Why Bank Capital matters for Monetary Policy?

Group:
Mostafa Kamal
Nargiz Jabiyeva
Kaan Peksen

23 May, 2023
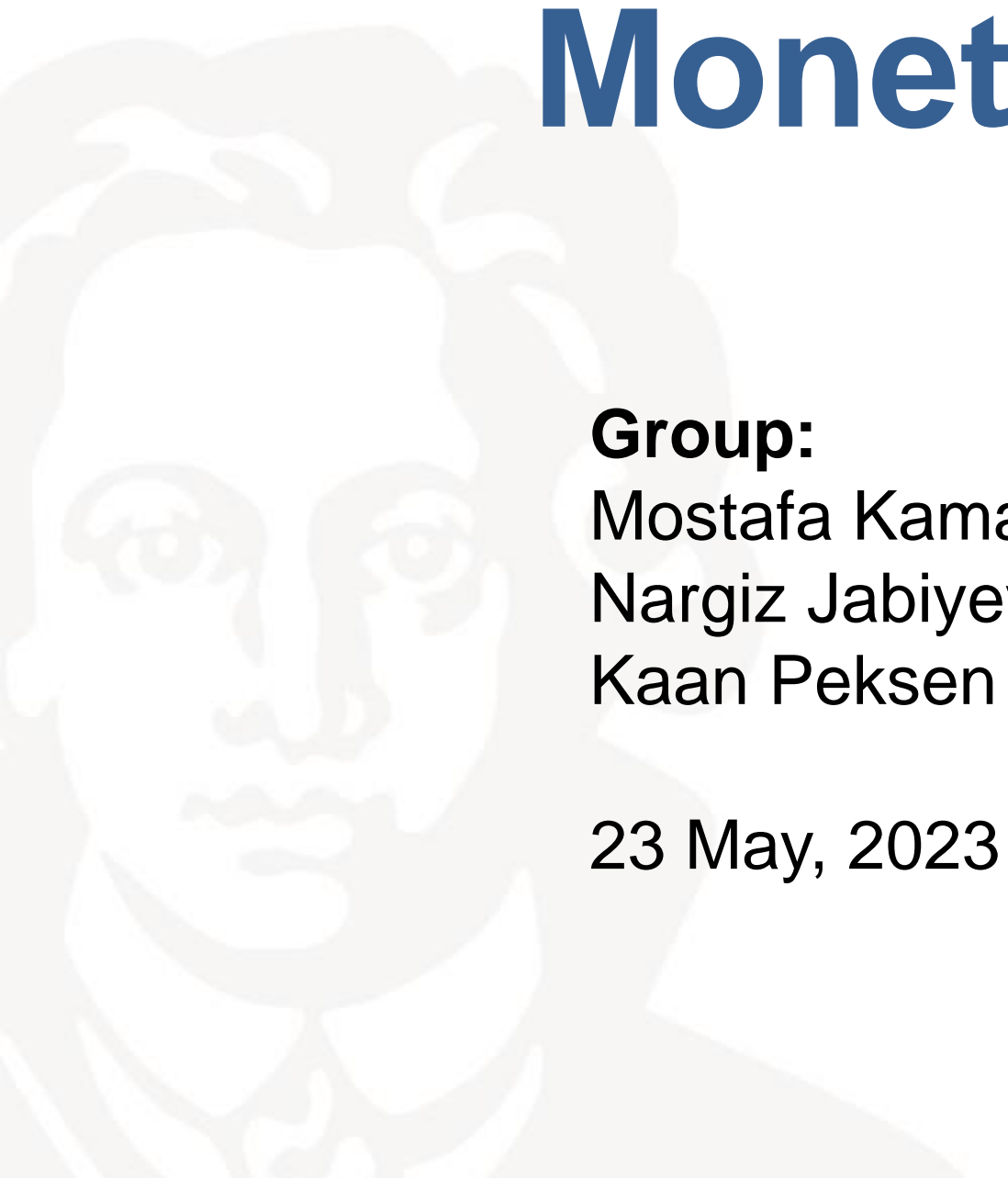
Outline

GOETHE
UNIVERSITÄT
FRANKFURT AM MAIN

Introduction

Timeline of main financial events

1988: Basel Capital Accord (commonly known as a Basel 1) had been introduced

2007: The U.S. housing bubble bursts as the subprime mortgage market collapses.

October 3, 2008: The U.S. government passes the Troubled Asset Relief Program (TARP)

2009: Governments worldwide implement various measures to stabilize financial systems, including bank bailouts, stimulus packages, and regulatory reforms.

March 2015: The asset purchase program of the European Central Bank (ECB) was implemented

2004: The BCBS introduces Basel II, a revised framework for international banking regulations.

September 15, 2008: Lehman Brothers, one of the largest investment banks in the U.S., files for bankruptcy

October 8, 2008: The Federal Reserve, along with other central banks, announces coordinated interest rate cuts to ease credit conditions and restore confidence in global financial markets.

2010: In response to the financial crisis, the BCBS introduces Basel III, an updated framework for global banking regulations.

July 2018: The paper "Why bank capital matters for monetary policy" by L. Gambacorta and H.S. Shin got published
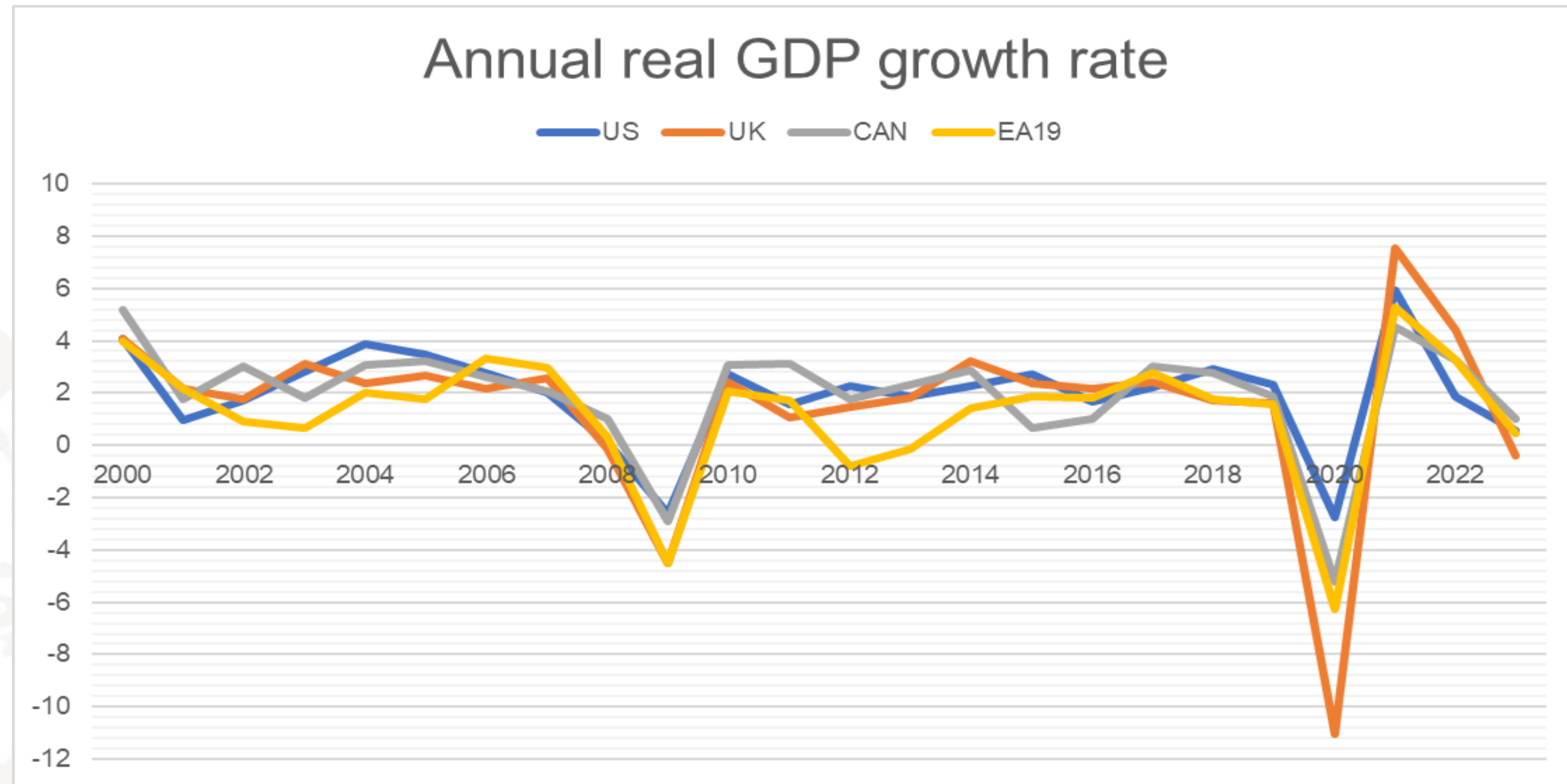
Introduction

EU19 : Austria, Belgium, Germany, Ireland, Spain, France, Italy, Luxembourg, the Netherlands, Portugal, Finland, Greece, Slovenia, Cyprus, Malta, Slovakia, Estonia, Latvia and Lithuania.
Source: OECD

Introduction

Annual real GDP growth rate

EU19 : Belgium, Germany, Ireland, Spain, France, Italy, Luxembourg, the Netherlands, Austria, Portugal, Finland, Greece, Slovenia, Cyprus, Malta, Slovakia, Estonia, Latvia and Lithuania.
Source: OECD

Literature Review

The role played by the bank capital in lending that has been extensively debated for a long time, especially after the 1988 Basel Capital Accord…

The great majority of empirical literature has examined the impact of capital requirements on bank risk taking.

The effects of bank capital on lending and monetary policy took on greater prominence with the literature on the "bank lending channel"**(Kashyap and Stein, (1995); Jayaratne and Morgan, (2000); Kishan and Opiela, (2000)**

Van den Heuvel (2002) argues that in the presence of capital regulation when a Central Bank goes for expansionary monetary policy by reducing policy rate, banks with the binding capital requirement may not channelize those additional reserves to the private sector by extending credits.

(Kashyap and Stein 1995) notes that banks can raise funds by selling bonds, certificate of deposits (CDs) etc. in the capital market and thereby can meet the funding requirement from the market when the central bank money turns costlier.

Literature Review

Admati and Hellwig (2014), Ellis and Flannery (1992) support the idea that banks with adequate capital ratio can raise funds with less cost and hence could maintain high loan growth.

Altunbas, Gambacorta, and Marques-Ibanez (2010) note that banks with higher capital have a lower credit risk and hence face a lower risk premium.

Kishan and Opela (2006) found that bank capital being a buffer against losses helps the bank to raise funds with less risk premium and unlock the lending channel.

The cyclical nature of capital makes it an ' automatic destabilizer' **Van den Heuvel (2002)**

Adrian, Boyarchenko and Shin (2010) argue that instead of extending credit during the boom phase, banks may pay out some debt liabilities (by reducing equity) to lessen the leverage. In this particular case, leverage might become countercyclical or acyclic.

Testable predictions

Bank Capital Channel

- ❑ Bank equity has an elasticity of greater than one with respect to total assets.
- ❑ Bank equity is positively correlated with cyclical conditions. It increases in a boom and decreases in a bust.

Bank Lending Channel

- ❑ Less leveraged banks pay less for their debt funding.
- ❑ Less leveraged banks get more debt funding.
- ❑ Less leveraged banks supply more lending.
- ❑ The effects of (iii)–(v) should be less pronounced (not significant) when controlling for market leverage, which is influenced by more volatile financial conditions

Data and stylized facts on bank capital

Data used by authors		Data used by us
BankScope	**Source**	Bloomberg
1994-2012	**Period**	1998-2022
Annual	**Frequency**	Annual
105	**Number of Banks**	26
Belgium, Canada, Switzerland, Germany, France, Italy, Japan, the Netherlands, Sweden, the United Kingdom, the United States, Austria, Australia and Spain	**Countries**	The United States, the United Kingdom, Canada and Germany
Annual GDP and stock market growth	**The cycle indicators**	The annual growth rate of GDP and S&P 500
Three-month interbank rates	**Monetary policy measure**	LIBOR rate

Variables

		Author's Estimation					Our Estimation				
Variable name	Variable description	N	Mean	Std.dev	Min.	Max.	N	Mean	Std.dev	Min.	Max.
Endogenous Variables											
Log equity	Logarithm of bank equity (in billion dollars)	1587	2.06	1.39	−2.486	5.40	709	3.02	1.15	0.42	5.58
Log assets	Logarithm of bank total assets (in billion dollars)	1587	5.08	1.48	0.48	8.25	709	5.79	1.17	2.59	8.23
Equity growth	Growth rate of bank equity	1587	9.30	17.10	−70.495	79.62	709	8.14	15.81	-63.21	163.02
Tier 1 Capital growth	Growth of Tier 1 bank capital	1278	0.09	0.16	−0.948	1.35	709	4.58	16.59	-74.94	134.64
Cost of funding	Average cost for debt funding (percentage points)	1587	3.11	1.60	0.01	8.92	709	2.89	3.32	-0.63	27.36
Funding growth	Growth rate of debt funding	1587	8.56	13.75	−79.976	94.61	709	8.98	15.70	-43.64	80.46
Loan growth	Growth rate of lending	1587	7.52	12.02	−37.582	72.62	709	8.10	18.17	-42.22	194.29
Total assets/equity	Accountancy leverage measure given by total bank assets over total common equity	1587	23.55	14.79	5.03	174.12	709	16.14	7.69	5.23	69.01
Exposure measure/Tier 1	Basel III measure of leverage given by total exposure over Tier 1	1331	26.54	12.70	7.00	99.59	-	-	-	-	-
RWA/TIER1	Risk-weighted assets over Tier 1	1442	11.58	3.02	2.24	22.73	709	8.89	2.33	1.03	16.79
Total assets market value/ total market equity	Market measure for leverage given by the market capitalisation over the market value of equity	958	15.96	13.96	3.05	99.15	709	463.11	509.75	16.42	5198.74
Bank-specific characteristics											
Asset risk	Asset volatility, std. dev, percentage change in market value of assets	1587	4.76	2.77	0.17	31.72	709	7.71	12.43	-35.69	83.92
ROA	Return on assets given by profits before taxes over total assets*100	1587	0.58	0.64	−6.002	3.70	709	0.80	0.60	-2.91	3.19
Rescued	Dummy variable that takes the value of one if a bank had public capital on its balance sheet and 0 elsewhere	1587	0.40	0.49	0.00	1.00	-	-	-	-	-
Macro Controls											
ΔRGDP	Growth rate of real GDP, adjusted	1587	2.02	1.98	−5.277	5.93	709	2.30	1.86	-2.77	5.95
ΔStock market	Stock market growth, adjusted	1587	5.93	18.03	−35.004	54.36	709	6.76	13.24	-24.78	28.52
ΔMP	Change in the three-month interbank interest rate, adjusted	1587	-0.269	1.16	−3.867	1.77	709	-4.53	75.66	-152.27	270.39
MP	Level of the three-month interbank interest rate, adjusted	1587	3.31	1.91	0.25	9.36	709	3.34	2.76	0.16	14.77
Other Controls											
Crisis	Dummy that takes the value of 1 in the years 2008–12 and 0 otherwise	1587	0.36	0.48	0.00	1.00	709	0.22	0.42	0.00	1.00
IFRS	Dummy that takes the value of 1 if a bank reported under IFRS and 0 elsewhere	1587	0.36	0.48	0.00	1.00	709	0.31	0.46	0.00	1.00

Variables

	Author's Estimation				Our Estimation			
	Low leveraged banks	Highly leveraged banks	Difference	Full Sample	Low leveraged banks	Highly leveraged banks	Difference	Full Sample
Number of banks	27	26	-	105	11	3	-	26
Observations	423	369	-	1587	264	101	-	709
Assets (bil. USD)	268.70	676.80	-408.10 ***	402.60	479.36	1037.81	-558.45	628.63
Cost of debt financing	2.60	3.50	-0.90 ***	3.10	2.08	2.28	-0.20 **	2.89
Annual growth rate of debt financing	8.05	6.22	1.83 *	8.56	9.36	7.27	2.09	8.98
Annual growth rate of lending	7.41	4.64	2.77 ***	7.52	8.22	5.86	2.36	8.10
Asset Risk	4.02	5.00	-1.00 ***	4.82	12.75	16.22	-3.47	12.43
ROA	0.95	0.19	0.76 ***	0.58	1.11	0.22	0.89 *	0.80
Non-interest income over income	31.59	17.05	14.50 ***	22.99	-	-	- -	-

Empirical & Critical Analysis

Research question & Result of authors

- **Elasticity of bank activity with respect to bank capital**

$$Ln(Total\ Assets)_{i\ jt} = \alpha\ Ln\ (Common\ Equity)_{i\ jt} + \varepsilon_{i\ jt}$$

➢ $Ln(Total\ Assets)_{i\ jt}$ - the the logarithm of total asset balance sheet items
➢ $Ln\ (Common\ Equity)_{i\ jt}$ - the logarithm of total common equity in period t of bank i headquartered in country j .

Elasticity between total assets and common equity.

Variables	Ln (total assets) (I)	Ln (total assets) (II)	Ln (total assets) (III)	Ln (total assets) (IV)
Ln(common equity)	0.9986***	0.9908***	0.8470***	0.6641***
	(0.0092)	(0.0083)	(0.0094)	(0.0176)
Bank-specific characteristics [1]	No	Yes	Yes	Yes
Bank fixed effects	No	No	Yes	Yes
Time-fixed effects	No	No	No	Yes
Ho: unit root test residual [2]:	0.000	0.000	0.000	0.000
Test unit elasticity (Prob > F=)	0.875	0.267	0.000	0.000
Observations	1587	1587	1587	1587
R-squared	0.8785	0.9046	0.9795	0.9829

Note: The sample includes annual data of 105 international banks operating in 14 advanced economies over the period 1995–2012. Annual data. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (1) Bank specific characteristics include: ROA and asset risk. (2) Fisher test for panel unit root using a Phillips–Perron test (4 lags). P-values are in parenthesis.

Key result: There is a positive association between two variables. Modifying the specification by adding control variables doesn't change the result, instead decreases the elasticity between two variables

Results from our analysis

- **Elasticity of bank activity with respect to bank capital**

Explanatory variables	Dependent variable: ln(total assets)			
	(I)	(II)	(III)	(IV)
Ln(common equity)	1.050***	1.024***	0.868***	0.760***
	(0.018)	(0.015)	(0.009)	(0.024)
Bank specific characteristics (2)	No	Yes	Yes	Yes
Bank fixed effects	No	No	Yes	Yes
Time fixed effects	No	No	No	Yes
Observations	709	709	709	709
R- squared	0.831	0.881	0.936	0.620

- **Does equity react to the cycle?**

$$\Delta Ln(Equity)_{ijt} = \alpha_i + \beta \Delta Ln\,(Equity)_{i\,jt-1} + \chi Y_{it} + \delta X_{ijt-1} + \gamma IFRS_{ijt} + \varepsilon_{i\,jt}$$

$$\Delta Ln(Equity)_{ijt} = \alpha_i + \varphi C_t + (\beta + \beta * C_t)\Delta Ln\,(Equity)_{i\,jt-1} + (\chi + \chi * C_t)Y_{it} + (\delta + \delta * C_t)X_{ijt-1} + \gamma IFRS_{ijt} + \varepsilon_{i\,jt}$$

> $\Delta Ln(Equity)_{ijt}$ - the annual growth rate of equity in period t of bank i headquartered in country j

> $\Delta Ln(Equity)_{ijt-1}$ - the lagged dependent variable captures equity adjustment costs caused by asymmetric information and rigidities in capital markets that make it difficult to raise capital at short notice in response to negative capital shocks

> X_{ijt-1} - bank-specific characteristics, which includes bank profitability (return on assets, ROA) and asset risk (standard deviation of the annual percentage change in the market value of assets)

> Y_{it} - one at a time, a cycle indicator

> C_t - dummy variable, takes the value of one in 2008–12 and 0 elsewhere. It captures not only the effect of the financial crisis, but also changes in the banks' behavior after Basel III regulatory reform

> $IFRS_{ijt}$ - takes the value of one once a bank has adopted International Financial Reporting Standards (IFRS) and 0 elsewhere. This dummy controls for changes in the measurement of certain balance sheet items and other differences in accounting due to the introduction of the new IFRS standards.

- **Does equity react to the cycle?**

How does equity react to changes in the business and financial cycle?

Explanatory variables	Dependent variable: growth rate of common equity				Dependent variable: growth rate of TIER1 capital			
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Real GDP growth, adjusted (1)	0.4100 (0.3405)		−3.223*** (1.1160)		−0.0694 (0.2540)		−1.6221*** (0.6021)	
Real GDP growth, adjusted × C (1)			4.1825*** (1.2893)				1.1961* (0.7264)	
Stock market price growth, adj. (1)		0.0838 (0.0810)		−0.1014** (0.0431)		0.0208 (0.0259)		−0.1026*** (0.0310)
Stock market price growth, adj. × C (1)				0.2878*** (0.0682)				0.1142** (0.0544)
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank specific characteristics (2)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1587	1587	1587	1587	1278	1278	1278	1278
Serial correlation test (3)	0.210	0.190	0.901	0.993	0.822	0.830	0.233	0.349
Hansen test (4)	0.174	0.156	0.119	0.117	0.567	0.591	0.529	0.572

Note: The sample includes annual data of 105 international banks operating in 14 advanced economies over the period 1995–2012. Standard errors in parentheses. The model is estimated using the dynamic Generalised Method of Moments (GMM) panel. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (1) Cycle indicators are weighted according the location of banks' ultimate borrowers. (2) Bank specific characteristics include: ROA, asset risk and IFRS dummy. (3) Reports p-values for the null hypothesis that the errors in the first difference regression exhibit no second-order serial correlation. (4) Reports p-values for the null hypothesis that the instruments used are not correlated with the residuals.

Key result:
- The first two columns indicate that the growth rate of equity is not correlated with the cycle indicators - the real GDP growth and stock market growth. Interestingly, the finding reported in the third and fourth columns of the table indicate that the growth rate of equity is reduced when the economy is booming and increases in a financial crisis.
- These results are supported by the findings of Muduli and Behera (2021). They find a significant negative correlation between bank equity and output gap, which supports the finding that leverage is procyclical (Adrian and Shin, 2010, 2014; Adrian et al., 2014; Laux and Rauter, 2014). Adrian, Boyarchenko and Shin (2010) argue that instead of extending credit during the boom phase, banks may pay out some debt liabilities (by reducing equity) to lessen the leverage. In this particular case, leverage might become countercyclical or acyclic.
- The results do not change if we use Tier 1 instead of common equity as the measure of bank capital) or changing the specification.

Result from our analysis

- **Does equity react to the cycle?**

Explanatory variables	Dependent variable: growth rate of common equity				Dependendent variable:growth rate of TIER1			
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Real GDP growth, adjusted (1)	-0.782***		0.344		-1.519***		-0.770**	
	(0.286)		(0.325)		(0.330)		(0.380)	
Real GDP growth, adjusted × C (1)			-3.199***				-1.356*	
			(0.648)				(0.738)	
Stock market price growth, adj. (1)		-0.066*		-0.013		-0.105**		0.044
		(0.038)		(0.047)		(0.044)		(0.054)
Stock market price growth, adj. × C (1)				-0.058				-0.312***
				(0.079)				(0.090)
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank specific characteristics (2)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R- squared	0.349	0.344	0.392	0.369	0.231	0.213	0.261	0.262
Observations	683	683	683	683	683	683	683	683
Serial correlation test (3)	0.461	0.388	0.455	0.688	0.000	0.002	0.000	0.000

Key result: We find a significant negative correlation between growth rate of the common equity and the cycle indicators. Our results are aligned with the argument that during the recession, the capital may decline, or banks may need to keep provisions for expected future defaults (Van den Heuvel 2002).

Research question

- **Impact of bank capitalization on funding costs**

$$Cost\_funds_{ijt} = \alpha_i + \theta_t + \beta Cost\_funds_{i\,jt-1} + \lambda Leverage_{ijt-1} + \delta X_{ijt-1} + \gamma IFRS_{ijt} + \varepsilon_{i\,jt}$$

- $Cost\_funds_{ijt}$ - the average cost of funding given by total interest rate paid over the total level of debt
- $Cost\_funds_{i\,jt-1}$ - one lag of the dependent variable is introduced in order to obtain white noise residuals
- X_{ijt-1} - bank risk and profitability indicators, other bank-specific controls that could affect the cost of funding:
  (i) the share of short- term funding (deposits, money market and other forms of short- term debt) over total debt funding;
  (ii) a diversification ratio, given by non-interest income to total income;
  (iii) a dummy variable that takes the value of 1 if a bank had public capital on its balance sheet in any given year and 0 elsewhere.
- $Leverage_{ijt-1}$ - the three different measures of accounting leverage:
  (i) the standard one, given by total bank assets over total common equity;
  (ii) a Basel III measure of leverage, given by total exposure over Tier 1 capital;
  (iii) a risk-weighted leverage, given by risk-weighted assets over Tier 1.
- $IFRS_{ijt}$ - takes the value of one once a bank has adopted International Financial Reporting Standards (IFRS) and 0 elsewhere.
  This dummy controls for changes in the measurement of certain balance sheet items and other differences in accounting due to the introduction of the new IFRS standards.

Results of authors

- **Impact of bank capitalization on funding costs**

Less leveraged banks pay less for their funding.

Explanatory variables	Dependent variable: average cost of funding (percentage points)						
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
(Total assets/Common equity) $_{t-1}$	0.0010*** (0.0003)			0.0012*** (0.0003)			
(Total exposure/TIER 1) $_{t-1}$		0.0080* (0.0048)			0.0073** (0.0032)		
(RWA/TIER1) $_{t-1}$			0.0218** (0.0110)			0.0199** (0.0082)	
((Equity/Total assets)×100) $_{t-1}$							−0.042*** (0.0148)
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank specific characteristics (1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls (2)	No	No	No	Yes	Yes	Yes	Yes
Observations	1587	1331	1442	1587	1331	1442	1587
Serial correlation test (3)	0.779	0.123	0.341	0.989	0.092	0.739	0.382
Hansen test (4)	0.174	0.479	0.134	0.325	0.180	0.940	0.129

Note: The sample includes annual data of 105 international banks operating in 14 advanced economies over the period 1995–2012. Standard errors in parentheses. The model is estimated using the dynamic Generalised Method of Moments (GMM) panel methodology. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (1) Bank specific characteristics include: ROA, asset risk, short tern funding ratio, diversification ratio, rescue dummy and IFRS dummy. (2) Macroeconomic controls include GDP growth and stock market growth. These variables are weighted according the location of banks' ultimate borrowers. (3) Reports *p*-values for the null hypothesis that the errors in the first difference regression exhibit no second-order serial correlation. (4) Reports *p*-values for the null hypothesis that the instruments used are not correlated with the residuals

Key result: 1 percentage point increase in the equity-to-total-assets ratio is associated with approximately a four basis point reduction in the average cost of debt funding
Overall, the conclusion based on the sample is that a shift in the funding mix toward equity results small, and possible negligibly small change in the funding cost of the bank.

Result from our analysis

- **Impact of bank capitalization on funding costs**

Explanatory variables	Dependent variable: average cost of funding (percentage points)				
	(I)	(II)	(III)	(IV)	(V)
(Total assets/Common equity) t −1	0.003		0.007		
	(0.011)		(0.012)		
(RWA/TIER1) t −1		0.078***		0.074***	
		(0.024)		(0.025)	
((Equity/Total assets) ×100) t −1					-0.072*
					(0.039)
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes
Bank specific characteristics (2)	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls (2)	No	No	Yes	Yes	Yes
Observations	681	681	681	681	681
Serial correlation test (3)	0.938	0.965	0.967	0.991	0.948

Key result: In general, the result are aligned with the findings of the authors, and they don't change when we add the macroeconomic variables to the model.
The insignificance of the results in the first and third columns can be explained by the irrelevance of the funding mix to the overall cost of financing which was supported by **Modigliani and Miller (1958)**.

Research question

- **Do less leveraged banks get more funding?**

$$\Delta\ln(funds)_{ijt} = \alpha_i + \theta_t + \beta\Delta\ln(funds)_{i\,jt-1} + \lambda Leverage_{ijt-1} + \delta X_{ijt-1} + \gamma IFRS_{ijt} + \varepsilon_{i\,jt}$$

- ➢ $\Delta\ln(funds)_{ijt}$ - the annual growth rate of debt funding
- ➢ $\Delta\ln(funds)_{ijt-1}$ - one lag of the dependent variable is introduced in order to obtain white noise residuals
- ➢ X_{ijt-1} - bank risk and profitability indicators, other bank-specific controls that could affect the cost of funding:
  - (i) the share of short- term funding (deposits, money market and other forms of short- term debt) over total debt funding;
  - (ii) a diversification ratio, given by non-interest income to total income;
  - (iii) a dummy variable that takes the value of 1 if a bank had public capital on its balance sheet in any given year and 0 elsewhere.
- ➢ $Leverage_{ijt-1}$ - the three different measures of accounting leverage:
  - (i) the standard one, given by total bank assets over total common equity;
  - (ii) a Basel III measure of leverage, given by total exposure over Tier 1 capital;
  - (iii) a risk-weighted leverage, given by risk-weighted assets over Tier 1.
- ➢ $IFRS_{ijt}$ - takes the value of one once a bank has adopted International Financial Reporting Standards (IFRS) and 0 elsewhere.
  This dummy controls for changes in the measurement of certain balance sheet items and other differences in accounting due to the introduction of the new IFRS standards.

Results of authors

- **Do less leveraged banks get more funding?**

Table 7
Less leveraged banks get more funding.

Explanatory variables	Dependent variable: growth rate of debt funding					
	(I)	(II)	(III)	(IV)	(V)	(VI)
(Total assets/Common equity) $_{t-1}$	−0.1562*** (0.0594)			−0.1576*** (0.0600)		
(Total exposure/TIER 1) $_{t-1}$		−0.1494*** (0.0406)			−0.153*** (0.0392)	
(RWA/TIER1) $_{t-1}$			−0.5427*** (0.2058)			−0.4678** (0.2063)
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls (1)	No	No	No	Yes	Yes	Yes
Observations	1587	1331	1442	1587	1331	1442
Serial correlation test (2)	0.580	0.668	0.152	0.563	0.575	0.150
Hansen test (3)	0.205	0.207	0.108	0.132	0.187	0.111

Note: The sample includes annual data of 105 international banks operating in 14 advanced economies over the period 1995–2012. Standard errors in parentheses. The model is estimated using the dynamic Generalised Method of Moments (GMM) panel methodology. We include in all specifications also a rescue dummy and IFRS dummy. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (1) Macroeconomic controls include GDP growth and stock market growth. These variables are weighted according the location of banks' ultimate borrowers. (2) Reports p-values for the null hypothesis that the errors in the first difference regression exhibit no second-order serial correlation. (3) Reports p-values for the null hypothesis that the instruments used are not correlated with the residuals.

Key result: A one standard deviation decrease in leverage determines an increase in the average annual rate of debt funding between 1.6 and 2.3%, depending on the different definitions. Results do not change if we also include in the specification a complete set of macroeconomic controls.

Results from our analysis

- **Do less leveraged banks get more funding?**

Explanatory variables	Dependent variable: average growth rate of debt funding			
	(I)	(II)	(III)	(IV)
(Total assets/Common equity) t −1	−0.123		−0.155*	
	(0.085)		(0.086)	
(RWA/TIER1) t −1		0.222		0.211
		(0.177)		(0.185)
Lagged dependent variable	Yes	Yes	Yes	Yes
Bank specific characteristics (2)	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Macroeconomic controls (2)	No	No	Yes	Yes
Observations	681	681	681	681
Serial correlation test (3)	0.514	0.662	0.747	0.899

Research question

- **Do less leveraged banks supply more credit?**

$$\Delta\ln(loans)_{ijt} = \alpha_i + \theta_t + \beta\Delta\ln(loans)_{i\,jt-1} + \lambda Leverage_{ijt-1} + \delta X_{ijt-1} + \gamma IFRS_{ijt} + \varepsilon_{i\,jt}$$

➢ $\Delta ln(loans)_{ijt}$- the annual growth rate of lending to the non-financial sector (firms and households).
➢ $\Delta ln(loans)_{ijt-1}$- one lag of the dependent variable is introduced in order to obtain white noise residuals
➢ X_{ijt-1} - bank risk and profitability indicators, other bank-specific controls that could affect the cost of funding:
  (i) the share of short- term funding (deposits, money market and other forms of short- term debt) over total debt funding;
  (ii) a diversification ratio, given by non-interest income to total income;
  (iii) a dummy variable that takes the value of 1 if a bank had public capital on its balance sheet in any given year and 0 elsewhere.
➢ $Leverage_{ijt-1}$ - the three different measures of accounting leverage:
  (i) the standard one, given by total bank assets over total common equity;
  (ii) a Basel III measure of leverage, given by total exposure over Tier 1 capital;
  (iii) a risk-weighted leverage, given by risk-weighted assets over Tier 1.
➢ $IFRS_{ijt}$ - takes the value of one once a bank has adopted International Financial Reporting Standards (IFRS) and 0 elsewhere.

Results of authors

▪ Do less leveraged banks supply more credit?

Explanatory variables	Dependent variable: growth rate of lending						
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
(Total assets/Common equity)$_{t-1}$	−0.1203*** (0.0458)			−0.1065* (0.0550)			
(Total exposure/TIER 1)$_{t-1}$		−0.1337*** (0.0474)			−0.1040*** (0.0337)		
(RWA/TIER1)$_{t-1}$			−0.6162*** (0.1097)			−0.6608*** (0.1566)	
((Equity/Total assets)×100)$_{t-1}$							0.5997*** (0.1734)
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls (1)	No	No	No	Yes	Yes	Yes	Yes
Observations	1587	1331	1442	1587	1331	1442	1587
Serial correlation test (2)	0.641	0.175	0.380	0.668	0.179	0.439	0.601
Hansen test (3)	0.310	0.320	0.815	0.401	0.526	0.814	0.419

Note: The sample includes annual data of 105 international banks operating in 14 advanced economies over the period 1995–2012. Standard errors in parentheses. The model is estimated using the dynamic Generalised Method of Moments (GMM) panel methodology. We include in all specifications also rescue dummy and IFRS dummy. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (1) Macroeconomic controls include GDP growth, house price growth and three-month interbank rate. The first two variables are weighted according the location of banks' ultimate borrowers; the interbank rate is a weighted average across the jurisdictions in which each bank gets funding. (2) Reports p-values for the null hypothesis that the errors in the first difference regression exhibit no second-order serial correlation. (3) Reports p-values for the null hypothesis that the instruments used are not correlated with the residuals.

Key points:
- Leverage is inversely associated with the changes in lending on an average
- Flipping the ratio (leverage) changes the association from negative to positive (Berger and Bouwman, 2013) –higher equity in earlier period speeds up lending growth
  - Regulatory restriction, risk management and prudent lending (prior performance), economic conditions and credit demand

Result from our analysis

- Do less leveraged banks supply more credit?

Explanatory variables	Dependent variable: average growth rate of lending				
	(I)	(II)	(III)	(IV)	(V)
(Total assets/Common equity) t −1	0.409***		0.376***		
	(0.129)		(0.132)		
(RWA/TIER1) t −1		-0.083		-0.381	
		(0.275)		(0.537)	
((Equity/Total assets) ×100) t −1					-1.599*
					(0.887)
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes
Bank specific characteristics (2)	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls (2)	No	No	Yes	Yes	Yes
Observations	681	681	681	655	655
Serial correlation test (3)	0.234	0.091	0.435	0.000	0.000

Sample Financial Overview (1989 - 2022)
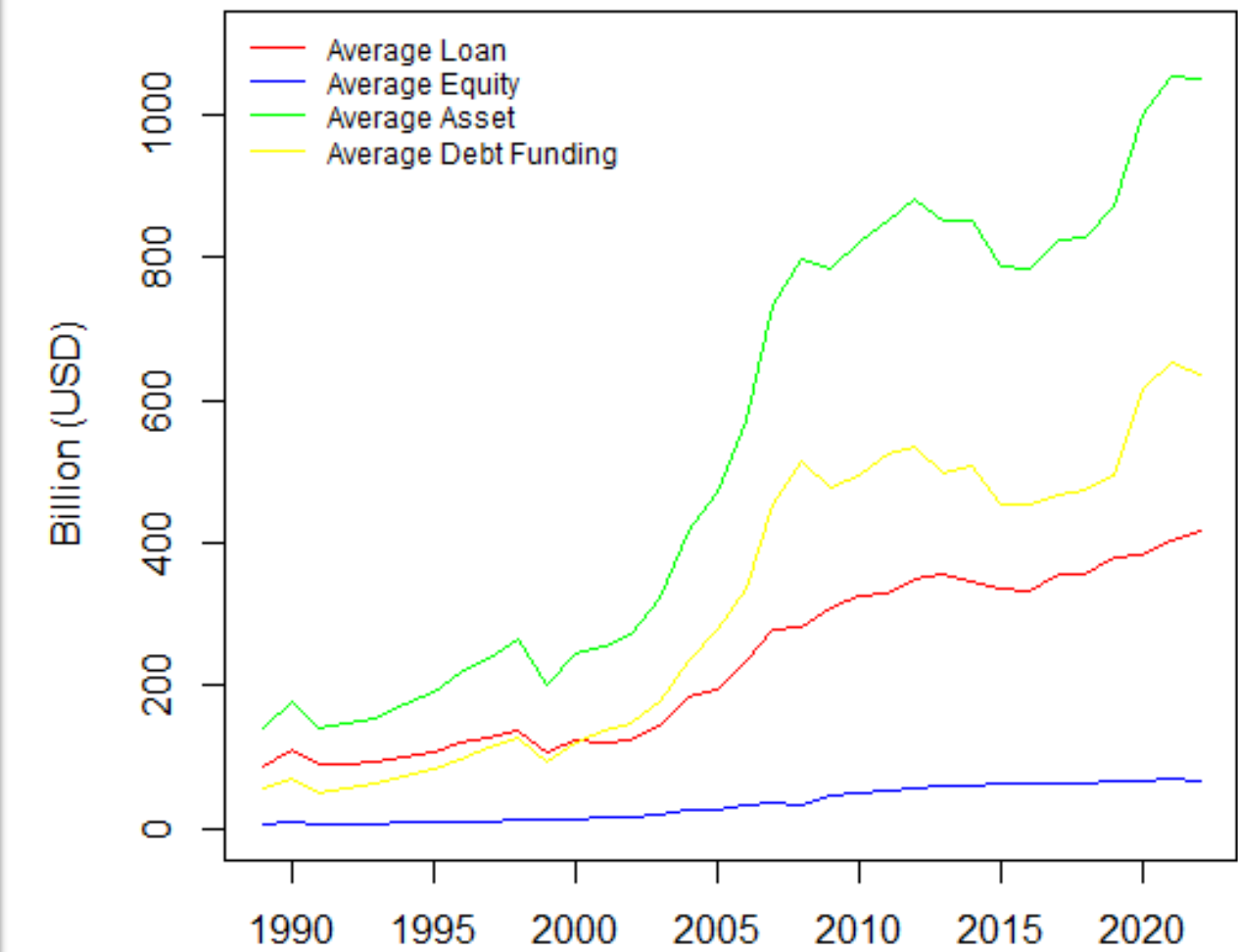
Key result:
- Opposite findings– positive association (Alessi and Detken, 2018)
    - Why? Increased risk appetite, improved access to funding, favorable market conditions
    - Bank expansion ... leverage ... credit growth to financial crisis (Schularick and Taylor, 2011)

Research question

- Is it a simple rebalancing effect?

$$\Delta\ln(equity)_{ijt}= \alpha_i + \theta_t + \beta\Delta\ln(equity)_{i\,jt-1} +\lambda Leverage_{ijt-1} + \delta X_{ijt-1} + \gamma IFRS_{ijt} + \varepsilon_{i\,jt}$$

➢ $\Delta\ln(equity)_{ijt}$ - equity growth
➢ $\Delta\ln(equity)_{ijt-1}$ - one lag of the dependent variable is introduced in order to obtain white noise residuals
➢ X_{ijt-1} - bank risk and profitability indicators, other bank-specific controls that could affect the cost of funding:
   (i) the share of short- term funding (deposits, money market and other forms of short- term debt) over total debt funding;
   (ii) a diversification ratio, given by non-interest income to total income;
   (iii) a dummy variable that takes the value of 1 if a bank had public capital on its balance sheet in any given year and 0 elsewhere.
➢ $Leverage_{ijt-1}$ - the three different measures of accounting leverage:
   (i) the standard one, given by total bank assets over total common equity;
   (ii) a Basel III measure of leverage, given by total exposure over Tier 1 capital;
   (iii) a risk-weighted leverage, given by risk-weighted assets over Tier 1.
➢ $IFRS_{ijt}$ - takes the value of one once a bank has adopted International Financial Reporting Standards (IFRS) and 0 elsewhere. This dummy controls for changes in the measurement of certain balance sheet items and other differences in accounting due to the introduction of the new IFRS standards.
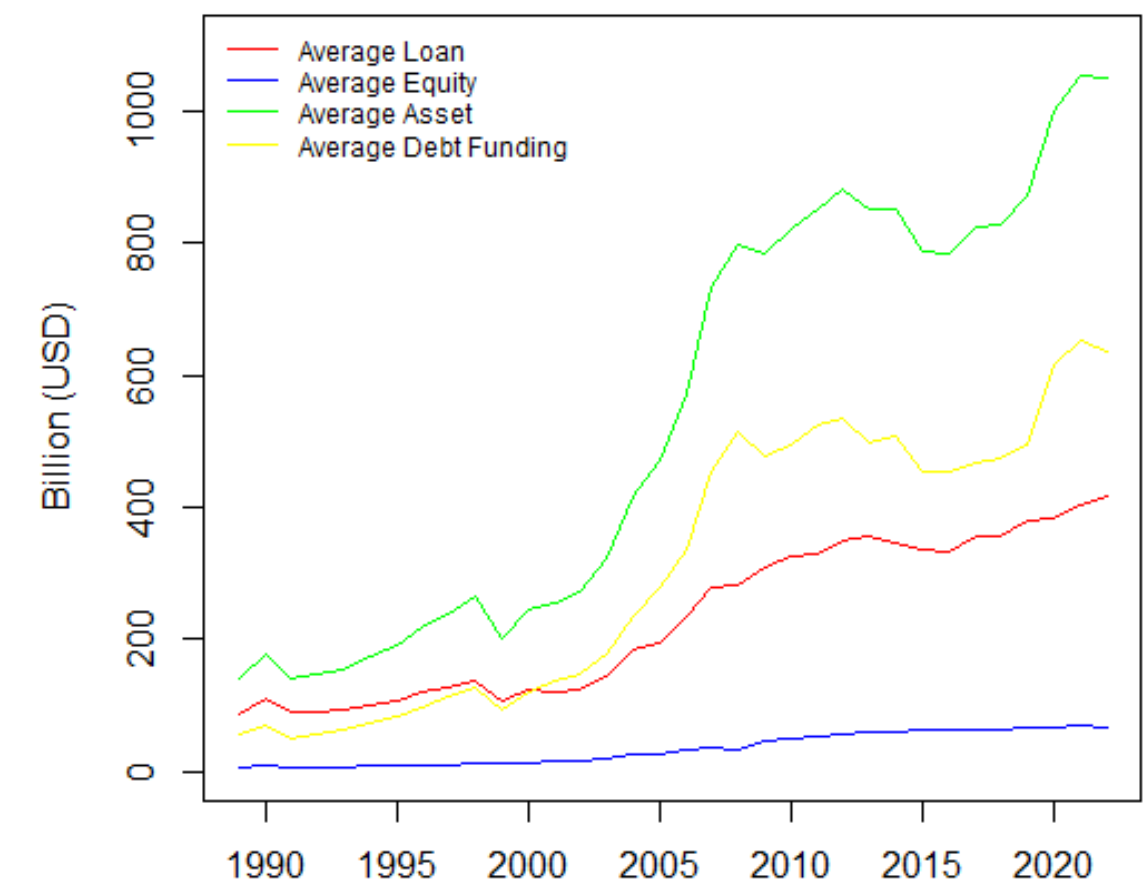
Key result:
- The results indicate that there is no significant link between leverage in t −1 and the growth of equity in t (λ≈0) (not reported in the paper)

Result from our analysis

- Do less leveraged banks concerns about equity growth?

Explanatory variables	Dependent variable: average growth rate of common equity				
	(I)	(II)	(III)	(IV)	(V)
(Total assets/Common equity) t −1	0.805***		0.821***		
	(0.114)		(0.117)		
(RWA/TIER1) t −1		0.294		0.291	
		(0.246)		(0.260)	
((Equity/Total assets) ×100) t −1					-3.274***
					(0.375)
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes
Bank specific characteristics (2)	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls (2)	No	No	Yes	Yes	Yes
Observations	681	681	681	655	655
Serial correlation test (3)	0.005	0.224	0.012	0.509	0.022

Sample Financial Overview (1989 - 2022)

Key result:
- Opposite findings– earlier leverage affects equity growth –aligned with (Cohen and Scatigna, 2014)
  - Increased profitability, capital accumulation, or successful investment strategies
- Lagged equity to asset ratio associates negatively with equity growth
  - Conservative capital structure approach (lower level of debt funding), and financial constraints –less investment

- **Market leverage vs accounting leverage**

  - Since the market values of assets and equity tend to be more volatile than book values, *could a market measure of leverage have a different impact (with respect to an accounting measure) on the cost and quantity of bank funding and on overall bank lending?*

Explanatory variables	Dependent variables					
	Average cost of funding (I)	Growth rate of debt financing (II)	Growth rate of lending (III)	Average cost of funding (IV)	Growth rate of debt financing (V)	Growth rate of lending (VI)
(Market value of bank assets/market value of bank's equity)$_{t-1}$ (1)	0.0002	−0.0013	−0.0706	0.0012	−0.0004	−0.0484
	(0.0016)	(0.0016)	(0.0772)	(0.0020)	(0.0015)	(0.0492)
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls (2)	No	No	No	Yes	Yes	Yes
Observations	958	958	958	958	958	958
Serial correlation test (3)	0.191	0.275	0.507	0.346	0.207	0.538
Hansen test (4)	0.862	0.602	0.992	0.871	0.514	0.997

Note: The sample includes annual data of 75 international banks operating in 14 advanced economies over the period 1995–2012. Standard errors in parentheses. The model is estimated using the dynamic Generalised Method of Moments (GMM) panel methodology. We include in all specifications also rescue dummy and IFRS dummy. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (1) The market value of banks' equity is given by the share price multiplied by the number of shares outstanding. (2) Macroeconomic controls include GDP growth, house price growth and three-month interbank rate. The first two variables are weighted according the location of banks' ultimate borrowers; the interbank rate is a weighted average across the jurisdictions in which each bank gets funding. (3) Reports *p*-values for the null hypothesis that the errors in the first difference regression exhibit no second-order serial correlation. (4) Reports *p*-values for the null hypothesis that the instruments used are not correlated with the residuals.

Key result:
- The main finding is that a market measure is **not statistically significant**, as opposed to the accounting measures of the leverage ratio. Results **do not change if we also include in the specification a complete set of macroeconomic controls**.

Results from our analysis

- **Market leverage vs accounting leverage**

Explanatory variables	Dependent variable					
	Average cost of funding (I)	Growth rate of debt financing (II)	Growth rate of lending (III)	Average cost of funding (IV)	Growth rate of debt financing (V)	Growth rate of lending (VI)
(Market value of bank assets/market value of bank's equity) t −1	0.0002	0.0002	0.0004	0.0002	-0.0003	0.004
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes
Bank specific characteristics (2)	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls (2)	No	No	No	Yes	Yes	Yes
Observations	681	681	681	681	681	681
Serial correlation test (3)	0.917	0.548	0.136	0.921	0.775	0.326

Key result:
- Same as author's findings! Even after controlling the macro variables.

Research questions

- **The effect of bank capital in the monetary transmission mechanism**

$$\Delta\ln(loans)_{ijt} = \alpha_i + \theta_t + \beta\Delta\ln(loans)_{i\,jt-1} + \lambda Leverage_{ijt-1} + \kappa\Delta MP_{it}Leverage_{ijt-1} + \delta X_{ijt-1} + \gamma IFRS_{ijt} + \varepsilon_{i\,jt}$$

- ➢ $\Delta\ln(loans)_{ijt}$ - the annual growth rate of lending to the non-financial sector (firms and households).
- ➢ $\Delta\ln(loans)_{ijt-1}$ - one lag of the dependent variable is introduced in order to obtain white noise residuals
- ➢ X_{ijt-1} - bank risk and profitability indicators, other bank-specific controls that could affect the cost of funding:
  (i) the share of short- term funding (deposits, money market and other forms of short- term debt) over total debt funding;
  (ii) a diversification ratio, given by non-interest income to total income;
  (iii) a dummy variable that takes the value of 1 if a bank had public capital on its balance sheet in any given year and 0 elsewhere.
- ➢ $Leverage_{ijt-1}$ - the three different measures of accounting leverage:

  (i) the standard one, given by total bank assets over total common equity;
  (ii) a Basel III measure of leverage, given by total exposure over Tier 1 capital;
  (iii) a risk-weighted leverage, given by risk-weighted assets over Tier 1.
- ➢ $IFRS_{ijt}$ - takes the value of one once a bank has adopted International Financial Reporting Standards (IFRS) and 0 elsewhere. This dummy controls for changes in the measurement of certain balance sheet items and other differences in accounting due to the introduction of the new IFRS standards.
- ➢ $\Delta MP_{it}Leverage_{ijt-1}$ - interaction term between leverage and the monetary policy indicator

Results of authors

- **The effect of bank capital in the monetary transmission mechanism**

Explanatory variables	Dependent variable: growth rate of lending					
	(I)	(II)	(III)	(IV)	(V)	(VI)
(Total assets/Common equity) $_{t-1}$	−0.123** (0.0618)			−0.1317* (0.0777)		
(Total exposure/TIER 1) $_{t-1}$		−0.152*** (0.0374)			−0.123*** (0.0373)	
(RWA/TIER1) $_{t-1}$			−0.744*** (0.1283)			−0.5742*** (0.1422)
(Total assets/Common equity) $_{t-1} \times \Delta MP_t$	−0.0569* (0.0339)			−0.061** (0.0274)		
(Total exposure/TIER 1) $_{t-1} \times \Delta MP_t$		−0.0408** (0.0184)			−0.0357* (0.0196)	
(RWA/TIER1) $_{t-1} \times \Delta MP_t$			−0.244*** (0.0817)			−0.2344** (0.1031)
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls (1)	No	No	No	Yes	Yes	Yes
Bank-specific characteristics (2)	No	No	No	Yes	Yes	Yes
Observations	1667	1317	1598	1667	1317	1598
Serial correlation test (3)	0.612	0.464	0.398	0.723	0.522	0.420
Hansen test (4)	0.174	0.678	0.264	0.206	0.746	0.234

Note: The sample includes annual data of 105 international banks operating in 14 advanced economies over the period 1995–2012. Monetary policy measures are weighted averages across the jurisdictions in which each bank gets funding. Standard errors in parentheses. The model is estimated using the dynamic Generalised Method of Moments (GMM) panel methodology. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (1) Macroeconomic controls include GDP growth, house price growth and three-month interbank rate. The first two variables are weighted according the location of banks' ultimate borrowers; the interbank rate is a weighted average across the jurisdictions in which each bank gets funding. (2) Controls include ROA, bank asset risk and rescue dummy. We include in all specifications also IFRS dummy (3) Reports *p*-values for the null hypothesis that the errors in the first difference regression exhibit no second-order serial correlation. (4) Reports *p*-values for the null hypothesis that the instruments used are not correlated with the residuals.

Key result:
The effects of a **monetary tightening are smaller for banks with higher capitalization**, which have easier access to uninsured financing.

- Italian banks (Gambacorta and Mistrulli, 2004) ;
- Spanish banks (Jiménez et al., 2012a)

- Increasing rates –negatively associates the bank lending

Results from our analysis

- **The effect of bank capital in the monetary transmission mechanism**

Explanatory variables	Dependent variable: average growth rate of lending			
	(I)	(II)	(III)	(IV)
(Total assets/Common equity) t −1	0.473***		0.169	
	(0.177)		(0.146)	
(RWA/TIER1) t −1		1.147***		-0.265
		(0.327)		(0.291)
(Total assets/Common equity) t − 1 × ΔMP	-0.002		-0.004***	
	(0.001)		(0.001)	
(RWA/TIER1) t −1 × ΔMP		0.004		-0.004
		(0.005)		(0.004)
Lagged dependent variable	Yes	Yes	Yes	Yes
Bank specific characteristics (2)	No	No	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Macroeconomic controls (2)	No	No	Yes	Yes
Observations	681	681	681	681
Serial correlation test (3)	0.496	0.365	0.064	0.165

Possible reasons:

- Increased financial risk
- Reduced liquidity, or
- Tighter credit conditions

- Low-capitalised banks are therefore more exposed to asymmetric information problems and have less capacity to shield their credit relationships (Jayaratne and Morgan, 2000; Kishan and Opiela, 2000).

Key result:
- Combined effects of lagged leverage ratio and 3-month interbank lending rate (LIBOR) on lending growth –**negative!**
- **Same as authors' findings (standard leverage)**

Conclusion & Findings

Summary of the findings

Authors' **VS** **Ours**

|		Authors'	Ours
1	Bank equity has an elasticity of greater than one with respect to total assets	✓ True	✓ **True**
2	Bank equity is positively correlated with cyclical conditions. It increases in a boom and decreases in a bust	✓ True	✗ **Opposite is True**
3	Less leveraged banks pay less for their debt funding	✓ True	✗ **Not necessarily (MP matters)**
4	Less leveraged banks get more debt funding	✓ True	✗ **Opposite is True**
5	Less leveraged banks supply more lending	✓ True	✗ **Not necessarily (efficiency)**
5	The effects of (3)–(5) should be less pronounced (not significant) when controlling for market leverage, which is influenced by more volatile financial conditions	✓ True	✓ **True**

Limitations and Future Research directions

- Small sample size and centric to the USA, Canada, UK and Germany
- Didn't adjust merger and acquisition
- Public recapitalization during crisis moments
- Linear interpolation to predict the missing values

- Only GFC is considered as the financial crisis effects where data range covers Dotcom bubble (2001), GFC (2008-10), ESDC (2010-12), and COVID-19 (2020-2021)

- Countercyclical buffering for each country (country specific risk)
  - Tier 1 capital requirement stays same but CCYB changes overtime
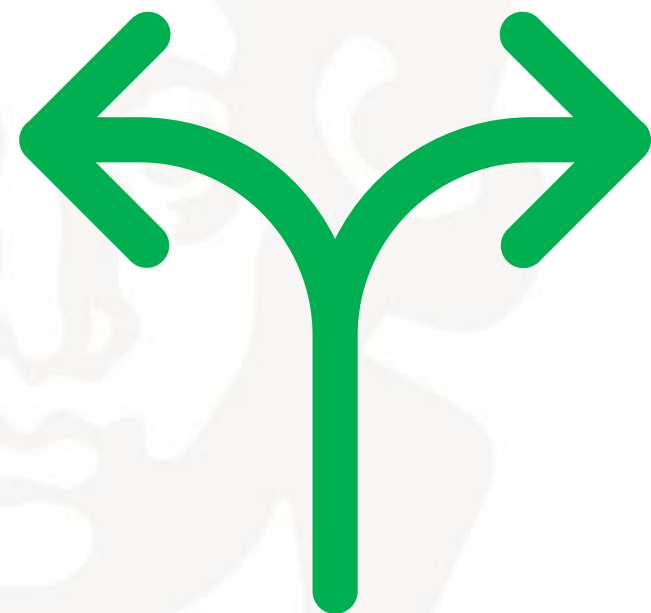
- Considering cross banks interactions
- Risk taking behaviors (NPL/loan ratio)
- Sectoral and industrial consideration of banks

- Monetary policy tracking -QE/QT
- Bank rating
- Systemic and non-or-mild systemic classifications

- Data range and diversified samples (e.g., emerging markets)

Thank you!

Any questions?

References