Banking Market Structure and Macroeconomic Stability: Are Low-Income Countries Special?

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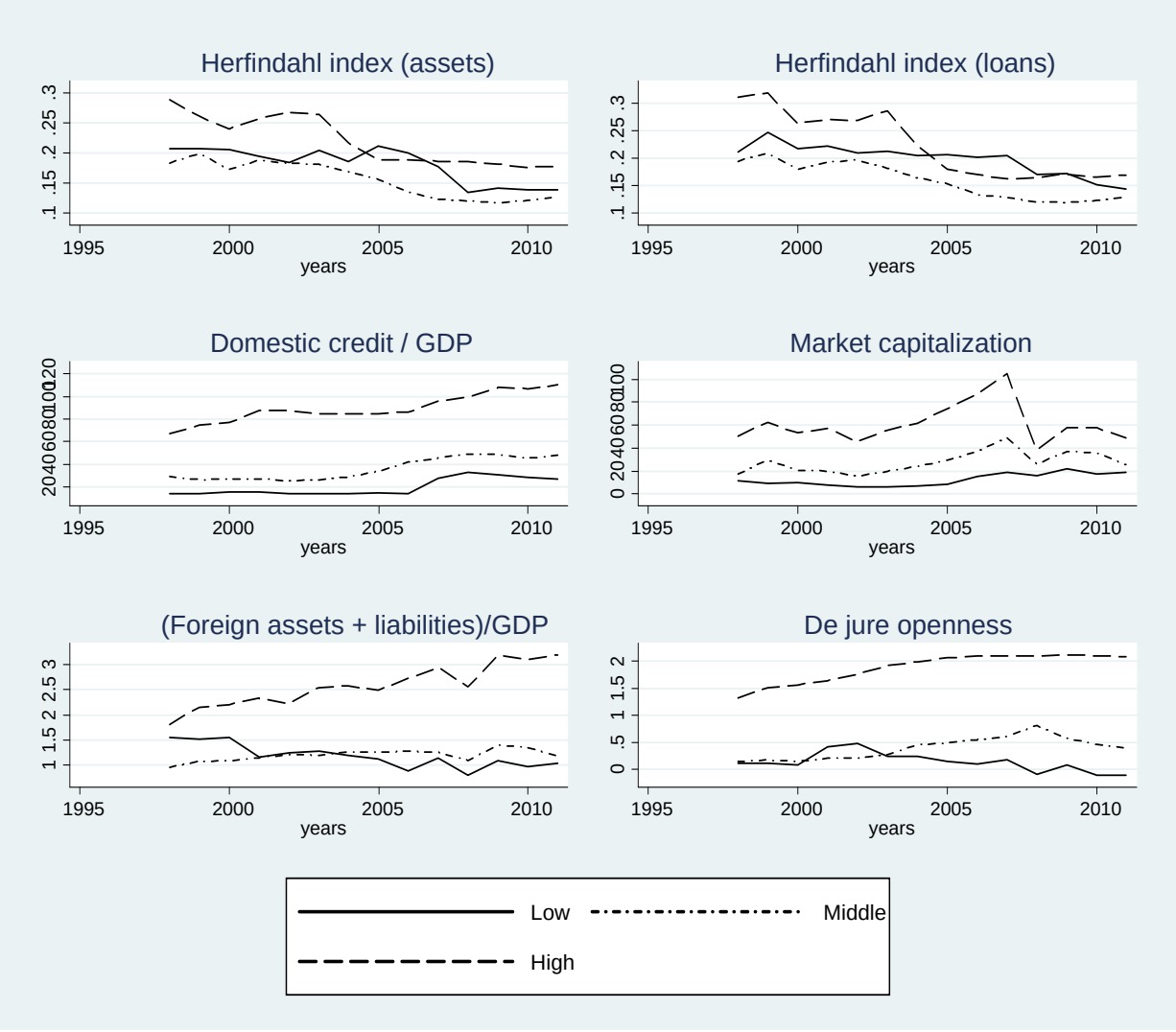
Macroeconomic Challenges Facing Low-Income Countries
Washington D.C., January 30-31, 2014

Motivation

- The effects of macroeconomic volatility on long-term growth and welfare can be particularly pronounced in low income countries (LICs) (Calderon and Yeyati 2009, Loayza et al. 2007).
- Real and financial cycles are closely related (Claessens et al. 2011, 2012).
- Differences in macroeconomic stability between LICs and higher-income economies may be due to banking market structures.

➢ **Does banking market structure affect macroeconomic volatility? Is this link different in low income countries?**

The structure of banking markets in LICs differs from that in higher-income economies.

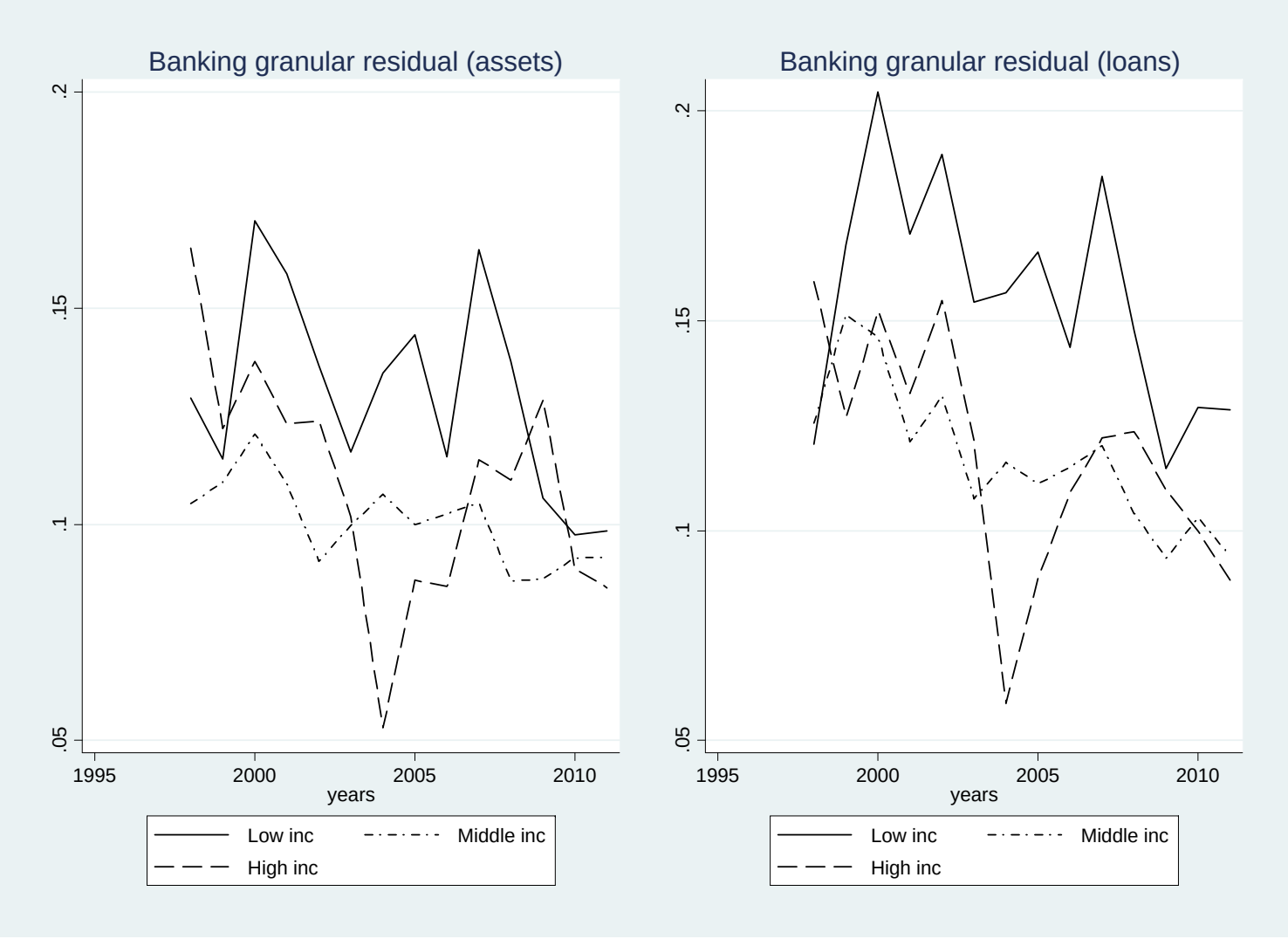


Concentration

Size

Openness

Idiosyncratic, bank-level volatility is higher in LICs.



This paper

- **We explore the channels through which the structure of banking markets impacts macroeconomic volatility.**
  - Banking sector size
  - Financial openness
  - Banking sector concentration
  - Idiosyncratic, bank-level risk

- **We combine micro and macro data to estimate the link between banking market structures and macroeconomic volatility.**

(How) does banking market structure affect macroeconomic volatility?

- **Banking sector size (credit to GDP) can be a proxy for financial depth, but also for leverage in an economy.**
  - ➢ No clear impact on macroeconomic volatility.
- **Financial openness may affect volatility due to international shock transmission or better diversification.**
  - ➢ No clear impact on macroeconomic volatility.
- **Banking sector concentration can, according to the concept of granularity (Gabaix 2011), imply that firm-specific shocks affect macroeconomic volatility.**
  - ➢ The higher **concentration** or **idiosyncratic bank risk**, the higher is macroeconomic volatility.

Previous literature on granular effects

- **Findings of Gabaix (2011) for non-financial firms in the US suggest that the size of firms is power-law distributed.**

  → Firm-level fluctuations do *not* average out in the aggregate.

- Macroeconomic volatility = idiosyncratic volatility * concentration

$$\sigma_{GDP} = \left[\sum_{i=1}^{N} Vol_i \cdot \left(\frac{S_{it}}{Y_t} \right)^2 \right]^{1/2}$$

- **Bank-level volatility can impact the macroeconomy via the credit market** (Amiti and Weinstein 2013, Bremus et al. 2013).

Measuring idiosyncratic volatility: The Banking Granular Residual

- Idiosyncratic shocks are identified by regressing asset (or credit) growth on country-year fixed effects and retaining the residual:

$$\log(Assets)_{ic,t} - \log(Assets)_{ic,t-1} = \alpha_{c,t} + \epsilon_{ic,t}$$

- The Banking Granular Residual is a weighted sum of idiosyncratic volatility:

$$BGR_{c,t} = \left(\sum_{i=1}^{N} |\epsilon_{ic,t}| \left(\frac{Assets_{ic,t}}{Assets_{c,t}} \right)^2 \right)^{1/2} = \left(\sum_{i}^{N} |\epsilon_{ic,t}| s_{ict}^2 \right)^{1/2}$$

Decomposing the Banking Granular Residual

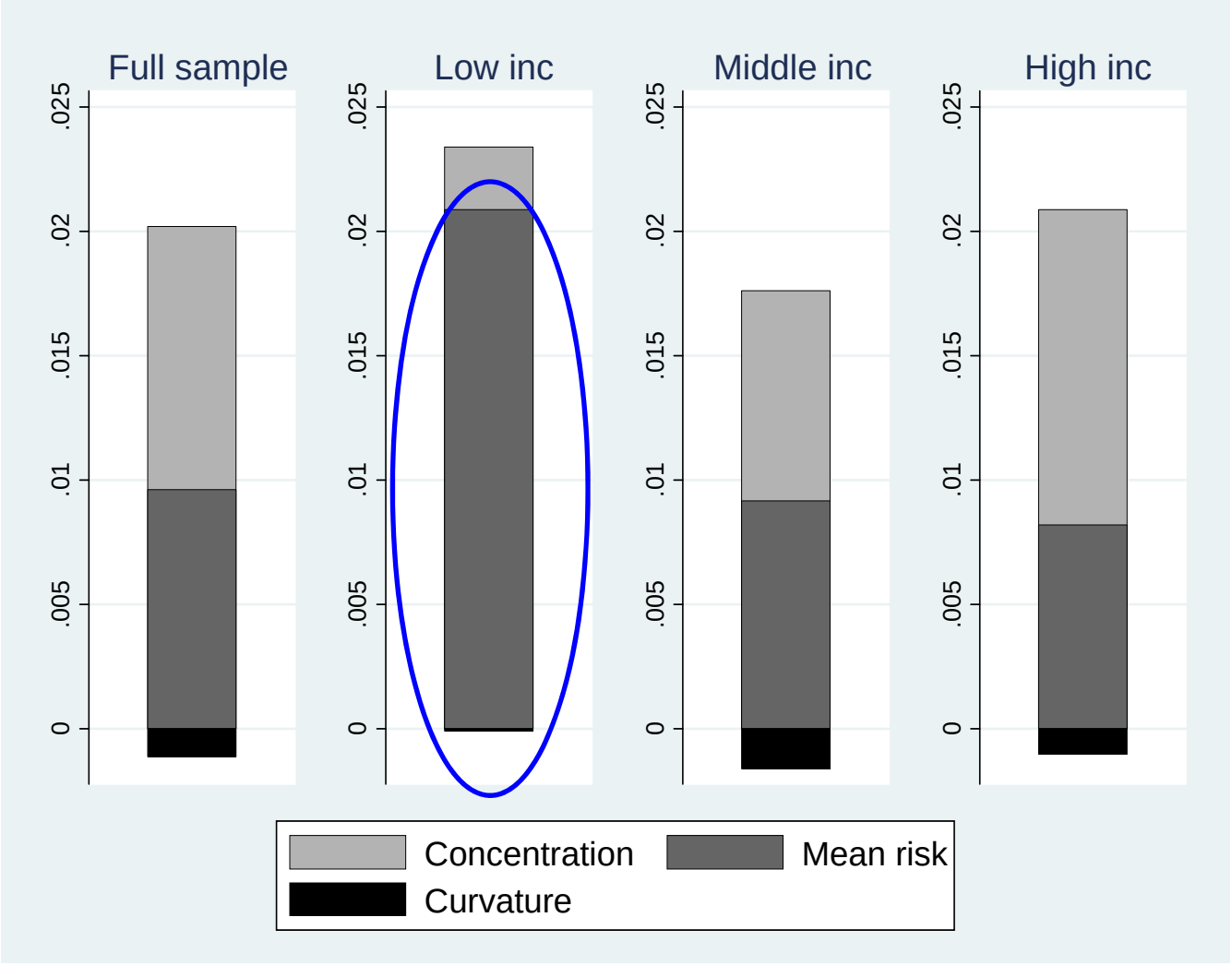
Following Di Giovanni and Levchenko (2012), the BGR can be decomposed as follows:

$$\mathrm{BGR}_{ct} = \left(\sum_i^N \varepsilon_{ict} s_{ict}^2\right)^{1/2}$$

$$= \left(\bar{\varepsilon}_{ct} \sum_i^N s_{ict}^2 + 2\,\bar{s}_{ct} \sum_i^N s_{ict}\varepsilon_{ict} + \sum_i^N (s_{ict} - \bar{s}_{ct})^2 (\varepsilon_{ict} - \bar{\varepsilon}_{ct}) - x\right)^{1/2}$$

ε_{ict}	bank-specific volatility
$\sum_i^N s_{ict}^2$	Herfindahl index
$\sum_i^N s_{ict}\varepsilon_{ict}$	mean risk of country c's banking sector
$\sum_i^N (s_{ict} - \bar{s}_{ct})^2 (\varepsilon_{ict} - \bar{\varepsilon}_{ct})$	"curvature", i.e. the interaction between mean risk and the Herfindahl index.

Mean banking sector risk is high in LICs.



Measuring macroeconomic volatility

Macroeconomic volatility:

- Based on real GDP per capita growth

$$\ln(GDP)_{c,t} - \ln(GDP)_{c,t-1} = \lambda_t + \alpha_c + GDPShock_{c,t}$$

$$Vol(GDP)_{c,t} = \left|GDPShock_{c,t}\right|$$

Unbalanced micro-macro panel:

- Annual data for 14 years (1998-2011)
- 97 countries, 15 LICs

Empirical model explaining macroeconomic volatility

Baseline fixed-effects regression:

$$\mathrm{Vol}_{c,t} = \alpha_t + \gamma_c + \beta_1 \mathrm{BGR}_{c,t} + \beta_2 \mathrm{BGR}_{c,t-1} + \beta_3 \frac{\mathrm{Credit}}{\mathrm{GDP}}_{c,t} + \beta_4 \mathrm{MCap}_{c,t} + \boldsymbol{\beta}_5 \mathrm{FI}_{c,t} + \epsilon_{c,t}$$

- $FI_{c,t}$: de facto and de jure financial openness
- Instead of the BGR, we use HHI and $MRisk$ separately in additional regressions.
- Moreover, we include additional macroeconomic control variables.
- We examine differences between low- and higher-income countries using
  - Sample splits
  - Interaction terms with low-income dummy

Determinants of GDP-volatility: Full sample

	(1)	(2)
Banking Granular Residual		
BGR (assets)	0.013	
	(1.021)	
Lagged BGR (assets, t-1)	0.007	
	(0.831)	
Mean risk (assets)		0.012
		(0.936)
Lagged mean risk (assets, t-1)		0.022**
		(2.293)
HHI (assets)		-0.004
		(-0.738)
Banking market structure		
Domestic credit to private sector (% of GDP)	0.000**	0.000**
	(2.383)	(2.460)
(Foreign assets + liabilities) / GDP	-0.000	-0.000*
	(-1.560)	(-1.838)
Chinn-Ito index of capital controls	-0.003***	-0.003***
	(-3.429)	(-3.470)
Market capitalization of listed companies (% of GDP)	-0.000	-0.000
	(-0.275)	(-0.236)
Observations	1,245	1,245
R^2	0.076	0.079
Number of countries	97	97

Determinants of GDP-volatility: Sample splits by income group

	(1)	(2)	(3)	(4)	(5)	(6)
	Low income		Middle income		High income	
Banking Granular Residual						
BGR (assets)	-0.048*		0.040		0.021	
	(-1.837)		(1.234)		(1.452)	
Lagged BGR (assets t-1)	0.049**		-0.010		0.011	
	(2.437)		(-0.580)		(1.018)	
Mean risk (assets)		-0.050*		0.028		0.014
		(-1.888)		(1.198)		(0.869)
Lagged mean risk (assets t-1)		0.057*		-0.003		0.017
		(1.825)		(-0.141)		(1.449)
HHI (assets)		-0.003		-0.005		-0.001
		(-0.185)		(-0.452)		(-0.144)
Banking market structure						
Domestic credit to private sector (% of GDP)	0.001**	0.001**	0.000*	0.000	0.000*	0.000*
	(2.295)	(2.444)	(1.772)	(1.662)	(1.716)	(1.719)
(Foreign assets + liabilities) / GDP	0.017***	0.017**	-0.000	-0.000	-0.000	-0.000
	(3.223)	(2.762)	(-0.227)	(-0.495)	(-0.203)	(-0.308)
Chinn-Ito index of capital controls	-0.012	-0.014	-0.002	-0.002	-0.008**	-0.008**
	(-1.454)	(-1.745)	(-1.004)	(-0.974)	(-2.510)	(-2.469)
Market capitalization (% of GDP)	0.000	0.000	0.000	0.000	-0.000	-0.000
	(0.100)	(0.250)	(0.324)	(0.348)	(-1.414)	(-1.468)
Macroeconomic control variables						
Private consumption per capita	0.000	0.000	-0.000*	-0.000*	0.000	0.000
	(1.609)	(1.571)	(-1.894)	(-1.752)	(0.471)	(0.471)
Government consumption expenditure (% of GDP)	0.002***	0.002**	0.001**	0.001*	0.001	0.002
	(3.543)	(2.513)	(2.122)	(2.029)	(0.782)	(0.882)
Inflation (consumer prices, annual %)	-0.001	-0.001	0.000	0.000	-0.000	0.000
	(-1.240)	(-1.203)	(1.614)	(1.612)	(-0.012)	(0.019)
Money and quasi money (M2) as % of GDP	-0.001**	-0.001**	-0.000	-0.000	-0.000***	-0.000**
	(-2.684)	(-2.551)	(-1.451)	(-1.442)	(-2.777)	(-2.597)
Absolute residual of M2 / GDP	-0.000	-0.000	0.000	0.000	0.000	-0.000
	(-0.635)	(-0.609)	(0.554)	(0.477)	(0.004)	(-0.004)
(Imports + Exports) / GDP	0.000	0.000	0.000	0.000	0.000	0.000
	(1.409)	(1.288)	(0.900)	(0.948)	(0.285)	(0.260)
Absolute residual of Terms of trade	0.043	0.042	0.014	0.016	-0.095**	-0.094**
	(1.659)	(1.614)	(0.463)	(0.511)	(-2.620)	(-2.618)
Observations	126	126	433	433	413	413
R^2	0.398	0.410	0.207	0.203	0.284	0.281
Number of countries	14	14	36	36	45	45

Determinants of GDP-volatility: Interactions low income countries

	(1)	(2)	(3)	(4)
Banking Granular Residual				
BGR (assets)	0.028*	0.029*		
	(1.709)	(1.718)		
BGR (assets) * Dummy(PRGT)	-0.071***	-0.066**		
	(-3.178)	(-2.506)		
Lagged BGR (assets, t-1)	-0.001	-0.000		
	(-0.063)	(-0.035)		
Lagged BGR (assets) * Dummy(PRGT)	0.027	0.036		
	(0.905)	(1.513)		
Mean risk (assets)			0.020	0.021
			(1.329)	(1.334)
Mean risk (assets) * Dummy(PRGT)			-0.055**	-0.048
			(-2.027)	(-1.645)
Lagged mean risk (assets, t-1)			0.007	0.007
			(0.664)	(0.668)
Lagged mean risk (assets) * Dummy(PRGT)			0.034	0.045
			(1.061)	(1.560)
HHI (assets)			-0.007	-0.007
			(-0.981)	(-0.937)
HHI (assets) * Dummy(PRGT)			0.020*	0.018
			(1.721)	(1.479)
Banking market structure				
Domestic credit to private sector (% of GDP)	0.000***	0.000***	0.000***	0.000***
	(3.392)	(3.278)	(3.310)	(3.178)
Credit/GDP * Dummy(PRGT)		-0.000		0.000
		(-0.018)		(0.360)
(Foreign assets + liabilities) / GDP	-0.000	-0.000	-0.000	-0.000
	(-1.092)	(-1.139)	(-1.514)	(-1.498)
(Foreign assets + liabilities) / GDP * Dummy(PRGT)		0.006		0.006
		(0.885)		(0.916)
Chinn-Ito index of capital controls	-0.005***	-0.005**	-0.005***	-0.005**
	(-2.666)	(-2.541)	(-2.638)	(-2.515)
Chinn-Ito index * Dummy(PRGT)		-0.002		-0.004
		(-0.439)		(-0.713)
Market capitalization (% of GDP)	-0.000	-0.000	-0.000	-0.000
	(-0.963)	(-0.950)	(-1.015)	(-1.012)
Observations	972	972	972	972
R^2	0.188	0.189	0.187	0.188
Number of countries	95	95	95	95

Robustness tests

- We use the BGR based on banks‘ net loans instead of assets.
- We include a banking crisis dummy as well as interactions between this dummy and the variables of interest.
- We run instrumental variables regressions in order to account for endogeneity issues.

➢ **The main results are not affected.**

Summary of findings

- **We have explored the links between banking market structures and macroeconomic volatility with a focus on low income countries.**
- **Three main results emerge from our study:**
  1) Greater **size** of banking markets (credit to GDP) increases aggregate volatility, especially in LICs
  2) Greater **openness** has not clear effect: De facto openness tends to increase, de jure openness tends to lower GDP-volatility.
  3) **Concentration** and **idiosyncratic risk** have no strong effects.

What drives the BGR?
Explaining idiosyncratic volatility

Bank-level fixed-effects regression:

$$|AssetShock_{ic,t}| = \lambda_t + \alpha_c + \eta_i + \gamma_1 \frac{Loans}{Assets}_{ic,t} + \gamma_2 \frac{Equity}{Assets}_{ic,t} + \gamma_3 Size_{ic,t} + \gamma_4 Size^2_{ic,t} + \gamma_5 \frac{Cost}{Income}_{ic,t} + \beta_1 \frac{Credit}{GDP}_{c,t} + \boldsymbol{\beta_2} FI_{c,t} + \beta_3 Capital_{c,t} + \beta_4 HHI_{c,t} + \epsilon_{ic,t}$$

- $\boldsymbol{\gamma}$: Effects of bank characteristics
- $\boldsymbol{\beta}$: Effects of banking system characteristics
- We split the sample with respect to income groups.

Determinants of idiosyncratic bank-level volatility

	(1) Full sample	(2) Low	(3) Middle	(4) High
Bank-level variables				
Log real assets	-0.045*	0.082	-0.060***	-0.027
	(0.025)	(0.343)	(0.020)	(0.032)
Log real assets squared	0.002**	-0.003	0.002***	0.002
	(0.001)	(0.012)	(0.001)	(0.001)
Loans / assets	-0.073***	-0.106**	-0.111***	-0.055**
	(0.020)	(0.040)	(0.036)	(0.022)
Bank equity to assets ratio (%)	0.000	0.007**	0.000	0.001
	(0.001)	(0.002)	(0.002)	(0.002)
Return on Average Assets (%)	-0.002***	-0.003	-0.003***	-0.003***
	(0.000)	(0.003)	(0.001)	(0.000)
Cost to income ratio (%)	0.000***	0.000	0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Country-level variables				
Domestic credit to private sector (% of GDP)	0.000**	0.003	0.000	0.000
	(0.000)	(0.003)	(0.000)	(0.000)
HHI index assets for country j	-0.030	0.102**	-0.161	-0.014
	(0.031)	(0.037)	(0.111)	(0.027)
(Foreign assets + liabilities) / GDP	0.000	0.037	-0.000	0.007***
	(0.001)	(0.057)	(0.000)	(0.002)
Chinn-Ito index of capital controls	-0.010**	-0.100	-0.004	-0.027***
	(0.004)	(0.126)	(0.004)	(0.007)
Capitalization (%)	0.114***	-0.012	0.073	0.142***
	(0.029)	(0.187)	(0.054)	(0.031)
Capital stringency	0.001	-0.014	0.002	0.001
	(0.001)	(0.010)	(0.002)	(0.002)
Share of foreign banks	-0.000	-0.027***	-0.000	-0.000*
	(0.000)	(0.003)	(0.000)	(0.000)
Share of government banks	-0.001*	-0.006***	-0.000	-0.001**
	(0.000)	(0.001)	(0.000)	(0.000)
Observations	59,389	650	6,892	51,847
R^2	0.024	0.174	0.031	0.028
Number of banks	8,869	137	1,187	7,545

Policy implications

Our findings suggest that aggregate volatility can be reduced…

- by limiting the excessive expansion of credit in an economy
  - ➢ Both domestic banking sector size and foreign activities of the financial system matter.
- by reducing bank-level volatility
- by reducing the degree of concentration in the banking system.

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