The International Transmission of Monetary Policy

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Materials from joint work with Claudia Buch, Matthieu Bussiere, and Robert Hills. The views are those of the author and not necessarily reflective of those of the Bundesbank, Banque de France, the Bank of England, the Federal Reserve Bank of NY, or the Federal Reserve System.

IBRN Project Overview and Meta-analysis

International Banking Research Network (IBRN) initiative explores transmission of monetary policy through banks, into real lending activity.

Participants jointly design methodology, compile needed information for common implementation of methods, independently analyze confidential data at the country level, and *write own papers with deeper exploration*.

Meta-analysis reports patterns in findings from across teams, without publication bias.

"The International Transmission of Monetary Policy"

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Big picture

- Financial flows across borders, with realized pressures on exchange rates, interest rates, and asset prices
- Large volumes of international capital flows, particularly through banks
- International bank flows among the most responsive to shocks

- Active debate about the importance of different drivers:
- What is the role of advanced economy monetary policy?
  - ✓ Transmission through banks, across borders, to the real economy?
  - ✓ What characteristics of banks / frictions are associated with transmission?

IBRN Project Overview and Meta-analysis Paper

- Tests focus on the reaction of **lending of banks to monetary policy decisions** of euro area, US, UK, and JP.
  - Use unique **bank-level datasets** of 17 country teams
  - Enables **cross-country comparisons , meta-analysis**
  - Consider **robustness of lessons** from across experiences
  - Distinguish periods of **conventional and unconventional policies**

Transmission

→ **Inward:** changes in foreign monetary policy affect the balance sheet of hosted affiliates of foreign banks and of domestic banks

(eg. Morais, Peydro and Ruiz 2015 for Mexico)

→ **Outward :** domestic banks adjust their foreign lending to changes in domestic monetary policy, including via affiliates in other countries

(eg. Correa and Murry 2009, Cetorelli and Goldberg 2012, Temesvary, Ongena and Owen, 2015)

Countries and transmissions explored within the meta-analysis

	Inward transmission		Outward transmission
	All resident banks	Foreign-owned resident branches	All resident banks (local claims, x-border)
Austria	✓		
Canada			✓
Chile	✓		
France	✓		
Germany	✓		✓
Hong Kong	✓	✓	
Ireland	✓		
Italy	✓		
Netherlands			✓
Poland	✓		
Portugal	✓		
Russia	✓		
South Korea	✓		
Spain			✓
Switzerland	✓		
United Kingdom	✓	✓	
United States			✓
Total	12	2	5

High level takeaways

- **Extensive evidence for international spillovers**
  - Significance in all **inward transmission** of foreign policy to domestic banks
  - **Outward transmission** significant through global banks
- **Monetary policy proxy matters during unconventional policy periods**
  - Short rate/QE and shadow policy rate produce similar results during conventional periods; shadow rate - more evidence of spillovers during unconventional
    - ✓ size of central bank's balance sheet size misses consequences of forward guidance, balance compositional effects that work along the yield curve.
- **Degree of spillovers differs between source countries**
  - US policy generates significant spillovers for almost all countries
  - Evidence of transmission more varied for other source countries

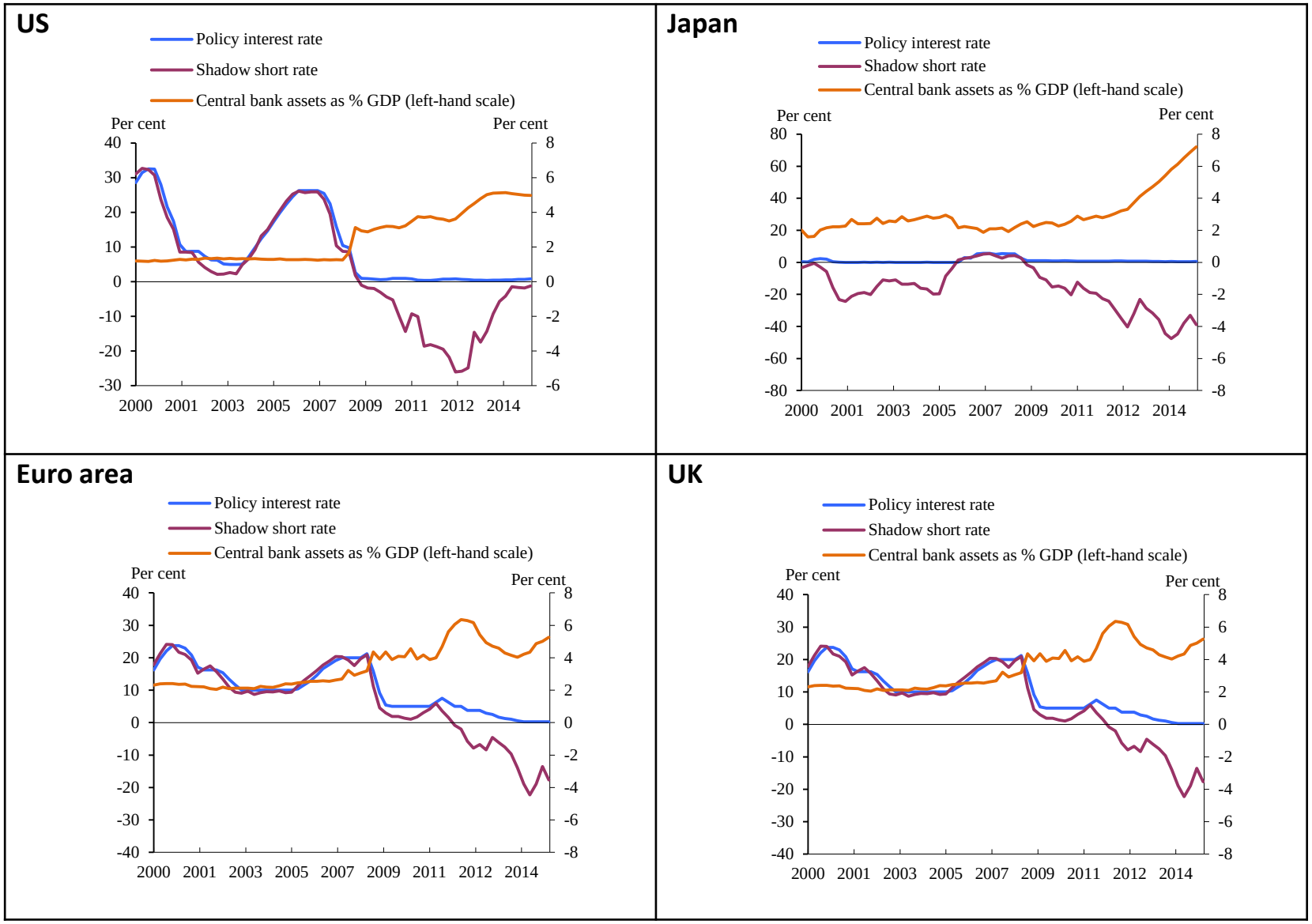
High level takeaways, cont.

- **Bank characteristics matter, spillovers to lending are heterogeneous.**
  - Cross-border and liability positions of banks matter most
  - Internal capital markets: banks have lower friction on shifting assets across countries or drawing on other funding sources
  - Frictions vary by currency of transmission, monetary policy regime (conventional/unconventional), and country characteristics
  - Frictions and market structures differ across countries, do not map directly to bank lending and portfolio channels. Other frictions arise for some countries (e.g. from FX risk, access to FX funding)
- **Domestic lending activity is more insulated than expected**
  - "Global factor" story does not dominate domestic loan growth; despite substantial spillovers, low explanatory power

Our Focus: on "frictions", rather than "channels"

- **Frictions are useful for interpreting econometric results**
  - Banks' reactions depends on relevant balance sheet constraints
  - "International" introduces new frictions (e.g. exchange rate risk)
  - Specific bank characteristics are indicators for frictions
- **Frictions can map to transmission channels**
  - *Channels* reflect theoretical mechanisms: e.g, the bank lending channel reflects frictions across banks in access to external finance
  - Heterogeneous characteristics driving effects on bank lending sometimes overlap in assignment to channels and frictions
- **Frictions, and policy spillovers, may differ between conventional v. unconventional policy periods**
  - Alternate measures of policy stance for unconventional policy periods
  - Role of specific bank-level characteristics may differ as frictions faced by banks changes (e.g. unconventional, ample liquidity period)

For empirical analysis, consider alternative measures of monetary policy for US, euro area, UK and Japan, 2000-2015



(a) Policy interest rate. Source: Datastream. (b) Shadow short rate. Source: Krippner (2016). (c) Central bank assets as % GDP. Source: Datastream.

Identification through heterogeneity: Inward transmission

$$\Delta Y_{b,t} = \alpha_0 + \sum_{ctry}\left(\sum_{k=0}^{K}\left(\alpha_{1,k}^{ctry} \cdot \Delta MP_{t-k}^{ctry} \cdot Channel_{b,t-K-1}^{ctry}\right) + \alpha_2^{ctry} Channel_{b,t-K-1}^{ctry}\right) + \alpha_3 X_{b,t-1} + f_b + f_t + \epsilon_{b,t}$$

The dependent variable in this case is the log change of lending to the private non-bank sector by bank b at time t

Allow breaks in effects of policy rate at ZLB or Unconventional policy periods

- QE: includes $\Delta QE_{t-k}^{ctry} \cdot Channel_{b,t-K-1}^{ctry}$ interaction
- ZLB: includes $\Delta MP_{t-k}^{ctry} \cdot Channel_{b,t-K-1}^{ctry} \cdot ZLB_{t-k}^{ctry}$ and $Channel_{b,t-K-1}^{ctry} \cdot ZLB_{t-k}^{ctry}$ interactions

Controls include domestic monetary policy

“Channel” is a time-varying bank balance sheet construct

Identification through heterogeneity: Outward transmission

$$\Delta Y_{b,j,t} = \alpha_0 + \sum_{k=0}^{K} \left(\alpha_{1,k}\, \Delta MP_{t-k}^{domestic} \cdot Channel_{b,j,t-K-1}\right) + \alpha_2\, Channel_{b,j,t-K-1} + \alpha_3 X_{b,t-1} + f_{j,t} + f_b + \epsilon_{b,j,t}$$

The dependent variable in this case is local lending by the affiliate of the domestic bank b in country j at time t, or the cross-border claims to j.

Allow breaks in effects of policy rate at ZLB or Unconventional policy periods

- QE: includes $\Delta QE_{t-k}^{ctry} \cdot Channel_{b,t-K-1}^{ctry}$ interaction
- ZLB: includes $\Delta MP_{t-k}^{ctry} \cdot Channel_{b,t-K-1}^{ctry} \cdot ZLB_{t-k}^{ctry}$ and $Channel_{b,t-K-1}^{ctry} \cdot ZLB_{t-k}^{ctry}$ interactions

Controls include foreign monetary policy

“Channel” is a time-varying bank balance sheet construct

Countries explore multiple forms of bank heterogeneity to inform the meta-analysis

	Inward transmission		Outward transmission	
Channel	All resident banks	Foreign-owned resident branches	Local lending	Cross-border Lending
Without Bank Heterogeneity Interaction	13	2	5	5
XB Liabilities/Total Assets	13			
Net XB Liabilities/Total Assets	10			
Core Deposits/Total Assets		2		
Short Term Funding Ratio			5	5
XB Assets/Total Assets	11			
XB Assets to Bank/Total Assets	9			
XB Assets to Nonbank/Total Assets	8			
Liquid Assets/Total Assets	13	2	5	5
Securities/Total Assets	9	2	5	5
C&I Loans/Total Assets	10		5	5
Total Claims on Foreign Borrowers/ Assets			5	5
Loans/Total Assets		2		
Net Intragroup Funding Ratio/Total Assets	5	2	3	3
Tier 1 Ratio	12	1	5	5
Log Total Assets			5	5
Impaired Loan Ratio		1		

All countries find statistically significant international transmission of monetary policy, with some differences by conventional vs unconventional periods, and by monetary policy proxy.

	Inward transmission of								Outward transmission of							
Mon. Policy Instrument	All resident banks*				Foreign-owned resident branches				Local Lending				Cross-Border Lending			
	At the 10% level, Countries with: a=no significant results, b=significant results															
	C		**U**		**C**		**U**		**C**		**U**		**C**		**U**	
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
Short rate and QE	IT	AT, CH, CL, DE, FR, GB, HK, IE, KR, PL, PT, RU	PL RU	AT, CH, CL, DE, FR, GB, HK, IE, IT, KR, PT		GB, HK	GB	HK		CA, DE, ES, NL, US	DE, ES	NL, US	DE	CA, ES, NL, US	DE	ES, NL, US
Shadow rate with ZLB	PL	AT, CH, CL, DE, FR, GB, HK, IE, IT, KR, PT, RU	IT	AT, CH, CL, DE, FR, GB, HK, IE, KR, PL, PT, RU		GB, HK		GB HK		DE, ES, NL, US		DE, NL, US		DE, ES, NL, US		DE, NL, US

AT- Austria, CA- Canada, CH- Switzerland, CL- Chile, DE- Germany, ES- Spain, FR- France, GB- United Kingdom, HK- Hong Kong, IE- Ireland, IT- Italy, KR- Republic of Korea, NL- Netherlands, PL- Poland, PT- Portugal, RU- Russian Federation, US- United States.

U. S. monetary policy spillovers are most studied, and most prevalent.

	Inward transmission of all resident banks															
Monetary Policy Instrument	United States MP				Euro area MP				Japan MP				UK MP			
	C: Conventional, U: Unconventional. Significance at 10% level, a=no significant results, b=significant results															
	C		U		C		U		C		U		C		U	
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
Short rate and QE	IT	AT, CH, CL, DE, FR, GB, HK, IE, KR, PL, PT, RU	CH, FR, IE, PL, RU	AT, CL, DE, GB, HK, IT, KR, PT	CH, RU	GB, HK, KR, PL	PL, RU	CH, GB, HK, KR	HK, IT	AT, DE, FR, GB, KR	HK	AT, DE, FR, GB, IT, KR	CH, IT	AT, DE, FR, HK, IE, KR, PT	DE, FR	AT, CH, HK, IE, IT, KR, PT
Shadow rate with ZLB	IT, PL	AT, CH, CL, DE, FR, GB, HK, IE, KR, PT, RU	FR, IT, KR	AT, CH, CL, DE, GB, HK, IE, PL, PT, RU	HK, PL, RU	CH, GB, KR	CH, PL, RU	GB, HK, KR	AT, HK, IT, KR	DE, FR, GB	IT	AT, DE, FR, HK, KR	FR	AT, CH, DE, HK, IE, IT, KR, PT	DE, FR	AT, CH, HK, IE, KR, PT
Does not report this policy rate spillover					AT, CL, DE, FR, IE, IT, PT				CH, CL, IE, PL, PT, RU GB does not report for Shadow rate unconventional				CL, GB, PL, RU IT does not report for Shadow rate unconventional.			

In Conventional policy spillovers, X-border exposures are the most prevalent form of heterogeneity differentiating inward spillover effects of US Policy to domestic nonbank lending.

"Conventional" panel, the coefficient of interest is the shadow rate interacted with bank balance sheet channel. A green (red) symbol in the row, "Without bank heterogeneity interaction" indicates that lending growth is higher when monetary policy is tightened. A green (red) symbol indicates that this effect is amplified (dampened) for banks with higher values of that type of heterogeneity.

			Euro Area Countries						Emerging Markets					
Bank Balance Sheet Characteristics	CH	GB	AT	DE	FR	IE	IT	PT	CL	HK	KR	PL	RU	# Sig/ Total
Conventional														
Without Bank Heterogeneity Interaction		O				O		O					O	4/13
XB Liabilities/Total Assets	O	O	O		O			O						5/13
Net XB Liabilities/Total Assets	O		O			O		O		O				5/10
XB Assets/Total Assets					O									1/11
XB Assets to Bank/Total Assets					O			O						2/9
XB Assets to Nonbank/Assets	O			O										2/8
Liquid Assets/Total Assets											O			1/13
Securities/Total Assets								O						1/9
C&I Loans/Total Assets					O					O				2/10
Net Intragroup Funding Ratio/Total Assets			O						O	O				3/4
Tier 1 Ratio								O		O	O			3/12

Unconventional monetary policy has fewer balance sheet characteristics differentiating lending spillovers across banks

"Unconventional" panel, the coefficient of interest is the sum of the coefficient of the shadow rate interacted with bank balance sheet channel and the coefficient of a triple interaction between the shadow rate, bank balance sheet channel, and ZLB period indicator.

Bank Balance Sheet Characteristics			Euro Area Countries						Emerging Markets					
	CH	GB	AT	DE	FR	IE	IT	PT	CL	HK	KR	PL	RU	#Sig/ Total
Unconventional														
Without Bank Heterogeneity Interaction				O		O		O		O				4/13
XB Liabilities/Total Assets			O					O	O				O	4/13
Net XB Liabilities/Assets			O	O				O	O					4/10
XB Assets/Total Assets				O										1/11
XB Assets to Bank/Total Assets								O						1/9
XB Assets to Nonbank/ Asset														0/8
Liquid Assets/Total Assets		O										O		2/13
Securities/Total Assets			O					O						2/9
C&I Loans/Total Assets		O										O		2/10
Net Intragroup Funding Ratio/Total Assets														0/4
Tier 1 Ratio	O					O		O						3/12

Adjusted R-Squared for Shadow Rate Specifications in Inward Transmission of Monetary Policy: Many low explanatory power regressions, with few cases of heterogeneity contributing much to our understanding of domestic loan growth variation.

Bank Balance Sheet Characteristics			Euro Area Countries						Emerging Markets				
	CH	GB	AT	DE	FR	IE	IT	PT	CL	HK	KR	PL	RU
Without Bank Heterogeneity Interaction	0.10	0.05	0.01	0.00	0.02	0.29	0.00	0.02	0.22	0.05	0.21	0.20	-.02
XB Liabilities/Total Assets	0.12	0.06	**0.11**	**0.06**	0.03	**0.78**	-.01	0.03	**0.31**	0.05	**0.26**	0.16	-.02
Net XB Liabilities/Assets	0.12	0.06	**0.10**	0.01	0.02	**0.77**		0.04	**0.31**	0.05	**0.28**		
XB Assets/Total Assets	0.13	0.06	**0.10**	0.04	0.02	**0.76**	0.00	0.03	**0.29**	0.05	0.14		
XB Assets to Bank/Asset	0.12	0.06	**0.06**	**0.05**	0.01	**0.76**		0.04		0.06	0.23		
XB Assets to Nonbank/ Assets	**0.16**	0.05	**0.07**	0.03	0.01	**0.74**				0.05	0.09		
Liquid Assets/Assets	0.13	0.05	**0.05**	0.01	0.01	**0.76**	0.01	0.04	**0.30**	0.04	0.17	0.20	-.02
Securities/Total Assets		0.05	**0.07**	0.01	0.02			0.04	**0.30**	0.05	0.24	0.20	
C&I Loans/Total Assets		0.06	**0.04**	0.01	0.02	**0.74**		0.03	**0.30**	0.06	0.15	0.20	
Net Intragroup Funding/ Total Assets			0.00	0.00					**0.32**	0.06			
Tier 1 Ratio	0.12	0.05	0.02	0.01	0.03	**0.72**	0.10	0.05	**0.30**	0.06	0.22	0.23	

Similar lessons apply to the adjusted R2 of specifications on outward transmission of monetary policy to local lending growth and cross border lending (here using shadow rate specifications.

	Local Lending					Cross-Border Lending				
	Euro Area Countries					Euro Area Countries				
Bank Balance Sheet Characteristics	DE	ES	NL	CA*	US	DE	ES	NL	CA*	US
Without Bank Heterogeneity Interaction	0.02	0.01	0.00	0.00	0.01	0.02	0.00	0.01	0.00	0.01
Short Term Funding Ratio	**0.19**	0.02	0.00	0.02	0.05	**0.14**	0.01	0.01	0.00	0.03
Liquid Assets/Total Assets	**0.19**	0.02	0.01	0.02	0.05	**0.13**	0.01	0.01	0.00	0.03
Securities/Total Assets	**0.19**	0.02	-0.01	0.02	0.05	**0.14**	0.01	0.01	-0.01	0.03
C&I Loans/Total Assets	**0.19**	0.02	0.00	0.02	0.05	**0.14**	0.01	0.01	0.00	0.03
Total Claims on Foreign Borrowers/Total Assets	**0.19**	0.02	0.01	0.02	0.05	**0.14**	0.01	0.01	-0.01	0.03
Net Intragroup Funding Ratio/Total Assets	**0.19**			0.02	0.05	**0.13**			0.00	0.03
Tier 1 Ratio	**0.19**	0.02	0.00	0.02	0.05	**0.14**	0.01	0.01	0.00	0.03
Log Total Assets	**0.19**	0.02	0.00	0.02	0.05	**0.13**	0.01	0.01	0.00	0.03

Wrap up

- IBRN coordinated the analysis of international spillovers of monetary policy through banks, with both inward and outward spillovers explored.

- Extensive evidence of spillovers, not of all policy rates to all countries. Monetary policy proxy used matters.

- Identification through heterogeneity: various frictions bind across banks. Cross-border exposures are most frequently identified.

- Importance of frictions vary between conventional and unconventional monetary policy periods.

- Monetary policy spillovers often do not explain much of the cross-sectional and intertemporal variation in loan growth rates.

Thank you.

Reference slides

Chart 1: Annual growth in bank borrowing by non-banks, 2000-2015

Sample of 56 BIS-reporting countries. Credit in all currencies. Non-banks include other financial companies, government and the non-financial private sector. 'Non-resident' includes lending by all BIS-reporting banks, except domestic banks for each country.

Source: BIS Global liquidity indicators.

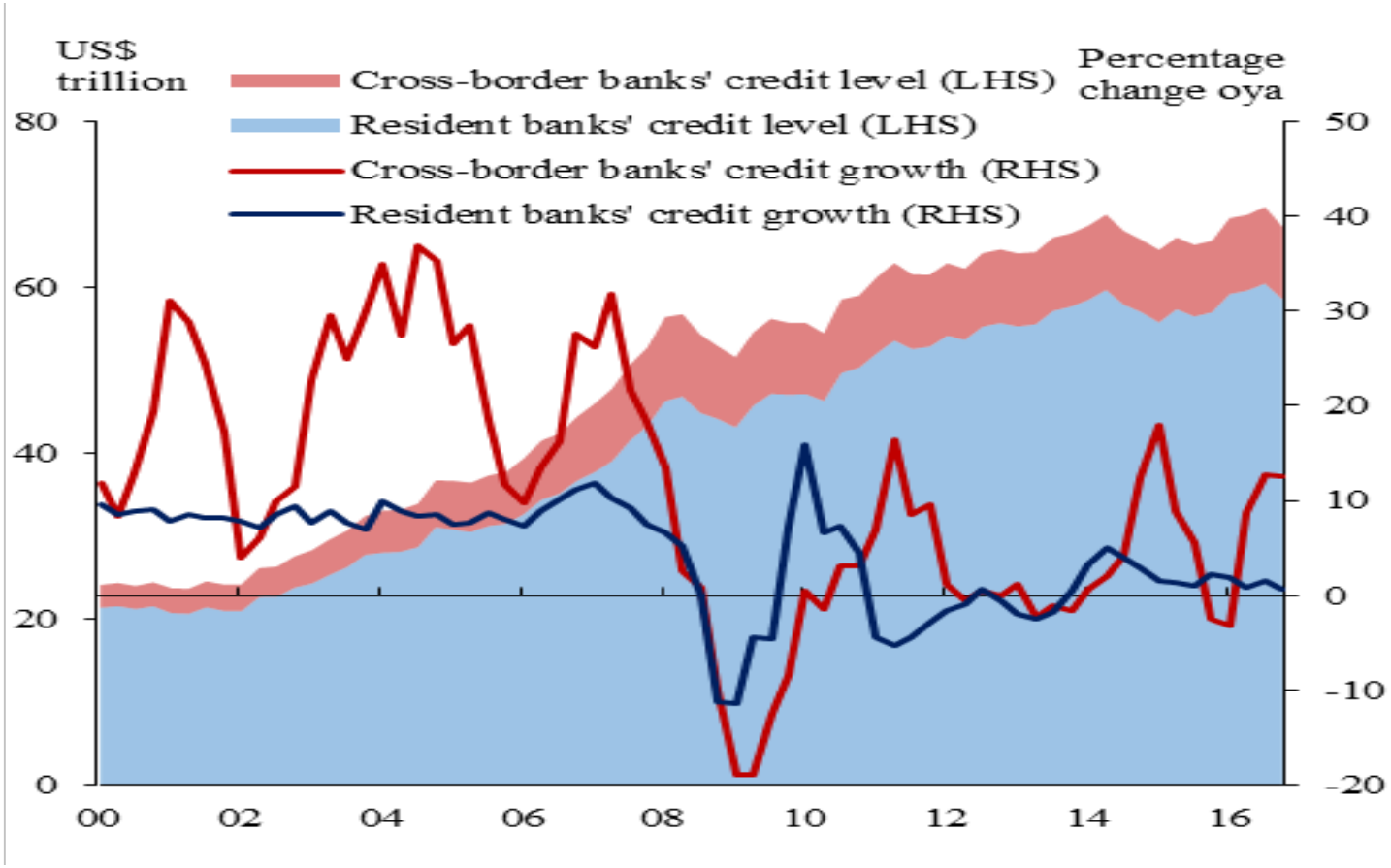


Chart 2: Inward and outward transmission of monetary policy

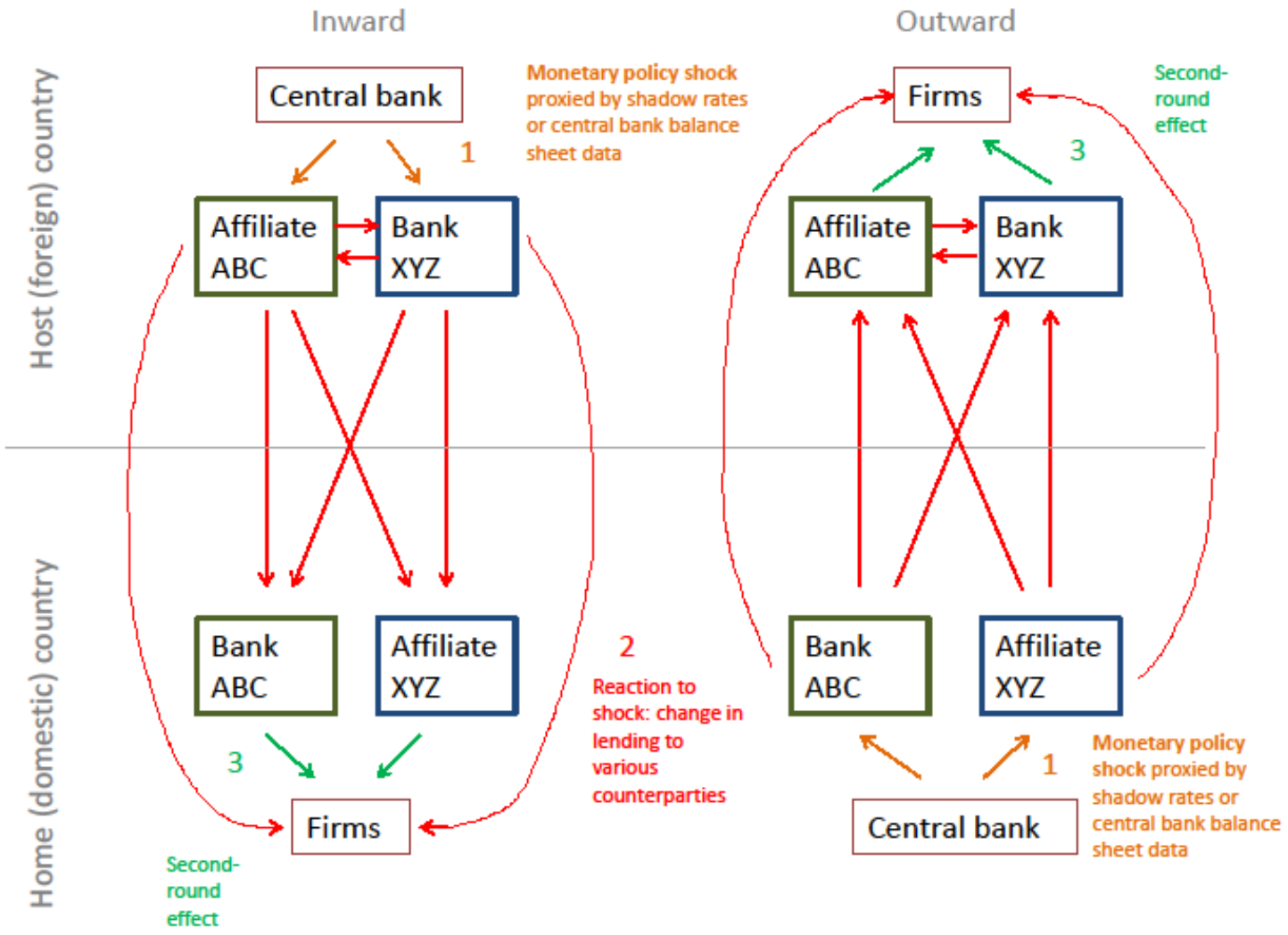


Table 2: Country Banking Sector Characteristics

Foreign Exposure Share is defined as the negative value of the total net cross-border liabilities/total assets for the countries completing the inward analysis (Austria, Chile, France, Germany, Hong Kong, Ireland, Italy, Portugal, South Korea, Switzerland, and United Kingdom) and as the total claims to foreign borrowers/total assets for the countries completing the outward analysis (Canada, Germany, Netherlands, Spain, and United States).

Country	Bank Assets (USD mn)		# Banks	C&I Loan Share		Core Deposits Ratio		Foreign Exposure Share	
	Mean	SD		Mean	SD	Mean	SD	Mean	SD
Austria (IN)	19361	37503	38	0.17	0.11	0.38	0.23	-0.06	0.23
Canada (OUT)	535298	198255	4	0.23	0.03	0.53	0.13	0.17	0.03
Chile (IN)	13468	13880	12	0.38	0.12	0.17	0.09	0.01	0.04
France (IN)	33899	144265	170	0.26	0.23	0.14	0.16	0.08	0.31
Germany (IN)	94059	254393	78	0.15	0.14	0.25	0.25	-0.01	0.05
Germany (OUT)	85172	291876	123	0.35	0.29	0.17	0.21	0.58	0.28
Hong Kong (IN)	19675	42033	86	0.51	0.14	0.66	0.21	-0.10	0.21
Ireland (IN)	37385	39910	9	0.20	0.15	0.30	0.13	TBE+	TBE+
Italy (IN)	49459	164081	99			0.42	0.19		
Netherlands (OUT)	113535	275198	7	0.48	0.29	0.51	0.24	0.43	0.33
Poland (IN)	10020	14713	28	0.26	0.17	0.21	0.15		
Portugal* (IN)	5942	14995	67	0.30	0.26	0.15	0.19	0.12	0.36
Russia (IN)	1027	11878	1065	0.38	0.20	0.30	0.21		
South Korea (IN)	74185	68875	14	0.33	0.12	0.24	0.07	0.03	0.06
Spain (OUT)	107548	248777	97	0.65	0.17	0.54	0.12	0.09	0.14
Switzerland* (IN)	107548	248777	18			0.57	0.13	0.00	0.01
U Kingdom (IN)	26838	117000	297	0.12	0.17	0.21	0.28	0.11	0.30
United States (OUT)	253121	497591	36	0.13	0.09	0.44	0.23	0.11	0.13

Balance Sheet Characteristics

- log of total real assets, i.e. assets deflated by GDP deflator $(Log\ total\ assets_{b,t-1})$
- percentage of banking organization's regulatory Tier 1 risk-based capital to asset ratio $\left(Tier1\ ratio_{b,t-1}\right)$
- percentage of a bank's portfolio of assets that is liquid $\left(Liquid\ assets\ ratio_{b,t-1}\right)$
- percentage of banking organization's net intragroup funding, which is defined as the liabilities minus the assets of the Head Office with the rest of the banking group, scaled by total assets $(Net\ IG\ funding\ ratio_{b,t-1})$
- percentage of the banking organization's balance sheet financed with core deposits $\left(Core\ deposits\ ratio_{b,t-1}\right)$

Literature dominated by discussion of "Channels" of transmission

- **Bank lending channel:**
  - MP affects the liability side of banks' balance sheets
  - If monetary policy tightens, banks experience a drop in deposits.

    If banks are not able to mobilize alternative funding, i.e. via wholesale funding markets, adjust the asset side of their balance sheet (loans).
- **Portfolio channel (also risk-taking channel):**
  - MP affects the asset side of banks' balance sheets, changing the supply of assets available in financial markets
  - If MP tightens (central bank sells sovereign bonds), the price of sovereign bonds drops and lending becomes relatively less attractive.

    Banks react to these changes by adjusting asset side of balance sheet.

    MP affects riskiness of assets. When MP tightens, creditworthiness of firms and households weakens and banks reduce lending.

Table 7: Patterns of Heterogeneity in Outward Transmission

This table reports the significance of outward transmission of own country monetary policy into local lending and into cross-border lending, and form of heterogeneity at the 10% level. An empty cell indicates no significant results, and a grey cell indicates that the given country-channel specification was not run. For the top "Conventional" panel, the coefficient of interest is the shadow rate interacted with bank balance sheet channel. A green (red) symbol in the first row, "Without bank heterogeneity interaction" indicates that external lending growth is higher when monetary policy is tightened. A green (red) symbol in the following bank heterogeneity rows indicates that this effect is amplified (dampened) for banks with higher values of that type of heterogeneity. For the bottom "Unconventional" panel, the coefficient of interest is the sum of shadow rate interacted with channel and shadow rate interacted with channel and an indicator for ZLB period. The rightmost column reports the number of countries that found significant spillovers for that channel and the total number of countries reporting that specification. * Canada uses the short rate instead of the shadow rate, since they never entered the ZLB period or used QE.

	Local Lending					Cross-Border Lending						
	Euro Area Countries					Euro Area Countries						
Bank Balance Sheet Characteristics	DE	ES	NL	CA*	US	DE	ES	NL	CA*	US	Local #Sig/Total	Cross-Border #Sig/Total
Conventional												
Without Bank Heterogeneity Interaction	O	O	O		O	O			O	O	4/5	3/5
Short Term Funding Ratio				O				O		O	1/5	2/5
Liquid Assets/Total Assets					O		O			O	1/5	2/5
Securities/Total Assets											0/5	0/5
C&I Loans/Total Assets					O				O	O	1/5	2/5
Total Claims on Foreign Borrowers/Total Assets							O				0/5	1/5
Net Intragroup Funding Ratio/Total Assets											0/3	0/3
Tier 1 Ratio				O							1/5	0/5
Log Total Assets							O		O	O	0/5	3/5

Table 7 Patterns of Heterogeneity in Outward Transmission (cont)

Bank Balance Sheet Characteristics	Local Lending					Cross-Border Lending					Local #Sig/Total	Cross-Border #Sig/Total
	Euro Area Countries					Euro Area Countries						
	DE	ES	NL	CA*	US	DE	ES	NL	CA*	US		
Unconventional												
Without Bank Heterogeneity Interaction	O		O			O				O	2/5	2/5
Short Term Funding Ratio						O		O			0/5	2/5
Liquid Assets/Assets					O						1/5	0/5
Securities/Total Assets			O								1/5	0/5
C&I Loans/Total Assets											0/5	0/5
Total Claims on Foreign Borrowers/Total Assets	O		O								2/5	0/5
Net Intragroup Funding /Assets											0/3	0/3
Tier 1 Ratio					O			O			1/5	1/5
Log Total Assets								O		O	0/5	2/5