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ECB Announcements and Stock Market Volatility

Frederik Neugebauer

WHU
Otto Beisheim School of Management

"...the frequency of our monetary policy meetings will change to a six-week cycle, from January 2015..."

Mario Draghi, 3^{rd} July 2014

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Less announcements $\rightarrow$ reduction in market volatility?

Road map

1 Motivation

Research question

Quantify ECB's contribution to national stock market volatility:
Do member states differ?

Mechanism:

1. announcement on monetary policy
2. new information given to financial markets
3. markets react leading to higher volatility

1 Motivation

Related studies find level effects

- Haitsma et al. (2016): Eurostoxx 50
- Fausch and Sigonius (2018): MSCI Germany
- Georgiadis and Gräb (2016): non-EA stock market indices

1 Motivation

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Contribution of this paper

1. volatility instead of level analysis
2. covers key market indices of 11 EA countries
3. longer time span than comparable studies

2 Model and Data: High frequency realized volatility

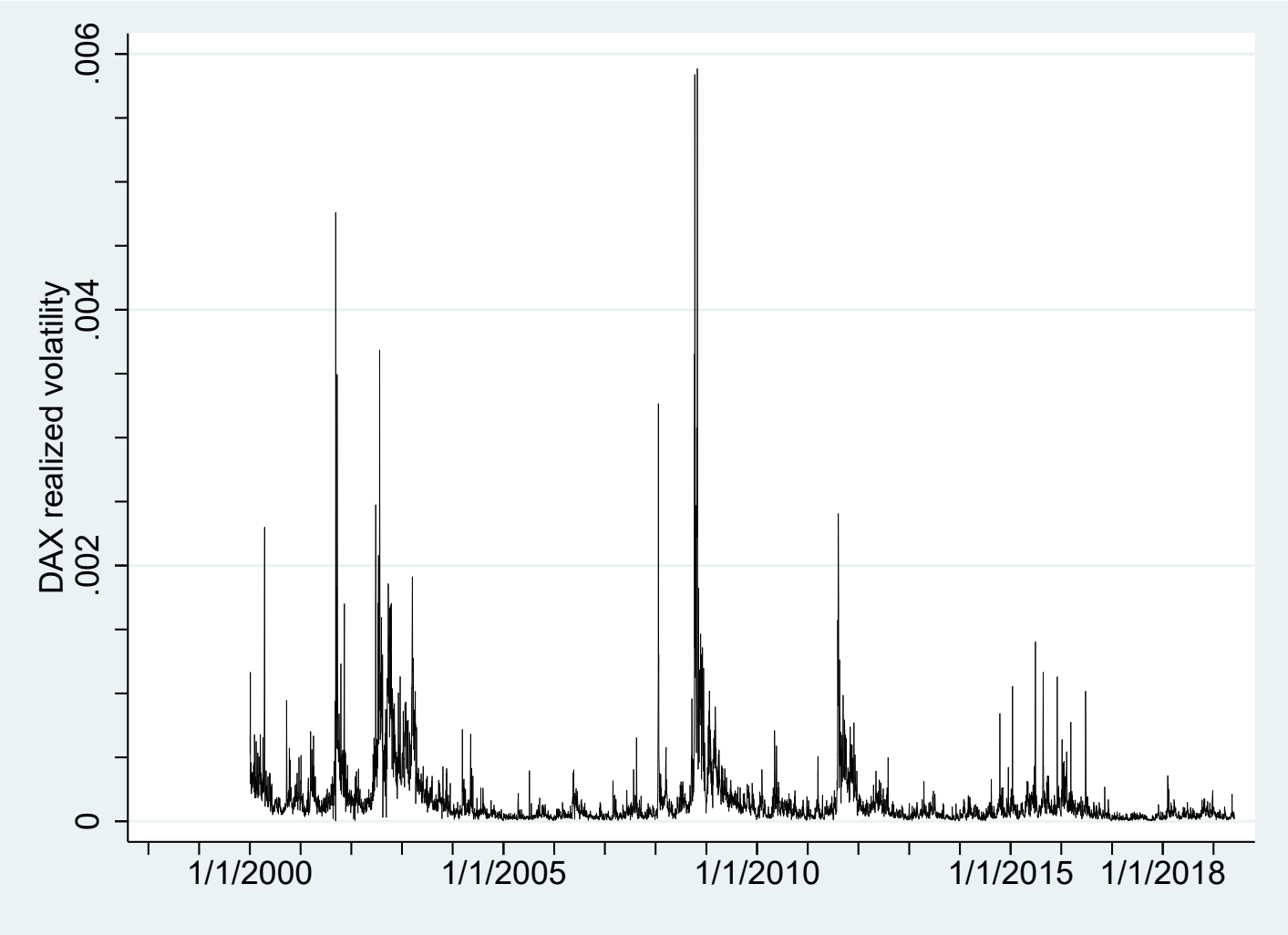
$$RV_t = \sum_{i=1}^{n} r_{i,t}^2 \tag{1}$$

$$RV_t = \alpha + \beta_1 RV_{t-1} + \beta_2 \Delta ln(MSCI_t) + \gamma ECB_t + \varepsilon_t \tag{2}$$

- 8 EA stock market indices:
  BE, DE, ES, EU, FI, FR, IT, NL
- 7 non-EA stock market indices:
  CH, DK, GB, JP, NW, SW, US
- data availability: January 3, 2000 to May 31, 2019
- event study with 299 relevant announcements
- OLS with Newey-West robust standard errors

2 Model and Data: High frequency realized volatility

Figure 1: Realized Volatility of German index



5 minutes frequency data. Using a 10 minutes frequency yields a similar pattern. Time span: January 3, 2000 to May 31, 2019.

2 Model and Data: Daily price range

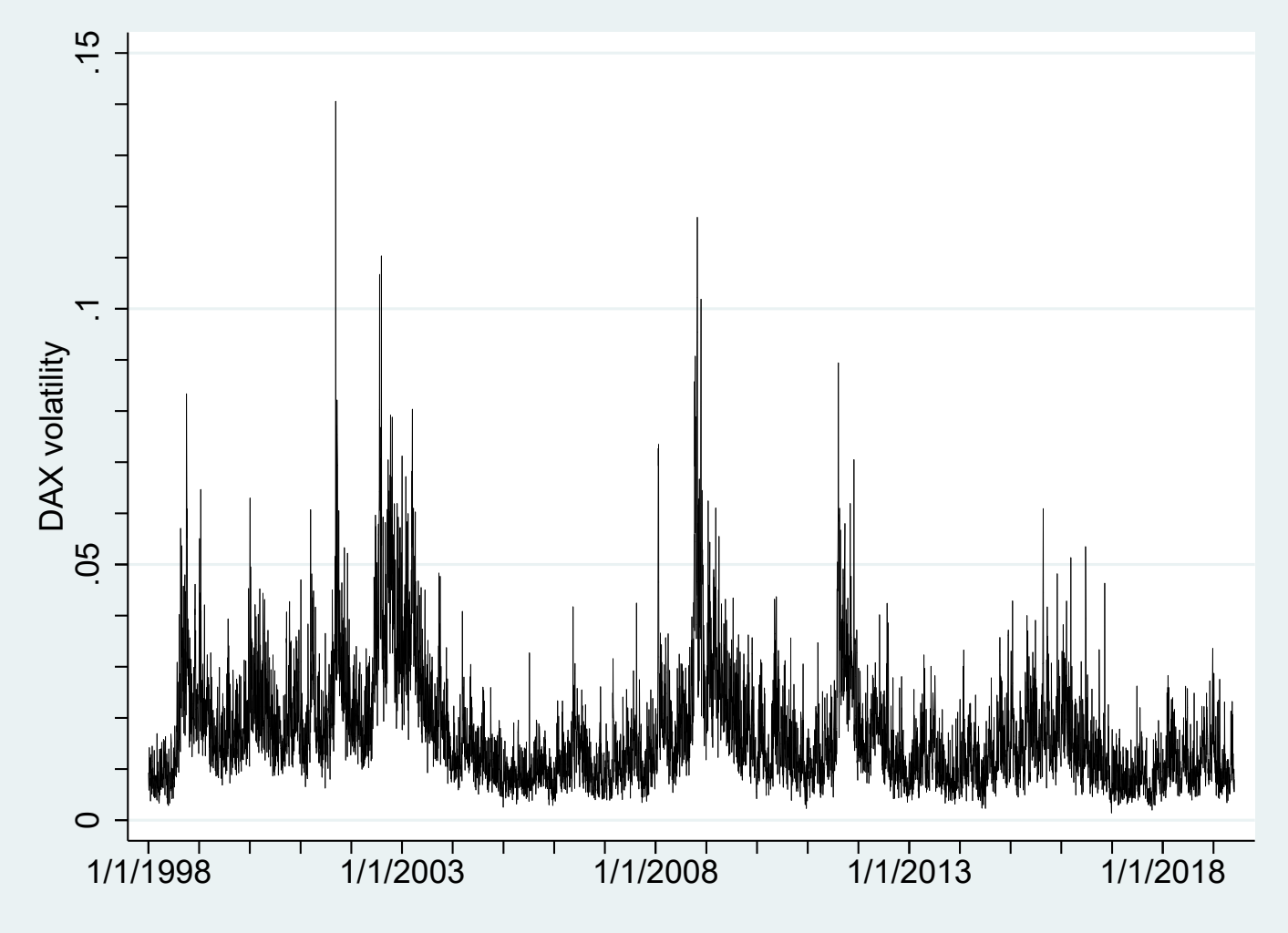
$$range_t = \alpha + \beta_1 range_{t-1} + \beta_2 \Delta ln(MSCI_t) + \gamma ECB_t + \varepsilon_t \quad (3)$$

$$\text{with } range_t = \frac{p_{max} - p_{min}}{p_{open}}$$

- 11 EA stock market indices:
  AU, BE, DE, ES, FI, FR, GR, IR, IT, NL, PT
- 7 non-EA stock market indices:
  CH, DK, GB, JP, NW, SW, US
- data availability: January 2, 1998 to May 31, 2019
- event study with 338 relevant announcements
- OLS with Newey-West robust standard errors

2 Model and Data

Figure 2: Daily price range of German index



Source: Datastream. Time span: January 2, 1998 to May 31, 2019.

3.1 Results: long-term period

Table 1: Effect of ECB announcements on realized asset volatility: EA

	constant	RV_{t-1}	$\Delta MSCI_t$	ECB_t	observations
BE_5	0.0297***	632.6***	-2.118***	0.0343***	4,945
BE_{10}	0.0273***	667.6***	-2.010***	0.0340***	
DE_5	0.0442***	708.7***	-2.988***	0.0628***	4,923
DE_{10}	0.0439***	706.4***	-2.505***	0.0606***	
ES_5	0.0497***	625.5***	-2.681***	0.0553***	4,915
ES_{10}	0.0620***	546.9***	-1.928*	0.0562***	
EU_5	0.0631***	530.4***	-4.648**	0.0512***	4,188
EU_{10}	0.0715***	463.8***	-4.781*	0.0558***	
FI_5	0.0916***	210.2	-1.295	0.0404*	3,427
FI_{10}	0.0567***	521.3***	-1.602	0.0624**	
FR_5	0.0391***	679.6***	-3.469***	0.0585***	4,947
FR_{10}	0.0443***	640.5***	-3.150***	0.0631***	
IT_5	0.0392***	634.5***	-2.108***	0.0814***	2,538
IT_{10}	0.0416***	617.5***	-1.812***	0.0746***	
NL_5	0.0274***	742.2***	-3.155***	0.0369***	4,948
NL_{10}	0.0273***	746.0***	-2.885***	0.0376***	

Sample period: January 2000 to May 2019. The country's subindices 5 and 10 indicate a 5 or 10 minutes frequency, respectively. To enhance legibility, all coefficients are multiplied by the factor 1000.

3.1 Results: long-term period

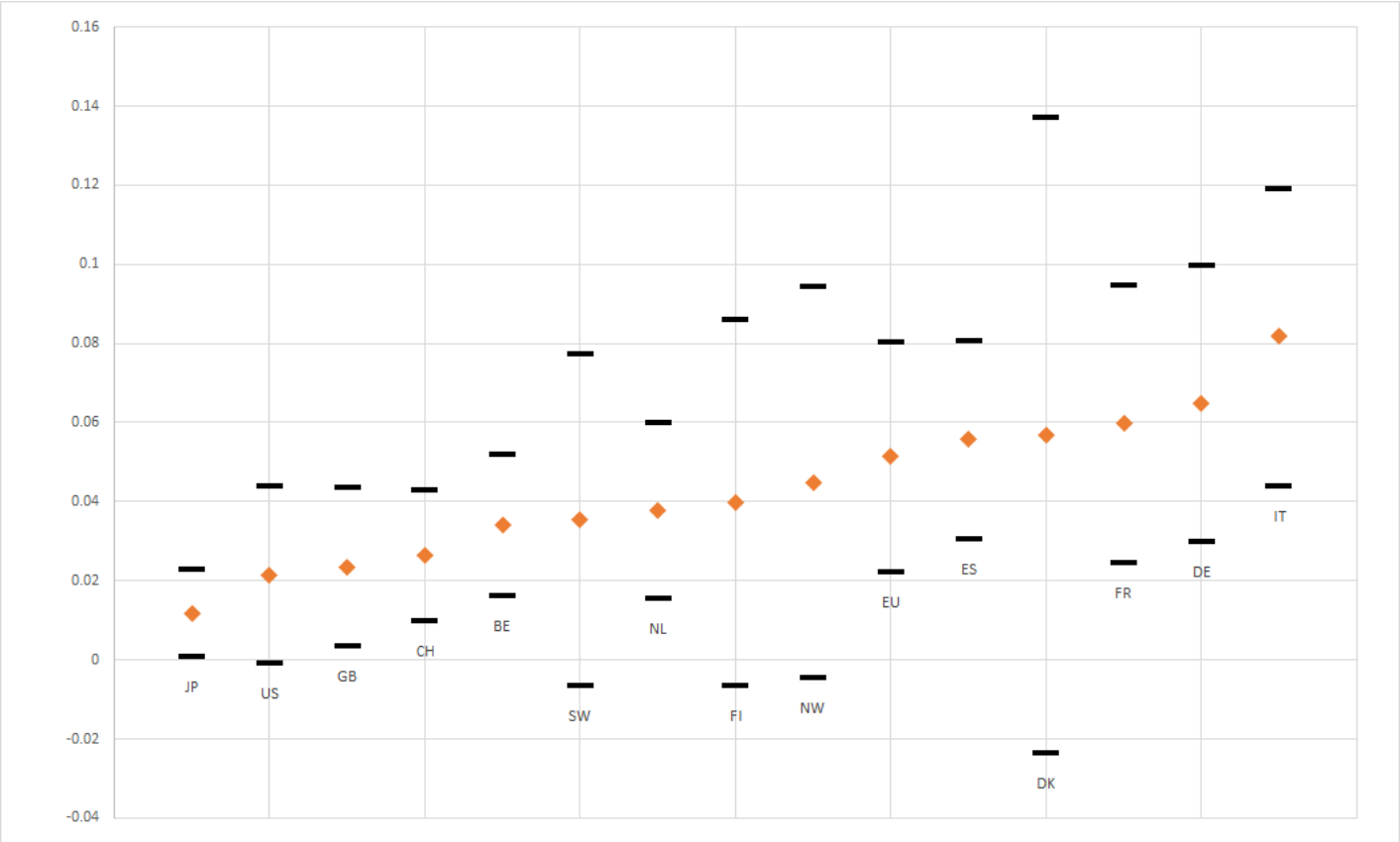
Table 2: Effect of ECB announcements on realized asset volatility: non-EA

	constant	RV_{t-1}	$\Delta MSCI_t$	ECB_t	observations
CH_5	0.0275***	650.5***	-2.570***	0.0261***	4,863
CH_{10}	0.0301***	616.8***	-2.587***	0.0252***	
DK_5	0.0799***	364.6**	-3.321**	0.0536	3,396
DK_{10}	0.0779***	402.5***	-3.821**	0.0661	
GB_5	0.0588***	484.6***	-3.731*	0.0224**	4,893
GB_{10}	0.0681***	438.6***	-4.012	0.0284**	
JP_5	0.0335***	669.1***	-2.871***	0.0119**	4,723
JP_{10}	0.0411***	621.2***	-3.442***	0.0180**	
NW_5	0.0477***	609.8***	-2.188**	0.0444*	4,422
NW_{10}	0.0542***	562.1***	-2.761**	0.0552*	
SW_5	0.0637***	362.2**	-0.975	0.0348*	3,428
SW_{10}	0.0693***	397.4***	-1.412	0.0480*	
US_5	0.0334***	679.9***	-2.133***	0.0206*	4,871
US_{10}	0.0340***	-1.904**	679.3***	0.0213*	

Sample period: January 2000 to May 2019. The country's subindices 5 and 10 indicate a 5 or 10 minutes frequency, respectively. To enhance legibility, all coefficients are multiplied by the factor 1000.

3.1 Results: long-term period

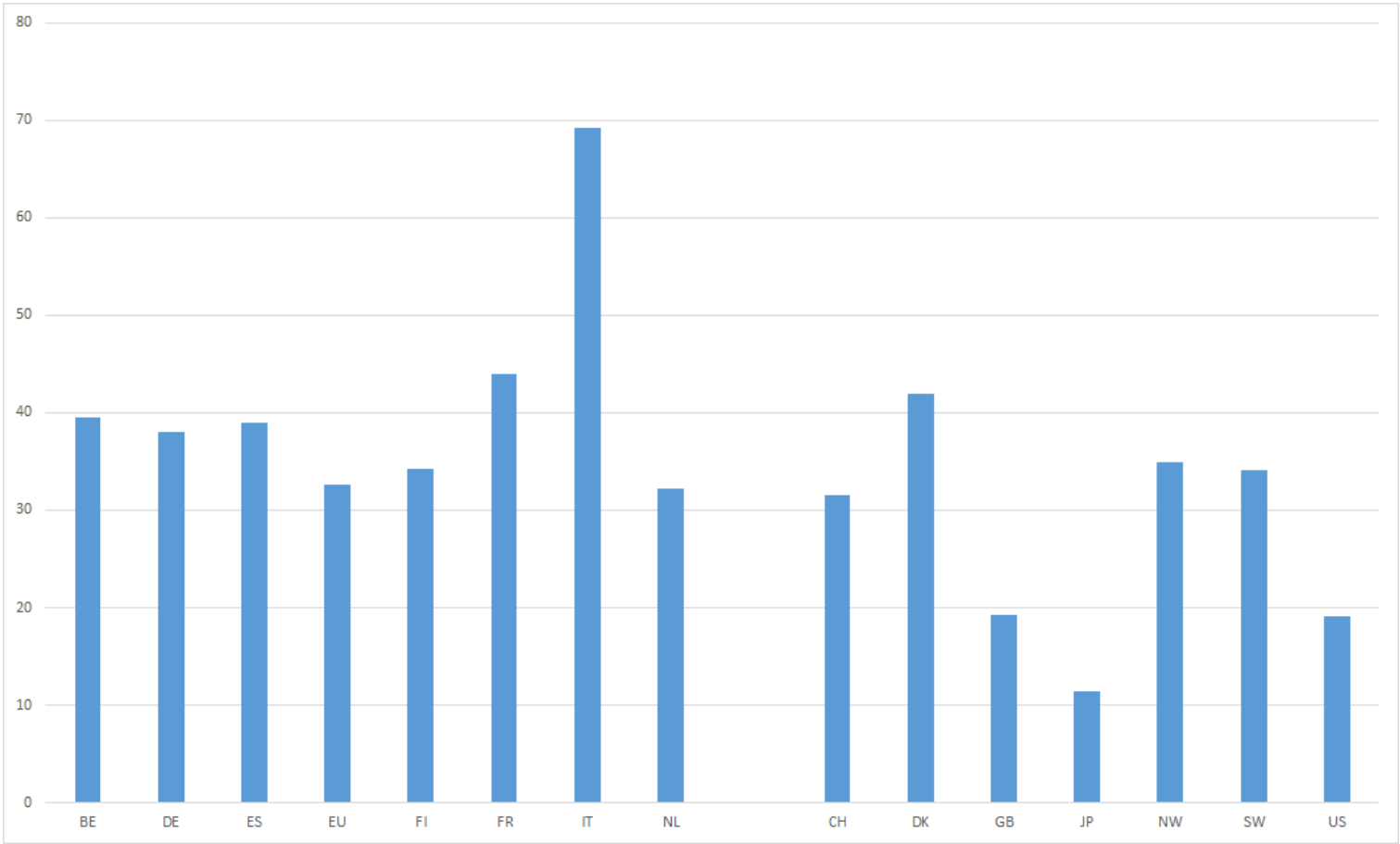
Figure 3: 95% confidence intervals of announcement impact: realized stock market volatility



The rhombus gives the estimated coefficient for γ. The lines indicate the lower and upper bound of the 95% confidence interval.

3.1 Results: long-term period

Figure 4: Average reaction to ECB announcements in terms of mean realized volatility



The ordinate gives the change of realized volatility as a percentage of the mean price range. The left side covers 8 EA markets while the right sight shows the reactions of 7 non-EA markets. Realized volatility is calculated using 5 minutes frequency.

3.1 Results: long-term period

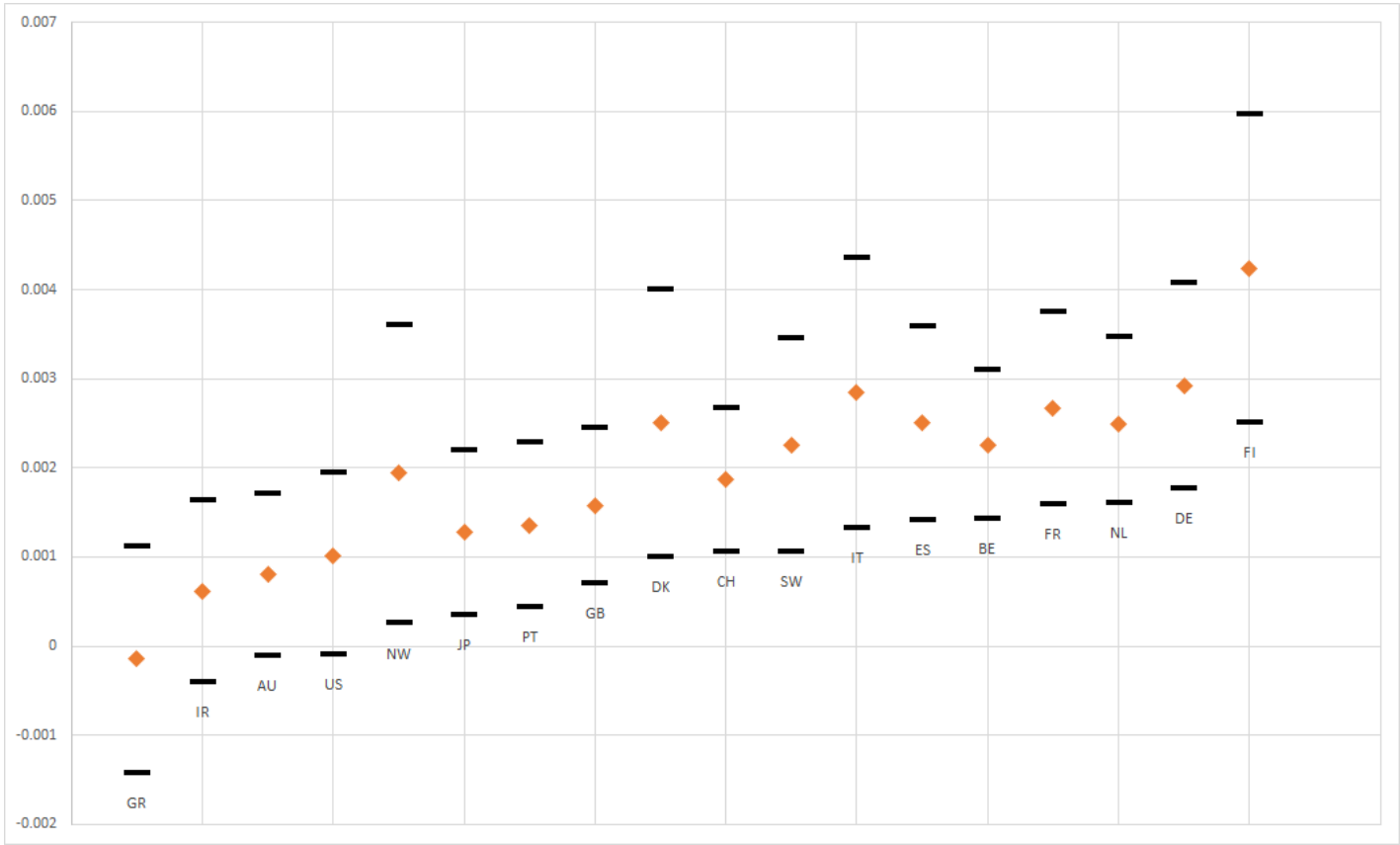
Table 3: Effect of ECB announcements on daily price range

	constant	$range_{t-1}$	$\Delta MSCI_t$	ECB_t	observations
AU	0.00603***	0.624***	-0.0884***	0.000843*	5,309
BE	0.00483***	0.624***	-0.107***	0.00227***	5,450
DE	0.00553***	0.670***	-0.0948***	0.00288***	5,433
ES	0.00673***	0.604***	-0.0891***	0.00250***	5,424
FI	0.00478***	0.744***	-0.0761***	0.00422***	5,370
FR	0.00558***	0.638***	-0.101***	0.00265***	5,464
GR	0.00945***	0.553***	-0.0515**	-8.16e-05	5,285
IR	0.00758***	0.526***	-0.0577**	0.000641	4,885
IT	0.00569***	0.646***	-0.123***	0.00290***	4,022
NL	0.00467***	0.675***	-0.105***	0.00253***	5,468
PT	0.00494***	0.614***	-0.135***	0.00140***	4,897
CH	0.00427***	0.661***	-0.128***	0.00185***	5,380
DK	0.00959***	0.383***	-0.0972***	0.00246***	4,916
GB	0.00511***	0.637***	-0.0871***	0.00156***	5,408
JP	0.00657***	0.532***	-0.103***	0.00128***	5,253
NW	0.00495***	0.683***	-0.102***	0.00193**	3,270
SW	0.00576***	0.632***	-0.0602***	0.00224***	4,495
US	0.00468***	0.646***	-0.0779***	0.000996**	5,386
VAEX	0.0888***	0.0891**	-1.236**	0.0845*	2,776
VCAC	0.144***	0.169***	-2.601***	0.134**	2,776
VDAX	0.0471***	0.271***	-0.746***	0.00931***	3,561
VSTOXX	0.0594***	0.171**	-0.968***	0.00893**	3,563

The horizontal lines separate the volatility measures. The upper part considers 11 EA national stock market volatility measures, the middle part 7 non-EA stock markets, while the lower part covers 4 volatility measures of volatility indices.

3.1 Results: long-term period

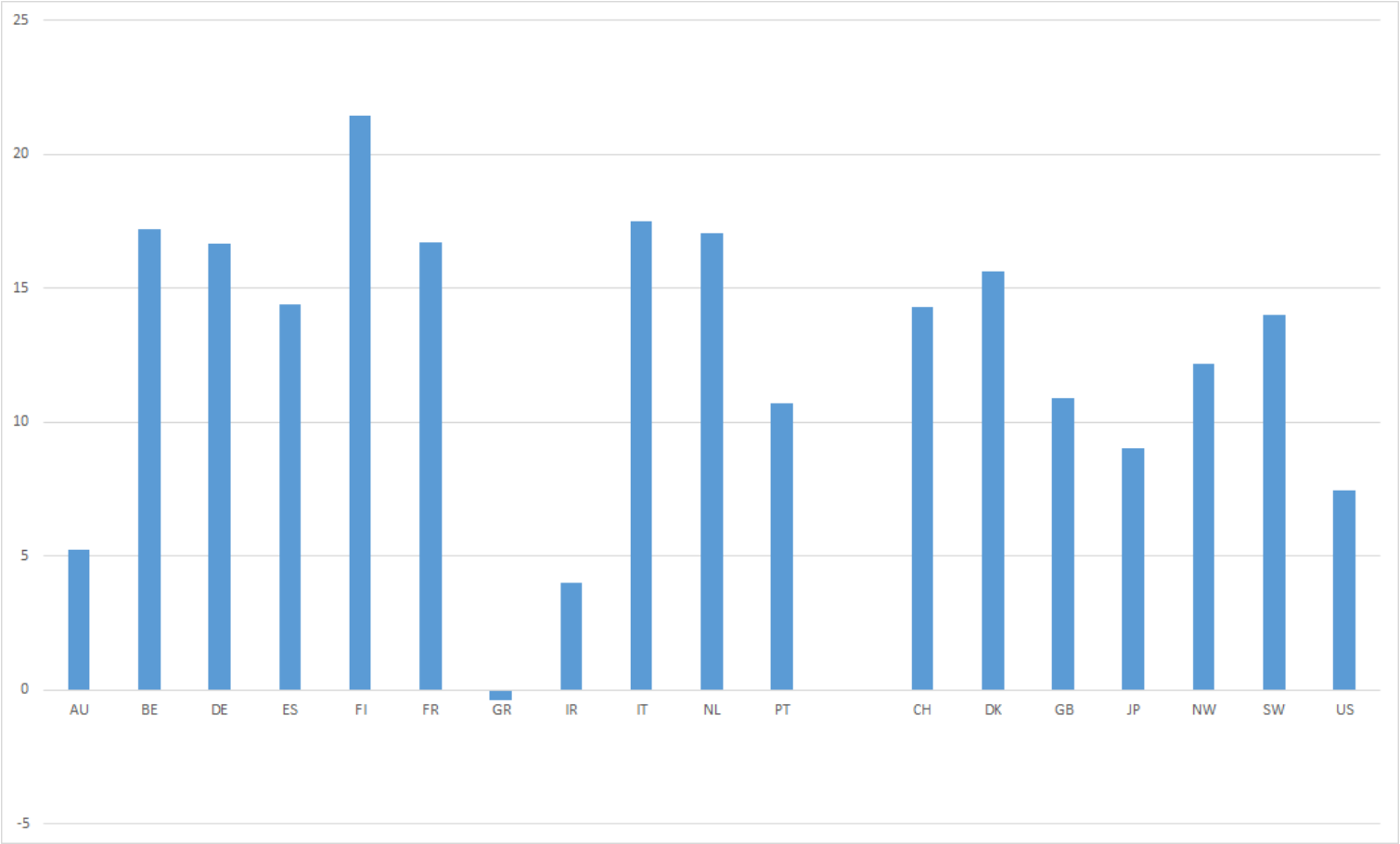
Figure 5: 95% confidence intervals of announcement impact: stock market price range



The rhombus gives the estimated coefficient for γ while the lines indicate the lower and upper bound of the 95% confidence interval.

3.1 Results: long-term period

Figure 6: Average reaction to ECB announcements in terms of mean price range



The ordinate gives the change of price range as a percentage of the mean price range. The left side covers 11 EA markets while the right sight shows the reactions of 7 non-EA markets.

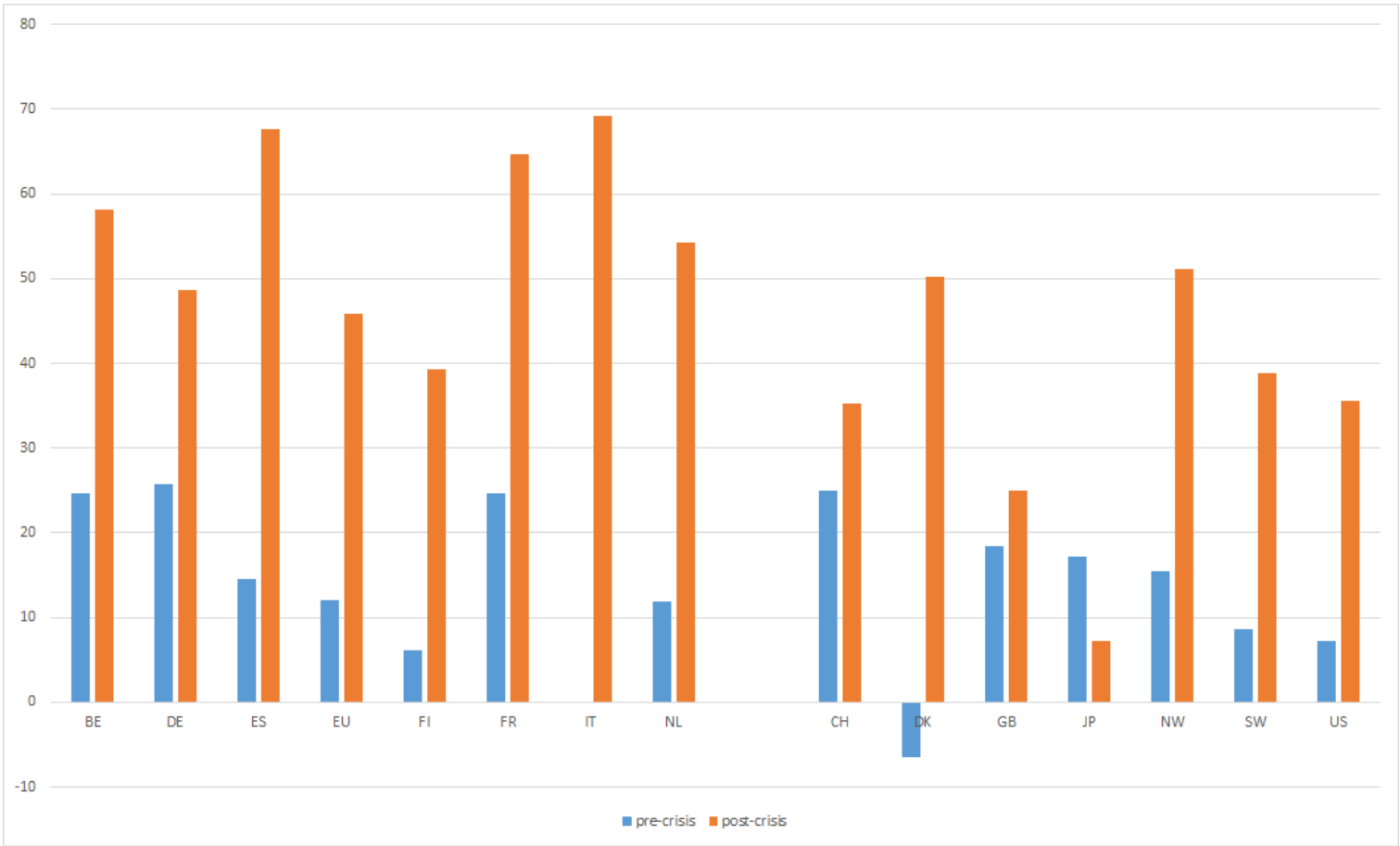
3.2 Structural Break

Table 4: Distinguishing observation periods for RV_t: Coefficients of ECB_t

	long-term	pre-crisis	post-crisis	shortend post-crisis	$crisis_t$
BE_5	0.0343***	0.0214***	0.0505***	0.0590**	0.00251
DE_5	0.0628***	0.0425	0.0802***	0.0842***	-0.0200***
ES_5	0.0553***	0.0206*	0.0961***	0.109***	0.0193***
EU_5	0.0512***	0.0189*	0.0719***	0.0816***	0.0224**
FI_5	0.0404*	0.00718	0.0465*	0.0462	0.0444**
FR_5	0.0585***	0.0328*	0.0861***	0.0975**	-0.000697
IT_5	0.0814***		0.0814***	0.0871***	
NL_5	0.0369***	0.0137	0.0621***	0.0690**	-0.00425
CH_5	0.0261***	0.0207**	0.0291**	0.0327*	-0.000128
DK_5	0.0536	-0.00831	0.0643	0.0905	0.0343***
GB_5	0.0224**	0.0216*	0.0292*	0.0405*	0.0131
JP_5	0.0119**	0.0178**	0.00748	0.0156	-0.00296
NW_5	0.0444*	0.0198	0.0651	0.0849	0.0138**
SW_5	0.0348*	0.00878	0.0396*	0.0460	0.0242**
US_5	0.0206*	0.00779	0.0382*	0.0549*	0.00845
period	01/2000-09/2019	01/2000-08/2007	08/2007-05/2019	08/2007-03/2015	08/2007-05/2019
# of events	299	161	138	98	138

3.2 Structural Break

Figure 7: Average reaction to ECB announcements in terms of mean realized volatility: pre-crisis vs. post-crisis



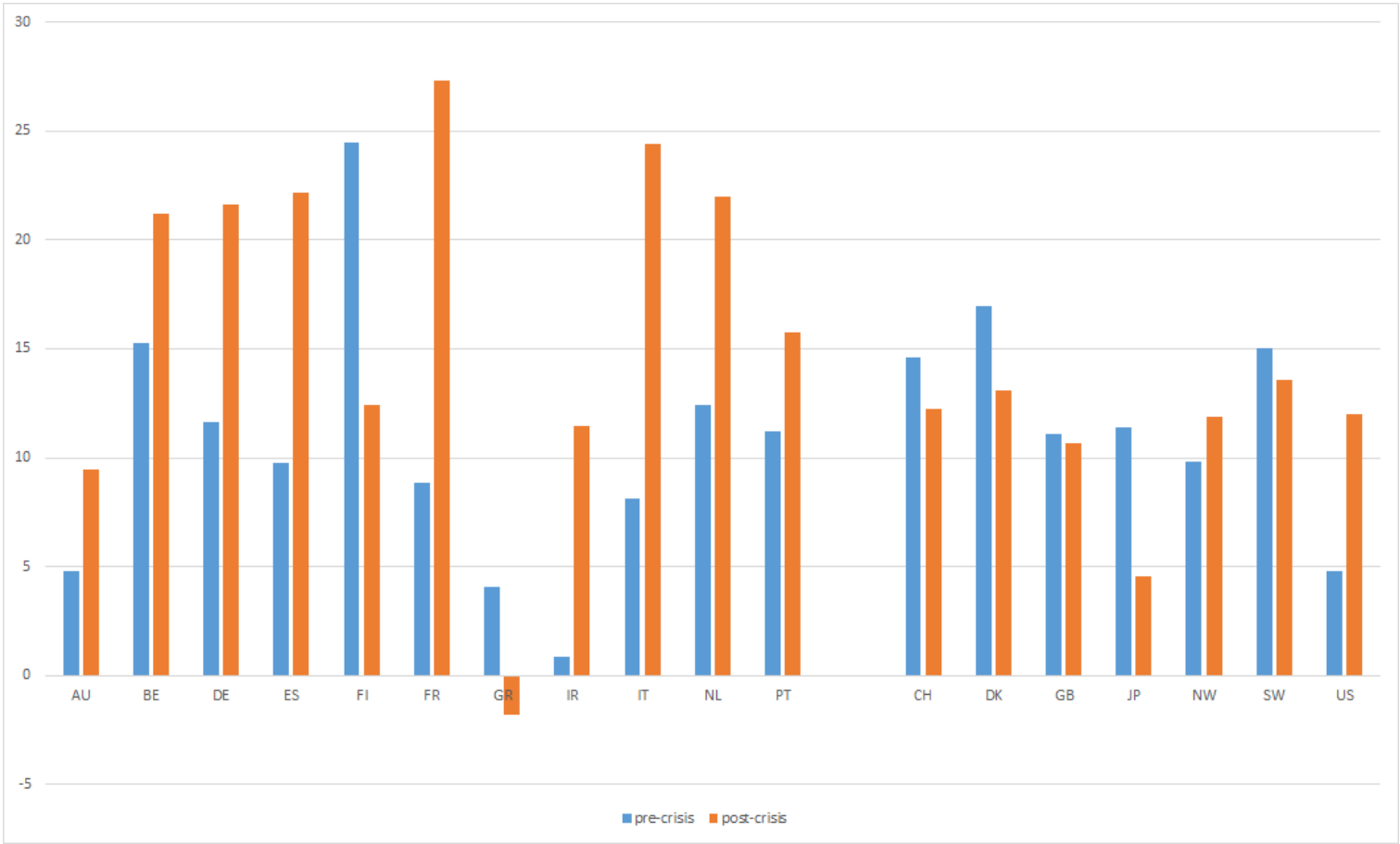
The ordinate gives the change of realized volatility as a percentage of the mean price range. The left side covers 8 EA markets while the right sight shows the reactions of 7 non-EA markets. Realized volatility is calculated using 5 minutes frequency.

Table 5: Distinguishing observation periods for $range_t$: Coefficients of ECB_t

	long-term	pre-crisis	post-crisis	shortend post-crisis	$crisis_t$
AU	0.000843*	0.000773	0.00153*	0.00176*	0.00196***
BE	0.00227***	0.00202***	0.00280***	0.00310***	0.000272
DE	0.00288***	0.00201**	0.00373***	0.00395***	-0.00108***
ES	0.00250***	0.00169**	0.00385***	0.00424***	0.000555*
FI	0.00422***	0.00482***	0.00245***	0.00229***	-0.00309***
FR	0.00265***	0.00140**	0.00433***	0.00463***	-0.000266
GR	-8.16e-05	0.000860	-0.000382	-0.000468	0.00325***
IR	0.000641	0.000141	0.00184**	0.00157*	0.00168***
IT	0.00290***	0.00134*	0.00404***	0.00454***	0.00418***
NL	0.00253***	0.00184***	0.00326***	0.00356***	-0.000594**
PT	0.00140***	0.00147**	0.00206***	0.00199***	0.00160***
VAEX	0.0845*		0.0845*	0.104*	
VCAC	0.134**		0.134**	0.102***	
VDAX	0.00931***	0.0152	0.00799***	0.00956***	0.00141
VSTOXX	0.00893**	0.0105	0.00892***	0.0108***	-0.000110
CH	0.00185***	0.00189***	0.00158***	0.00160***	-0.000567**
DK	0.00246***	0.00267**	0.00206**	0.00214**	-0.000681
GB	0.00156***	0.00159***	0.00153**	0.00163**	-0.000132
JP	0.00128***	0.00162**	0.000646	0.000951	-0.00118***
NW	0.00193**	0.00156	0.00189**	0.00187*	-0.000284
SW	0.00224***	0.00240**	0.00217***	0.00235***	-0.000264
US	0.000996**	0.000642	0.00160**	0.00220***	-0.000374
period	01/1998-05/2019	01/1998-08/2007	08/2007-05/2019	08/2007-03/2017	08/2007-05/2019
# of events	338	200	138	117	138

3.2 Structural Break

Figure 8: Average reaction to ECB announcements in terms of mean price range: pre-crisis vs. post-crisis



The ordinate gives the change of price range as a percentage of the mean price range. The left side covers 11 EA markets while the right sight shows the reactions of 7 non-EA markets.

3.3 Robustness checks

Choice of events

- neither anticipated nor delayed effects
- random selection of events
- selection of asset purchase announcements
- crisis dummy supports structural break
- Thursday effect negligible

Choice of control variables

- MSCI World excluding Europe
- surprise and uncertainty indices by Scotti (2016)
- V2TX index
- CESI index

▸ output

4 Identification of monetary policy shocks

Based on Rogers et al. (2014):

$$shock_t = 100 \times ln\left(\frac{y_t}{y_{t-1}}\right) \tag{4}$$

$$RV_t = \alpha + \beta_1 RV_{t-1} + \beta_2 \Delta ln(MSCI_t) + \gamma |shock_t| \times ECB_t + \varepsilon_t \tag{5}$$

$$range_t = \alpha + \beta_1 range_{t-1} + \beta_2 \Delta ln(MSCI_t) + \gamma |shock_t| \times ECB_t + \varepsilon_t \tag{6}$$

▸ shock as control

4 Identification of monetary policy shocks

Table 6: Comparison of ECB_t versus $shock_t$: EA markets

	full-time		pre-crisis		post-crisis	
	ECB_t	$shock_t$	ECB_t	$shock_t$	ECB_t	$shock_t$
AU	0.000843*	0.000108	0.000773	0.000551	0.00153*	6.22e-05
BE	0.00227***	0.000366**	0.00202***	0.00213***	0.00280***	0.000302**
DE	0.00288***	5.36e-05	0.00201**	0.00260**	0.00373***	5.26e-05
ES	0.00250***	0.00144***	0.00169**	0.00195**	0.00385***	0.00134***
FI	0.00422***	7.08e-05	0.00482***	0.00421***	0.00245***	6.05e-05
FR	0.00265***	0.000609***	0.00140**	0.00183**	0.00433***	0.000569***
GR	-8.16e-05	0.00148**	0.000860	0.00125	-0.000382	0.00162*
IR	0.000641	0.000335***	0.000141	0.00105	0.00184**	0.000295***
IT	0.00290***	0.00212***	0.00134*	0.00185**	0.00404***	0.00202***
NL	0.00253***	0.000240**	0.00184***	0.00241***	0.00326***	0.000223**
PT	0.00140***	0.00109***	0.00147**	0.00148*	0.00206***	0.00103***
VAEX	0.0845*	0.00190**			0.0845*	0.00190**
VCAC	0.134**	0.0358			0.134**	0.0358
VDAX	0.00931***	7.38e-05	0.0152	0.0267	0.00799***	5.58e-05
VSTOXX	0.00893**	0.00115*	0.0105	0.0235	0.00892***	0.00115**
BE_5	0.0343***	0.00387*	0.0214***	0.0233***	0.0505***	0.00327*
DE_5	0.0628***	0.00109	0.0425	0.0615	0.0802***	0.00106
ES_5	0.0553***	0.0279***	0.0206*	0.0177	0.0961***	0.0280***
EU_5	0.0512***	0.00613*	0.0189*	0.0241*	0.0719***	0.00535
FI_5	0.0404*	-0.000183	0.00718	0.0241	0.0465*	-0.000302
FR_5	0.0585***	0.00825**	0.0328*	0.0373**	0.0861***	0.00736**
IT_5	0.0814***	0.0362***			0.0814***	0.0362***
NL_5	0.0369***	0.00207	0.0137	0.0175*	0.0621***	0.00192

4 Identification of monetary policy shocks

Table 7: Comparison of ECB_t versus $shock_t$: non-EA markets

	full-time		pre-crisis		post-crisis	
	ECB_t	$shock_t$	ECB_t	$shock_t$	ECB_t	$shock_t$
CH	0.00185***	0.000213**	0.00189***	0.00245***	0.00158***	0.000155*
DK	0.00246***	0.000146	0.00267**	0.00162*	0.00206**	0.000187**
GB	0.00156***	0.000160*	0.00159***	0.00180**	0.00153**	0.000117
JP	0.00128***	-7.97e-05	0.00162**	0.00139**	0.000646	-8.48e-05
NW	0.00193**	8.87e-05	0.00156	0.00360	0.00189**	8.87e-05
SW	0.00224***	0.000250**	0.00240**	0.00262**	0.00217***	0.000216**
US	0.000996**	3.85e-05	0.000642	0.000902	0.00160**	3.60e-05
CH_5	0.0261***	0.00144	0.0207**	0.0248**	0.0291**	0.000698
DK_5	0.0536	0.000435	-0.00831	0.00201	0.0643	8.93e-05
GB_5	0.0224**	2.01e-05	0.0216*	0.0245**	0.0292*	-0.000932
JP_5	0.0119**	-0.000474	0.0178**	0.0189**	0.00748	-0.000799
NW_5	0.0444*	0.00145	0.0198	0.0162	0.0651	0.000935
SW_5	0.0348*	0.000190	0.00878	0.0342	0.0396*	-0.000152
US_5	0.0206*	0.000362	0.00779	0.00724	0.0382*	-5.20e-05

5 Summary

- both realized volatility and price range suggest announcement impact
- volatility increases similarly among EA key stock market indices
- structural break: stronger impact since financial crisis despite fewer statements
- Chow tests support structural break
- noticeable spill-over effects

6 Outlook

1. Forward looking

$$\sum_{i=0}^{m} RV_{t+i} = \alpha + \beta_1 RV_{t-1} + \beta_2 \Delta ln(MSCI_t) + \gamma ECB_t + \varepsilon_t, \quad (7)$$

   with m = 1,3,5, and 10 days

2. Historical volatility

$$r_t = ln\left(\frac{P_t}{P_{t-1}}\right) \quad (8)$$

$$vol_t^b = \sqrt{252}\sqrt{\frac{1}{n-1}\sum_{k=1}^{n}(r_{t-k} - \bar{r})^2} \quad (9)$$

3. Persistence of announcement effects
   - local projections (Jordà, 2005)

Table 8: Robustness checks: choice of events

	ECB_t	$random_t$	ECB_{t-1}	ECB_{t+1}	APA_t	$Thursday_t$	$adj\_Thursday_t$
AU	0.00153*	0.00102	-0.000176	0.000260	0.00372	0.000386	0.000116
BE	0.00280***	0.000523	-0.000344	-7.13e-05	0.00370	0.000880***	0.000393
DE	0.00373***	0.000938	-0.000173	-0.000584	0.00719***	0.00121***	0.000543
ES	0.00385***	-0.000373	0.000597	-0.000200	0.0108**	0.00123***	0.000450
FI	0.00245***	-0.000244	6.77e-05	-0.000125	0.00413**	0.00103**	0.000713
FR	0.00433***	-0.000863	-0.000435	-0.000351	0.00911***	0.00138***	0.000587
GR	-0.000382	-0.00176	0.000872	0.000219	0.00481	-0.000683	-0.000759
IR	0.00184**	0.000754	-0.00106	0.000157	0.00828***	0.000740*	0.000386
IT	0.00404***	0.000675	0.000134	-0.00134*	0.0107***	0.00137***	0.000534
NL	0.00326***	-0.000222	-0.000682	-0.000451	0.00606***	0.000647*	1.87e-05
PT	0.00206***	0.000898	0.000456	-0.00102**	0.00460***	0.000715**	0.000421
VAEX	0.0845*	0.0305	-0.0246***	0.0244	0.0330*	0.0347*	0.0190
VCAC	0.134**	-0.00870	-0.0192	-0.00743	0.270*	0.0552***	0.0287
VDAX	0.00799***	-0.00355	-0.00141	0.00675**	0.0135*	0.00678***	0.00646***
VSTOXX	0.00892***	-0.00457	-0.00263	0.00708**	0.0240***	0.00990***	0.00986***
CH	0.00158***	0.000251	-0.000959*	0.000251	0.00257*	0.00124***	0.00116***
DK	0.00206**	0.000187	-0.000337	-0.000577	0.00300*	0.000697*	0.000487
GB	0.00153**	7.76e-05	-0.000402	-0.000111	0.00402**	0.000310	0.000118
JP	0.000646	0.000608	-5.24e-05	0.000300	-0.00163	0.000797**	0.000885**
NW	0.00189**	0.00115	-0.000691	0.000223	0.00479**	0.000420	9.60e-05
SW	0.00217***	-0.000194	-0.000562	-0.000159	0.00124	0.000349	-4.89e-05
US	0.00160**	-0.000187	0.000189	0.000209	0.00383**	0.000791**	0.000480

Table 9: Robustness checks: choice of events

	ECB_t	$random_t$	ECB_{t-1}	ECB_{t+1}	APA_t	$Thursday_t$	$adj\_Thursday_t$
BE_5	0.0505***	-0.00571	0.00322	-0.00409	0.00226	0.0115***	0.00465
DE_5	0.0802***	-0.000744	-0.000175	-0.00568	0.0854	0.0141**	0.00105
ES_5	0.0961***	0.00468	0.00442	-0.0136	0.235*	0.0261***	0.00828
EU_5	0.0719***	0.0831	-0.0114	0.00942	0.108*	0.0128	0.00185
FI_5	0.0465*	0.224	-0.0130	0.0330	0.0264	0.0106	0.00670
FR_5	0.0861***	-0.0123	0.000422	-0.00642	0.107**	0.0182**	0.00732
IT_5	0.0814***	0.00424	-0.000109	-0.0148	0.150**	0.0285***	0.0122**
NL_5	0.0621***	0.0109	0.000910	-0.00393	0.0491	0.0109*	0.00142
CH_5	0.0291**	-0.000574	-0.00278	0.00686	-0.00660	0.0169**	0.0157*
DK_5	0.0643	-0.00651	-0.0183*	-0.00107	0.00432	-0.00907	-0.0129
GB_5	0.0292*	0.0719	-0.00552	0.0147	-0.0296	0.00257	-8.78e-06
JP_5	0.00748	-0.000108	-0.00540	0.0166	-0.0234	0.00662	0.00516
NW_5	0.0651	-0.0148*	-0.00843	-0.00327	-0.0304	0.0104	0.00742
SW_5	0.0396*	0.0788	-0.0115	0.0220	-0.0310	-0.00478	-0.0100
US_5	0.0382*	0.00745	-0.0129	0.0235*	-0.00976	0.0135	0.00963

back

$$RV_t = \alpha + \beta_1 RV_{t-1} + \beta_2 \Delta ln(MSCI_t) + \gamma |shock_t| \times ECB_t + \delta |shock_t| + \varepsilon_t \quad (10)$$

$$range_t = \alpha + \beta_1 range_{t-1} + \beta_2 \Delta ln(MSCI_t) + \gamma |shock_t| \times ECB_t + \delta |shock_t| + \varepsilon_t. \quad (11)$$

Table 10: Robustness Check to inclusion of $shock_t$ as a control

	Eq. (5)	Eq. (10)	
	γ	γ	δ
BE_5	0.00387*	0.00457**	-0.000850**
DE_5	0.00109	0.00135	-0.000282***
ES_5	0.0279***	0.0214***	0.00987**
EU_5	0.00613*	0.00606*	0.000100
FI_5	-0.000183	0.000375	-0.000599*
FR_5	0.00825**	0.00921**	-0.00120**
IT_5	0.0362***	0.0350***	0.00191
NL_5	0.00207	0.00218	-0.000136**
CH_5	0.00144	0.00205**	-0.000773***
DK_5	0.000435	0.000615	-0.000232
GB_5	2.01e-05	7.17e-06	1.63e-05
JP_5	-0.000474	-0.000435	-4.83e-05
NW_5	0.00145	0.00187	-0.000534
SW_5	0.000190	0.00184*	-0.00213***
US_5	0.000362	0.00112	-0.000953**

Table 11: Robustness Check to inclusion of $shock_t$ as a control

	Eq. (6)	Eq. (11)	
	γ	γ	δ
AU	0.000108	5.72e-05	6.05e-05*
BE	0.000366**	0.000364**	2.67e-06
DE	5.36e-05	6.22e-05	-9.31e-06**
ES	0.00144***	0.00110***	0.000516***
FI	7.08e-05	9.13e-05	-2.19e-05
FR	0.000609***	0.000609***	4.52e-07
GR	0.00148**	0.000875	0.00131**
IR	0.000335***	0.000300***	4.55e-05
IT	0.00212***	0.00148***	0.000975***
NL	0.000240**	0.000246***	-7.23e-06**
PT	0.00109***	0.000760***	0.000558***
CH	0.000213**	0.000240**	-3.45e-05**
DK	0.000146	0.000177**	-3.96e-05
GB	0.000160*	0.000146	1.75e-05
JP	-7.97e-05	-4.16e-05	-4.64e-05*
NW	8.87e-05	0.000112	-3.06e-05
SW	0.000250**	0.000246**	5.42e-06
US	3.85e-05	9.58e-05	-7.24e-05***
VAEX	0.00190**	0.00188**	2.21e-05
VCAC	0.0358	0.0333	0.00333
VDAX	7.38e-05	4.14e-05	3.59e-05
VSTOXX	0.00115*	0.000849	0.000392**

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