Cross-Country Monetary Policy Transmission

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Abstract

I analyze the cross-country monetary policy transmission on mortgage and deposit rates via the bank market power channel. Europe provides an interesting study of heterogeneous countries within a monetary union where the central bank has implemented a broad range of monetary policies. My results show that, when the policy rate increases by 100 basis points (bps), banks with high market power transmit a 49 bps lower deposit rate and a 20 bps higher mortgage rate relative to banks with low market power. Lower deposit rates decrease bank funding, which makes mortgage rates more expensive. Banks with high market power appear to be less resilient to monetary contractions, as they are more constrained by lower profitability margins. As a consequence, monetary policy decisions are transmitted to mortgage and deposit rates mainly through banks with low market power. In periods of financial stress, monetary policy is less effective in countries with highly concentrated banking sectors.

JEL Codes: E44, E52, G21

Keywords: Monetary policy transmission, market power

1 Introduction

Lending conditions matter for central banks to understand the effectiveness of monetary policy transmission on aggregate demand. From the early 2000s to the end of 2007, monetary policy transmission in the euro area was relatively homogeneous across countries, while it has been heterogeneous across countries during the financial and sovereign debt crises. For example, The Danmarks Nationalbank, the Swedish Riksbank, and the Swiss National Bank have entered negative interest rate territory. The European central bank (ECB) has been involved with credit easing and quantitative easing measures to secure the lowest rate on new loans and for banks to maintain the same level of lending to households and businesses as in the previous year. Altavilla et al. (2019) and Claessens et al. (2018) have studied monetary policy transmission to firm borrowing rates through sovereign debt exposure and bank profitability margin channels. However, there has not been any analysis on cross-country monetary policy transmission via the bank market power channel.

In this paper, I explain cross-country monetary policy transmission on mortgage and deposit rates through the bank market power channel. I focus on mortgages because monetary policy stimulates the economy by reducing mortgage payments, which could increase household spending. I focus on deposits as it determines banks' funding to make loans. When pricing frictions are present, changes in monetary policy alter banks' lending margins. Compression of lending margins is more pronounced for banks with higher exposure to sovereign debt, which tends to be banks with higher market power (Altavilla et al., 2019). Thus, when financial frictions matter, monetary policy influences not only how much the banking system lends, but also how it is funded. Lower funding increases the mortgage rate for newly issued loans.

My empirical analysis focuses on cross-country monetary policy transmission in the euro area from 2000 to 2020. The euro area provides an interesting case study as bank market structure is heterogeneous across the countries within the monetary union. It is an ideal setting to check whether bank market power plays any role during monetary policy transmission. I condition on bank and macro characteristics and control for cross-country and time-series heterogeneity. The cross-country and time-series panel provides a strong way to isolate the effect of low interest rate transmission through bank market power. Then, I use local projection to see impulse response functions of a monetary policy shock on mortgage and deposit rates. I also compare monetary policy transmission before 2009, which I call the pre-zero lower bound (pre-ZLB) period, and after 2009 as the ZLB period.

I find that in response to a positive 100 basis points (bps) shock in the policy rate, banks with high market power transmit a 49 bps lower deposit rate relative to banks with low market power. The number of loans and deposits do not change. Reduction in the deposit rate lowers bank funding, which contributes to a higher mortgage rate for banks with high market power. Banks with high market power transmit mortgage rates by 20.7 bps more relative to banks with low market power. The effectiveness of monetary policy on mortgage and deposit rates is dampened by market power. Ineffective transmission of policy rate changes makes it more challenging for a central bank to regulate the dynamics of aggregate demand. Thus, lending conditions are crucial to determine the effectiveness of monetary policy. Lastly, monetary policy shocks have negligible effect on mortgage and deposit rates during ZLB. Monetary policy transmission is reduced during ZLB relative to pre-ZLB periods.

Related Literature The focus of the paper is on the transmission of monetary policy through the bank market power channel. Altavilla et al. (2019) study the dispersion of monetary policy transmission through the sovereign risk exposure channel.

Following a monetary expansion, banks with higher net worth or lower sovereign risk exposure reduce their lending rates considerably more than poorly capitalized and highly exposed banks. They find that, over the period 2007-2014, there has been a significant fall in the median transmission of a policy rate change relative to the pre-2007 period, where capital inadequacy and sovereign risk exposure account for the decline in transmission dispersion.

In the US, the transmission to lending rates has been found to be stronger for small (Kashyap and Stein, 1995), illiquid (Stein (1995), Kashyap and Stein (2000)), and poorly capitalized banks (Peek and Rosengren (1995), Kishan and Opiela (2000), Van den Heuvel et al. (2002)). Larger, better capitalized, and more liquid banks are more resilient to monetary contractions as they can more easily substitute across sources of external financing, absorb expected future losses, and divert liquidity to satisfy increases in loan demand. In this paper, I find that the transmission to mortgage and deposit rates are stronger for banks with less market power.

Peersman (2011) studies macroeconomic effects and pass-through of monetary policy in the euro area, and finds that a 25 bps decline in the policy rate is comparable to a 10% increase in the monetary base in terms of the magnitude of their impact on economic activity. Yet, bank interest rate spreads increase significantly after an expansionary interest rate innovation, whereas spreads decline persistently after a rise in the size of the Eurosystem's balance sheet. Boeckx et al. (2017) use a monthly bank-level dataset to analyze the effectiveness and transmission of credit support policies during Europe's banking and sovereign debt crisis. They find that banks that were more constrained in terms of external funding benefited the most from these policies. I focus on the effectiveness of conventional and unconventional cross-country monetary policy transmission.

My analysis contributes to the literature on low interest rates by looking at cross-

country transmission in the euro area on mortgage and deposit rates. While research on cross-country monetary policy transmission focuses on bank profitability, I focus on bank market power. Claessens et al. (2018) analyze how low policy rates shrink banks' net interest margins and adversely affect bank profitability. Borio et al. (2017) study how monetary policy affects bank profitability across Europe, Japan, and the United States. They find that monetary policy is less effective in stimulating bank lending growth when interest rates are very low.

Recently, imperfect monetary policy transmission has been explained by bank market power. Drechsler et al. (2017) show that market power allows banks to keep deposit rates stable, but an increase in the policy rate transmits less to deposit rates. Banks lose deposit funding because deposits become less attractive as a store of value. There is a literature that evaluates the effect of low interest rates on the aggregate economy. Heider et al. (2018) examine empirically how negative policy rates transmit to the real economy. Eggertsson et al. (2019) present New Keynesian macroeconomic models to evaluate the impact of negative policy rates. I explain cross-country monetary policy transmission via the bank market power channel.

Outline The remainder of this paper is structured as follows. Section 2 introduces the data and demonstrates cross-country differences in mortgage and deposit rates. Section 3 describes the empirical specification and results for monetary policy transmission across countries, and Section 4 discusses the effects on mortgage and deposit rates from the local projection method. Section 5 concludes.

2 Data

My main data source is the ECB Statistical Data Warehouse. I use the period 2000 to 2020 for 25 European countries[1]. I further obtain macroeconomic variables from Eurostat, monetary variables from ECB BSI statistics, and monetary policy shocks, including the euro area shadow rate- from Wu and Xia (2017), and US monetary policy shocks from Swanson (2021).

The main variables of interest are deposit and mortgage rates and ECB deposit facility rates (DFR). The DFR is the rate banks earn on their overnight deposits with the Eurosystem. While the ECB sets the rate on the marginal lending facility and the main refinancing operations, the DFR is the relevant rate during this period because of the ample liquidity provided by the central bank. The introduction of the ECB's expanded asset and credit purchase program increased the volume of excess liquidity in the system. A bank that has excess liquidity can either deposit it with the ECB or lend it to another bank in the system, where the interbank interest rate moves towards the DFR. Thus, the interest rate at which banks are able to deposit their excess liquidity has become the relevant variable in determining bank costs.

Summary statistics of my sample of countries are displayed in Table 1. Countries' Herfindahl-Hirschman Index (HHI) is on average 0.11 and at maximum 0.14. A lower HHI indicates that the banking market is competitive, while a higher HHI indicates a concentrated market. Banks have an average return on assets (ROA) of 0.33. Government bonds are represented as a percentage of GDP, and the average among countries in my sample is 3.8%. The sovereign stress indicator (SSI) measures stress

[1]The countries in my sample are: Austria, Belgium, Bulgaria, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithunia, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden, and Spain.

in sovereign debt markets in the euro area. It integrates measures of credit risk, volatility, and liquidity at short-term and long-term bond maturities into a broad measure of sovereign market stress. Higher values indicate a greater degree of stress. On average, inflation rates in these countries are 1.25%, deposit rates are 0.24%, and mortgage rates are 2.65%.

Table 1: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max	P25	P50	P75
HHI	.11	.07	.02	.36	.07	.1	.14
Government debt	3.82	3.33	0	16.4	1.3	2.6	6.3
ROA	.33	.8	-10.9	2.97	.16	.35	.6
Deposit rate	.24	.32	0	2.07	.04	.11	.33
Mortgage rate	2.65	1.02	.88	5.73	1.9	2.45	3.24
ECB Policy rates	.56	.5	.25	1.75	.25	.27	.75
SSI	.17	.19	.008	.987	.048	.087	0.206
Inflation	1.25	1.25	-1.6	5.7	.35	1.2	2.2
Unemployment rate	8.77	4.83	2.4	27.5	5.7	7.25	10.4
Population (000s)	18,231	23,188	420	83,084	3,517	9,198	18,380

Notes: Data on mortgage and deposit rates come from Eurosystem policy and exchange rates, return on assets (ROA) come from the European Bank Authority, HHI in bank assets are from Banking Structural Financial Indicators, and government debt measured as a percentage of GDP is from Government Finance Statistics. Inflation and the sovereign stress indicator come from Statistical Data Warehouse, while GDP growth comes from national accounts. Data on policy rates are from Eurosystem policy and exchange rates, and unemployment rates are from Eurostat.

Table 2 shows similarities across countries with different mortgage types. On average, countries with fixed-rate mortgages (FRMs) have higher mortgage and deposit rates than countries with adjustable-rate mortgages (ARMs). Countries with FRMs have higher population and government debt, whereas countries with ARMs have

higher inflation and unemployment rates. In Europe, 70% of countries use ARMs and 30% of countries use FRMs.

Table 2: Summary Statistics by Mortgage Type

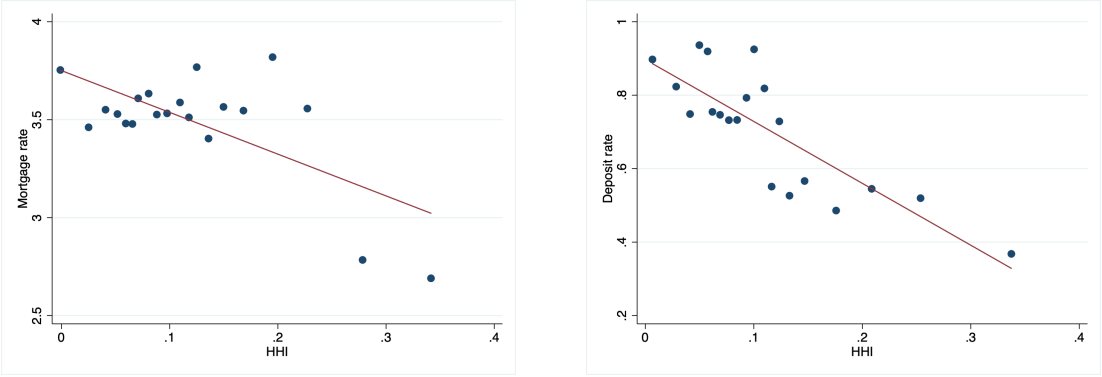
Variable	Mean	Std. Dev.	Min	Max	P25	P50	P75
Adjustable-Rate Mortgages							
HHI	.1	.08	.02	.39	.04	.08	.12
Government debt	4.61	3.09	.06	12.19	2.13	3.66	6.88
ROA	.17	.77	-10.93	1.94	.08	.29	.5
Deposit rate	.57	.61	.01	7.38	.11	.38	.89
Mortgage rate	3.15	1.4	.88	7.55	1.98	3.06	4.18
Sovereign Stress Indicator	.2	.23	.01	.99	.05	.09	.25
Inflation	1.95	1.52	-1.4	15.3	1	1.9	2.9
Unemployment rate	9.96	4.85	1.9	27.5	6.3	8.8	11.9
Population (000s)	21,961.35	19,638.26	409.51	60,789.1	8,388.53	10,522.3	38,517
Fixed-Rate Mortgages							
HHI	.1	.07	.01	.27	.05	.11	.17
Government debt	4.71	4.43	0	17.39	.88	2.97	8.6
ROA	.3	.38	-1.81	2.13	.12	.27	.41
Deposit rate	.66	.72	0	3.67	.09	.41	1.06
Mortgage rate	3.74	1.15	1.6	5.94	2.67	3.99	4.62
Sovereign Stress Indicator	.14	.14	.01	.81	.05	.08	.17
Inflation	1.87	1.54	-1.6	12	1	1.8	2.3
Unemployment rate	7.25	2.68	3	19.6	5.2	7.3	8.5
Population (000s)	31,986.38	30,759.31	2,792.55	83,084	7,177.99	16,225	65,330

Notes: Data on mortgage and deposit rates come from Eurosystem policy and exchange rates, return on assets (ROA) come from the European Bank Authority, HHI in bank assets are from Banking Structural Financial Indicators, and government debt measured as a percentage of GDP is from Government Finance Statistics. Inflation and the sovereign stress indicator come from Statistical Data Warehouse, while GDP growth comes from national accounts. Data on policy rates are from Eurosystem policy and exchange rates, and unemployment rates are from Eurostat. Fixed-Rate Mortgages include Belgium, Bulgaria, Denmark, France, Germany, Lithuania, and the Netherlands. Adjustable-Rate Mortgages include Austria, Greece, Finland, Italy, Latvia, Luxembourg, Poland, Portugal, Slovenia, Spain, and Sweden.

2.1 Cross-country Analysis

Figure 1 illustrates the variation in mortgage and deposit rates across countries. Scatterplots for all European countries in our sample are shown in the Appendix. Slovakia has the highest mortgage rate among the European countries. On average, Sweden and Denmark offer the lowest mortgage rates while Germany and Slovakia offer the highest rates. Sweden and Denmark have higher bank market concentration and higher ROA. Portugal and Sweden have lower deposit rates than the ECB policy rate while Poland has a higher deposit rate than the policy rate.

Figure 1: Cross-sectional mortgage and deposit rates by market concentration



(a) Mortgage rate

(b) Deposit rate

Notes: Highly concentrated banks offer lower deposit rates.

The following summary statistics show the mean and standard deviation of mortgage and deposit rates in low-concentration versus high-concentration markets. On average, banks in highly concentrated banking industries transmit less onto mortgage and deposit rates, with higher variation in mortgage rates and lower variation in deposit rates.

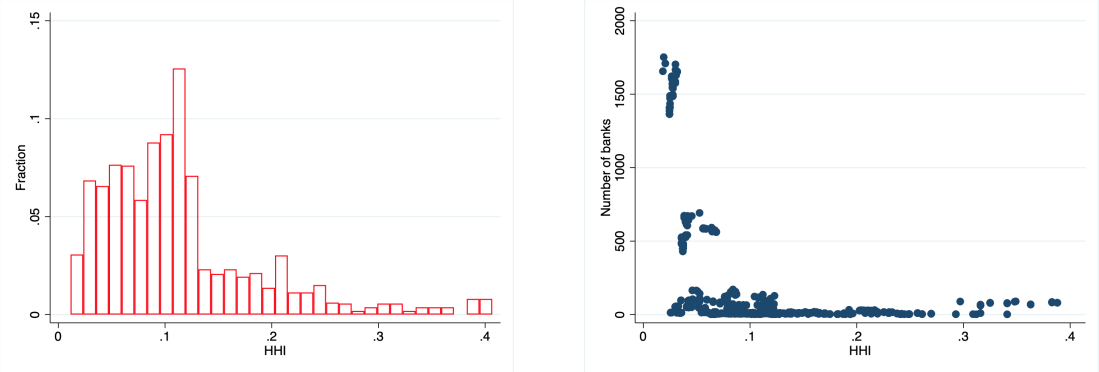
Table 3: Summary Statistics by Market Concentration

Variable	Low Market Concentration	High Market Concentration
Mortgage rate	2.77	2.59
	(0.86)	(1.08)
Deposit rate	.36	.15
	(0.402)	(0.195)

Notes: Banks in low market concentration charge higher mortgage and deposit rates.

Figure 2 illustrates the dispersion in cross-country bank market concentration. Finland has higher market concentration. Market concentration is rising for Cyprus, whereas it remains constant for Austria. In Europe, there are high number of competitive banks and market concentration is widely spread.

Figure 2: Cross-Country Herfindahl-Hirchsman Index



(a) HHI (b) Number of banks by market concentration

Notes: Austria has the lowest HHI, while Finland has the highest HHI.

3 Monetary Policy Transmission Across Countries

Countries have different levels of bank market power, because there is variation in government support for big banks across Europe. Government support to financially stressed countries can distort bank competition in various ways. First, the government support may give an advantage to banks in financially stressed countries over banks in non-financially stressed countries. The expansion of banks in financially stressed countries could affect bank competition. Second, it could prevent potential entry by foreign banks into the domestic market. In this paper, I ask if market concentration plays a role in the variation in deposit and mortgage rates.

$$y_{ct} = \alpha_c + \alpha_t + \beta_1 HHI_{ct} + \beta_2 \Delta i_t + \beta_3 HHI_{ct} \times \Delta i_t + \gamma X_{ct} + \epsilon_{ct}, \tag{1}$$

where y_{ct} is either deposit or mortgage rates, HHI_{ct} is the Herfindahl-Hirschman Index in total bank assets, and Δi_t is the change in percentage points compared to the previous ECB deposit facility rate. Throughout all regressions, I control for quarter t and country c fixed effects and cluster at the country level. X_{ct} includes bank and macro controls. The fixed effects α_c ensure that all country-specific influences are accounted for, provided they are invariant over time. Year fixed effects, α_t, are included to reflect time-varying factors common to all countries.

β_1 captures how banks in concentrated markets transmit monetary policy to deposit or mortgage rates, while β_2 tells us how policy rate changes affect deposit and mortgage rates. The main variable of interest is β_3, which tells us how banks in a concentrated market react to policy rate changes in deposit and mortgage rates.

Second, I sort banks by their market concentration.

$$y_{ct} = \alpha_c + \alpha_t + \beta_1 dHHI_{ct} + \beta_2 \Delta i_t + \beta_3 dHHI_{ct} \times \Delta i_t + \epsilon_{ct}, \tag{2}$$

where $dHHI_{ct}$ equals one when a country is above the 50th (75th) percentile of concentrated markets. β_1 captures whether high market power banks transmit more to mortgage or deposit rates, and β_3 shows how banks with higher market power respond to monetary policy changes.

3.1 Results

Column (1) in Table 4 shows that a 100 bps increase in the policy rate raises deposit rates on average by 49 bps. The results are statistically significant and robust across different regression specifications. Market concentration is not statistically significant when time fixed effects are included in column (4). Banks in highly concentrated markets transmit 37 bps more on deposit rates than their lower counterparts. The interaction between monetary policy and market concentration is negative, where banks in highly concentrated markets lower deposit rates when the policy rate increases. This is in line with Drechsler et al. (2017)'s findings that banks transmit less of the policy rate towards deposit rates and thus lose deposit funding. In the overall effect, high market power banks reduce deposit rates by 77 bps in response to a contractionary monetary policy shock. However, the amount of deposits does not change, which lowers bank funding.

Table 4: Deposit Market

	Deposit Rates					log(deposit)
	(1)	(2)	(3)	(4)	(5)	(6)
Δi_t	0.497***	0.496***	0.527***	0.539***	0.457***	3.623
	(0.0377)	(0.0419)	(0.0397)	(0.0555)	(0.115)	(4.916)
HHI	0.0188	0.0137	0.262	0.377*	0.986	1.394
	(0.229)	(0.203)	(0.249)	(0.225)	(1.007)	(5.976)
$\Delta i_t \times$HHI	-1.273***	-1.270***	-1.279***	-1.379***	-1.677**	-10.43
	(0.281)	(0.315)	(0.279)	(0.313)	(0.793)	(17.89)
ROA		-0.00113		-0.00132	-0.000730	0.00133
		(0.000803)		(0.000827)	(0.00199)	(0.00819)
Log(population)			0.0150**	0.0143**	0.588	3.621
			(0.00762)	(0.00698)	(1.045)	(2.305)
Employment rate			-0.00390	-0.00644***	0.0263	-0.0146
			(0.00249)	(0.00248)	(0.0235)	(0.0445)
Inflation			-0.0191**	0.000295	0.0567*	0.153**
			(0.00940)	(0.0124)	(0.0318)	(0.0559)
Time FE	No	No	No	Yes	Yes	Yes
Country FE	No	No	No	No	Yes	Yes
R^2	0.361	0.372	0.369	0.416	0.762	0.993
N	667	522	667	522	522	440

Notes: Results from estimating

$$y_{ct} = \alpha_c + \alpha_t + \beta_1 HHI_{ct} + \beta_2 \Delta i_t + \beta_3 HHI_{ct} \times \Delta i_t + \gamma X_{ct} + \epsilon_{ct},$$

where y_{ct} is either deposit or mortgage rates, HHI_{ct} is the Herfindahl-Hirschman Index in total bank assets, and Δi_t is the change in percentage points compared to the previous ECB deposit facility rate. Standard errors are clustered at the country level. $*p < 0.1, **p < 0.05, ***p < 0.01$.

Table 5 shows the response of mortgage rates to a contractionary monetary policy shock. One standard deviation increase in the policy rate raises mortgage rates by 6.7 bps, while high market power banks further transmit mortgage rates by 20.7 bps

more. This result indicates that high market power banks transmit less to deposit rates, which lowers their funding, and thus they transmit higher mortgage rates relative to low market power banks.

Table 5: Mortgage Market

	Mortgage Rates					log(loan)
	(1)	(2)	(3)	(4)	(5)	(6)
Δi_t	0.00895	0.0128	0.0124	0.0667***	0.0572**	-0.0590
	(0.00841)	(0.0103)	(0.00848)	(0.0166)	(0.0239)	(0.243)
HHI	-0.0466	-0.0295	-0.0315	-0.0576	-0.405*	-7.448
	(0.0660)	(0.0717)	(0.0737)	(0.0764)	(0.231)	(6.214)
$\Delta i_t \times$ HHI	0.105*	0.0915	0.116**	0.140**	0.0788	1.440
	(0.0583)	(0.0704)	(0.0572)	(0.0648)	(0.0540)	(1.427)
ROA		0.0000204		-0.000529	-0.00110**	0.0132
		(0.000388)		(0.000371)	(0.000524)	(0.0152)
Log(population)			-0.00516	-0.00473	-0.865**	-6.590
			(0.00332)	(0.00335)	(0.355)	(9.359)
Employment rate			-0.00327***	-0.00187	-0.0104	-0.181
			(0.00117)	(0.00133)	(0.00665)	(0.165)
Inflation			0.0139***	0.0299***	0.00817	0.111
			(0.00474)	(0.00684)	(0.0143)	(0.0767)
Time FE	No	No	No	Yes	Yes	Yes
Country FE	No	No	No	No	Yes	Yes
R^2	0.058	0.053	0.107	0.256	0.547	0.939
N	415	358	415	358	358	360

Notes: Results from estimating

$$y_{ct} = \alpha_c + \alpha_t + \beta_1 HHI_{ct} + \beta_2 \Delta i_t + \beta_3 HHI_{ct} \times \Delta i_t + \gamma X_{ct} + \epsilon_{ct},$$

where y_{ct} is either deposit or mortgage rates, HHI_{ct} is the Herfindahl-Hirschman Index in total bank assets, and Δi_t is the change in percentage points compared to the previous ECB deposit facility rate. Standard errors are clustered at the country level. $*p < 0.1, **p < 0.05, ***p < 0.01$.

Table 6 groups banks into high versus low market power. Columns (1) and (2) in Table 6 show mortgage rates and columns (3) and (4) show deposit rates. I set market concentration thresholds at the 50th and 75th percentiles. The interaction between the policy rate and a dummy indicator for market power is not statistically significant for mortgage rates. However, it is statistically significant for deposit rates. Banks in highly concentrated markets transmit 34 bps less onto deposit rates relative to their low-concentration counterparts.

Table 6: High vs Low Market Power

	Mortgage rate	Mortgage rate	Deposit rate	Deposit rate
	(1)	(2)	(3)	(4)
Δi_t	1.136***	1.274***	0.448***	0.349***
	(0.220)	(0.261)	(0.108)	(0.0912)
HHI50	0.0109		0.0516	
	(0.114)		(0.0341)	
$\Delta i_t \times$HHI50	0.0981		-0.343***	
	(0.185)		(0.120)	
HHI75		0.159		0.0494
		(0.139)		(0.0435)
$\Delta i_t \times$HHI75		-0.00667		-0.240**
		(0.138)		(0.110)
Log(population)	4.208	4.933*	0.353	-0.0336
	(2.490)	(2.654)	(0.733)	(0.781)
Employment rate	-0.0615	-0.0637	0.0216	0.0202
	(0.0524)	(0.0505)	(0.0179)	(0.0205)
Inflation	0.0412	0.0432	0.0291	0.0314
	(0.0728)	(0.0735)	(0.0216)	(0.0251)
ROA	-0.00386	-0.00446	-0.00220	-0.000610
	(0.00374)	(0.00403)	(0.00206)	(0.00212)
R^2	0.918	0.919	0.787	0.747
N	510	510	594	594

Notes: Results from estimating

$$y_{ct} = \alpha_c + \alpha_t + \beta_1 dHHI_{ct} + \beta_2 \Delta i_t + \beta_3 dHHI_{ct} \times \Delta i_t + \epsilon_{ct},$$

where $dHHI_{ct}$ equals one when a country is above the 50th (75th) percentile of concentrated markets. β_1 captures whether high market power banks transmit more to mortgage or deposit rates, and β_3 shows how banks with higher market power respond to monetary policy changes. Standard errors are clustered at the country level. $*p < 0.1, **p < 0.05, ***p < 0.01$.

4 Local Projection Method

I estimate whether the pass-through of monetary shocks to mortgage and deposit rates depend on the level of interest rates. I use Jordà (2005)'s local projection method and estimate the following regression equations at horizons $h = 0, ..., 4$ years:

$$y_{c,t+h} - y_{c,t-1} = \alpha_{ch} + \theta_{ch} i_t + \beta x_{ct} + \epsilon_{c,t+h}. \tag{3}$$

Dependent variables y_c are the mortgage and deposit rates, α_{ch} represents country fixed effects for each horizon regression, i_t is monetary shocks from Wu and Xia (2016), and x_{ct} includes country-specific and bank controls. I control for macroeconomic variables, including GDP growth, inflation rate, sovereign stress indicator, population, and unemployment rate for each country. For bank controls, I take into account the ROA and HHI for credit institutions' total assets and the holding of government bonds on commercial bank balance sheets.

Let θ_{ch} represent the estimate of the impulse response functions (IRFs) at horizon h. I estimate a simple regression for each horizon h rather than impose the dynamic structure from a VAR. The local projection method imposes fewer restrictions, but the IRFs are often estimated less precisely. Control variables do not need to be the same in every set of regressions. By construction, the error terms are a moving average, so I use HAC standard errors.

Second, to see the interaction of monetary policy shock and bank market power, I implement:

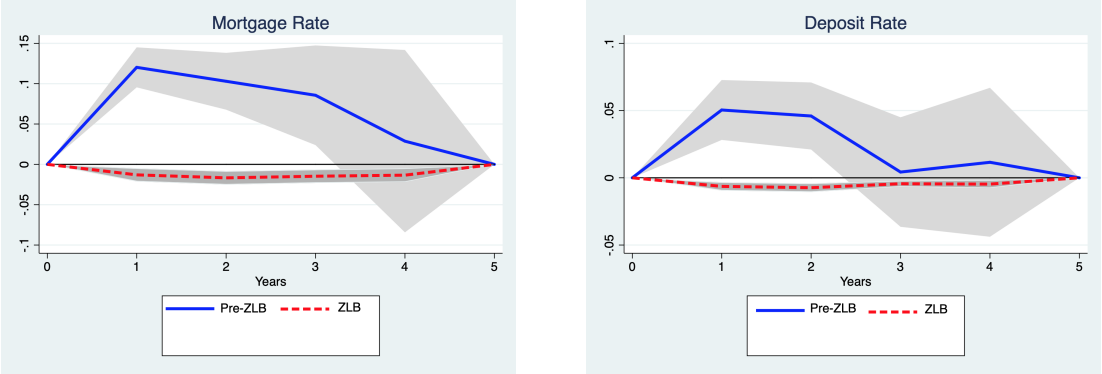
$$y_{c,t+h} - y_{c,t-1} = \alpha_{ch} + \theta_{ch} i_t + \beta_1 x_{ct} + \beta_{2h} HHI_{ct} + \gamma_{ch} i_t \times HHI_{ct} + \epsilon_{c,t+h}, \tag{4}$$

where $i_t \times HHI_{ct}$ is interpreted as an additional effect of market concentration on $y_{c,t+h} - y_{c,t-1}$ (on top of the policy effect), if the policy effect simultaneously increases by 100 bps.

4.1 Are the effects of unconventional policy actions different from conventional policy rate changes?

I use local projection to show impulse responses against a monetary policy shock. Panels (a) and (b) in Figure 3 show that monetary policy has a greater impact in the pre-ZLB period than the ZLB period. The solid blue line is above zero, signifying that the pass-through of monetary shocks to mortgage rates is higher at higher policy rates. However, the dashed red line is below zero, indicating that monetary policy transmission to mortgage rates is lower at lower policy rates during ZLB. During the ZLB period, monetary policy has a negligible negative effect on mortgage and deposit rates.

Figure 3: Conventional vs Unconventional Monetary Policy



(a) Mortgage rates (b) Deposit rates

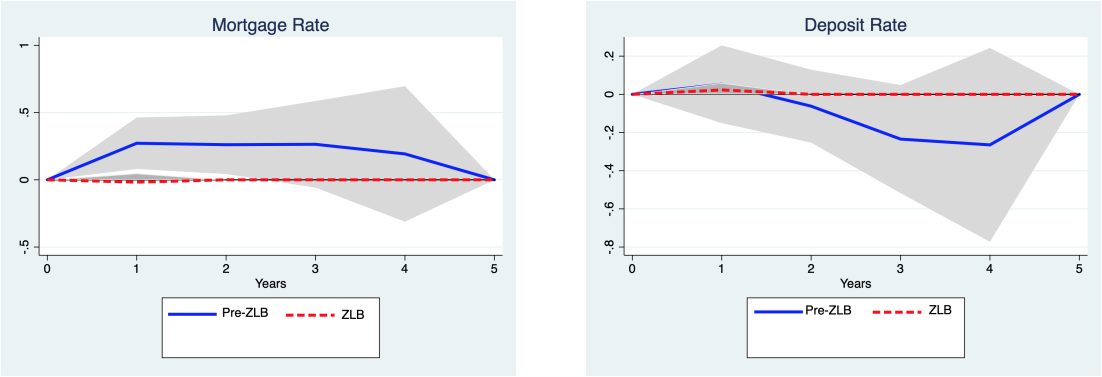
Notes: Comparison between conventional and unconventional monetary policy transmission. Results are estimated from

$$y_{c,t+h} - y_{c,t-1} = \alpha_{ch} + \theta_{ch} i_t + \beta x_{ct} + \epsilon_{c,t+h}.$$

Dependent variables y_c are the mortgage and deposit rates, α_{ch} represents country fixed effects for each horizon regression, i_t is monetary shocks from Wu and Xia (2016), and x_{ct} includes country-specific and bank controls. I control for macroeconomic variables, including GDP growth, inflation rate, sovereign stress indicator, population, and unemployment rate for each country. For bank controls, I take into account the ROA and HHI for credit institutions' total assets and the holding of government bonds on commercial bank balance sheets.

Figure 4 shows that market concentration amplifies monetary policy transmission pre-ZLB, but dampens pass-through during ZLB periods. Monetary policy shocks to mortgage and deposit rates are negligible during ZLB, because the ECB's less aggressive rate cuts led to increases in relative funding costs. Given that European banks rely less on deposits as a source of funding, high market power banks transmit lower deposit rates during contractionary monetary policy pre-ZLB but do not respond during the ZLB period. European banks also have low profitability relative to US banks due to lower returns on earning assets, higher funding costs, and lower scale efficiency. As a result, the response is dampened by market concentration due to a drop in bank profitability. In addition, highly concentrated US banks have deposit franchises that allow them pay an average rate on deposits that is lower than European banks.

Figure 4: Conventional vs Unconventional Monetary Policy Transmission x Market Power



(a) Mortgage rates (b) Deposit rates

Notes: Comparison between conventional and unconventional monetary policy transmission interacted with bank market power. Results are estimated from

$$y_{c,t+h} - y_{c,t-1} = \alpha_{ch} + \theta_{ch} i_t + \beta x_{ct} + \epsilon_{c,t+h}.$$

Dependent variables y_c are the mortgage and deposit rates, α_{ch} represents country fixed effects for each horizon regression, i_t is monetary shocks from Wu and Xia (2016), and x_{ct} includes country-specific and bank controls. I control for macroeconomic variables, including GDP growth, inflation rate, sovereign stress indicator, population, and unemployment rate for each country. For bank controls, I take into account the ROA and HHI for credit institutions' total assets and the holding of government bonds on commercial bank balance sheets.

5 Conclusion

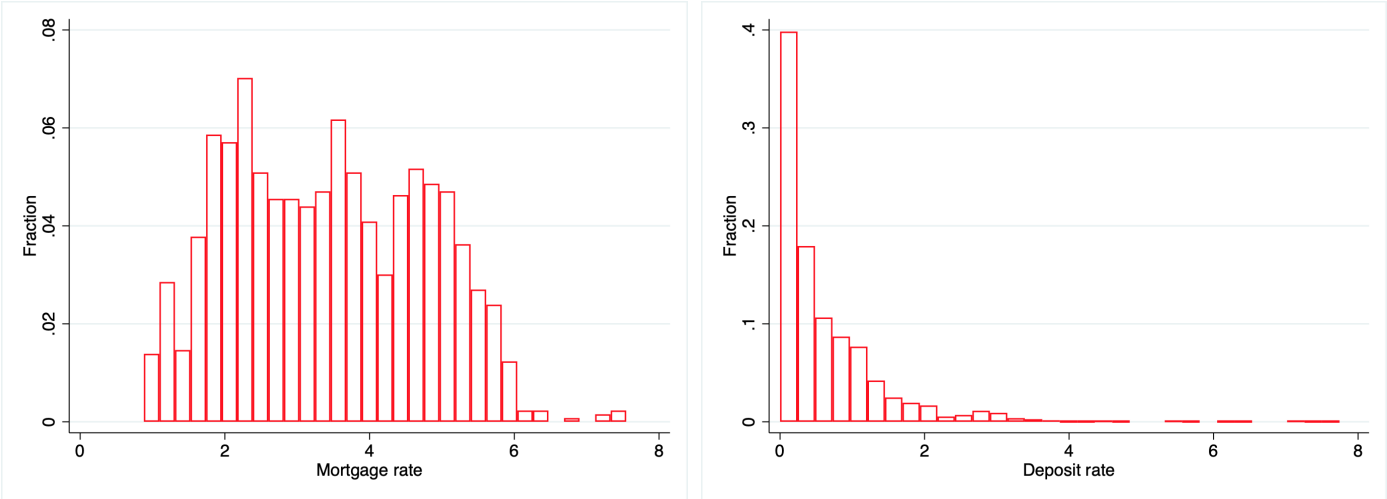
Monetary policies since 2014 have challenged banks when setting deposit and mortgage rates. While prior research has carefully studied policy transmission to deposit rates in low interest rate environments, I propose a novel mechanism – bank market power – by analyzing monetary policy transmission across countries. I focus on the euro area, as it provides bank and country heterogeneity within a monetary union. This paper empirically documents that banks with high market power decrease de-

posit rates which reduces their funding. Thus, banks issue mortgage loans at a more expensive rate relative to banks with low market power. Monetary policy thereby becomes less effective during ZLB periods relative to pre-ZLB periods.

Banks with high market power are more prone to lower profitability margins and leave less room to tackle the transmission of monetary policy on mortgage rates. Thus, countries with high bank market power transmit greater decreases in their deposit rates and greater increases in their mortgage rates than in countries with lower bank market power. A monetary policy shock would decrease funding costs for banks, hamper a component of their profitability, and render the banking system vulnerable.

6 Appendix

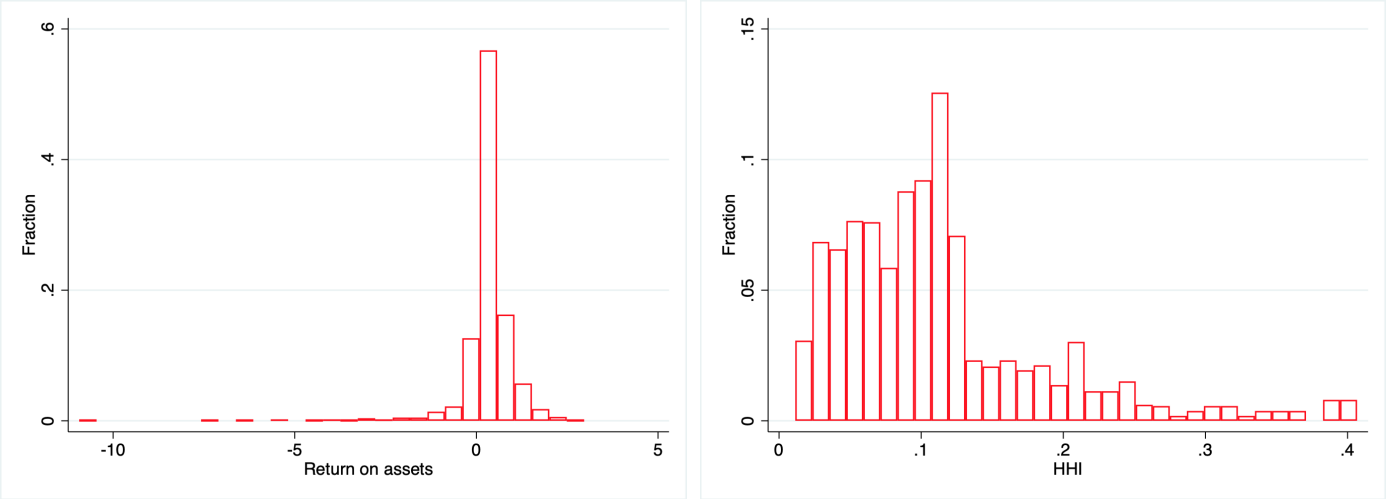
Figure 5: Cross-country differences in mortgage and deposit rates



(a) Mortgage rate

(b) Deposit rate

Figure 6: Cross-country differences in Return on Assets (ROA) and HHI



(a) Return on Assets

(b) HHI

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