Money Market Disconnect

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Paper in a nutshell

Research question: Understand frictions in the money market and *how* they lead to market segmentation.

What we do:

- Identify **two aspects of the central bank framework** which lead to a *segmentation in money markets*: banks' access to the central bank's deposit facility and assets' eligibility for Quantitative Easing (QE).
- Identify the underlying **mechanism** behind it.

What we find:

- Money market becomes more segmented when the **role of collateral** in repos dominates the role of funding.
- Repo rates lent by **banks with access** to the deposit facility and secured by **QE eligible assets** are more collateral-driven and disconnected from funding-based money market rates.
- Our results are relevant for different **monetary policies** and have suggestive implications for the monetary policy pass-through.

Contribution to the literature

Literature on **money markets**

- First, we show that the money market becomes more segmented when the repo market is predominately collateral-driven. Second, we identify two disconnecting mechanisms as the sources of this segmentation.
- Arrata et al. (2020), and Corradin and Maddaloni (2020), investigate the effects of QE purchases on the level of *special* repo rates. Kraenzlin and Nellen (2015), analyze segmentation effects in the Swiss unsecured money market and Bech and Klee (2011) evaluate the impact of bargaining power.

Literature on **monetary policy**

- Our results about money market segmentation are relevant for different monetary policies. We also provide suggestive evidence that the monetary policy pass-through can be impeded by two key features of the central bank framework.
- Relevant studies include, for example, Duffie and Krishnamurthy (2016), and Drechsler, Savov, and Schnabl (2017), who analyze the interest-rate pass-through in the U.S.

Setting

Repo rate development

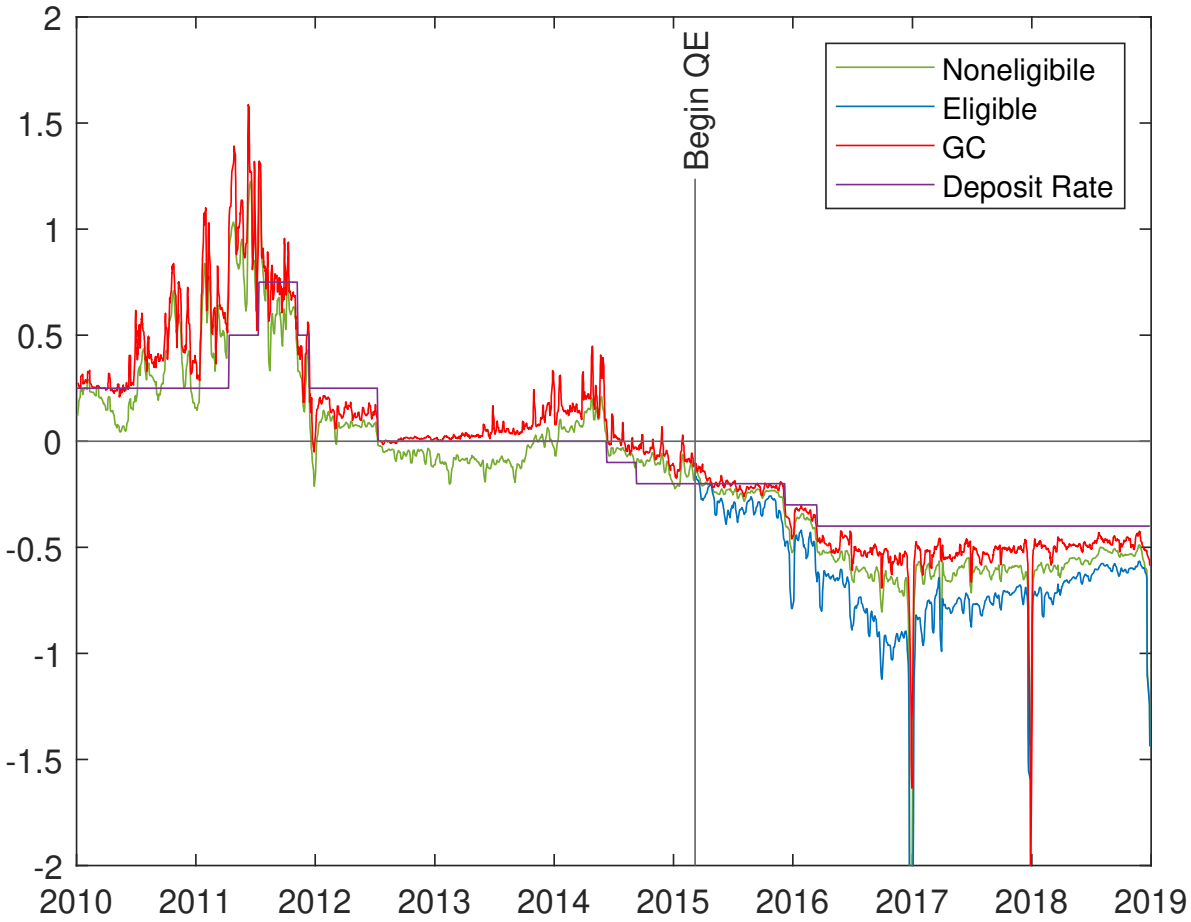

Figure: Repo rate development

importance data

ECB Access

ECB access

The *first* aspect that we investigate is that only a given set of money market participants are banks that have **access to the central bank's deposit facility.**

- Banks operate as repo *lenders* of cash (a) to have a short-term, safe investment (**funding motive**) or (b) to source a high-quality collateral (**collateral motive**).
- Storing funds at the deposit facility is the **outside option** to funding-based repo trades for banks with access to it.
- This option becomes **more convenient** in the GC $<$ DFR environment.
- Banks without access have a higher need for cash immediacy.

Hypothesis I

We expect an **endogenous selection of access banks into more collateral-driven segments** of the repo market which are less aligned with funding-based money market rates, in particular in the GC $<$ DFR environment.

theoretical framework volume and spread

Impulse response functions

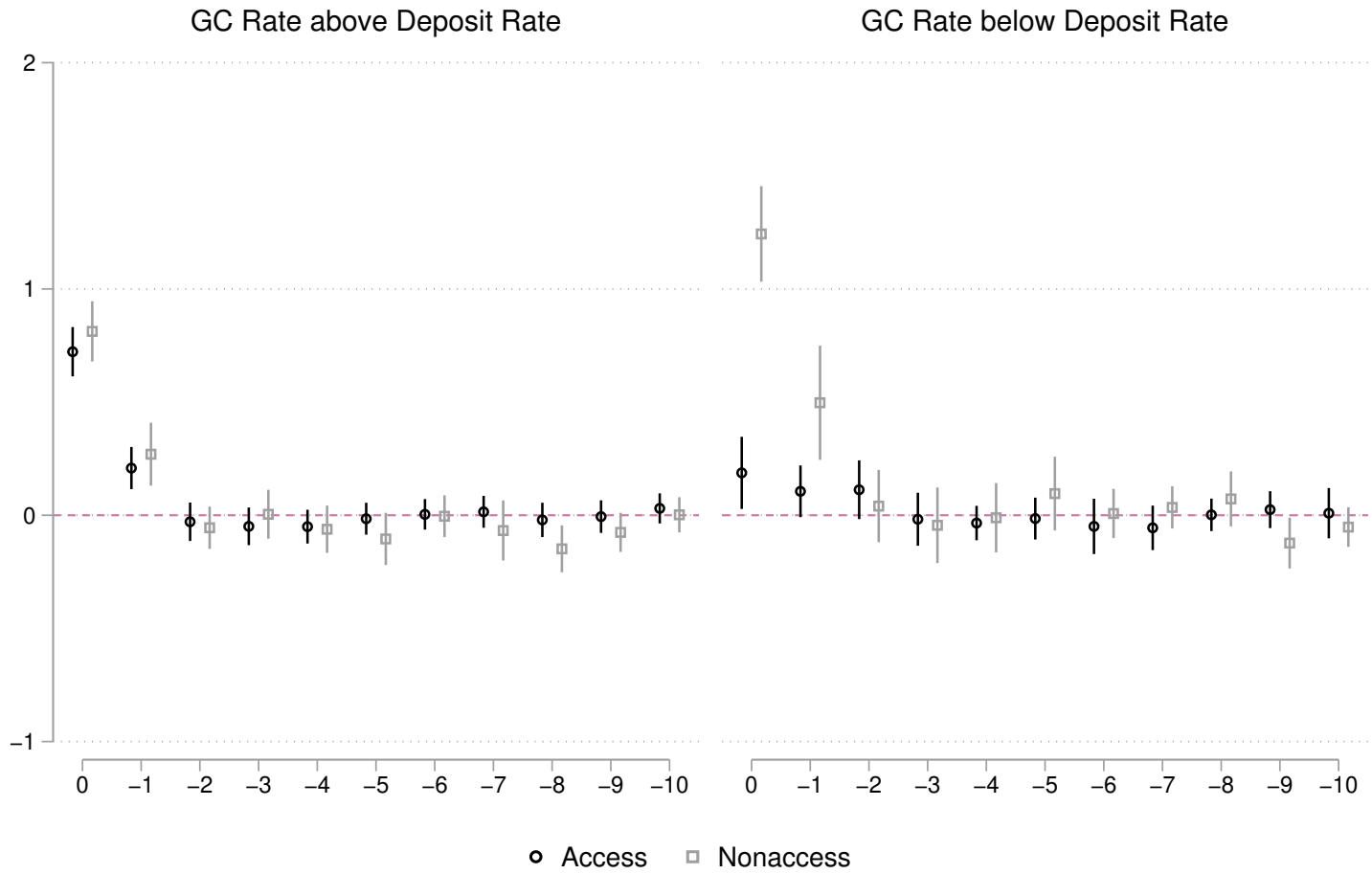

Figure: Impulse response for trades involving access/nonaccess banks

Empirical results

Table: ECB access

	Germany		
	(1)	(2)	(3)
	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$
$\Delta MMRate$	0.612***	0.762***	0.708***
	(15.672)	(10.955)	(8.515)
D^{Dep}	−0.027		−0.029
	(−1.271)		(−1.366)
$\Delta MMRate \cdot D^{Dep}$	−0.073		0.294**
	(−0.886)		(2.274)
D^{Access}		0.002	0.003
		(0.265)	(0.308)
$\Delta MMRate \cdot D^{Access}$		−0.216***	−0.128
		(−2.697)	(−1.358)
$\Delta MMRate \cdot D^{Access} \cdot D^{Dep}$			−0.590***
			(−3.730)
N	10,172	10,172	10,172
R^2	0.225	0.228	0.232
FE	Yes	Yes	Yes
$\Delta repo^{GC}$ lagged	Yes	Yes	Yes

Distance to DFR

Table: ECB access: Distance to deposit facility rate

	Germany		Core		All	
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$
$\Delta MMRate$	0.762***	0.762***	0.742***	0.742***	0.641***	0.642***
	(10.951)	(10.945)	(17.878)	(17.887)	(18.239)	(18.248)
D^{Access}	0.001	0.001	−0.003	−0.004	−0.005	−0.006
	(0.103)	(0.092)	(−0.639)	(−0.791)	(−1.321)	(−1.560)
$\Delta MMRate \cdot D^{Access}$	−0.266***	0.067	−0.343***	0.103*	−0.261***	0.124**
	(−2.978)	(0.742)	(−6.661)	(1.813)	(−6.022)	(2.424)
$\Delta MMRate \cdot D^{Access} \cdot DFRDistance$	−0.324**		−0.468***		−0.294***	
	(−2.133)		(−5.095)		(−3.665)	
$\Delta MMRate \cdot D^{Access} \cdot D^{DFR1}$		−0.224**		−0.147**		−0.251***
		(−2.248)		(−2.311)		(−3.547)
$\Delta MMRate \cdot D^{Access} \cdot D^{DFR2}$		−0.276***		−0.419***		−0.371***
		(−3.495)		(−8.699)		(−8.459)
$\Delta MMRate \cdot D^{Access} \cdot D^{DFR3}$		−0.548***		−0.494***		−0.387***
		(−5.355)		(−7.230)		(−5.805)
N	10,172	10,172	35,650	35,650	59,029	59,029
R^2	0.229	0.232	0.204	0.207	0.196	0.197
FE	Yes	Yes	Yes	Yes	Yes	Yes
$\Delta repo^{GC}$ lagged	Yes	Yes	Yes	Yes	Yes	Yes

other euro area countries | different SEs | different FEs | without period-ends | shorter time period

Tiering as a natural experiment

Table: ECB access: Introduction of ECB tiering system

	Germany	Core	All
	(1)	(2)	(3)
	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$
$\Delta MMRate$	0.901***	0.765***	0.791***
	(17.522)	(13.081)	(17.834)
$D^{Tiering}$	−0.016*	−0.021***	−0.041***
	(−1.822)	(−3.181)	(−4.330)
$\Delta MMRate \cdot D^{Tiering}$	0.145	0.068	0.220
	(0.740)	(0.342)	(0.509)
D^{Access}	−0.001	−0.003	−0.002
	(−0.267)	(−1.294)	(−0.460)
$\Delta MMRate \cdot D^{Access}$	−0.070	0.063	0.035
	(−0.588)	(0.681)	(0.477)
$\Delta MMRate \cdot D^{Access} \cdot D^{Tiering}$	−0.210	−0.566**	−0.944*
	(−0.819)	(−2.215)	(−1.648)
N	503	1,614	2,735
R^2	0.464	0.366	0.339
FE	Yes	Yes	Yes
$\Delta repo^{GC}$ lagged	Yes	Yes	Yes

QE Eligibility

QE eligibility

The *second* aspect relates to the QE eligibility criteria which specify that only a given set of assets is **eligible** to be purchased by the ECB.

- Compare repo lending rates of **eligible and noneligible assets**.
- Employ the provisions of the Public Sector Purchase Program (**PSPP**) since the start of QE and retrospectively to compare time trends between (hypothetically) eligible and noneligible assets (difference-in-difference setting).
- Specialness premium of QE-eligible assets increases due to asset scarcity and the repo rates secured by those assets become more **collateral-driven** disconnecting them from funding-based money market rates.

Hypothesis II

Repos secured by **QE-eligible assets** are more collateral-driven and **disconnected** from funding-based money market rates. Similar reactions of both types of collateral before QE would imply common trends and allow us to interpret the results as *causal*.

theoretical framework volume and spread

Empirical results

Table: Asset eligibility

	Germany		
	(1)	(2)	(3)
	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$
$\Delta MMRate$	0.106***	0.098***	0.109***
	(19.746)	(13.001)	(13.196)
D^{QE}	−0.016		−0.016
	(−1.448)		(−1.420)
$\Delta MMRate \cdot D^{QE}$	−0.150***		−0.120***
	(−15.860)		(−8.160)
$D^{Eligible}$		0.004	0.004
		(0.443)	(0.428)
$\Delta MMRate \cdot D^{Eligible}$		0.006	−0.005
		(0.537)	(−0.462)
$\Delta MMRate \cdot D^{Eligible} \cdot D^{QE}$		−0.172***	−0.052***
		(−14.030)	(−2.736)
N	301,766	301,766	301,766
R^2	0.116	0.116	0.116
FE	Yes	Yes	Yes
$\Delta repo^{Special}$ lagged	Yes	Yes	Yes

other euro area countries | different SEs | different FEs | without period-ends | shorter time period | time since eligibility

Extensions

Internal and external validity

External validity: Our results are robust if we consider **alternative** funding-based money market **rates**: ECB Access results QE Eligibility results

- EONIA-€STR combination with €STR rates beginning in March 2017.
- Overnight euro LIBOR.
- Overnight point of the OIS-implied zero curve and the EURIBOR-implied zero curve.
- One-week OIS rate.
- Rate on the ECB GC Pooling Basket.

Internal validity: We consider the **joint effects** of the two features of the central bank framework leading to money market segmentation. results

Monetary Policy Implications

Monetary policy implications

Our results are relevant for the interpretation of different monetary policies:

- We show that policies such as **tiering** encourage access banks to deposit additional amounts at the DFR, creating even stronger segmentation.
- The excessive usage of the deposit facility by access banks discourages interbank trading which inhibits **price determination** (Keister, Martin, and McAndrews, 2008).
- Amendments to the Capital Requirements Regulation (**CRR**) focusing on the exclusion of central bank reserves from the calculation of the leverage ratio could also manifest money market segmentation.

Monetary policy transmission

*"...there is a risk that, under the current framework, some short-term market rates would **not respond fully** to changes in our key interest rates or, even if they would, that a continued dispersion of short-term rates would **adversely impact** the transmission of our monetary policy stance."*

—Benoît Cœuré in May 2018

Repo market dispersion

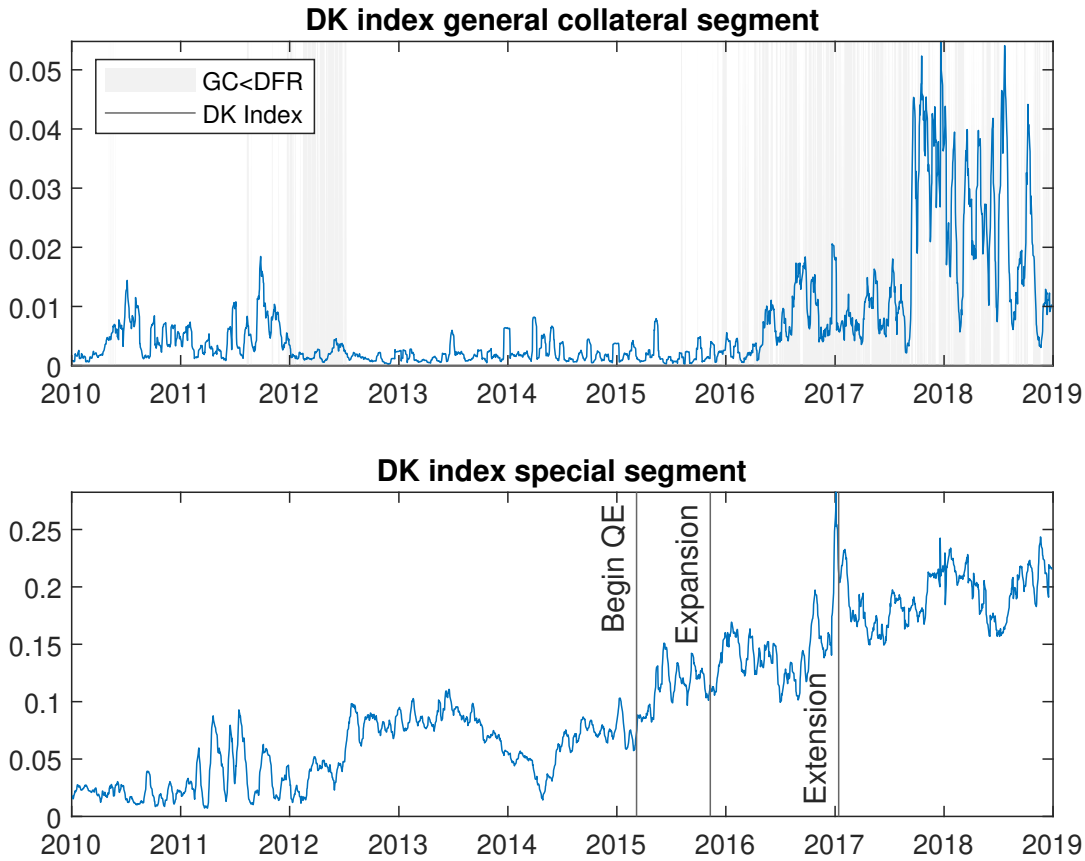

Figure: Repo market dispersion

Pass-through to lending rates

Conclusion

Conclusion

Although designed to support monetary policy, **two crucial aspects of the central bank framework** have led to a **segmentation in money markets**.

- Banks with **access** to the central bank's deposit facility lend at short-term rates that are more misaligned with the monetary policy target rate.
- Secured loans whose collateral assets are the target of **Quantitative Easing** programs are more disconnected from the monetary policy rate.

Money market segmentation emerges when the **role of collateral** in repos becomes dominant to the role of funding.

References I

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Appendix: Data

Table: Breakdown of the repo data.

	Access banks	Nonaccess banks
General collateral euro area repos		
Trade size (mn)	206.0	133.7
Repo rate (GC $>$ DFR)	0.16%	0.13%
Repo rate (GC $<$ DFR)	-0.22%	-0.29%
Interquartile range	0.51%	0.66%
# Baskets traded in per month	4.0	3.7
Total assets (bn)	290.6	241.2
Leverage ratio	16.7	17.2

	QE eligible assets	QE noneligible assets
Special collateral euro area repos		
Trade size (mn)	22.3	21.6
Repo rate (pre-QE)	0.16%	0.26%
Repo rate (post-QE)	-0.58%	-0.13%
Interquartile range	0.60%	0.74%
Bond issue size (bn)	37.8	36.7
Bond tenor (years)	12.6	6.4
Bond coupon rate	3.2%	3.1%

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Appendix: The importance of the repo market

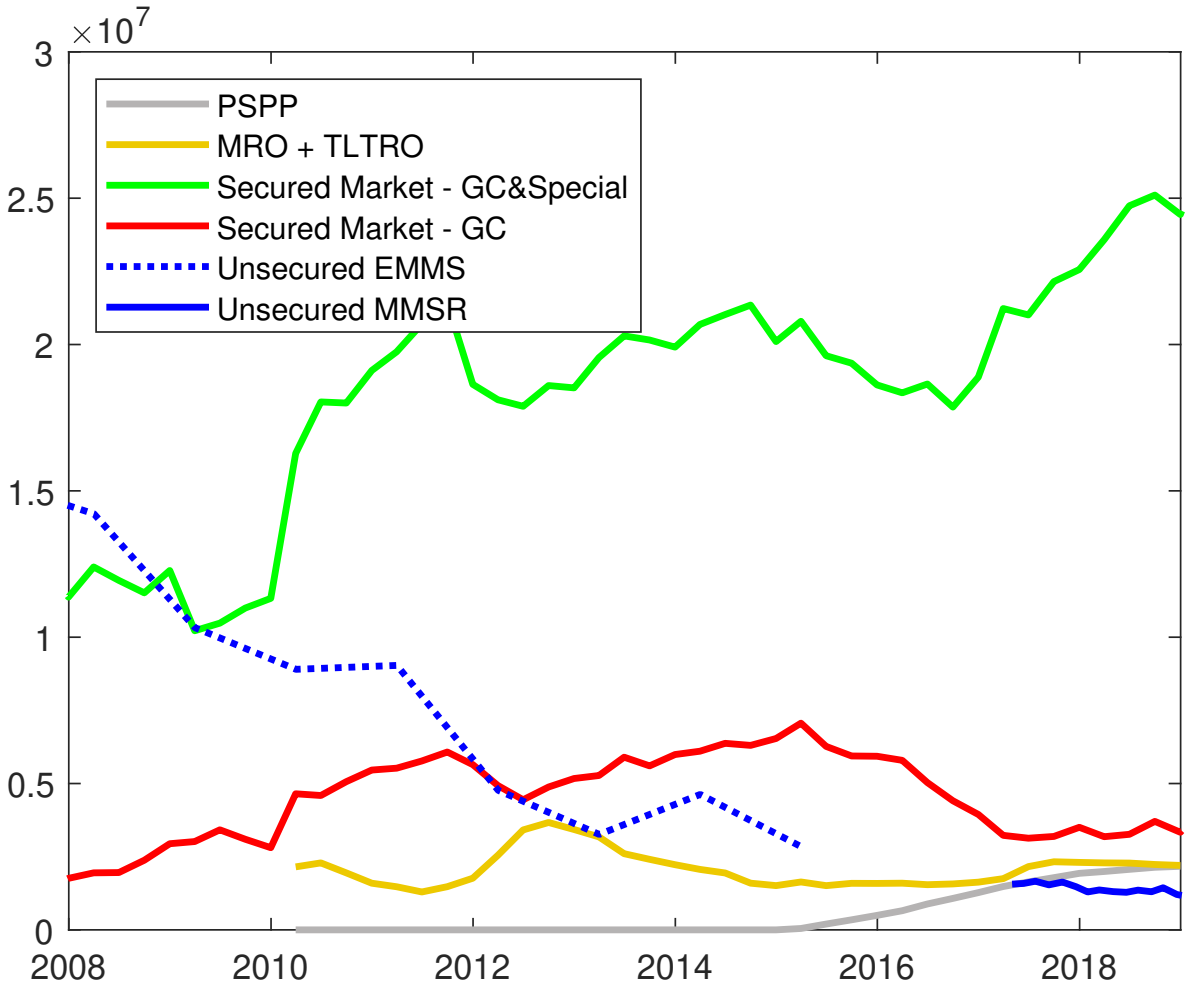

Figure: Different market turnovers (in euro million)

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Appendix: Mechanism

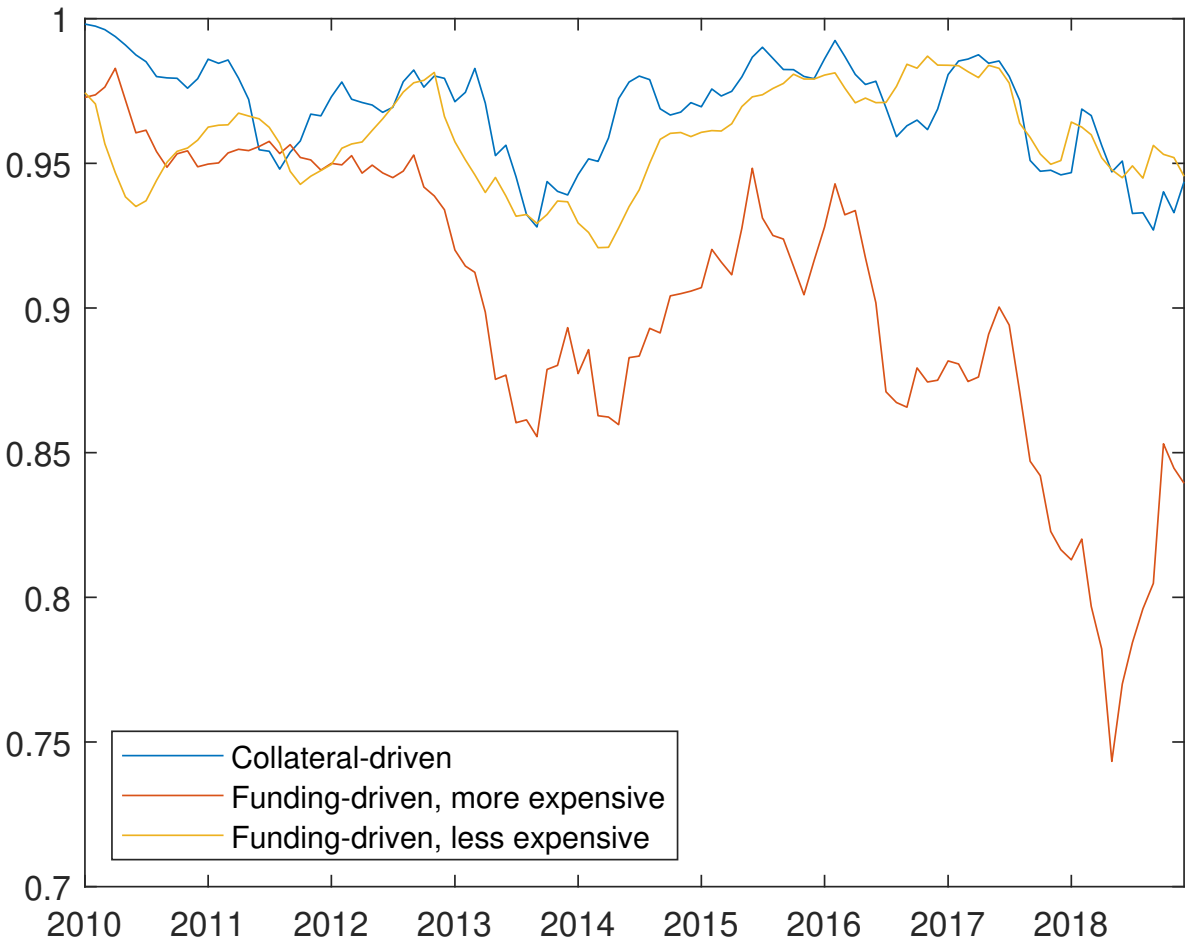

Figure: Trading share of access banks

Appendix: Theoretical framework for ECB access

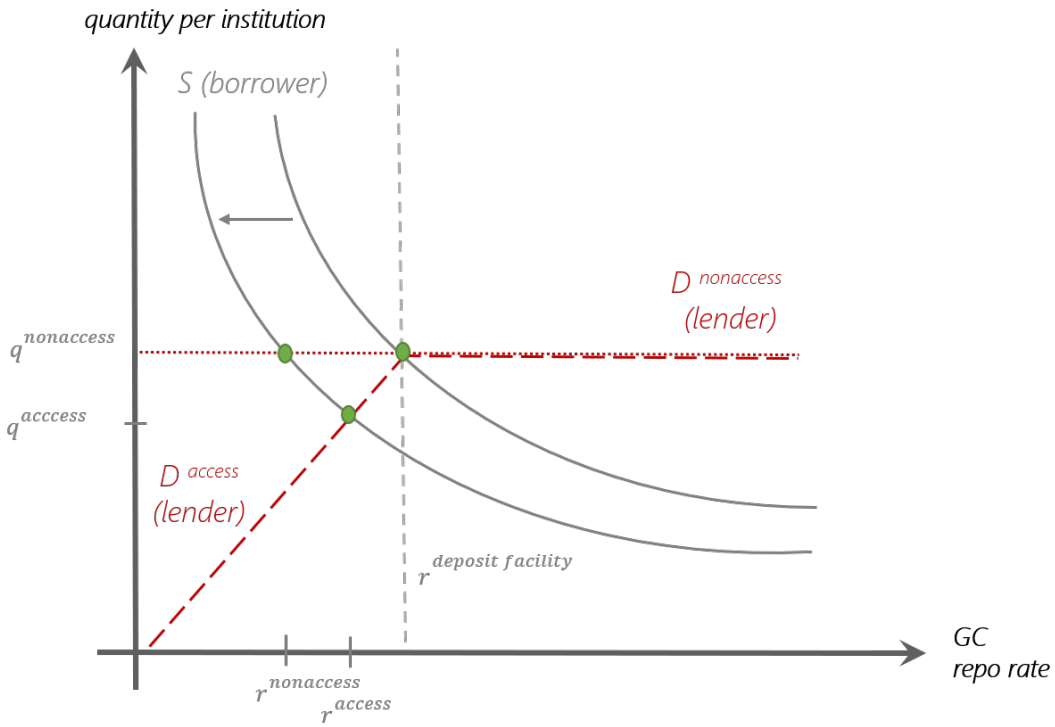

Figure: Impact of supply shock in the GC repo market

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Appendix: Demand for cash immediacy

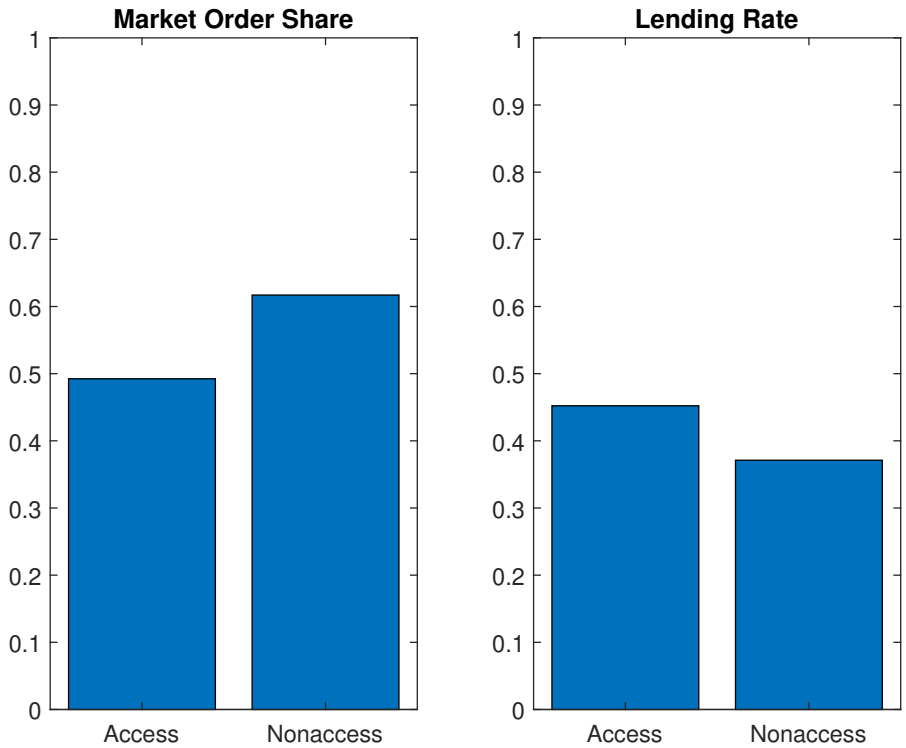

Figure: Market order share and excess rate frequency.

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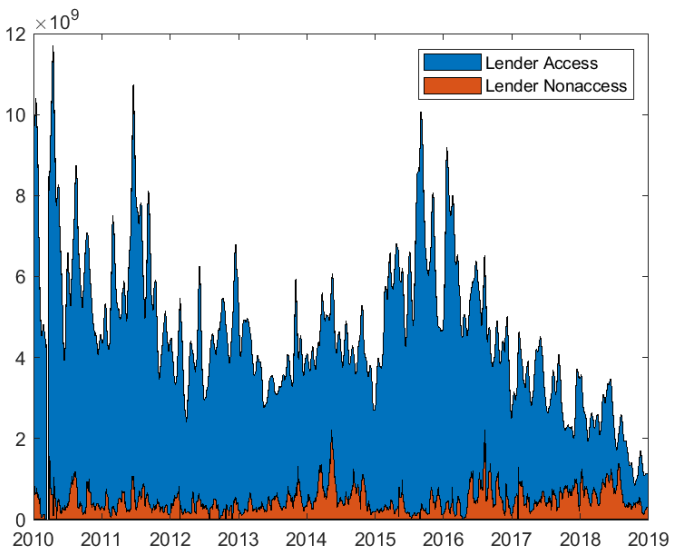
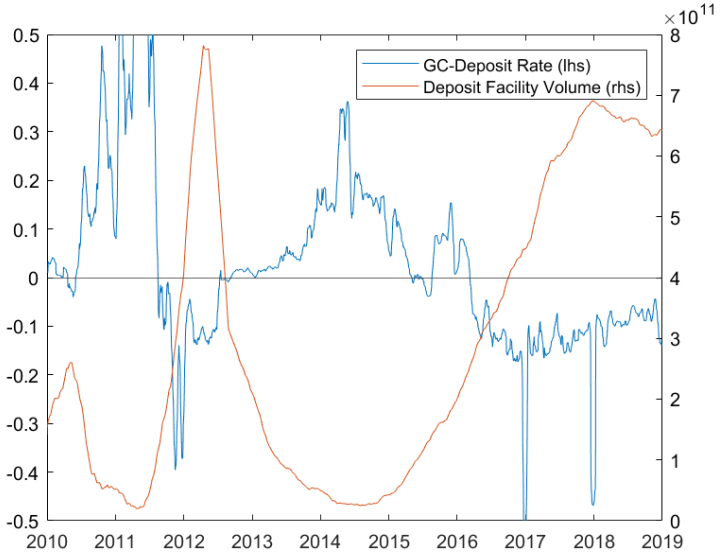
Appendix: Graphs on volume and spread for ECB access



(a) General collateral trading volumes



(b) Deposit facility volume and spread between GC rate and DFR

Figure: Repo market and deposit facility volumes

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Appendix:Distance to DFR

Table: ECB access: Distance to deposit facility rate

	Germany		Core		All	
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$
$\Delta MMRate$	0.762***	0.762***	0.742***	0.742***	0.641***	0.642***
	(10.951)	(10.945)	(17.878)	(17.887)	(18.239)	(18.248)
D^{Access}	0.001	0.001	−0.003	−0.004	−0.005	−0.006
	(0.103)	(0.092)	(−0.639)	(−0.791)	(−1.321)	(−1.560)
$\Delta MMRate \cdot D^{Access}$	−0.266***	0.067	−0.343***	0.103*	−0.261***	0.124**
	(−2.978)	(0.742)	(−6.661)	(1.813)	(−6.022)	(2.424)
$\Delta MMRate \cdot D^{Access} \cdot DFRDistance$	−0.324**		−0.468***		−0.294***	
	(−2.133)		(−5.095)		(−3.665)	
$\Delta MMRate \cdot D^{Access} \cdot D^{DFR1}$		−0.224**		−0.147**		−0.251***
		(−2.248)		(−2.311)		(−3.547)
$\Delta MMRate \cdot D^{Access} \cdot D^{DFR2}$		−0.276***		−0.419***		−0.371***
		(−3.495)		(−8.699)		(−8.459)
$\Delta MMRate \cdot D^{Access} \cdot D^{DFR3}$		−0.548***		−0.494***		−0.387***
		(−5.355)		(−7.230)		(−5.805)
N	10,172	10,172	35,650	35,650	59,029	59,029
R^2	0.229	0.232	0.204	0.207	0.196	0.197
FE	Yes	Yes	Yes	Yes	Yes	Yes
$\Delta repo^{GC}$ lagged	Yes	Yes	Yes	Yes	Yes	Yes

Appendix: Different regional classifications

Table: ECB access: Different regional classifications

	Germany only	Core excl. Germany	Periphery only
	(1)	(2)	(3)
	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$
	ON/TN b/t	ON/TN b/t	ON/TN b/t
$\Delta MMRate$	0.708***	0.693***	0.527***
	(8.515)	(12.340)	(9.647)
D^{Dep}	−0.029	−0.016	0.049***
	(−1.366)	(−1.390)	(5.297)
$\Delta MMRate \cdot D^{Dep}$	0.294**	0.332***	0.404
	(2.274)	(3.248)	(0.774)
D^{Access}	0.003	−0.003	−0.004
	(0.308)	(−0.494)	(−0.694)
$\Delta MMRate \cdot D^{Access}$	−0.128	−0.256***	−0.157**
	(−1.358)	(−4.055)	(−2.458)
$\Delta MMRate \cdot D^{Access} \cdot D^{Dep}$	−0.590***	−0.363***	−0.079
	(−3.730)	(−2.818)	(−0.139)
N	10,172	25,477	23,379
R^2	0.232	0.192	0.197
FE	Yes	Yes	Yes
$\Delta repo^{GC}$ lagged	Yes	Yes	Yes

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Appendix: Other euro area countries for ECB access

Table: ECB access: Other euro area countries

	Germany			Core			All		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$
$\Delta MMRate$	0.612***	0.762***	0.708***	0.531***	0.741***	0.698***	0.480***	0.641***	0.610***
	(15.672)	(10.955)	(8.515)	(24.119)	(17.871)	(15.026)	(26.602)	(18.235)	(16.458)
D^{Dep}	−0.027		−0.029	−0.017*		−0.018*	−0.001		−0.001
	(−1.271)		(−1.366)	(−1.731)		(−1.783)	(−0.228)		(−0.228)
$\Delta MMRate \cdot D^{Dep}$	−0.073		0.294**	0.032		0.318***	0.101**		0.418***
	(−0.886)		(2.274)	(0.603)		(3.976)	(1.994)		(5.472)
D^{Access}		0.002	0.003		−0.002	−0.001		−0.004	−0.003
		(0.265)	(0.308)		(−0.346)	(−0.220)		(−1.023)	(−0.919)
$\Delta MMRate \cdot D^{Access}$		−0.216***	−0.128		−0.271***	−0.217***		−0.209***	−0.176***
		(−2.697)	(−1.358)		(−5.758)	(−4.144)		(−5.252)	(−4.184)
$\Delta MMRate \cdot D^{Access} \cdot D^{Dep}$			−0.590***			−0.436***			−0.461***
			(−3.730)			(−4.328)			(−4.753)
N	10,172	10,172	10,172	35,650	35,650	35,650	59,029	59,029	59,029
R^2	0.225	0.228	0.232	0.198	0.203	0.204	0.192	0.195	0.196
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\Delta repo^{GC}$ lagged	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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Appendix: Clustered standard errors for ECB access

Table: ECB access: Clustered standard errors

	Germany			Core			All		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	
$\Delta MMRate$	0.612***	0.762***	0.708***	0.531***	0.741***	0.698***	0.480***	0.641***	0.610***
	(7.645)	(7.510)	(6.250)	(11.798)	(12.554)	(11.575)	(16.815)	(12.824)	(12.915)
D^{Dep}	−0.027**		−0.029**	−0.018**		−0.018**	−0.001		−0.001
	(−2.394)		(−2.551)	(−2.054)		(−2.146)	(−0.115)		(−0.120)
$\Delta MMRate \cdot D^{Dep}$	−0.073		0.294**	0.032		0.318***	0.105		0.418***
	(−0.652)		(2.387)	(0.426)		(4.585)	(1.242)		(5.458)
D^{Access}		0.002	0.003		−0.002	−0.001		−0.004**	−0.003*
		(0.567)	(0.707)		(−0.676)	(−0.416)		(−2.030)	(−1.888)
$\Delta MMRate \cdot D^{Access}$		−0.216	−0.128		−0.271***	−0.217***		−0.209***	−0.176***
		(−1.498)	(−0.858)		(−3.528)	(−2.807)		(−3.529)	(−3.099)
$\Delta MMRate \cdot D^{Access} \cdot D^{Dep}$			−0.590***			−0.436***			−0.454***
			(−3.474)			(−4.010)			(−3.807)
N	10,172	10,172	10,172	35,650	35,650	35,650	59,029	59,029	59,029
R^2	0.225	0.228	0.232	0.198	0.203	0.204	0.192	0.195	0.196
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\Delta repo^{GC}$ lagged	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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Appendix: Different FEs for ECB access

Table: ECB access: Different fixed effect specifications (*illustratively for Germany*)

	(1) $\Delta repo^{GC}$	(2) $\Delta repo^{GC}$	(3) $\Delta repo^{GC}$	(4) $\Delta repo^{GC}$	(5) $\Delta repo^{GC}$
$\Delta MMRate$	0.675***	0.684***	0.712***	0.725***	0.725***
	(8.781)	(9.300)	(9.197)	(8.733)	(8.709)
D^{Dep}	−0.047**	−0.047**	−0.027**	−0.032***	−0.021*
	(−2.338)	(−2.274)	(−2.068)	(−3.606)	(−1.795)
$\Delta MMRate \cdot D^{Dep}$	0.265**	0.269**	0.279**	0.313**	0.293**
	(2.082)	(2.350)	(2.225)	(2.358)	(2.228)
D^{Access}	−0.000	−0.002	0.003	0.002	0.003
	(−0.035)	(−0.146)	(0.265)	(0.155)	(0.338)
$\Delta MMRate \cdot D^{Access}$	−0.177**	−0.149*	−0.130	−0.138	−0.139
	(−2.100)	(−1.766)	(−1.456)	(−1.461)	(−1.468)
$\Delta MMRate \cdot D^{Access} \cdot D^{Dep}$	−0.719***	−0.686***	−0.665***	−0.591***	−0.583***
	(−4.970)	(−4.821)	(−4.400)	(−3.616)	(−3.608)
FE	Basket× Month× Term	Basket× Month	Basket× Year	Basket	Year
N	10,007	10,104	10,170	10,173	10,173
R^2	0.220	0.239	0.227	0.220	0.223
$\Delta repo^{GC}$ lagged	Yes	Yes	Yes	Yes	Yes

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Appendix: Without period-ends for ECB access

Table: ECB access: Results without quarter ends and end of ECB maintenance periods (*illustratively for Germany*)

	w/o quarter end days			w/o end of ECB maintenance period			w/o weeks of quarter end and end of ECB maintenance period		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$
$\Delta MMRate$	0.619***	0.760***	0.703***	0.605***	0.767***	0.723***	0.608***	0.828***	0.785***
	(15.512)	(10.694)	(8.235)	(14.918)	(10.386)	(8.149)	(11.873)	(9.183)	(7.430)
D^{Dep}	−0.029		−0.030	−0.011		−0.016	−0.005		−0.003
	(−1.360)		(−1.401)	(−0.510)		(−0.722)	(−0.431)		(−0.296)
$\Delta MMRate \cdot D^{Dep}$	−0.070		0.312**	−0.002		0.254**	0.059		0.271
	(−0.847)		(2.386)	(−0.021)		(1.990)	(0.523)		(1.578)
D^{Access}		0.005	0.005		−0.000	0.000		0.003	0.003
		(0.557)	(0.624)		(−0.047)	(0.008)		(0.380)	(0.362)
$\Delta MMRate \cdot D^{Access}$		−0.205**	−0.111		−0.218***	−0.154		−0.301***	−0.245**
		(−2.508)	(−1.157)		(−2.602)	(−1.565)		(−2.918)	(−2.058)
$\Delta MMRate \cdot D^{Access} \cdot D^{Dep}$			−0.621***			−0.439***			−0.385*
			(−3.893)			(−2.703)			(−1.778)
N	10,061	10,061	10,061	9,727	9,727	9,727	7,437	7,437	7,437
R^2	0.227	0.230	0.234	0.210	0.214	0.216	0.212	0.219	0.221
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\Delta repo^{GC}$ lagged	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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Appendix: Shorter time period for ECB access

Table: ECB access: Results for shorter time period

	Germany			Core			All		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	$\Delta repo^{GC}$	
$\Delta MMRate$	0.611***	0.761***	0.708***	0.531***	0.744***	0.698***	0.477***	0.641***	0.609***
	(15.664)	(10.685)	(8.520)	(24.074)	(17.741)	(15.007)	(26.328)	(18.002)	(16.307)
D^{Dep}	−0.027		−0.029	−0.020**		−0.021**	−0.014***		−0.013***
	(−1.274)		(−1.373)	(−1.968)		(−2.028)	(−2.946)		(−2.948)
$\Delta MMRate \cdot D^{Dep}$	−0.074		0.329**	0.046		0.369***	0.112**		0.477***
	(−0.861)		(2.329)	(0.820)		(4.408)	(2.062)		(5.931)
D^{Access}		0.005	0.005		−0.001	−0.001		−0.004	−0.003
		(0.410)	(0.415)		(−0.211)	(−0.094)		(−0.913)	(−0.720)
$\Delta MMRate \cdot D^{Access}$		−0.213***	−0.128		−0.274***	−0.217***		−0.212***	−0.176***
		(−2.613)	(−1.360)		(−5.761)	(−4.144)		(−5.265)	(−4.179)
$\Delta MMRate \cdot D^{Access} \cdot D^{Dep}$			−0.616***			−0.493***			−0.539***
			(−3.638)			(−4.737)			(−5.370)
N	8,062	8,062	8,062	26,363	26,363	26,363	44,746	44,746	44,746
R^2	0.226	0.229	0.233	0.198	0.203	0.204	0.188	0.191	0.193
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\Delta repo^{GC}$ lagged	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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Appendix: Other money market rates for ECB access

Table: ECB access: Other money market rates

	(1) EONIA $\Delta repo^{GC}$	(2) €STR $\Delta repo^{GC}$	(3) euro LIBOR $\Delta repo^{GC}$	(4) zero OIS $\Delta repo^{GC}$	(5) zero EURIBOR $\Delta repo^{GC}$	(6) OIS 1W $\Delta repo^{GC}$	(7) GC Pooling $\Delta repo^{GC}$
$\Delta MMRate$	0.708***	0.708***	0.497***	0.358***	0.188***	0.393***	0.799***
	(8.515)	(8.516)	(9.608)	(5.435)	(4.537)	(4.894)	(17.268)
D^{Dep}	−0.029	−0.029	−0.043**	−0.026	−0.026	−0.030	−0.033*
	(−1.366)	(−1.366)	(−2.038)	(−1.110)	(−1.003)	(−1.312)	(−1.704)
$\Delta MMRate \cdot D^{Dep}$	0.294**	0.312**	0.384***	0.304***	0.204**	0.333***	0.231**
	(2.274)	(2.400)	(4.799)	(2.773)	(2.386)	(2.864)	(2.179)
D^{Access}	0.003	0.003	0.001	0.004	0.000	0.003	−0.001
	(0.308)	(0.363)	(0.106)	(0.450)	(0.046)	(0.348)	(−0.143)
$\Delta MMRate \cdot D^{Access}$	−0.128	−0.127	−0.059	−0.194***	−0.079*	−0.081	−0.155***
	(−1.358)	(−1.358)	(−0.888)	(−2.768)	(−1.801)	(−0.871)	(−2.684)
$\Delta MMRate \cdot D^{Access} \cdot D^{Dep}$	−0.590***	−0.592***	−0.445***	−0.353***	−0.274***	−0.142	−0.409***
	(−3.730)	(−3.727)	(−3.810)	(−3.010)	(−3.041)	(−0.966)	(−2.725)
N	10,172	10,172	10,121	10,007	9,775	10,096	10,154
R^2	0.232	0.233	0.220	0.130	0.123	0.161	0.329
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\Delta repo^{GC}$ lagged	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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Appendix: Theoretical framework for QE eligibility

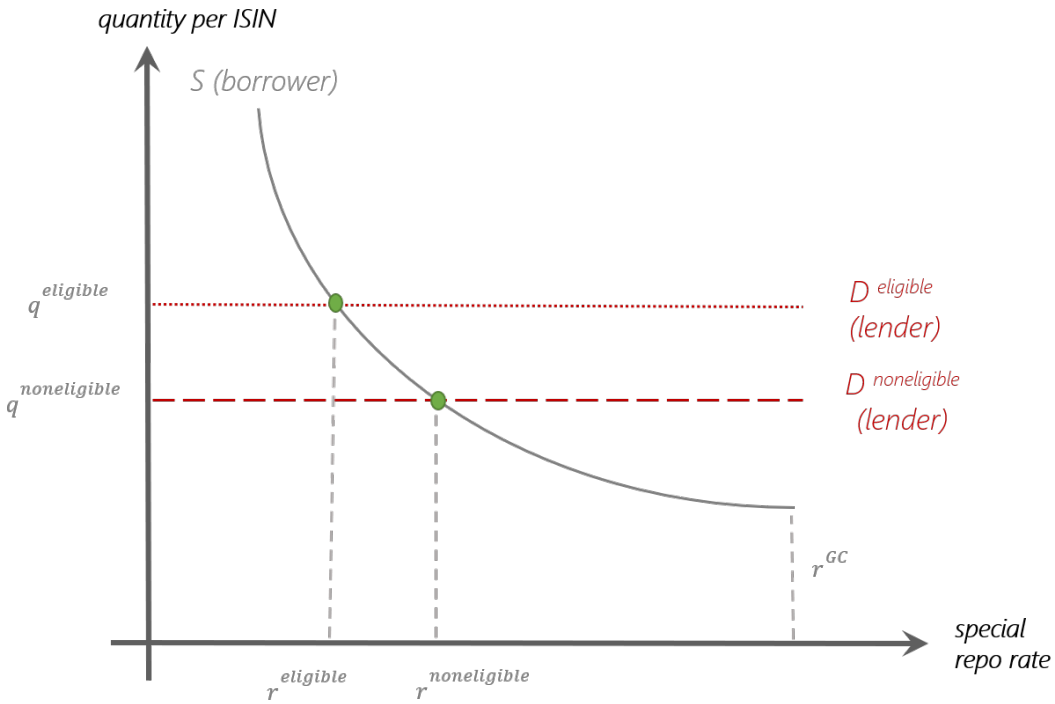

Figure: Impact of demand shock in the special repo market

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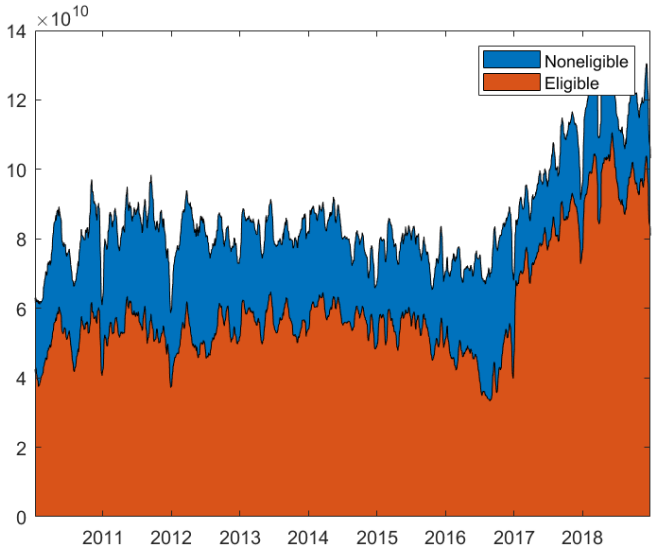
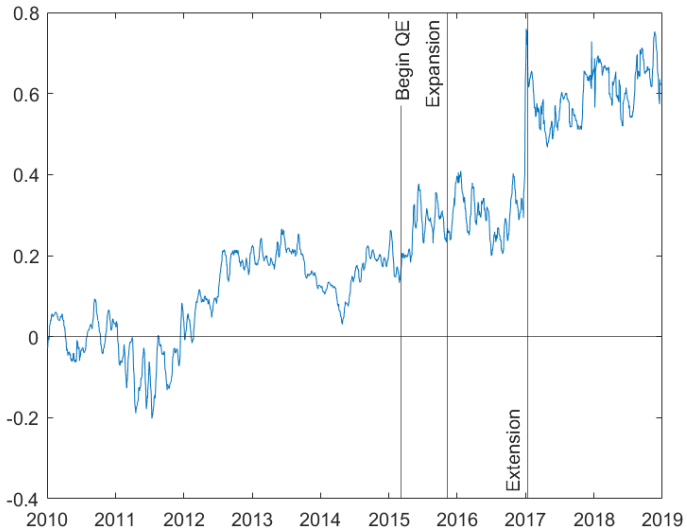
Appendix: Graphs on volume and spread for QE eligibility



(a) Special collateral trading volume



(b) Spread between (hypothetically) eligible and noneligible assets

Figure: Special collateral repo market

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Appendix: Time since QE eligibility

Table: Asset eligibility: Time since eligibility

	Germany		Core		All	
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$
$\Delta MMRate$	0.106***	0.106***	0.105***	0.105***	0.099***	0.099***
	(19.745)	(19.745)	(31.250)	(31.250)	(30.217)	(30.217)
D^{QE}	−0.015	−0.016	−0.008	−0.008	−0.020*	−0.020**
	(−1.365)	(−1.409)	(−1.091)	(−1.146)	(−1.951)	(−1.987)
$\Delta MMRate \cdot D^{QE}$	−0.093***	−0.120***	−0.080***	−0.104***	−0.070***	−0.082***
	(−9.025)	(−8.483)	(−11.334)	(−9.789)	(−10.101)	(−7.532)
$\Delta MMRate \cdot TSE$	−0.001***		−0.001***		−0.001***	
	(−9.655)		(−9.894)		(−10.604)	
$\Delta MMRate*$						
TSE^1_{Bucket}		−0.008		−0.010		−0.022*
		(−0.467)		(−0.817)		(−1.776)
TSE^2_{Bucket}		−0.279***		−0.087**		−0.037
		(−5.995)		(−2.515)		(−1.376)
TSE^3_{Bucket}		−0.465***		−0.455***		−0.377***
		(−6.458)		(−9.473)		(−11.092)
N	301,766	301,766	706,015	706,015	943,926	943,926
R^2	0.116	0.116	0.113	0.113	0.117	0.117
FE	Yes	Yes	Yes	Yes	Yes	Yes
$\Delta repo^{Special}$ lagged	Yes	Yes	Yes	Yes	Yes	Yes

Appendix: Other euro area countries for QE eligibility

Table: Asset eligibility: Other euro area countries

	Germany			Core			All		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$
$\Delta MMRate$	0.106***	0.098***	0.109***	0.105***	0.095***	0.103***	0.099***	0.094***	0.101***
	(19.746)	(13.001)	(13.196)	(31.250)	(17.688)	(17.850)	(30.217)	(18.379)	(18.370)
D^{QE}	−0.016		−0.016	−0.008		−0.008	−0.020**		−0.020**
	(−1.448)		(−1.420)	(−1.176)		(−1.157)	(−2.001)		(−1.996)
$\Delta MMRate \cdot D^{QE}$	−0.150***		−0.120***	−0.126***		−0.106***	−0.108***		−0.091***
	(−15.860)		(−8.160)	(−19.822)		(−9.820)	(−17.347)		(−8.349)
$D^{Eligible}$		0.004	0.004		0.003	0.003		0.001	0.001
		(0.443)	(0.428)		(0.580)	(0.578)		(0.236)	(0.214)
$\Delta MMRate \cdot D^{Eligible}$		0.006	−0.005		0.011	0.002		0.004	−0.004
		(0.537)	(−0.462)		(1.622)	(0.299)		(0.594)	(−0.556)
$\Delta MMRate \cdot D^{Eligible} \cdot D^{QE}$		−0.172***	−0.052***		−0.136***	−0.030**		−0.116***	−0.026*
		(−14.030)	(−2.736)		(−17.421)	(−2.211)		(−15.232)	(−1.936)
N	301,766	301,766	301,766	706,015	706,015	706,015	943,926	943,926	943,926
R^2	0.116	0.116	0.116	0.113	0.113	0.113	0.117	0.117	0.117
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\Delta repo^{Special}$ lagged	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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Appendix: Clustered standard errors for QE eligibility

Table: Asset eligibility: Clustered standard errors

	Germany			Core			All		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$
$\Delta MMRate$	0.106**	0.098**	0.109**	0.105***	0.095***	0.103***	0.099**	0.094***	0.101***
	(34.655)	(37.041)	(38.232)	(120.664)	(78.946)	(88.152)	(48.406)	(122.590)	(103.312)
D^{QE}	−0.016		−0.016	−0.008		−0.008	−0.020		−0.020
	(−0.820)		(−0.823)	(−0.705)		(−0.692)	(−0.742)		(−0.740)
$\Delta MMRate \cdot D^{QE}$	−0.150		−0.120**	−0.126*		−0.106**	−0.108*		−0.091**
	(−5.753)		(−23.555)	(−9.290)		(−35.762)	(−9.468)		(−50.415)
$D^{Eligible}$		0.004	0.004		0.003	0.003		0.001	0.001
		(0.388)	(0.388)		(0.669)	(0.663)		(0.262)	(0.237)
$\Delta MMRate \cdot D^{Eligible}$		0.006	−0.005		0.011*	0.002		0.004	−0.004
		(2.173)	(−1.241)		(7.898)	(1.164)		(3.513)	(−2.011)
$\Delta MMRate \cdot D^{Eligible} \cdot D^{QE}$		−0.172***	−0.052*		−0.136***	−0.030*		−0.116***	−0.026**
		(−124.249)	(−7.961)		(−169.593)	(−9.881)		(−129.110)	(−22.176)
N	301,766	301,766	301,766	706,015	706,015	706,015	943,926	943,926	943,926
R^2	0.116	0.116	0.116	0.113	0.113	0.113	0.117	0.117	0.117
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\Delta repo^{Special}$ lagged	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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Appendix: Different FEs for QE eligibility

Table: Asset eligibility: Different fixed effect specifications (*illustratively for Germany*)

	(1) $\Delta repo^{Special}$	(2) $\Delta repo^{Special}$	(3) $\Delta repo^{Special}$	(4) $\Delta repo^{Special}$	(5) $\Delta repo^{Special}$
$\Delta MMRate$	0.109***	0.111***	0.117***	0.118***	0.118***
	(13.196)	(13.216)	(13.670)	(13.773)	(13.820)
D^{QE}	−0.016	−0.016	0.047***	0.013***	0.047***
	(−1.420)	(−1.414)	(9.011)	(5.899)	(9.399)
$\Delta MMRate \cdot D^{QE}$	−0.120***	−0.121***	−0.129***	−0.129***	−0.131***
	(−8.160)	(−8.175)	(−8.599)	(−8.559)	(−8.719)
$D^{Eligible}$	0.004	0.004	−0.010**	−0.002	−0.000
	(0.428)	(0.496)	(−2.336)	(−0.819)	(−0.020)
$\Delta MMRate \cdot D^{Eligible}$	−0.005	−0.006	−0.002	−0.003	−0.004
	(−0.462)	(−0.510)	(−0.216)	(−0.297)	(−0.344)
$\Delta MMRate \cdot D^{Eligible} \cdot D^{QE}$	−0.052***	−0.053***	−0.053***	−0.051***	−0.052***
	(−2.736)	(−2.738)	(−2.712)	(−2.598)	(−2.644)
FE	ISIN× Month× Term	ISIN× Month	ISIN× Year	ISIN	Year
N	301,766	302,017	302,054	302,055	302,055
R^2	0.116	0.119	0.116	0.116	0.117
$\Delta repo^{Special}$ lagged	Yes	Yes	Yes	Yes	Yes

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Appendix: Without period-ends for QE eligibility

Table: Asset eligibility: Results without quarter ends and end of ECB maintenance periods (*illustratively for Germany*)

	w/o quarter end days			w/o end of ECB maintenance period			w/o weeks of quarter end and end of ECB maintenance period		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$
$\Delta MMRate$	0.118***	0.111***	0.123***	0.120***	0.107***	0.120***	0.111***	0.126***	0.142***
	(21.365)	(14.189)	(14.386)	(20.436)	(13.080)	(13.328)	(14.880)	(12.206)	(12.419)
D^{QE}	−0.016		−0.015	−0.012		−0.012	−0.000		0.048***
	(−1.413)		(−1.390)	(−1.140)		(−1.134)	(−0.040)		(7.992)
$\Delta MMRate \cdot D^{QE}$	−0.171***		−0.136***	−0.167***		−0.139***	−0.153***		−0.169***
	(−17.209)		(−8.846)	(−17.466)		(−9.519)	(−13.432)		(−9.788)
$D^{Eligible}$		0.003	0.002		−0.000	−0.000		−0.011**	−0.009**
		(0.374)	(0.298)		(−0.011)	(−0.018)		(−2.525)	(−2.011)
$\Delta MMRate \cdot D^{Eligible}$		0.004	−0.008		0.013	0.000		0.003	−0.014
		(0.363)	(−0.700)		(1.184)	(0.011)		(0.222)	(−0.920)
$\Delta MMRate \cdot D^{Eligible} \cdot D^{QE}$		−0.197***	−0.061***		−0.188***	−0.049**		−0.193***	−0.026
		(−15.224)	(−3.042)		(−14.791)	(−2.558)		(−12.207)	(−1.124)
N	298,122	298,122	298,122	288,634	288,634	288,634	221,393	221,757	221,757
R^2	0.116	0.116	0.116	0.117	0.116	0.117	0.119	0.109	0.109
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\Delta repo^{Special}$ lagged	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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Appendix: Shorter time period for QE eligibility

Table: Asset eligibility: Results for shorter time period

	Germany			Core			All		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$
$\Delta MMRate$	0.106***	0.099***	0.109***	0.105***	0.095***	0.103***	0.099***	0.095***	0.101***
	(19.671)	(13.020)	(13.144)	(31.157)	(17.810)	(17.780)	(30.157)	(18.492)	(18.310)
D^{QE}	−0.016		−0.015	−0.008		−0.008	−0.019*		−0.019*
	(−1.415)		(−1.353)	(−1.128)		(−1.096)	(−1.921)		(−1.908)
$\Delta MMRate \cdot D^{QE}$	−0.137***		−0.113***	−0.111***		−0.093***	−0.096***		−0.079***
	(−14.406)		(−7.702)	(−17.365)		(−8.603)	(−15.130)		(−7.245)
$D^{Eligible}$		0.009	0.010		0.006	0.006		0.004	0.004
		(1.055)	(1.060)		(0.999)	(1.021)		(0.705)	(0.702)
$\Delta MMRate \cdot D^{Eligible}$		0.005	−0.005		0.010	0.002		0.003	−0.004
		(0.481)	(−0.448)		(1.468)	(0.328)		(0.425)	(−0.554)
$\Delta MMRate \cdot D^{Eligible} \cdot D^{QE}$		−0.155***	−0.042**		−0.120***	-0.027**		−0.104***	−0.025*
		(−12.555)	(−2.176)		(−15.287)	(−2.012)		(−13.344)	(−1.859)
N	225,533	225,533	225,533	519,447	519,447	519,447	655,830	655,830	655,830
R^2	0.111	0.111	0.111	0.109	0.109	0.109	0.112	0.112	0.112
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\Delta repo^{Special}$ lagged	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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Appendix: Other money market rates for QE eligibility

Table: Asset eligibility: Other money market rates

	(1) EONIA	(2) €STR	(3) euro LIBOR	(4) zero OIS	(5) zero EURIBOR	(6) OIS 1W	(7) GC Pooling
	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$	$\Delta repo^{Special}$
$\Delta MMRate$	0.109***	0.109***	0.104***	0.050***	0.046***	0.110***	0.201***
	(13.196)	(13.196)	(11.539)	(9.063)	(9.272)	(13.665)	(19.083)
D^{QE}	−0.016	−0.016	−0.039***	−0.028**	−0.030**	−0.039***	−0.014
	(−1.420)	(−1.407)	(−3.102)	(−2.327)	(−2.451)	(−3.466)	(−1.274)
$\Delta MMRate \cdot D^{QE}$	−0.120***	−0.115***	−0.109***	−0.022***	−0.019***	−0.050***	0.453***
	(−8.160)	(−7.874)	(−9.379)	(−3.136)	(−2.937)	(−3.203)	(9.917)
$D^{Eligible}$	0.004	0.004	0.003	0.003	0.002	0.002	0.005
	(0.428)	(0.424)	(0.304)	(0.317)	(0.247)	(0.223)	(0.562)
$\Delta MMRate \cdot D^{Eligible}$	−0.005	−0.005	0.000	0.014*	0.002	−0.018*	−0.008
	(−0.462)	(−0.462)	(0.005)	(1.960)	(0.393)	(−1.777)	(−0.555)
$\Delta MMRate \cdot D^{Eligible} \cdot D^{QE}$	−0.052***	−0.044**	−0.023	−0.031***	−0.017**	−0.022	−0.311***
	(−2.736)	(−2.287)	(−1.491)	(−3.321)	(−2.045)	(−0.998)	(−5.435)
N	301,766	301,766	300,047	295,606	289,216	299,622	301,192
R^2	0.116	0.116	0.117	0.116	0.116	0.114	0.123
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\Delta repo^{Special}$ lagged	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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Appendix: Joint effects

Table: Joint effects of both forms of market segmentation

	Germany		Core		All	
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta repo^{GC}$	$\Delta repo^{Special}$	$\Delta repo^{GC}$	$\Delta repo^{Special}$	$\Delta repo^{GC}$	$\Delta repo^{Special}$
	ON/TN b/t	TN/SN b/t	ON/TN b/t	TN/SN b/t	ON/TN b/t	TN/SN b/t
$\Delta MMRate$	0.533***	0.158***	0.670***	0.153***	0.677***	0.159***
	(4.603)	(12.932)	(11.649)	(17.592)	(13.171)	(18.622)
D^{Dep}	−0.069***	0.019***	−0.029**	0.006**	−0.008**	0.008***
	(−2.621)	(3.611)	(−2.193)	(2.049)	(−2.034)	(2.709)
$\Delta MMRate \cdot D^{Dep}$	0.344*	0.027	0.463***	0.115***	0.439***	0.116***
	(1.881)	(0.969)	(5.122)	(5.035)	(5.071)	(5.169)
D^{Access}	−0.004	−0.005***	−0.004	−0.005***	−0.004	−0.005***
	(−0.357)	(−2.673)	(−0.685)	(−4.207)	(−0.731)	(−4.517)
$\Delta MMRate \cdot D^{Access}$	−0.149	−0.061***	−0.280***	−0.062***	−0.313***	−0.072***
	(−1.206)	(−5.132)	(−4.752)	(−7.841)	(−5.931)	(−9.181)
$\Delta MMRate \cdot D^{Access} \cdot D^{Dep}$	−0.469**	−0.191***	−0.373***	−0.245***	−0.330***	−0.239***
	(−2.311)	(−6.483)	(−3.525)	(−10.253)	(−3.194)	(−9.984)
D^{QE}	−0.081	−0.013	−0.033	−0.007	−0.034	−0.011
	(−1.060)	(−1.218)	(−1.002)	(−0.979)	(−0.676)	(−1.301)
$D^{Eligible}$	−0.004	0.003	−0.001	0.004	−0.000	0.004
	(−0.416)	(0.374)	(−0.341)	(0.655)	(−0.081)	(0.611)
$\Delta MMRate \cdot D^{Eligible}$	0.192**	−0.006	0.058	0.006	0.060	0.005
	(2.204)	(−0.531)	(1.333)	(0.849)	(1.450)	(0.684)
$\Delta MMRate \cdot D^{Eligible} \cdot D^{QE}$	−0.157	−0.097***	−0.381***	−0.105***	−0.355***	−0.109***
	(−1.095)	(−6.258)	(−5.340)	(−10.268)	(−5.329)	(−11.589)
N	6,897	301,525	30,675	628,424	37,950	758,182
R^2	0.233	0.116	0.197	0.113	0.189	0.116
FE	Yes	Yes	Yes	Yes	Yes	Yes
$\Delta repo$ lagged	Yes	Yes	Yes	Yes	Yes	Yes

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Appendix: Repo dispersion and the pass-through to lending rates

Table: Repo dispersion and the pass-through to lending rates.

	(1)	(2)	(3)	(4)
	Non-Fin. Corporate Δr^L	Non-Fin. Corporate Δr^L	New Housing Δr^L	New Housing Δr^L
$\Delta MMRate$	0.506***	0.501***	0.787**	0.792**
	(3.431)	(3.327)	(2.804)	(2.778)
$\Delta MMRate \cdot D^{DK_{GC}}$	−0.522***		−0.690**	
	(−3.254)		(−2.326)	
$\Delta MMRate \cdot D^{DK_{Special}}$	−0.445		−0.570***	
	(−1.653)		(−3.318)	
$\Delta MMRate \cdot D^{DK_{Repo}}$		−0.526**		−0.723**
		(−3.072)		(−2.286)
N	1,101	1,101	1,017	1,017
R^2	0.126	0.125	0.174	0.173
FE	Yes	Yes	Yes	Yes