

**Mending the broken link: heterogeneous bank lending and
unconventional monetary policy**

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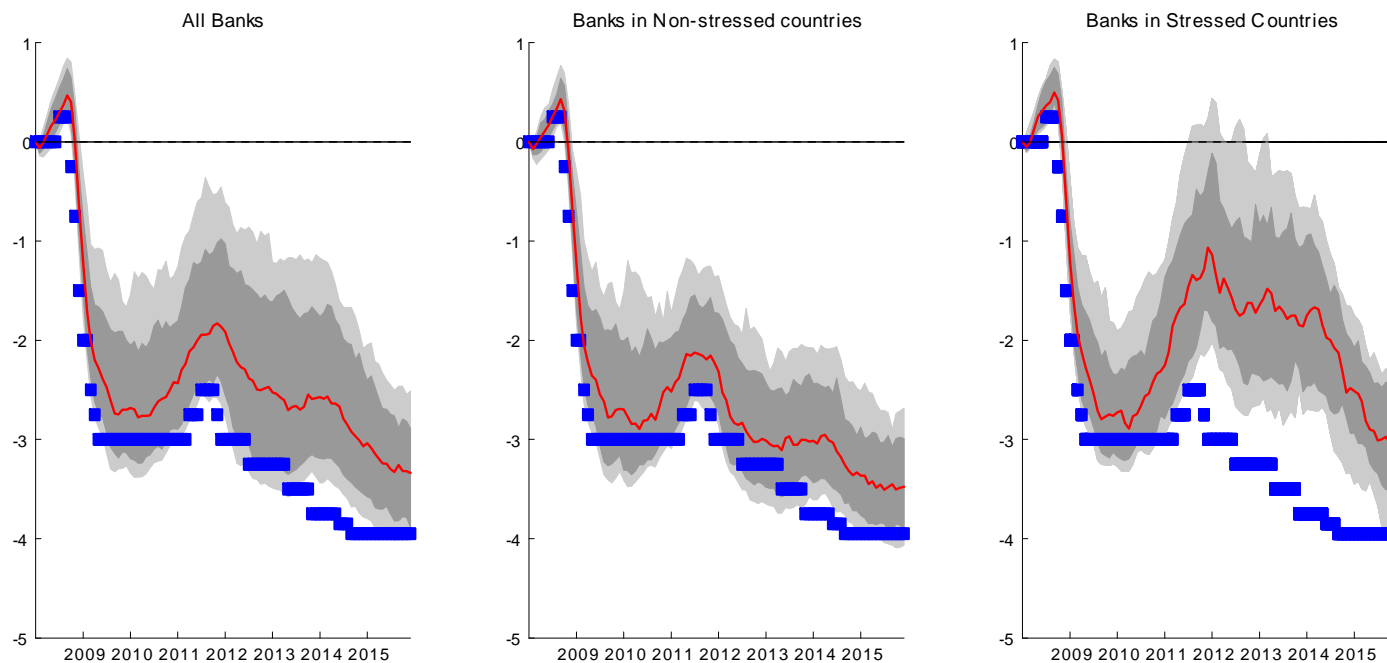
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Introduction

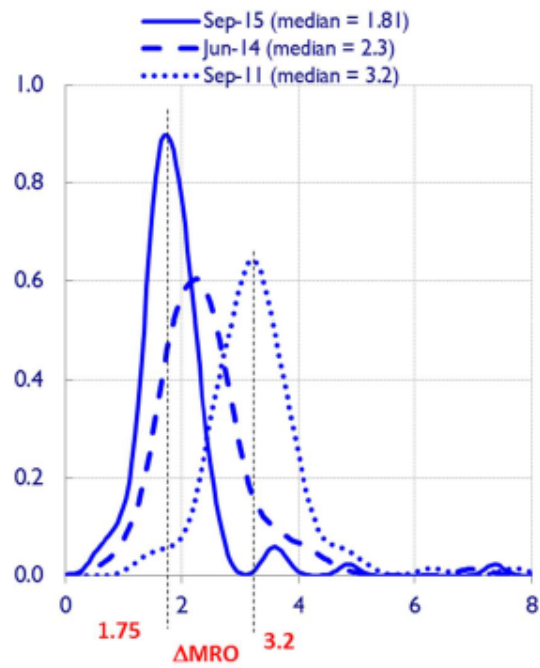
- Bank loans are 50% of external financing of euro area firms in 2000-2009 (in U.S. only 25%).
- With working capital and wage bill constraints, impairment of lending activities constrain economic activity and welfare.
- Poor lending conditions may hamper monetary policy transmission.
- From 2000 to 2009 monetary policy pass-through: homogeneous across countries (see, Ciccarelli et al. 2013), almost complete in the long run (see, Hristov et al. 2014). What happens after 2009?

Distribution of lending rates and the policy rate

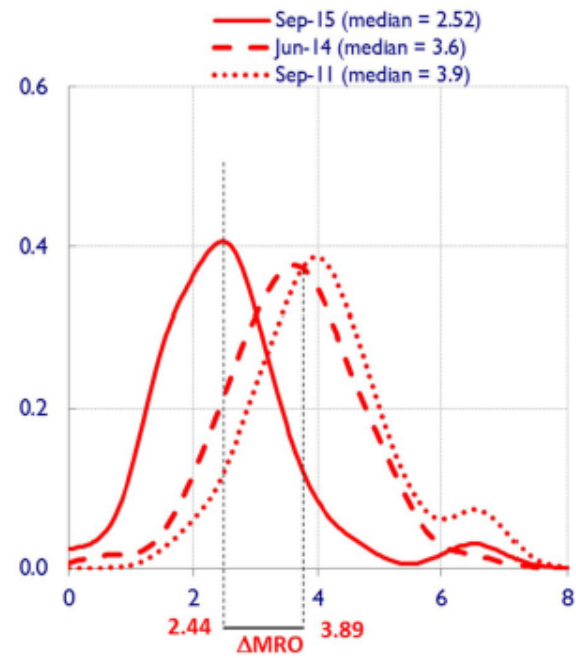


Lending rates

Banks in Non-stressed Countries



Banks in Stressed Countries



Four phases:

- 1) 2007-2008: distribution of lending rates follow the dynamics of the policy rate and cross sectional spread is small.
- 2) 2009-mid 2011: median of the distribution continue to follow policy rate, but spread of distribution up.
- 3) mid 2011-mid 2014: median of the distribution no longer follows policy rate, especially for banks operating in financially stressed countries. Lending rate heterogeneity large even within group.
- 4) May 2014-end 2015: median and the spread of distributions fall. The decline large for stressed countries.

Questions

- Why has the pass-through of monetary policy changed during the period of financial turmoil?
- Why different banks, even located in similar countries, responded differently to monetary policy changes?
- What characteristics make banks respond differently?
- Why was the pattern reversed after 2014? Which feature of monetary policy responsible for the changes?

Literature

- Monetary policy contractions in US in normal times: pass-through stronger for small (Kashyap and Stein, 1995), illiquid (Stein, 1998; Kashyap and Stein, 2000), and poorly capitalized (Peek and Rosengren, 1995; Kishan and Opiela, 2000; Van den Heuvel, 2002) banks.
- Gambacorta (2005) and (2008): same for Italian banks. De Santis and Surico (2013) heterogeneities in euro area pass-through by country and type (savings vs. commercial).
- Larger, better capitalized, more liquid banks more easily substitute sources of external financing when monetary policy is tight, absorb expected future losses, and divert liquidity to satisfy loan demand increases.
- Restrictive monetary policy decisions works through small, illiquid, and poorly capitalized banks.

- Crisis times? Contradictory conclusions for euro area.
- Hristov et al. (2014); Holton and Rodriguez d'Acri, (2015); Von Borstel et al. (2015); Illes et al. (2015): insignificant difference with pre-crisis times; mild decline of pass-through due to common structural changes.
- Jimenez et al. (2012), Acharya et al. (2015): balance sheet characteristics matter during the crisis. There is a relationship between balance sheet and banks' portfolio choices (e.g., Acharya and Steffen, 2015; Altavilla et al. 2016, Acharya et al., 2016).
- Problem: country aggregate data generally used. Sample mixes crisis and non-crisis times. Single equation (static) analyses. Dynamic heterogeneity disregarded.

This paper

- Examines monetary pass-through to lending rates in the euro area.
- Concentrate on the 2007-2015; employs a novel monthly data set covering 260 systemic banks.
- Focus on the pass-through of standard and non-standard measures [credit easing (TLTRO); quantitative easing (APP)].
- Examine lending rates to firms and households separately.
- Measure implications of non-standard measures for lending margins.
- Derive a few macroeconomic implications.

Results 1: Conventional MP

- Median long run pass-through 0.6; significantly smaller than pre-2007.
- Distinction banks in stressed vs. non-stressed countries irrelevant.
- Level of capitalization, of sovereign debt exposure determine the spread of the pass-through distribution. The percentage on non-performing loans matter for large banks; the level of stable funding for small banks.
- Difference top-bottom quartiles of pass-through distribution large up to 50 basis points in long run. Instantaneous pass-through similar: long run difference due to sluggish rate adjustment of problematic banks.
- Banks with low capital, lots of sovereign debt and of non-bad loans try to make the balance sheet look better by keeping lending rates high.

Results 2: Non-standard MP

- Median pass-through of non-standard announcements strong; cross sectional dispersion smaller than in previous years; and larger long-run pass-through.
- Better lending rates achieved via i) improvement of instantaneous pass-through and ii) dynamic funding-cost relief and signaling effects.
- Most responsive banks have high share of non-performing loans and of sovereign bond exposure.
- Lending rates to firms and households display similar pattern.
- Significant fall in lending margins for banks with low capital, high sovereign exposure, higher level of non-performing loans. Macroprudential implications?

Results 3: Macroeconomic implications

- Distribution of lending rates responses pre-2014 imply higher average and more persistent inflation rate than observed. Flattening of the Phillips curve? Strategic considerations (Gilchrist et al, 2015)?
- Non-standard policies boosted output (gain 0.5%) and moved inflation away from zero (gain 0.6%).
- Under perfect pass-through, output gap and inflation paths would have been very similar.

ECB non-standard policies

Credit and Quantitative Easing

➤ Features of the TLTRO I (announced 5th June, 2014)

- ✓ **Initial allowance:** up to 7% of a specific part of their loans in two operations in September and December 2014.
- ✓ **Additional allowance:** amounts can be borrowed in further TLTROs, depending on the evolution of the banks' eligible lending activities in excess of bank-specific benchmarks.
The additional borrowing allowance is limited to 3 times the difference between the net lending since 30 April 2014 and the benchmark at the time it is claimed. (maturity: 26 Sept 2018)

➤ Features of the APP I (announced 22nd January, 2015)

- ✓ **Size:** when announced combined monthly purchases of €60 billion (CBPP, ABSPP, PSPP).
Intended purchases: €1.14 tr. (about 11% of euro area GDP)
- ✓ **Composition** (maturity and assets)
 - primarily, securities issued by euro area central government with a residual maturity from 2 to 30 years
 - securities with different credit ratings

➤ Extension and Expansions

- ✓ December 15 GovC (3 December 2015): extension to March 17 (reinvestment principal payments, debt instruments issued by regional and local governments)
- ✓ March 16 GovC (10 March 2016): monthly purchases expanded to €80 billion (investment-grade euro-denominated bonds issued by non-bank corporations)

Channels of monetary policy transmission

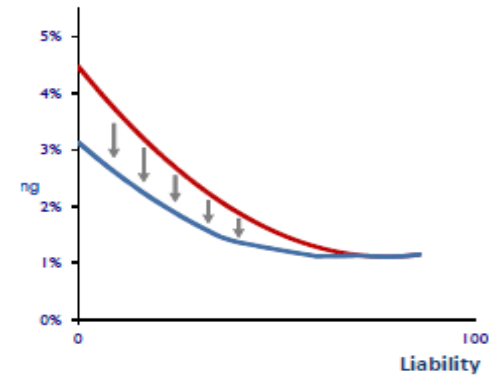
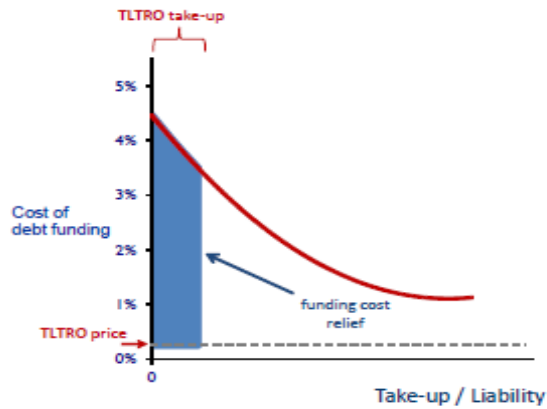
- Conventional monetary policy: expectational channel, the interest rate channel, the asset price channel, and the credit (bank lending and borrower's balance sheet) channel, see e.g. Russell (1992), Bernanke and Gertler (1995), or Mishkin (1996).
- Non-standard monetary policies: many other channels see e.g. Joyce et al. (2011a,b); Krishnamurthy and Vissing-Jorgensen (2011).
- ECB policies likely to work through: **the funding cost relief, the portfolio rebalancing , and the signalling channel.**

Credit Easing

Asset	Liability
Securities (S)	Wholesale Funding (wf) $p^{wf} \downarrow$
Loans (L) $p^L \downarrow$	Eurosystem Credit (EC) $q^{EC} \uparrow$

Quantitative Easing

Asset	Liability
Securities (S) $q^S \downarrow$ $p^S \uparrow$	Wholesale Funding (wf) $p^{wf} \downarrow$
Loans (L) $q^L \uparrow$ $p^L \downarrow$	Eurosystem Credit (EC)



Notes: The figure shows the effects of credit easing (left box) and quantitative easing policies (right box) in a stylized balance sheet of a bank.

- CE-based asset purchases: replace market-based with central bank funding.
- By arbitrage, yields for **all** bank bonds lower, including those of banks not participating the programme. Reduction in the supply of bank bonds.
- Lending rates fall, if bank pass to customers **funding cost relief**.
- Similar for QE-based asset purchases: if asset are close substitute for bank bonds.

- QE change relative yields, especially if the liquidity content of asset sold is different from liquidity the private sector receives is not a perfect. Sellers rebalance their portfolios with assets with similar characteristics: **portfolio rebalancing channel**. Similar to carry trade.
- Yields compression makes lending more attractive; leads to lower rates.
- Portfolio rebalancing channel may also occur with CE: banks can borrow multiples of their eligible lending and use it to purchase government or private sector securities.

- With CE, central banks signal the path of future monetary policies to market participants.
- **Signalling channel** works through a credible commitment to keep interest rates low in the future. If not, central bank suffers losses on the assets they purchased (Eggertsson and Woodford, 2003).
- Can trigger a revision of market expectations for future short rates.
- May re-anchor inflation expectations.

Data

- ECB Individual Balance Sheet Indicators, (IBSI): main balance sheet variables for 260 euro area banks, 2007:7-2015:12.
- Only 120 banks were subject to EBA(2014) stress test. Test used only 2-3 discrete snapshot of balance sheet condition.
- Head institutions; domestic or foreign subsidiaries; no branches.
- Commercial and saving; public and private; domestic and foreign banks.
- Covers 75% of euro area industry.

	Head Institution	Domestic Subsidiary	Foreign Subsidiary	Total
Austria	6	2	1	9
Belgium	3	-	7	10
Cyprus	4	-	1	5
Germany	42	13	10	65
Estonia	-	-	4	4
Spain	19	3	4	26
Finland	5	-	4	9
France	10	22	6	38
Greece	4	2	-	6
Ireland	4	1	8	13
Italy	16	4	7	27
Lithuania	-	-	4	4
Luxembourg	3	-	8	11
Latvia	2	-	3	5
Malta	3	-	1	4
Netherlands	7	-	3	10
Portugal	4	-	2	6
Slovenia	3	-	2	5
Slovakia	-	-	3	3
Total	135	47	78	260

- Bank lending rates = average of lending rates for different maturities with new loans volume as weights (from ECB Individual MFI Interest Rates,IMIR)).
- Takes into account new volume and fixed vs flexible loans. No compositional bias due to banks lending only short or long term.
- Match with data on the bidding behavior of banks in the long-term refinancing operations; on bank bond yields for individual banks from Markit (Iboxx); on non-performing loans from SNL; on CDSs (Datasteam).
- **Bank bond yields available only for large banks; non-performing loans only for a subset of banks; missing data for some banks characteristics.**

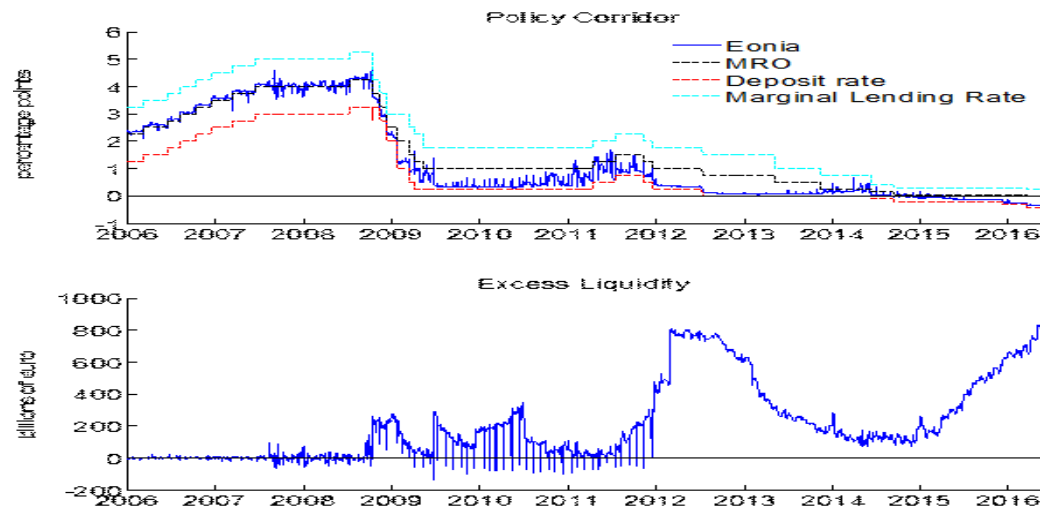
Summary statistics

	N. obs	N. banks	Percentile		
			25th	50th	75th
Lending rate to NFCs	19717	234	2.72	3.24	4.05
Lending rate to HHs	19841	229	3.28	3.99	4.91
Bank bond yields	9332	115	2.14	2.98	4.02
Deposit rate	19299	226	1.18	1.64	2.31
Sovereign debt exposure (over main assets)	23935	258	0.83	4.05	8.09
Non-performing loans (over RWA)	7137	141	3.89	5.93	9.23
CET1 capital ratio	10264	147	8.89	9.54	10.59
Leverage ratio	23935	258	4.30	6.84	10.19
Credit default swap (CDS)	14891	160	0.95	1.27	2.00
Capital and Reserve (bn)	23935	258	0.73	2.23	6.05
Total Assets (bn)	23935	258	12.76	34.27	85.39

The econometric methodology

- Use a cross-sectional VAR methodology. Why?
- Static pass-through equations do not account for endogenous and dynamic interaction between lending and funding conditions within a bank in response to monetary policy changes.
- Dynamic heterogeneities make standard panel techniques inappropriate.
- Canova and Ciccarelli (2009) panel VAR setup inefficient.
- Two step approach: 1) Estimate the dynamic response of lending rates (margins) to policy disturbances bank by bank; 2) sort the distribution of pass-through using bank specific characteristics and measure the average difference in the upper and lower quartiles of the distribution.
- Similar to interaction VAR of Sa et al. (2014).

- For each bank $i = 1, \dots, N$, use a VAR with lending rate, deposit rate, bond yields; country specific variables (the 10-year sovereign bond yields, the expected default frequency of non-financial corporations, and the unemployment rate) and overnight interbank rate (EONIA).
- EONIA rate better indicator of policy: it moves at daily frequency (rather than jumps at discrete dates); it responds to both standard and non-standard measures; it has no floor at zero.



- Contemporaneous relationships have a block recursive structure.

$$y_{it} = A_{ij}x_{jt} + B_{ij}z_t + u_{it} \quad (1)$$

$$x_{jt} = C_j z_t + e_{jt} \quad (2)$$

$$z_t = v_t \quad (3)$$

- Constraint v_t so as to make the policy rate weakly exogenous with respect to country specific and bank specific variables.
- Because of slope heterogeneities and short T use small sample exact Bayesian methods.

Let β_i be the vector of bank specific coefficients, $\beta = [\beta'_1, \dots, \beta'_N]$,

Let $\Sigma_u = \text{diag}[\Sigma_{u,1}, \dots, \Sigma_{u,N}]$ be the covariance matrix of the disturbances, and let $\theta = (\beta, \Sigma)$.

- Use a Normal-Inverse Wishart prior for θ ,
- Add Minnesota, “sum-of-coefficients”, “dummy-initial-observation” restrictions, see DLS (1984), Sims and Zha (1998).

- An estimate of the responses of bank variables to a standard monetary policy disturbance (replication m) is:

$$y_{it}^m \equiv \omega_i^m(L)v_t \quad i = 1, 2, \dots, N \quad (4)$$

where $\omega_i^m(L)$ is a 3×1 vector for each i.

- Letting $y_{it}^{1,m}$ be the response of the lending rate at time t for bank i in country j, the pass-through at horizon h is:

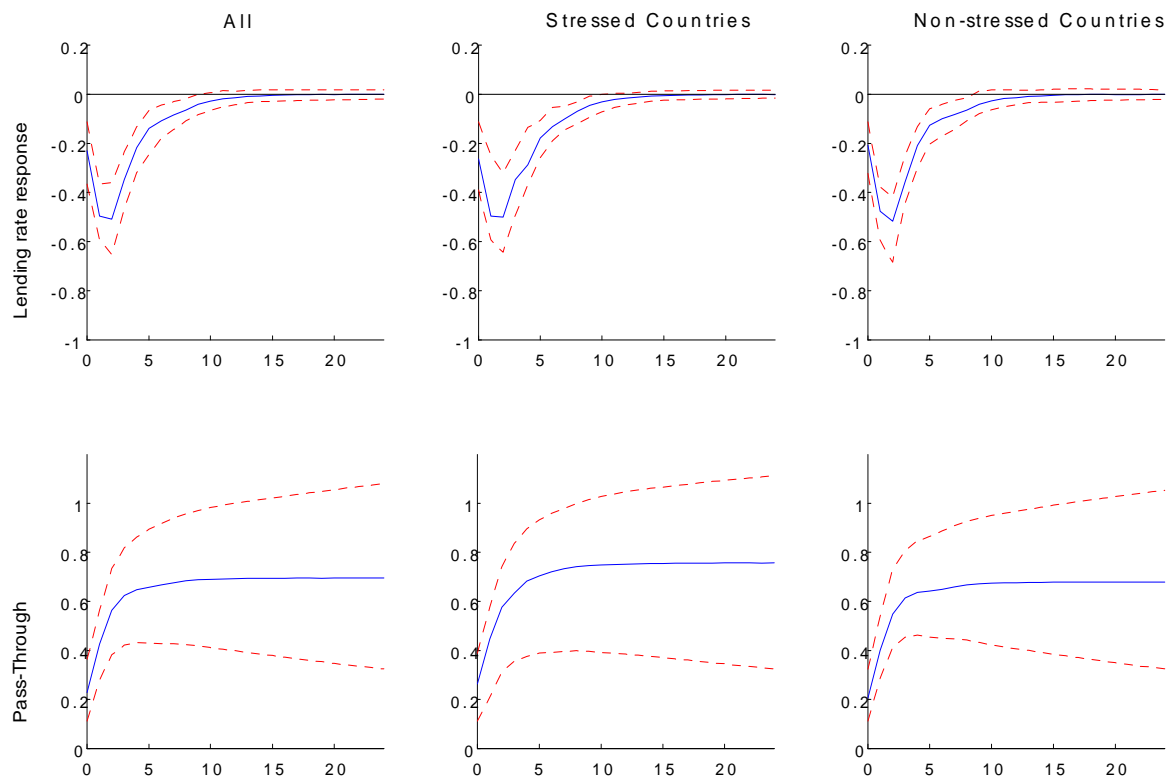
$$PT_i^{h,m} \equiv \frac{\sum_{\iota=0}^h \omega_{i\iota}^{1,m}}{\sum_{\iota=0}^h \delta_{\iota}^m}, \quad h = 1, 2, \dots, H \quad (5)$$

where $z_{1t} = \delta(L)v_t$.

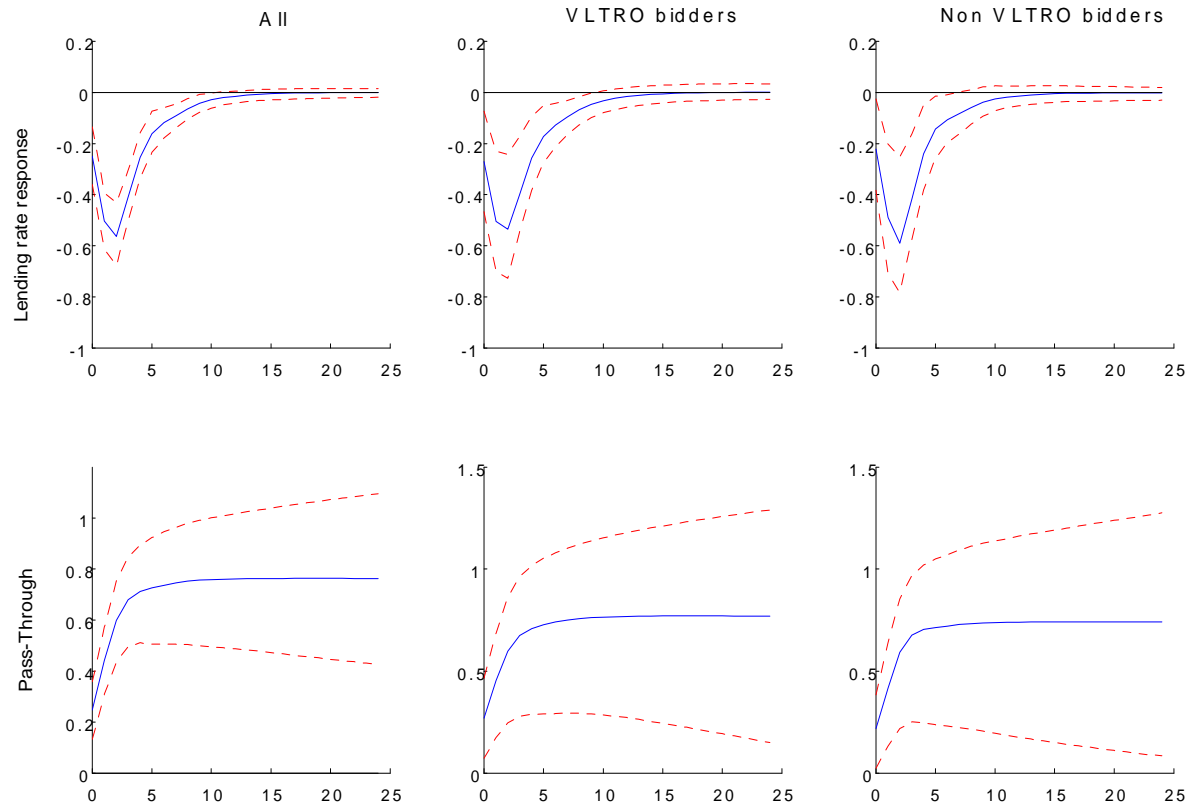
- If $w_{it}^{1,m} = y_{it}^{1,m} - y_{it}^{2,m} = \psi^{im}(L)v_t$ where $y_{it}^{2,m}$ is the response of the deposit rate, the pass-through to lending margins is computed using $\psi_{i\iota}^{1,m}$ for $\omega_{i\iota}^{1,m}$ in (5).

- Construct the posterior distribution of PT_1^h .
- Use balance sheet characteristics at the beginning of 2007 to sort.
- Standard monetary policy period: 2007:7 to 2014:4.
- Non-standard monetary policy period: 2014:5 to 2015:12.
- Two samples: N=168 (all units with non-performing loans information); N=76 (only units with bank bonds).

Does CMP pass-through depend on countries?

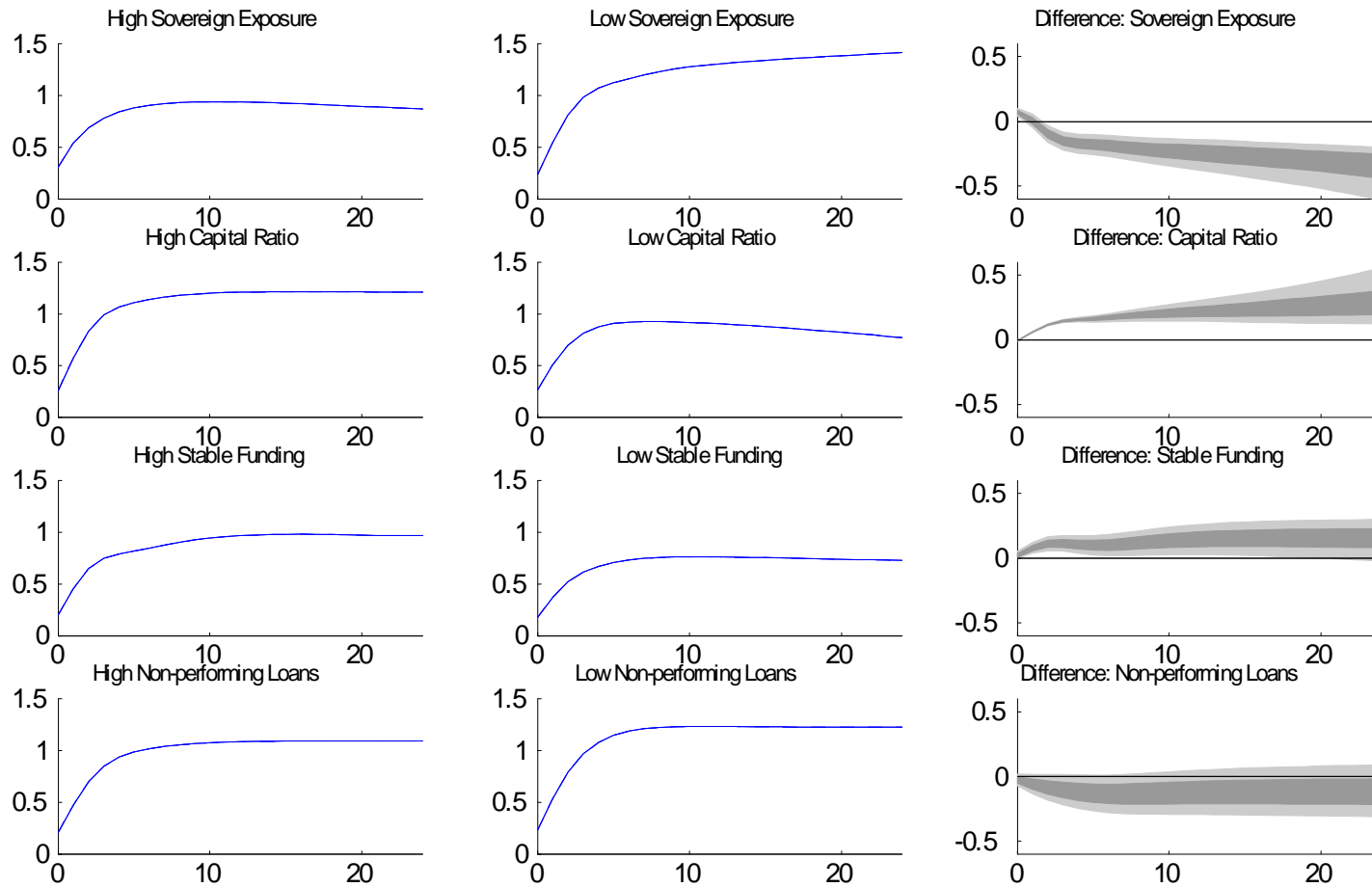


Are results influenced by the presence of UMP measures?

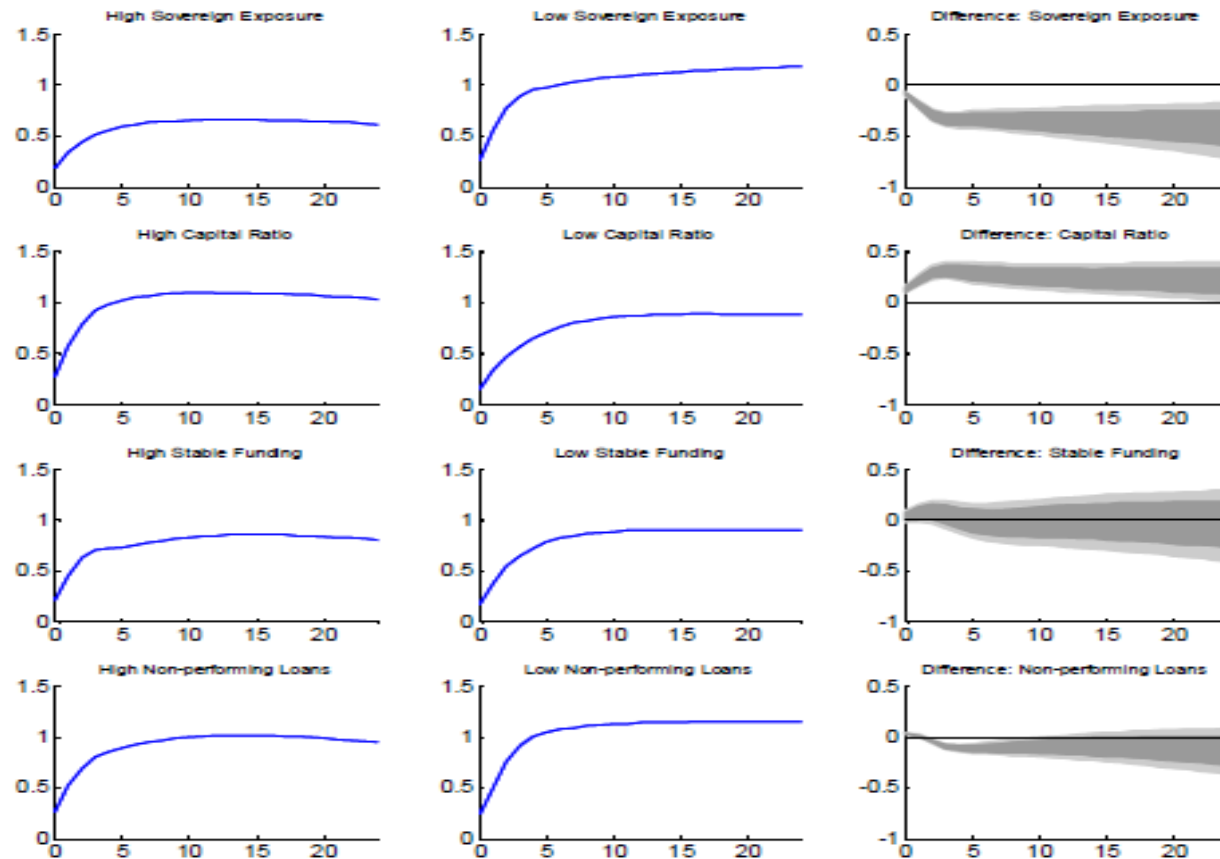


- Median pass-through: 0.2-0.3 in short run, 0.6-0.7 long run. Smaller than pre-2007.
- Dispersion of pass-through large.
- Distribution of pass-through sorted by countries overlap.
- VLTRO and Non-VLTRO bidder have similar pass-through.

Pass-through sorted by bank characteristics: large sample



Pass-through sorted by bank characteristics: small sample



- Pass-through low for banks with high sovereign debt exposure and weak capital position. Differences between quartiles significant.
- Instantaneous pass-through similar: difference due to sluggish lending rate adjustment of exposed and poorly capitalized banks.
- The funding structure matter for small banks. Non-performing loans matter only for large banks.

The pass-through of non-standard measures

- Idea: CE and QE transmitted through a signalling channel (the expected path of the EONIA rate), and funding-cost relief/portfolio rebalancing channels (the implied path for sovereign bond yields and bank bond yields).
Two step approach:

1) Measure the response of EONIA, bank bond and sovereign bond yields to non-standard policy announcements using high-frequency methodology (e.g. Krishnamurthy and Vissing-Jorgensen 2011; Altavilla et al. 2015a).

$$\Delta y_t = aD_t + bD_{t-1} + cX_t + e_t \quad (6)$$

Δy_t = the daily change in either the EONIA rate, bank bond and sovereign bond yields.

X_t = the standardized difference between the actual value and the consensus forecast made by professional forecasters (from Bloomberg).

D_t = twenty-eight announcements dates: two for the TLTRO programme (Governing Council meeting of May and June 2014), seventeen for the APP programme (see Altavilla et al. (2015a) for details), and nine anticipatory effects related to the December 2015 new APP package.

- Use a two-day window to allow for a sluggish market reaction to the news (results with a one-day window are similar).
- The policy component of the changes in the three variables = cumulation of monthly predicted path produced by (6) over the projection sample.

FINANCIAL TIMES

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Analysis. Capital markets

20 September/21 September 2014

Weak ECB loan take-up paves way for QE

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Global overview

Thursday 27 November 2014

US data disappoint as possibility of European QE comes into focus

FINANCIAL TIMES

29 November/30 November 2014

Draghi needs support on QE in the eurozone

Orthodox sceptics led by Germany should give ECB president backing



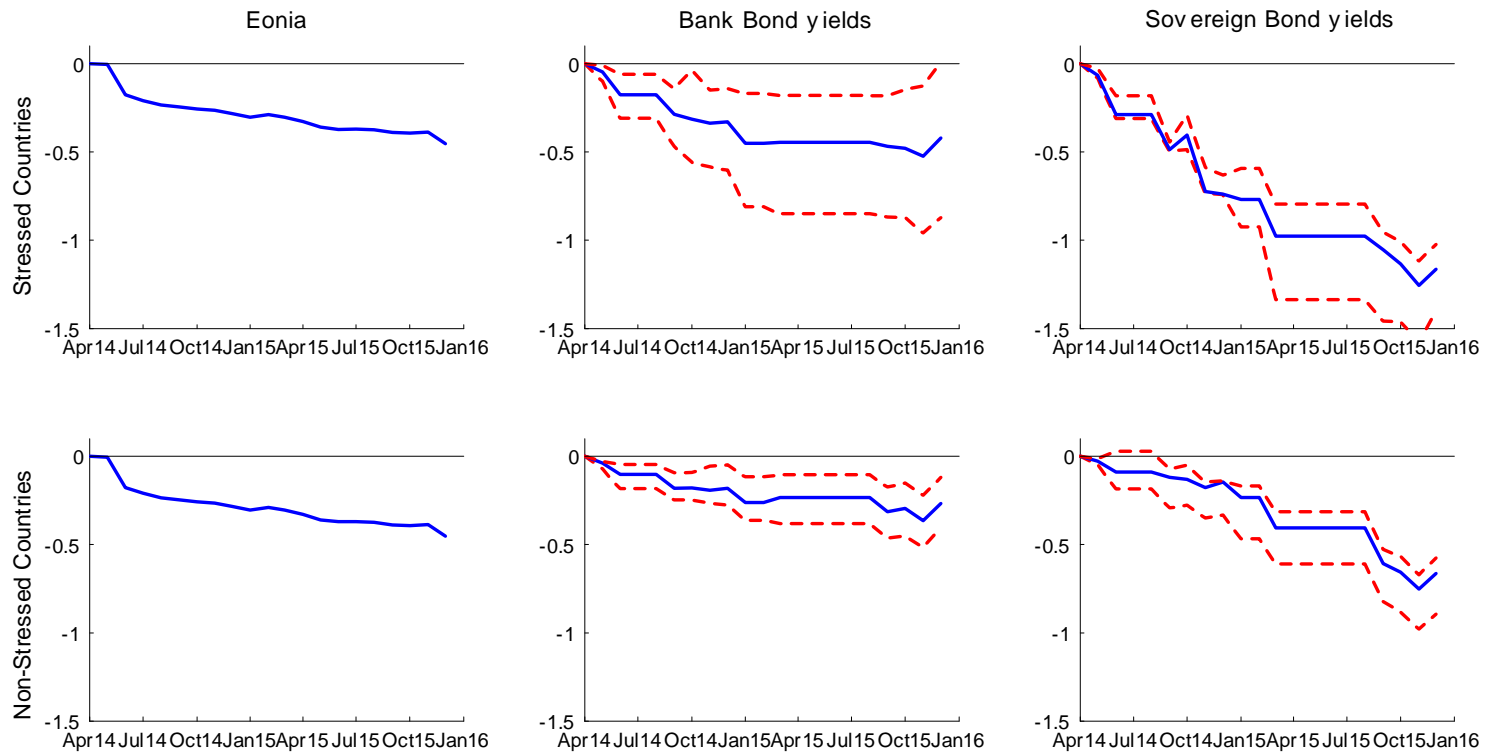
Jan 3rd 2015 | From the print edition

Euro-zone quantitative easing

Coming soon?

The ECB might unleash its long-awaited programme in early 2015

Paths for EONIA, bank and sovereign bond yields due to non-standard measures

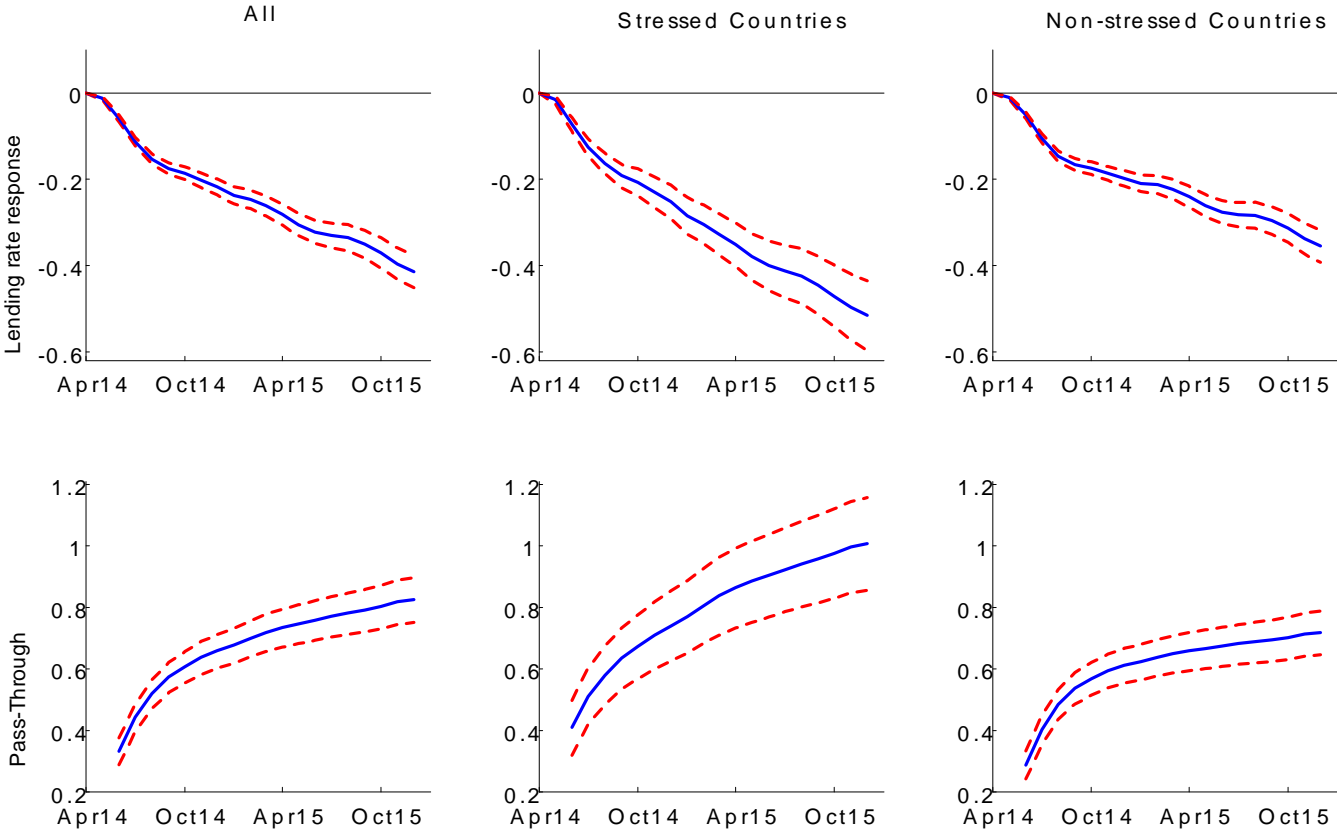


2) Forecast lending rates from May 2014 through December 2015 conditional on the path of the EONIA rate, of sovereign and of bank bond yields that would have occurred if the euro area were hit only by non-standard policy announcements and unconditionally:

$$u_{it+h} = E \left(y_{it+h}^1 \mid \Omega_t, z_{1t+h}^*, y_{jt+h}^* \right) - E \left(y_{it+h}^1 \mid \Omega_t, z_{1t+h}, y_{it+h} \right) \quad (7)$$

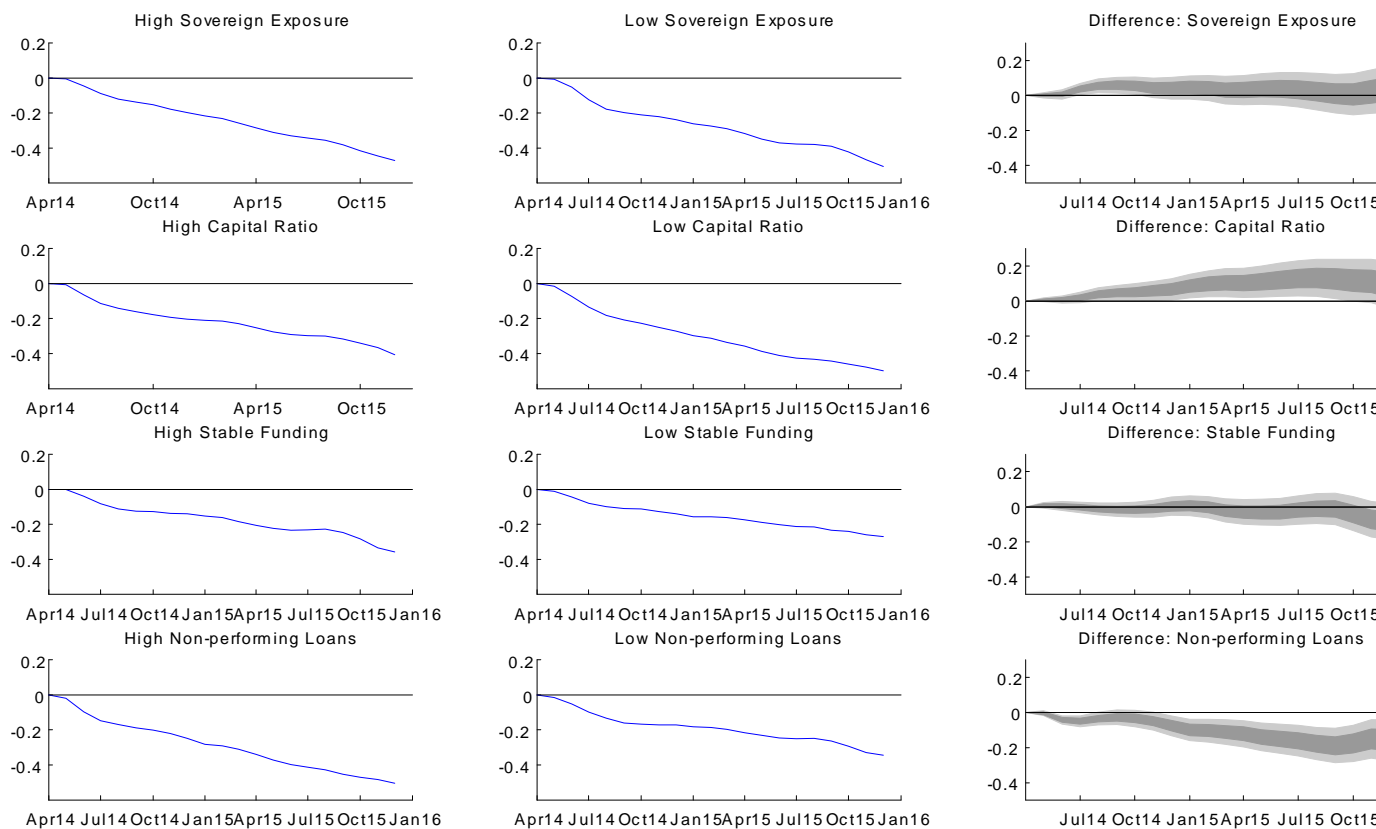
where Ω_t is the state of the economy at time t , y_{it+h}^1 is the path of lending rate in bank i at horizon $h = 1, 2, \dots$, z_{1t+h}^* and y_{it+h}^* are the policy induced path and z_{1t+h}, y_{it+h} their unconditional paths.

Effects on lending rates and pass-through by countries

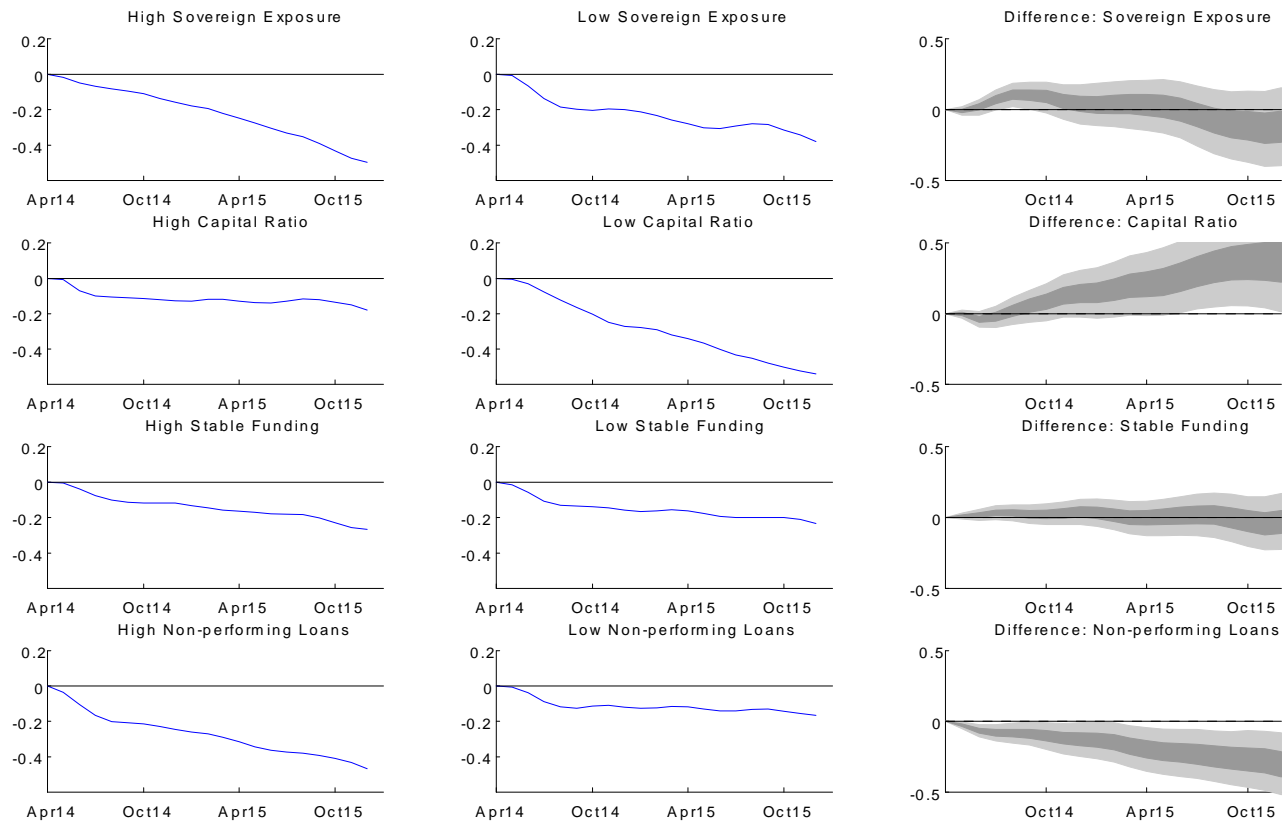


- The funding cost relief important for banks in stressed countries: by 2015:12, bank bond fell by 50 basis point, sovereign bond risk by over 100 basis points.
- For a typical bank in non-stressed countries the reduction was of 30 and 60 basis points.
- Significant fall in lending rates: in the median about 40 basis points.
- Fall stronger for banks in stressed countries (50 vs. 30 basis points), after 18 months.

Lending rate differences by bank characteristics, large sample



Lending rate differences by bank characteristics, small sample

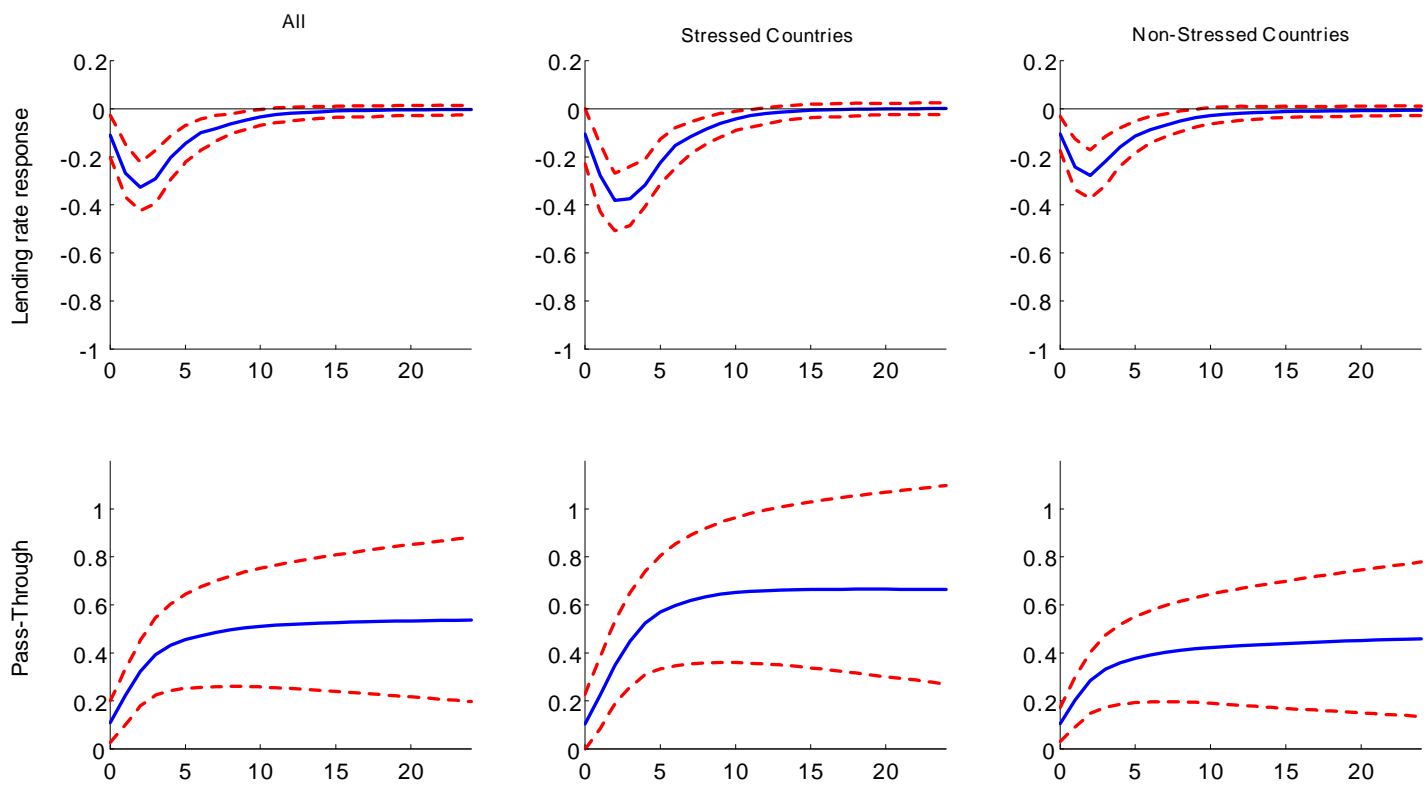


- Banks with a high share of non-performing loans, low capital most affected.
- Average difference in the upper and lower quartiles of the distribution up to 40 basis points. Strongly significant after about 18 months.
- Some temporary significant differences in lending rates when sorting by sovereign debt exposure in both samples.
- No difference when stable funding is used to sort distribution of lending rate responses.

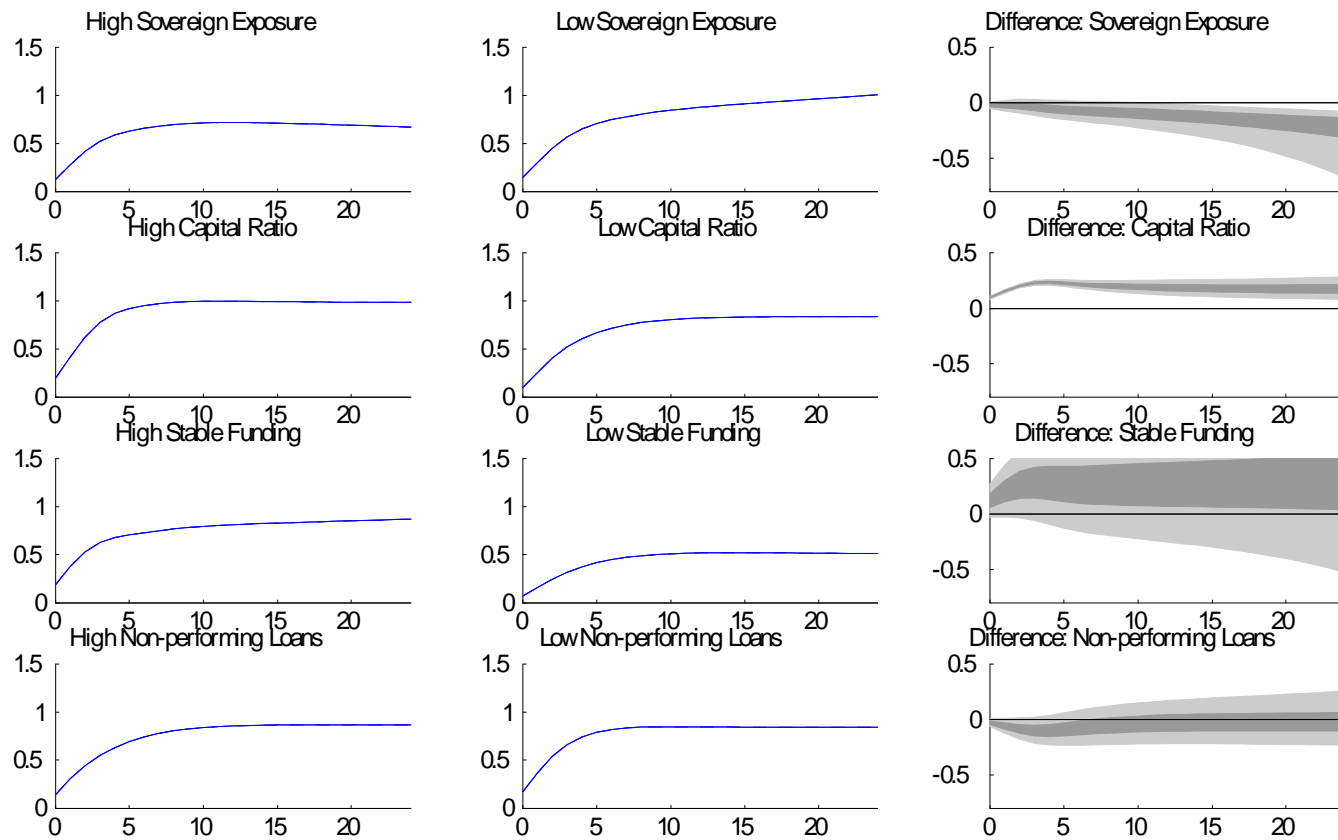
Lending rates of households

- What happened to lending rates to households?
- Expect differences because market highly non-competitive and cross country heterogeneities in fixed vs. variables loans.
- No qualitative difference with lending rates to firms. Quantitatively, pass-through smaller.
- Quartiles of distribution of lending rates and pass-through more homogenous for household lending rates.

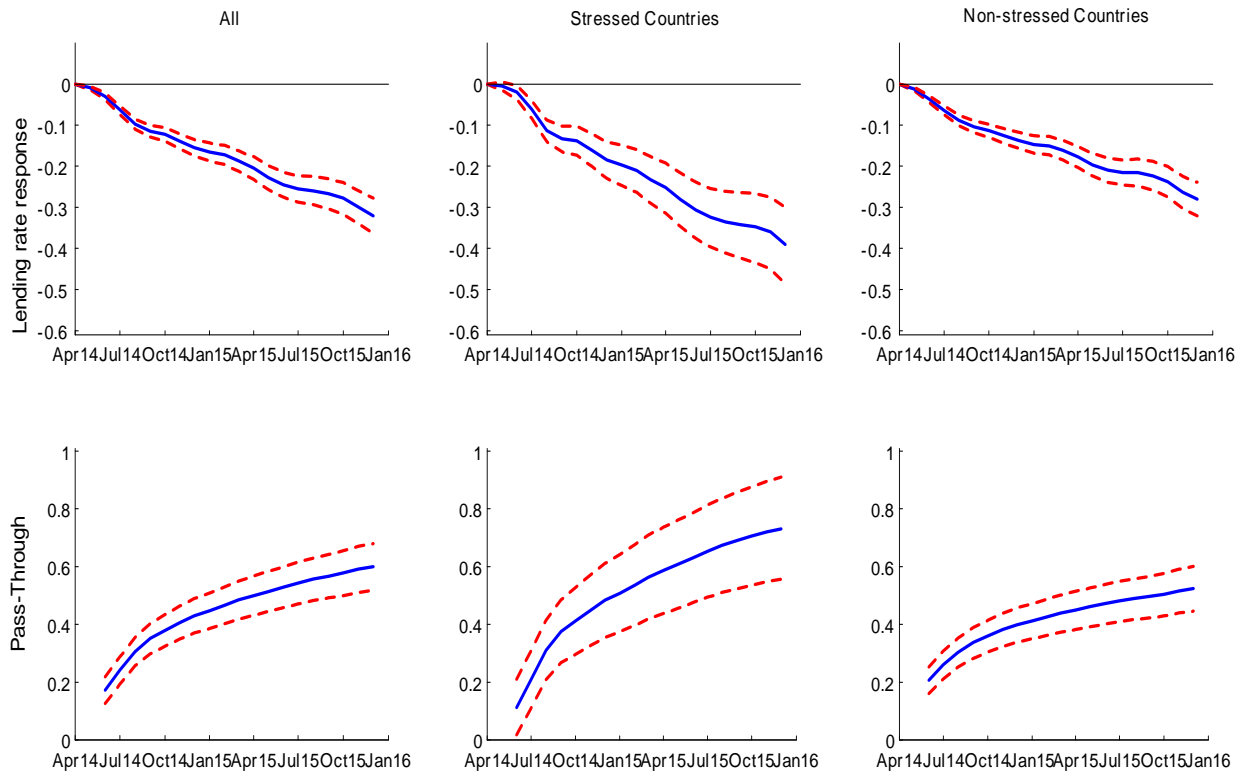
Household lending rates pass-through: conventional measures.



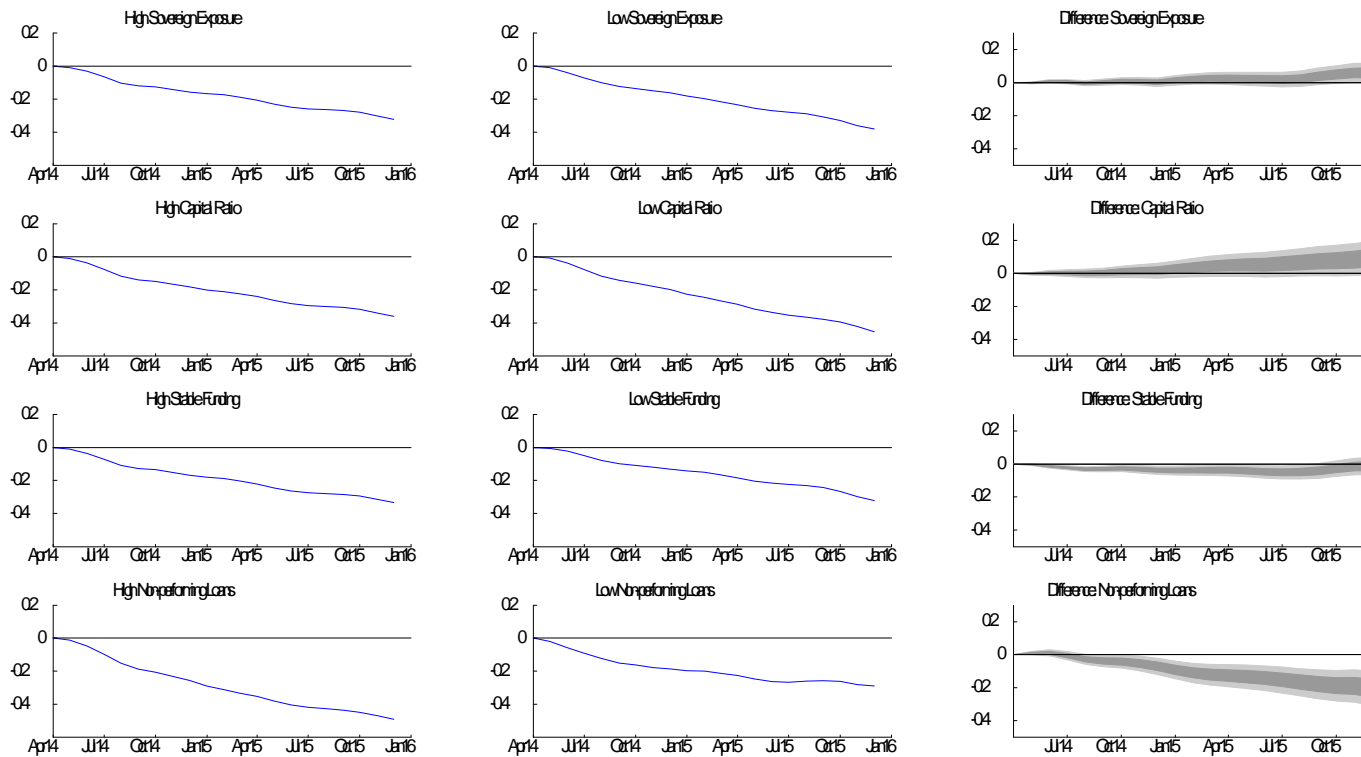
Pass-through dynamics of households lending rates by bank characteristics



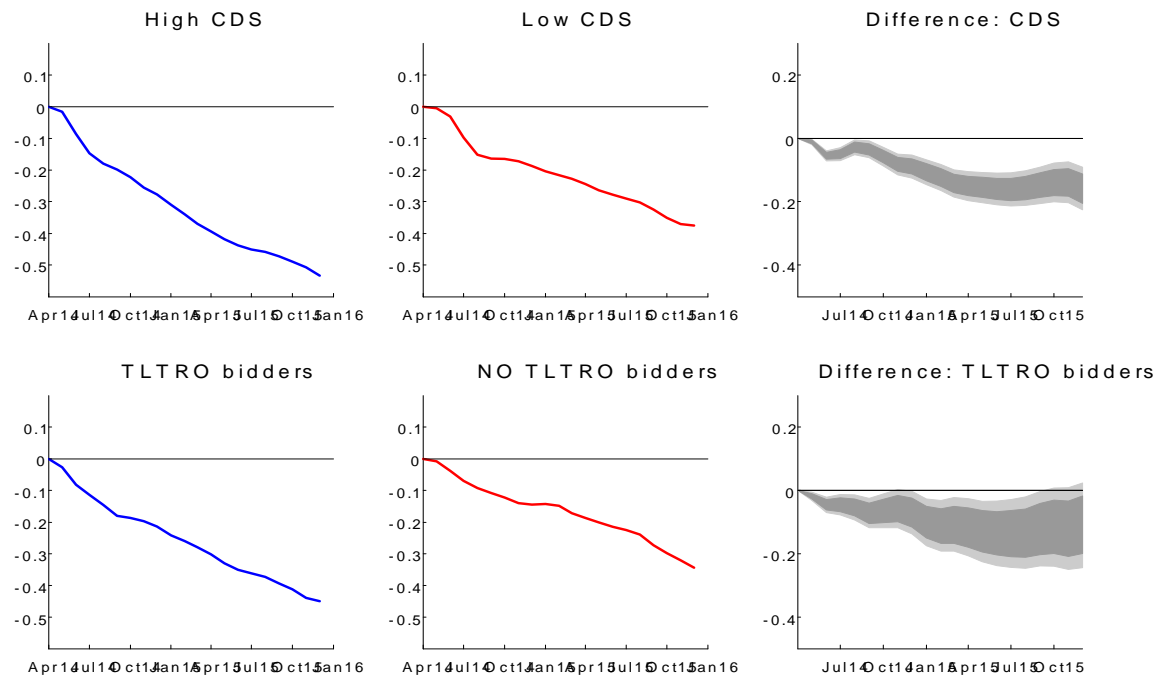
Household lending rates pass-through: non-standard measures



Dynamics of lending rates to household by bank characteristics.



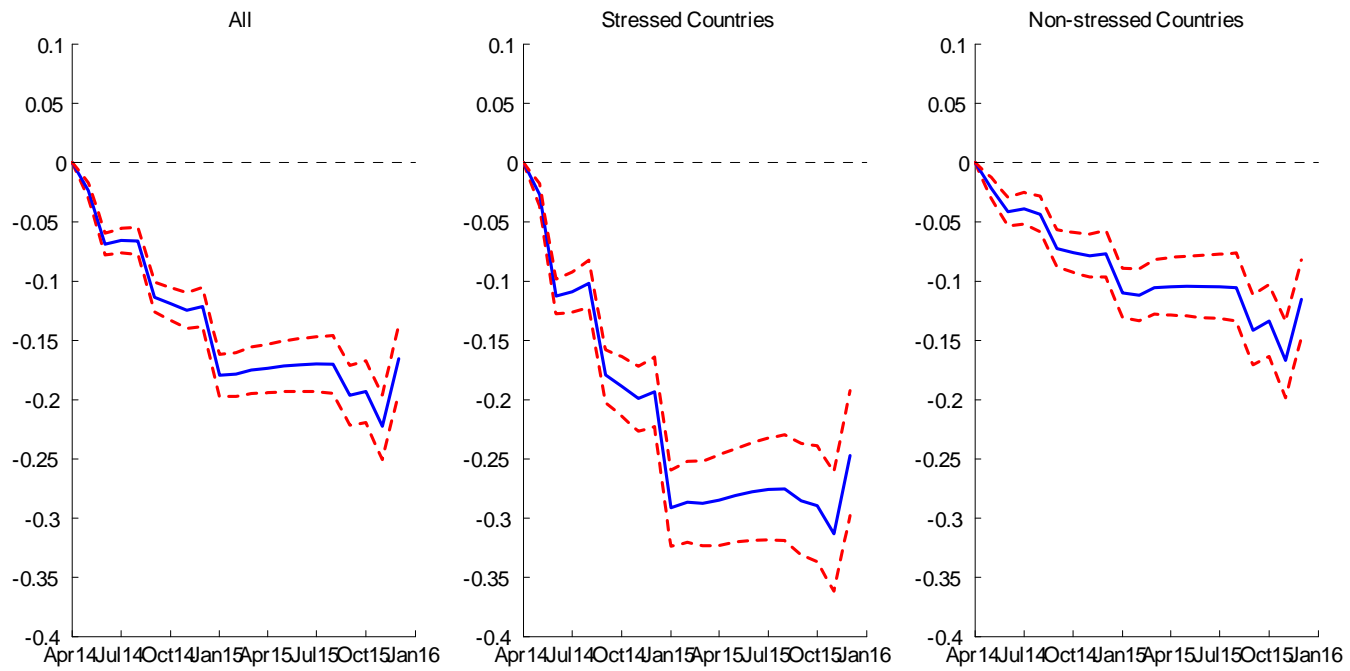
Lending rates to firms



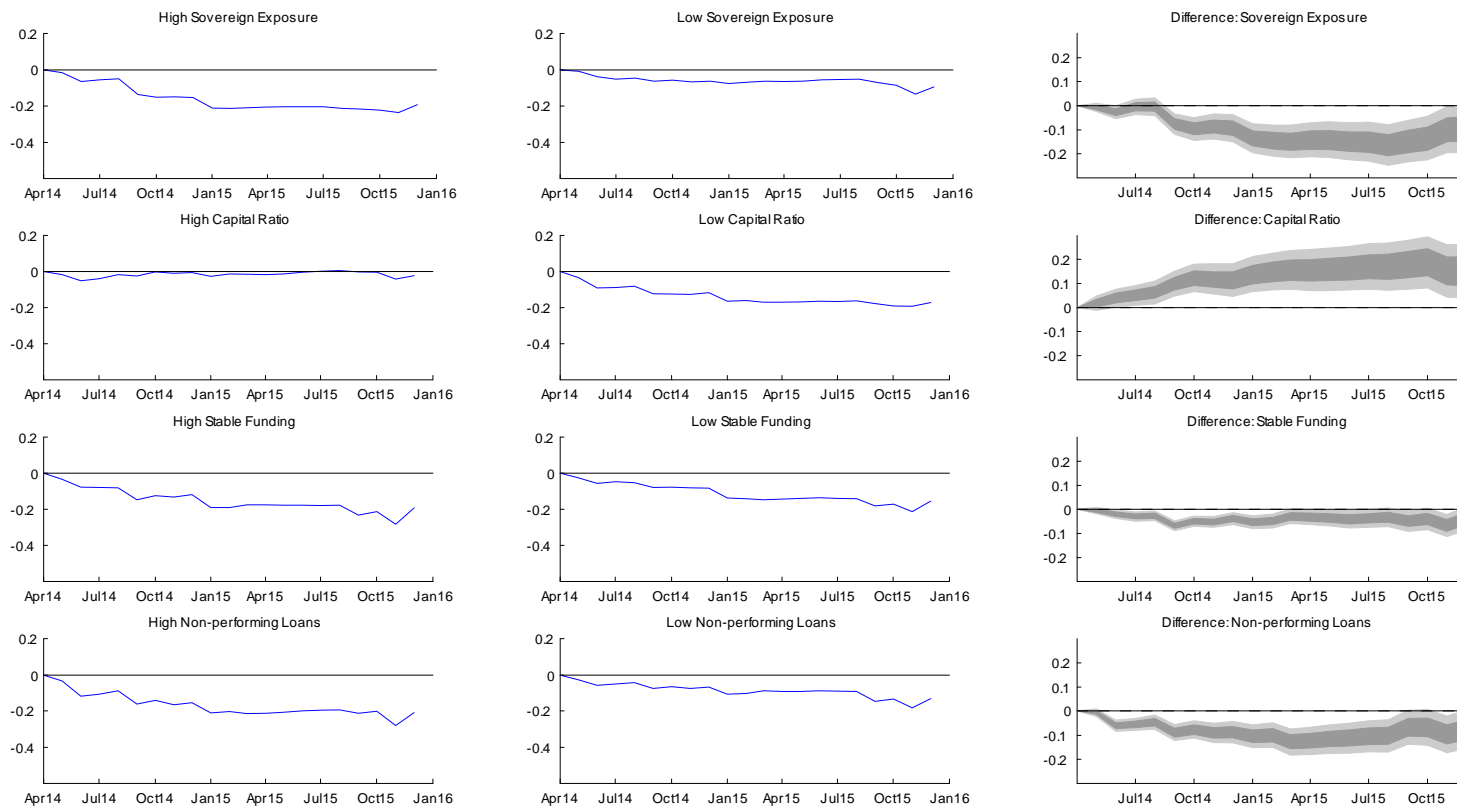
Dynamics of lending margins

- Non-standard measures may affect bank profitability.
 - i) Asset purchases flatten the yield curve, make maturity transformation less attractive, hamper profits.
 - ii) Asset purchases reduce banks' provisioning needs; increase profits; lead to valuation gains.
- Dreschsler et. al (2016): with imperfect competition, monetary policy affects banks' effective market power and lending margins.
- Macroprudential implications (see Alessandri and Nelson, 2015)? Monetary policy affects how banks are funded, alter the quantity of safe and liquid assets banks produce.

Lending margin responses to non-standard measures by country



Lending margin responses to non-standard measures by bank characteristics



- Fall of lending margins by 20 basis points in the median
- Larger in stressed countries (30 vs. 15 basis points).
- Larger for banks with a low level of capital, less stable funding structure, and high share of non-performing loans.
- Dynamics due to sluggish deposit rate dynamics.

Macro implications 1: Inflation rates 2007-2014

- Distribution of lending rates implies distribution of marginal costs (cost channel) and thus of inflation rates.
- Expect higher average inflation with sluggish inflation dynamics.
- Use a basic NK model with sticky prices, habit, exogenous policy-lending and lending-deposit spreads to quantify effect.
- Spreads calibrated to match dynamics of three rates in Euro area over 2007-2014.
- Calibration of other parameters standard.

Model

$$w_t = \left(\frac{\sigma_n}{1-\alpha} + \frac{\sigma_c}{1-h} \right) y_t - \frac{h\sigma_c}{1-h} y_{t-1} - \frac{\sigma_n}{1-\alpha} z_t - \chi_t \quad (8)$$

$$y_t = \frac{1}{1+h} y_{t+1} + \frac{h}{1+h} y_{t-1} + \frac{1-h}{(1+h)\sigma_c} (\chi_{t+1} - \chi_t + rd_t - \pi_{t+1}) \quad (9)$$

$$\pi_t = \beta\pi_{t+1} + \frac{1-\alpha}{1-\alpha\theta} \frac{(1-\beta\zeta)(1-\zeta)}{\zeta} (e^{\mu_t} + (rl_t - \pi_{t+1}) + w_t + \frac{\alpha}{1-\alpha} y_t - \frac{1}{1-\alpha} n_t) \quad (10)$$

$$r_t = \rho_r r_{t-1} + (1-\rho_r)(\rho_p \pi_t + \rho_y y_t) + e^{r_t} \quad (11)$$

$$rl_t = r_t + spl_t \quad (12)$$

$$rd_t = rl_t + spd_t \quad (13)$$

$$n_t = \frac{1}{1-\alpha} (y_t - z_t) \quad (14)$$

$$z_t = \rho_z z_{t-1} + e^{z_t} \quad (15)$$

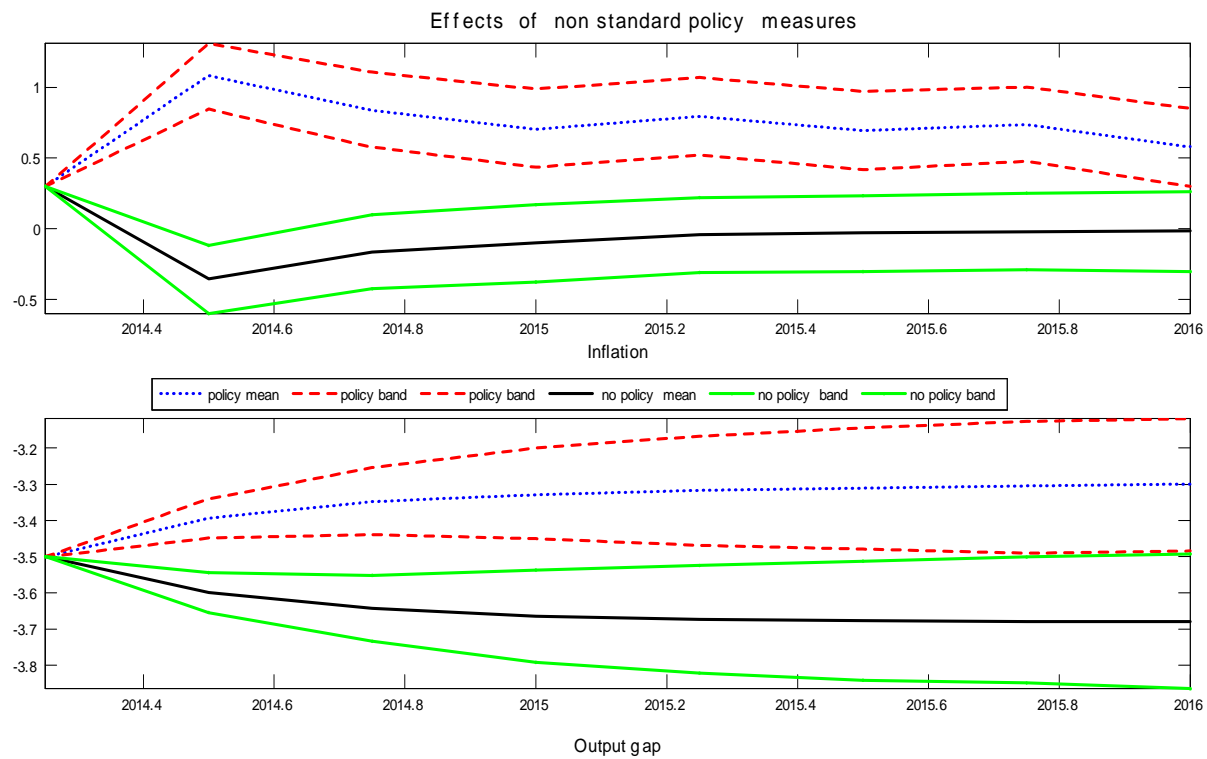
$$\chi_t = \rho_c \chi_{t-1} + e^{c_t} \quad (16)$$

$$spl_t = \rho_l spl_{t-1} + e^{rl_t} \quad (17)$$

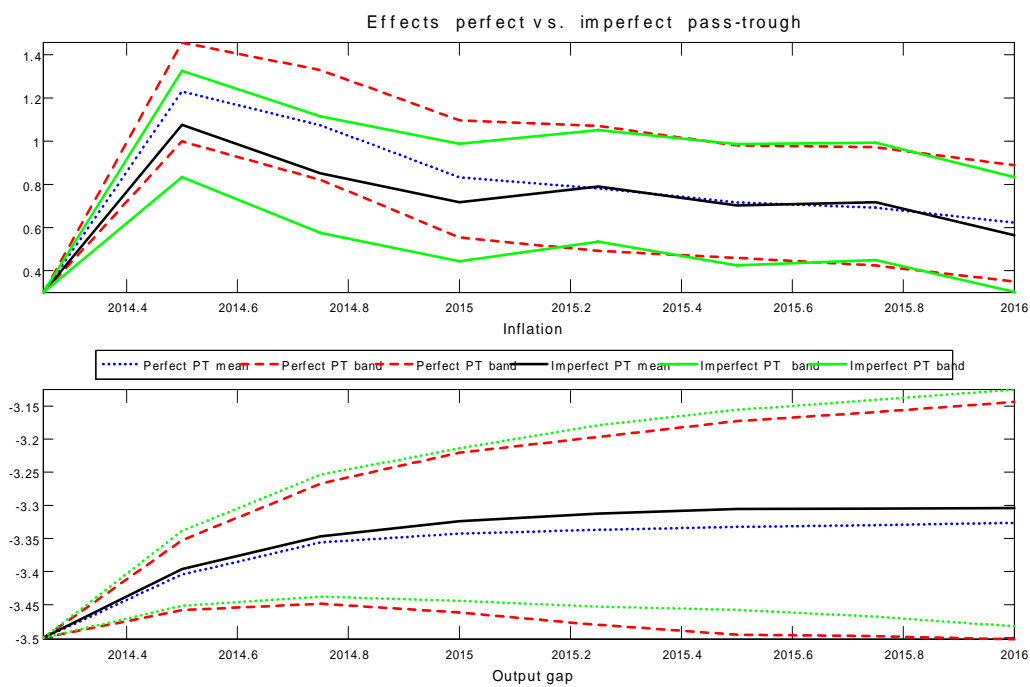
$$spd_t = \rho_d spd_{t-1} + e^{rd_t} \quad (18)$$

- Lack of pass-through implies that inflation should have been 0.5% higher than with steady state pass-through. Inflation persistence should have been 0.5 vs 0.3.
- In 2007-2014 inflation in euro area below average; persistence low by historical standards. Why?
- Flattening of the slope of Phillips curve?
- Disturbances other than non-standard policy shocks?
- Strategic interaction between pricing and financial frictions (Gilchrist et al., 2015)?

Macro implication 2: effect of non-standard policies on output gap and inflation



Macro implication 3: effect of perfect pass-through on output gap and inflation



Conclusions

- Non-standard measures mended policy pass-through in the euro area.
- Funding cost relief channel is crucial.
- They have implications for bank profitability (and capital formation?)
- Do they have effects on the riskiness of the banking system?
- Quantitatively relevant: effect on inflation about 0.6%, effect on output gap 0.5%.