

# Cross-border effects of macroprudential policy

Dennis Reinhardt and Rhiannon Sowerbutts

Bank of England

14 November 2014

Conference on 'Effective Macroprudential Instruments'

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

We exploit a source of uneven application of regulation.....

- Capital requirements only apply to home banks and foreign subsidiaries
- Lending standards regulation applies to all products sold in a country

to ask the questions.....

- How does the borrowing of domestic banks and non-banks from foreign banks change following domestic macropru actions?
- Does cross-border borrowing undermine the effectiveness of macroprudential policies?
- If so does it undermine some instruments more than others?
- And for both tightening and loosening actions?

We exploit a source of uneven application of regulation.....

- Capital requirements only apply to home banks and foreign subsidiaries
- Lending standards regulation applies to all products sold in a country

to ask the questions.....

- How does the borrowing of domestic banks and non-banks from foreign banks change following domestic macropru actions?
- Does cross-border borrowing undermine the effectiveness of macroprudential policies?
- If so does it undermine some instruments more than others?
- And for both tightening and loosening actions?

We exploit a source of uneven application of regulation.....

- Capital requirements only apply to home banks and foreign subsidiaries
- Lending standards regulation applies to all products sold in a country

to ask the questions.....

- How does the borrowing of domestic banks and non-banks from foreign banks change following domestic macropru actions?
- Does cross-border borrowing undermine the effectiveness of macroprudential policies?
- If so does it undermine some instruments more than others?
- And for both tightening and loosening actions?

We exploit a source of uneven application of regulation.....

- Capital requirements only apply to home banks and foreign subsidiaries
- Lending standards regulation applies to all products sold in a country

to ask the questions.....

- How does the borrowing of domestic banks and non-banks from foreign banks change following domestic macropru actions?
- Does cross-border borrowing undermine the effectiveness of macroprudential policies?
- If so does it undermine some instruments more than others?
- And for both tightening and loosening actions?

We exploit a source of uneven application of regulation.....

- Capital requirements only apply to home banks and foreign subsidiaries
- Lending standards regulation applies to all products sold in a country

to ask the questions.....

- How does the borrowing of domestic banks and non-banks from foreign banks change following domestic macropru actions?
- Does cross-border borrowing undermine the effectiveness of macroprudential policies?
- If so does it undermine some instruments more than others?
- And for both tightening and loosening actions?

## Our question: Do foreign bank flows undermine the effectiveness of macroprudential policies?

Matters for the design of instruments:

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

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

- UK banks
- Reciprocation

Our question: Do foreign bank flows undermine the effectiveness of macroprudential policies?

Matters for the design of instruments:

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

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

- UK banks
- Reciprocation



Our question: Do foreign bank flows undermine the effectiveness of macroprudential policies?

Matters for the design of instruments:

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

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

- UK banks
- Reciprocation

## What we look at:

We investigate these issues using a database on macroprudential policy actions (collected by us) and cross-border banking statistics (BIS) for a number of different instruments:

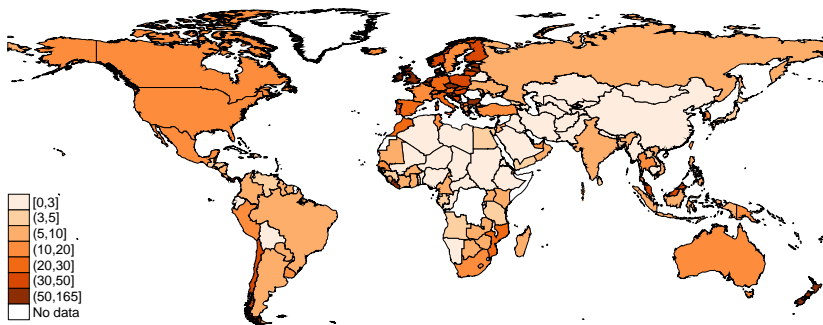
- Capital requirements
- Lending standards regulation
- Reserve Requirements

And over a number of dimensions:

- Borrowing of different sectors: non-banks and banks
- Borrowing over different time horizons

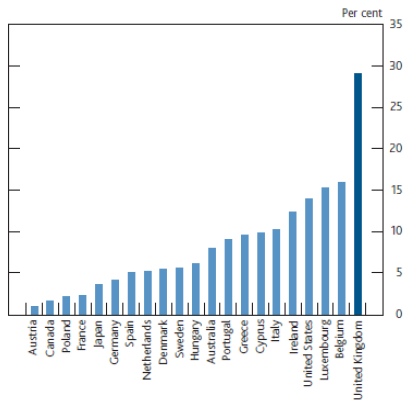
## The size of foreign bank lending

### Gross Foreign Liabilities of Non-Banks (% of GDP)



## The size of lending by branches

**Chart 1**  
**Foreign branches as a share of total resident banking system assets, 2012**



Source: PRA Consultation Paper CP4/14 (2014).

## Related literature I

### Domestic impact of regulation:

- Lim et al. (2011, IMF). Macroprudential Policy: What Instruments and How to Use Them. Lessons from Country Experiences
- Vandebussche, Vogel, Detragiache. 2012. Macroprudential Policies and Housing Prices - A New Database and Empirical Evidence for Central, Eastern, and Southeastern Europe.

### Regulatory policies and capital controls with cross-country spillovers: Theory

- Bengui, Julien and Javier Bianchi. 2014. Capital Flow Management when Capital Controls Leak.
- Korinek, Anton. 2013. Capital Controls and Currency Wars. Manuscript, University of Maryland.

## Related literature I

### Domestic impact of regulation:

- Lim et al. (2011, IMF). Macroprudential Policy: What Instruments and How to Use Them. Lessons from Country Experiences
- Vandebussche, Vogel, Detragiache. 2012. Macroprudential Policies and Housing Prices - A New Database and Empirical Evidence for Central, Eastern, and Southeastern Europe.

### Regulatory policies and capital controls with cross-country spillovers: Theory

- Bengui, Julien and Javier Bianchi. 2014. Capital Flow Management when Capital Controls Leak.
- Korinek, Anton. 2013. Capital Controls and Currency Wars. Manuscript, University of Maryland.

## Related literature II

- Leakages
  - Aiyar, Calomiris, Wieladek (2014, JMCB) Does Macropru Leak? Evidence from a UK Policy Experiment
- Outward transmission of own-country policy
  - Capital: Aiyar, Calomiris, Hooley, Korniyenko and Wieladek (2014, JFE), The international transmission of minimum bank capital requirements
  - Regulation and capital flows: Houston, Lin, and Ma (2011, JF) Regulatory Arbitrage and International Bank Flows
  - Regulation and risk taking: Popov, Ongena, and Udell (2013, JFE) When the Cat's Away the Mice Will Play: Does Regulation at Home Affect Bank Risk Taking Abroad?

## Related literature II

- Leakages
  - Aiyar, Calomiris, Wieladek (2014, JMCB) Does Macropru Leak? Evidence from a UK Policy Experiment
- Outward transmission of own-country policy
  - Capital: Aiyar, Calomiris, Hooley, Korniyenko and Wieladek (2014, JFE), The international transmission of minimum bank capital requirements
  - Regulation and capital flows: Houston, Lin, and Ma (2011, JF) Regulatory Arbitrage and International Bank Flows
  - Regulation and risk taking: Popov, Ongena, and Udell (2013, JFE) When the Cat's Away the Mice Will Play: Does Regulation at Home Affect Bank Risk Taking Abroad?



## Hypotheses

We have a number of hypotheses which we build from a number of priors and are informed by the theoretical literature

- Raising capital is expensive. Not having to do it leads to a competitive
- Raising capital is expensive. Banks may delever (shrink their balance sheet instead)
- If banks are perceived as safer this reduces their cost of borrowing and leads to increased borrowing from abroad.
- Replacing liquidity is costly. Foreign banks are able to replace it from abroad/their parents more easily leading to a competitive advantage.
- Regulations affecting all banks such as lending standards should have no relative effects

## Hypotheses

We have a number of hypotheses which we build from a number of priors and are informed by the theoretical literature

- Raising capital is expensive. Not having to do it leads to a competitive
- Raising capital is expensive. Banks may delever (shrink their balance sheet instead)
- If banks are perceived as safer this reduces their cost of borrowing and leads to increased borrowing from abroad.
- Replacing liquidity is costly. Foreign banks are able to replace it from abroad/their parents more easily leading to a competitive advantage.
- Regulations affecting all banks such as lending standards should have no relative effects

## Hypotheses

We have a number of hypotheses which we build from a number of priors and are informed by the theoretical literature

- Raising capital is expensive. Not having to do it leads to a competitive
- Raising capital is expensive. Banks may delever (shrink their balance sheet instead)
- If banks are perceived as safer this reduces their cost of borrowing and leads to increased borrowing from abroad.
- Replacing liquidity is costly. Foreign banks are able to replace it from abroad/their parents more easily leading to a competitive advantage.
- Regulations affecting all banks such as lending standards should have no relative effects

## Hypotheses

We have a number of hypotheses which we build from a number of priors and are informed by the theoretical literature

- Raising capital is expensive. Not having to do it leads to a competitive
- Raising capital is expensive. Banks may delever (shrink their balance sheet instead)
- If banks are perceived as safer this reduces their cost of borrowing and leads to increased borrowing from abroad.
- Replacing liquidity is costly. Foreign banks are able to replace it from abroad/their parents more easily leading to a competitive advantage.
- Regulations affecting all banks such as lending standards should have no relative effects

## Hypotheses

We have a number of hypotheses which we build from a number of priors and are informed by the theoretical literature

- Raising capital is expensive. Not having to do it leads to a competitive
- Raising capital is expensive. Banks may delever (shrink their balance sheet instead)
- If banks are perceived as safer this reduces their cost of borrowing and leads to increased borrowing from abroad.
- Replacing liquidity is costly. Foreign banks are able to replace it from abroad/their parents more easily leading to a competitive advantage.
- Regulations affecting all banks such as lending standards should have no relative effects

## Hypotheses

A tightening in each instrument and the effect on borrowing from foreign banks....

Instrument	Non-banks	Banks
Capital	Increase	Ambiguous
Lending standards	No effect	Increase
Reserve requirements	Increase	Increase

Loosening should show opposite effects

## Hypotheses vs Results

What we find for tightening in each instrument and the effect on borrowing from foreign banks....

Instrument	Non-banks	Banks
Capital	Increase	Ambiguous
	✓ (for tightening)	No effect
Lending standards	No effect	Increase
	✓	✓ (for tightening)
Reserve requirements	Increase	Increase
	✓	✓ (fall for loosening)

## 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 and liabilities
- 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

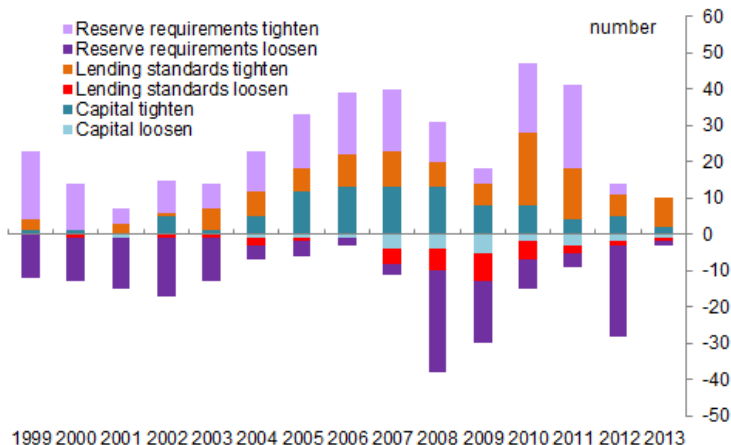
### Independent variable: change in regulation

- Hand-collected database
- 1000+ actions on 68 emerging markets and advanced economies
- Mid-90s to 2014
- 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
  - 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)

# The macroprudential database



## Types of macroprudential tool used

	<b>Advanced economies</b>	<b>Other countries</b>
Capital	21.5%	14.8%
Liquidity	8.1%	6.0%
Provisioning	3.4%	7.8%
Reserves	2.8%	27.3%
Credit growth limits	2.8%	3.9%
Exposure limits	4.0%	8.1%
FX restrictions	1.2%	10.3%
Lending criteria	44.5%	17.2%
Other	11.5%	4.5%

## Data: Banking Flows

- **BIS Consolidated International Banking Statistics**
  - Bilateral cross-border *and* local lending of affiliates abroad
  - Ultimate risk basis (Data available from 2005 onwards)
  - By sector and by type (cross-border/local) but not both
  - **Leakages:** Cross-border and local lending to non-bank sector following domestic macropru action
    - Subsidiaries or branches?

## Data: Dependent variable

Dependent variable: Quarterly per cent change in bilateral banking liabilities:

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

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

Adjustments:

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

## Estimation Methodology

Panel regression with country level fixed effects:

$$\Delta \text{Borrowing}_{i,j,t} = \alpha + \beta \text{Macropru}_{i,t-x} + \text{Controls} + \delta_i + \theta_{j,t} + \epsilon_{i,j,t} \quad (2)$$

- *Macropru* is a dummy variable
- $\delta_i$  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, 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)

## Borrowing of non-bank sectors

	(1)	(2)
Lending Standards Tightening	0.43 (0.54)	0.22 (0.55)
Lending Standards Loosening	1.09 (1.10)	1.29 (1.09)
Reserve Requirements Tightening	1.29** (0.62)	1.29** (0.62)
Reserve Requirements Loosening	-1.76*** (0.58)	-1.61*** (0.59)
Capital Regulation Tightening	1.91*** (0.63)	1.46** (0.63)
Capital Regulation Loosening	-1.20 (1.31)	-1.16 (1.32)
FX Return (Domestic)		-4.27 (5.89)
GDP Growth (Domestic)		0.10 (0.10)
Inflation (Domestic)		0.02 (0.14)
Credit Growth (Domestic)		0.10*** (0.02)
Constant	2.79*** (0.83)	-0.46 (1.69)
Lags of Dep. Var	1	1
Observations	14,988	14,988
Country Pairs	517	517
Adjusted R2	0.233	0.235



## Borrowing of non-bank sectors: Lending Standards

	(1)	(2)
Lending Standards Tightening	0.43 (0.54)	0.22 (0.55)
Lending Standards Loosening	1.09 (1.10)	1.29 (1.09)
Reserve Requirements Tightening	1.29** (0.62)	1.29** (0.62)
Reserve Requirements Loosening	-1.76*** (0.58)	-1.61*** (0.59)
Capital Regulation Tightening	1.91*** (0.63)	1.46** (0.63)
Capital Regulation Loosening	-1.20 (1.31)	-1.16 (1.32)
Controls	NO	YES
Lags of Dep. Var	1	1
Observations	14,988	14,988
Country Pairs	517	517
Adjusted R2	0.233	0.235

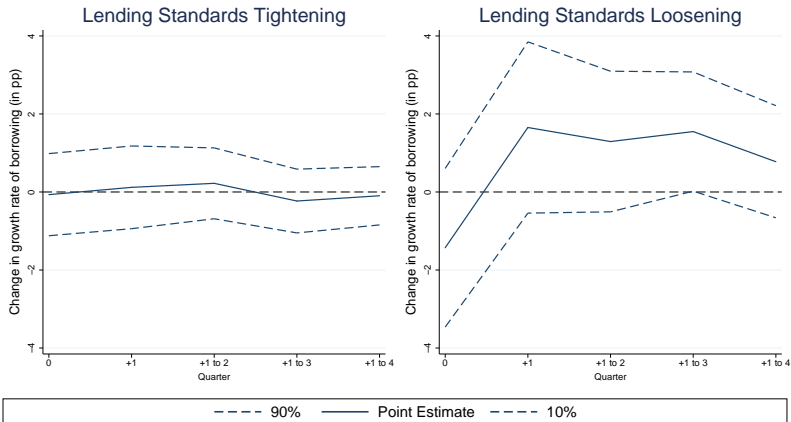
## Borrowing of non-bank sectors: Reserve Requirements

	(1)	(2)
Lending Standards Tightening	0.43 (0.54)	0.22 (0.55)
Lending Standards Loosening	1.09 (1.10)	1.29 (1.09)
Reserve Requirements Tightening	1.29** (0.62)	1.29** (0.62)
Reserve Requirements Loosening	-1.76*** (0.58)	-1.61*** (0.59)
Capital Regulation Tightening	1.91*** (0.63)	1.46** (0.63)
Capital Regulation Loosening	-1.20 (1.31)	-1.16 (1.32)
Controls	NO	YES
Lags of Dep. Var	1	1
Observations	14,988	14,988
Country Pairs	517	517
Adjusted R2	0.233	0.235

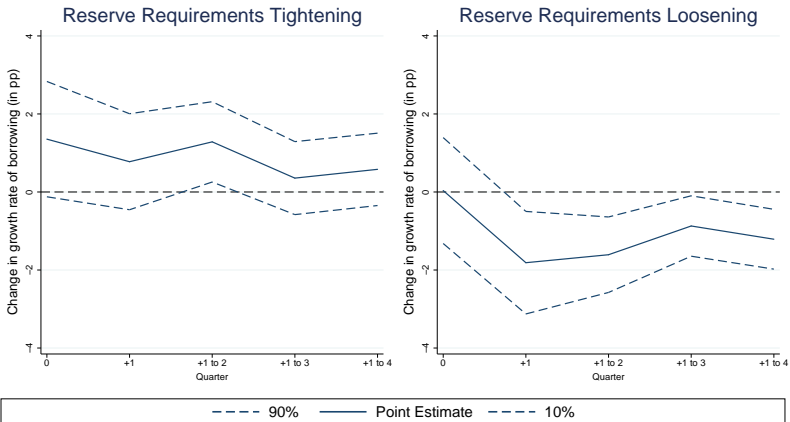
## Borrowing of non-bank sectors: Capital Requirements

	(1)	(2)
Lending Standards Tightening	0.43 (0.54)	0.22 (0.55)
Lending Standards Loosening	1.09 (1.10)	1.29 (1.09)
Reserve Requirements Tightening	1.29** (0.62)	1.29** (0.62)
Reserve Requirements Loosening	-1.76*** (0.58)	-1.61*** (0.59)
Capital Regulation Tightening	1.91*** (0.63)	1.46** (0.63)
Capital Regulation Loosening	-1.20 (1.31)	-1.16 (1.32)
Controls	NO	YES
Lags of Dep. Var	1	1
Observations	14,988	14,988
Country Pairs	517	517
Adjusted R2	0.233	0.235

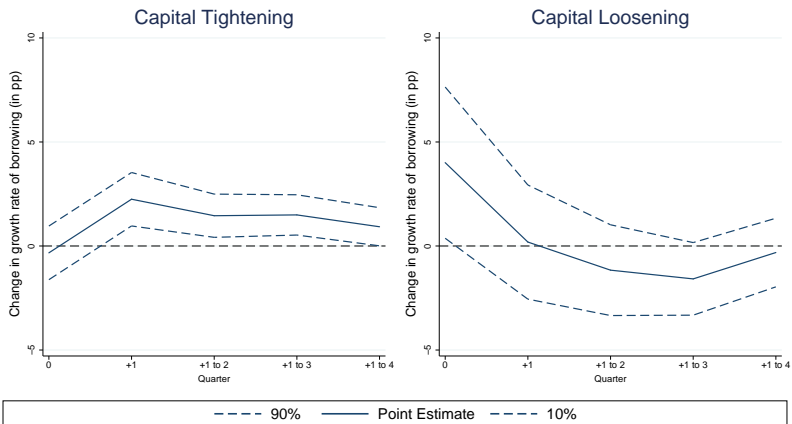
## Borrowing of non-bank sectors: Lending Standards



## Borrowing of non-bank sectors: Reserve Requirements



## Borrowing of non-bank sectors: Capital Requirements



## Share of subsidiaries

	(1)	(2)
	Non-Bank Borrowing	
Lending Standards Tightening	0.47 (0.74)	0.20 (0.74)
Lending Standards Loosening	0.86 (1.79)	0.77 (1.79)
Reserve Requirements Tightening	1.16 (0.73)	1.14 (0.74)
Reserve Requirements Loosening	-1.76*** (0.64)	-1.73*** (0.65)
Capital Regulation Tightening [1]	2.85** (1.12)	2.62** (1.13)
Capital Regulation Loosening	-1.01 (1.93)	-0.65 (1.94)
Capital Tightening* Share of Subsidiaries [2]	-0.49 (1.85)	-1.33 (1.83)
Test [1] + [2] = 0 (p-value)	0.073*	0.3256
Controls	NO	YES
Lags of Dep. Var	1	1
Observations	11,825	11,825
Countries	413	413
Adjusted R2	0.251	0.252

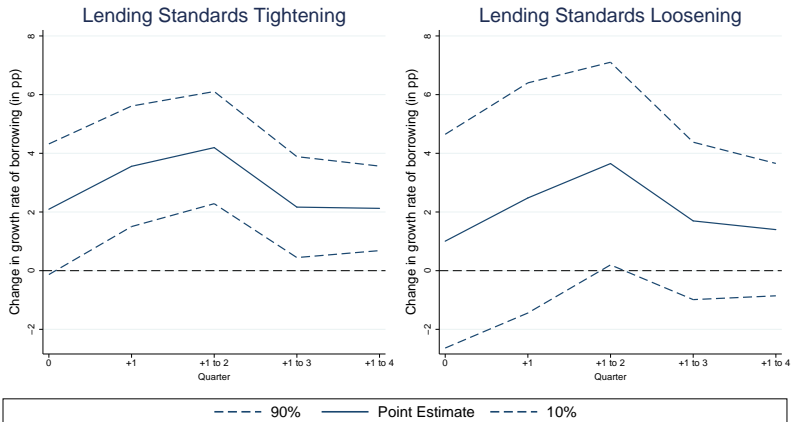
Data on share of subsidiaries: Fiechter et al. (2011)

## Borrowing of bank sectors

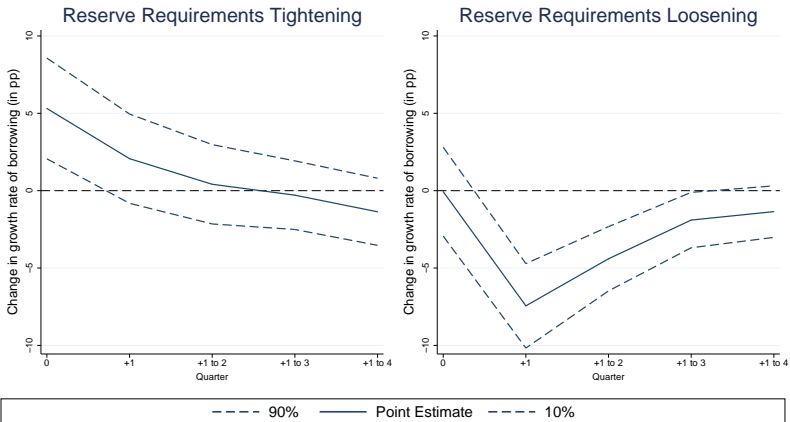
	(1)	(2)
Lending Standards Tightening	4.72*** (1.15)	4.19*** (1.16)
Lending Standards Loosening	3.24 (2.08)	3.65* (2.09)
Reserve Requirements Tightening	0.40 (1.57)	0.41 (1.55)
Reserve Requirements Loosening	-4.52*** (1.26)	-4.40*** (1.26)
Capital Regulation Tightening	0.43 (1.32)	-0.26 (1.31)
Capital Regulation Loosening	2.39 (2.85)	2.33 (2.87)
FX Return (Domestic)		-4.39 (12.06)
GDP Growth (Domestic)		0.07 (0.18)
Inflation (Domestic)		0.56* (0.29)
Credit Growth (Domestic)		0.18*** (0.04)
Constant	9.52*** (1.63)	-0.24 (3.55)
Lags of Dep. Var	1	1
Observations	15,077	15,077
Country Pairs	517	517
Adjusted R2	0.169	0.170



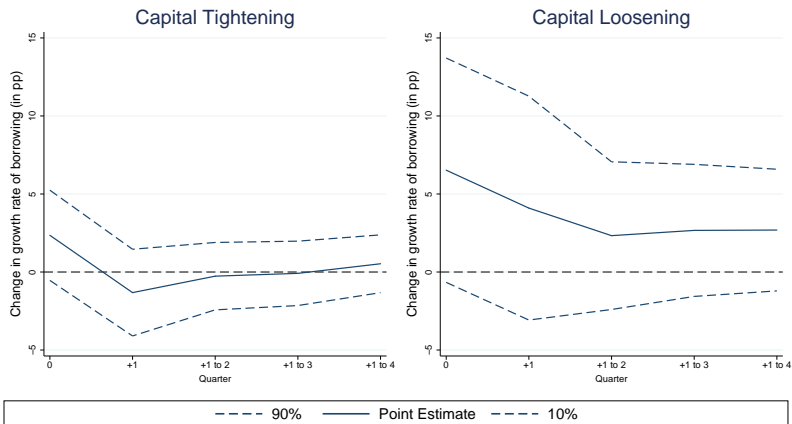
## Borrowing of bank sectors: Lending Standards



## Borrowing of bank sectors: Reserve Requirements



## Borrowing of bank sectors: Capital Requirements



## Excluding the crisis (2008Q4 - 2009Q2)

	(1)	(2)
	Non-Bank liabilities	Bank Liabilities
Lending Standards Tightening	0.25 (0.55)	4.06*** (1.15)
Lending Standards Loosening	1.54 (1.09)	3.81* (2.07)
Reserve Requirements Tightening	1.07* (0.62)	0.17 (1.55)
Reserve Requirements Loosening	-1.15** (0.56)	-3.37** (1.32)
Capital Regulation Tightening	1.32** (0.64)	-0.22 (1.29)
Capital Regulation Loosening	-0.49 (1.40)	3.09 (2.91)
Controls	YES	YES
Lags of Dep. Var	1	1
Observations	14,637	14,553
Country Pairs	517	517
Adjusted R2	0.167	0.232

## Splitting into AEs and EMEs

	(1)	(2)	(3)	(4)
	Non-Bank liabilities		Bank Liabilities	
	AEs	EMEs	AEs	EMEs
Lending Standards Tightening	0.19 (0.77)	0.16 (0.87)	4.66*** (1.38)	2.60 (2.06)
Lending Standards Loosening	2.37 (1.45)	0.61 (1.75)	3.61 (2.62)	1.63 (3.80)
Reserve Requirements Tightening	2.49 (4.29)	0.63 (0.73)	-3.56 (4.42)	-1.14 (1.85)
Reserve Requirements Loosening	-1.26 (1.03)	-0.41 (0.83)	-4.14* (2.23)	-4.80*** (1.64)
Capital Regulation Tightening	2.22** (1.05)	0.07 (0.78)	-0.17 (1.81)	-3.05* (1.78)
Capital Regulation Loosening	-2.46 (2.14)	-1.27 (1.59)	3.27 (4.05)	3.86 (3.65)
Controls	YES	YES	YES	YES
Observations	10,810	4,178	10,939	4,138
Country Pairs	374	143	374	143
Adjusted R2	0.254	0.221	0.194	0.161

## Results

What we find for tightening in each instrument and the effect on borrowing from abroad....

Instrument	Non-banks	Banks
Capital	Increase	Ambiguous
	✓ (for tightening)	No effect
Lending standards	No effect	Increase
	✓	✓ (for tightening)
Reserve requirements	Increase	Increase
	✓	✓ (fall for loosening)

## What does this mean for policy?

- Instrument choice matters
- Stronger instruments
- Reciprocation desirable for the policymaker taking an action
- ..... and desirable for the foreign policymaker too.

## Extensions

- Extensions
  - Explore detailed capital regulations: provisions, requirements, risk weights, profit redistribution
  - Do leakages depend on sending or receiving country characteristics? Interaction terms.
  - Does the state of the cycle matter?