Volatility analysis of EONIA in the Dutch money market

By:

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"I'm not going to kid you, it's a volatile market."

Outline

- Objective
- Literature review
- Data and methodology
- Background: money market and monetary policy
- Evolution of Dutch EONIA
- Results
- Conclusion
- Future work

Objectives

- What are the seasonal, calendar and monetary policy effects on the Dutch segment of EONIA?
- How do these determine the volatility of EONIA?
- How have these effects changed along the period 1999- May 2012?

Literature review

- Hamilton (1996) introduced an aproach to measure the volatility of the fed funds rate, taking into account the tails and the infrequent spikes that characterizes these kind of rates.

- Bartolini and Prati (2005) assess the volatility of overnight interest rates for a range of countries, including the euro area.

- Nautz and Offermanns (2008) examined volatility transmission in the European money market over the period 2000 to 2006.

- Other: Würtz (2003); Gaspar et al. (2008); Soares & Rodrigues (2011).

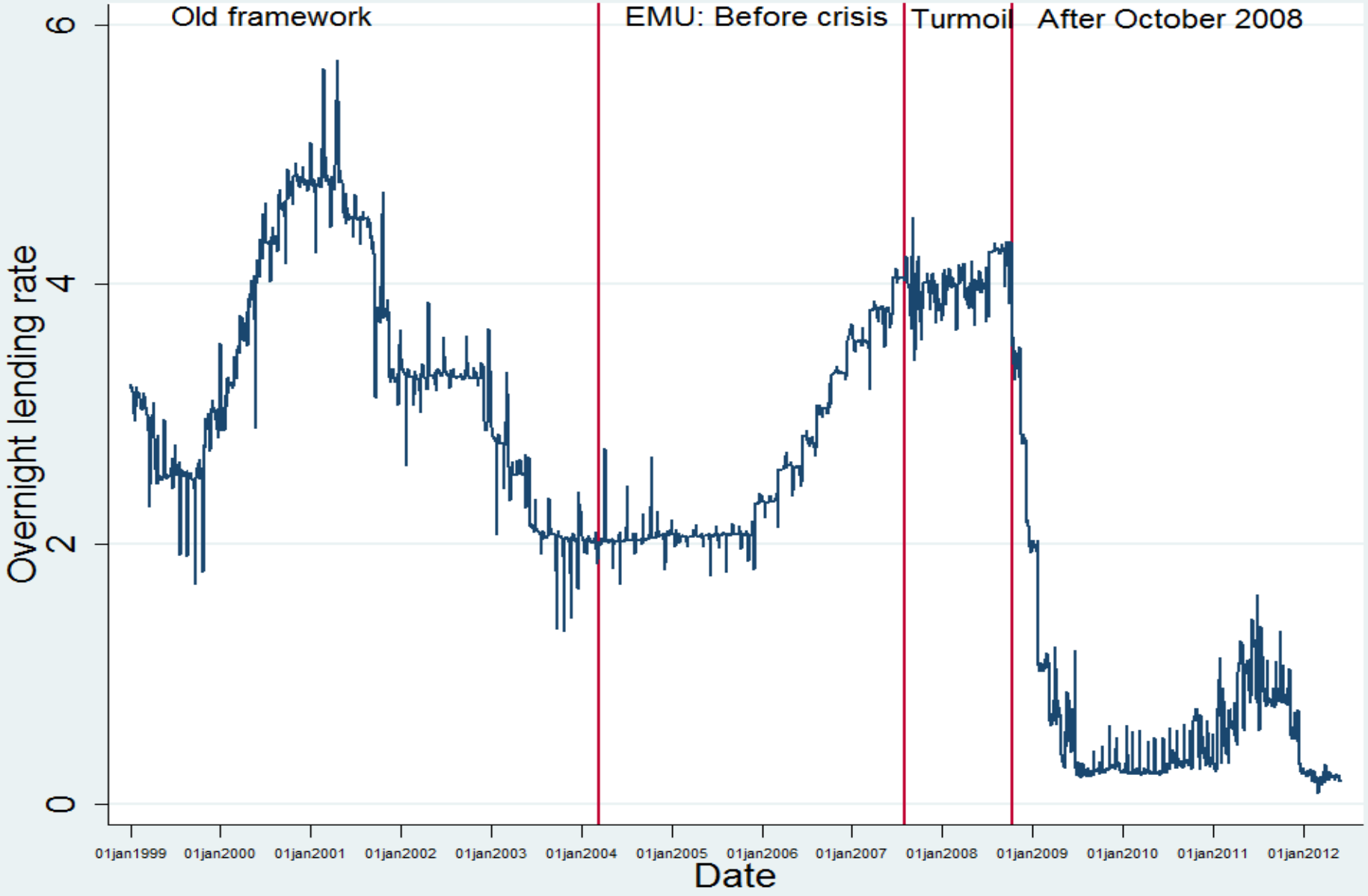
Data and methodology

- The variable analysed is the daily effective Euro Overnight Index Average (EONIA) of banks trading in the Dutch money market (DEONIA) and registered in the Dutch segment of the Target2 system.

- The data runs from 1999 to May 2012:
  - Loans obtained using the algorithm of Heijmans et al. (2010), which is based on Furfine (1999).
  - Only overnight loans are used.
  - Weekends and banking holidays are excluded from this dataset.

- Dataset with information for 162 maintenance periods and 3,425 usable observations.

Data and methodology



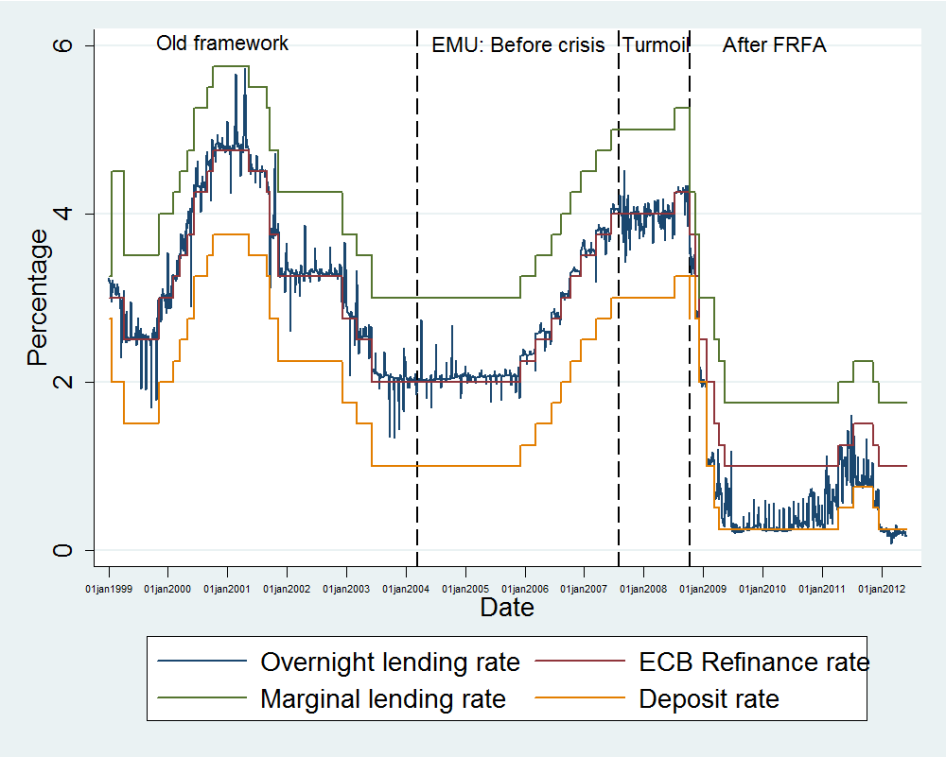
Background: monetary policy

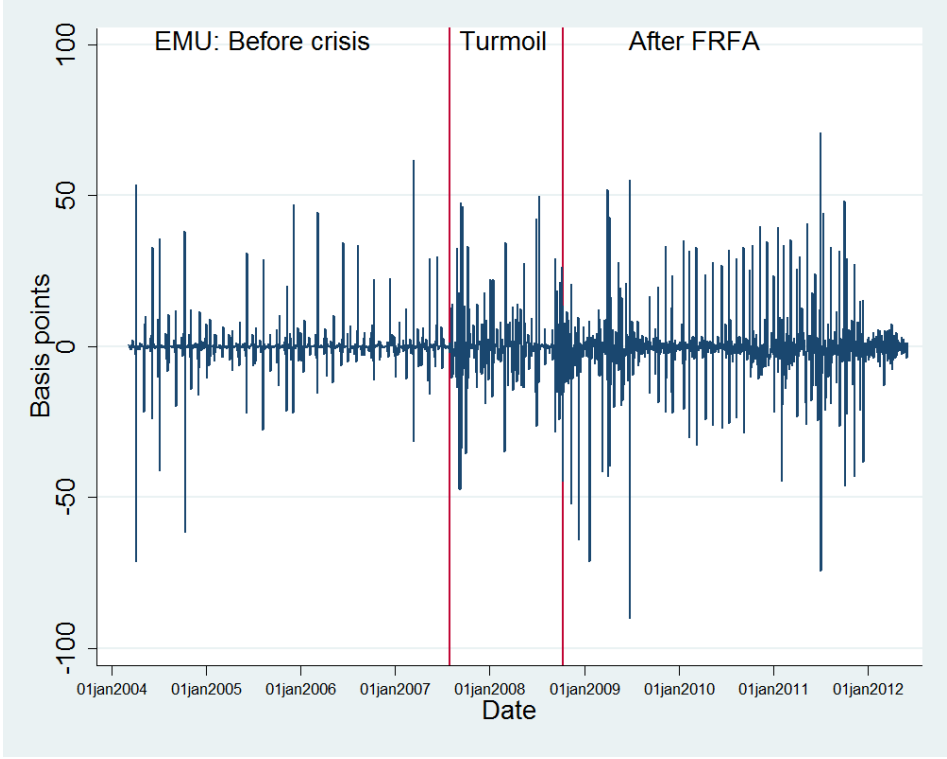
- New operational framework introduced in March 2004
  - Tenders from 2 to 1 week
  - Reserve maintenance period from 24th of a Month_t to 23 Month_t+1 to a moving MP of on average 20 days

- Start of crisis ECB (summer 2007)

- After collapse of Lehman ECB introduced Fixed Rate Full Allotment (FRFA).
  - FRFA since Lehman
  - 1-year tenders starting in July 2009
  - 3-years tenders starting in December 2011
  - What else to come in the (near) future

Background: interest rate and volatility





Background: number of lenders & borrowers

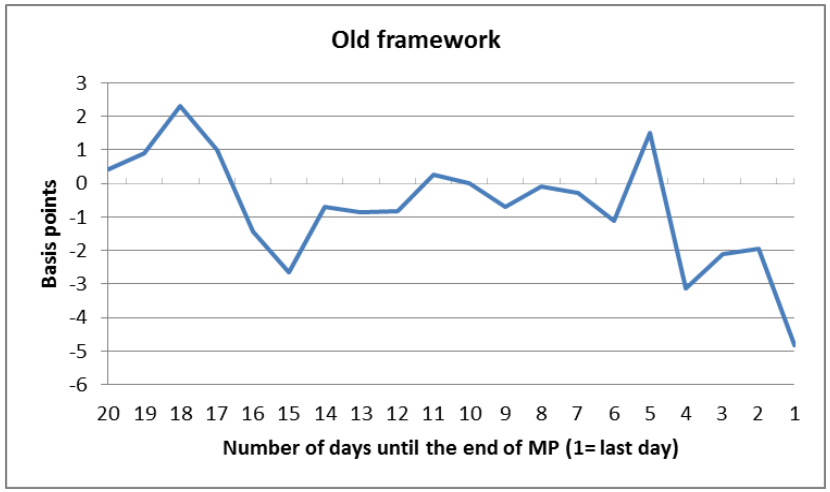
Evolution of Dutch EONIA

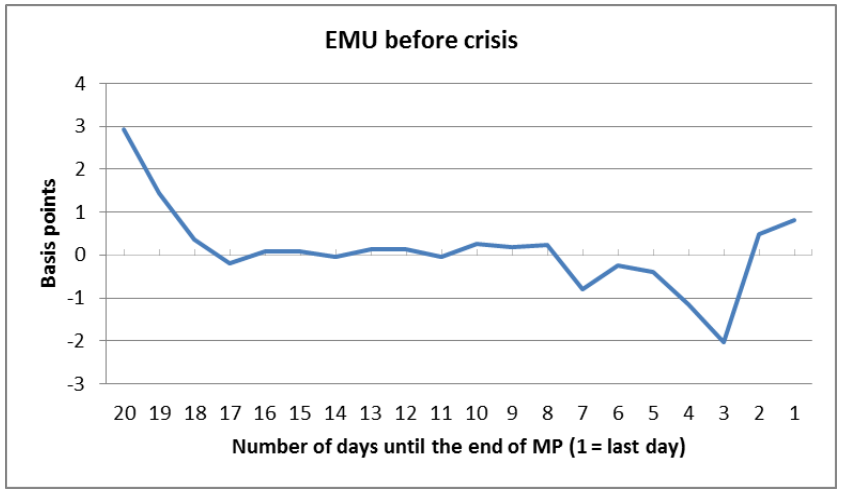
T1. Summary characteristics (Δr In basis points)

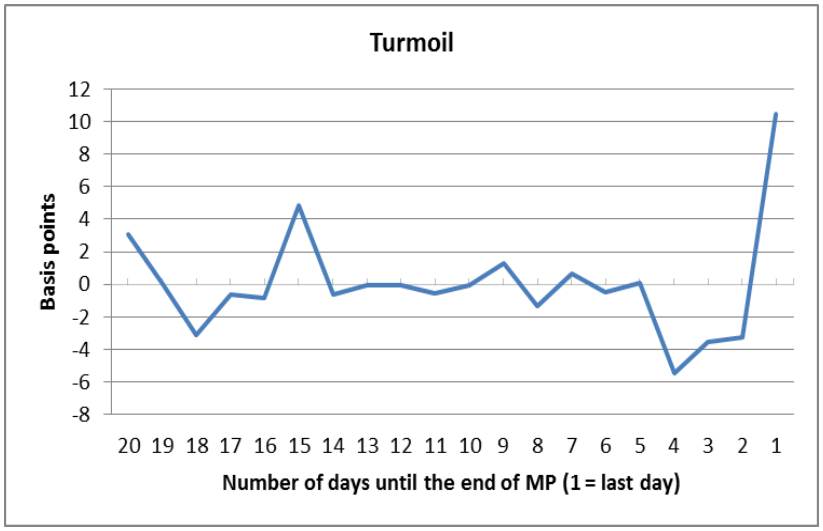
	Old framework		EMU: Before crisis		EMU: Turmoil		EMU: After FRFA	
	r	Δr	r	Δr	r	Δr	r	Δr
Mean	3.31	-0.09	2.58	0.24	4.01	0.09	0.77	-0.43
Median	3.28	-0.18	2.14	0.00	4.01	-0.08	0.41	-0.30
Minimum	1.33	-95.74	1.69	-71.05	3.42	-47.29	0.08	-90.07
Maximum	5.73	115.96	4.12	61.65	4.52	49.80	4.33	70.73
Std. Dev	0.91	12.96	0.67	7.18	0.16	10.84	0.90	11.41
Skewness	0.32	1.13	0.90	0.37	-0.29	0.54	2.54	-0.58
Kurtosis	2.10	20.92	2.31	38.68	4.08	10.61	8.97	16.69

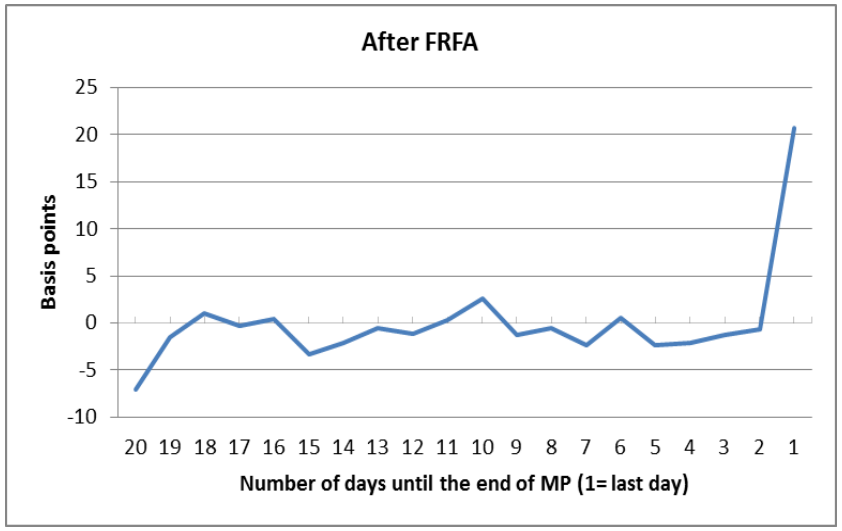
Evolution of Dutch EONIA

Average Δr over the reserve maintenance period

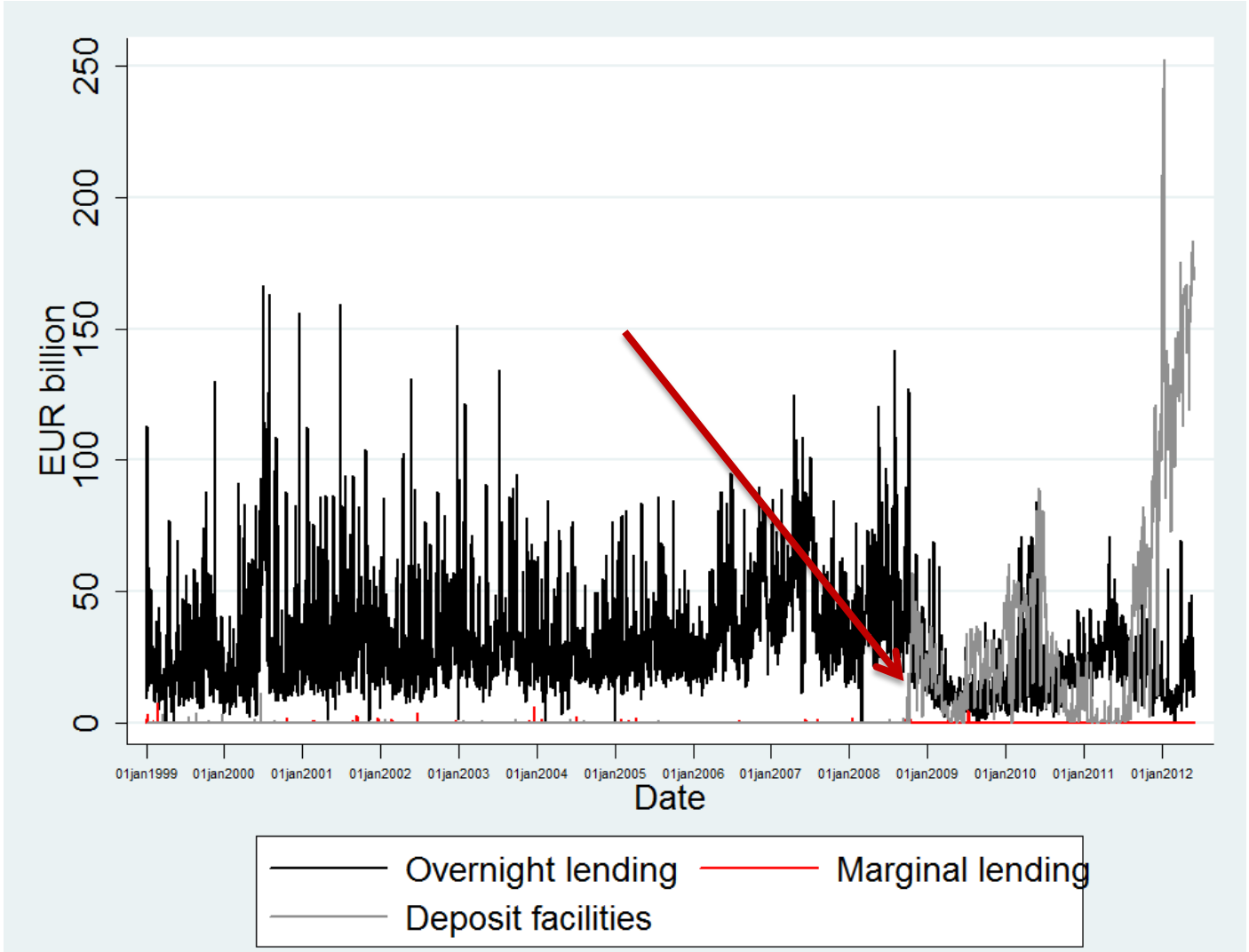








Evolution of Dutch EONIA: lending value



Data and methodology

- The empirical model has the form:

$$r_t = \mu_t + \sigma_t v_t$$

Mean equation

$$\mu = r_{t-1} + \delta_{m_t} + \delta_{w_t} + \delta_{c_t} + \alpha' h_t$$

Interest rate volatility

The model of EONIA's variance, $\sigma^2 = E[r_t - \mu_t)^2$, for $m_t = T,\ldots,1,0$ as

$$\log(\sigma^2) - \xi_{m_t} - \xi_{w_t} - \xi_{c_t} - \omega' h_t = \lambda[\log(\sigma^2{}_{t-1}) - \xi_{m_{t-1}} - \xi_{w_{t-1}} - \xi_{c_t-1} - \omega' h_{t-1}] + \varepsilon_{t-1}$$

Results

	Old framework	EMU: before crisis	Emu: Turmoil	After FRFA
Mean equation				
Constant	0.081	-0.037	-0.004	0.066
ΔDeonia(-1)	-0.032	0.002	0.010	-0.011
ΔDeonia(-2)	-0.028	-0.003	-0.130***	0.106***
ΔDeonia(-3)	-0.020*	-0.003*	-0.168***	0.018
ΔDeonia(-4)	-0.028***	-0.004**	-0.021	-0.034**
ΔDeonia(-5)	-0.012	-0.004*	0.113***	-0.017
ΔRefinance	-55.597**	116.644***	210.811**	79.195***
ΔMarginal lending	31.072***			
ΔDeposit rate	50.128***			
ΔLiquidity imbalances	0.111***	0.011**	0.070	0.085***
Before holidays	-2.961**	0.294	1.547	1.480
After holidays	2.965*		-2.974	0.376
Begin MP	9.859***	3.463***	0.704	-7.081***
End MP	-0.879	-0.676	9.282*	20.203***
Day 2 from end of MP	-0.084	1.534	-3.267	-0.432
Day 3 from end of MP	-1.865*	-3.345***	-1.270	-0.058
Day 4 from end of MP	-1.693	-0.073	-1.232	-0.621*
Day 5 from end of MP	-0.343	-0.152	-0.230	0.612
Half of MP	-0.182	0.049	-0.478	-0.392
Before end of the month	0.896**	-0.033	-0.939	0.230
End of the month	4.297***	1.902***	8.780**	2.076**
After end of the month	-4.336***	-1.784***	-4.440***	-2.710***
First day of the quarter	-5.410***	-3.269***	-19.121***	-0.770
Last day of the quarter	5.493***	2.934***	9.166	9.419***
Day before end of the year	25.862***	-0.279	-22.253***	-9.596**
Day after end of the year	-0.707	-0.459**	4.767***	-1.682*

Results

	Old framework		EMU: before crisis		Emu: Turmoil		After FRFA	
Variance Equation								
Constant	-0.121		-0.957	***	3.553	***	-0.073	
|RES|/SQR[GARCH[(1)	1.152	***	0.943	***	0.867	***	1.022	***
RES/SQR[GARCH](1)	0.078		0.135		-0.141		0.102	
EGARCH(1)	0.665	***	0.000		-0.040		0.555	***
Before holidays	0.523		0.454		-1.728		-0.613	
After holidays	0.314		1.127	***	0.462		-1.063	***
Begin MP	1.694	***	6.600	***	0.580		0.775	**
End MP	2.675	***	5.445	***	1.711	***	3.230	***
Day 2 from end of MP	1.408	***	4.654	***	1.267	***	0.649	**
Day 3 from end of MP	1.117	***	4.020	***	-0.088		0.273	
Day 4 from end of MP	2.020	***	3.322	***	0.055		-0.150	
Day 5 from end of MP	1.285	***	1.544	***	-1.053	**	1.239	***
Half of MP	0.019		-0.950	***	-0.006		0.831	***
Before end of the month	-0.485		-0.234		-0.450		-0.009	
End of the month	0.079		0.434		-0.621		1.758	***
After end of the month	1.069	***	-0.543		-1.418		0.388	
First day of the quarter	-0.693		1.213	***	2.164		0.962	**
Last day of the quarter	1.758	***	0.775	*	1.261		1.678	***
Day before end of the year	1.068		-1.667	**	-16.624	***	-0.109	
Day after end of the year	-1.999	***	-1.108	**	-22.923	***	-1.229	***
R-squared	0.098		0.250		0.287		0.390	
Adjusted R-squared	0.081		0.231		0.228		0.375	
S.E. of regression	12.447		6.295		9.742		8.974	
Sum squared resid	200327.800		33487.900		26385.490		72964.400	
Log likelihood	-4013.696		-1409.315		-1015.612		-2861.156	
Durbin-Watson stat	2.228		2.566		2.177		2.272	
Mean dependent var	-0.090		0.235		0.091		-0.446	
S.D. dependent var	12.981		7.178		11.090		11.349	
Akaike info criterion	6.156		3.346		7.017		6.248	
Schwarz criterion	6.337		3.582		7.558		6.476	
Hannan-Quinn criter.	6.224		3.437		7.234		6.335	

Conclusions

- The model takes into account infrequent spikes of the rate for its correct measurement.

- The model shows the patterns of behavior of the rate during 4 different periods and how volatility has changed during this time:
  - Volatility decreased with the introduction of EMU: i.o.w. ECB was better able to steer the interest rate in the money market. (Period I to II)
  - The variance of the rate increased during the turmoil starting in August 2007 (Period II)
  - Volatility became more sensitive when crisis worsened in 2008
  - Volatility's persistence increased in Period IV, taking longer to die out after a shock

Conclusions

- Period IV:
  - While volatility became more sensitive and persistent, its average value had a significant decrease caused by limited number of active lenders/borrowers. Lenders only lend to banks with high rating and borrowers could often borrow below overnight deposit!
  - Only last day of MP volatility high (20 bp).

→ partly caused by liquidity absorbing tenders (banks could deposit at ECB at rates above overnight deposit)

→ increased market rates as banks could go to ECB i.o lending to market.

Future work

- Finalize testing the model
- Look into (domestic) stress events
  - Specific bank failures that took place in the last 12 yeas
- Expand analysis to European level.
- Expand analysis to individual (group of banks).

Thank you!