A high frequency assessment of the ECB Securities Markets Programme

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The opinions are those of the authors and do not necessarily reflect those of the Eurosystem

The Securities Market Programme

- The SMP was announced on 10 May 2010 together with other measures to address severe tensions in financial markets.

- The ECB could *"conduct interventions in the euro area public and private debt securities markets to ensure depth and liquidity in those segments which are dysfunctional"*.

- The objective of the programme is *"to address the malfunctioning of securities markets and restore an appropriate monetary policy transmission mechanism"*.

Eurosystem's SMP holdings as at 31 December 2012

Issuer country	Outstanding amounts		Average remaining maturity (in years)
	Nominal amount (EUR billion)	Book value [1] (EUR billion)	
Ireland	14.2	13.6	4.6
Greece	33.9	30.8	3.6
Spain	44.3	43.7	4.1
Italy	102.8	99.0	4.5
Portugal	22.8	21.6	3.9
Total	**218.0**	**208.7**	**4.3**

Source: ECB website, http://www.ecb.europa.eu/press/pr/date/2013/html/pr130221_1.en.html

Challenges in assessing the impact of SMP

- Obvious impact on yields of announcement of SMP.

- Impact on following months more difficult to assess.

  - If Eurosystem interventions triggered by strong price deteriorations, estimates of daily impact of SMP purchases on yield changes will be biased upwards.

- Simple regressions of daily changes in yields on daily purchases often give insignificant or even positive coefficients.

→ *It would be unwarranted to conclude from this evidence that SMP purchases have been ineffective.*

→ *Zero correlations at daily frequencies are perfectly compatible with negative correlations at intraday frequency.*
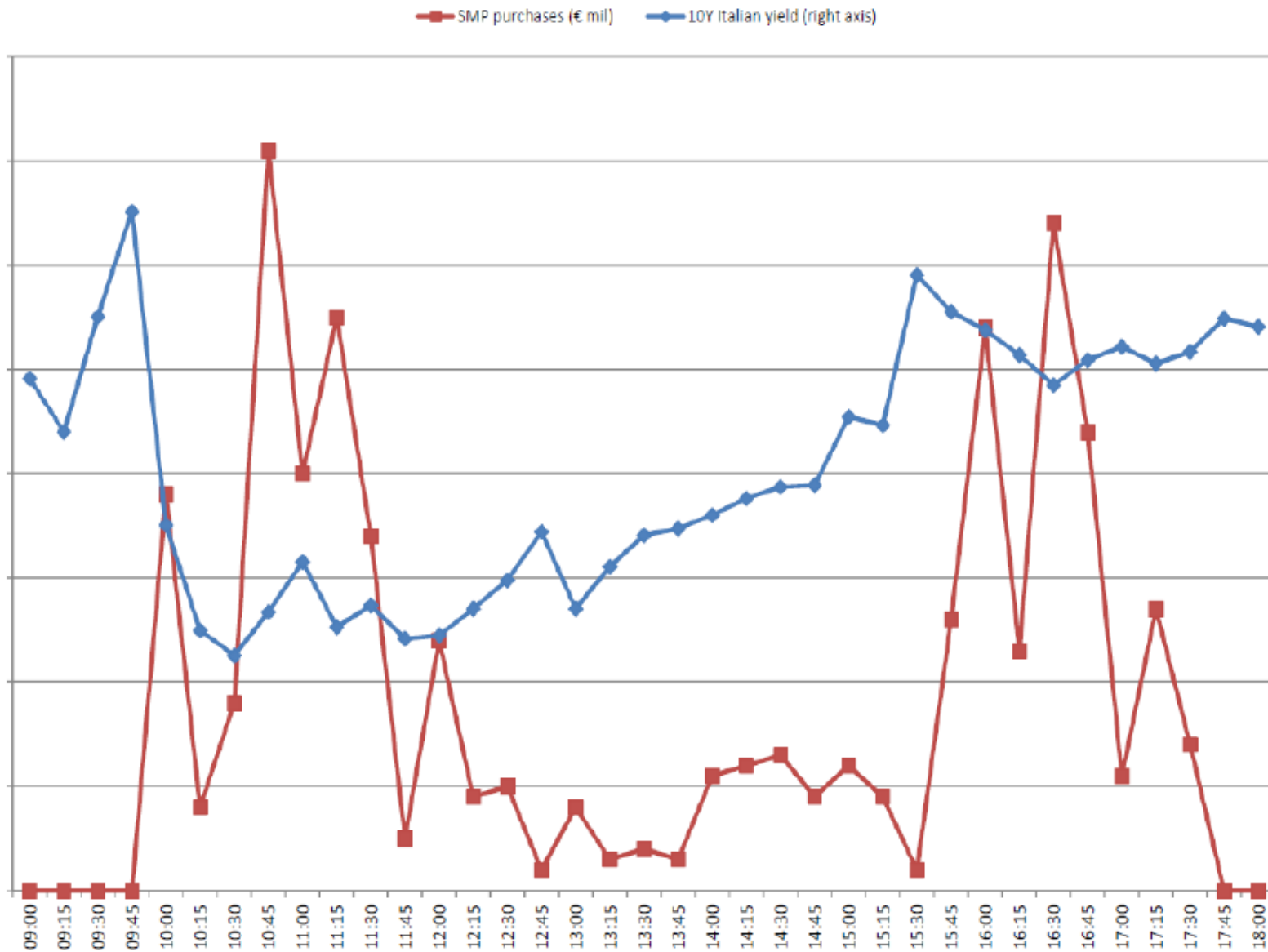
Descriptive statistics of changes in yields

		Non-intervention			Intervention
		all	pre-crisis	crisis	
ES	mean	**0**	-0.4	0.3	**2.3**
	median	0.2	-0.2	0.7	2.2
GR	mean	**9.1**	0.4	18.8	**5.9**
	median	0.8	0.1	4	3.6
IE	mean	**0.4**	-0.2	1.1	**2.7**
	median	-0.1	-0.2	0.4	4.1
IT	mean	**-0.1**	-0.5	0.3	**4.7**
	median	0	-0.4	0.7	1.3
PT	mean	**1.7**	-0.3	4.4	**2.5**
	median	0.2	-0.4	3.2	4.8

Changes in yields for 5-year maturities measured in basis points
Pre-debt crisis: 1 Oct 08 to 31 Mar 10; Debt crisis: 1 Apr 10 - 20 Dec 11.
Source: Eser and Schwaab (2012)

Outline

- Endogeneity issues

- Econometric model

- Empirical results

- Conclusion

Endogeneity

ECB purchases

$$\Delta y_t^i = c^i + s_t^i + \delta^i SMP_t^i + \varepsilon_t^i$$

News hitting the market

$$SMP_t^i = f(s_t^i)$$

Purchases are correlated with negative news: ECB buys in days of greater market pressure

$$\Delta y_t^i = \widetilde{c}^i + \widetilde{\delta}^i SMP_t^i + u_t^i \qquad u_t^i \equiv s_t^i + \varepsilon_t^i$$

→ If latent variable is omitted, there is an omitted variable bias (the error is correlated with the regressor)

Solution 1: Estimate unobserved component

$$\Delta y_t^i = c^i + s_t^i + \delta^i SMP_t^i + \varepsilon_t^i$$

- Recognize that s_t is an 'unobserved component'
- Estimate it via the Kalman Filter
- Use both observed and unobserved factors

- Eser and Schwaab (2012)

Solution 2: Go high frequency

$$\Delta y_t^i = c^i + s_t^i + \delta^i SMP_t^i + \varepsilon_t^i$$

- As data is sampled at higher frequency, the impact of unobserved shocks becomes less severe.

Data

- Data on SMP purchases from Eurosystem.

- Data matched with intraday data on government bond yield from Thomson Reuters Tick Capture Engine.

- Benchmark bonds for 2, 5, and 10-year maturities at 15 minutes frequency between 8am and 6pm.

- Look at bid side of the market, to measure the impact of SMP on willingness of banks to buy government bonds.

- However, similar results when looking at mid-quotes.

Basic model

$$\Delta y_t^i = c^i + \gamma^i \Delta y_{t-1}^i + \sum_{k=0}^{3} \delta_k^i SMP_{t-k}^i$$

Specifics of the model are more involved, as it accounts for:
- Lower frequency daily dynamics
- Intraday seasonality patterns
- Dynamics of volatility

First moments

$$\Delta y_{i,t} = \frac{1}{N}\eta_t + \phi_i + \mu_{i,t} + \sqrt{\sigma_t^2 \cdot d_i^2 \cdot g_{i,t}} \cdot \varepsilon_{i,t}$$

Daily component:

$$\Delta y_t = \omega_1 + \sum_{p=1}^{P_1} \beta_p \Delta y_{t-p} + \sum_{j=0}^{J_1} \left[\gamma_{1,j} \sum_{i=1}^{N} SMP_{i,t-j} \right] + u_t = \eta_t + u_t,$$

Intraday seasonality:

$$\phi_i = \frac{1}{T} \sum_{t=1}^{T} \left[\Delta y_{i,t} - \frac{1}{N}\eta_t \right]$$

Intraday component:

$$x_{i,t} = \omega_2 + \sum_{p=1}^{P_2} \alpha_p x_{i-p,t} + \sum_{j=0}^{J_2} \left[\gamma_{2,j} SMP_{i,t-j} \right] + \nu_{i,t} = \mu_{i,t} + \nu_{i,t},$$

Second moments

$$\Delta y_{i,t} = \frac{1}{N}\eta_t + \phi_i + \mu_{i,t} + \sqrt{\sigma_t^2 \cdot d_i^2 \cdot g_{i,t}} \cdot \varepsilon_{i,t}$$

Daily component:

$$\sigma_t^2 = w_1 + a_1 u_{t-1}^2 + b_1 \sigma_{t-1}^2 + \sum_{j=1}^{J_1}\left[\gamma_{3,j}u_{t-j}^2 I(SMP_{t-j} > 0)\right]$$

Intraday seasonality:

$$d_i^2 = 1/T \sum_{t=1}^{T} \frac{\nu_{i,t}^2}{\sigma_t^2}.$$

Intraday component:

$$g_{i,t} = (1 - a_2 - b_2) + a_2\left[\frac{\nu_{i,t-1}}{d_i\sigma_t}\right]^2 + b_2 g_{i-1,t} + \sum_{j=1}^{J_2}\left[\gamma_{4,j}\left[\frac{\nu_{i,t-j}}{d_i\sigma_t}\right]^2 I(SMP_{i,t-j} > 0)\right]$$

# Daily estimates – Full sample

	SMP1			SMP2			
	PT	IE	GR	PT	IE	ES	IT
2-year Bonds							
Impact on 1st moment	-0.20	1.96*	0.42	-2.75	-90.3***	0.26	0.24*
	-0.25	1.67	0.54	-0.21	-5.60	0.98	1.78
Impact on 2nd moment	-223.59***	-38.11*	-450.14***	306.13	95.47	23.62	46.58*
	-5.27	-1.71	-4.65	1.65	0.83	1.61	1.73
5-year Bonds							
Impact on 1st moment	-0.62	0.50	0.62	-14.9	-32.7***	0.2	0.15
	-0.97	0.58	1.36	-1.35	-4.63	0.84	1.53
Impact on 2nd moment	-40.99**	4.30	-57.81	370.97*	211.59*	11.30	43.76*
	-12.09	0.91	-1.36	1.77	1.75	1.46	1.83
10-year Bonds							
Impact on 1st moment	-0.29	0.12	0.17	-4.31	-16.8***	0.10	0.055
	-0.59	0.19	0.54	-0.95	-6.06	0.50	0.64
Impact on 2nd moment	-8.47*	0.45	-57.06	-3.14	-25.59	17.39	29.26
	-1.69	0.10	-1.33	-0.15	-0.35	1.17	1.53

Intradaily estimates – Full sample

|	SMP1			SMP2			
	PT	IE	GR	PT	IE	ES	IT
2-year Bonds							
Impact on 1st moment	-2.76***	-1.33***	-1.22	-8.08*	-29.60***	-0.19	-0.13
	-3.36	-2.40	-1.20	-1.90	-2.98	-1.05	-1.53
Impact on 2nd moment	-0.47***	0.03***	-0.01***	-0.17***	-0.10***	0.03***	-0.01
	-38.3	7.24	-15.48	-10.2	-5.83	2.34	-0.906179
5-year Bonds							
Impact on 1st moment	-2.24***	-1.67***	-0.32	-11.70*	-27.90***	-0.29***	-0.079
	-4.05	-2.10	-0.59	-1.88	-3.47	-2.25	-1.28
Impact on 2nd moment	-0.12***	-0.049***	0.20***	0.12***	-0.17***	0.11***	-0.01***
	-44.26	-27.89	35.72	11.4	-7.22	8.12	-2.36
10-year Bonds							
Impact on 1st moment	-1.49***	-1.34***	-0.168	-5.20**	-8.2***	-0.30***	-0.08*
	-4.28	-2.46	-0.41	-2.07	-6.33	-3.20	-1.77
Impact on 2nd moment	-0.47***	-0.094***	-0.15***	-0.11***	-0.17**	0.07***	-0.03***
	-23.81	-20.86	-31.8	-15.72	-2.07	7.94	-15.1

Long term impact of EUR 100 ml – 2 year
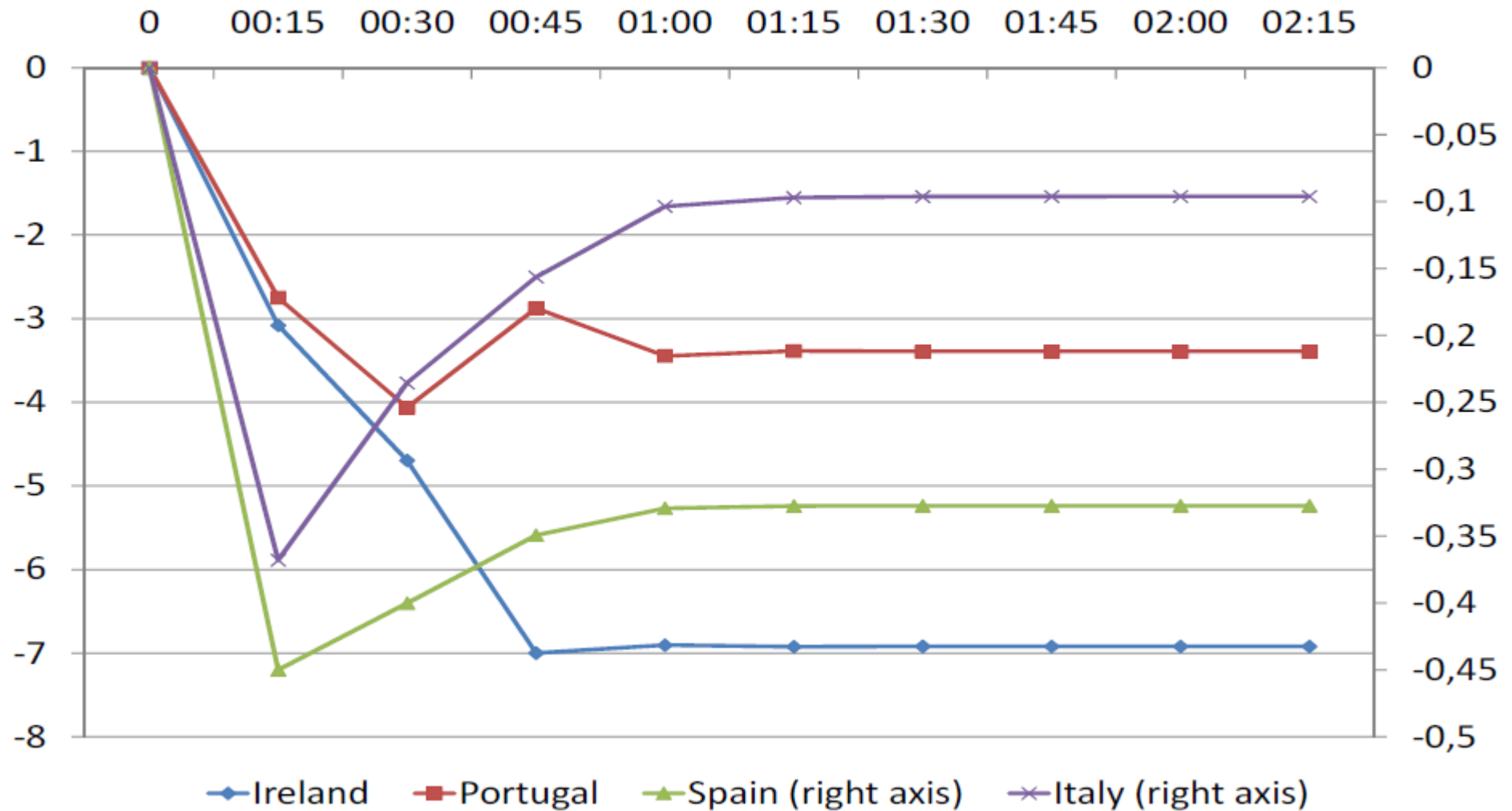
Long term impact of EUR 100 ml – 5 year
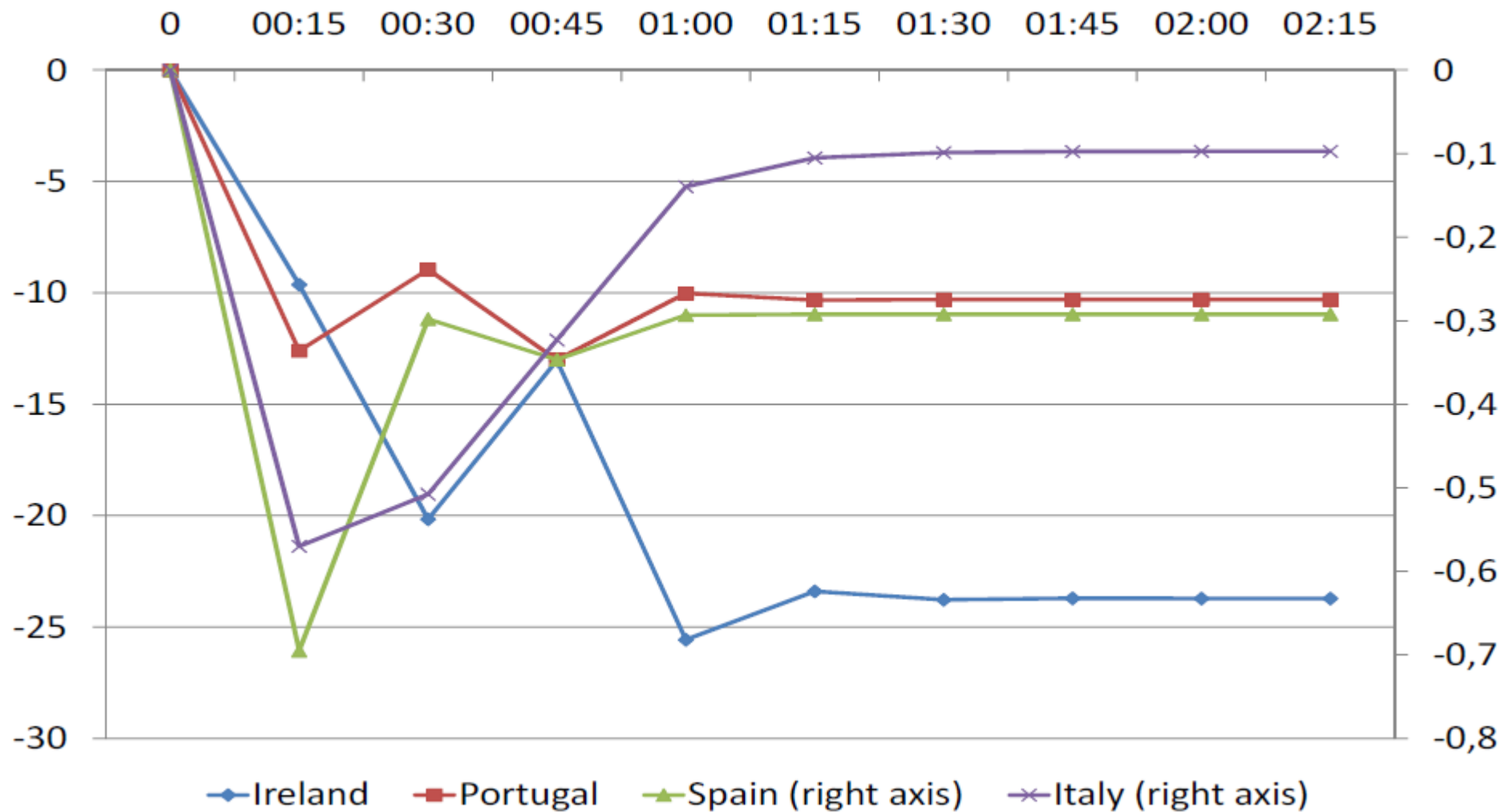
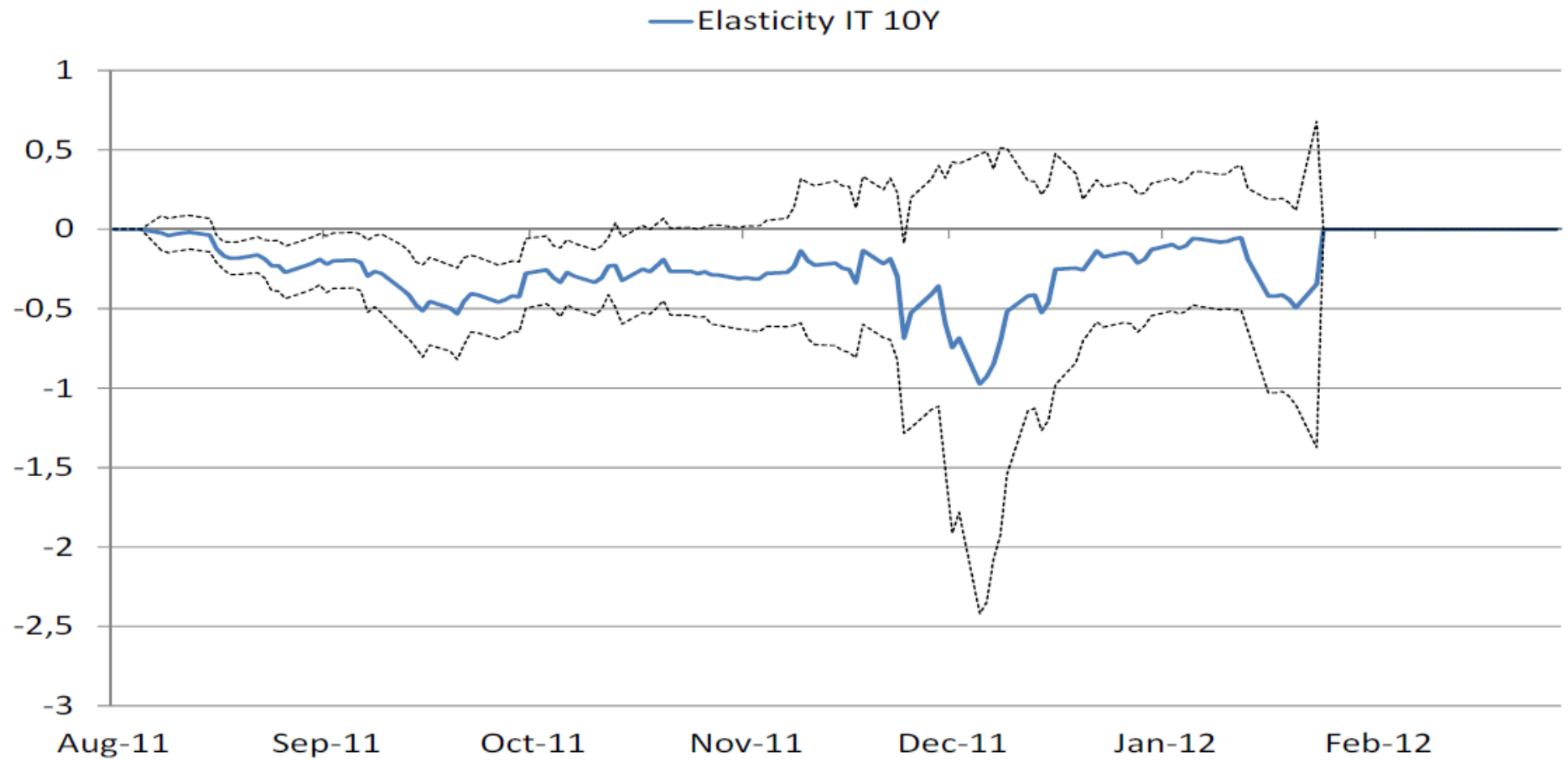# Long term impact of EUR 100 ml –10 year
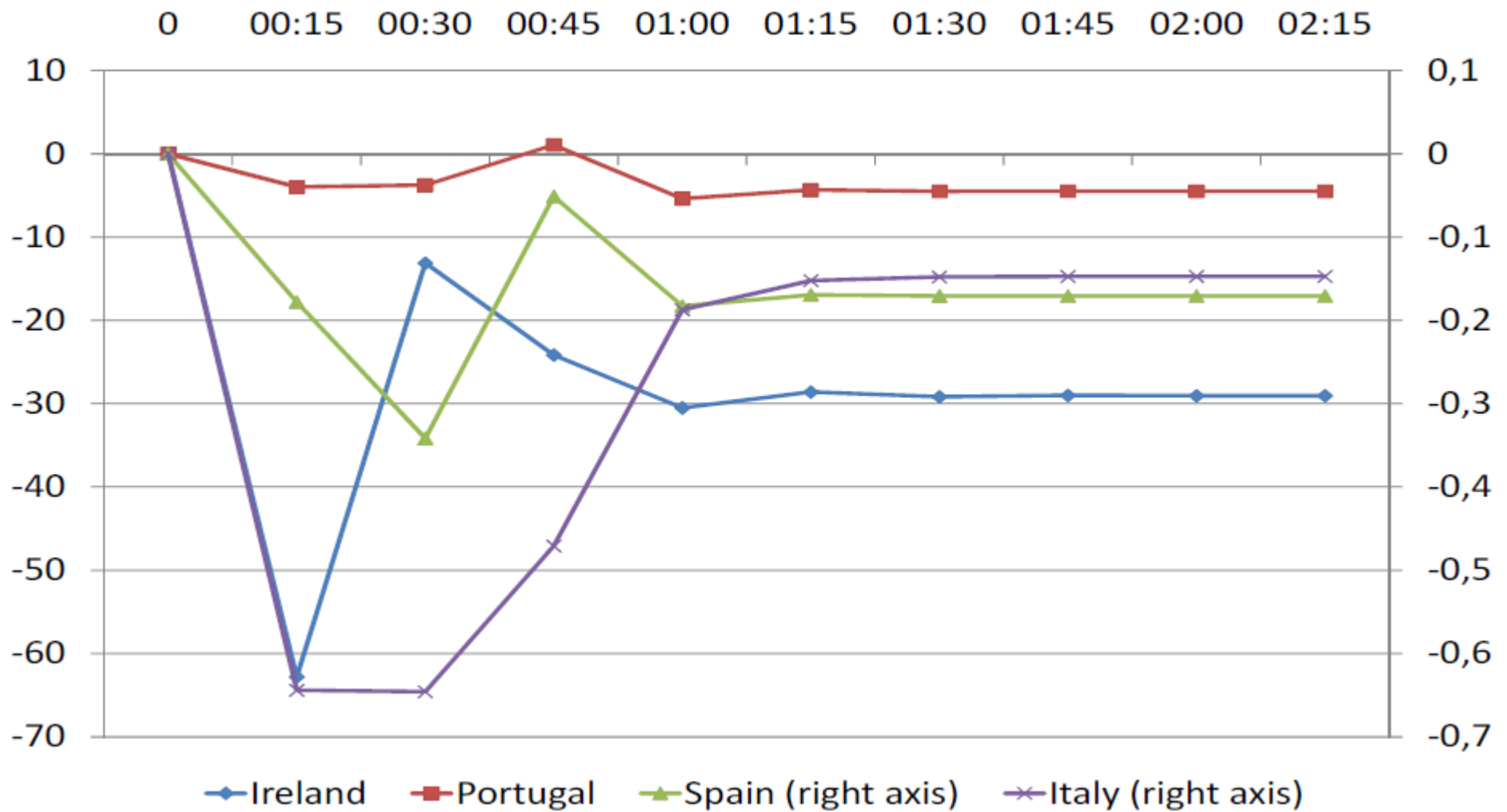
Counterfactual
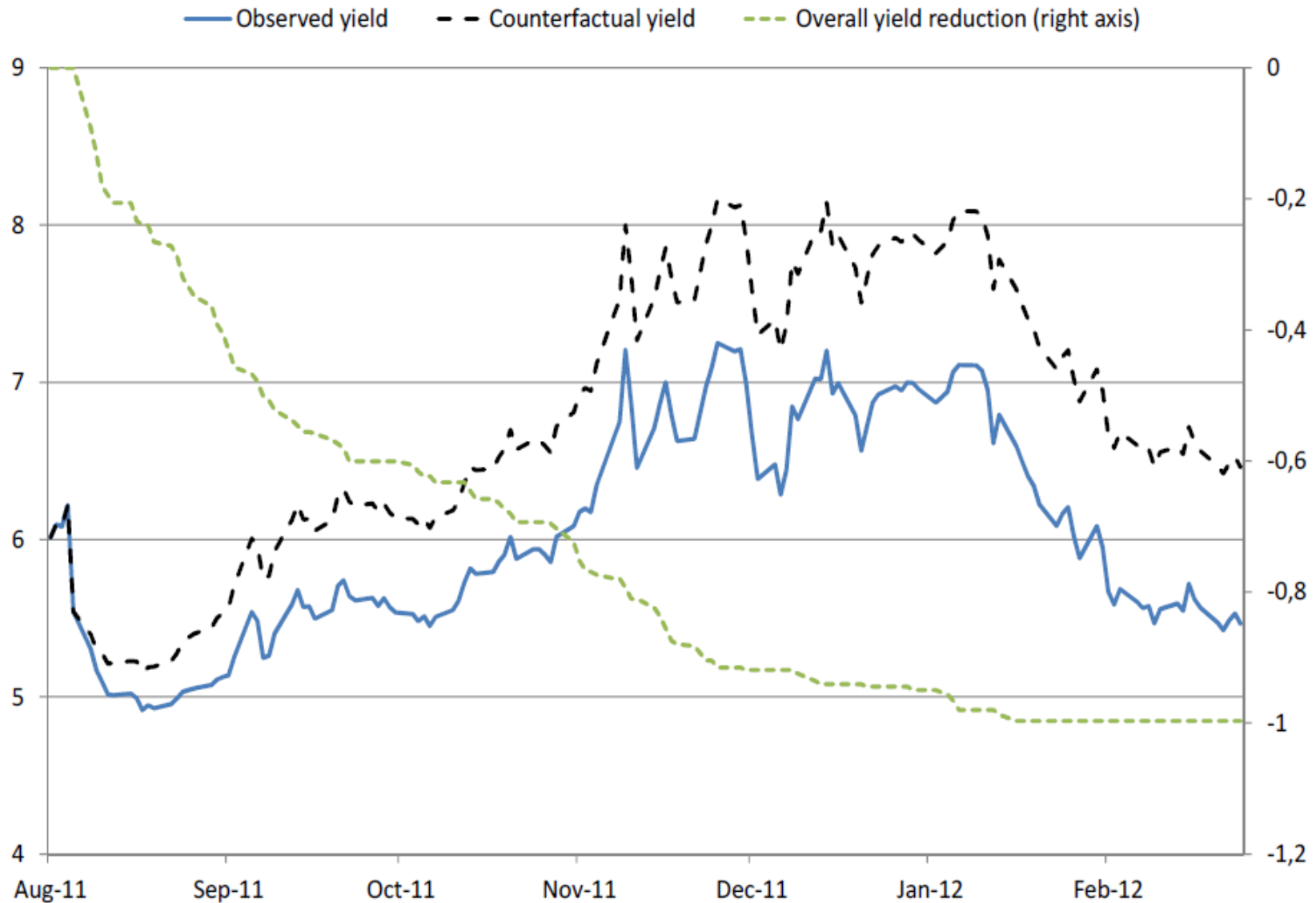
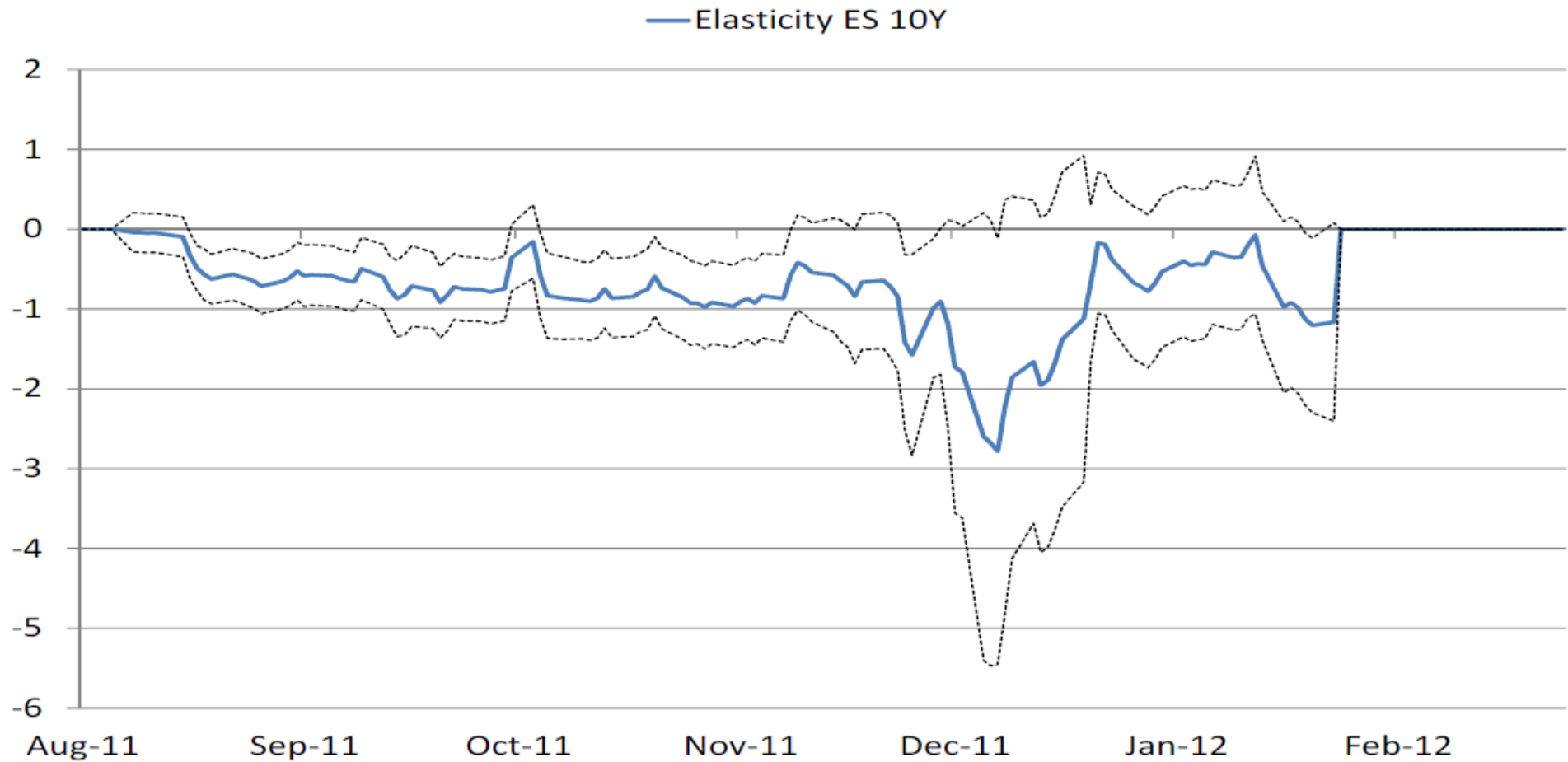# Time-varying elasticities – Italy

Time-varying elasticities – Spain

Elasticity ES 10Y

Conclusion

- Assessing the impact on SMP government bond purchases requires careful treatment of endogeneity problems

- More refined analysis shows that SMP was moderately successful at avoiding abrupt market movements and containing volatility, relative to a situation of no intervention

  - Consistent with the stated objective of improving market functioning

- Exploiting high frequency data, it is possible to develop econometric tools to monitor in real time the market impact of purchases