Credit Supply and Demand in Unconventional Times

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The opinions in this presentation are those of the authors and do not necessarily reflect the views of the European Central Bank and the Eurosystem.

Research questions

- ✓ Do individual bank supply and demand both determine credit?
- ✓ Do borrowers demand less credit from weak banks?
- ✓ How have monetary policy measures impacted loan growth, after controlling for bank specific demand?

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Contributions to the literature: Using bank lending surveys

- **Establishing determinants of credit using bank lending surveys**

  - US: Lown, Morgan, and Rohatgi (2000), Lown and Morgan (2006), Bassett, Chosak, Driscoll, and Zakrajek (2014)

  - European countries: Blaes (2011), Del Giovane, Eramo, Nobili (2011), Pintarić (2015)
    Euro area: Ciccarelli, Maddaloni, Peydró (2013), Ciccarelli, Maddaloni, Peydró (2015), Altavilla, Darracq Paries and Nicoletti (2015)

Contributions to the literature: Identifying credit supply from demand

- **Identifying changes in credit supply from demand**
  - **Macro:** Bernanke and Blinder (1992), **Bank level:** Kashyap and Stein (2000) Kishan and Opiela (2000); Greenstone, Mas and Nguyen (2014), **Loan level:** Khwaja and Mian (AER 2008), **Incl. loan applications:** Jiménez, Ongena, Peydró and Saurina (2012)

- **Identification strategies rely on credit demand being <u>firm-specific</u>**
  - **Caveats:**
    - Evidence that demand is homogenous within **location-sector "clusters"**: e.g., Degryse, De Jonghe, Jakovljević, Mulier and Schepens (2017), Auer and Ongena (2017), De Jonghe, Dewachter, Mulier, Ongena and Schepens (2017)
    - Demand may be **firm-bank-specific** (at times and in places) Paravisini, Rappoport and Schnabl (2015)

- **Credit demand may depend on bank resilience**
  - Firms may want to align themselves with stronger banks in order to signal their quality (Billett, Flannery and Garfinkel (1995))
  - Banks with stronger balance sheets are capable of maintaining loan growth when faced with a shock (Kishan and Opiela (2000), Kashyap and Stein (2000), Gambacorta and Mistrulli (2004))
  - Switching banks is costly (Sharpe (1990) and Rajan (1992))

Contributions to the literature: Non-standard monetary policy

- **Effects of non-standard monetary policy measures on credit**

  - E.g., Joyce and Spaltro (2014), Bowman, Cai, Davies and Kamin (2015), Altavilla, Canova, Ciccarelli (2016), Rodnyansky and Darmouni (2017), Temesvary, Ongena and Owen (2018)

Preview of the results

- ✓ Both individual bank supply as well as demand are a significant determinant of credit developments

- ✓ The strength of the credit supply channel may be time-varying, i.e., stronger during the crisis
  - ❑ Both in absolute terms and relative to the importance of credit demand

- ✓ Bank characteristics affect not only individual bank supply changes but also demand changes
  - ❑ Implying that credit demand may at times be bank-specific

- ✓ Banks more exposed to non-standard measures increase credit granted

Data and Stylised facts

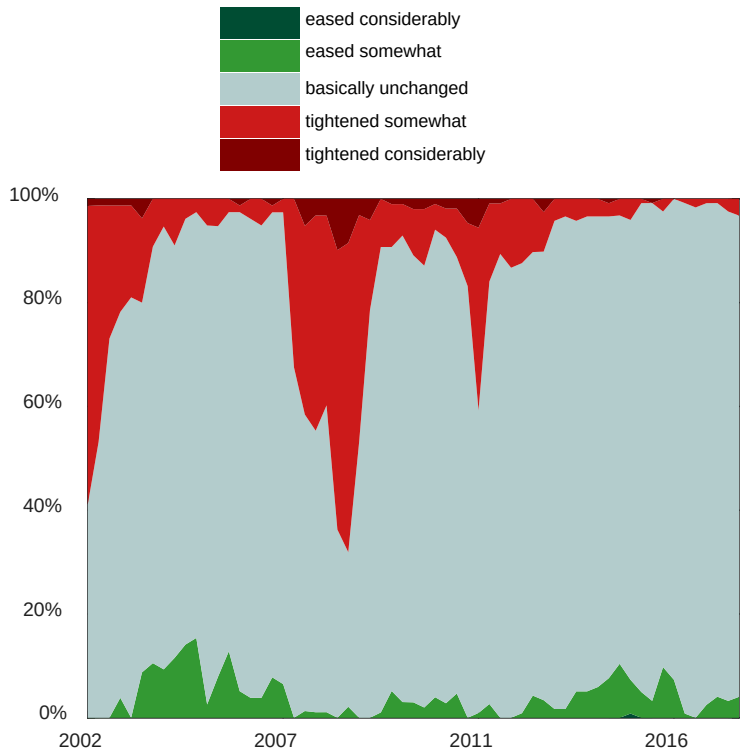
- **Data**
  - **Individual Bank Lending Survey responses (iBLS)**
    - ✓ Granular - information on 116 BLS banks from 13 countries
    - ✓ Representative - includes over 50% of total loans to enterprises
    - ✓ Time-series - quarterly data from 2002Q4-2017Q4
    - ✓ Qualitative – five point scale

Novelty: Linking individual banks' survey information to their loan developments and balance sheet characteristics

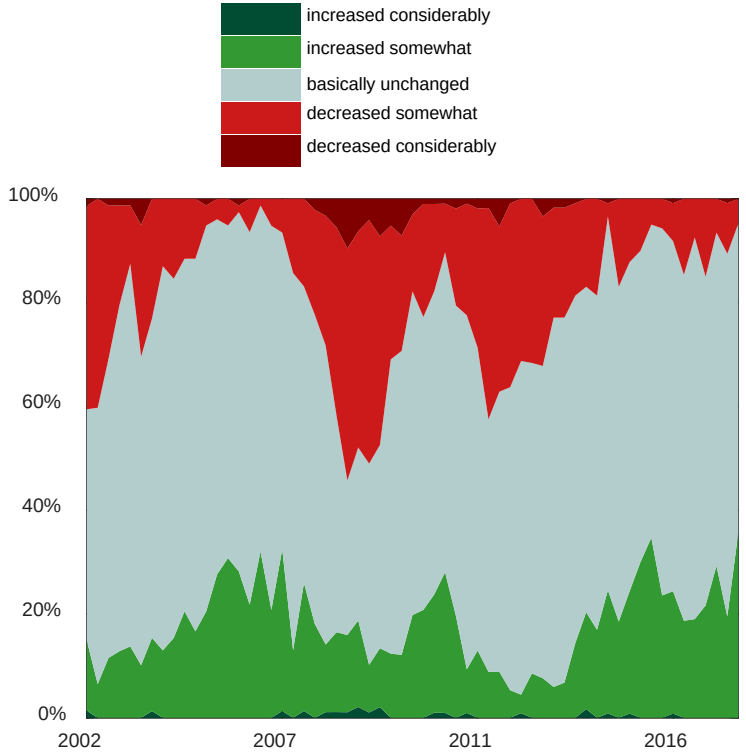
  - **Individual Balance sheet information (iBSI)**
    - ✓ Monetary financial institutions (MFIs) – 134 linked to the BLS banks
    - ✓ Data from mid-2007
  - **Bank-level data on liquidity operations with the Central Bank**
  - **Financial market data**

Data and Stylised facts

Credit supply
(percentage of bank responses)

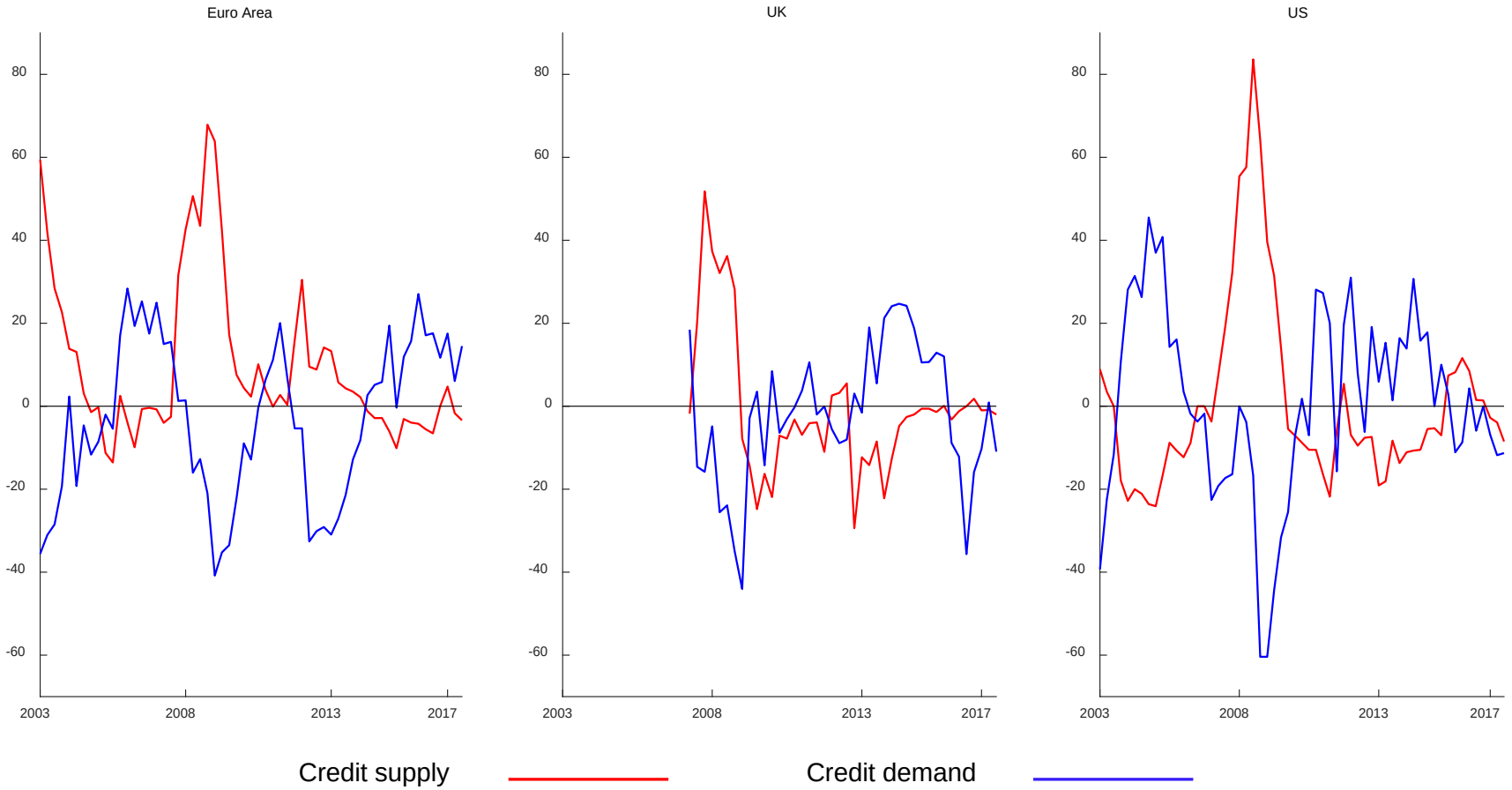


Credit demand
(percentage of bank responses)



Notes: iBLS bank responses, ESCB

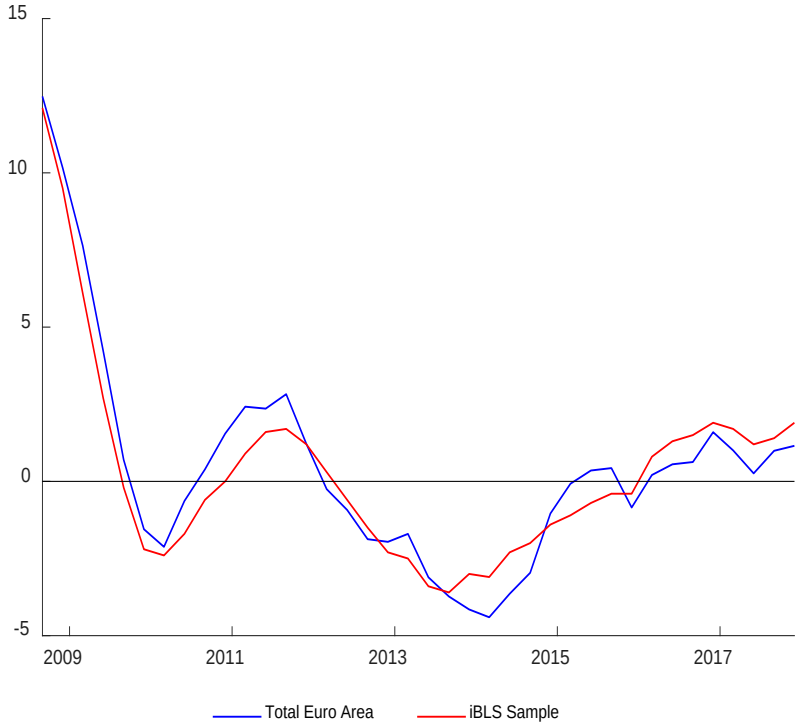
Credit conditions across regions



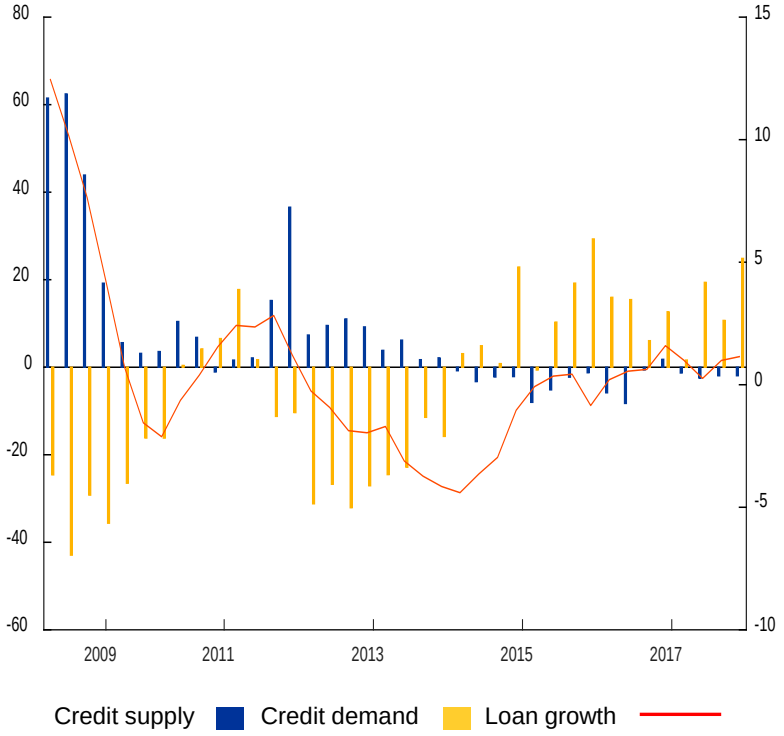
Notes: Source: Eurosystem BLS, Bank of England Credit Conditions Survey, Federal Reserve System Senior Loan Officer Opinion Survey on Bank Lending Practices

Data and Stylised facts

Loans to euro area NFCs
(annual growth rates)



Loans to NFCs, credit standards and demand
(net percentages, annual growth rates)



Credit developments, BLS supply and demand

- ✓ Do individual bank supply and demand both determine credit?

$$\Delta Loans_{b,c,t} = \alpha_b + \delta_{c,t} + \sum_{n=1}^{4} \beta_n \Delta Loans_{b,c,t-n} + \gamma_1 \Delta Credit\ Supply_{b,c,t} + \gamma_2 \Delta Credit\ Demand_{b,c,t} + \epsilon_{b,c,t}$$

$\Delta Loans_{b,c,t}$ = QoQ loan growth

b = bank, c = country, t = time

Credit developments, BLS supply and demand

$$\Delta Loans_{b,c,t} = \sum_{n=1}^{4} \beta_n \Delta Loans_{b,c,t-n} + \gamma_1 \Delta Credit\ Supply_{b,c,t} + \gamma_2 \Delta Credit\ Demand_{b,c,t} + \epsilon_{b,c,t}$$

Dependent variable:	$\Delta Loans_{b,c,t}$
ΔCredit supplyb,c,t	0.566***
ΔCredit demandb,c,t	0.464***
Bank fixed effects	No
Country-time fixed effects	No
Number of observations	3308
Number of banks	107
R^2	0.153

The dependent variable is the quarterly bank level growth rate of loans to non-financial corporations during the period 2007Q2-2017Q4. Coefficients are listed in the first row, robust standard errors that are corrected for clustering at the bank level are reported in brackets, and the corresponding significance levels are indicated with stars. "Yes" indicates that the set of characteristics or fixed effects is included. "No" indicates that the set of characteristics or fixed effects is not included. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Credit developments, BLS supply and demand

$$\Delta Loans_{b,c,t} = \sum_{n=1}^{4} \beta_n \Delta Loans_{b,c,t-n} + \gamma_1 \Delta Credit\ Supply_{b,c,t} + \gamma_2 \Delta Credit\ Demand_{b,c,t} + \epsilon_{b,c,t}$$

Dependent variable:	$\Delta Loans_{b,c,t}$	$\Delta Loans_{b,c,t}$
ΔCredit supplyb,c,t	0.566***	0.305***
ΔCredit demandb,c,t	0.464***	0.453***
Bank fixed effects	No	Yes
Country-time fixed effects	No	No
Number of observations	3308	3308
Number of banks	107	107
R^2	0.153	0.201

The dependent variable is the quarterly bank level growth rate of loans to non-financial corporations during the period 2007Q2-2017Q4. Coefficients are listed in the first row, robust standard errors that are corrected for clustering at the bank level are reported in brackets, and the corresponding significance levels are indicated with stars. "Yes" indicates that the set of characteristics or fixed effects is included. "No" indicates that the set of characteristics or fixed effects is not included. *** Significant at 1%, ** significant at 5%, * significant at 10%.

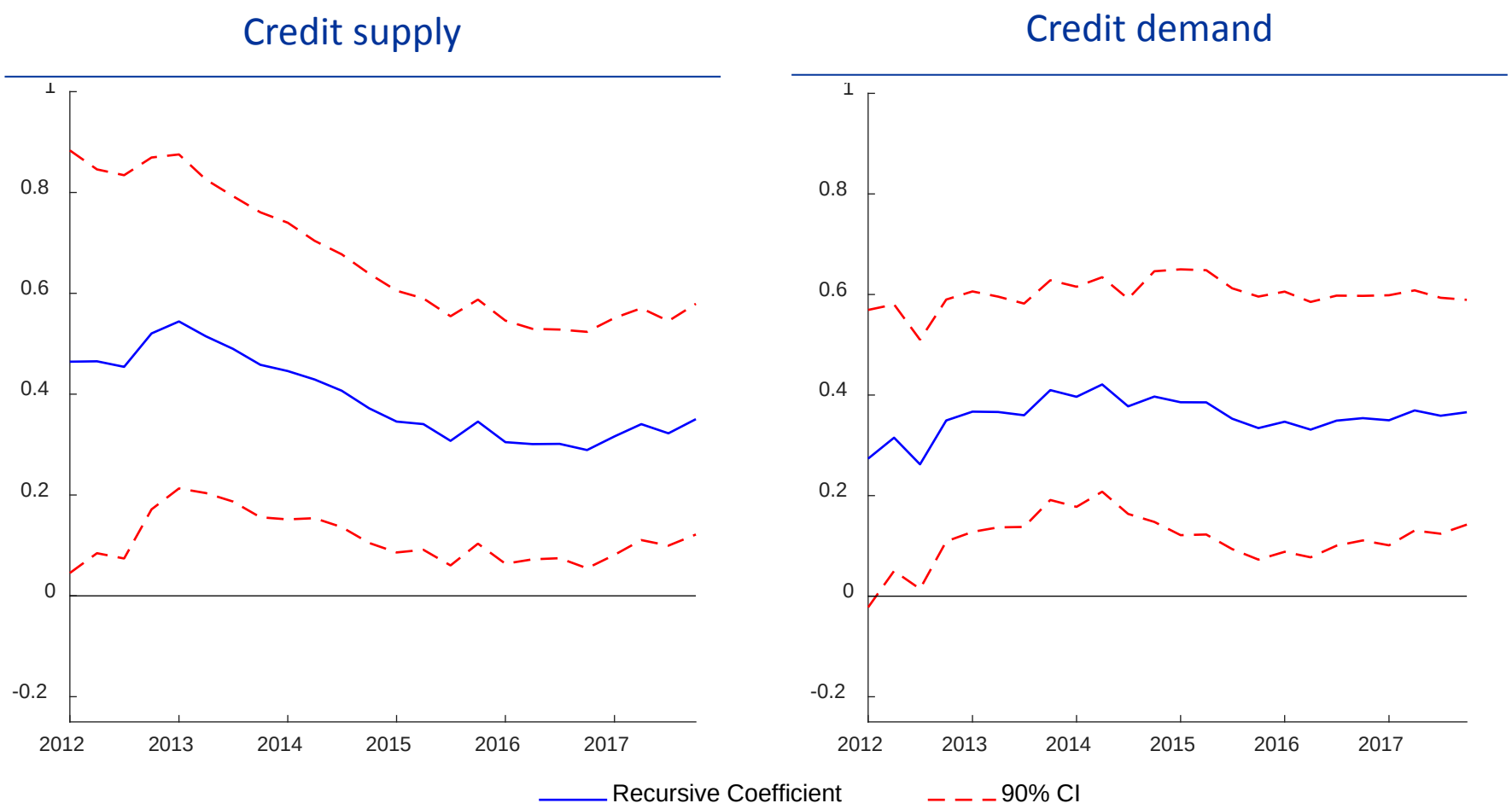
Credit developments, BLS supply and demand

$$\Delta Loans_{b,c,t} = \sum_{n=1}^{4} \beta_n \Delta Loans_{b,c,t-n} + \gamma_1 \Delta Credit\ Supply_{b,c,t} + \gamma_2 \Delta Credit\ Demand_{b,c,t} + \epsilon_{b,c,t}$$

Dependent variable:	$\Delta Loans_{b,c,t}$	$\Delta Loans_{b,c,t}$	$\Delta Loans_{b,c,t}$
ΔCredit supplyb,c,t	0.566***	0.305***	0.350**
ΔCredit demandb,c,t	0.464***	0.453***	0.366***
Bank fixed effects	No	Yes	Yes
Country-time fixed effects	No	No	Yes
Number of observations	3308	3308	3308
Number of banks	107	107	107
R^2	0.153	0.201	0.360

The dependent variable is the quarterly bank level growth rate of loans to non-financial corporations during the period 2007Q2-2017Q4. Coefficients are listed in the first row, robust standard errors that are corrected for clustering at the bank level are reported in brackets, and the corresponding significance levels are indicated with stars. "Yes" indicates that the set of characteristics or fixed effects is included. "No" indicates that the set of characteristics or fixed effects is not included. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Data and Stylised facts



Notes: The figure displays the recursive estimates of the coefficients, with one and two standard deviation bands, on ΔLoan supply and ΔLoan demand for windows starting in 2007Q3 and ending in the year and quarter indicated on the x-axis. The dependent variable is the quarterly bank level growth rate of loans to non-financial corporations.

Balance sheet strength, credit demand and supply

✓ Do borrowers demand less credit from weak banks?

$$\Delta BLS_{b,c,t} = \alpha_b + \delta_{c,t} + \sum_{n=1}^{4} \beta_n \Delta BLS_{b,c,t-n} + \omega\, Shock_t + \psi\, X_{b,c,t-1} + \phi(Shock_t \times X_{b,c,t-1}) + \theta Borrower\ risk_{b,c,t} + \epsilon_{b,c,t}$$

BLS = Credit Supply (CS), Credit Demand (CD)

Shock = change in 3-month Euribor

$X_{b,c,t-1}$= bank specific measure of risk (CDS)

Balance sheet strength, credit demand and supply

$$\Delta CS_{b,c,t} = \alpha_b + \delta_{c,t} + \sum_{n=1}^{4} \beta_n \Delta CS_{b,c,t-n} + \omega\, Shock_t + \psi\, X_{b,c,t-1} + \phi\,(Shock_t \times X_{b,c,t-1}) + \theta Borrower\ risk_{b,c,t} + \epsilon_{b,c,t}$$

Dependent variable:	ΔCredit supply$_{b,c,t}$	
$\Delta CDS_{b,c,t-1}$	-0.000554**	-0.000499***
$\Delta Euribor_{t-1}$ x $\Delta CDS_{b,c,t-1}$	-0.000960*	-0.000847**
Borrower risk$_{b,c,t}$		-0.331***
Bank fixed effects	Yes	Yes
Country-time fixed effects	Yes	Yes
Number of observations	2662	2659
Number of banks	90	90
R^2	0.554	0.616

Notes: The dependent variables are the bank reported changes in Credit supply and Credit demand during the period 2007Q2-2017Q4. Coefficients are listed in the first row, robust standard errors that are corrected for clustering at the bank level are reported in the row below, and the corresponding significance levels are indicated with stars. "Yes" indicates that the set of characteristics or fixed effects is included. "No" indicates that the set of characteristics or fixed effects is not included. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Balance sheet strength, credit demand and supply

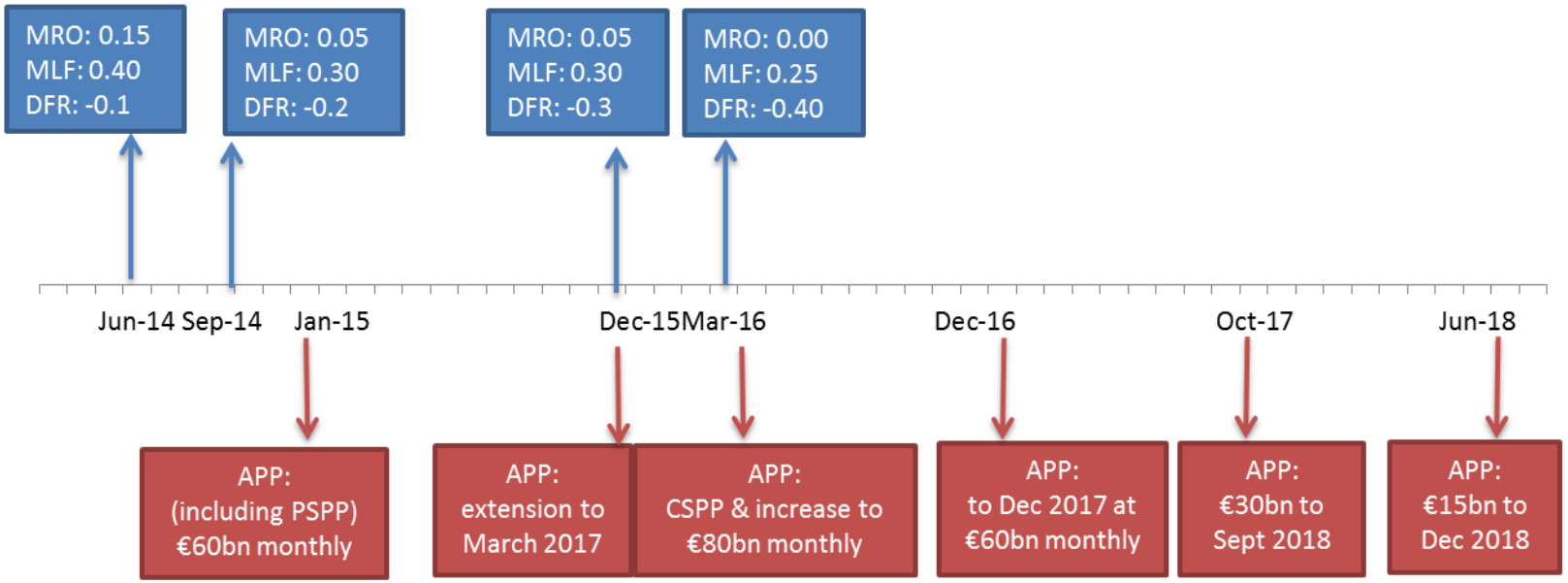
$$\Delta CD_{b,c,t} = \alpha_b + \delta_{c,t} + \sum_{n=1}^{4} \beta_n \Delta CD_{b,c,t-n} + \omega\, Shock_t + \psi\, X_{b,c,t-1} + \phi\, (Shock_t \times X_{b,c,t-1}) + \theta Borrower\ risk_{b,c,t} + \epsilon_{b,c,t}$$

Dependent variable:	ΔCredit supply$_{b,c,t}$		ΔCredit demand$_{b,c,t}$	
$\Delta CDS_{b,c,t-1}$	-0.000554**	-0.000499***	-0.000782***	-0.000757***
$\Delta Euribor_{t-1}$ x $\Delta CDS_{b,c,t-1}$	-0.000960*	-0.000847**	-0.00147***	-0.00142**
Borrower risk$_{b,c,t}$		-0.331***		-0.199***
Bank fixed effects	Yes	Yes	Yes	Yes
Country-time fixed effects	Yes	Yes	Yes	Yes
Number of observations	2662	2659	2642	2639
Number of banks	90	90	90	90
R^2	0.554	0.616	0.499	0.509

Notes: The dependent variables are the bank reported changes in Credit supply and Credit demand during the period 2007Q2-2017Q4. Coefficients are listed in the first row, robust standard errors that are corrected for clustering at the bank level are reported in the row below, and the corresponding significance levels are indicated with stars. "Yes" indicates that the set of characteristics or fixed effects is included. "No" indicates that the set of characteristics or fixed effects is not included. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Overview of relevant unconventional measures

- ✓ How have monetary policy measures impacted loan growth, after controlling for credit demand?
  - Negative deposit facility rate (DFR)
  - Asset purchase programme (APP)



Effect of unconventional measures on lending

✓ How have monetary policy measures impacted loan growth, after controlling for credit demand?

- **Negative deposit facility rate (DFR)**
  - Channels of transmission:
    - Reduces funding costs
    - Increases opportunity cost of holding liquidity and incentivises lending
    - **Treatment**: banks reporting bigger impact on net interest income (NII)
      - Banks with more excess liquidity

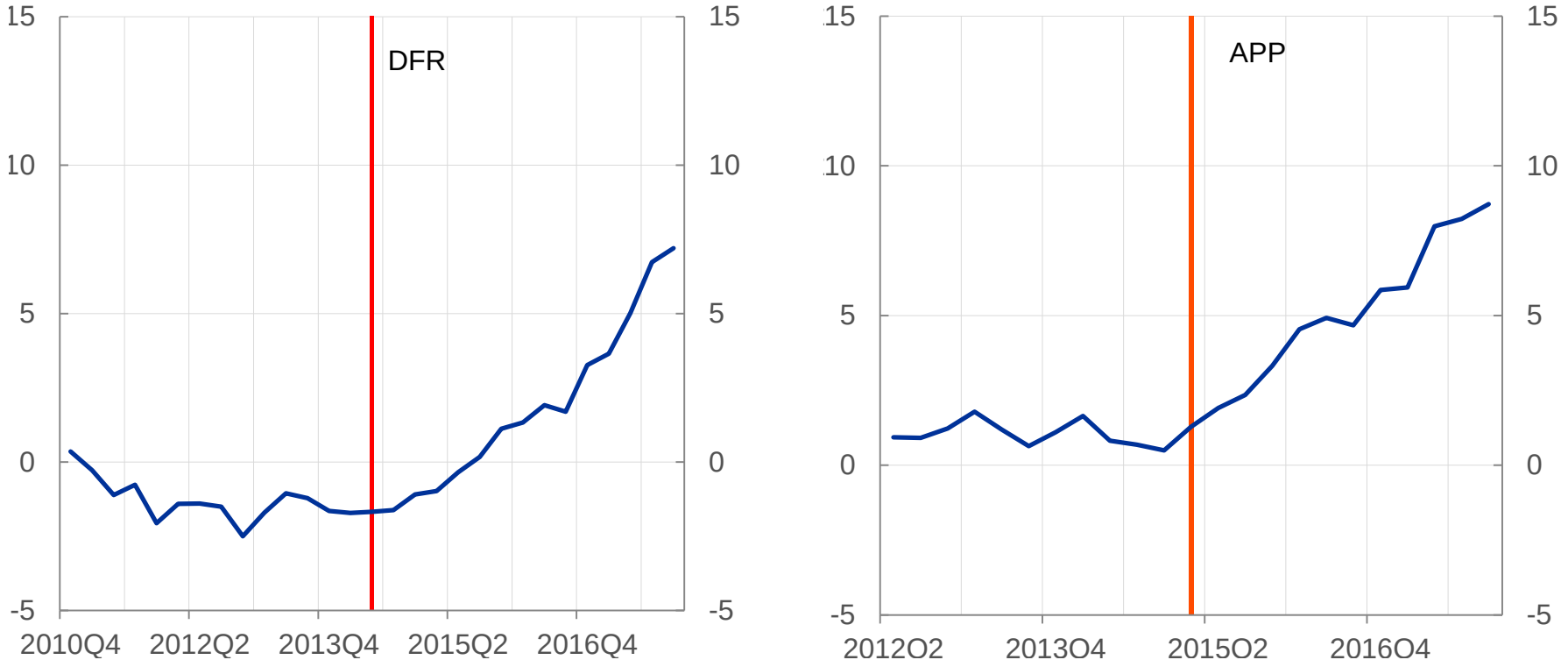
- **Asset purchase programme (APP)**
  - Channels of transmission:
    - Improves liquidity conditions
    - Eases leverage constraints
    - Induces portfolio rebalancing
    - **Treatment**: banks reporting high liquidity inflows
      - Banks with more sovereign bonds

Effect of unconventional measures on lending

✓ How have monetary policy measures impacted loan growth, after controlling for credit demand?

Difference in NFC loan growth between more and less exposed to the policies

(cumulated differences in quarterly growth rates)



Notes: The figures display the cumulated differences in quarterly growth rates between banks in the treatment and control groups for the APP (LHS) and DFR (RHS). For the APP, treated banks are those who on average reported that the APP impact on their liquidity position was more positive. For the DFR, treated banks are those who on average reported that the impact of the negative interest rate policy on their net interest margin was stronger.

Effect of unconventional measures on lending

✓ How have monetary policy measures impacted loan growth, taking into account supply and demand?

$$\Delta Loans_{b,c,t} = \alpha_b + \delta_{c,t} + \sum_{n=1}^{4} \beta_n \Delta Loans_{b,c,t-n} + \beta_1 (Treated_{b,c} \times Post_t)$$
$$\beta_3 Treated_{b,c} + \beta_2 Post_t + \beta_4 \Delta Credit\ Demand_{b,c,t}$$
$$\beta_5 Borrower\ risk_{b,c,t} + \gamma X_{b,c,t-1} + \epsilon_{b,c,t}$$

$Treated_{b,c}$

DFR: banks that reported strong impact on their net interest income (NII) in the BLS

APP: banks that reported strong liquidity inflows in the BLS

DFR and APP: banks that were affected by both

$Post_t$

DFR: dummy equal to one from 2014Q3 onwards

APP: dummy equal to one from 2015Q1 onwards

$X_{b,c,t-1}$

Leverage, size, liquidity, TLTRO borrowings

APP and DFR have stimulated lending activities

- ✓ How have monetary policy measures impacted loan growth, taking into account supply and demand?

Dependent variable: QoQ enterprise loan growth at individual banks

Policy measure:	DFR	APP	DFR and APP
$(Treated_{b,c}) \times (Post_t)$	0.567***	0.561**	1.088***
$Post_t$	0.0103	0.347*	-0.00417
$Treated_{b,c,t}$	-0.152	-0.130	-0.303
Bank controls	Yes	Yes	Yes
Lagged dependent variables	Yes	Yes	Yes
Bank fixed effects	No	No	No
Country-time fixed effects	No	No	No
Number of observations	3304	3196	1553
Number of banks	106	103	49
R^2	0.165	0.165	0.162

APP and DFR have stimulated lending activities

- ✓ How have monetary policy measures impacted loan growth, taking into account supply and demand?

Dependent variable: QoQ enterprise loan growth at individual banks

Policy measure:	DFR		APP		DFR and APP	
$(Treated_{b,c}) \times (Post_t)$	0.567***	0.601**	0.561**	0.709**	1.088***	1.267***
$Post_t$	0.0103	0.0563	0.347*	0.440**	-0.00417	0.158
$Treated_{b,c,t}$	-0.152		-0.130		-0.303	
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Lagged dependent variables	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	No	Yes	No	Yes	No	Yes
Country-time fixed effects	No	No	No	No	No	No
Number of observations	3304	3304	3196	3196	1553	1553
Number of banks	106	106	103	103	49	49
R^2	0.165	0.211	0.165	0.214	0.162	0.213

APP and DFR have stimulated lending activities

- ✓ How have monetary policy measures impacted loan growth, taking into account supply and demand?

Dependent variable: QoQ enterprise loan growth at individual banks

Policy measure:	DFR			APP			DFR and APP		
$(Treated_{b,c}) \times (Post_t)$	0.567***	0.601**	0.865***	0.561**	0.709**	0.494*	1.088***	1.267***	1.092**
$Post_t$	0.0103	0.0563		0.347*	0.440**		-0.00417	0.158	
$Treated_{b,c,t}$	-0.152			-0.130			-0.303		
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged dependent variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Country-time fixed effects	No	No	Yes	No	No	Yes	No	No	Yes
Number of observations	3304	3304	3304	3196	3196	3196	1553	1553	1553
Number of banks	106	106	106	103	103	103	49	49	49
R^2	0.165	0.211	0.368	0.165	0.214	0.367	0.162	0.213	0.385

Cross checking the treatment

- ✓ How have monetary policy measures impacted loan growth, after controlling for credit demand?

  - ❑ **Negative deposit facility rate (DFR)**
    - **Treatment**: banks reporting bigger impact on net interest income (NII)

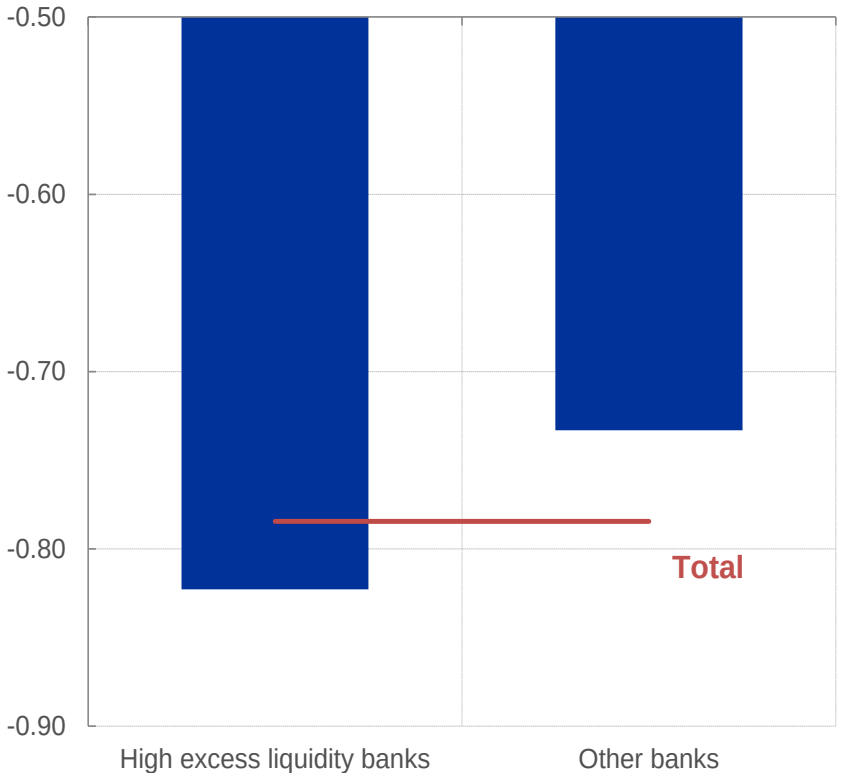
Banks with more excess liquidity

  - ❑ **Asset purchase programme (APP)**
    - **Treatment**: banks reporting high liquidity inflows

Banks with more sovereign bonds

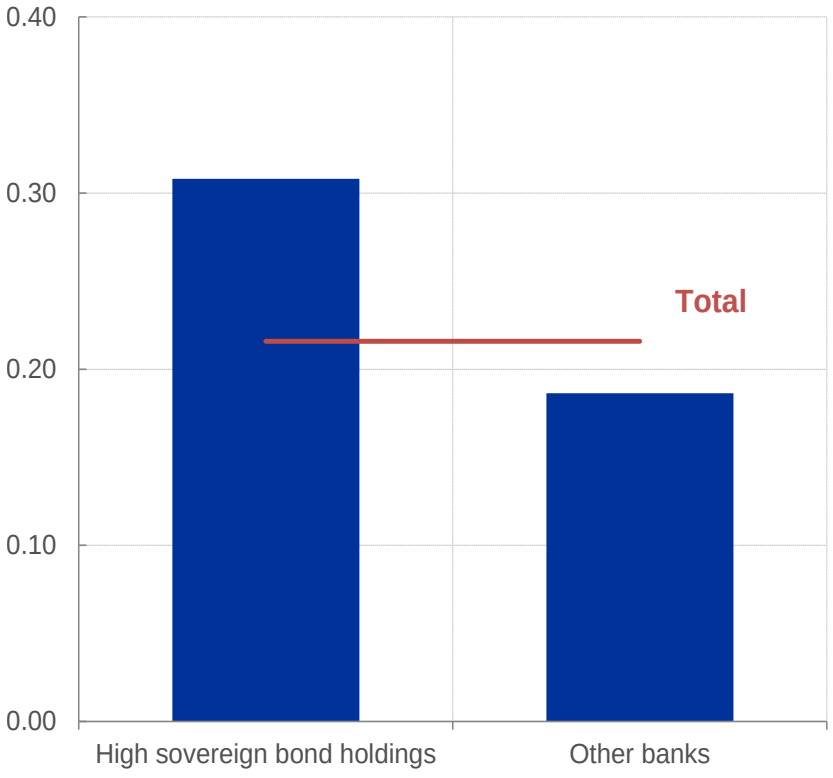
Cross checking the treatment

Effect of negative DFR on NII across banks *(net percentages)*



Source: ECB. Net percentages are the percentage reporting a positive impact minus the percentage reporting a negative impact. High deposit banks are those that are in the 75th percentile in terms of their household deposits to main assets. Other banks are the remainder.
Latest observation: April 2018.

Effect of APP on liquidity across banks *(net percentages)*



Source: ECB. Net percentages are the percentage reporting a positive impact minus the percentage reporting a negative impact. . High sovereign holding banks are those that are in the 75th percentile in terms of their holdings of sovereign bonds to main assets. Other banks are the remainder.
Latest observation: April 2018.

Cross check: APP and DFR have stimulated lending activities

✓ How have monetary policy measures impacted loan growth, taking into account supply and demand?

Dependent variable: QoQ enterprise loan growth at individual banks

Balance sheet measure:	Excess liquidity	Excess liquidity (Jun 2014)	Sovereign bond holdings	Sovereign bond holdings (Dec 2014)
(Balance sheet measure$_{b,c,t-1}$) x (Post$_t$)	29.58***	-13.34	5.612*	6.023**
Balance sheet measure$_{b,c,t-1}$	-25.56***		-3.567	
Bank fixed effects	Yes	Yes	Yes	Yes
Country-time fixed effects	Yes	Yes	Yes	Yes
Number of observations	2524	2498	3305	3279
Number of banks	82	77	107	102
R^2	0.398	0.393	0.366	0.365

Conclusions

- ✓ Both individual bank supply and demand are significant determinants of credit developments
- ✓ Borrowers demand less credit from banks with weaker balance sheets
- ✓ Banks more exposed to non-standard measures increase credit granted


Thank
You
köszönöm
Asante
Shukria
Vinaka
Kiitos
Maake
Dhanyavadagalu
Dankscheen
спасибо
Manana
Dankon
Terima Kasih
감사합니다
Kam Sah Hammida
شكرا
Matondo
Diolch i Chi
Dank Je
Mauruuru
Biyan
Taiku
Blagodaram
Tack
Ngiyabonga
Dziekuje
Chokrane
Grazie
Juspaxar
Arigato
Mochchakkeram
Gracias
Khap
Paldies
Tingki
நன்றி
धन्यवाद
cảm ơn bạn
Bedankt
D'akujem
Grazas
Gratias Tibi
Ua Tsaug Rau Koj
Kia Ora
Obrigado
Kop Khun
Děkuji
Nirringrazzjak
Di Ou Mèsi
ありがとう
Suksama
Nuwun
Hvala
Rahmat
谢谢
хвала
Welalin
Djiere Dieuf
Matur
Misaotra
Danke
Merci
Go Raibh Maith Agat
Tuke
Eskerrik Asko
ขอบคุณ
Salamat
Najis