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Fragmentation in the Euro overnight unsecured money market☆

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HIGHLIGHTS

- We study fragmentation in the Euro overnight unsecured money market.
- We identify several periods of severe market stress.
- Non-standard policy measures broadly reduced market tensions.
- Considerable market fragmentation remained in mid 2013.

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ABSTRACT

This paper examines the degree of fragmentation in the Euro overnight unsecured money market during the period June 2008–August 2013 using interbank loans constructed from payments data. After controlling for cross-country differences in bank risk, we document several episodes of significant market fragmentation. While non-standard measures such as the provision of long-term liquidity were successful in reducing tensions, considerable signs of market fragmentation remained at the end of the sample period.

1. Introduction

The overnight money market represents the initial element in the monetary transmission chain and is therefore of vital importance for the design and conduct of monetary policy. Since the onset of the financial crisis in 2007, central banks around the globe have been spending large efforts in order to contain stress in short-term interbank markets. This has been particularly true for Europe, where the outbreak of the sovereign debt crisis in 2010 led to a reversal of the long-term trend of financial integration that was induced by the adoption of the single currency in 1999 (see e.g. ECB, 2013). Accordingly, several of the ECB's policy measures were taken with the aim of preserving the "singleness" of monetary policy.

Unfortunately, there is little quantitative evidence on the development of the Euro money market throughout the sovereign debt crisis because trading in the interbank market usually takes place over-the-counter.[1] This paper presents an assessment of the degree of fragmentation in the Euro Area overnight unsecured money market for the period mid 2008–mid 2013 based on interbank loans constructed from payments data.[2]

2. Data

Our principal dataset consists of unsecured overnight interbank loans identified from payments data in the ECB's TARGET2

☆ We thank participants at the ESCB MaRs Workshop on TARGET2 data for helpful comments and suggestions. The views expressed in this paper are the authors' and do not necessarily reflect those of the European Central Bank or the Eurosystem.

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[1] Exceptions include studies using Italian e-MID data, see e.g. Angelini et al. (2011).

[2] The use of payments data is standard in the literature on the US Fed Funds market, see e.g. Afonso et al. (2011).

Table 1
Country breakdown of banks.

	DE	BE	AT	ES	FI	FR	GR	IE	IT	LU	NL	PT	All
Banks	43	3	10	29	5	8	9	4	54	4	14	15	198
Mean active	24.3	2.6	7.6	19.9	1.9	5.8	6.7	2.5	36.1	2.8	6.9	8.6	124.3
Min active	15	1	5	11	0	3	3	1	29	1	3	5	99
Max active	33	3	10	26	4	8	9	4	44	4	13	12	150

This table provides an overview of the total number of participants by country as well as some statistics on their participation.

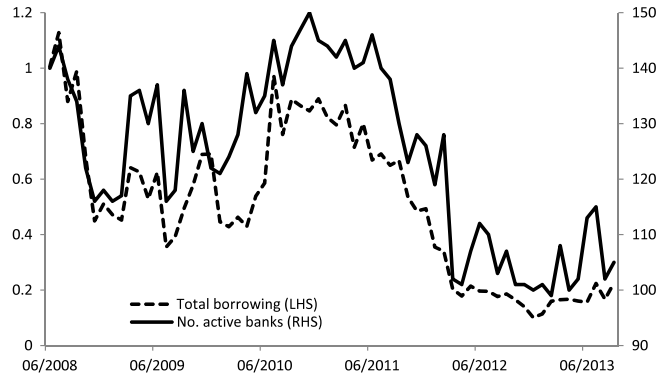

Fig. 1. Borrowing amounts and participation. This figure depicts the total monthly borrowing amount (in trillion EUR) as well as the monthly number of borrowing banks.

settlement system via the Furfine (1999) algorithm. Importantly, the data allows for the identification of the ultimate originator and beneficiary and, accordingly, does not suffer from the large error rates that plague similar dataset based on Fedwire (see Armatier and Copeland, 2012).[3] For each loan, the data comprises the transaction date, the amount, and the annualized interest rate. The sample period is June 2008–August 2013.

Given our focus on bank funding, we only consider gross borrowing. Because most banks transact rather irregularly, we aggregate information on amounts and (weighted average) interest rates at the monthly frequency and at the banking group level. To generate a stable sample, we only consider banks with at least 1 loan in the first and last 6 months of the sample and stem from one of the following 12 countries: AT, BE, DE, ES, FI, FR, GR, IE, IT, NL, LU, PT.[4] This leaves us with a final sample of 198 banks. Table 1 details the geographical composition, while Fig. 1 depicts the evolution of activity over time.

We also collect data on banks' credit ratings from the three major rating agencies (Fitch, Moody's, S&P). Banks are grouped into risk categories based on their average credit rating across all agencies (in case of multiple ratings) in a given month: high (AAA to AA−, or Moody's equivalent), medium (A+ to A−) and low (BBB+ and lower). The averaging across ratings follows Beaver et al. (2006). Non-rated banks are collected in a fourth category, not rated (NR).

Finally, the dataset is complemented with data from banks' participation in the ECB's weekly main refinancing operations (MROs).

3. Methodology

The purpose of this paper is to examine market fragmentation both in terms of funding costs and the ability to meet funding needs. Our methodology is motivated by the law of one price, which states that assets with identical payoffs and risks should command the same price. Accordingly, in a perfectly integrated market, the rate charged for unsecured overnight interbank loans should not vary systematically across countries after controlling for differences in credit risk.

Let $y_{i,t}$ denote the weighted average borrowing rate paid on unsecured overnight loans by bank i in month t, and decompose it into a risk-free rate (y_t), a risk premium based on the bank's risk category r (y_t^r), and a country (or country group) premium (y_t^c):

$$y_{i,t} = y_t + y_t^r + y_t^c + \varepsilon_{i,t}. \tag{1}$$

Perfect integration implies that $y_t^c = 0$ for all countries c and at each point in time t.

The above decomposition can also be applied to banks' ability to access the market for overnight unsecured loans. A market where banks of comparable credit quality face differences in their ability to tap other financial institutions for short-term funding should be considered as fragmented. In order to control for banks' (unobservable) demand for short-term funding, we rely on the idea that institutions that are not able to borrow from other counterparties will ultimately have to resort to the central bank. Let $IB_{i,t}$ denote the total overnight interbank borrowing by bank i in month t, and let $MRO_{i,t}$ be the liquidity drawn from the ECB's weekly main refinancing operation (with 7 days maturity) during the same period.[5] This yields the following measure of banks' (market) funding ability

$$\phi_{i,t} = \frac{IB_{i,t}}{IB_{i,t} + 7 * MRO_{i,t}}. \tag{2}$$

In case a bank does not borrow at all in a given month (neither in the market nor from the Eurosystem), we set $\phi_{i,t} = 1$ because the bank does not resort to public liquidity. This measure can be decomposed in the same fashion as $y_{i,t}$.

4. Results

The decomposition in Eq. (1) for borrowing rates and the corresponding equivalent for banks' funding ability, $\phi_{i,t}$, can be easily estimated via OLS regression on a set of indicator variables corresponding to time-period fixed effects, time-period*country (or country group) fixed effects and time-period*rating-category fixed effects. In all estimations, we cluster standard errors at the bank level.

4.1. Borrowing rates

For illustration, we begin by presenting the results for an estimation based on two country groups, stressed (ES, GR, IE, IT, PT) and non-stressed (the rest). In the notation of Eq. (1), we have $c \in \{S, NS\}$. Fig. 2 depicts the monthly time series of $\hat{y}_t^S$, the estimated

[3] Frutos et al. (2013) verify this dataset with regulatory data from Spain and find error rates of ca. 10%.

[4] Most Portuguese banks join TARGET2 in March 2009, so that we require at least one loan in the first 6 months after this date.

[5] We adjust for the fact that interbank liquidity borrowed on a Friday has a maturity of 3 days. Our results are qualitatively unchanged if we additionally consider resort to the infrequently used marginal lending facility (MLF) and 1-week unsecured interbank loans (constructed via the Furfine algorithm).

Table 2
Regression coefficients for borrowing rates.

	Stressed	Rating			Individual countries (relative to DE)						
		Medium	Low	None	AT	ES	FR	GR	IT	NL	PT
Pre Lehman	1.07	−1.66	−7.62	−1.19	0.47	−4.89*	−3.24	3.85**	2.00	−6.07***	
	(0.43)	(0.26)	(0.38)	(0.43)	(0.81)	(0.07)	(0.41)	(0.03)	(0.22)	(0.01)	
Post Lehman 1	−1.51	−4.82	−4.91	−1.26	−5.89	−5.24	−11.88	14.56	−20.62***	−12.72	
	(0.78)	(0.57)	(0.74)	(0.87)	(0.51)	(0.55)	(0.49)	(0.15)	(0.01)	(0.21)	
Post Lehman 2	3.17*	−0.46	5.37	6.35**	−1.60	4.12	−2.22	8.36***	−5.33***	−2.45	16.68**
	(0.09)	(0.84)	(0.50)	(0.03)	(0.56)	(0.36)	(0.35)	(0.01)	(0.01)	(0.45)	(0.05)
Post GR support	9.83***	3.11	20.19***	10.42***	−3.63**	6.65**	−2.72	19.79**	2.80	−6.74***	23.91***
	(0.00)	(0.11)	(0.00)	(0.00)	(0.04)	(0.02)	(0.13)	(0.02)	(0.15)	(0.00)	(0.00)
Post IE support	14.76***	3.70	19.77**	6.79***	−0.05	13.35***	−5.13	13.16	10.06***	−3.24	27.40***
	(0.00)	(0.12)	(0.02)	(0.01)	(0.99)	(0.00)	(0.14)	(0.19)	(0.00)	(0.28)	(0.01)
Post PT support	5.65**	2.86	22.61***	9.05***	−2.25	5.79	−2.96	27.53***	1.30	−0.85	11.94
	(0.02)	(0.29)	(0.00)	(0.00)	(0.55)	(0.15)	(0.29)	(0.00)	(0.63)	(0.86)	(0.17)
Summer 2011	26.26***	5.06*	19.57***	17.86***	−1.29	30.37***	3.91	86.07***	17.16***	−2.20	29.11**
	(0.00)	(0.08)	(0.00)	(0.00)	(0.70)	(0.00)	(0.23)	(0.00)	(0.00)	(0.48)	(0.02)
Fall 2011	63.02***	1.55	11.39	30.46***	1.07	60.49***	12.30***	84.80***	70.35***	6.14	45.89**
	(0.00)	(0.82)	(0.22)	(0.00)	(0.82)	(0.00)	(0.00)	(0.00)	(0.00)	(0.25)	(0.01)
Post LTROs	17.25***	−0.54	13.07**	12.87***	−3.79*	10.86***	0.74	117.08***	2.05	−2.40	44.42***
	(0.00)	(0.83)	(0.04)	(0.00)	(0.08)	(0.00)	(0.72)	(0.00)	(0.27)	(0.52)	(0.00)
Summer 2012	21.21***	4.89*	−1.38	15.89***	1.20	32.44***	3.31	66.13***	10.18***	2.92	41.84***
	(0.00)	(0.08)	(0.80)	(0.00)	(0.77)	(0.00)	(0.34)	(0.00)	(0.00)	(0.42)	(0.01)
Post speech	13.51***	0.69	−3.54	5.88***	0.97	24.45***	3.15*	44.36***	5.21**	6.88	34.99***
	(0.00)	(0.46)	(0.35)	(0.01)	(0.71)	(0.00)	(0.06)	(0.00)	(0.03)	(0.12)	(0.00)

This table contains the regression coefficients from estimating the decomposition of banks' borrowing rates in Eq. (1). The first four columns are based on an estimation for two country groups (stressed and non-stressed) and report the average premium paid by banks from stressed countries relative to banks from non-stressed countries as well as the effects of being in the respective rating category, relative to banks with a high credit rating. The remaining columns are based on an estimation with the full set of country*time fixed effects and tabulate the estimated premia for banks from individual countries, relative to Germany. *P*-values in brackets are based on standard errors clustered at the bank level. The sub-periods are defined in footnote 5.

*** Denotes significance at the 1% level.
** Denotes significance at the 5% level.
* Denotes significance at the 10% level.

average premium paid by banks from stressed countries relative to banks from non-stressed countries with a comparable credit rating. Overall, the results suggest that the overnight unsecured interbank market was reasonably well integrated in late 2008 and throughout all of 2009. While the Lehman bankruptcy led to an increase in the dispersion of borrowing rates, there is little evidence of widespread fragmentation across borders. Overall, one can identify four periods of significant market fragmentation: May–Jul 2010 (Greek request for financial support), Sep 2010–Mar 2011 (Irish and Portuguese requests for financial support), Jun–Dec 2011 (crisis spreads to Italy and Spain), and Jun–Jul 2012 (re-ignition of crisis). The third period clearly marks the most intense episode of fragmentation, when the average premium paid by banks from stressed countries peaked at above 70 bps in November and December 2011. Evidently, the decision to provide liquidity to banks' via 3-year long-term refinancing operations (LTROs) proved successful in reducing market tensions.

The first four columns of Table 2 report the coefficient estimates (based on sub-periods for parsimony) for the average premium for stressed countries as well as the premia associated with banks' credit risk.[6] As expected, we find that lower rated banks tend to face higher borrowing costs. However, the effect appears to be largely concentrated in periods of market tensions, consistent with lenders being wary of counterparty risk.

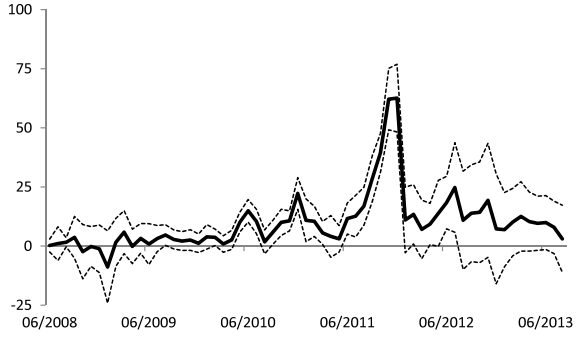

Fig. 2. Premium paid by banks from stressed countries. This figure depicts the estimated average premium (in bps) for borrowing by banks from stressed countries relative to banks from non-stressed countries based on the decomposition in Eq. (1). The dashed lines indicate the 95% confidence interval based on standard errors clustered at the bank level.

We proceed by estimating the country-specific premia, relative to German banks, via a separate estimation on the full set of country*time effects. The results are detailed in the remaining columns of Table 2, where the coefficients for credit risk are omitted for brevity. Due to confidentiality requirements, we also omit the coefficients for countries that display month with less than three active banks (BE, FI, IE, and LU).

Our estimates suggest that German banks were in fact facing higher borrowing costs than their foreign peers in the months following the Lehman bankruptcy, consistent with their considerable exposures to the US subprime mortgage market. However, the effect is statistically significant in only one case (Italy). It can be seen that there were very few instances where banks from

[6] The sub-periods are: Pre Lehman (06/08–08/08), Post Lehman 1 (09/08–02/09), Post Lehman 2 (03/09–04/10), Post GR bailout (05/10–09/10), Post IE bailout (10/10–03/11), Post PT bailout (04/11–06/11), Summer 2011 (07/11–10/11), Fall 2011 (11/11–12/11), Post LTROs (01/12–05/12), Summer 2012 (06/12–08/12), Post London Speech (after 08/12).

Table 3
Regression coefficients funding ability.

	Stressed	Rating			Individual countries (relative to DE)						
		Medium	Low	None	AT	ES	FR	GR	IT	NL	PT
Pre Lehman	0.12**	−0.03	0.11	0.15**	0.15	0.20**	0.26**	0.01	0.31***	0.37***	
	(0.04)	(0.71)	(0.53)	(0.03)	(0.17)	(0.02)	(0.02)	(0.94)	(0.00)	(0.00)	
Post Lehman 1	0.06	−0.23***	−0.20	0.06	−0.08	0.05	0.06	−0.15	0.23***	0.23*	
	(0.29)	(0.00)	(0.24)	(0.40)	(0.54)	(0.53)	(0.67)	(0.22)	(0.00)	(0.05)	
Post Lehman 2	−0.04	−0.15***	−0.26***	−0.04	−0.02	−0.07	0.07	−0.30***	0.09*	0.05	−0.06
	(0.31)	(0.00)	(0.00)	(0.34)	(0.85)	(0.30)	(0.31)	(0.00)	(0.08)	(0.49)	(0.50)
Post GR support	−0.28***	−0.10	−0.27***	0.01	−0.25***	−0.41***	0.01	−0.72***	−0.14***	0.01	−0.41***
	(0.00)	(0.11)	(0.01)	(0.82)	(0.01)	(0.00)	(0.84)	(0.00)	(0.01)	(0.87)	(0.00)
Post IE support	−0.29***	−0.10	−0.44***	−0.02	−0.08	−0.28***	0.13***	−0.57***	−0.21***	−0.02	−0.32***
	(0.00)	(0.13)	(0.00)	(0.76)	(0.52)	(0.00)	(0.01)	(0.00)	(0.00)	(0.81)	(0.01)
Post PT support	−0.23***	−0.13*	−0.38***	−0.04	0.02	−0.09	0.21***	−0.56***	−0.11	0.17**	−0.33***
	(0.00)	(0.06)	(0.00)	(0.55)	(0.87)	(0.31)	(0.00)	(0.00)	(0.11)	(0.02)	(0.01)
Summer 2011	−0.31***	−0.14**	−0.24***	0.01	−0.11	−0.25***	−0.15	−0.57***	−0.31***	0.06	−0.41***
	(0.00)	(0.03)	(0.00)	(0.85)	(0.40)	(0.00)	(0.15)	(0.00)	(0.00)	(0.37)	(0.00)
Fall 2011	−0.47***	−0.20***	−0.22***	−0.05	−0.20	−0.37***	−0.26*	−0.66***	−0.60***	0.03	−0.43***
	(0.00)	(0.00)	(0.01)	(0.42)	(0.14)	(0.00)	(0.07)	(0.00)	(0.00)	(0.57)	(0.00)
Post LTROs	−0.25***	−0.04	−0.20***	−0.08*	−0.07	−0.11*	−0.06	−0.73***	−0.27***	−0.02	−0.42***
	(0.00)	(0.21)	(0.00)	(0.05)	(0.42)	(0.10)	(0.20)	(0.00)	(0.00)	(0.84)	(0.00)
Summer 2012	−0.26***	−0.03	−0.18***	−0.04	0.04	−0.26***	−0.14**	−0.60***	−0.18***	−0.05	−0.51***
	(0.00)	(0.21)	(0.00)	(0.30)	(0.11)	(0.00)	(0.04)	(0.00)	(0.00)	(0.45)	(0.00)
Post speech	−0.21***	0.00	−0.06	0.04	−0.01	−0.17***	−0.08**	−0.48***	−0.09**	0.01	−0.51***
	(0.00)	(0.86)	(0.17)	(0.10)	(0.68)	(0.00)	(0.03)	(0.00)	(0.01)	(0.40)	(0.00)

This table contains the regression coefficients from estimating the decomposition of banks' funding ability in Eq. (1). The first four columns are based on an estimation for two country groups (stressed and non-stressed) and report the average funding ability of banks from stressed countries relative to banks from non-stressed countries as well as the effects of being in the respective rating category, relative to banks with a high credit rating. The remaining columns are based on an estimation with the full set of country*time fixed effects and tabulate the estimated funding ability for banks from individual countries, relative to Germany. *P*-values in brackets are based on standard errors clustered at the bank level, The sub-periods are defined in footnote 5.
*** Denotes significance at the 1% level.
** Denotes significance at the 5% level.
* Denotes significance at the 10% level.

non-stressed countries paid borrowing costs that differed significantly from those of their German peers. Turning to the stressed countries, one can see that Portuguese and Greek banks were the first to face considerable premia for overnight borrowing, starting already before the Greek rescue package. Italian and Spanish banks held up relatively well until the summer of 2011, but ultimately faced a dramatic surge in funding costs that only came to a halt after the first 3-year LTRO. The re-ignition of the European sovereign debt crisis in summer 2012 particularly hit Spanish institutions, while Italian banks appeared to have been largely insulated against this shock. While Draghi's speech in London and the successive OMT announcement reduced market tensions significantly, some market segments still remained fragmented at the end of the sample period.

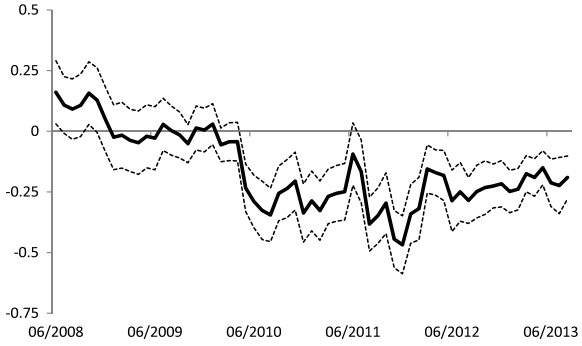

Fig. 3. Relative funding ability for banks from stressed countries. This figure depicts the estimated average funding ability for banks from stressed countries relative to banks from non-stressed countries based on applying the decomposition in Eq. (1) to the measure $\phi_{i,t}$. The dashed lines indicate the 95% confidence interval based on standard errors clustered at the bank level.

4.2. Funding ability

As in the previous section, we first present the results based on an estimation with only two country groups. Fig. 3 depicts the estimated time-series for $\hat{\phi}_t^S$, the relative funding ability of banks from stressed countries. An estimate of −0.1 implies that a bank from a stressed country is able to satisfy 10% less of its funding needs from the private market compared to a bank from a non-stressed country with comparable credit risk. The regression coefficients based on sub-periods are tabulated in the first column of Table 3.

Overall, the results from this analysis closely mirror the above results on fragmentation in borrowing rates. The first incidence of fragmentation in terms of funding ability occurs in May 2010, coinciding with the Greek bailout programme. In the following, short periods of relief take turns with episodes of stress on peripheral sovereigns, and the largest extent of fragmentation is reached in December 2011 just before the allotment of the first 3-year LTRO. Clearly, the ability to obtain cheap long-term funding significantly reduced banks' need to resort to the ECB's weekly operations. While the market displayed a slow movement towards re-integration in the following months, considerable fragmentation in terms of access to short-term funding remained at the end of the sample period.

The coefficients on the different rating categories in Table 3 (columns 2–4) reveal that banks of lower credit quality find it more difficult on average to obtain funding in the private market.

However, as for rates, this effect appears to have been largely confined to periods of severe market stress.

Turning to the results for the individual countries (again resulting from a separate estimation using the full set of country*time effects), we observe that banks from most countries relied less on public funding that the average German bank around the Lehman Bankruptcy, which is consistent with our earlier observations on borrowing rates. Throughout the Euro sovereign debt crisis, there was relatively little variation in funding ability among non-stressed countries. For stressed countries however, one can observe the same two-sided picture as before. While the policy interventions were largely successful in addressing the deteriorating situation of Spanish and in particular Italian banks, both Greek and Portuguese institutions were effectively locked out of the market since the beginning of the sovereign debt crisis, and this was still the case in August 2013.

5. Conclusion

This paper has examined the degree of fragmentation of the Euro Area overnight unsecured money market from June 2008 to August 2013 based on loans identified from payments data. Our analysis is based on (risk-adjusted) borrowing rates and banks' ability to satisfy their funding needs, controlling for resort to short-term central bank liquidity. Several episodes of market fragmentation are identified. Overall, the evidence suggests that non-standard measures such as long-term liquidity operations were broadly effective in dampening market tensions. However, considerable market fragmentation remained at the end of the sample period.

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