Monetary policy, excessive risk-taking and banking crisis

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Abstract

This paper examines the relationship between monetary policy and banks excessive risk-taking and banking crisis. We use a panel of data consisting of 22 Latin American countries, the OECD and South-East Asia, which experienced banking crises between 1990 and 2013. Our empirical results show that the adoption of an expansionary monetary policy via an increase in the money supply and the application of low interest rates over an extended period of time may induce an increase in banks risk-taking. However, a restrictive monetary policy with high interest rates increases the risk of banking crisis.
Keywords: Monetary policy, Bank risk, Panel co-integration test
JEL Classification:E44, E51, E52, G21

1 Introduction

The 2008 financial crisis showed the real fragility of development country financial systems that was said to be the most advanced in the world, the failure and collapse of international financial markets has resulted in them destructive effects on the real economy in the world. The rapid expansion of credit and the collapse of a series of asset bubbles in the real estate markets that have duelled on one hand the flame of the crisis causing disruptions in the global credit markets and also undermined the global economic stability.

Policy makers and researchers have questioned the real causes of the crisis, trying to explain the creative forces of the fragility of the global financial system. There seems to be a consensus on the possible causes of the crisis, such as the failure of regulation and control, the development of instruments for complex credit markets and poor governance practices. On the other hand, central banks are also blamed for their frequent adoptions too accommodative monetary policies, which have fuelled a lively debate among economists. The argument is that a prolonged period of low interest rates and lax liquidity conditions encourage financial institutions to take more risks. Proponents of this view argue that monetary policy is an important driving force in the emergence of the financial crisis. This statement is even more controversial because many central banks lowered interest rates in response to the crisis in an attempt to overcome the recession.

In light of these developments, the debate on the relationship between monetary policy and financial stability has been intensified. During the pre-crisis, central banks do not take into account most of the time the aspect of financial stability, as conventional wisdom for the practice of monetary policy was only to maintain price stability. Ensuring price stability is advanced as the best contribution by central banks to improve economic progress, while macro-prudential tools are supported by regulatory authorities and monitoring. However, recent crises have demonstrated that the actions of monetary policy can affect the stability of banks and can influence their behaviour and make them immune to risks.

However, a development in technology transfer credit native of financial innovation has often been seen as contributing to financial stability. Certainly the financial changes and new financial instruments have contributed to the improved profitability, but they forced banks to take more risk. Such risk is mainly due to changes in the behaviour of banks after the wave of financial liberalization in the 70s. First, the resulting

competition from deregulation of the banking system would erode the franchise value of the bank and encourage them to pursue riskier policies in an attempt to maintain its former earnings. Then, increased risk transfer through securitization that banks typically use on one hand to diversify and to reduce concentration of credit risk and also as a source of alternative funding. But after the subprime crisis of 2007, a general reassessment of risk associated with structured financial instruments is observed throughout the financial community.

On this view, we consider monetary policy to lower the real interest rate, thirst for profitability and increasing competition in financial markets are strong factors responsible for the behavioural change banks opting for decision risk making them more vulnerable to the occurrence of a banking crisis. Thus, this chapter will initially study the effect of monetary policy and speculative behaviour by banks on their excessive risk-taking and in a second test the effect of this excessive risk taking the occurrence of a banking crisis.

2 Related Literatures

Several authors such as [Fisher, 1933] , [Hayek, 1937] and Kindleberger (1978) previously emphasized that accommodative monetary conditions are a classic ingredient of changes in financial and economic activities between growth and recession. Indeed, low interest rates could induce a financial imbalance by lower aversion of banks and other investors to risk. This part of the monetary transmission mechanism was recently listed as the first of the three channels of risk-taking, which refers to how the exchange rate in monetary policy affect, the perception or risk tolerance (Borio and Zhu, 2008).Similarly, vein, [Adrian and Shin, 2010] argue that the continued weakness of the low rates imply a steep yield curve for some time, a higher net interest margin in the future, and thus a greater capacity of risk-taking in the banking sector.

The second mechanism involves a search for more performance with low nominal interest rates; prompting asset managers of banks to take more risks ([Rajan, 2005]).Low interest rates can increase incentives pushing asset managers to take more risk for a number of factors. Some are psychological or behavioural in-kind such as the so-called money illusion: investors may ignore the fact that nominal interest rates can refuse to compensate for inflation. Others may reflect institutional or regulatory constraints. For example, life insurance and pension funds typically manage their assets with reference to their companies' liability. In some countries, the commitments are linked to a guaranteed minimum nominal rate of return or yields reflect actuarial assumptions in the long term rather than the current level of yields.

In general, when interest rates are low for an extended period of time, banks to deal with a reduction in the margin between the debtor and the deposit rate are encouraged to move to riskier assets with higher expected returns. From then on, more or less similar mechanism could be set up in executive compensation and bank managers who would be directly related to their yields. Lower yields on safe assets such as bonds with high ratings issued by government involve lower compensation for managers who want to play safe, and vice versa. More broadly, the link between low interest rates and excessive risk-taking is also influenced by competition, the structure of the systems management bonuses and gaps in surveillance and regulation.

The third mechanism is that monetary policy could also affect risk-taking through how the central bank will respond to adverse shocks. The commitment, for example, a central bank for the lowest future interest rates in the case of a threatening shock, reduces the likelihood of incurring large downside risks, which encourages banks to take on more risk (transparency effect). This is a typical problem of moral hazard. It should be stressed here that this effect operates through the expected interest rate rather than the current low rates themselves. For this, the magnitude of this effect, however, depends on the current level of the policy rate. Moreover, [De Nicolò et al., 2010] explain that the reduction in interest rates provided tend to correspond to a position of higher risk when there is more room for monetary expansion, ie when current rates are high.

In the same vein [Altunbas et al., 2010] explain that risk-taking can also be influenced by the level of economic activity. Indeed, during economic expansion, agents become less risk averse because of the anticipation of higher profits from their investments. Therefore, monetary easing could, stimulating real economic activity, so that asset managers are encouraged to take up positions at high risk.

Several empirical studies have attempted to verify the existence of a relationship between the decline

in interest rates and the risk-taking behaviour of banks and to highlight the key features. Generally, these empirical studies have focused on the impact of changes in monetary policies mainly through lower interest rates on excessive risk-taking by banks. While the act of taking more risk is often linked to banks behaviour change. Indeed, new financial tools have facilitated the transfer of bank behaviour such as securitization activity for the banks to get rid of bad loans, a practice that is more cost effective than traditional intermediation activity. While these tools improve bank profitability but a sudden reversal or speculative attack will inevitably lead to a banking crisis.

3 Data and methodology

The data used in this study were extracted from the database of the World Bank (2013) and the database of Demirgüç-Kunt and Levine (2012).Our panel consists of 22 Latin American countries, the OECD and South East Asia and that experienced banking crises between 1990 and 2013: Argentina, Colombia, France, Germany, Greece, Indonesia, Ireland, Italy, Japan, Korea, Sweden, Malaysia, Mexico, Philippines, Poland, Portugal, Spain, Thailand, Tunisia, Turkey, United Kingdom, United States of America and Uruguay.

To measure risk-taking banks three variables are to be involved; the ratio of non-performing loans (NPL), the index of banking stability (Zscore) and the ratio of provisions for doubtful debts (Provnpl). Indeed, the NPL ratio gives an indication of the quality of assets in terms of the potential for adverse exposure to earnings and market values of equity due to worsening loan quality. Generally, non-performing loans allow to reflect the level of portfolio risk loans or loans from a bank and the highest levels of this report suggest a portfolio of riskier loans as part of the non-performing loans would likely result in losses for the bank ([Delis and Kouretas, 2011]).The second proposed by [Roy, 1952] and measure used by [Goyeau and Tarazi, 1992] , [Boyd, 2006] , [Laeven and Levine, 2009], indicates the separation distance of insolvency. Thus, a higher value of Zscore indicates a low risk of default. Mathematically, Zscore can be written as follows:

$$\text{Zscore}_i = \frac{ROA_i + \frac{E}{TA_i}}{\sigma(ROA_i)} \tag{1}$$

Where $\text{ROA}_i$the return on assets of banks, $\frac{E}{TA_i}$ the equity ratio and $\sigma(ROA_i)$ represents the standard deviation of asset returns. Moreover, Zscore ratio represents the probability of a negative shock on profits that push banks to fail.Indeed, when Zscore increases with higher profitability and market capitalization, it decreases with an unstable income captured by the difference in return on assets. Therefore, a higher value of Zscore involves a high level of bank stability and therefore less risk.

We chose as a third measure of risk variable in provisions for doubtful debts (Provnpl).The latter is often called upon as a barometer of bank health. Generally banks make provisions to dodge against the possible risk of party and non-repayment of loans. Thus, the increase in provisions is often synonymous with rising risk. Indeed, the application of a restrictive monetary policy to decrease the volume of money in circulation, increases interest rates, reduces reserves and bank deposits which lead to a deterioration in loan quality and a significant rise in provisions. To explain the excessive risk-taking by banks we retain 6 variables for the various macroeconomic and monetary dimensions of banks. They represent the different measurement indicators of excessive risk-taking by banks, and they are grouped in the following table 1 and their expected signs:

Table 1 – Banks Excessive Risk-Taking Indicators

Variables	sign	Interpretation
GDP	(+/-)	(+) A good economic condition means profitable investment and therefore a lower risk (-) Also provied good economic incentives for banks to seek more profits and thus expose themeselves to more risk.
INF	(+/-)	(+) The increase in inflation results in rising costs of spending local businesses and therefore increases the probability of their insolvencies. (-) The decline in inflation worsens the liquidity and thus increases bank insolvency.
TIR	(+/-)	(-) Low interest rates could lead to a financial imbalance by decline in aversion of banks and other investors to the risks (+) High interest rates attract riskier investors
M2R	(+)	An increase in the money supply relative to foreign exchange reserves increases countries'vulnerability to sudden capital outflows and which leads to a rapid collapse of the exchange rate.
Cap	(-)	A decline in the market capitalization increases bank risk

In this study we adopt a conditional empirical strategy to choose the most appropriate estimation method. The choice rule responds to what the variables of our models are co-integrated or not. If there is at least one variable co-integrated then the least squares method modified (FMOLS) is used to model the panel co-integrated and if the method of system GMM estimators in dynamic panel of[Arellano and Bover, 1995] is applied and [Blundell and Bond, 1998].

The GMM-System method allows us to face a number of challenges identification and, therefore, it is the appropriate estimation method for several reasons.

We choose to estimate a dynamic empirical model in which we introduce the lagged dependent variable with the explanatory variables that explains the persistence and the dynamic nature of risk. In addition, the interest rate is considered endogenous in the bank risk equations. In other words, the direction of causality between monetary policy and bank risk is not clear, and therefore, it is necessary to control for reverse causality as a particular form of endogeneity. Moreover, some of the control variables are not strictly exogenous. The endogeneity between risk and the specific characteristics of banks, which are explanatory variables in our model, is another identification problem. In this context, the GMM estimator proposed by [Arellano and Bover, 1995] and [Blundell and Bond, 2000] is the preferred method because it incorporates both the persistence of the risk and the potential endogeneity of the specific characteristics of the bank using appropriate instruments, represented by their respective lags.

This estimator ensures efficiency and consistency provided that the dynamic regression model is not subject to autocorrelation of second order, and that the instruments used are valid. For this we use the tests of autocorrelation of first and second order AR (1) and AR (2). Indeed, we would expect the presence of a first-order autocorrelation in the first differentiated residuals. The p-value of AR (2) must largely accept the null hypothesis of no serial correlation of order two in the first-difference errors. Because higher-order autocorrelation would imply that lags of the dependent variable are not really endogenous and so bad instruments. In addition, the validity of the instruments is verified using Sargan test of over-identifying restrictions. Our model is written as follows:

$$y_{it}=\alpha y_{it-1}+\beta X_{it}+\eta_i+\epsilon_{it} \tag{2}$$

Where y_{it} respectively for each model, represents the non-performing loans (NPL), the indicator of bank stability (Zscore) and the provision made for doubtful debts (Provnpl). X_{it} is the matrix of control variables, η_i is the individual specific effect and ϵ_{it} the error term.

Otherwise, a regression involving levels of integration of order 1 I (1) variables estimated using ordinary least squares (OLS), can produce false results. In particular, the presence of an integration I (1) variables may cause spurious regression. However, it is well known that if the series are co-integrated, the static MCO, converge at a faster rate than is standard ([Hamilton, 1994]). The fully modified OLS method (FMOLS), allows us to find out the long-term relationship between the variables in the estimated model. This estimation method was proposed by [Phillips and Hansen, 1990] and extended by [Phillips, 1995]. It is a

semi-parametric procedure to estimate parameters of a co-integrating relationship which allows us to correct the long-term endogeneity. This technique uses kernel estimators of nuisance parameters that affect the asymptotic distribution of OLS. To achieve asymptotic efficiency, this technique modifies the least squares method taking into accounts the effects of correlation of test series and the endogenous explanatory variables resulting from the existence of a co-integration relationship.

[Phillips and Hansen, 1990] show that the FMOLS estimator works well even with small samples when we intend to make inferences of co-integrated system. FMOLS allows us to contribute to the empirical literature on the estimation of a co-integrated panel model with non-stationary variables. With FMOLS method we can estimate a multivariate model that identifies the main determinants of bank risk-taking and its variation over time.

Before estimating our models, it is necessary to check the stationarity of the series in the panel and the lack of co-integrating relationship between them.

To check the stationarity of series we asked the panel test by [Levin et al., 2002] and [Im et al., 2003] according to which the null hypothesis means the presence of a unit root and thus non-stationarity of the series. In addition, the feature of both tests lies in the fact that the first ([Levin et al., 2002]) allows the presence of individual effects and specific heterogeneity between individuals, while the second ([Im et al., 2003]) allows the possibility of a heterogeneity in the very presence of a unit root in the panel. Test results are provided by the following table 2:

Table 2 – Panel unit root test in level

Variables	Levin,Lin et Chu		Im,Pesaran et Shin	
	Statistics	P-value	Statistics	P-value
NPL	-6.21049	0.0000	-2.12234	0.0169
GPIB	-9.35229	0.0000	-8.58800	0.0000
INF	-183.310	0.0000	-87.9998	0.0000
TIR	-1.42433	0.0772	-1.33671	0.0907
m2r	-17.0940	0.0000	-22.1136	0.0000
CAP	-9.94980	0.0000	-3.51186	0.0002
zscore	-0.87092	0.1919	-0.74039	0.2295
Provnpl	-3.77521	0.0001	-3.62873	0.0001

The null hypothesis of the presence of a unit root could not be rejected for TIR level and Zscore series. In order to make these stationary series we have differentiated the first order and the results are provided in the following table 3:

Table 3 – Panel unit root test (first difference)

Variables	Levin, Lin et Chu		Im, Pesaran et Shin	
	Statistics	P-value	Statistics	P-value
TIR	-27.0216	0.0000	-23.2066	0.0000
zscore	-9.55112	0.0000	-8.09777	0.0000

After an initial differentiation, the variables are stationary in first differences "I (1),"which suggests the existence of a co-integration relationship. To test the existence of co-integration relationship between the variables in our three models we applied the test proposed by [Pedroni, 1997] [Pedroni, 1998] [Pedroni, 2001] that the null hypothesis means the absence of co-integration.

Table 4 – Pedroni cointegration test

Moddel	PP		ADF	
	Stat. Panel	Stat. Groupe	Stat. Panel	Stat. Groupe
NPL	−0.985223 (0.1623)	0.585561 (0.7209)	−1.015572 (0.1549)	−0.369783 (0.3558)
Zscore	−2.217880 (0.0133)	−4.394762 (0.0000)	−2.699923 (0.0035)	−4.600342 (0.0000)
ProvNpl	1.896614 (0.9711)	0.432692 (0.6674)	1.752641 (0.9602)	−0.526751 (0.2992)

This table 4 shows that the test [Pedroni, 1997] [Pedroni, 1998] [Pedroni, 2001] accepts the null hypothesis of no co-integrating relationship between the NPL and ProvNpl models and their explanatory variables. Furthermore, the test rejects the null hypothesis of absence of co-integration relationship between the variables of Zscore's model. Thereafter, we can say that there is a long-term relationship between banking stability and the regressors.

In the next section, we will proceed with the presentation and interpretation of the results of our empirical analysis.

4 Results and discussion

The estimation results of the three models are shown in the following table 5:

Table 5 – Estimation results

Model	MR= NPL $[GMM]$	MR=$ProvNpl$ $[GMM]$	MR= $Zscore$ $[FMOLS]$
	t-Statistic	t-Statistic	t-Statistic
MR_{t-1}	$84.77200^{(***)}$ (0.0000)	$1.01E+11^{(***)}$ (0.0000)	-
GPIB	$-3.954368^{(***)}$ (0.0001)	$-3.684187^{(***)}$ (0.0003)	$5.593271^{(***)}$ (0.0000)
CAP	$-3.669624^{(***)}$ (0.0003)	$4.225457^{(***)}$ (0.0000)	$2.686414^{(**)}$ (0.0075)
INF	$4.216202^{(***)}$ (0.0000)	$4.066478^{(***)}$ (0.0001)	−0.250905 (0.8020)
TIR	$-2.968566^{(**)}$ (0.0032)	$-3.193535^{(**)}$ (0.0015)	0.608066 (0.5435)
M2R	$-3.134413^{(**)}$ (0.0018)	$-3.096506^{(**)}$ (0.0021)	$3.218823^{(**)}$ (0.0014)

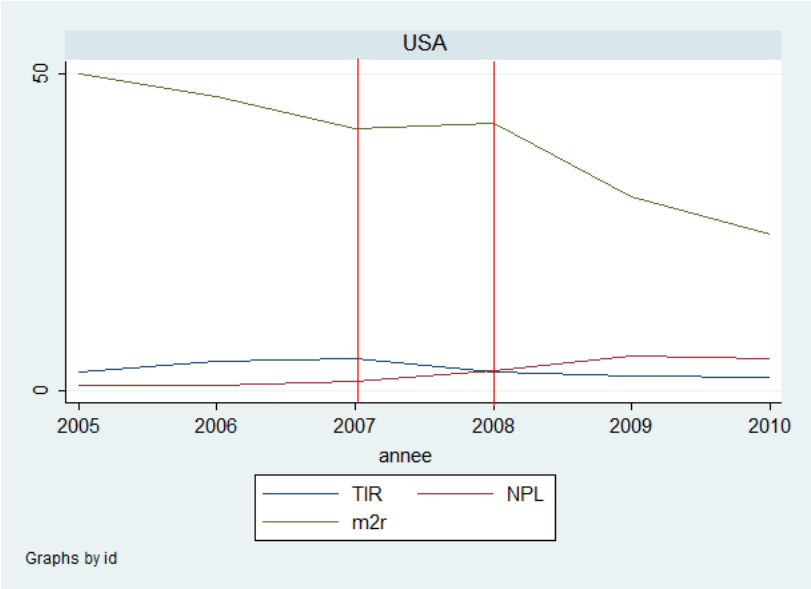
Signif. codes: 0 (***) 0.001 (**) 0.01 (*) 0.05 (.) 0.1 ( ) 1

The estimation results on the first model Mnpl shows that all variables are statistically significant with a negative sign to an exception made for inflation (INF) which shows a positive sign. In fact, the stance of monetary policy measured by the change in the real rate internet giving a negative significance at 5%, suggesting that the decline in the rate negatively impacts the quality of the loan portfolio and therefore the financial banks strength. In other words, the bank risk-taking increases when the real interest rate decreases. This is consistent with the findings of previous empirical literature ([Rajan, 2005]) that decreases in long-term interest rates encourage asset managers to take more risk for more return. As indicated in[Altunbas et al., 2010] , the decline in the quality of the loan portfolio is probably enhanced by the reduction in funding costs of banks' liquidity due to lower short-term rates of interest ([Diamond and Rajan, 2009], [Adrian and Shin, 2010]).

Moreover, the variable money supply relative to reserves is statistically significant at 5% with a negative sign for both models Mnpl, MprovNpl and positive for Mzscore. This means that an expansionary monetary policy increases the money supply, induces long-term reduced risk and the provision of risk and promotes banking stability. This can be explained by the fact that an increase in the money supply favouring lower

interest rates attract risk-averse investors and stabilize the performance of bank loans. Moreover, households and investors with risky projects rather have preference to higher interest rates since they think they will win if their investments will pay off. But the opposite can occur when low rates are charged on mortgages that attract the lowest power repayment household wishing to acquire a home. This is the case of the mortgage crisis of 2008 in the United States shown in the following figure 1.

Figure 1 – Monetary Expansion, Interest Rate Reduction and Increased risk Mbpl



On the other hand, the variable inflation is statistically significant at 1% with a positive sign indicating that an increase in inflation increases the risk Mnpl and MprovNpl. Indeed, growth in the money supply leads to a rise in the levels of expected prices and consequently an increase in inflation which adversely affects the ability of borrowers to repay their debts because of their increased spending cost. Figure 2 reflects the behaviour of the variable inflation (INF), the real interest rate (TIR) and the relative risk Mnpl, shows that during the year 2007-2008 along with believes the risk of inflation and inversely with the TIR rates.

Figure 2 – Inflation, Interest Rate Reduction and Increased risk Mnpl

Regarding the impact of macroeconomic variables, GDP growth is significantly negative at 1%, as shown in the first column of Table 2.6, which implies that the probability of default is negatively correlated with the growth rate GDP. Good economic condition is always associated with an increased number of projects that can pay off in terms beings, which in turn leads to a reduction in the overall bank credit risk ([Kashyap and Stein, 1994], [Altunbas et al., 2010]). In addition, borrowers earn more and, therefore, their ability to repay their loans would be higher in periods of rapid economic growth. This result is consistent with the findings of[Gambacorta, 2009] , [Altunbas et al., 2010], while it is the opposite of [Delis and Kouretas, 2011] who demonstrate a positive relationship between the economic growth (GDP) and risk in the European banking sector. One possible interpretation of this positive relationship is that in times of good macroeconomic conditions, banks looking for high returns tend to give more credit and soften their control standards. Contrariwise, and as shown in our results this is not the case of the banking systems of our study.

The bank capitalization variable is statistically significant at 1% with a negative sign, meaning that well-capitalized banks give fewer non-performing loans and thus a relatively low level of risk. The negative impact of capital on bank risk suggests that banks with strong capital and equity ratio compared to higher assets are less exposed to the risk of moral hazard and tend to behave more cautiously. Banks use this capital as a buffer to offset the risk of possible losses on risky assets. On the other hand, regulators and markets do not encourage riskier banks to accumulate capital ([Altunbas et al., 2012]), that is to say, they do not have to compensate for the risk by higher levels of capitalization. In addition, our result is in line with the hypothesis of moral hazard, which suggests that when the level of bank capital is low, bank managers have more incentives to take excessive risks arising from the existence of problems agency agreement between bank managers and shareholders. Thereafter, we can say that banks with higher capital levels tend to have a better loan portfolio quality and therefore enjoy lower credit risk.

5 Conclusion

In this study we tested the effect of monetary policy and speculative behavior of banks as factors of risk-taking on the probability of a banking crisis. The results show that in a favorable economic situation with a restrictive monetary policy when interest rates are high, the risk of a banking crisis increases. It turned out that banks in a phase of economic expansion are more lax in terms of credit supply, which increases the volume of bad loans. In addition, some monetary authorities, adopting high interest rates as a laborer to counteract the credit boom, fall into adverse selection and attract more and more risk borrowers. This reversal rate also aggravates the situation of former borrowers since they will therefore pay more and so some are insolvent, making banks more vulnerable and exposed to the risk of bankruptcy.

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