Asset Purchase Programmes and Financial Markets: Lessons from the Euro Area

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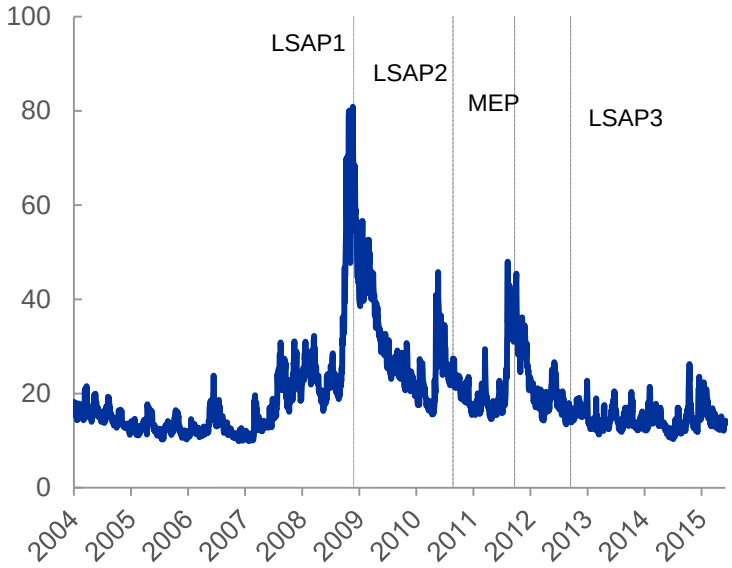
The opinions in this presentation are those of the authors and do not necessarily reflect the views of the European Central Bank and the Eurosystem.

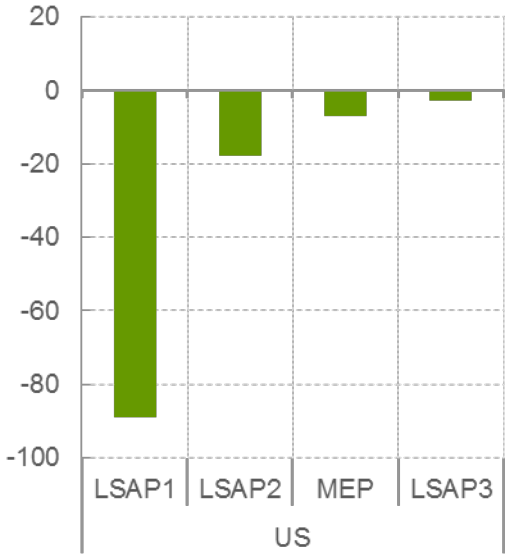
Effectiveness of asset purchases and financial market distress

➢ QE more effective at time of high financial distress – mostly "stock effects"

A proxy for market stress: VIX



Impact of purchases: event studies



"*… these effects are all sizeable and probably much more than one should expect in general. The period from November 2008 to March 2009 was an unusual time of financial crisis … .*" (Krishnamurthy and Vissing-Jorgensen, 2011, p. 243)

➢ Multiple channels of transmissions – largely "narrow channels"

"*The portfolio balance channel of QE works largely through narrow channels … .*" (Krishnamurthy and Vissing-Jorgensen, 2013, p. 1)

Assessing the impact of the euro area Asset Purchase Programme (APP)

➢ The euro area as a "laboratory"

- ✓ Low financial distress
- ✓ Jan 2015 APP: intended purchases of €1.14 tr. (11% of GDP), 2y-30y maturity, securities with different credit ratings

➢ Evaluating the financial market effects of APP and its transmission channels

- ✓ Model-based predictions: extending a term structure model with bond supply effects (Vayanos and Vila, 2009):
  - ✓ Local supply / scarcity channel
  - ✓ Duration risk channel
  - ✓ Credit risk channel
- ✓ Empirical validation: event-study methodology
  - ✓ Transmission channels identified by exploiting cross-asset price movements (Krishnamurthy and Vissing-Jorgensen, 2011, 2013)

Summary of our results

- **Twofold finding** :
  - Economically meaningful impact on a broad set of market segments, with effects rising with maturity and riskiness
  - Low financial distress weakens local supply channel (“narrow channels”), but …
    … it reinforces “broad channels” by interplaying with the composition of the APP:
    - targeting long maturity and investment-grade space -> “duration” and “credit risk”
    - spill-overs to non-targeted assets

- **Rationalising the evidence from the literature:**
  - High financial distress, large segmentation, strong impact on targeted assets, but …
  - … because of segmentation, small spill-overs across market segments (“narrow channels”)

A model with bond supply effects (no credit risk)

➢ **Arbitrageurs' problem:**

$$\text{Max}\left\{ E_t R^P_{(t,t+1)} - \frac{1}{2}\sigma Var_t R^P_{(t,t+1)} \right\}$$

where

- $R^P_{(t,t+1)} = \left(\omega_t^{(1)} \left(\frac{P_{t+1}^{(0)}}{P_t^{(1)}} \right) + \omega_t^{(2)} \left(\frac{P_{t+1}^{(1)}}{P_t^{(2)}} \right) + \cdots + \right)$
- σ: risk aversion

- **Conjectured equation for (log) bond prices**

$$p_t^{(n)} = -a_n - b_n' X_t \qquad y_t^{(n)} = -p_t^{(n)}/n$$

- **Macroeconomic factors VAR process**

$$X_{t+1} = \mu + \Phi X_t + \varepsilon_t \quad \varepsilon_t \sim N(0, \Sigma)$$

➢ **Arbitrageurs' FOCs:**

$$\underbrace{E\{R^{(n)}\}}_{\text{expected returns of bonds}} - r = \underbrace{b_{n-1}}_{\text{q of risk}} \underbrace{\Sigma\lambda}_{\text{p of risk}}$$

A model with bond supply effects (no credit risk)

➢ Arbitrageurs

$$\lambda \equiv \sigma\left(\omega^{(2)} b_1 + \omega^{(3)} b_2 + \cdots\right)$$

bond demand $\omega^{(n)}$ = bond supply $S^{(n)}$

$$\lambda \equiv \sigma\left(S^{(2)} b_1 + S^{(3)} b_2 + \cdots\right)$$

- σ: risk aversion
- $\omega^{(n)}$: holding of bonds with maturity *n*
- b_i: sensitivity of bond price to interest rate (rises with maturity *n)*

- is affected by changes in bond supply (bond purchases) …
- … in particular by those at long maturities

➢ Preferred-habitat investors

$$\xi_t^{(n)} = \varphi(y_t^{(n)} - \beta^{(n)})$$

- **Implications for bond market equilibrium and price of risk**

$$\omega^{(n)} = (S^{(n)} - \xi^{(n)}) \longrightarrow \lambda \equiv \sigma\left((S^{(2)} - \xi^{(2)})\, b_1 + (S^{(3)} - \xi^{(3)})\, b_2 + \cdots\right)$$

Extending the model with bond supply effects to credit risk

- **Zero-coupon bonds are subject to default**

$$\bar{P}_{t+1}^{(0)} = \begin{cases} 1 & with\ prob\ \exp(-\psi_{t+1}) \\ 0 & with\ prob\ 1-\exp(-\psi_{t+1}) \end{cases}$$

- **Default intensity is assumed function of macroeconomic factors:**

$$\psi_{t+1} = \gamma X_{t+1}$$

$\gamma = 0$ leads to Vayanos and Vila (2009)

  - ✓ **expected payoff**
  - ✓ **risk compensation because more uncertain bond prices**

- **Solution for pricing coefficients: akin to affine term structure models, where**

$$\lambda(\gamma) \equiv \sigma\left(S^{(2)}(\bar{b}_1(\gamma)+\gamma) + S^{(3)}(\bar{b}_2(\gamma)+\gamma) + \cdots\right)$$

Extending the model with bond supply effects to credit risk

- **Long-term bond yields:**

$$y_t^{(n)} = \frac{1}{n} E_t\{(r_t + r_{t+1} + \cdots) + \ \ldots$$

expected future short-term rates (signaling channel)

$$\ldots (\gamma(\mu + \Phi X_t) + \gamma(\mu + \Phi X_{t+1}) + \cdots) +$$

compensation for credit risk irrespective of risk aversion

$$\ldots (\bar{b}_{n-1}(\gamma) + \gamma)\Sigma\lambda_t(\gamma) + (\bar{b}_{n-2}(\gamma) + \gamma)\Sigma\lambda_{t+1}(\gamma)\}$$

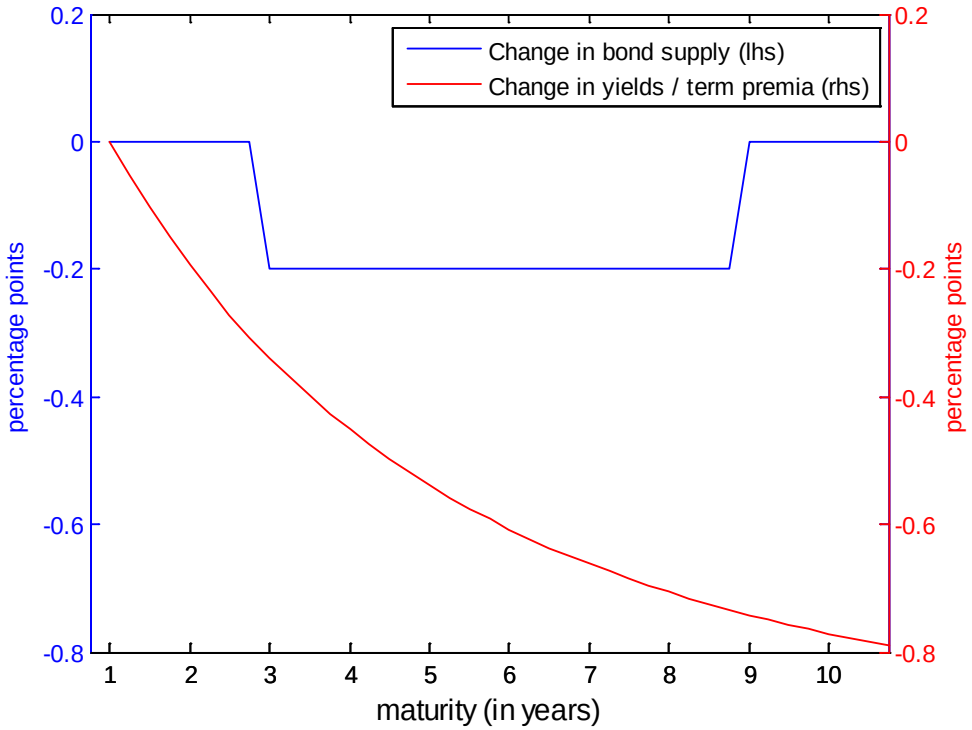
additional compensation demanded by risk-averse arbitrageurs:

- term premia
- credit risk

- $\lambda_{t+j} = \sigma\left(S_{t+j}^{(2)}(\bar{b}_1(\gamma) + \gamma) + S_{t+j}^{(3)}(\bar{b}_2(\gamma) + \gamma) + \cdots\right)$

“Stock effects” of asset purchases

“Shock”: Anticipated reduction in future bond supply S^n_{t+j}



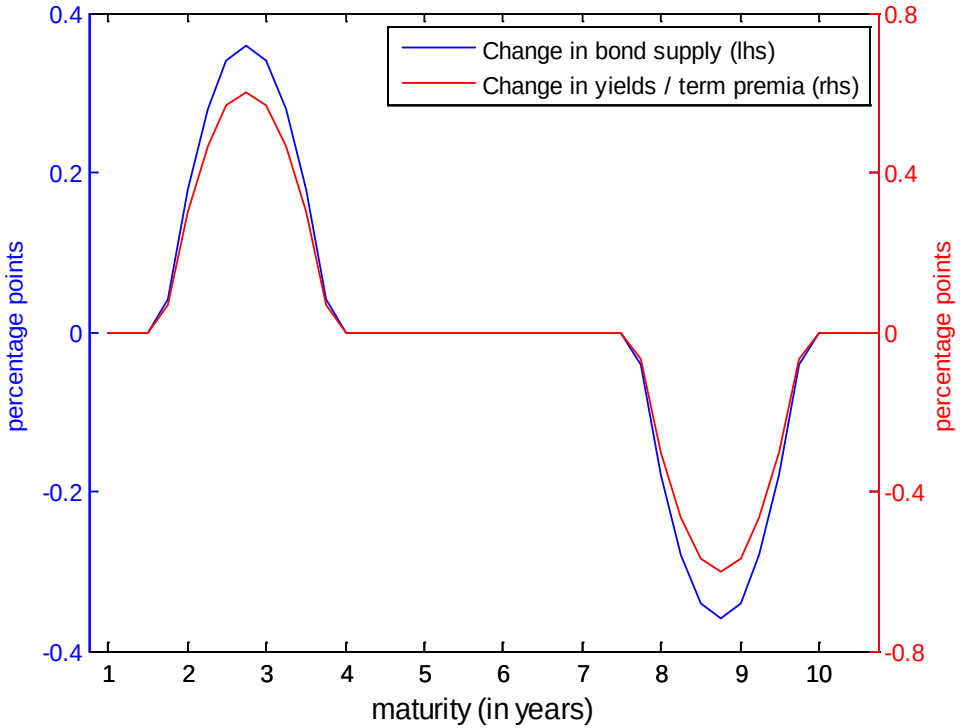
Model prediction:

Expected future withdraws of bond supply affect bond yield today (“stock effects”)

Transmission channels: “Local supply / scarcity channel”

“Shock”: Reduction in the maturity structure of bond supply

- $\gamma = 0$ $\longrightarrow$ *shutting down credit risk channel*
- *Arbitrary large risk aversion* σ $\longrightarrow$ *shutting down arbitrageurs (high-segmentation case)*



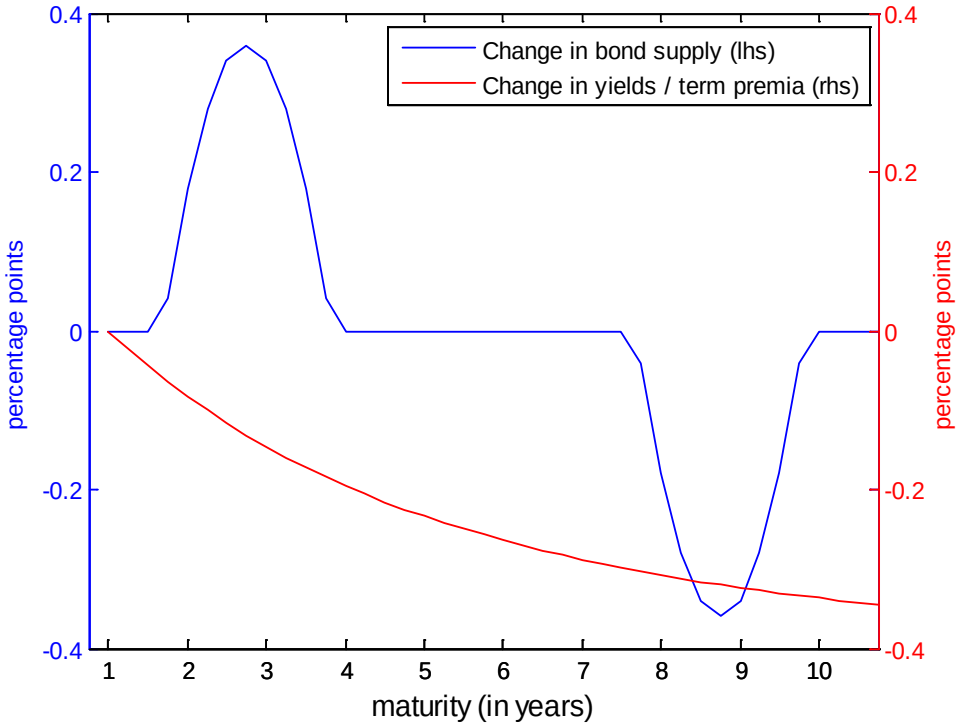
Model prediction:

- ***impact on targeted maturity segments***
- ***limited spill-overs to non-targeted segments***

Transmission channels: “Duration channel”

“Shock”: Reduction in the maturity structure of bond supply

- $\gamma = 0 \longrightarrow$ *shutting down credit risk channel*
- *“low” risk aversion* σ



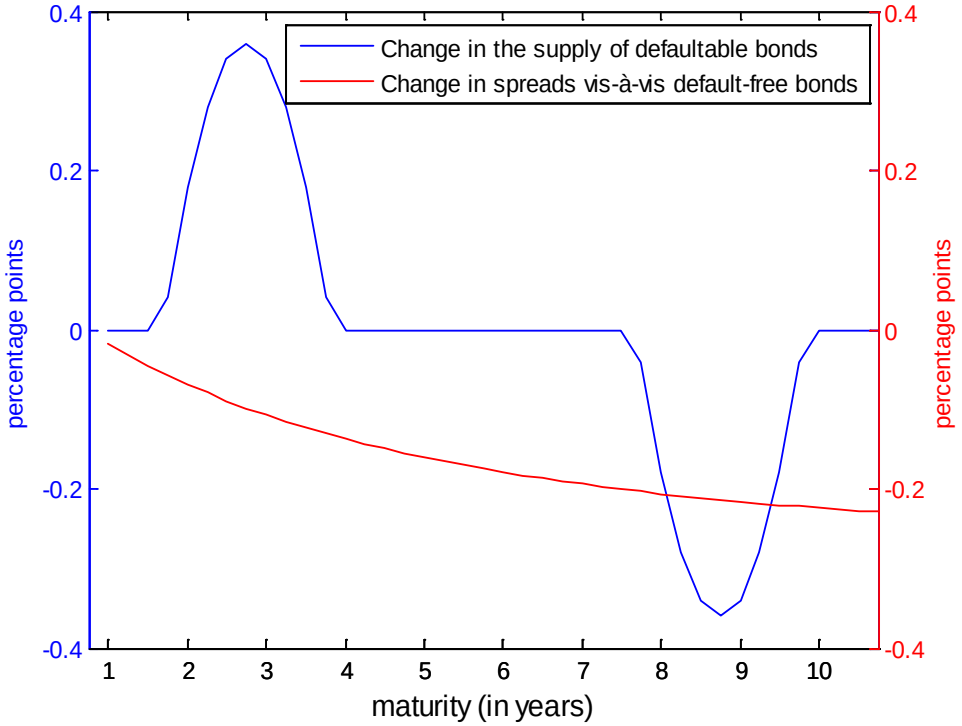
Model prediction:

- ***compression of term premia in targeted segments***
- ***spill-overs across maturity segments; the effects raise with the term to maturity***

Transmission channels: “Credit risk channel”

“Shock”: Reduction in the maturity structure of bond supply

- $\gamma > 0 \longrightarrow$ *credit risk channel*
- *“low” risk aversion* σ

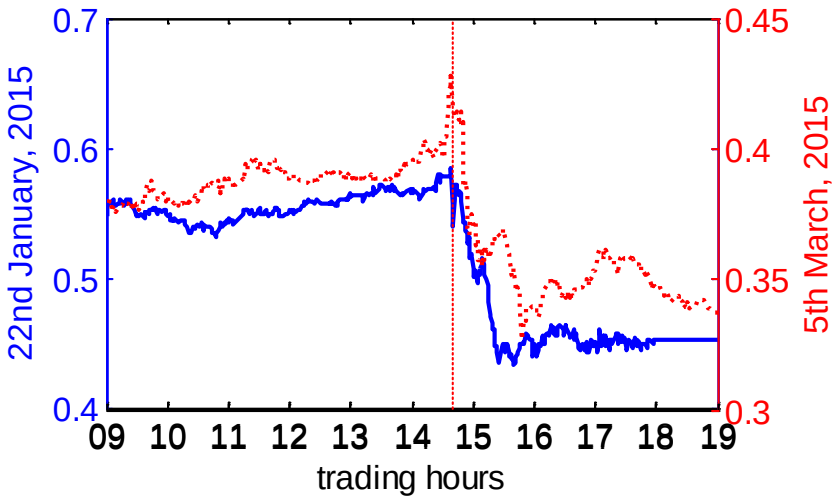


Model prediction:

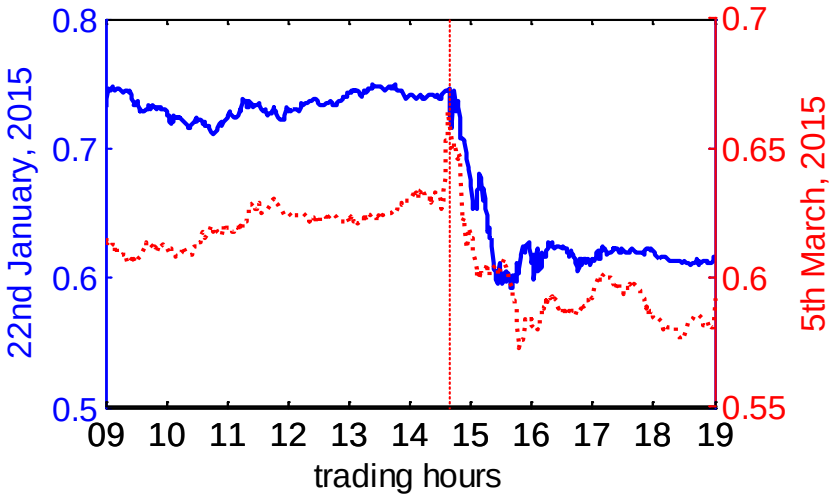
- ***compression of credit risk premia in targeted segments***
- ***spill-overs across market segments***

Empirical framework: policy announcement (intraday data, 10-year yields)

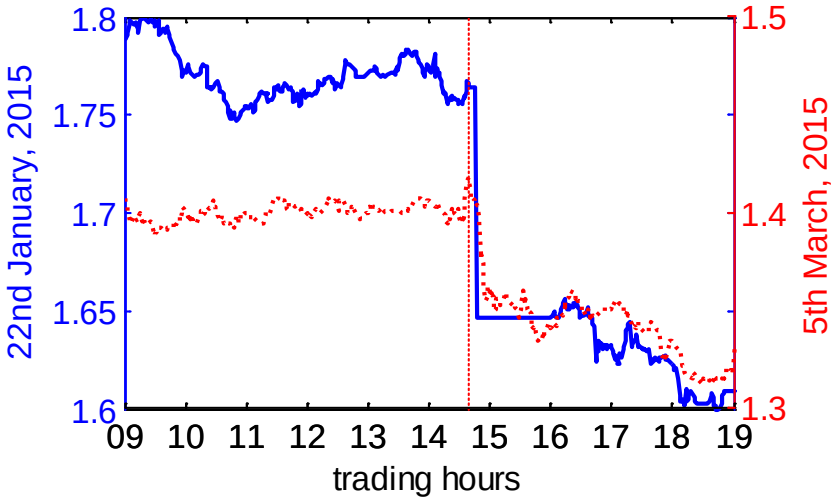
Germany



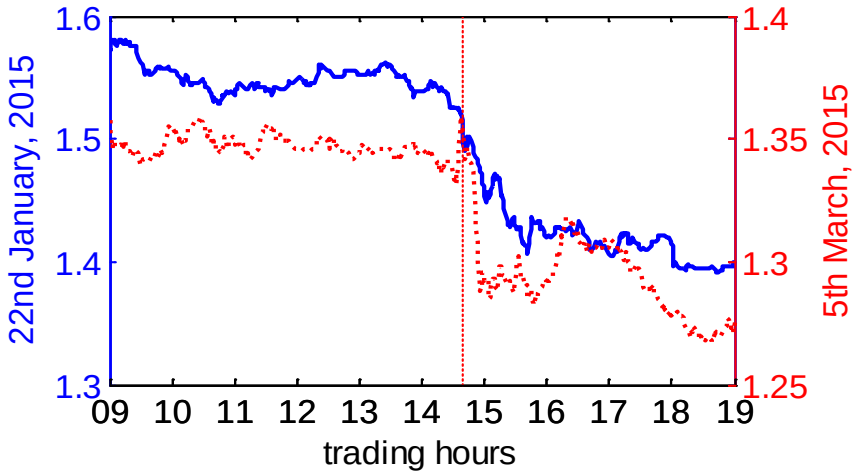
France



Italy



Spain



Challenge: APP was largely anticipated

FINANCIAL TIMES

20 September/21 September 2014

Analysis. Capital markets

Weak ECB loan take-up paves way for QE

FINANCIAL TIMES

Thursday 27 November 2014

Global overview

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

The Economist

Jan 3rd 2015 | From the print edition

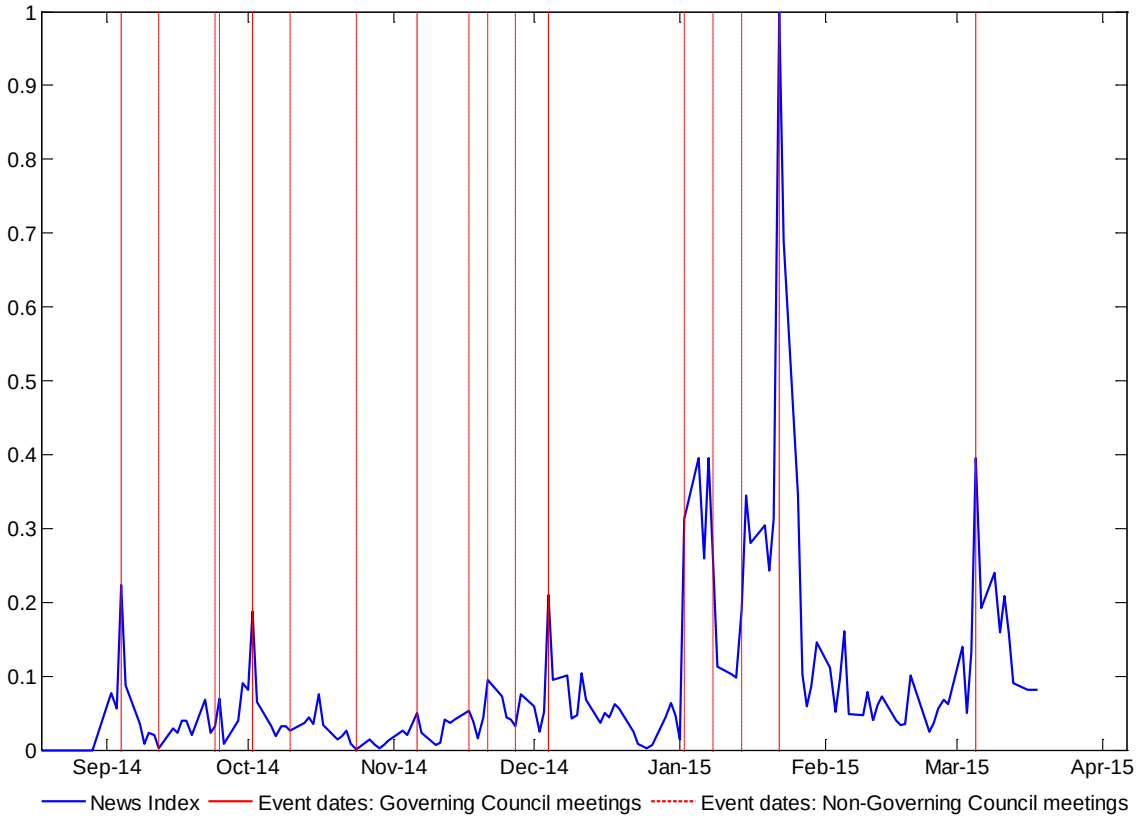
Euro-zone quantitative easing

Coming soon?

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

Identifying the events

- ✓ **A "narrative approach": GC meetings and official communication by ECB**
  - ✓ **Cross-check with an "agnostic" approach based on an index of intensity of news (Factiva)**



Note: The figure reports for News Index computed from Factiva. The query is set so that for an article to be included in our sample it should simultaneously contains at least one word coming from two different sets. The first set is "ECB", "European Central Bank", and "Draghi". The second set is "QE", "quantitative easing", "asset purchase", and "APP". The vertical red solid lines represent the date of the ECB's Governing Council meetings, i.e. September, 04 2014; October, 02 2014; November, 06 2014; December, 04 2014; January, 22 2015; and March, 05 2015. The vertical red dashed lines represent the non-Governing Council events.

A Controlled Event Study

$$\Delta y_t = \sum_{j=1}^{k} \alpha_j D_{j,t} + \sum_{j=1}^{k} \beta_j D_{j,t-1} + \sum_{s=1}^{m} \gamma_s News_{s,t} + \varepsilon_t$$

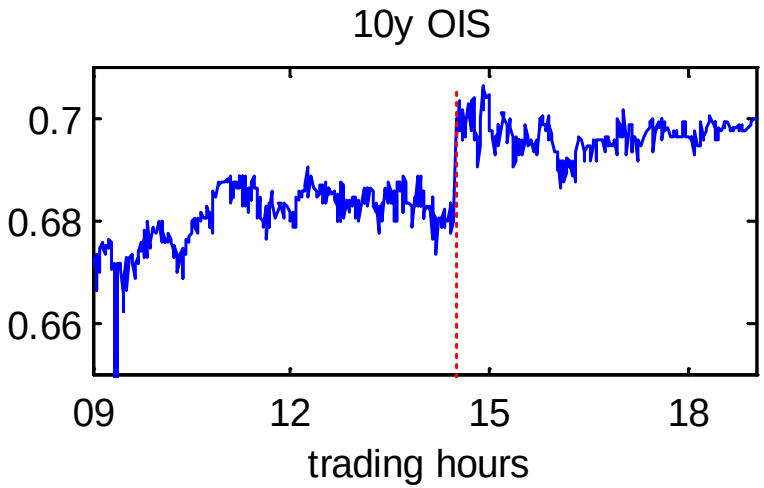
Δy_t	Daily change in yields for a given asset y
$D_{j,t}$	1 if t ϵ Event Set (k=17) 0 otherwise
News	Surpirse component of macro release (m=40)

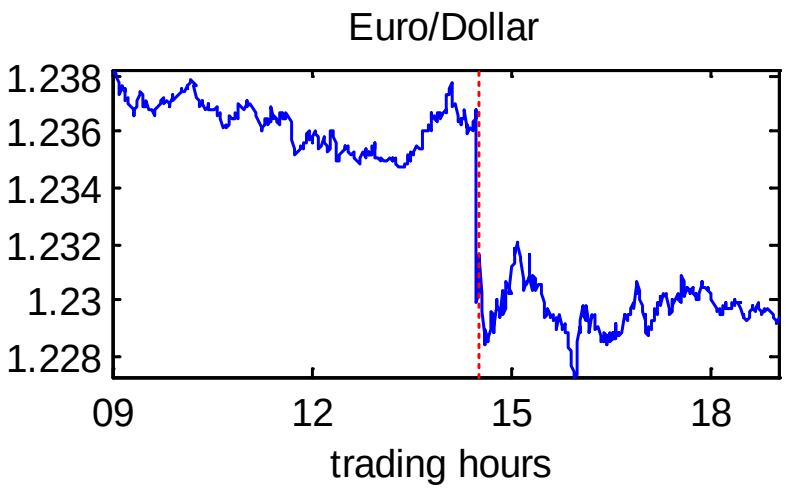
Altavilla, C. and Giannone, D., (2014), "The Effectiveness of Non-Standard Monetary Policy Measures: Evidence from Survey Data", CEPR Discussion Papers 10001, C.E.P.R. Discussion Papers.

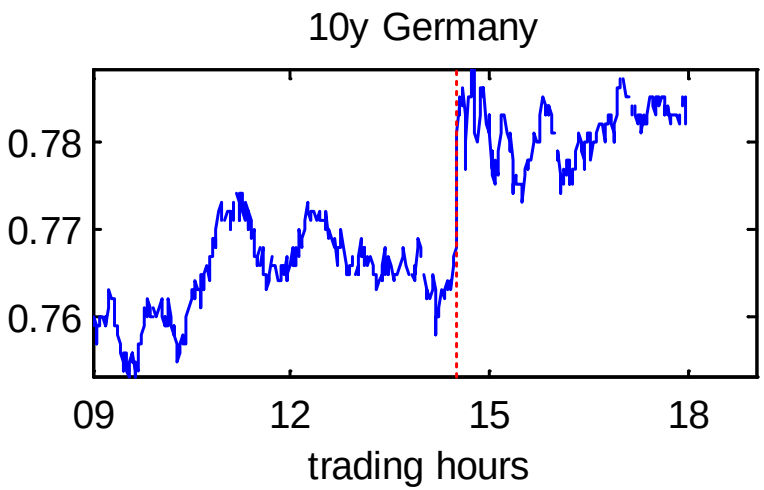
Why controlling for News is important?

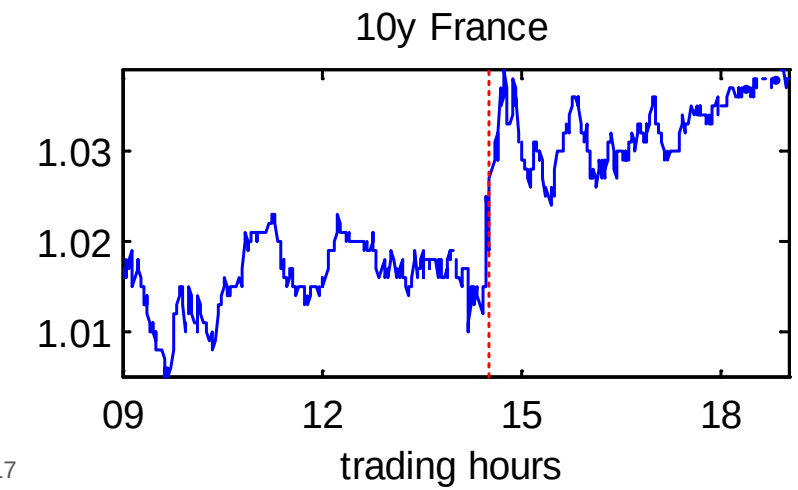
Dec. 5, 2014: Positive surprise in the US Empoyment report released at 14.30

Release	Expected	Actual
NonF Payroll	230E+3	321E+3









Estimating “stock effects” of the APP on targeted assets

Changes in sovereign bond yields of selected euro area economies around the APP event dates *(basis points)*

	5-year maturity					*10-year maturity*					*20-year maturity*				
	Euro Area	*Germany*	*France*	*Italy*	*Spain*	*Euro Area*	*Germany*	*France*	*Italy*	*Spain*	*Euro Area*	*Germany*	*France*	*Italy*	*Spain*
Controlled event study															
1-day	-30*	2	-21	-60***	-67***	-29*	-17	-30*	-75***	-80***	-22	-13	-28*	-72***	-78***
2-day	-33**	2	-21*	-27***	-44***	-47*	-18*	-27*	-60***	-65***	-54**	-30*	-38**	-71***	-79***
Standard event study															
1-day	-27*	1	-21	-63***	-65***	-24*	-16*	-30*	-79***	-78***	-17**	-14*	-29*	-70***	-68***
2-day	-36**	-3	-26*	-42***	-49***	-48*	-23*	-36**	-72***	-69***	-56***	-37*	-50**	-78***	-77***

- **Economically meaningful impact, rising with maturity, and more pronounced for high-yield countries**

Asterisks denote statistical significance at the *** 1 percent level, ** 5 percent level, * 10 percent level.

Signaling channel

Prediction: The APP lowers expected future short-term risk-free interest rates, with largest effects intermediate maturities

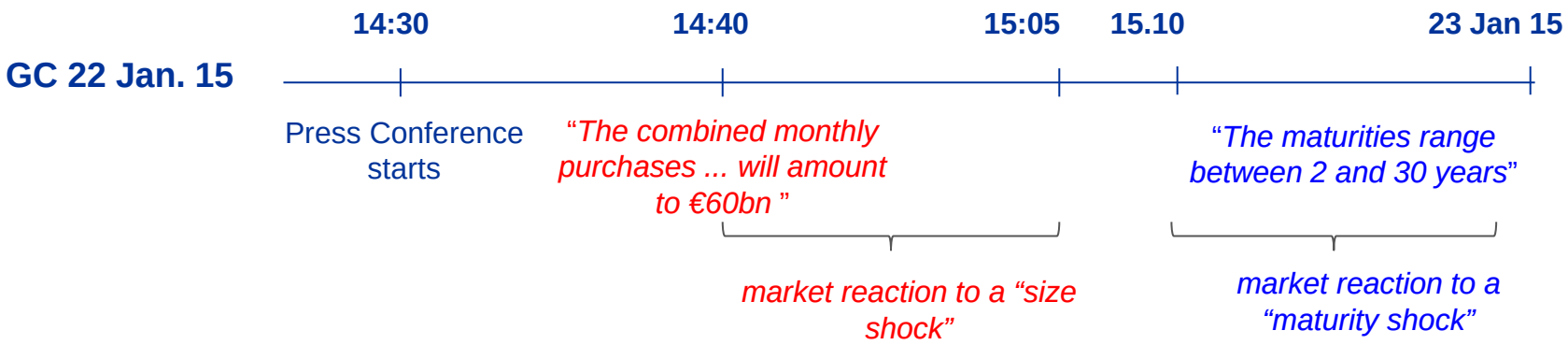
Changes in OIS forward rates around the APP announcement dates (basis points)

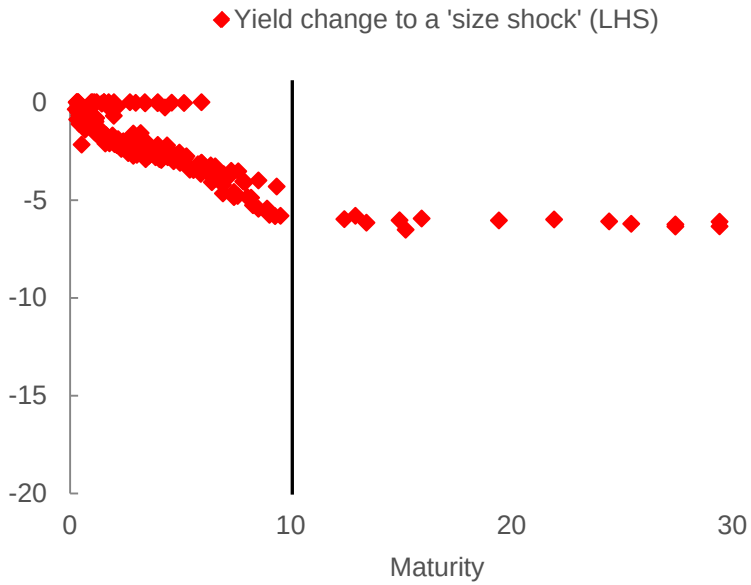
	3-month OIS forward rates, term to maturity			
Date	*1y*	*2y*	*3y*	*4y*
Controlled event study				
1-day change	-9	-3	2	2
2-day change	-1	-11	-5	1
Standard event study				
1-day change	-11	-4	1	0
2-day change	-3	-12	-9	-4

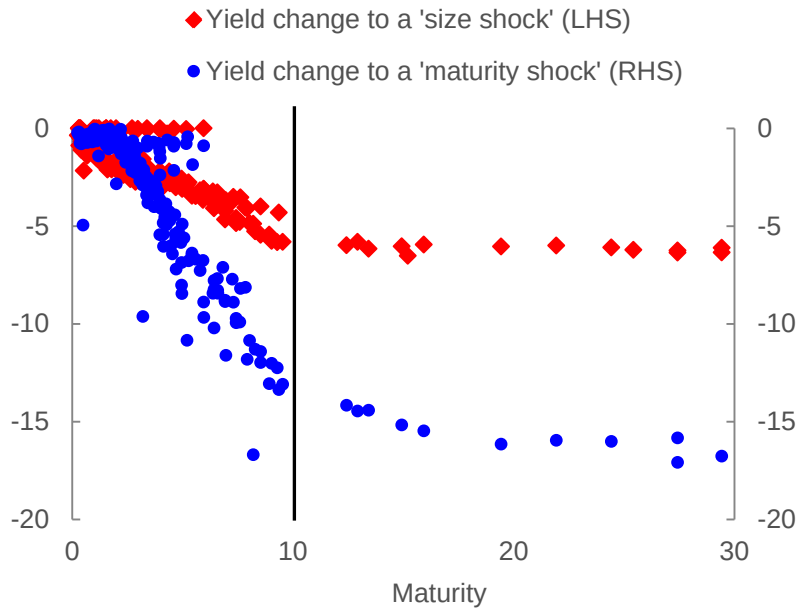
- **Some impact via the signaling channel (two-day window)**

Local supply / Scarcity channel (preference for liquid safe assets – i.e. Bunds)

Prediction: limited impact on Bunds for maturities >10y prior to the final announcement (markets expected no purchases above that maturity)







Duration risk channel (liquid safe assets – i.e. Bunds)

Prediction: the APP lowers long-term yields of the risk-free asset

Changes in Bund yields around the APP announcement dates (basis points)

	maturity				
Date	*1y*	*3y*	*5y*	*10y*	*20y*
Controlled event study					
1-day change	-8	-5	2	-17	-13
2-day change	-10	-3	2	-18	-30
Standard event study					
1-day change	-8	-6	1	-16	-14
2-day change	-13	-5	-3	-23	-37

➢ **Meaningful impact via a narrowly defined duration channel**

Duration risk channel

Broadly defined: wider spectrum of long-term securities

Prediction: the APP lowers long-term yields of a broad spectrum of risk-free assets

Changes in sovereign (CDS-adjusted) yields in larger euro area economies at 10-year maturity (basis points)

	10-year maturity			
Date	*Germany*	*France (CDS adjusted)*	*Italy (CDS adjusted)*	*Spain (CDS adjusted)*
Controlled event study				
1-day change	-17	-25	-33	-44
2-day change	-18	-17	19	-8
Standard event study				
1-day change	-16	-23	-33	-43
2-day change	-23	-20	9	-12

➢ **Also evidence of broadly defined duration channel**

Credit risk channel

Prediction: the APP compresses credit premia of targeted assets

Changes in the spreads of sovereign bonds around APP event dates (basis points)

	Sovereign bonds spreads					
	5-year maturity			*10-year maturity*		
Date	*France*	*Italy*	*Spain*	*France*	*Italy*	*Spain*
Controlled event study						
1-day change	-17	-62	-40	-13	-58	-56
2-day change	-17	-29	-44	-9	-42	-53
Standard event study						
1-day change	-22	-64	-36	-13	-63	-54
2-day change	-23	-40	-48	-13	-50	-56

- **Sizeable impact targeted assets via credit premia channel**

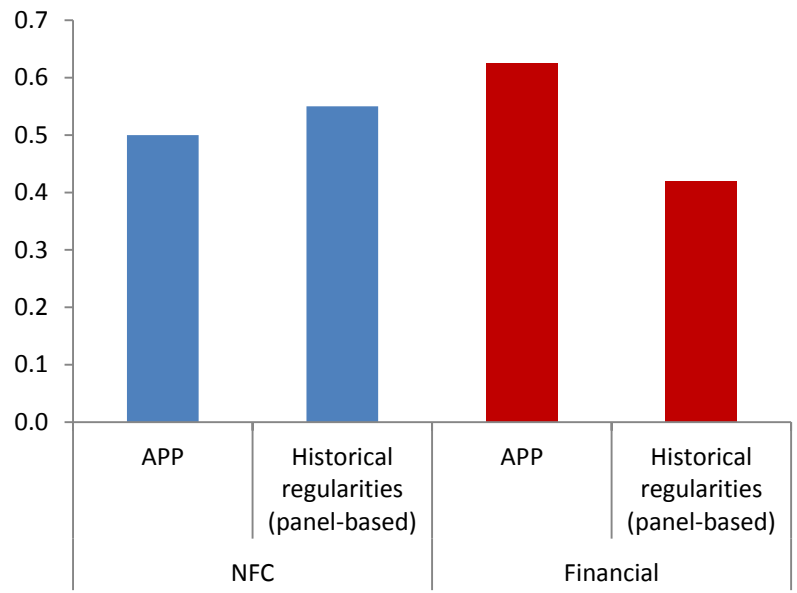
Credit risk channel

Prediction: The APP compresses credit premia of non-targeted assets

Changes in euro area spreads of sovereign and corporate bonds around APP event dates (basis points)

Date	*Sovereign bonds spreads*	*Corporate bond spreads*	
		Financial	*Non-financial*
Controlled event study			
1-day change	-32	-20	-16
2-day change	-35	-27	-22
Standard event study			
1-day change	-28	-19	-9
2-day change	-34	-28	-15

Spill-over intensity sovereign-to-corporate bond spreads for the euro area



➢ **Important spillovers from sovereign to corporate spreads**

Conclusions

- **We evaluate the effects of the APP on financial markets and assess channels of transmission**
  - by extending a model with bond supply effects to account for different types of risk premia
  - by validating the model-based predictions using a refined event-study methodology

- **Twofold finding:**
  - Economically meaningful impact on a broad set of market segments, with effects rising with maturity and riskiness
  - Low financial distress weakens local supply channel (“narrow channels”), but …

    … reinforces “broad channels” by interplaying with the composition of the APP:

    - targeting long maturity and investment-grade space -> “duration” and “credit risk” channels
    - spill-overs to non-targeted assets