Credit/GDP)_{i,t} - Trend_{LT\,i,t}$	World development indicator (WDI) (2013)
Dep	Deposit to Credit ratio.	Financial Development and Structure Dataset (2013)
Sup	Indicator of banking supervision constructed by Abiad et al.(2008)	Abiad et al.(2008)
Lib.	Indicator of liberalization measured by Defacto liberalization = (stock of external assets + stock of external Liabilities / GDP.	Lane and Milesi-Ferretti (2007) updated to cover the period 1970 - 2011
Nim	Net interest margin, measured as the total interest received minus total interest paid over total interest assets.	Banckscope publishied by Global Financial

		Development Database (GFDD)(2013)
Quinn	This variable is an index constructed by Quinn to measure capital control (see Quinn, Schindler et Toyoda (2011))	IMF (2013) « External Balance Assessment». http://www.imf.org/external/np/res/eba/data.htm

The sample used includes a sample of 25 developing countries observed during the period 1986-2010. The list of these countries is presented in Table 2 below.

Table2. Credit boom

Pays	Credit boom
South Africa	-
Argentina	1989
Brazil	1989 / 1993
Chili	2008
China	2003
Columbia	-
Costa Rica	2008
Czech Republic	1993
Egypt	-
Guatemala	-
Hungary	1990 et 2008
India	2008
Indonésie	1997
Malaisie	1997
Mexico	1994
Morocco	1997
Pakistan	-
Perou	1999
Philippines	1997
Russia	1993
Sri Lanka	1995
Thaïlande	1997
Tunisia	1986
Turkey	1997 - 2010
Uruguay	2002

Source: Author

2.2. Econometric approach

2.2.1. Panel Unit root tests

The unit root tests are conducted to check for stationarty of the variables in our model. We employ the most used tests for panel data analysis; i.e. such as Levin and Chu (LLC, 2002), Im, Pesaran and Shin (IPS, 2003), ADF PP and finally Breitung (2000).

2.2.2. The Toda-Yamamoto procedure

Toda and Yamamoto employ the basic VAR by the use of a Modified Wald test for restrictions on the parameters of the VAR (*k*) model and estimates a VAR [*k*+*dmax*], where *k* is the lag order of VAR and *dmax* is the maximal order of integration for the series in the system. This method is easy to process and more relevant than the basic Granger test. The multivariate framework of our case study can be expressed as follows:

$$FS_t = \alpha_1 + \sum_{i=1}^{k+d\max} \beta_{ii} FS_{t-i} + \sum_{i=1}^{k+d\max} \beta_{1i} Dep_{t-1} + \sum_{i=1}^{k+d\max} \beta_{1i} Nim_{t-i} + \sum_{i=1}^{k+d\max} \beta_{1i} Sup_{t-i} + \sum_{i=1}^{k+d\max} \beta_{1i} Quinn_{t-i} + \sum_{i=1}^{k+d\max} \beta_{1i} Lib_{t-i} + \mu_1 \quad (1)$$

$$Lib_t = \alpha_2 + \sum_{i=1}^{k+d\max} \beta_{2i} FS_{t-i} + \sum_{i=1}^{k+d\max} \beta_{2i} Dep_{t-1} + \sum_{i=1}^{k+d\max} \beta_{2i\,1i} Nim_{t-i} + \sum_{i=1}^{k+d\max} \beta_{2i} Sup_{t-i} + \sum_{i=1}^{k+d\max} \beta_{2i} Quinn_{t-i} + \sum_{i=1}^{k+d\max} \beta_{2i} Lib_{t-i} + \mu_2 \quad (2)$$

$$Dep_t = \alpha_3 + \sum_{i=1}^{k+d\max} \beta_{3ii} FS_{t-i} + \sum_{i=1}^{k+d\max} \beta_{3i} Dep_{t-1} + \sum_{i=1}^{k+d\max} \beta_{3i} Nim_{t-i} + \sum_{i=1}^{k+d\max} \beta_{3i} Sup_{t-i} + \sum_{i=1}^{k+d\max} \beta_{3i} Quinn_{t-i} + \sum_{i=1}^{k+d\max} \beta_{3i} Lib_{t-i} + \mu_3 \quad (3)$$

$$Nim_t = \alpha_4 + \sum_{i=1}^{k+d\max} \beta_{4i} FS_{t-i} + \sum_{i=1}^{k+d\max} \beta_{4i} Dep_{t-1} + \sum_{i=1}^{k+d\max} \beta_{4i\,1i} Nim_{t-i} + \sum_{i=1}^{k+d\max} \beta_{4i} Sup_{t-i} + \sum_{i=1}^{k+d\max} \beta_{4i} Quinn_{t-i} + \sum_{i=1}^{k+d\max} \beta_{4i} Lib_{t-i} + \mu_4 \quad (4)$$

$$Sup_t = \alpha_5 + \sum_{i=1}^{k+d\max} \beta_{5i} FS_{t-i} + \sum_{i=1}^{k+d\max} \beta_{5i} Dep_{t-1} + \sum_{i=1}^{k+d\max} \beta_{5i} Nim_{t-i} + \sum_{i=1}^{k+d\max} \beta_{5i} Sup_{t-i} + \sum_{i=1}^{k+d\max} \beta_{5i} Quinn_{t-i} + \sum_{i=1}^{k+d\max} \beta_{5i} Lib_{t-i} + \mu_5 \quad (5)$$

$$Quinn_t = \alpha_6 + \sum_{i=1}^{k+d\max} \beta_{6i} FS_{t-i} + \sum_{i=1}^{k+d\max} \beta_{6i} Dep_{t-1} + \sum_{i=1}^{k+d\max} \beta_{6i\,1i} Nim_{t-i} + \sum_{i=1}^{k+d\max} \beta_{6i} Sup_{t-i} + \sum_{i=1}^{k+d\max} \beta_{6i} Quinn_{t-i} + \sum_{i=1}^{k+d\max} \beta_{6i} Lib_{t-i} + \mu_6 \quad (6)$$

According to Toda and Yamamoto (1995), the estimation procedure is performed in two steps. First, we determine the lag length (*k*) of VAR model and the maximum order of integration (*d*) of the time

series variables in the system. After the selection of optimum lag length VAR (*k*) and the order of integration *dmax*, a level VAR is estimated with a total of [*k*+*dmax*] lags. The second step requests the application the standard Wald tests on the first (*k*) VAR coefficient matrix to make Granger causal inference using a chi square (χ^2) distribution.

$$\begin{pmatrix} FS \\ Dep \\ Sup \\ LIB \\ NIM \\ Quinn \end{pmatrix} = A_0 + \sum_{i=0}^{k} A_1 \begin{pmatrix} FS_{t-i} \\ Dep_{t-i} \\ Sup_{t-1} \\ LIB_{t-i} \\ NIM_{t-1} \\ Quinn_{t-1} \end{pmatrix} + \sum_{i=1}^{d\max} A_2 \begin{pmatrix} FS_{t-i} \\ Dep_{t-i} \\ Sup_{t-1} \\ LIB_{t-i} \\ NIM_{t-1} \\ Quinn_{t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{FS} \\ \varepsilon_{Dep} \\ \varepsilon_{Sup} \\ \varepsilon_{LIb} \\ \varepsilon_{NIM} \\ \varepsilon_{Quinn} \end{pmatrix} \quad (7)$$

Where FS is Financial Stability indicator measured by credit-to-GDP (FS), Dep is deposit to credit ratio NIM is net interest margin, Sup is bank supervision, LIB is an index of Liberalization measured by kaopen and Quinn is a measure of capital control proxied by the Quinn index (2007).

From Eq. (7) we can test the hypothesis that Deposit to credit ratio does not Granger cause Financial Stability (FS) in the following hypothesis: $H_0 = a_{12}^1 = 0$, where a_{12}^1 is the coefficient of Deposit to credit ratio variable in the first line of the matrix displayed in Eq. (7). Additionally, we can test the opposite non-causality from Financial Stability (FS) to Deposit to credit ratio in the following hypothesis: $H_0 = a_{21}^1 = 0$, where a_{21}^1 is the coefficient of deposit (Dep) variable in the second line of the matrix presented in Eq. (7).We can test the other hypotheses in a same manner.

3. Empirical results

3.1. Panel Unit root tests

To check for the stationarity of the variables, we conduct the Levin and Chu test, (LLC, 2002), the Im, Pesaran and Shin (IPS, 2003)) test, the Fisher-Type test by ADF and PP-test and finally Breitung (2000) test. The results are presented in Table 2. They show that the test statistics for the log levels of FS, Dep, Sup, Lib, NIM and Quinn, are statistically insignificant. When we apply the panel unit root

tests to the first difference of the six variables, all five tests reject the joint null hypothesis for each variable at the 1 per cent level. The stationary property of the difference series is thus suitable for further statistical analysis with the Granger no-causality test. Therefore, from all of the tests, the panel unit roots tests indicate that each variable is integrated of order one.

Table 3: Panel Unit Root Tests

	LLC		IPS		ADF		PP		BR	
	Level	1st	Level	1st	Level	1st	Level	1st	Level	1st
FS	-5.193	-14.187***	-8.766	-14.469***	173.620	286.283***	158.737	623.440***	0.120	-5.706***
Dep	-2.031	-8.216***	-0.641	-8.896***	47.176	176.443***	45.388	318.278***	-0.677	-4.554***
Sup	0.726	-3.392***	3.966	-4.151***	13.222	44.3067***	17.7252	99.951***	-2.408	-7.255***
Lib.	-1.415	-5.101***	0.351	-8.385***	41.885	164.470***	54.494	324.428***	-0.729	-4.652***
Nim	-5.240	-7.766***	-3.771	-6.573***	94.042	152.604***	106.037	302.338***	-3.159	-7.278***
Quinn	1.976	-8.359***	1.2528	-7.46242***	24.1968	115.219***	88.6742	682.390***	0.05988	-5.56350***

Note: (.) represent p-values.
*** Denote the rejection of the null hypothesis at 1% level of significance

Before proceeding with the Toda and Yamamoto (1995) procedures we need to determine the order of integration of the series (*dmax*) and the optimal lag length k, in order to avoid spurious causality or spurious absence of causality (Clark and Mirza, 2006).

The result of selecting optimal lag length of VAR indicates that lag order of VAR (k) is 2, for multivariate VAR. Now, after, determining the optimal lag length, the next step is to augment the VAR by the maximum order of integration of the series (*dmax*) and then performing the non-Granger causality test.

3.2. The Granger non-causality tests

We performed the Toda and Yamamato (1995) procedure to examine the direction of causality. The results of these tests are presented in Table 4.

Table 4: Results of the TY estimation

		FS	DEP.	NIM	Sup	Lib	Quinn
FS	*Chi-sq*	-	15.204	7.565	29.754	14.269	8.546
	Prob.	-	0.0000***	0.0228	0.0000***	0.0008***	0.0146**
DEP.	*Chi-sq*	24.317	-	4.619	3.780	16.411	0.9517
	Prob.	0.0000***	-	0.0993*	0.101*	0.0003***	0.6213
NIM	*Chi-sq*	4.873	12.9148	-	27.906	20.859	85.283
	Prob.	0.0874*	0.0016**	-	0.0000***	0.0000***	0.0000***
Sup	*Chi-sq*	1.707	6.548	3.667	-	10.142	2.365
	Prob.	0.425	0.0378**	0.100*	-	0.0063***	0.3064
Lib	*Chi-sq*	18.362	20.5857	5.8925	0.3408	-	6.048
	Prob.	0.0001***	0.7461	0.4525	0.8433	-	0.0486**
Quinn	*Chi-sq*	6.482	2.769	4.326	0.715	5.556	-
	Prob.	0.0391**	0.250	0.100*	0.699	0.0622*	-

Note: ***, ** and *, denote significant levels at 1%, 5% and 10% respectively for rejecting the hypothesis of no-Granger causality.

We can draw some interesting conclusions from the table above which could be summarized as follows.

First; in the financial stability (FS) equation, all the variables except net interest margin (NIM) act positively and significantly at 1% level of significance to financial stability. Therefore we can confirm the existence of unidirectional causality running from all the variables except NIM to FS. This exception could be explained by the fact that banks desire to have a large net interest margin and a high volume of credits. However in a competitive environment, interest rates are generally low and hence NIM is also low. To compensate, banks start exercising high risky activities and this could certainly threat the financial stability. However, in developing countries it is possible to see a system with a high interest margin and a high volume of credits. In our case study for developing countries, NIM does not have any significance on financial stability as the level of competition is very low and this could explain why financial sector is underdeveloped.

The second conclusion to be drawn from Table 3 is the existence of a bidirectional relationship between financial stability (FS) and deposit to credit ratio (Dep). This ratio measures the stable resources held at banks (core funding) used to allocate credit. Generally speaking, a weak ratio reveals a lack of liquidity (Shin and Shin (2011), Hahm *et al.* (2013)). However, the higher the ratio

is the lower banks are exposed to liquidity risk and the higher the financial sector is stable. Similarly, we can argue that in a stable financial sector, deposit to credit ratio is always high.

Another important conclusion is the existence of a bidirectional relationship between financial stability (FS) and liberalization (Lib). In fact, following the liberalization of the financial sector to international investors, a country can experience a movement of capital flows which in turn could influence the credit activities (Calderon and Kubota (2012); Caballero (2012)). In this sense, the effects could be positive or negative. In the literature, this relationship provides until today conflicting results. In fact, while some other have shown the positive impact of liberalization on the stability of the financial sector (Mc Kinnon (1973) and Shaw (1973), Goldberg (2004), Mishkin (2006)) some other authors showed that financial liberalization exerted harmful effects on the banking structure (Carlos Diaz Alejandro (1985), Demirguç-Kunt and Detragiache (1998)). They affirm that the opening of the financial sector to aboard amplified financial instability and increased the number of bankruptcies. At this level, Demirguç-Kunt and Detragiache (1998), Fisher and Chenard (1997), highlighted the existence of a relation between financial liberalization and banking fragility.

The output of the Toda and Yamamoto (1995) reveal the existence of a unidirectional relationship running from Liberalization to NIM. This result is not surprising as the opening of the financial sector will accelerate the competition between financial institutions (banks and non-banks) and will lead to the decrease of the lending interest rates and revenues which will in turn will decrease the NIM (Calderon and Kubota (2009)).

The results also show a unidirectional causal relationship running from supervision to deposit. This show the role of banking supervision in monitoring banks and banking activities and its role to keep the financial sector safe and resilient. Finally, Table 6 reveals the existence of bidirectional causality between financial stability and capital control proxied by Quinn index. In fact, liberalization and high competition have stimulated risk appetite and spur the search for yield. In this situation an effective prudential supervision by bank regulators and a good expertise in screening and monitoring borrowers would ultimately reduce the risk related to massive capital inflows and would provider better control to credit activities.

4. Conclusion

In this research paper, we aim investigated the dynamic relationship between financial liberalization and financial stability for a panel of 25 developing countries during the period 1986-2010. We precisely concentrated our attention on the role of capital control as a new Macroprudential policy tool. In this paper, financial stability was proxied by credit boom. In fact, following the period of massive capital inflows into developing countries, availability of funds were followed by boom of credits provided by banks and financial institutions. In this situation, a withdrawal of foreign funds could generate a liquidity and credit crises. To curb with this scenario, policy makers and regulators have introduced new policy tools to keep the financial sector sound. Our empirical analysis shows several important conclusions among them we found the existence of a bidirectional relationship between financial stability (FS) and deposit to credit ratio (Dep.) and a bidirectional relationship between financial stability (FS) and liberalization (Lib). We also found bidirectional causality between financial stability and capital control proxied by Quinn index. These results could be of great interest for policymakers and regulators of emerging market economies and developing countries as well to develop their financial sector and improve their regulatory framework by taking further steps to limit the spillover effects of capital flow volatility and an expected withdrawal of foreign funds.

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