

Mortgage Lending, Banking Crises and Financial Stability in Asia

Peter J. Morgan
Sr. Consultant for Research

Yan Zhang
Consultant

Asian Development Bank Institute

**ABFER Conference on “Financial Regulations:
Intermediation, Stability and Productivity”
Singapore, 16-17 January 2017**

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1. Motivation of Study

- Mortgage lending generally associated with development of housing bubbles and banking crises—many studies on relation of mortgage loan growth, housing prices and financial stability (e.g., Reinhart and Rogoff (2009), Bordo and Jeanne (2012))
- But mortgage lending could contribute to financial stability as well as a result of asset diversification, so the potential trade-off needs to be considered
- Mortgage lending could be considered a type of financial inclusion, and thereby contribute to financial development
- Mortgage lending is the most important component of household credit, averaging about 54% of total household lending in major Asian emerging economies (IMF 2011)
- Few studies in this area, especially bank-level analyses
- Mortgage lending is the only inclusion-related data item in the Bankscope database, which allows us to exploit the very large sample size

Contributions of Study

- Analyze the relation of the share of mortgage lending to two measures of bank financial stability—Z-score and non-performing loan (NPL) ratio—using a large panel data set of banks in advanced and emerging economies (1,889 banks in 65 economies, including 10 Asian economies)
- Analyze the differential effect of crisis and non-crisis periods on this relationship
- Identify differential behavior of Asian banks

2. Possible Relation between Mortgage Lending and Financial Stability

- **Positive**
 - Larger and more diverse bank assets contribute to resiliency
- **Negative**
 - Promotion of mortgage lending could lower asset quality (sub-prime lending)
 - Rapid growth of mortgage lending could lead to housing price bubble

Source: Khan (2011)

3. Literature review

- **Adasme, Majnoni and Uribe (2006)**
 - NPLs of small firms have quasi-normal loss distributions, while those of large firms have fat-tailed distributions, so systemic risk of former is less
- **Kumar (2014)**
 - Used micro-level data from Indian banks to estimate a regression model of determinants of non-performing loans (NPLs) as a measure of financial stability
 - Found that the change in the share of housing loans in total credit is negatively related with changes in NPL

Literature review (2)

- **IMF (2011)**

- Analyzed the relationship of housing finance and financial stability using a panel-data set of 36 advanced and emerging economies from 2004 through 2009
- Estimated a two-equation model of inflation-adjusted home price changes and the change in the proportion of NPLs
- Found that a 1 percentage point increase in the ratio of mortgage credit to GDP in 2004-2007 was associated with 0.15 percentage point increase in NPLs during the global financial crisis period of 2007-2009
- However, the overall effect of the change in the mortgage loan ratio on NPLs during 2004-2009 was negative and insignificant

Literature review (3)

- **Hesse and Cihak (2007), Cihak and Hesse (2008)**
 - Analyzed the effects of the type of banking institutions on Z-score as a measure of bank stability, including cooperative banks and Islamic banks
 - Found significant differences in Z-score according to the type of institution
 - Used a variety of bank-specific and country-specific control variables which are also used in our methodology

4. Data

- Bankscope database—Detailed profit/loss and balance sheet data on individual banks
 - 65 advanced and emerging economies: Angola, Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Canada, Chile, China, Colombia, Costa Rica, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Finland, France, Germany, Ghana, Greece, Guatemala, Honduras, Hungary, Iceland, India, Indonesia, Ireland, Italy, Japan, Kenya, Malaysia, Mauritius, Mexico, Morocco, Netherlands, New Zealand, Nicaragua, Nigeria, Norway, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Republic of Korea, Romania, Russian Federation, Singapore, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Thailand, Tunisia, Turkey, United Kingdom, United States, Uruguay, Venezuela, Zambia, Zimbabwe
 - 1,889 banks
 - Annual data 1987 through 2014 (unbalanced)
- Macro data: World Bank Databank
- Banking crises: Reinhart and Rogoff (2010)
- Financial regulation measures: World Bank & Cerutti, Claesens and Leaven (2015)

Financial stability measures used

- Bank Z-score
 - Commonly used measure of bank stability (World Bank 2013)
 - Measures probability of bank failure (higher Z-score => lower probability of failure)
 - $Z\text{-score} = (\text{ROA} + \text{Equity/assets}) / \text{Std dev of ROA}$
 - Numerator measures total equity cushion available against losses
 - Ratio effectively measures the number of standard deviations that a bank's rate of return on assets can fall in one period before it becomes insolvent
- NPL ratio (NPLs/Gross loans)
 - Higher NPL ratio implies greater potential drain on capital, and hence higher probability of bank failure

5. Methodology and Results

- To formally verify the link between financial access and financial stability, the regression model below was used:

$$finstab_{i,j,t} = \alpha + \beta mtgr_{i,j,t} + \gamma mtgr_{i,j,t}^2 + \theta X_{i,j,t} + \lambda C_{j,t} + \eta_t + v_i + \varepsilon_{i,j,t}. \quad (1)$$

- $finstab_{i,j,t}$: measure of bank financial stability (Z-score ($bzs_{i,j,t}$) or NPL ratio ($npl_{i,j,t}$))
- $mtgr_{i,j,t}$: share of mortgage loans in total loans
- $X_{i,j,t}$: vector of bank-specific variables:
- $C_{j,t}$: vector of economy-specific variables
- η_t, v_i : vectors of bank and year dummy variables
- $\varepsilon_{i,j,t}$: error term

Control Variables

- Bank-specific control variables ($X_{i,j,t}$) include:
 - logarithm of total assets ($lgast_{i,j,t}$)
 - ratio of liquid assets to the total deposits ($liq_{i,j,t}$)
 - ratio of liabilities to total assets ($la_{i,j,t}$)
 - ratio of operating cost to total income ($ci_{i,j,t}$)
 - income diversity ($ind_{i,j,t}$) = $1 - \text{abs}(\text{int. income} - \text{other income})/\text{total income}$
- Economy-specific control variables ($C_{i,t}$) include:
 - year-on-year change of real GDP ($gdpgr_{j,t}$)
 - year-on-year change of the Consumer Price Index ($inflation_{j,t}$)
 - banking crisis dummy ($crisis_{j,t}$)
 - Asian dummy ($asia_{j,t}$)
- Sensitivity analysis:
 - Bank-related macroprudential measures ($mpib_{j,t}$)
 - Index of regulatory quality ($rq_{j,t}$)
- Panel data for 1987-2014
- Estimate by system-GMM dynamic panel estimator to control for endogeneity

Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
z	9,965	26.33	23.56	0.68	136.37
npl	9,965	3.76	4.48	0.01	32.26
mtgr	3,921	0.4	0.25	0	1
liq	9,965	26.77	23.35	1.35	128.07
lgast	9,965	15.08	2.19	7.83	21.63
lgloans	9,965	14.57	2.2	7.54	21.03
la	9,965	0.63	0.17	0.09	0.96
ci	9,965	63.58	16.27	16.56	117.01
ind	9,615	0.17	0.22	0	1
gdpgr	9,965	2.89	3.05	-10.89	15.24
inflation	9,965	3.63	3.73	-1.31	26.67
mpib	9,965	0.21	0.54	0	2
rq	9,965	0.76	0.72	-1.29	2.12

Source: Authors' calculations

GMM Estimation results—Z-score

	(1)	(2)	(3)	(4)	(5)	(6)
	lnz	lnz	lnz	lnz	lnz	lnz
L.lnz	0.95*** (0.00)	0.95*** (0.00)	0.95*** (0.00)	0.94*** (0.00)	0.93*** (0.00)	0.93*** (0.00)
L.mtgr	0.07*** (0.00)	0.08*** (0.00)	0.09*** (0.00)	0.34*** (0.00)	0.38*** (0.00)	0.38*** (0.00)
L.mtgr ²	-0.06*** (0.00)	-0.02*** (0.00)	-0.03*** (0.00)	-0.25*** (0.00)	-0.29*** (0.00)	-0.29*** (0.00)
L.lgast	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
L.liq	-0.00007*** (0.00)	0.00019*** (0.00)	0.00029*** (0.00)	0.00011*** (0.00)	0.00007*** (0.00)	0.00007*** (0.00)
L.la	-0.15*** (0.00)	-0.11*** (0.00)	-0.10*** (0.00)	-0.13*** (0.00)	-0.13*** (0.00)	-0.13*** (0.00)
L.ci	0.00186*** (0.00)	0.00180*** (0.00)	0.00180*** (0.00)	0.00085*** (0.00)	0.00086*** (0.00)	0.00086*** (0.00)
L.crisis	0.03*** (0.00)	0.07*** (0.00)	0.16*** (0.00)	0.13*** (0.00)	0.13*** (0.00)	0.13*** (0.00)
L.mtgr*L.crisis		-0.10*** (0.00)	-0.09*** (0.00)	-0.06*** (0.00)	-0.08*** (0.00)	-0.08*** (0.00)
L.lgast*L.crisis			-0.01*** (0.00)	-0.01*** (0.00)	-0.00449*** (0.00)	-0.00449*** (0.00)
asia				0.04*** (0.00)	0.04*** (0.00)	0.04*** (0.00)
asia*L.crisis					-0.82*** (0.00)	
L.mtgr*asia*L.crisis						-6.85*** (0.00)
N	4915	4915	4915	4915	4915	4915
no of instruments	728	810	809	1093	1092	1092
AB test of R2 (p-value)	0.537	0.575	0.584	0.672	0.678	0.678
Hansen test (p-value)	1.000	1.000	1.000	1.000	1.000	1.000

GMM Estimation results—NPL ratio

	(7) npl	(8) npl	(9) npl	(10) npl	(11) npl	(12) npl
L.npl	0.70*** (0.00)	0.68*** (0.00)	0.68*** (0.00)	0.70*** (0.00)	0.70*** (0.00)	0.70*** (0.00)
L.mtgr	-3.27*** (0.00)	-2.98*** (0.00)	-3.08*** (0.00)	-4.90*** (0.00)	-5.23*** (0.00)	-5.23*** (0.00)
L.mtgr ²	3.34*** (0.00)	2.46*** (0.00)	2.53*** (0.00)	4.12*** (0.00)	4.53*** (0.00)	4.53*** (0.00)
L.lgst	0.04*** (0.00)	0.01*** (0.00)	0.00*** (0.00)	-0.07*** (0.00)	-0.07*** (0.00)	-0.07*** (0.00)
L.liq	0.02*** (0.00)	0.02*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
L.la	2.45*** (0.00)	2.58*** (0.00)	2.49*** (0.00)	0.81*** (0.00)	0.78*** (0.00)	0.78*** (0.00)
L.ci	0.02*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.00011 (0.06)	0.00001 (0.90)	0.00001 (0.90)
L.crisis	0.58*** (0.00)	0.16*** (0.00)	-0.89*** (0.00)	-1.60*** (0.00)	-1.59*** (0.00)	-1.59*** (0.00)
L.mtgr*L.crisis		1.12*** (0.00)	1.05*** (0.00)	1.18*** (0.00)	1.33*** (0.00)	1.33*** (0.00)
L.lgst*L.crisis			0.07*** (0.00)	0.10*** (0.00)	0.09*** (0.00)	0.09*** (0.00)
asia				-0.53*** (0.00)	-0.52*** (0.00)	-0.52*** (0.00)
asia*L.crisis					7.14*** (0.00)	
L.mtgr*asia*L.crisis						59.97*** (0.00)
N	4915	4915	4915	4915	4915	4915
no of instruments	805	810	809	1093	1092	1092
AB test of R2 (p-value)	0.869	0.844	0.824	0.931	0.933	0.933
Hansen test (p-value)	1.000	1.000	1.000	1.000	1.000	1.000

Effects of Macroprudential Policies and Regulatory Quality

Variable	(13) lnz	(14) lnz	(15) lnz	(16) npl	(17) npl	(18) npl
L.lnz	0.97*** (0.0)	0.98*** (0.0)	0.96*** (0.0)			
L.npl				0.73*** (0.0)	0.73*** (0.0)	0.73*** (0.0)
L.mtgr	0.41*** (0.0)	0.44*** (0.0)	0.67*** (0.0)	-3.78*** (0.0)	-3.22*** (0.0)	-3.65*** (0.0)
L.mtgr2	-0.57*** (0.0)	-0.62*** (0.0)	-0.79*** (0.0)	4.44*** (0.0)	4.29*** (0.0)	4.43*** (0.0)
L.lgast	0.01** (0.0)	-0.00* (0.04)	0.01*** (0.0)	0.09*** (0.0)	0.08*** (0.0)	0.10*** (0.0)
L.liq	0 (0.19)	0 (0.15)	0 (0.08)	0.01*** (0.0)	0.01*** (0.0)	0.01*** (0.0)
L.la	0.01 (0.83)	-0.08*** (0.0)	-0.14*** (0.0)	2.93*** (0.0)	2.84*** (0.0)	3.02*** (0.0)
L.ci	0.00*** (0.0)	0 (0.11)	0 (0.11)	0.04*** (0.0)	0.04*** (0.0)	0.04*** (0.0)
L.ind	-0.14*** (0.0)	-0.06** (0.01)	-0.13*** (0.0)	-0.78*** (0.0)	-0.49*** (0.0)	-0.76*** (0.0)
L.crisis	0.03*** (0.0)	0.03*** (0.0)	0 (0.85)	-0.09*** (0.0)	0 (0.92)	-0.09*** (0.0)
L.asia	-0.03*** (0.0)	0.0 (0.45)	-0.02*** (0.0)	0.05** (0.01)	0.03* (0.03)	0.0 (0.82)
L.mpib	-0.04*** (0.0)		-0.01*** (0.0)	-0.33*** (0.0)		-0.33*** (0.0)
L.rq		0.04*** (0.0)	0.01*** (0.0)		-0.09*** (0.0)	-0.10*** (0.0)
N	2144	2144	2144	2144	2144	2144
no of instruments	207	207	333	333	333	333
AB test of R2 (p-value)	0.644	0.644	0.551	0.812	0.78	0.807
Hansen test (p-value)	0.174	0.174	0.347	0.392	0.488	0.402

Robustness checks: mtgr lagged 2 years--Z-score

	(13)	(14)	(15)	(16)	(17)	(18)
	lnz	lnz	lnz	lnz	lnz	lnz
L.lnz	0.95*** (0.00)	0.95*** (0.00)	0.94*** (0.00)	0.94*** (0.00)	0.94*** (0.00)	0.94*** (0.00)
L2.mtgr	0.17*** (0.00)	0.20*** (0.00)	0.22*** (0.00)	0.32*** (0.00)	0.36*** (0.00)	0.36*** (0.00)
L2.mtgr ²	-0.11*** (0.00)	-0.13*** (0.00)	-0.15*** (0.00)	-0.20*** (0.00)	-0.25*** (0.00)	-0.25*** (0.00)
L.lgst	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
L.liq	-0.00018*** (0.00)	0.00001 (0.32)	0.00015*** (0.00)	0.00018*** (0.00)	0.00011*** (0.00)	0.00011*** (0.00)
L.la	-0.15*** (0.00)	-0.13*** (0.00)	-0.12*** (0.00)	-0.13*** (0.00)	-0.13*** (0.00)	-0.13*** (0.00)
L.ci	0.00235*** (0.00)	0.00189*** (0.00)	0.00192*** (0.00)	0.00115*** (0.00)	0.00117*** (0.00)	0.00117*** (0.00)
L.crisis	0.03*** (0.00)	0.07*** (0.00)	0.21*** (0.00)	0.18*** (0.00)	0.18*** (0.00)	0.18*** (0.00)
L2.mtgr*L.crisis		-0.12*** (0.00)	-0.11*** (0.00)	-0.07*** (0.00)	-0.10*** (0.00)	-0.10*** (0.00)
L2.lgst*L.crisis			-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)
asia				0.03*** (0.00)	0.03*** (0.00)	0.03*** (0.00)
asia*L.crisis					-0.99*** (0.00)	
L2.mtgr*asia*L.crisis						-7.97*** (0.00)
N	4047	3923	3923	3923	3923	3923
no of instruments	722	797	796	1045	1044	1044
AB test of R2 (p-value)	0.38	0.404	0.409	0.343	0.331	0.331
Hansen test (p-value)	1.000	1.000	1.000	1.000	1.000	1.000

Robustness checks: mtgr lagged 2 years—NPL ratio

	(19) npl	(20) npl	(21) npl	(22) npl	(23) npl	(24) npl
L.npl	0.69*** (0.00)	0.66*** (0.00)	0.65*** (0.00)	0.72*** (0.00)	0.72*** (0.00)	0.72*** (0.00)
L2.mtgr	-2.01*** (0.00)	-2.84*** (0.00)	-3.08*** (0.00)	-4.62*** (0.00)	-4.77*** (0.00)	-4.77*** (0.00)
L2.mtgr ²	1.87*** (0.00)	2.09*** (0.00)	2.26*** (0.00)	4.05*** (0.00)	4.23*** (0.00)	4.23*** (0.00)
L.lgst	0.05*** (0.00)	0.01*** (0.00)	-0.01*** (0.00)	-0.10*** (0.00)	-0.10*** (0.00)	-0.10*** (0.00)
L.liq	0.02*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.00288*** (0.00)	0.00311*** (0.00)	0.00311*** (0.00)
L.la	2.40*** (0.00)	2.05*** (0.00)	1.81*** (0.00)	0.80*** (0.00)	0.78*** (0.00)	0.78*** (0.00)
L.ci	0.02*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
L.crisis	0.69*** (0.00)	0.05*** (0.00)	-2.34*** (0.00)	-2.34*** (0.00)	-2.35*** (0.00)	-2.35*** (0.00)
L2.mtgr*L.crisis		1.14*** (0.00)	1.07*** (0.00)	0.72*** (0.00)	0.82*** (0.00)	0.82*** (0.00)
L2.lgst*L.crisis			0.16*** (0.00)	0.17*** (0.00)	0.17*** (0.00)	0.17*** (0.00)
asia				-0.27*** (0.00)	-0.26*** (0.00)	-0.26*** (0.00)
asia*L.crisis					3.81** (0.00)	
L2.mtgr*asia*L.crisis						30.58** (0.00)
N	4047	3923	3923	3923	3923	3923
no of instruments	781	797	796	1045	1044	1044
AB test of R2 (p-value)	0.222	0.191	0.189	0.216	0.214	0.214
Hansen test (p-value)	1.000	1.000	1.000	1.000	1.000	1.000

6. Findings/Conclusions

- Theoretically, mortgage ratio could have both positive and negative implications for financial stability
 - Positive: Diversification of bank assets
 - Negative: Erosion of credit standards (sub-prime), banking crises
- We find evidence during non-crisis periods an increased share of mortgage lending (up to 49%-68% of the total) aids financial stability by reducing the probability of default by banks and NPLs
- However, this effect reverses for higher mortgage loan shares
- In crisis periods, the implied desirable level of the mortgage share is lowered by 12-23 percentage points
- Asian banks show more sensitivity to mortgage share
- Regulatory quality positive, macroprudential measures mixed
- These suggest that mortgage lending is attractive both from in terms of asset diversification and financial inclusion, but there is a need for effective macroeconomic and macroprudential policies to contain housing-sector risk
- Further work: Other measures of financial stability?

Thank you