Short rates and a large balance sheet

Day-ahead conference, Atlanta Fed

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Federal Reserve Board and Federal Reserve Bank of Atlanta

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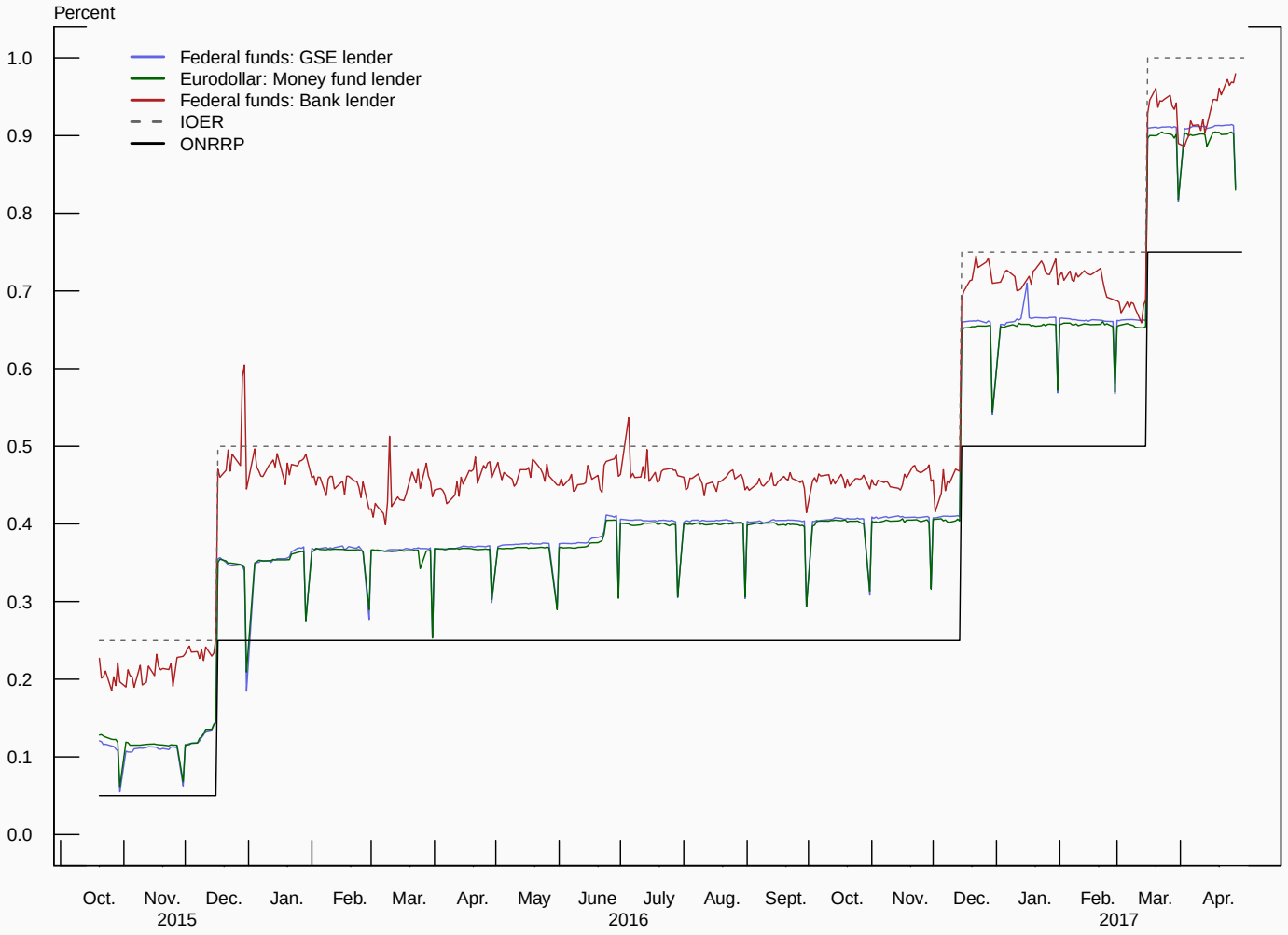
Introduction

Short rates and a large balance sheet



Question and answer

Question:

Why were money markets below the rate paid on reserves?

- ”Balance sheet costs”
- ”Imperfect competition”

Answer:

Some of both

- Theory: Some modifications to ”standard” model show that both are needed to have gaps.
- Empirics: Evidence of balance sheet costs and imperfect competition using a variety of estimation techniques.

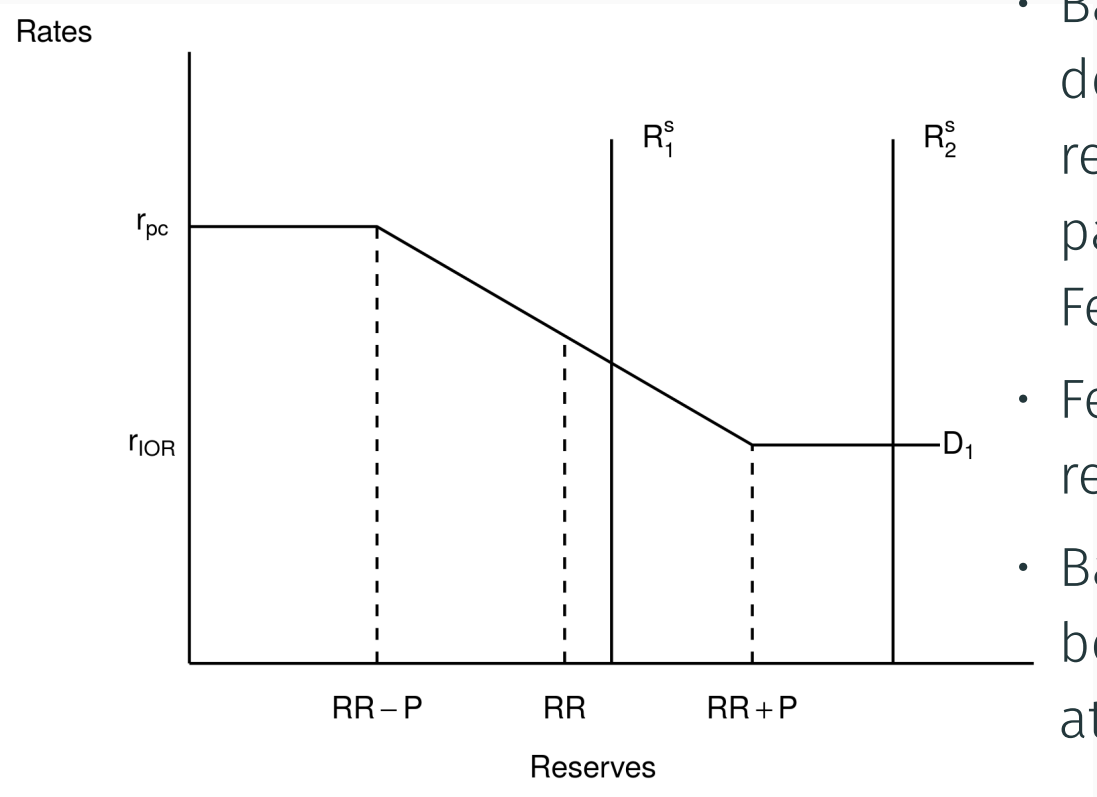
Balance sheet costs or imperfect competition?

Why is this question important?

- Broad economics and finance questions
  - How are money markets organized?
  - Are there implications of non-competitive behavior?
- Implementation questions
  - What could happen as the balance sheet shrinks?
  - Are there implications for monetary policy transmission?
- Regulatory questions
  - Why do ”wedges” arise in markets?

Theory

Canonical Poole (1968) model

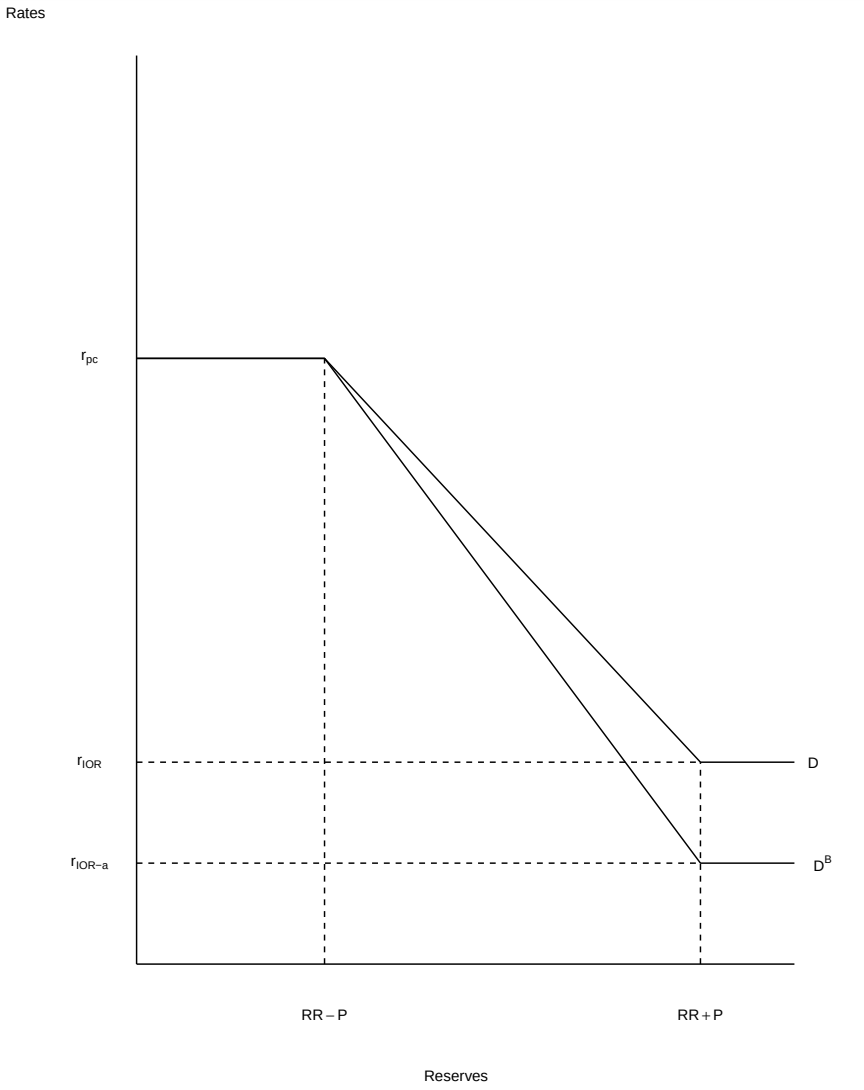


- Bank's demand for reserves depends on level of required reserves (RR), distribution of payment shocks $[-P, P]$, and Fed's policy rates, r_{PC} and r_{IOR}
- Fed determines supply of reserves, R_1^S or R_2^S.
- Banks demand funds at rates below curve and supply them at rates above.

Introducing balance sheet costs

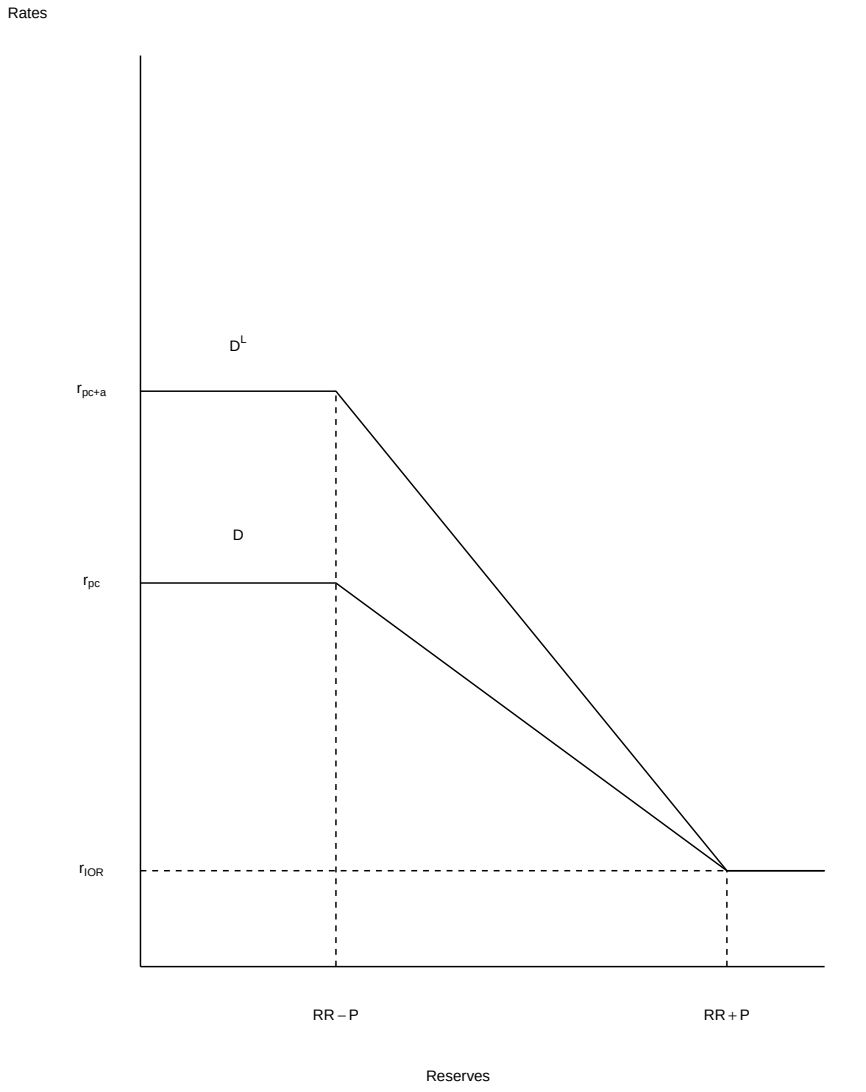
- Balance sheet costs (BSC) include FDIC fees, various leverage ratios
- Assume $BSC = aR^F$, where $R^F =$ final level of reserve balances
- BSCs affect both borrowers and lenders
    - affects demand curve differently

Balance sheet costs, borrower



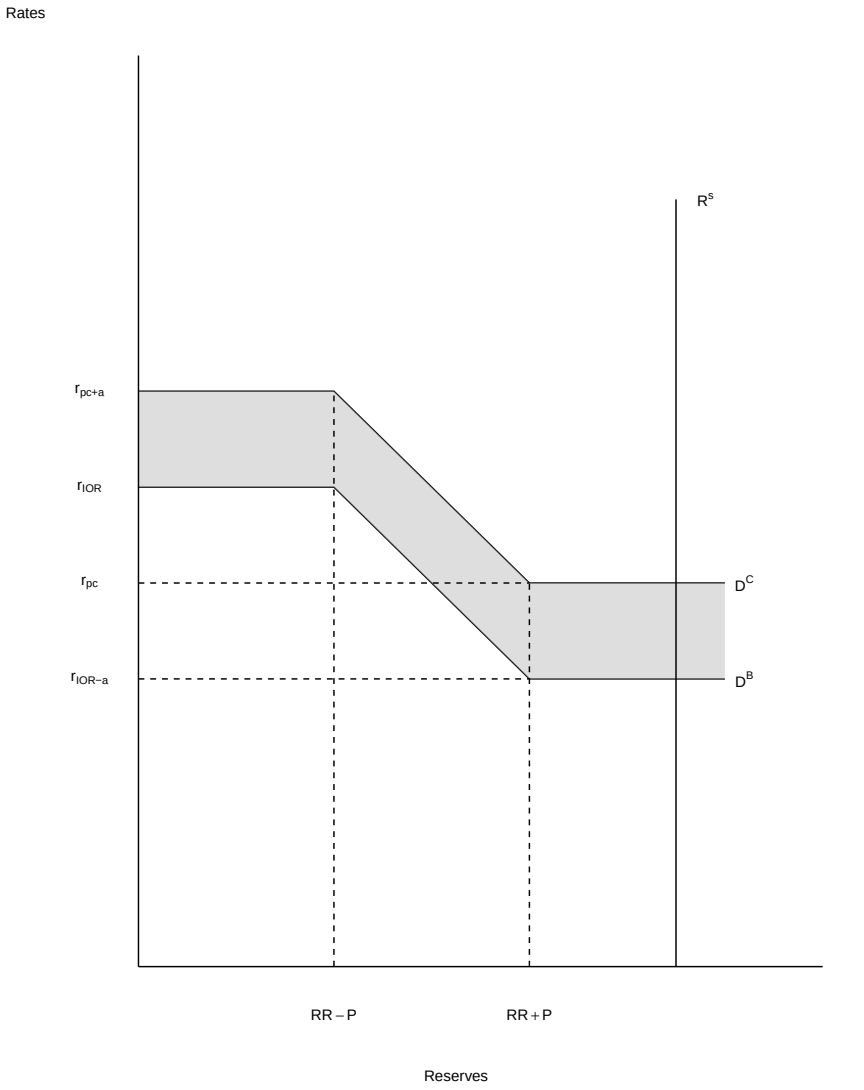
”Wedge” at high excess reserve levels reflects increasing probability of borrower expanding balance sheet

Balance sheet costs, lender



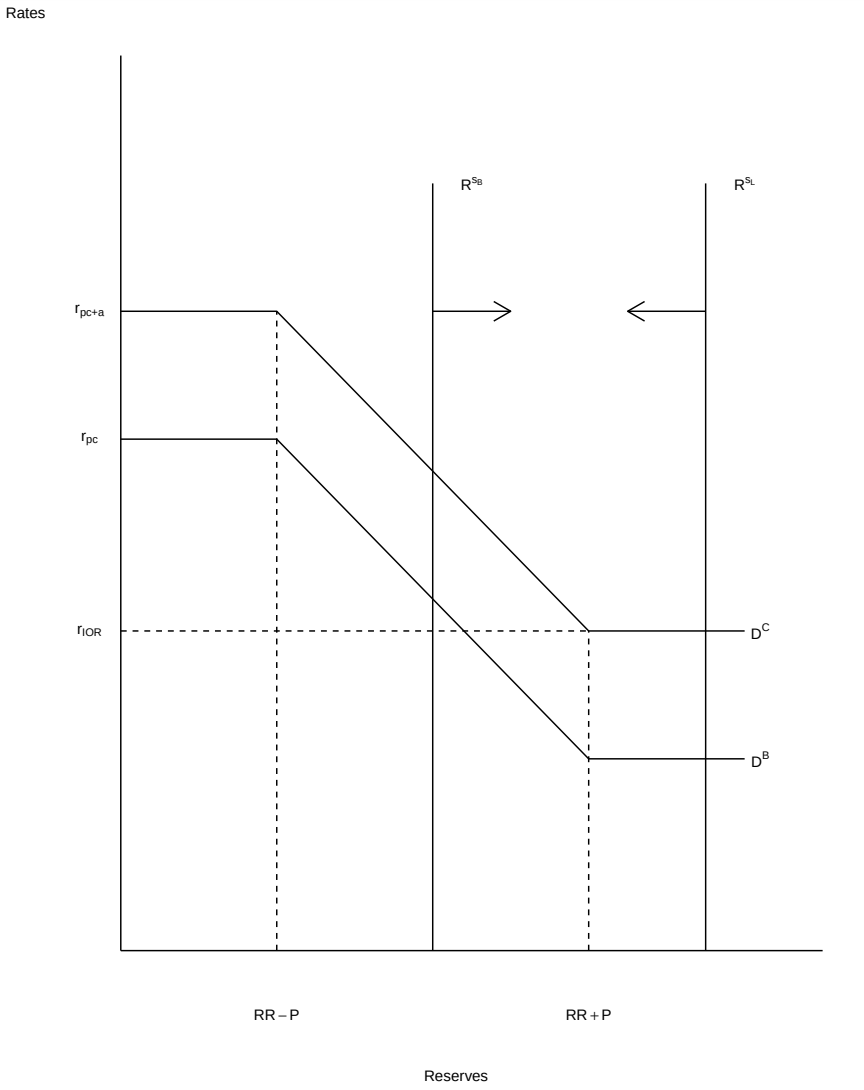
”Wedge” at low excess reserve levels reflects decreasing probability of lender expanding balance sheet

Demand correspondence



”Static” view: equilibrium fed funds rate is below the IOR rate

Theory: Perfect competition with active federal funds market



- Under perfect competition: BSCs + FHLBs + FBOs implies $r^*_{FF} \geq r_{IOR}$
- BSCs by themselves cannot explain the first graph

Imperfect competition with active federal funds market

Theory: Necessary conditions for $r^*_{FF} < r_{IOR}$

- Heterogeneous institutions: some earn IOR, some do not
- Abundant reserves held by institutions that earn IOR
- Limited number of counterparties for lenders

Empirics: Industrial organization models of imperfect competition

- Evidence of differential pricing according to lender type or number of counterparties can suggest imperfect competition
- Control for observable factors for prices, quantities
  - Unobserved factors may be proxies for imperfect competition
- Use money fund reform to identify any potential change in competitive structure

Empirics

Sources and sample

Data sources

- Money market rates and quantities (FR2420)
- Bank-level reserve balances
- Bank-level Call Report, FDIC fees

Data sample

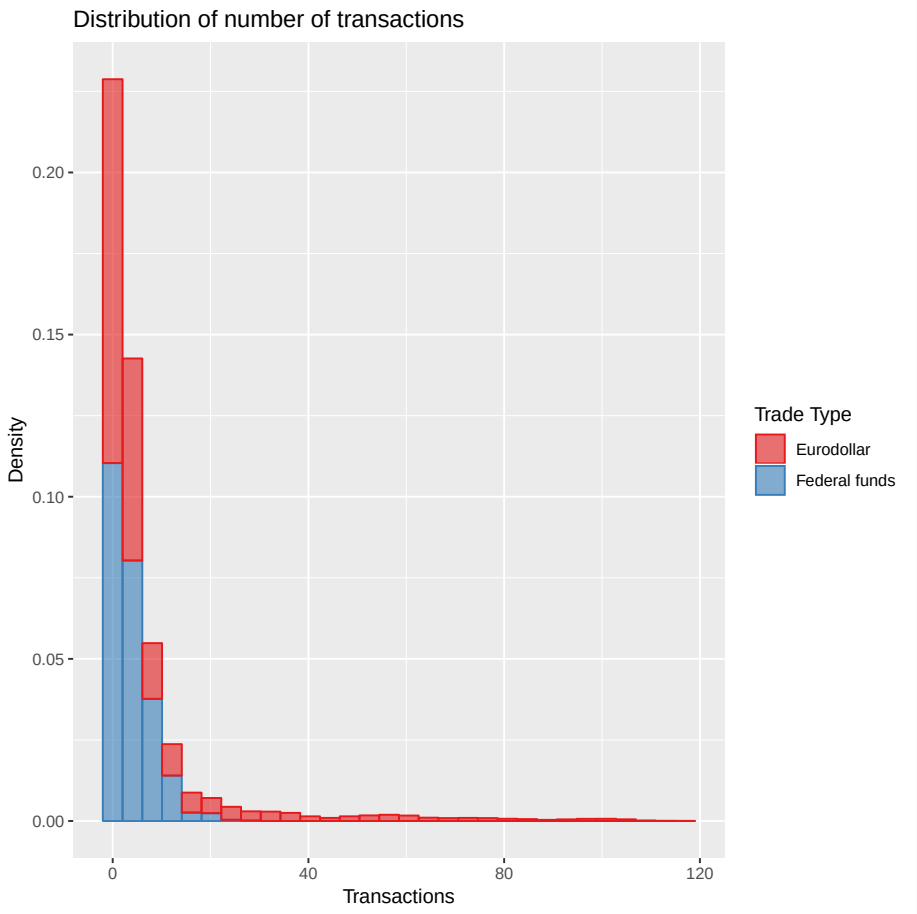
- October 2015 to April 2017
- ”Trade-level” data: Rate, quantity, borrower, lender
- Borrowers are identified at the individual bank level
- Lenders are identified by category

Federal funds	Eurodollars
Banks	Money market funds
FHLBs	Corporates

Three specifications and three results

- Market-wide rates, balance sheet costs, and counterparties
- Imperfect competition and importance of borrower characteristics for demand
- Imperfect competition, money fund reform, and importance of lender characteristics for supply

Number of transactions=number of counterparties?



Number of transactions can be a proxy for the number of counterparties

FDIC fees

	Risk category				Large institutions
	I	II	III	IV	
Initial base assessment rate	5-9	14	23	35	5-35
Unsecured debt adjustment	-4.5-0	-5-0	-5-0	-5-0	-5-0
Brokered deposit adjustment	N/A	0-10	0-10	0-10	0-10
Total base assessment rate	2.5-9	9-24	18-33	30-45	2.5-45

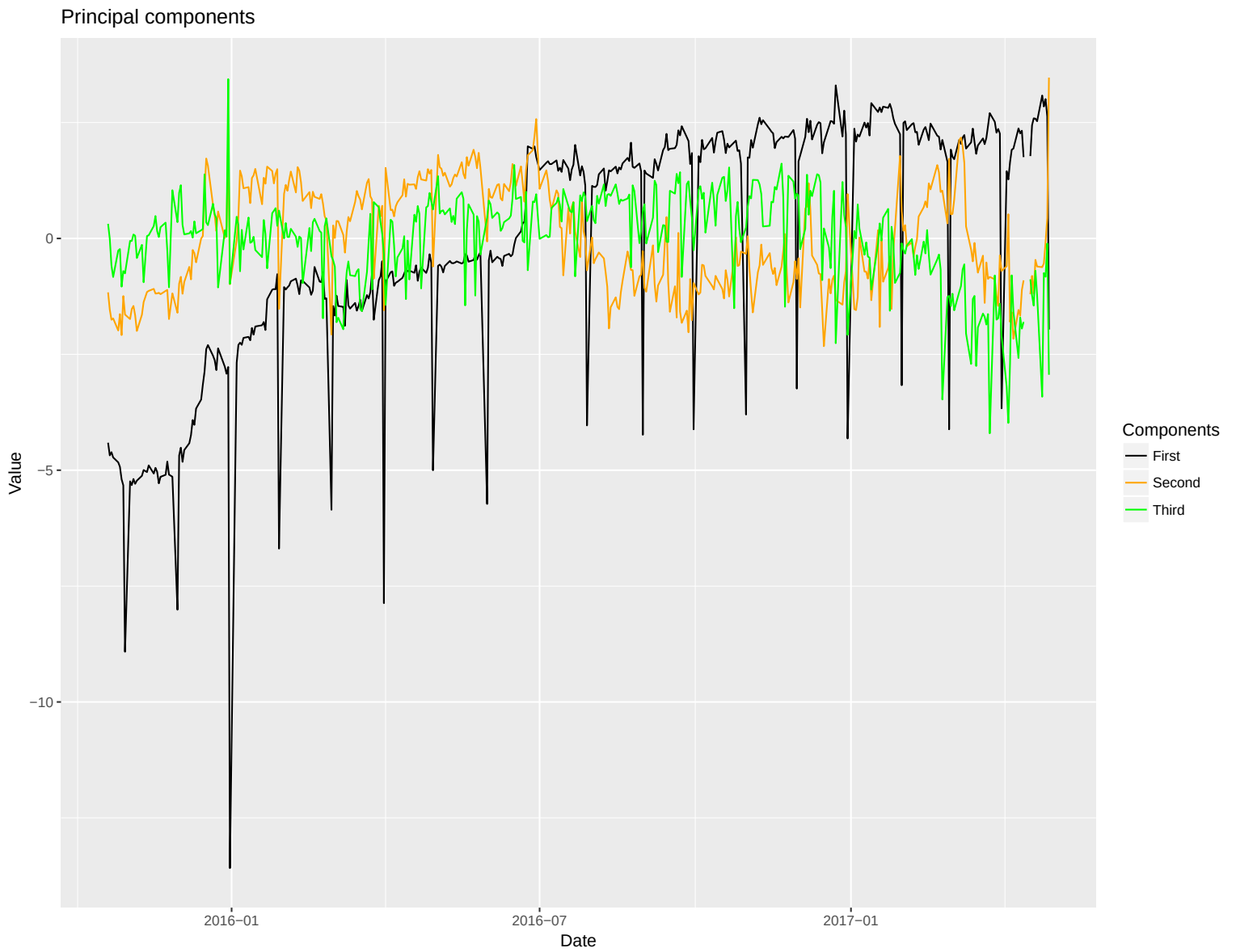
Source: FDIC, available at `https://www.fdic.gov/deposit/insurance/assessments/proposed.html`.

Market-beta approach

$$r_{jkt} = \alpha G_k + \gamma X_{jt} + \beta R_t + \delta_t + \epsilon_{jkt}$$

where

- r_{jkt}–rate for borrower j from lender k at time t
- G_k– lender fixed effects
- X_{jt}– time-varying borrower characteristics (including FDIC fees)
- R_t–market-wide rate
- δ_t–(quarterly) time fixed effect
- ϵ_{jkt}–error term


Principal components
0
−5
−10
Value
2016−01
2016−07
2017−01
Date
Components
First
Second
Third

Market-beta results

	Just repo & bills	Just PCA	Repo & PCA are collinear!
FDIC Fee	0.413**	0.414**	0.414**
	(0.15)	(0.15)	(0.15)
Month-end	-0.0599***	-0.0198***	-0.0218***
	(0.00)	(0.00)	(0.01)
Domestic	0.0250***	0.0250***	0.0251***
	(0.00)	(0.00)	(0.00)
Quarter-end	-0.00176	0.00184	0.00193
	(0.00)	(0.00)	(0.00)
Domestic	-0.0164*	-0.0169*	-0.0169*
	(0.01)	(0.01)	(0.01)
Repo rate	0.0660***		0.0173
	(0.02)		(0.02)
Bill yield	0.0331***		0.0272**
	(0.01)		(0.01)
PC 1		0.00708***	0.00664***
		(0.00)	(0.00)
PC 2		0.00190*	0.00170*
		(0.00)	(0.00)
PC 3		0.00289***	0.00285***
		(0.00)	(0.00)
Repo liabilities	0.0511***	0.0511***	0.0511***
	(0.01)	(0.01)	(0.01)
Transactions	0.000778***	0.000778***	0.000778***
	(0.00)	(0.00)	(0.00)
Constant	0.371***	0.362***	0.363***
	(0.07)	(0.07)	(0.07)
N	54316	54316	54316
adj. R-sq	0.292	0.293	0.293

Demand for ”deposits”

A lender $k = 1, ..., K$ is assumed to ”demand deposits” from a borrower $j = 1, ..., J$ at time $t = 1, ..., T$. The (indirect) utility u_{jkt} the lender derives from this transaction is

$$u_{jkt} = \beta^r r_{jkt} + \beta^x X_{jt} + \delta_j + \mu_k + \mu_t + \epsilon_{jkt}$$

where

- r_{jt} is the rate paid on the transaction
- X_{jt} is a vector of time-varying borrower characteristics
- δ_j is a time-invariant borrower fixed effect
- μ_k is a time-invariant lender fixed effect
- μ_t is a time fixed effect
- ϵ_{jkt} is a mean zero random disturbance

Assuming the ϵ_{jkt} have a type-I extreme value distribution, we can write

$$s_{jt} = \frac{\exp(\beta^r r_{jt} + \beta^x X_{jt} + \delta_j + \mu_t)}{\sum_{k=0}^{K} \exp(\beta^r r_{jt} + \beta^x X_{jt} + \delta_j + \mu_k + \nu_t)}$$

Estimating equation, markups and substitution patterns

Estimating equation:

$$\ln(s_{jkt}) = \beta^r r_{jkt} + \beta^x X_{jt} + \delta_j + \mu_t + \epsilon_{jkt},$$

- Instrument rates using "other" rates, costs
- "Imperfect," e.g. Bertrand competition parameters:
  - Own elasticity: $\beta^r s_j(1 - s_j)$
  - Markup: $\frac{1}{\beta^r(1-s_j)}$

  Supply curve:

$$f_t = r_j + c_j + \frac{1}{\beta^r(1 - s_j)}$$

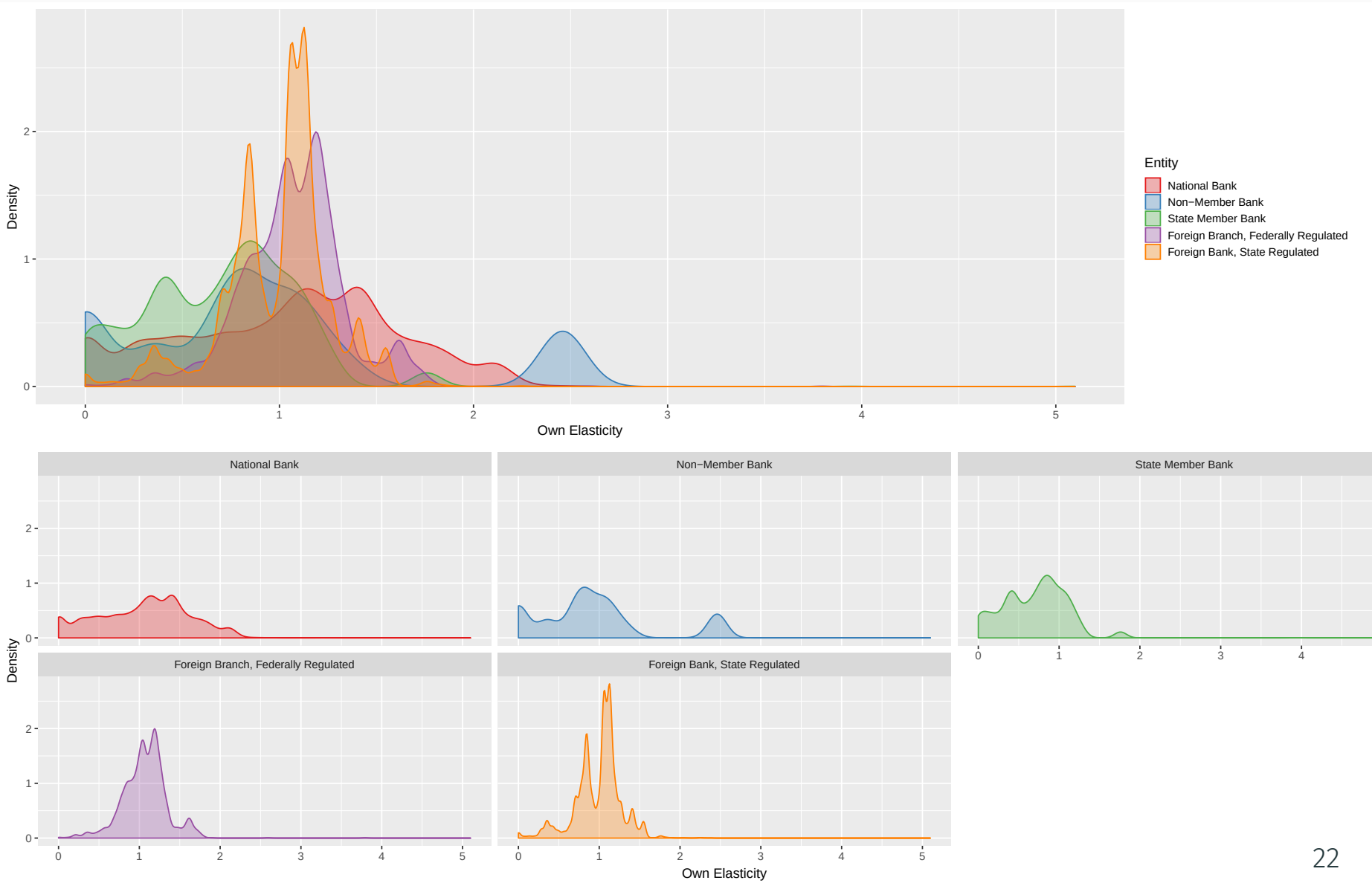
- Side note: "overly restrictive substitution patterns"
  - Also use random coefficients logit
  - Allows us to differentiate demand by day to capture regulatory costs

Demand results

	FE	IV, entity	IV, other bank	IV, entity+costs
	(1)	(2)	(3)	(4)
Deviation from ONRRP rate	4.950***	6.865**	8.525***	7.063**
	(0.770)	(2.557)	(1.671)	(2.164)
Share of liabilities, repo	-1.362*	-1.476*	-1.028	-1.493*
	(0.577)	(0.697)	(0.697)	(0.689)
Change in TGA	0.0724**	0.0745**	0.0831***	0.0747**
	(0.0225)	(0.0230)	(0.0248)	(0.0229)
Month-end	0.330***	0.451**	0.588***	0.463**
	(0.0664)	(0.170)	(0.120)	(0.147)
Month-endXDomestic	-0.0373	-0.0800	-0.136	-0.0848
	(0.0678)	(0.0967)	(0.0970)	(0.0931)
FDIC fee	-1.197	-1.851	-2.360	-1.876
	(1.352)	(1.446)	(1.631)	(1.362)
Constant	-7.349***	-7.507***	-7.538***	-7.528***
	(0.152)	(0.285)	(0.256)	(0.260)
N	37351	36827	30551	36827
First-stage F-statistic		77.8	105.1	103.027
Within R-sq	0.138	0.1288	0.1078	0.1265
Between R-sq	0.0002	0.0001	0.0282	0.0001
Overall R-sq	0.0574	0.0653	0.0477	0.0648

* $p<0.05$,** $p<0.01$, *** $p<0.001$
Rate is expressed as deviation from the ON RRP rate. Includes quarterly time controls.
Standard errors are clustered at the bank-counterparty-IBF-trade-type level.

Own-elasticity by bank charter types



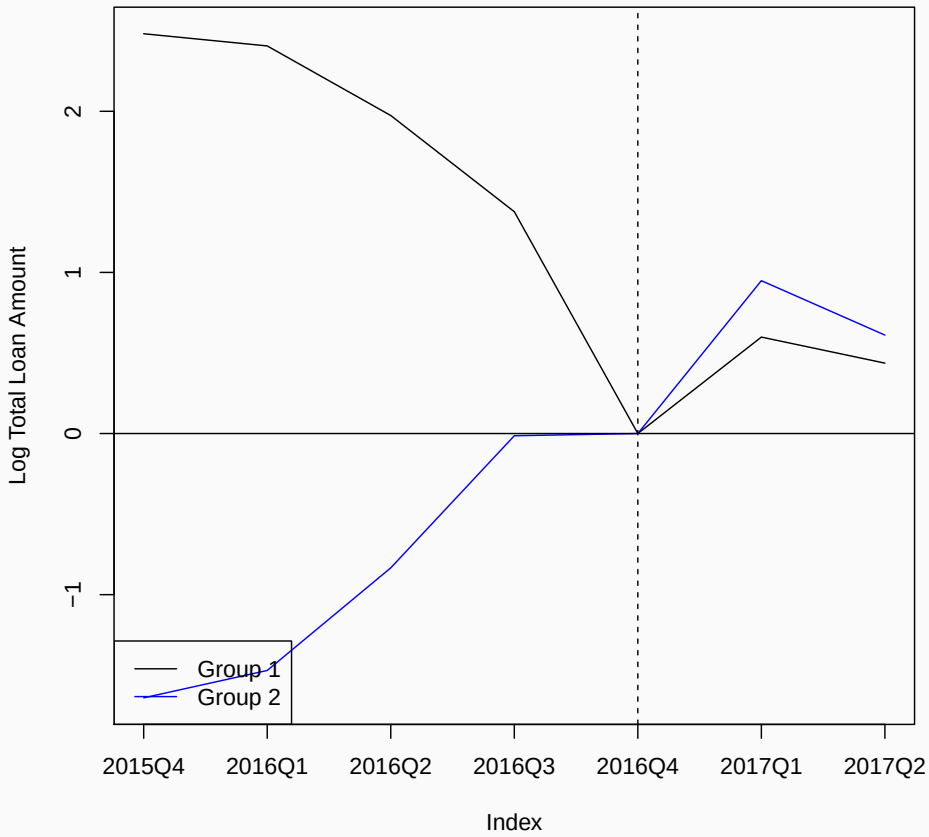
Random coefficients logit own-elasticities, by selected borrowers

	30-Mar-16			6-Apr-16		
Bank type	ED	FF	Average	ED	FF	Average
National bank	1.76	1.89	1.81	1.44	1.81	1.60
Non-member bank		0.05	0.05		1.74	1.74
State member bank	1.26	0.22	0.91	1.36	1.17	1.33
FBO	1.09	0.42	0.99	1.39	1.28	1.37
Average	1.21	1.05	1.17	1.38	1.66	1.46

Random coefficients logit own-elasticities, by selected lenders

	Average elasticity	
Lender type	30-Mar-16	6-Apr-16
Money fund	0.85	1.17
Domestic bank	1.58	1.91
GSE	0.44	1.44
Overall	1.17	1.46

Money fund reform



Use fixed and random effects to explore effect of money fund reform

Returning to our share equation:

$$s_{jt} = \frac{\exp(\beta^r r_{jt} + \beta^x X_{jt} + \delta_j + \mu_t)}{\sum_{k=0}^{K} \exp(\beta^r r_{jt} + \beta^x X_{jt} + \delta_j + \mu_k + \nu_t)}$$

All else equal: banks can offer lower deposit rates for higher levels of δ_j

- Also use random effect to generate time-varying component
- Egan et al. (2018) call this "productivity"

$$\hat{\delta_{jt}} = \ln(\hat{s_{jkt}}) - \hat{\beta}^r r_{jkt} - \hat{\beta}^x X_{jt} - \hat{\mu}_t$$

Effect of money fund reform

	δ_{jt}
Domestic	0.358***
	(0.0380)
Federal funds	-0.353***
	(0.0350)
Number of transactions	0.0683***
	(0.00103)
After money fund reform	0.0377
	(0.0250)
Federal funds X number of transactions	0.319***
	(0.00653)
Domestic X number of transactions	-0.0170***
	(0.00252)
Federal funds X domestic X number of transactions	-0.317***
	(0.00859)
Federal funds X domestic X after money fund reform X number of transactions	-0.0294**
	(0.00926)
Constant	-0.626***
	(0.0198)
N	18801
adj. R-sq	0.498
Robust standard errors in parentheses	

- Ability to attract counterparties for unobserved reasons may enable borrowing at lower rates.
- Money fund reform had little effect

Conclusion

Conclusion

- Balance sheet costs and imperfect competition are both likely present in money markets.
- Interaction of the two produces observed dynamics
- Caveat: Sample period held total reserve balances, Treasury issuance roughly constant
    - Likely an important direction for new research.