IV. Special Topics

IV.1 Macroprudential Policy and Bank Risk Taking

Summary

This special topic examines the effect of macroprudential policies on bank risk taking using bank level data from advanced and emerging market economies. There are three main findings: First, there is evidence suggesting that macroprudential tools have a significant impact on bank risk. Second, the responses to changes in macroprudential tools differ among banks, depending on their specific balance sheet characteristics. In particular, banks that are small, low capitalized and with a higher share of wholesale funding react more to changes in macroprudential tools. Third, macroprudential policies seem more effective in a tightening than an easing.

IV.1.1 Introduction

Prior to the global financial crisis financial stability was mainly considered from a microprudential perspective. The aim of supervisory policy was to reduce the risk that individual institutions would fail, without explicit regard for their impact on the system as a whole or on the overall economy. Lehman's default has showed us that financial stability has a macroprudential or systemic dimension. Therefore, current financial stability is considered with a macroprudential perspective.

However, the implementation of the new framework for financial stability raises a number of challenges. A first challenge is the evaluation of the effectiveness of macroprudential policies, especially when more than one tool is activated. Moreover, effectiveness should be analyzed with respect to the specific goal that macroprudential policies are designed to achieve. For instance, increasing the resilience of the financial system or taming financial booms and busts are among the first.

At the moment, most research focuses on analyzing the impact of macroprudential tools on bank lending while their impact on bank risk taking is being ignored.

A second challenge pertains to the varied nature of macroprudential objectives and instruments. Which tools to use, how to calibrate them, and when to deploy them will all depend on how the authorities view the vulnerabilities involved and how confident they are in their analysis. In this context, the legal and institutional setup will also be relevant. A given instrument's effects depend on a variety of factors, which have to be assessed against the chosen objective. Therefore, some instruments may work better to achieve the narrow aim of increasing financial system resilience rather than the broader aim of constraining the cycle.

Third, most of the macroprudential policies aim at containing systemic risk. Policymakers aim at limiting bank risk taking and the probability of the occurrence of a financial crisis by setting macroprudential tools. This means that we should more interested in macropruential policies' impact on a bank's contribution to systemic risk. Although some concepts have been developed (CoVaR, stress testing, and Shapley value measures), the measurement of systemic risk is still rudimentary. A compromise could be to evaluate how macroprudential tools impact on specific measures of bank risk, such as the expected default frequency (EDF) or the Z-score.

Analysis in this special feature complements other studies on the effectiveness of macroprudential policies. It basically analyses the effectiveness of macroprudential policies on bank risk using a large sample of banks and countries. In the run-up to the crisis, the macroprudential policies were generally ignored while emerging market economies have generally been more aware of the need to think about the financial system as a whole and to intervene in response to evidence of a build-up of risks (Chart IV.1.1). Therefore, data from a large number of banks operating in both advanced and emerging countries is used to control for different institutional setup affecting the risk-taking channel.

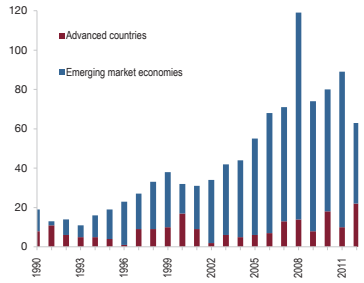
IV.1.2 Model and Data

The baseline empirical model is given by the following equation, adapted from Altunbas et al (2014):

$$(1)\ \Delta EDF_{i,k,t} = \alpha \Delta EDF_{i,k,t-1} + \beta \Delta EDF\_NF_{k,t} + \gamma MP_{k,t} + \psi MC_{k,t} + \lambda BSC_{i,k,t-1} + \varepsilon_{i,k,t}$$

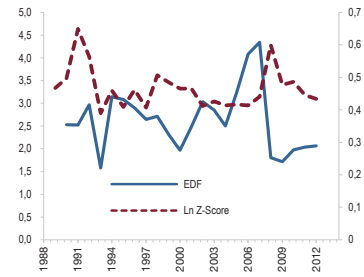
where with i=1,..., N , k= 1, ...,K and t=1, ..., T, where i is the number of banks, k is the country and t is time. Table 1 reports the summary statistics for the variables.

Chart IV.1.1
Number of Macroprudential Measures



Source: Authors' calcualtion, Lim et al. (2013), Kuttner and Shim (2013).

Chart IV.1.2
Cross-sectional Dispersion of Bank Risk Measures



Source: Authors' calculations.
Note: The series show the coefficient of variation of banks' expected default frequency (left hand scale) and the Z-score (right hand scale) in each year.

In the baseline equation (1), the annual change of the Expected Default Frequency (ΔEDF) for bank i, headquartered in country k, in quarter t, is regressed on its own lag and the EDF change for the non-financial sector in country k (ΔEDF_NF). This variable aims at filtering out the effects of changes in the market price of risk due to the business cycle. MP indicates the change in the macroprudential tools, which could be change in an aggregate index, as in Cerutti et al. (2015), or a complete vector of macroprudential tools. MC and BSC respectively represent additional macro variables and bank-specific characteristics.

The dependent variable EDF in the baseline model represents the probability that a bank will default within a given time horizon. EDF is a forward-looking indicator of risk, computed by Moody's KMV and based on Merton's model to price corporate bond debt. The EDF value is calculated by combining banks' financial statements with stock market information and Moody's proprietary default database. As a robustness test, the Z-score is used as an alternative measure of bank risk. Chart IV.1.2 shows the cross-sectional dispersion of banks' EDFs and Z-scores. It indicates that there were already significant differences in bank risk at the cross-sectional level prior to the crisis. Interestingly the cross-sectional dispersion of the Z-score is also very high in correspondence of the early 1990s' recession and associated banking crisis.

Macroprudential indicators, on the other hand, have been constructed with a few steps. First, an aggregate index is constructed to evaluate the overall effectiveness of macroprudential tools when multiple measures are activated at the same time. The index takes the value of +1 if a given

macroprudential tool has been tightened and -1 if it has been eased, leaving zero elsewhere. For the baseline analysis, the indicator is constructed using equal weights for each tool in the data set.

Second, it is considered that different macroprudential (MaP) tools could have different effects on bank risk. In particular, MaPs are classified into five categories: a) capital based instruments; b) liquidity based instruments; c) asset side instruments; d) reserve requirements; e) currency requirements. For further details on each category and data, see Altunbas, Binici and Gambacorta (2016).

Finally, changes in macroprudential tools are classified in easing and tightening cases. With such dissaggregation, the asymmetric effects of each tool can be examined. This specification also enables a comparision of current results against the existing literature. Cerutti et al (2015), for instance, find some evidence of the asymmetric impact of macroprudential policies, claiming that those policies seem more effective when credit growth rates are very high, but have a less positive impact in periods of bust.

In order to disentangle loan supply and loan demand factors, the bank lending channel literature has focused on cross-sectional differences across banks. According to this approach bank-specific characteristics (for example bank size, liquidity, capitalization, funding composition) only influence loan supply movements while a loan demand is largely independent of these factors.

Table IV.1.1

Summary Statistics

Variable	Number of Obs.	Median	Std. Dev.	Min.	Max.	Source
ΔEDF	20870	-0.003	2.094	-32.275	29.65	Moody's KMV
Z-score	20870	-2.847	-1.256	-5.298	-4.605	Authors' cal.
Δ EDF_NFS	20870	-0.150	1.546	-6.448	8.236	Moody's KMV
DIFF	20870	-0.009	0.025	-0.220	0.235	IMF/WB/OECD
ΔGDP	20870	2.720	2.967	-13.130	15.060	IMF/WB/OECD
DEP	20331	0.067	1.180	-0.802	0.966	Bloomberg
SIZE	20870	-0.137	2.192	-16.031	7.932	Bloomberg
CAP	20870	-0.048	0.176	-0.141	0.879	Bloomberg
LIQ	20862	-0.053	0.205	-0.267	0.783	Bloomberg

Not: ΔEDF = change in the EDF at the bank level; Z-score = indicator of the probability of default which is computed on the base of balance sheet variables; ΔEDF_NFS = EDF change for the non-financial sector at the country level; DIFF = real money market interest rate minus natural rate; GDP = changes in nominal GDP; DEP = deposit-to-total liability ratio *100; SIZE = log of total assets (USD millions); CAP = capital-to-total asset ratio *100; LIQ= Liquidity ratio

In line with the bank lending channel literature, it is investigated that whether the responses to macroprudential shocks differ by type of bank. Therefore, the product of a macroprudential indicator and bank specific characteristics is included in the model:

$$(2)\ \Delta EDF_{i,k,t} = \alpha \Delta EDF_{i,k,t-1} + \beta \Delta EDF\_NF_{k,t} + \gamma MP_{k,t} + \psi\ MC_{k,t} + \lambda BSC_{i,k,t-1} + \delta\ MP_{k,t} * BSC_{i,k,t-1} + \varepsilon_{i,k,t}$$

This approach assumes that after a policy tightening (monetary or macroprudential), the ability to shield loan portfolio differs among banks.

IV.1.3 Estimation Results

The main results are reported in Tables IV.1.2 and Table IV.1.3. The negative and significant coefficient of the MP_index indicates that a tightening (easing) in macroprudential policies reduces (increases) bank risk. All coefficients for bank specific indicators are also statistically significant. In sum, the baseline specifications indicate the existence of heterogeneity among the banks. For instance, banks that are larger, more liquid, well capitalized and have a higher fraction of deposits among liabilities have less significant risk taking. These results are in line with Gambacorta and Shin (2015).

The interaction terms between the MP_index and bank specific characteristics Tables IV.1.2 indicate that the impact of macroprudential policies on bank risk is stronger for banks that are low capitalized, smaller, with low liquidity buffers and with a higher incidence of wholesale funding.

The analysis of the other control variables also provides interesting insights. The positive value of the lagged dependent variable indicates persistence in the adjustment process for risk. Changes in the EDF of the non-financial sector are positively linked to banks' EDF. This implies that risk of both financials and non-financials are driven by general movements in the stock market. As indicated by the risk-taking channel, the monetary policy indicator (the difference between the real interest rate and the natural rate) is negatively correlated with bank risk. This means that an accommodative monetary policy is associated with a higher level of bank risk. The state of the business cycle (the growth rate of nominal GDP) is also negatively correlated

with changes in bank risk-taking. However this effect is statistically significant only when the Z-score is used as a risk taking measure.

Table IV.1.2

Baseline Regression with Aggregate Macroprudential Index

	Coef.		Standard Error	Coef.		Standard Error
ΔEDF_{t-1}	0.221	***	0.001	0.216	***	0.002
ΔEDF_NFS_t	0.411	***	0.067	0.395	***	0.060
$DIFF_t$	-0.012	***	0.002	-0.020	**	0.009
ΔGDP_t	-0.839		0.703	-0.533		0.671
$SIZE_{t-1}$	-0.010	***	0.001	-0.071	***	0.012
LIQ_{-1}	-0.118	***	0.005	-0.090	***	0.017
CAP_{t-1}	-0.158	***	0.009	-1027	***	0.156
DEP_{t-1}	-0.063	**	0.026	-0.627	***	0.072
MP_index_t	-0.655	***	0.022	-1770	***	0.079
*MP_index*CAP*				3189	***	0.119
*MP_index*SIZE*				0.491	***	0.019
*MP_index*LIQ*				0.201	**	0.097
*MP_index*DEP*				0.194	***	0.039
Number of obs.		18504			18504	
Number of banks		3400			3400	
Serialcorrelation test[1]		0.110			0.140	
Hansen Test[2]		0.560			0.640	

Notes: Robust standard errors (clustered at the bank level) are reported. The symbols *, **, and *** represent significance levels of 10%, 5%, and 1% respectively. (1) Reports p-values for the null hypothesis that the errors in the first difference regression exhibit no second order serial correlation. (2) Reports p-values for the null hypothesis that the instruments used are not correlated with the residuals. Sample perido: 1990-2012.

Table IV.1.3 presents the results including asymmetric effects for tightening and easing macroprudential policies. In the majority of cases, a macroprudential tightening has a negative and significant impact on bank-risk, while an easing has a positive effect. There are, however, some cases (depending on the measure of bank risk used) in which capital and liquidity tools do not produce significant effects on a bank's risk.

A second result is the effects are not always symmetric in magnitude. Also, the difference between the coefficients MP_easing and MP_tightening are in most cases not statistically significant. There is a slight tendency for asset class measures (such as changes in LTV or debt to income ratios) and, to some extent, currency tools to be more effective in an easing than in a tightening. On the contrary, reserve requirements seem more effective in a tightening but only when EDF is considered as a bank risk indicator.

Instead of using a macroprudential index, Altunbas et al. (2016) examine interaction terms of individual macroprudential indicators with bank specific characteristics, their asymmetric effects. Controlling for bank characteristics they find that macroprudential tools are more effective in a tightening than in an easing. The higher effectiveness of tightening measures when bank specific interactions are considered is in line with Claessens et al. (2014), Cerutti et al. (2015), McDonald (2015).

Table IV.1.3

Asymmetric Effects of Macroprudential Policies

	Dependent var.: EDF			Dependent var.: Z-score		
	Coef.		Standard Erros	Coef.		Standart Error
ΔEDF_{t-1}	0.265	***	0.027	0.613	***	0.009
ΔEDF_NFS_t	0.412	***	0.028	0.035	***	0.004
$DIFF_t$	-0.045	***	0.004	-0.022	***	0.003
ΔGDP_t	-0.061		1.503	-2.014	***	0.196
$SIZE_{t-1}$	-0.020	***	0.003	-0.024	**	0.011
LIQ_{-1}	-0.272	***	0.022	-0.059		0.082
CAP_{t-1}	-0.705	***	0.273	-0.685	***	0.203
DEP_{t-1}	-0.458	***	0.054	-0.466	***	0.090
MP_capital_easingt	0.187	***	0.024	0.037		0.041
MP_liquidity_easingt	0.153		0.168	0.088		0.058
MP_assets_easingt	1.159	***	0.297	0.157	***	0.059
MP_currency_easingt	1.432	***	0.056	0.393	***	0.088
MP_reserve_easingt	0.898	**	0.362	0.087	**	0.044
MP_capital_tighteningt	-0.475		0.302	-0.041		0.040
MP_liquidity_tighteningt	-0.214		0.300	-0.189	***	0.054
MP_assets_tighteningt	-0.149	***	0.013	-0.055	**	0.025
MP_currency_tighteningt	-0.593	***	0.140	-0.279	***	0.053
MP_reserve_tighteningt	-1.488	***	0.379	-0.074	**	0.033
Observations		17958			16300	
Number of banks		3177			3052	
Serial correlation test[1]		0.120			0.242	
Hansen Test[2]		0.709			0.699	

Notes: Robust standard errors (clustered at the bank level) are reported. The symbols *, **, and *** represent significance levels of 10%, 5%, and 1% respectively. (1) Reports p-values for the null hypothesis that the errors in the first difference regression exhibit no second order serial correlation. (2) Reports p-values for the null hypothesis that the instruments used are not correlated with the residuals. Sample period: 1990-2012.

IV.1.4 Conclusion

This special feature complements other studies on the effectiveness of macroprudential policies. Using data from 1990 to 2012 for banks operating in 61 advanced economies and emerging markets, it analyses the effectiveness of these policies on bank risk taking.

Three main results are presented: First, macroprudential tools are effective in modifying bank risk taking. Second, the responses to change in macroprudential tools depends on balance sheet characteristics. In particular, banks that are small, low capitalised and with a higher share of wholesale funding react more to changes in these tools. Third, macroprudential policies seem more effective in a tightening than in an easing.

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