Regulatory Arbitrage in Action: Evidence from Banking Flows and Macroprudential Policy

Dennis Reinhardt and Rhiannon Sowerbutts

Bank of England

April 2016

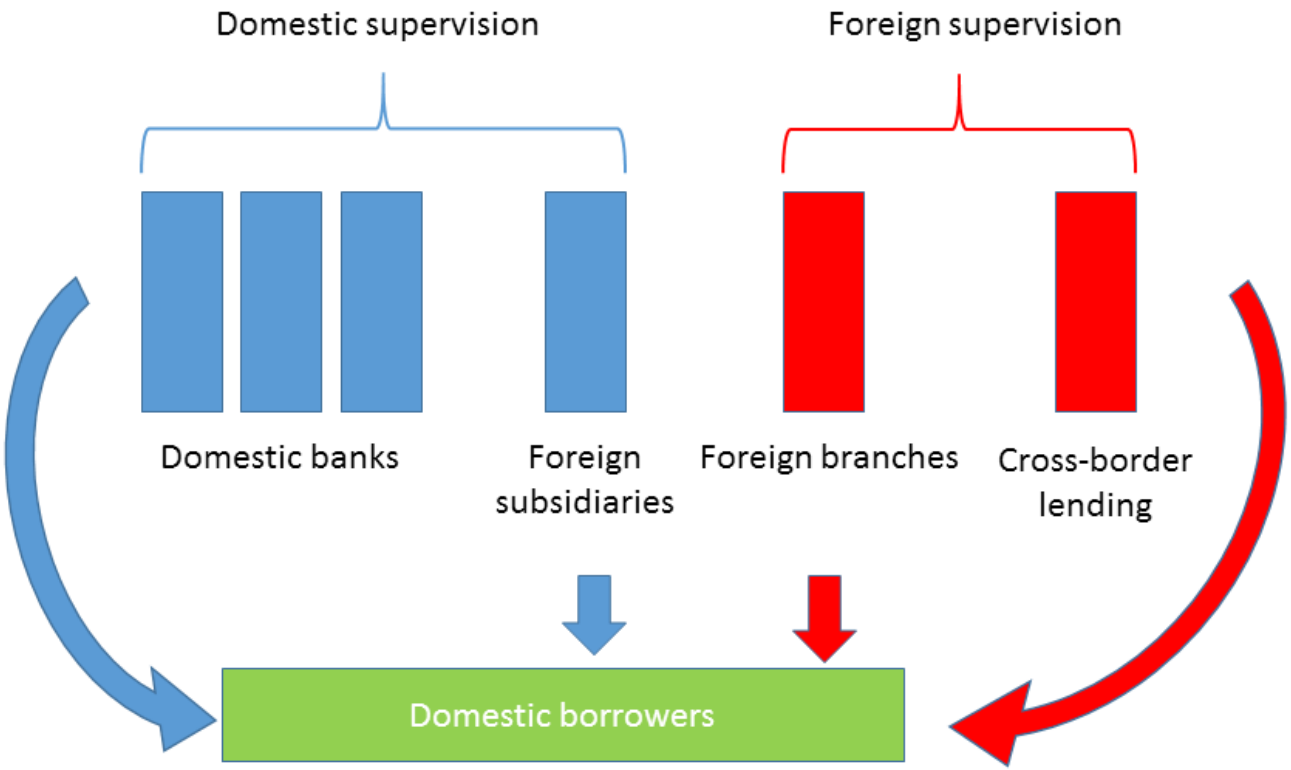
Central Bank of Iceland, Systemic Risk Centre at LSE, IMF
'Capital Flows, Systemic Risk, and Policy Responses'

The views expressed are those of the authors, and not necessarily those of the Bank of England.

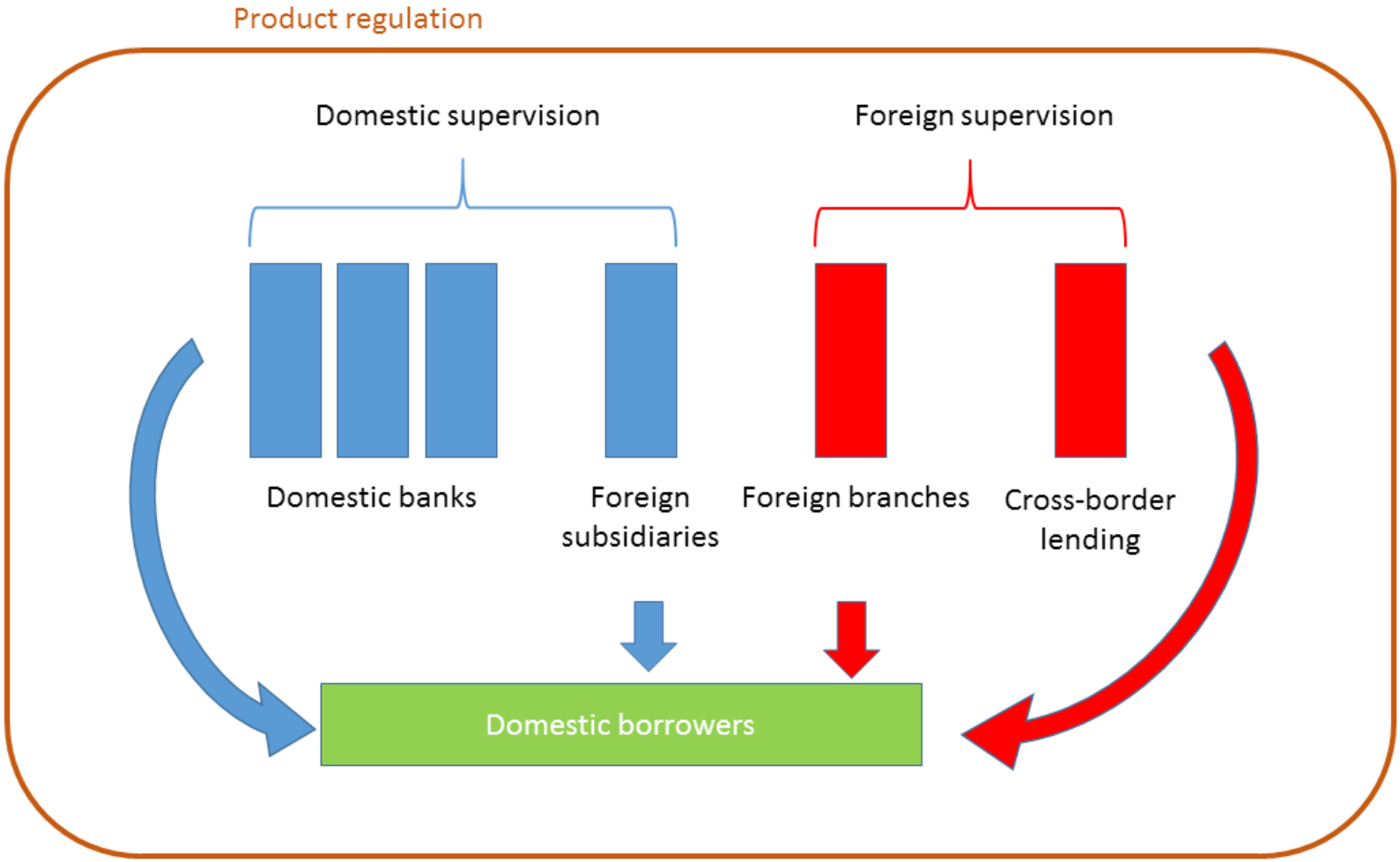
Macroprudential policies

- Since the global financial crisis there has been increased attention paid to ‘macroprudential polices’
- A number of policies have become widely used - such as increased capital requirements or loan-to-value limits on housing
- But these policies may be subject to ‘leakage’ as agents try to avoid them or are outside the regulatory perimeter
- Most of the focus has been on ‘shadow’ banks but alternative source can be borrowing from foreign banks

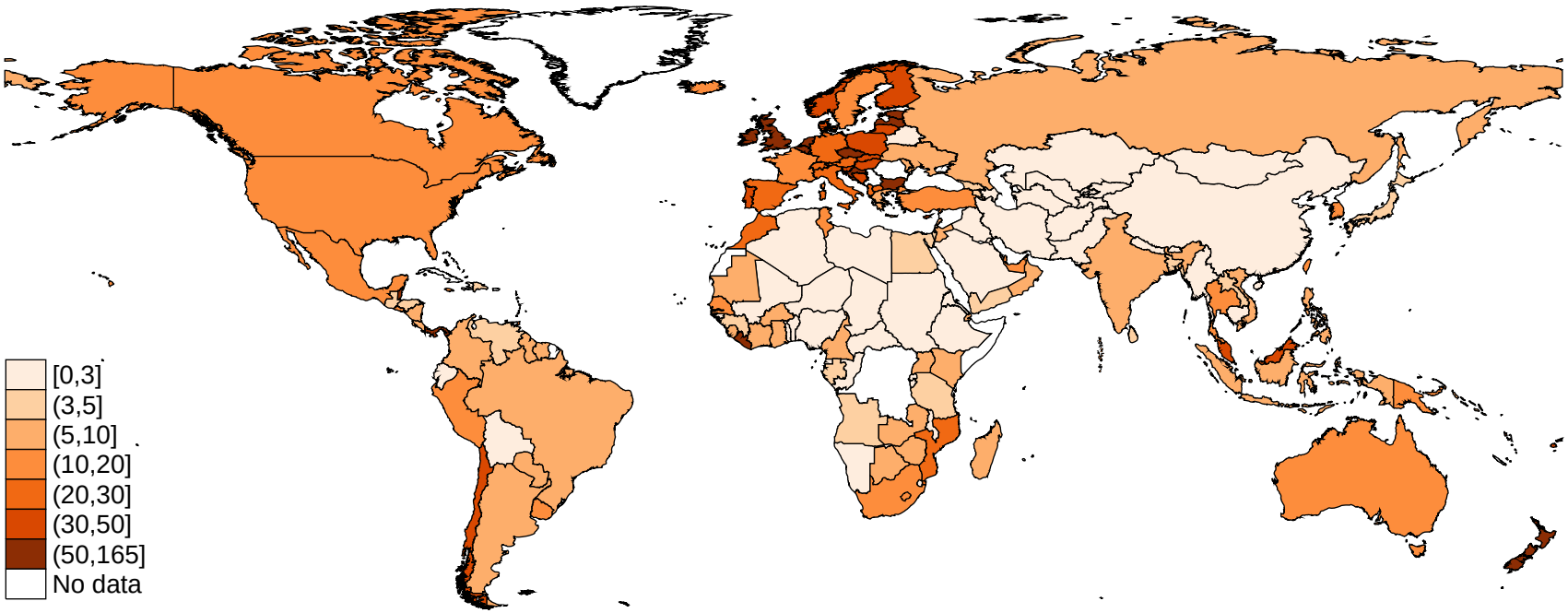
Capital regulation does not apply evenly



But lending standards usually apply to all products bought in a county



The size of foreign bank lending to domestic non-banks



Note: Gross Lending of Foreign Banks to Non-Banks in respective countries (2013 Q4, % of GDP)

The research question: we exploit an uneven application of regulation

- How does lending of foreign banks to domestic non-banks change following domestic macropru actions (conditional on the evolution of domestic credit)?
- If so does it change for some instruments more than others? Do macropru leakages differ by instrument?
- And for both tightening and loosening actions?

What we look at

We combine international banking statistics (BIS) with a new database on macroprudential policy actions. Investigation for a number of different instruments:

- Capital requirements (changes in risk weights, minimum capital ratios etc)
- Lending standards regulation (LTV, LTI, DSR limits etc)
- Reserve Requirements

We note that other macroprudential instruments have been used but there aren't enough actions to use in empirical analysis.

Policy Relevance

Matters for the design and effectiveness of instruments:

- Instrument choice
- Instrument strength
- Reciprocation (to get rid of this uneven application of regulation)

But also for understanding how banks react to other countries' macroprudential measures:

- Bank exposures
- Reciprocation
- Risk analysis

Policy Relevance

Matters for the design and effectiveness of instruments:

- Instrument choice
- Instrument strength
- Reciprocation (to get rid of this uneven application of regulation)

But also for understanding how banks react to other countries' macroprudential measures:

- Bank exposures
- Reciprocation
- Risk analysis

Hypotheses and Results

Hypotheses based on a number of priors informed by the theoretical literature and bank balance sheet mechanics:

- Raising/issuing capital is expensive. Not having to do it leads to a (short-term) competitive advantage.
- Replacing liquidity is costly. Foreign banks are able to replace it from aboad/their parents more easily leading to a competitive advantage.
- Regulations affecting all banks [such as lending standards] should have no relative effects.

Hypotheses and Results

Effect of **regulatory tightening** on foreign bank lending to non-banks (conditional on the evolution of domestic credit):

Instrument	Lending to non-banks
Capital	Increase
Lending standards	No effect
Reserve requirements	Increase

Hypotheses and **Results**

Effect of **regulatory tightening** on foreign bank lending to non-banks (conditional on the evolution of domestic credit):

Instrument	Lending to non-banks
Capital	Increase
	√ (for tightening)
Lending standards	No effect
	√
Reserve requirements	Increase
	√

- Tightening of domestic capital or reserve requirements requirements leads foreign banks to lend more to domestic non-banks
- No expansion of lending from foreign banks after tightening in lending standards regulation

Related literature I

Domestic impact of regulation:

- Lim et al. (2011); Vandenbussche, Vogel, Detragiache. (2015); Nier et al. (2011)

Regulation as driver of capital flows:

- Houston, Lin, and Ma (2011); Bremus and Fratscher (2015): Regulatory Arbitrage and International Bank Flows.
- Buch and Goldberg (2016): International Banking Research Network project. Examine international transmission of a range of prudential policies.
- Regulatory tightening and post-crisis banking 'de-globalisation': Ichiue and Lambert (2016), Forbes, Reinhardt and Wieladek (2016) (Interaction with UMP).
- Popov, Ongena, and Udell (2013): Regulation and risk taking

Related literature II: Leakages

Theoretical literature on capital controls:

- Bengui and Bianchi (2014): Capital Flow Management when Capital Controls Leak. (Also: Jeanne, 2014; Ostry, Ghosh, Korinek, 2012; Sandri and Korinek, 2015)

Leakages from foreign banks:

- Aiyar, Calomiris,Wieladek (2014): Evidence from UK and capital requirements.
- Evidence for cross-border leakages: Cerutti, Claessens and Laeven (2015) (IMF macropru survey for 119 countries), Beirne and Friedrich (2014).

Leakages from non-banks:

- Cizel, Frost, Houben and Wierts (2015): Substitution effects towards non-bank credit, especially in advanced economies.

Data

We use two main data sources apart from standard macroeconomic data sources:

1. Database of macroprudential actions for 68 countries - collected from the IMF and BIS and our own hand collection.
2. BIS International Banking Statistics database of bilateral consolidated international banking assets

- Baseline Sample
  - 38 AEs and EMEs: Argentina, Australia, Austria, Belgium, Brazil, Canada, Switzerland, China, Czech Republic, Germany, Denmark, Spain, Finland, France, UK, Greece, Hong Kong, Hungary, Indonesia, India, Ireland, Italy, Japan, Korea, Mexico, Malaysia, Netherlands, Norway, Poland, Portugal, Russia, Saudi Arabia, Singapore, Sweden, Thailand, Turkey, US, South Africa
  - 2005 Q1 to 2013 Q4

Data: Macroprudential policy actions

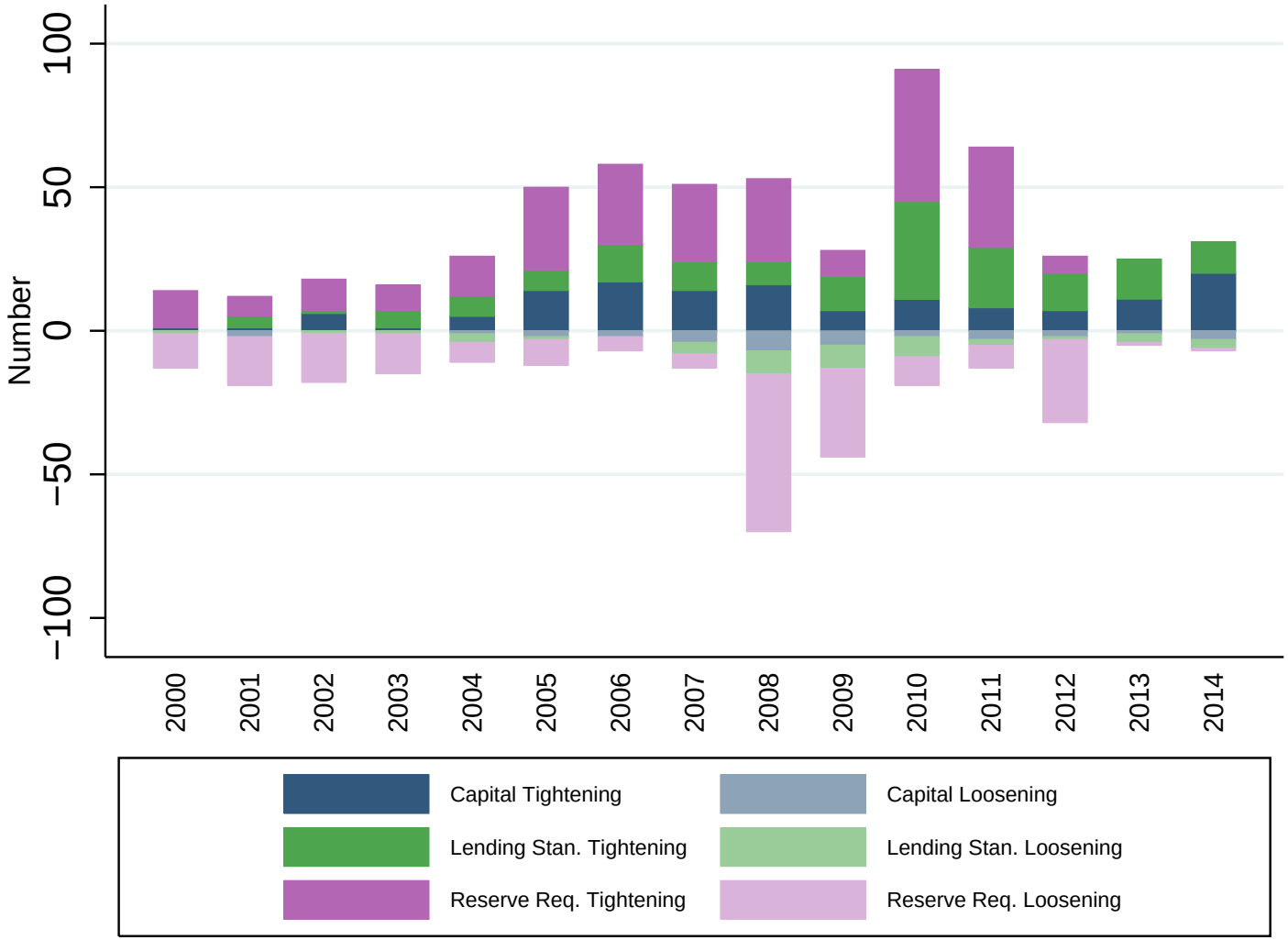
Independent variable: change in regulation

- Hand-collected database
- 1000+ actions on 68 emerging markets and advanced economies
- Mid-90s to 2015
- Covers a very wide range of actions - reflecting the lack of international framework pre-GFC
- Covers the action rather than the intent of an action - difficult to separate out macroprudential vs microprudential actions
- Implementation dates rather than announcement dates

Dealing with macroprudential actions

- Aggregate action 'types' together so:
  1. **Lending criteria**: LTV, DTI, DSR, underwriting criteria
  2. **Reserve requirements, liquidity**
  3. **Capital**: Risk weights, capital requirements, provisioning
- Dummy variable for if an action is taken in that quarter
- Focus in this paper: prudential measures rather than controls or FX measures (CFMs)

Macroprudential actions in the database



Data: Banking Flows (Dependent variable)

- BIS Consolidated International Banking Statistics
  - Bilateral cross-border *and* local lending of affiliates abroad
  - Can not split affiliates in branches vs. subsidiaries (Extension later: use data from Fiecher et al (2011) to estimate split).
  - Ultimate risk basis (Data available from 2005 onwards)
  - By sector and by type (cross-border/local) but not both

Data: Banking Flows (Dependent variable)

Dependent variable: Quarterly per cent change in bilateral lending by foreign banks j to domestic non-bank sectors i:

$$\Delta Lending_{i,j,t} = \frac{F_{i,j,t}}{S_{i,j,t-1}} \times 100, \quad (1)$$

- F denotes the change in lending of country j's banks to non-banks in country i at time t, while S denotes the previous-quarter *stock* of lending.

Adjustments:

- Winsorisation at the 5% level
- Exclude bilateral pairs where stock of bilateral foreign bank lending is below 0.2 % of receiving country GDP

Estimation Methodology

Panel regression with country level fixed effects:

$$\Delta Lending_{i,j,t} = \alpha + \beta Macropru_{i,t-x} + Controls_{i,j,t} + \delta_i + \theta_{j,t} + \epsilon_{i,j,t} \quad (2)$$

- $Macropru$ is a dummy variable
- δ_i are domestic (borrowing/taking macropru action) country fixed effects
- $\theta_{j,t}$ are lending country-quarter fixed effects
- Domestic $Controls$: Exchange Rate Depreciation, Inflation, Real GDP Growth (all expressed as a difference between country i and j) + Domestic Credit Growth
- Standard errors are clustered at the bilateral pair (i, j) level
- We vary the lag structure x of the Macropru variable to estimate longer-run effects (Baseline: t-1/2)

Baseline results: Lending of foreign banks to domestic non-bank sectors

	(1)	(2)
Lending Standards Tightening	0.428	0.274
	(0.453)	(0.457)
Lending Standards Loosening	0.320	0.556
	(0.919)	(0.927)
Reserve Requirements Tightening	1.425**	1.126*
	(0.664)	(0.665)
Reserve Requirements Loosening	-1.349**	-1.409***
	(0.543)	(0.539)
Capital Regulation Tightening	1.506***	1.289***
	(0.481)	(0.483)
Capital Regulation Loosening	-1.397	-1.298
	(1.495)	(1.472)
Credit Growth		0.058***
		(0.017)
GDP Growth Differential		0.298***
		(0.075)
Inflation Differential		0.271**
		(0.108)
ER Depreciation Differential		-0.342
		(4.191)
Constant	1.996***	-2.945**
	(0.769)	(1.150)
Observations	19,574	19,574
Country Pairs	584	584
Adjusted R2	0.180	0.181

Focusing in on Lending Standards

	(1)	(2)
Lending Standards Tightening	0.428	0.274
	(0.453)	(0.457)
Lending Standards Loosening	0.320	0.556
	(0.919)	(0.927)
Reserve Requirements Tightening	1.425**	1.126*
	(0.664)	(0.665)
Reserve Requirements Loosening	-1.349**	-1.409***
	(0.543)	(0.539)
Capital Regulation Tightening	1.506***	1.289***
	(0.481)	(0.483)
Capital Regulation Loosening	-1.397	-1.298
	(1.495)	(1.472)
Controls	NO	YES
Lags of Dep. Var	1	1
Observations	19,574	19,574
Country Pairs	584	584
Adjusted R2	0.180	0.181

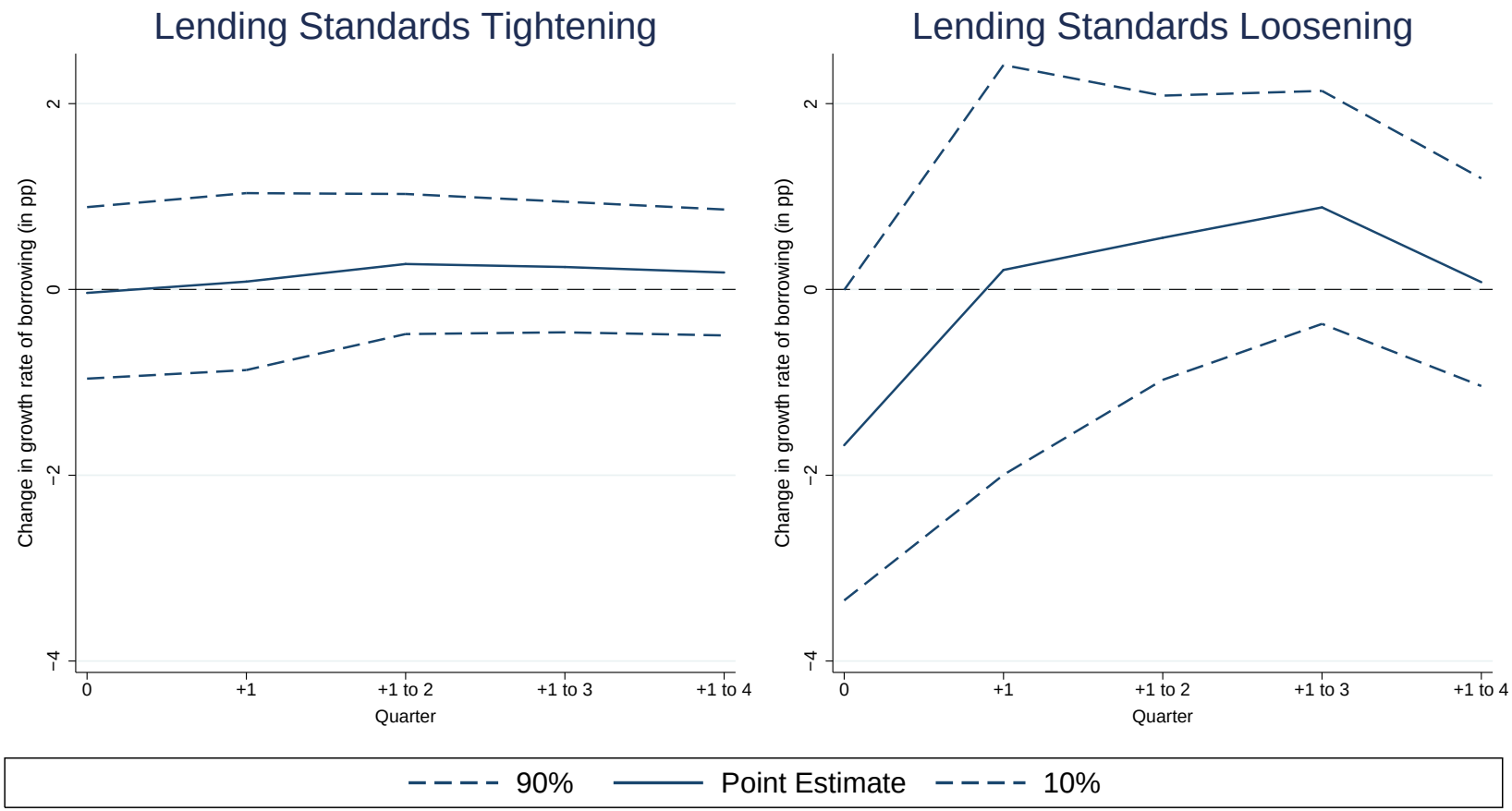
Reserve Requirements

	(1)	(2)
Lending Standards Tightening	0.428	0.274
	(0.453)	(0.457)
Lending Standards Loosening	0.320	0.556
	(0.919)	(0.927)
Reserve Requirements Tightening	1.425**	1.126*
	(0.664)	(0.665)
Reserve Requirements Loosening	-1.349**	-1.409***
	(0.543)	(0.539)
Capital Regulation Tightening	1.506***	1.289***
	(0.481)	(0.483)
Capital Regulation Loosening	-1.397	-1.298
	(1.495)	(1.472)
Controls	NO	YES
Lags of Dep. Var	1	1
Observations	19,574	19,574
Country Pairs	584	584
Adjusted R2	0.180	0.181

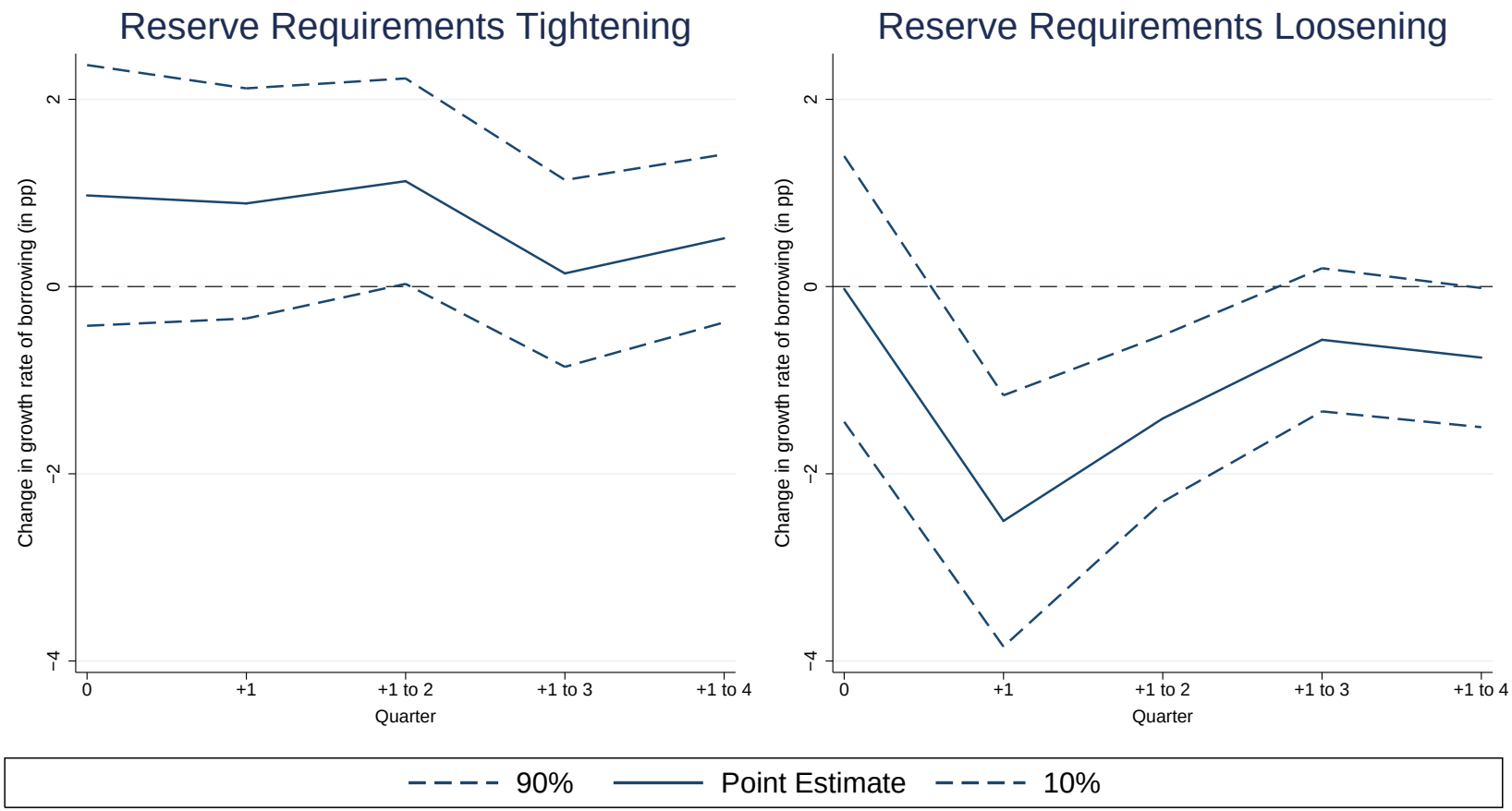
Capital Requirements

	(1)	(2)
Lending Standards Tightening	0.428	0.274
	(0.453)	(0.457)
Lending Standards Loosening	0.320	0.556
	(0.919)	(0.927)
Reserve Requirements Tightening	1.425**	1.126*
	(0.664)	(0.665)
Reserve Requirements Loosening	-1.349**	-1.409***
	(0.543)	(0.539)
Capital Regulation Tightening	1.506***	1.289***
	(0.481)	(0.483)
Capital Regulation Loosening	-1.397	-1.298
	(1.495)	(1.472)
Controls	NO	YES
Lags of Dep. Var	1	1
Observations	19,574	19,574
Country Pairs	584	584
Adjusted R2	0.180	0.181

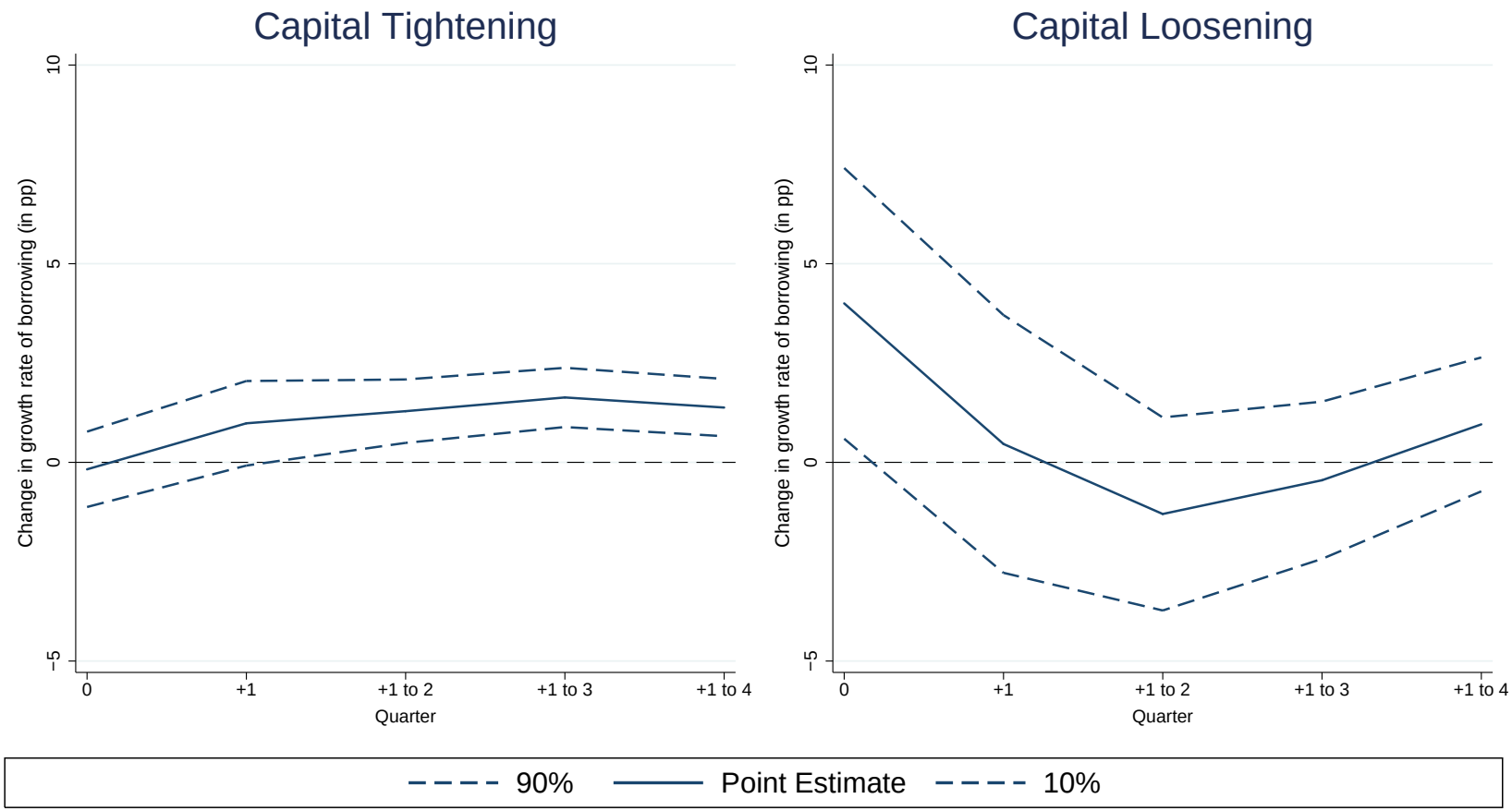
Lending Standards



Reserve Requirements



Capital Requirements



Share of subsidiaries

	(1)	(2)
Lending Standards Tightening	0.685	0.743
	(0.619)	(0.621)
Lending Standards Loosening	0.625	0.308
	(1.374)	(1.393)
Reserve Requirements Tightening [1]	2.506	0.690
	(1.887)	(0.792)
Reserve Requirements Loosening	-1.417**	-1.376**
	(0.622)	(0.618)
Capital Regulation Tightening [2]	1.242**	3.329***
	(0.608)	(0.928)
Capital Regulation Loosening	1.064	1.265
	(1.836)	(1.855)
Share of Subsidiaries	3.380	3.449
	(2.741)	(2.742)
RR Tightening * Share of Subsidiaries [3]	-2.267	
	(2.135)	
Capital Tightening * Share of Subsidiaries [4]		-3.750***
		(1.435)
Controls	YES	YES
Observations	15,677	15,677
Countries	475	475
Adjusted R2	0.192	0.192

Emerging markets vs AEs, excluding the crisis and including policy rates

	(1) EMEs	(2) Excluding Crisis	(3) Policy Rate
Lending Standards Tightening	-0.108	0.308	0.294
	(0.570)	(0.462)	(0.459)
Lending Standards Loosening	0.979	1.162	0.500
	(1.139)	(0.981)	(0.931)
Reserve Requirements Tightening	2.422	0.931	1.115
	(3.396)	(0.669)	(0.738)
Reserve Requirements Loosening	-1.218	-0.899	-1.253**
	(0.933)	(0.547)	(0.556)
Capital Regulation Tightening	1.467**	1.250**	1.344***
	(0.673)	(0.512)	(0.486)
Capital Regulation Loosening	-7.285***	-0.935	-1.383
	(2.173)	(1.545)	(1.479)
Lending Standards Tightening*EME	1.001		
	(0.937)		
Lending Standards Loosening*EME	-1.717		
	(1.880)		
Reserve Requirements Tightening*EME	-1.758		
	(3.464)		
Reserve Requirements Loosening*EME	-0.326		
	(1.112)		
Capital Regulation Tightening*EME	-0.448		
	(0.928)		
Capital Regulation Loosening*EME	9.232***		
	(2.804)		
EME Dummy	-4.170***		
	(1.260)		
Policy Rate (Change)			-0.272
			(0.417)

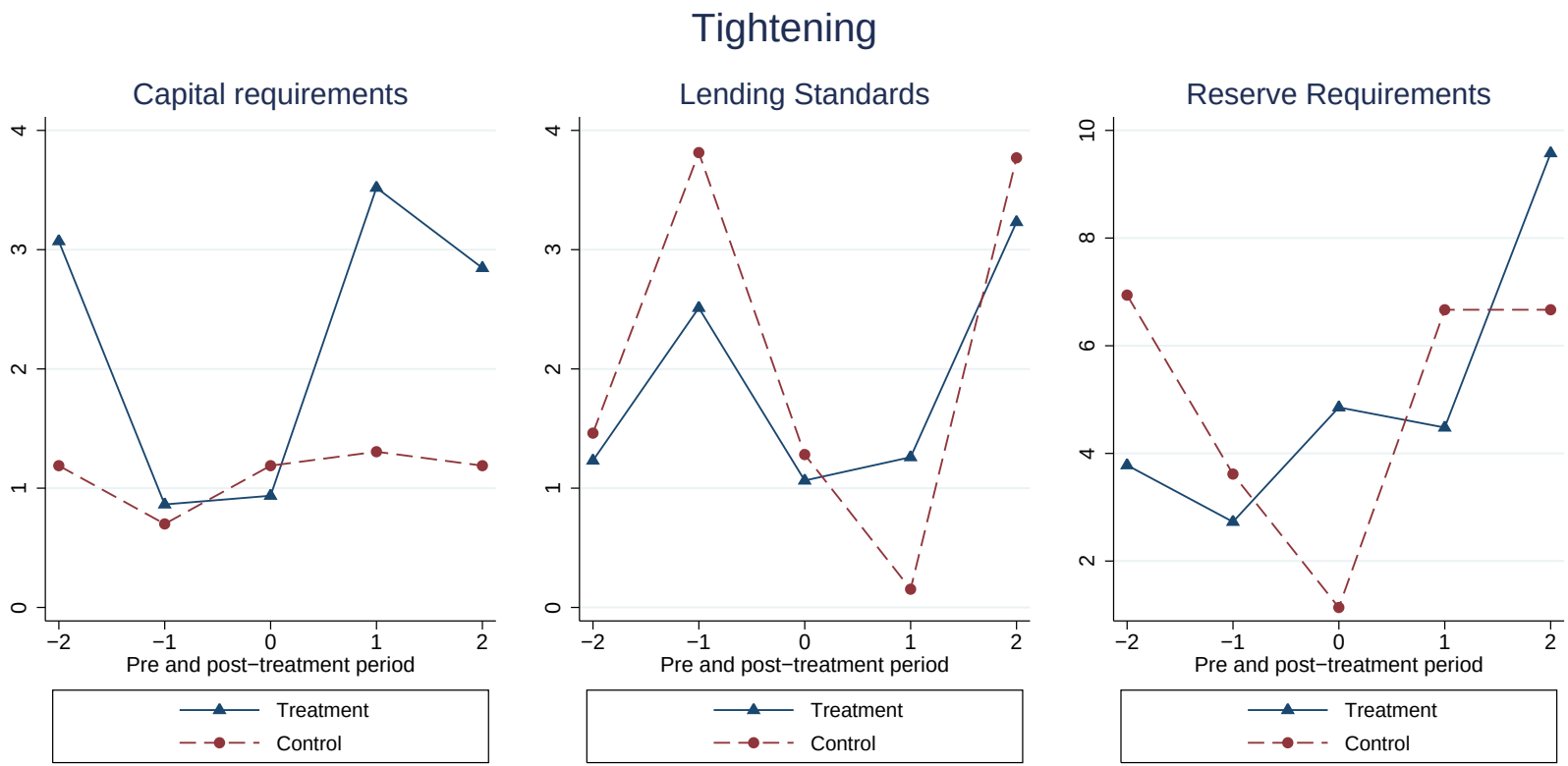
Conclusion

- Tightening of domestic capital requirements leads foreign banks to lend more to domestic non-banks
- Results stronger in countries with high proportion of branches [which are not subject to the regulation]
- Suggests banks expand lending when regulation is *tightened* so long as the regulation does not apply to them
- No expansion in borrowing from abroad after tightening in lending standards regulation
- Implications for instrument choice and design of reciprocity framework

Exogeneity of capital requirements to foreign lending

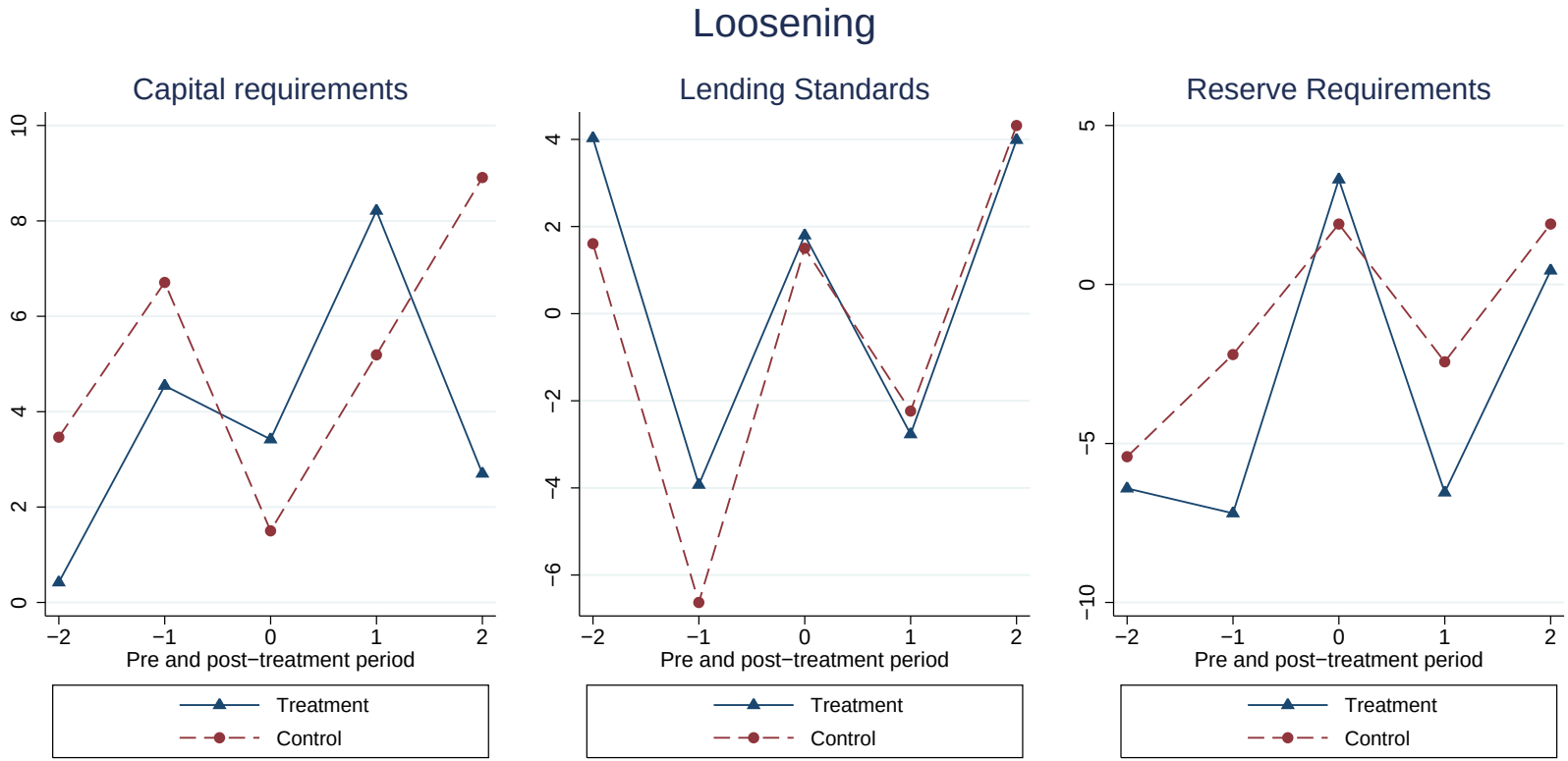
	(1)	(2)	(3)	(4)	(5)	(6)
	Lending Standards		Reserve Requirements		Capital Regulation	
	Tightening	Loosening	Tightening	Loosening	Tightening	Loosening
Foreign Bank Lending Growth	-0.0001*	-0.0000	0.0000	-0.0001	0.0001	0.0000
	(0.0001)	(0.0000)	(0.0001)	(0.0000)	(0.0001)	(0.0000)
Credit Growth	0.0009***	0.0002*	0.0004**	-0.0002*	0.0010***	0.0004***
	(0.0003)	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0001)
GDP Growth	0.0010	-0.0001	0.0046***	0.0008	0.0046***	-0.0015***
	(0.0011)	(0.0006)	(0.0013)	(0.0009)	(0.0011)	(0.0004)
Inflation	-0.0019	-0.0047***	0.0078***	0.0080***	-0.0058***	-0.0009
	(0.0012)	(0.0009)	(0.0018)	(0.0015)	(0.0015)	(0.0006)
ER Depreciation	0.2066***	-0.0227	0.1523***	0.0898**	-0.3131***	0.0248
	(0.0466)	(0.0203)	(0.0462)	(0.0409)	(0.0408)	(0.0209)
Constant	0.0067	0.0399***	-0.0667***	-0.0486***	0.0881***	0.0577***
	(0.0131)	(0.0095)	(0.0188)	(0.0138)	(0.0170)	(0.0058)
Observations	19,574	19,574	19,574	19,574	19,574	19,574
Country Pairs	584	584	584	584	584	584
Adjusted R2	0.0944	0.0619	0.191	0.240	0.103	0.0324

Pararell trends: Tightening



Note: The figure plots the mean of the growth in domestic non-bank borrowing from foreign banks around tightening or loosening events of regulatory policies.

Pararell trends: Loosening



Note: The figure plots the mean of the growth in domestic non-bank borrowing from foreign banks around tightening or loosening events of regulatory policies.