Sentiment in Central Banks' Financial Stability Reports*

Ricardo Correa[a] , Keshav Garud[b], Juan M. Londono[a], and Nathan Mislang[c]

a) Federal Reserve Board
b) University of Michigan
c) Cornell University

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*The views in this presentation are the responsibility of the authors and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or of any other person associated with the Federal Reserve System.

What we do in this paper

We use the text in financial stability reports (FSRs) to:

- Create a dictionary specific to the financial stability context.
- Calculate a financial stability sentiment (FSS) index for each FSR.

Using a panel dataset for 35 countries between 2005 and 2015, we explore:

- How information is incorporated in FSRs. FSS is mostly driven by developments in the banking sector.
- Relation between FSS and the financial cycle. FSS is related to credit growth, asset prices, and systemic risk.
- Predictive power of FSS for financial crises. FSS deteriorates just prior to the start of a crisis.

A financial stability dictionary

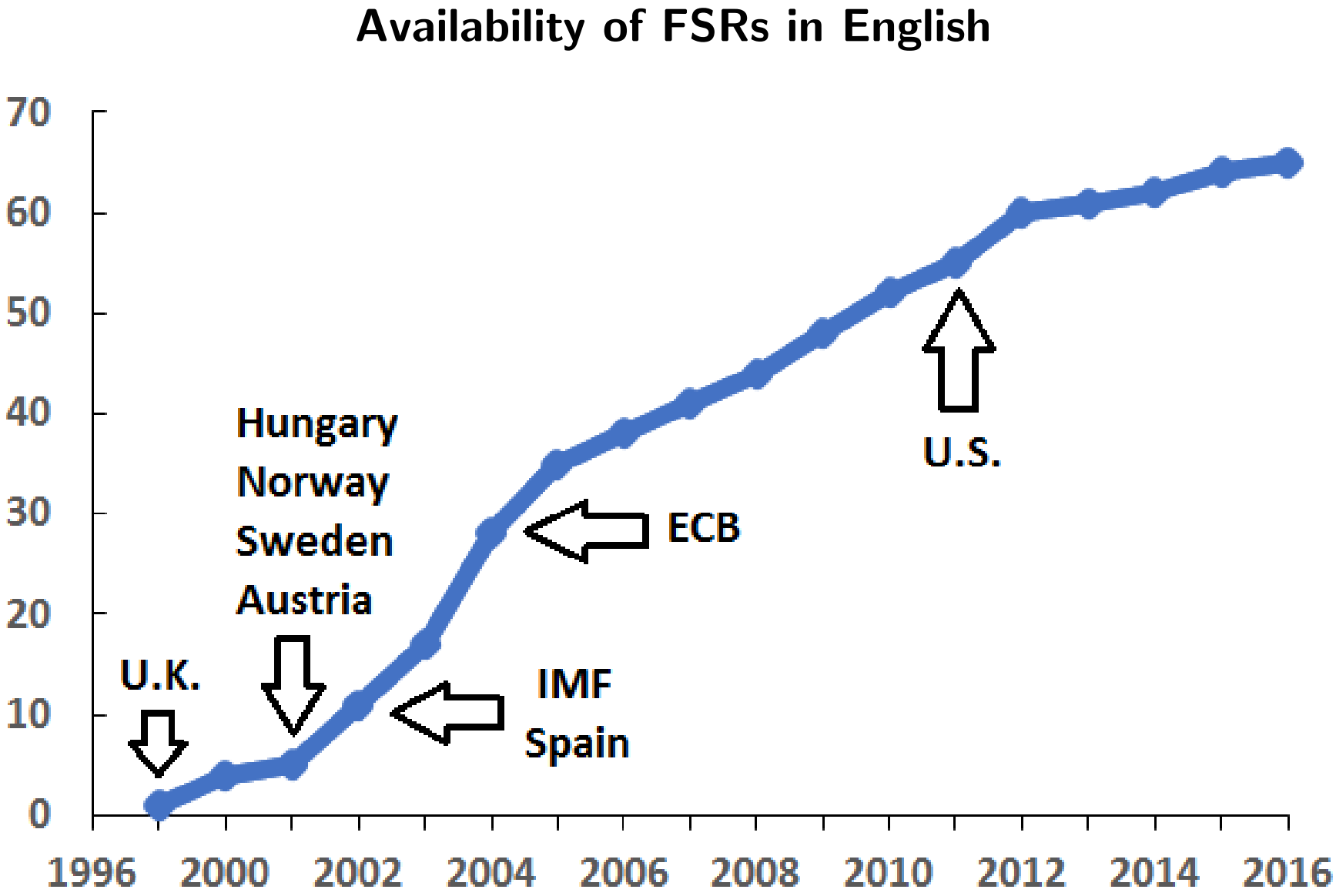
- General dictionaries, such as Harvard IV-4 and Diction, have been used extensively in the literature to analyze sentiment.
- Words might have different connotations depending on the context (Loughran and McDonald, JF, 2011; Henry, 2006 and 2008).
- Words in FSRs often have a different connotation compared to a general or finance context.

  $\Rightarrow$ Convey a different sentiment: "*confined*" defined as limited negative spillovers as opposed to restricted.

  $\Rightarrow$ Describe historical events: "*crisis*" to refer to the global financial crisis.

  $\Rightarrow$ Technical terms: "*delinquency*" used as part "*delinquency rates*".

Central banks' communication and FSRs



Central banks' communication and FSRs

Characteristics of financial stability reports

- Main goal is to identify risks and vulnerabilities in the financial system, and to increase transparency.
- Vary in length (38 to 184 pages) and format, across time and countries.
- Sections include: summary, overall assessment, domestic sector, external sector, financial sector, and special topics.
- The dictionary method is useful to investigate sentiment in FSRs.
- Other methods for sentiment analysis, such as machine learning, are powerful, but typically use unsupervised models, which require a pre-classified training sample (not always available).

This presentation

1. Constructing a dictionary for financial stability
2. The financial stability sentiment (FSS) index
3. Topics driving FSS
4. FSS and the financial cycle
5. FSS and financial crises
6. Conclusions

1. Constructing a dictionary for financial stability

- We process the text in 982 FSRs published in (or translated to) English between 2000 and 2015.
- Strip the text of all punctuation and delete stop words ("and," "the," "of")
- Select 98 percent of remaining words (7,388 words)
- Manually remove obviously non-financial-stability words ("vehicle," "study")
- Scoring: classify words into positive, negative, or neutral (no sentiment) (go$\longmapsto$)
- Our dictionary is available as an online appendix. (go$\longmapsto$)

1. Constructing a dictionary for financial stability

	Number of words	Word distribution (percent)	Word frequency (percent)
Total financial stability	391	5.38	4.01
Positive words	96	1.32	1.45
Negative words	295	4.06	2.56
Overlap with LM	270	3.72	3.28
Uniquely financial stability words	121	1.67	0.73

2. The FSS index

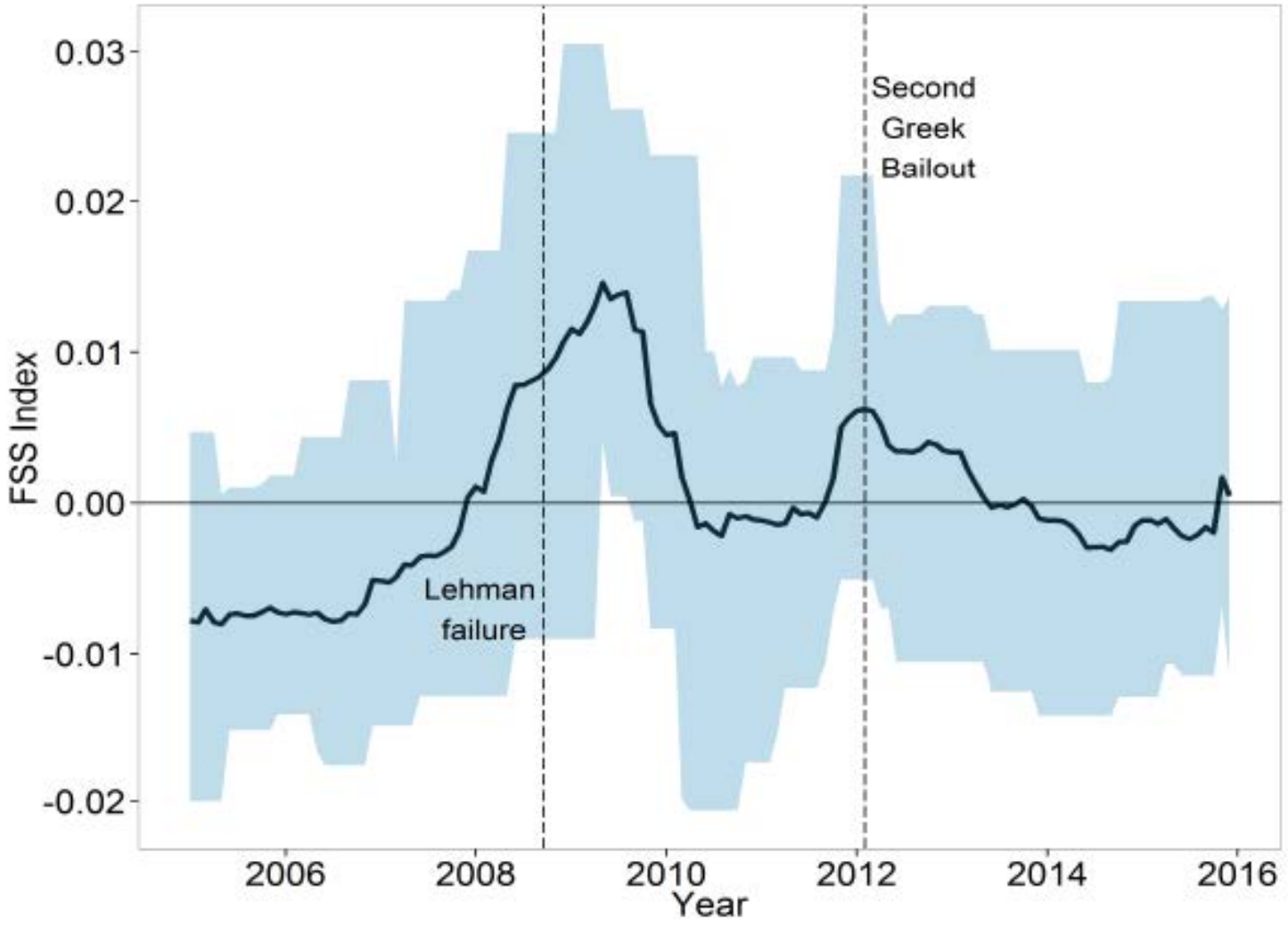
- For each cleaned report, the FSS index is calculated as:

$$FSS_{country,period} = \frac{\#Negative\ words - \#Positive\ words}{\#Total\ words}.$$

- Positive and negative words are defined by the financial stability dictionary.
- An increase in FSS implies a deterioration in sentiment.

2. The FSS index

Average FSS index (global aggregate)



3. Topics driving FSS

3. Topics driving FSS

- We construct sector-specific FSS indexes to explore two related questions:

  $\Rightarrow$ How are sector-specific indicators summarized by the sector FSS indexes?

  $\Rightarrow$ Which topics or sectors drive the time variation of the overall FSS index?

- We identify a set of words characterizing each topic: banking, asset valuations, real estate, households, corporate, external, sovereign. ($go \mapsto$)

- We use a panel-data setting to determine the relation between the FSS index, FSS topic indexes, and topic-specific indicators.

3. Topics driving FSS

How are sector-specific indicators summarized by the sector FSS indexes?

$$FSS^{j}_{i,t} = \mu_i + \beta X^{j}_{i,t-h} + e_{i,t}$$

Subindex	Variable	$h = 0$	$h = 1$	$h = 4$	N
Bank	SRISK to GDP	0.12^{***}	0.03^{**}	0.01	1,297
		(0.03)	(0.01)	(0.03)	
Household	DSR, households	0.50^{***}	0.20^{***}	0.56^{**}	564
		(0.08)	(0.04)	(0.13)	
Valuation	Stock volatility	0.00	0.01^{***}	0.00^{***}	1,363
		(0.01)	(0.00)	(0.00)	
External	Currency volatility	0.00^{**}	0.00^{*}	0.00	1,419
		(0.00)	(0.00)	(0.00)	
Sovereign	Sovereign CDS	0.22^{*}	0.09^{*}	0.06	1,351
		(0.09)	(0.04)	(0.06)	

Topic-specific indexes incorporate information from measures used to track the vulnerabilities of those sectors.

3. Topics driving FSS

Which topics or sectors drive the time variation of the overall FSS index?

$$FSS_{i,t} = \mu_i + \sum \beta_j FSS^j_{i,t} + \sum \gamma_j Freq^j_{i,t} + e_{i,t}$$

Topic		Topic	
Banking	0.48^{***}	External	0.13^{***}
	(0.04)		(0.02)
Household	0.19^{***}	Real estate	0.08^{**}
	(0.02)		(0.02)
Valuation	0.18^{***}	Sovereign	0.03
	(0.02)		(0.02)
Corporate	0.15^{***}		
	(0.03)		

The banking sector is the main driver of the overall FSS index.

4. FSS and the financial cycle

- Do central banks incorporate and predict developments in the financial cycle through FSRs?
- A lead-lag analysis suggests that FSS and financial cycle variables are endogenously determined.
- We use a panel VAR setting to relate the FSS index with a set of financial cycle characteristics.

4. FSS and the financial cycle

Do central banks incorporate and predict developments in the financial cycle through FSRs?

$$Y_{i,t} = \mu_i + \sum_{l=1}^{L} Y_{i,t-l} A_l + e_{i,t},$$

where

$$Y_{i,t} = \begin{bmatrix} FSS_{i,t} \\ X_{i,t} \end{bmatrix}$$

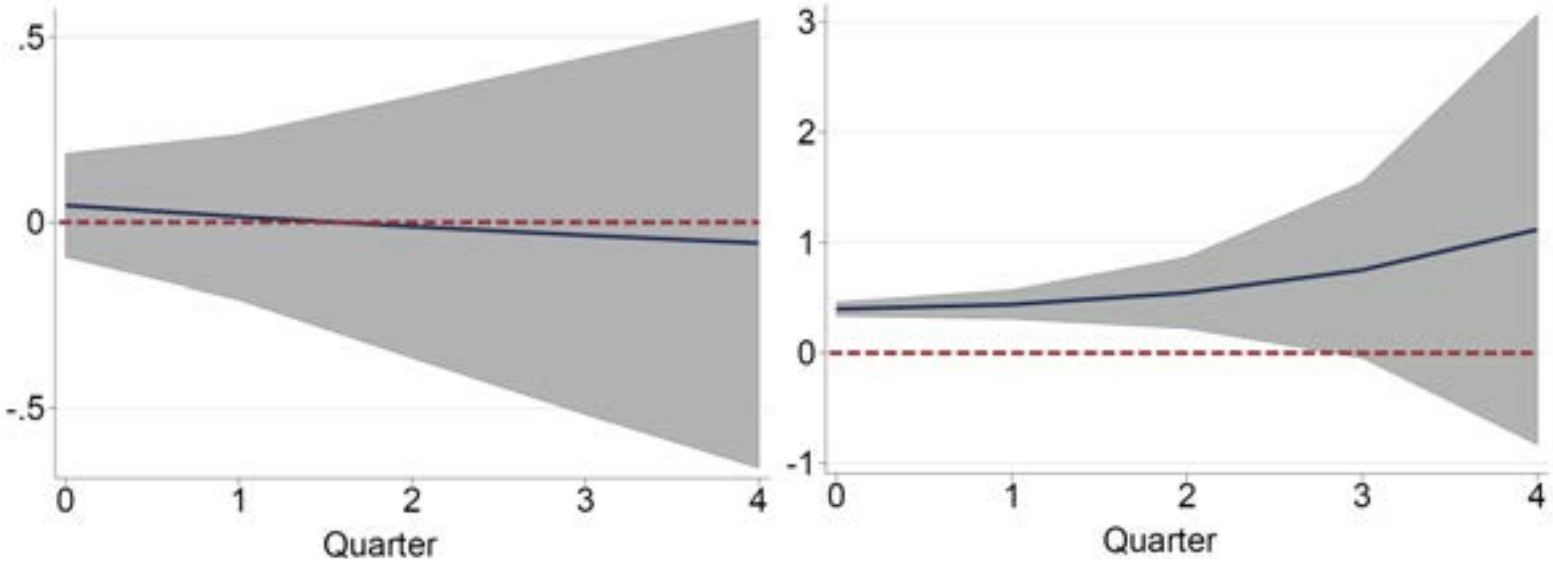
where $X_{i,t}$:

- $\Rightarrow$ Credit growth
- $\Rightarrow$ Asset prices
- $\Rightarrow$ Systemic risk measures

4. FSS and the financial cycle

Do central banks incorporate and predict developments in the financial cycle through FSRs?

Credit Growth



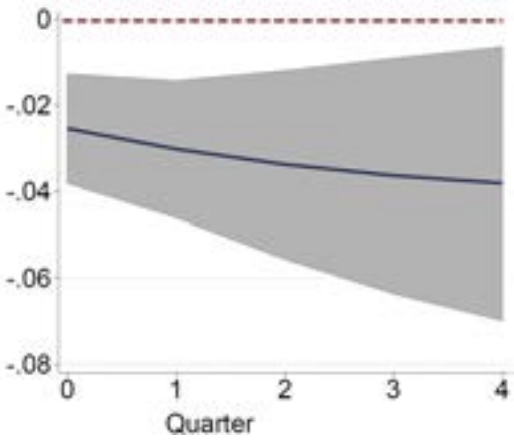
Credit-to-GDP gap

Debt service ratio

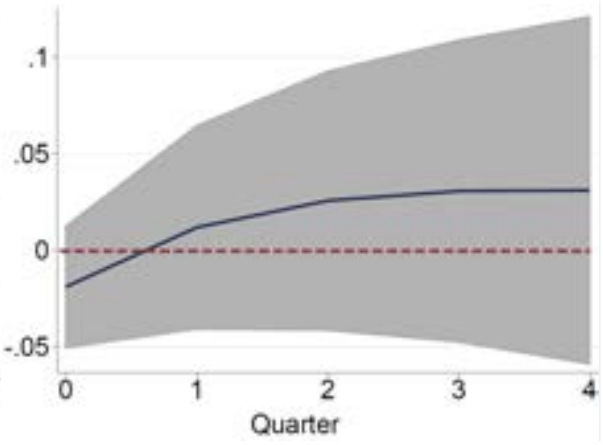
4. FSS and the financial cycle

Do central banks incorporate and predict developments in the financial cycle through FSRs?

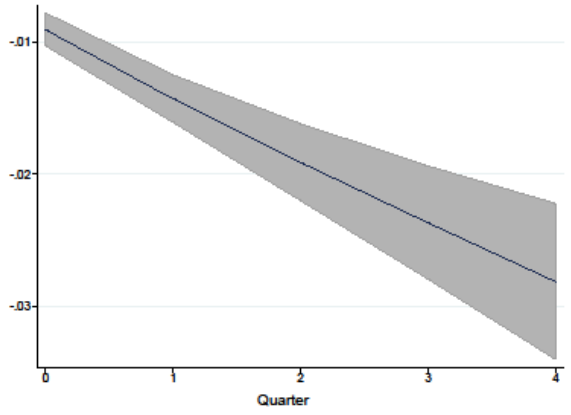
Asset prices



Market-to-book



Dividend yield

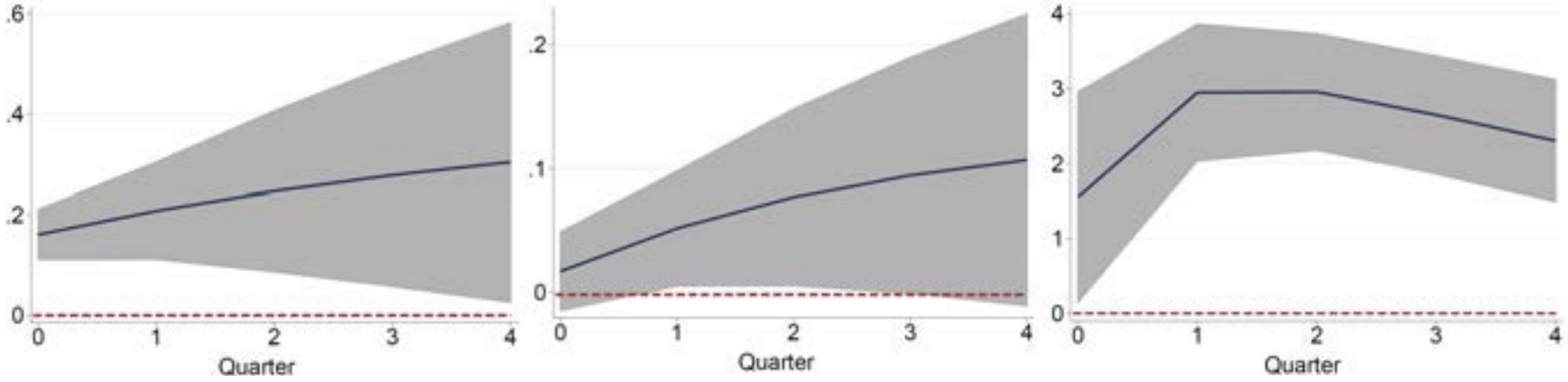


Real property price

4. FSS and the financial cycle

Do central banks incorporate and predict developments in the financial cycle through FSRs?

Systemic risk



SRISK | Bank CDS | Stock volatility

Sentiment captured by the FSS index translates into changes in credit growth, asset prices, and systemic risk indicators.

4. FSS and the financial cycle

Robustness tests

- Controlling for risk aversion (VIX) ($go\longmapsto$)
- Use a FSS index calculated using the Loughran and McDonald dictionary ($go\longmapsto$)
- Country-level standardized indexes (e.g., particularities in language use)
- Longer sample with early adopters

5. FSS and financial crises

- Are central banks able to communicate turning points in the financial cycle?
- We use a panel probit setting to investigate the predictive power of FSS for financial crises.
- We control for the credit-to-GDP gap and the debt service ratio.

5. FSS and financial crises

Are central banks able to communicate turning points in the financial cycle?

$$C_{i,t} = \mu_i + \beta_1 FSS_{i,t-h} + \beta_2 CGDP_{i,t-h} + \beta_3 DSR_{i,t-h} + e_{i,t}$$

h (quarters)	1	2	3	4
FSS	22.04*	19.84	2.97	−11.39
	(9.78)	(10.45)	(11.48)	(10.91)
AUC	0.70	0.67	0.55	0.44
Credit to GDP	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
AUC	0.66	0.65	0.64	0.63
DSR, private nonfinancial	0.02	0.01	0.02	0.02
	(0.02)	(0.01)	(0.01)	(0.02)
AUC	0.67	0.66	0.64	0.62

Sentiment deteriorates just prior to financial crises.

6. Conclusions

- We create a dictionary tailored to the financial stability context and construct a financial stability sentiment (FSS) index.
- We explore the topics driving FSS: FSS topic subindices summarize information from topic-specific characteristics, and the banking sector is the main driver of the FSS index.
- A deterioration in the FSS index is followed by a deterioration in financial cycle indicators: *Although central banks are able to identify and communicate financial stability risks, communications through FSRs alone are not sufficient to alleviate a deterioration in financial vulnerabilities.*
- FSS is a useful predictor of banking crises: *Central banks change the sentiment in their communications prior to crises, although they are not able to prevent them.*

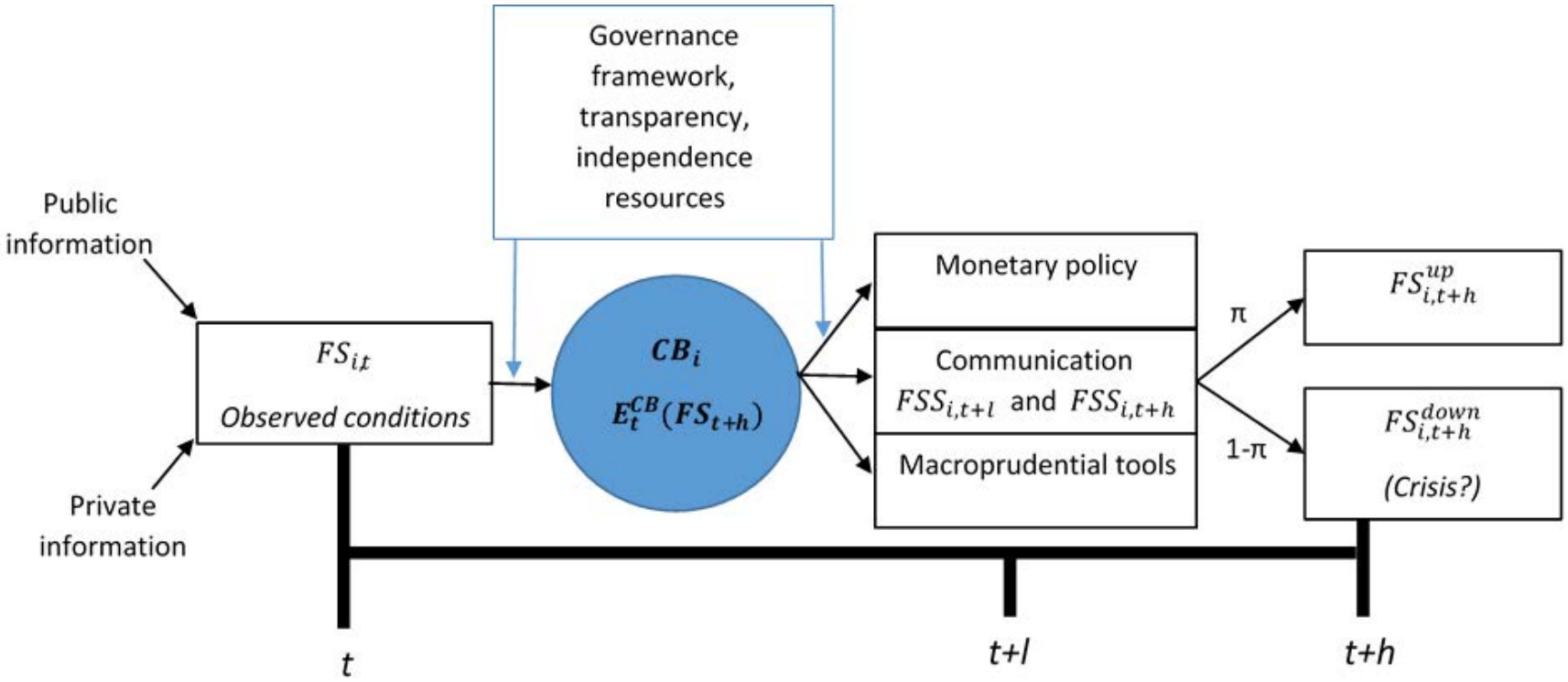
6. Research in progress

FSS's informational content and country-specific governance frameworks

Effectiveness of Communication: Is the wolf gone?
Communication Strategy: How close was the wolf?

6. Research in progress

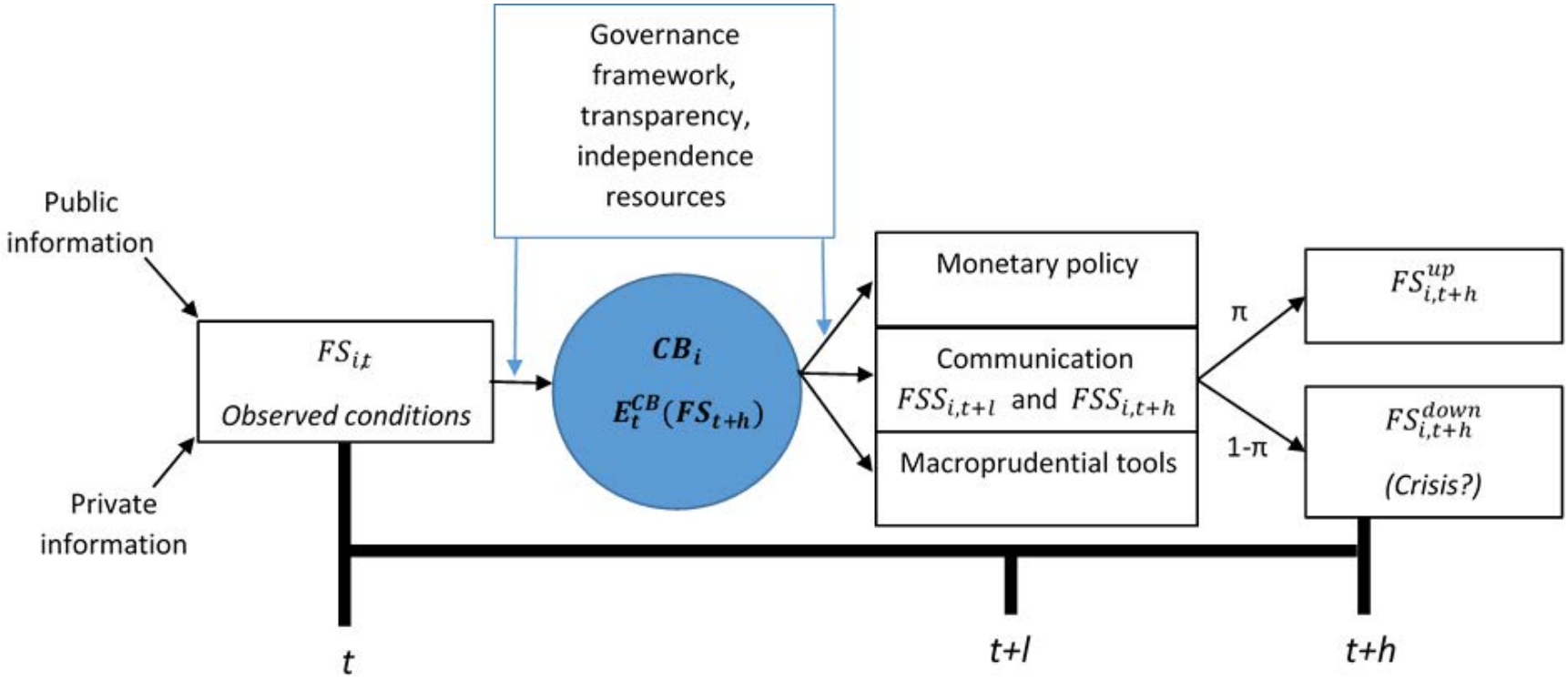
FSS's informational content and country-specific governance frameworks



Period 1: CB in country i observes initial financial conditions, $FS_{i,t}$, and forms expectations about final financial conditions, $E_{i,t}^{CB}(FS_{t+h})$

6. Research in progress

FSS's informational content and country-specific governance frameworks

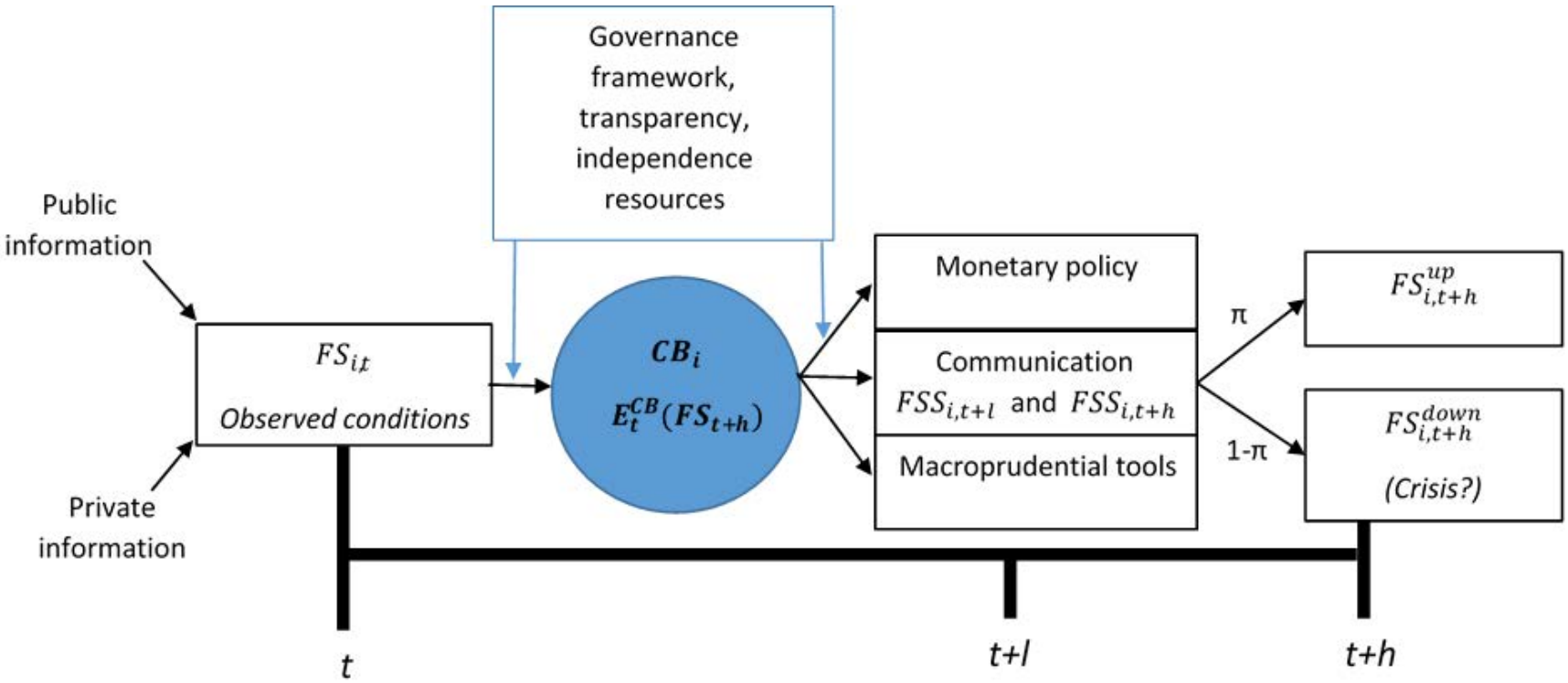


Period 2: CB communicates assessment of financial conditions and their evolution (financial stability sentiment, FSS), $FSS_{i,t+l}$ and $FSS_{i,t+h}$

Communication strategy: $FSS_{i,t+l}$ could differ from $FS_{i,t}$ and/or $FSS_{i,t+h}$ from $E_{i,t}^{CB}(FS_{t+h})$.

6. Research in progress

FSS's informational content and country-specific governance frameworks

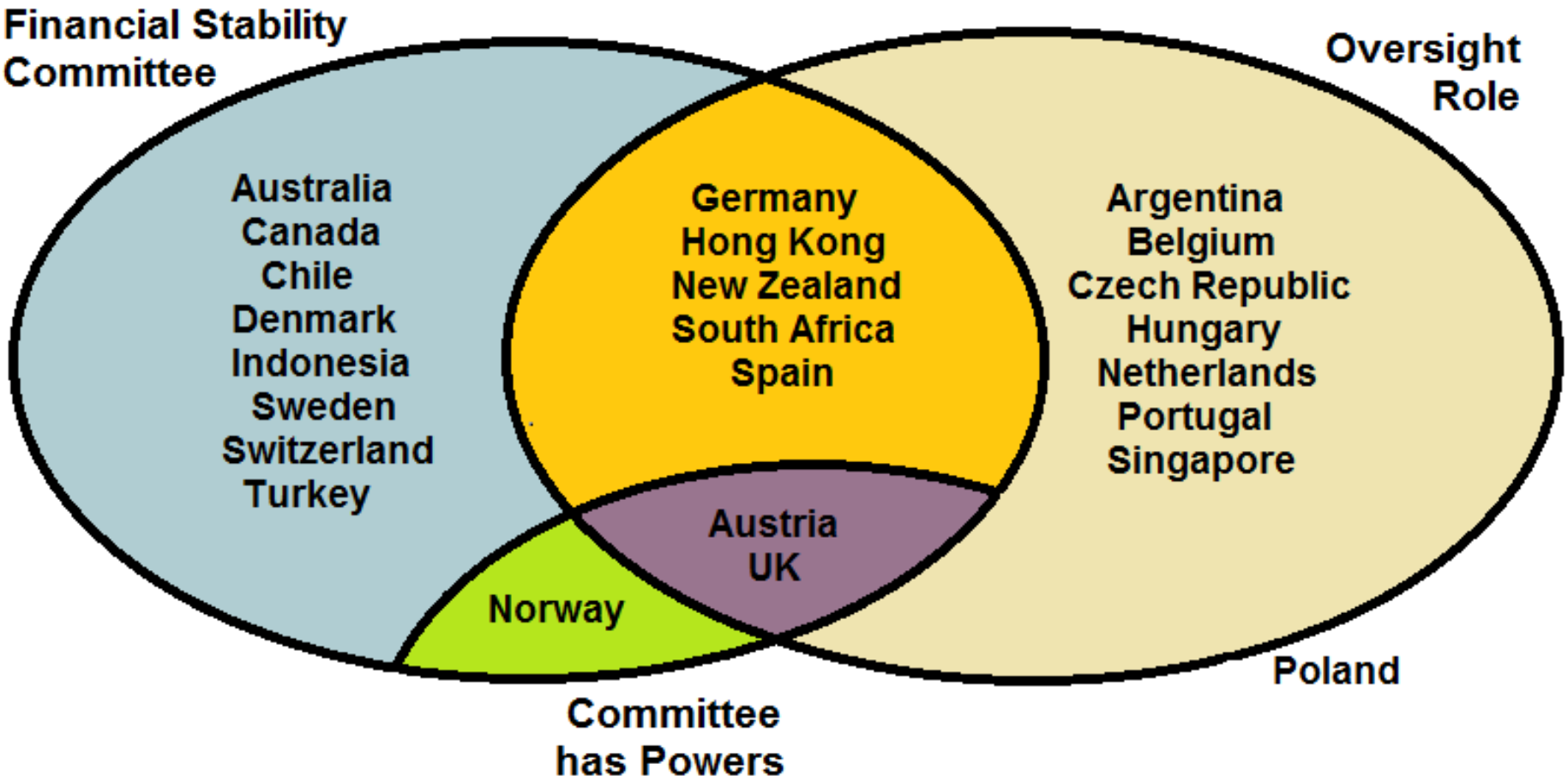


Period 3: Final financial stability conditions depending on $FS_{i,t}$, tools implemented by CB in period 2, including communication, and shocks to financial stability.

Effectiveness of communication: prevent the surge of financial crisis (minimize $1 - \pi$)

6. Research in progress

Governance characteristics (Correa, Edge, Liang, Londono, Mislang)



6. Research in progress

Evolution of the financial cycle

$$CGDPG_{i,t+1y} = \alpha + (\beta_1 + \underbrace{\beta_2 D_{i,t-1}}) FSS_{i,t} + \beta_3 CGDP_{i,t} + \beta_4 C_{i,t} + \epsilon_{i,t+h}$$

	All countries	Committee	Official Committee	Oversight	Official committee and oversight
β_1	0.26	0.80*	0.42*	0.56*	0.36
	(0.16)	(0.30)	(0.19)	(0.21)	(0.18)
β_2		-1.08**	-0.80*	-0.71*	-0.65**
		(0.37)	(0.34)	(0.31)	(0.22)
$\beta_1+\beta_2$		-0.27	-0.39	-0.15	-0.29
		(0.19)	(0.28)	(0.24)	(0.20)
R^2	0.87	0.88	0.87	0.87	0.87
N	916	903	903	903	903

Control variables: transparency, financial openness, foreign bank ownership, bank international claims, and monetary policy rate.

6. Research in progress

Turning points in the financial cycle

$$TP_{i,t+1y} = f(FSS_{i,t}, D_{i,t-1}, C_{i,t})$$

where $TP_{i,t}$ is a turning point (local maximum) in credit-to-GDP gap followed by a decrease over at least the next 4 quarters.

	All Countries	Official Committee		Supervision		Committee and supervision
		Yes	No	Yes	No	Yes
FSS	12.36	-59.87**	18.55**	-1.35	23.65***	-70.16***
	(6.52)	(19.71)	(5.89)	(7.81)	(7.18)	(19.88)

Additional Slides

A financial stability dictionary

"...uncertainty about Greece, to date, has not had an adverse impact on systemic risk levels in Spain which have remained contained and, after peaking around 2009 and after 2012, they have returned to similar levels to their pre-crisis ones."

(Financial stability report, May 2015, Bank of Spain)

"...animals are contained in cages, which could cause a sanitary crisis..."

A financial stability dictionary

"...uncertainty about Greece, to date, has not had an adverse impact on systemic risk levels in Spain which have remained **contained** *and, after peaking around 2009 and after 2012, they have returned to similar levels to their pre-*crisis *ones."*

(Financial stability report, May 2015, Bank of Spain)

"...animals are **contained** *in cages, which could cause a sanitary* crisis*..."*

Central banks' communication and FSRs

- Many central banks recently added a financial stability mandate to their monetary policy mandate (Jeanneau, 2014).
- Financial stability communication became a tool for central banks (Born et al., 2014).
- Most of the literature has focused on monetary policy communications (e.g., Blinder et., 2008; Ericsson, 2016; and Stekler and Symington, 2016).
- Because of the novelty of financial stability communications, most existing research is descriptive (e.g., Cihak et al., 2012; and Cihak, 2006).

Central banks' communication and FSRs

- Central banks' financial stability communications in the literature:

  $\Rightarrow$ Cihak (2006 and 2012) What are FSRs good for.

  $\Rightarrow$ Osterloo et al. (2011) explore the effect of the publication of FSRs on business and financial cycle characteristics.

  $\Rightarrow$ Born et al. (2014) analyze the effects of financial stability communications on stock returns using a general-purpose dictionary.

1. Constructing a dictionary for financial stability

- Scoring process for the remaining 1,484 words:
    1. Randomly sample 25 sentences for each word
    2. Each word classified by two researchers
    3. Solve initial conflicts (disagreement in connotation)
    4. Two additional researchers help to solve additional conflicts

back

1. Constructing a dictionary for financial stability

Examples of negative words in the dictionary

Adversely

- "This decline **adversely** affected firms operational profits."
- "That dampens economic recovery and **adversely** affects debt sustainability."

Instability

- "However, the risks could become a source of **instability** if there is a sharp correction in the property market...."
- "In addition, euro-area financial markets have been resilient to the political and fiscal **instability** in Italy, Greece, Portugal and Spain."

1. Constructing a dictionary for financial stability

Examples of positive words in the dictionary

Favorable

- "Domestic banks thus appear to have maintained **favorable** liquidity conditions."
- "The increase of syndication credits continues with more **favorable** conditions and terms during the last quarter of 2010."

Stable

- "While the US dollar was volatile against other major currencies, it remained broadly **stable** against the currencies of other important trading partners, including the Mainland."
- "US growth remained broadly **stable** in 2006 at 3.3%, while growth in the euro area accelerated to 2.7% (up from 1.4% in 2005)."

1. Constructing a dictionary for financial stability

Examples of words in the dictionary

Positive words		Negative words	
able	improving	abnormally	destabilizing
absorb	improve	abrupt	deteriorate
better	mitigate	bad	disrupted
brighter	rebound	burdened	escalated
broaden	succesfully	challenge	exacerbate
healthy	smooth	deficits	excessive
effective	sound	mipricing	unrest
enjoy	stabilize	overheated	volatile
excellent	upgraded	pessimism	weaken

back

3. Topics driving FSS

Topic subindexes

Topic	Words associated
Banking	Bank, financial/depository institution, financial service, lending standard, nonperforming loan/exposure (NPL and NPE)
Valuation	Financial/capital/commodity market, equity/bond/stock return, risky/riskier/financial asset, debt spread, corporate bond
Household	Credit card, personal/private/auto/vehicle loan, private consumption, consumer credit, auto/vehicle debt
Real estate	Real estate, residential, property/house price, housing, home purchase, mortgage, property market
Corporate	Firm, SME, nonfinancial company/business/private/corporation, corporate sector
External	Current account, external debt/imbalance, balance of payments, foreign currency, exports, emerging markets, international,
Sovereign	Government debt, fiscal, fiscal debt/balance

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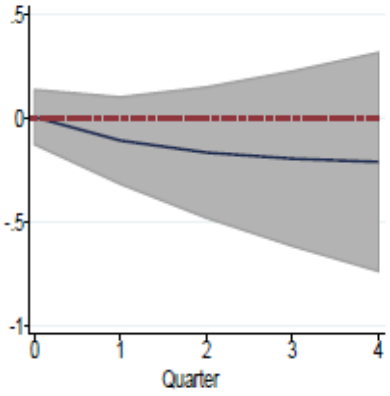
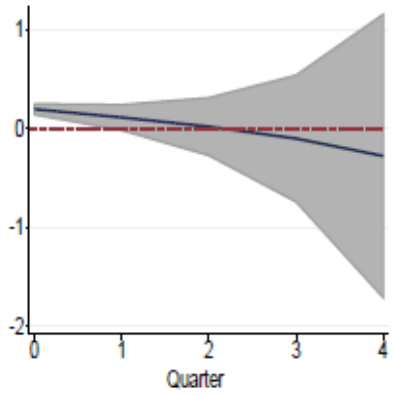
4. FSS and the financial cycle

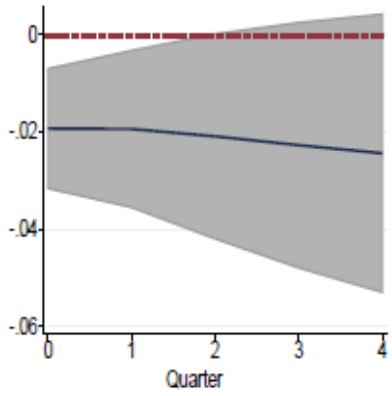
Robustness tests - Adding VIX



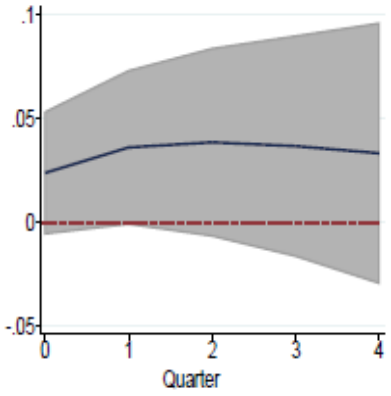
(a) Credit to GDP gap



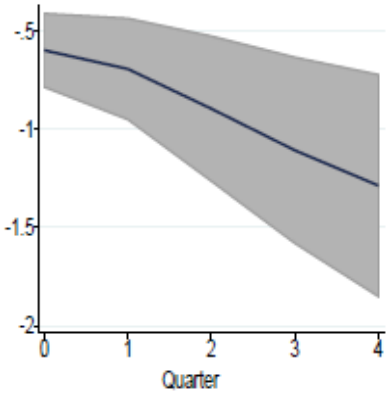
(b) Debt service ratio



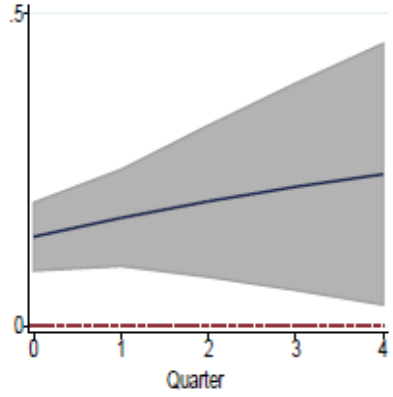
(c) Market-to-book ratio



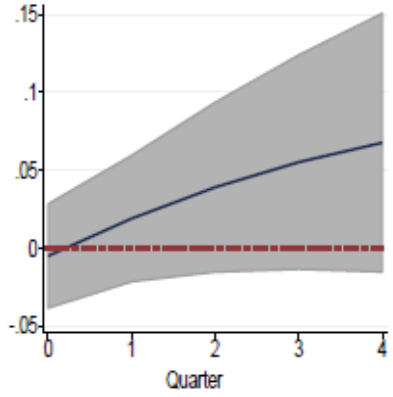
(d) Dividend yield



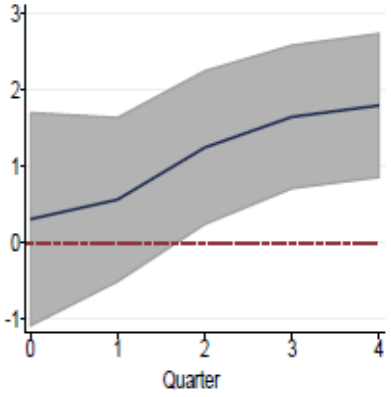
(e) Real property price



(f) SRISK-to-GDP



(g) Bank CDS



(h) Stock volatility

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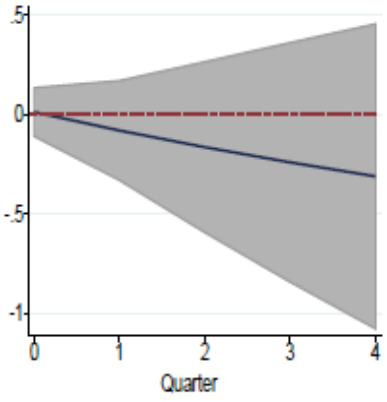
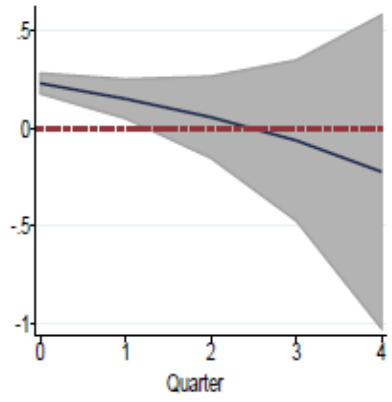
4. FSS and the financial cycle

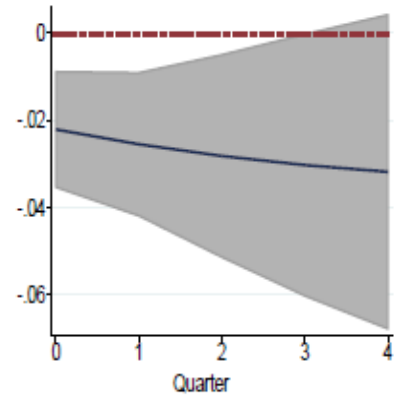
Robustness tests - LM dictionary



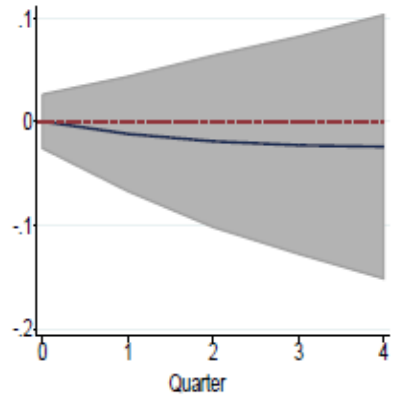
(a) Credit to GDP gap



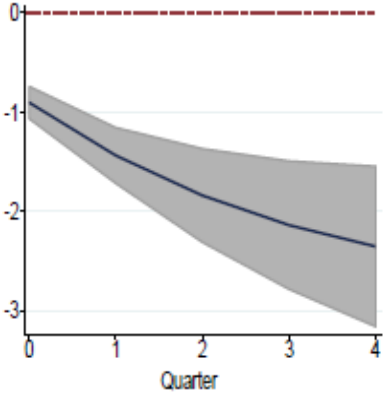
(b) Debt service ratio



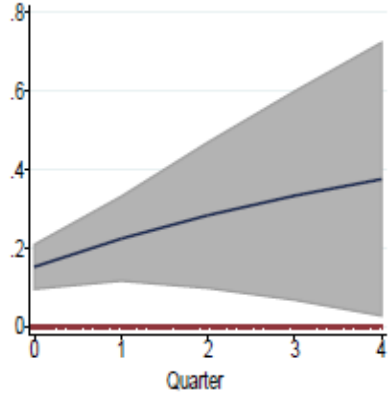
(c) Market-to-book ratio



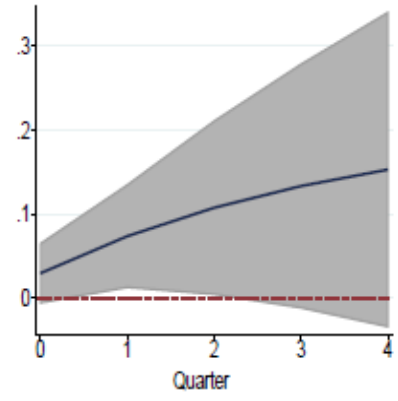
(d) Dividend yield



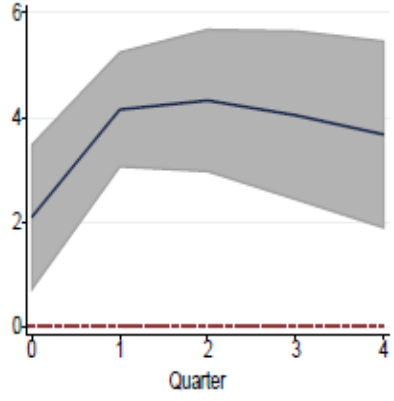
(e) Real property price



(f) SRISK-to-GDP



(g) Bank CDS



(h) Stock volatility

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