Negative Nominal Interest Rates and the Bank Lending Channel

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Questions

- Large literature on the zero lower bound on nominal interest rate (ZLB)
- Following 2008 crisis: Several central bank have set negative policy rates (Sweden's Riksbank, Bank of Denmark, ECB, Bank of Japan, Bank of Switzerland).
- Questions: Is cutting policy rate from 1% to 0.5% same as cutting from 0% to -0.5?
- ***Theoretical*** and ***empirical*** question

Are negative rates surprising?

Theory:

I will not give you 1 dollar ***unless*** you give me 1 dollar back.

Why?

Because ***otherwise*** would prefer to hold on the dollar as an asset.

Unless:

Giving you 1 dollar ***gives me some other service***

Negative Policy Rates

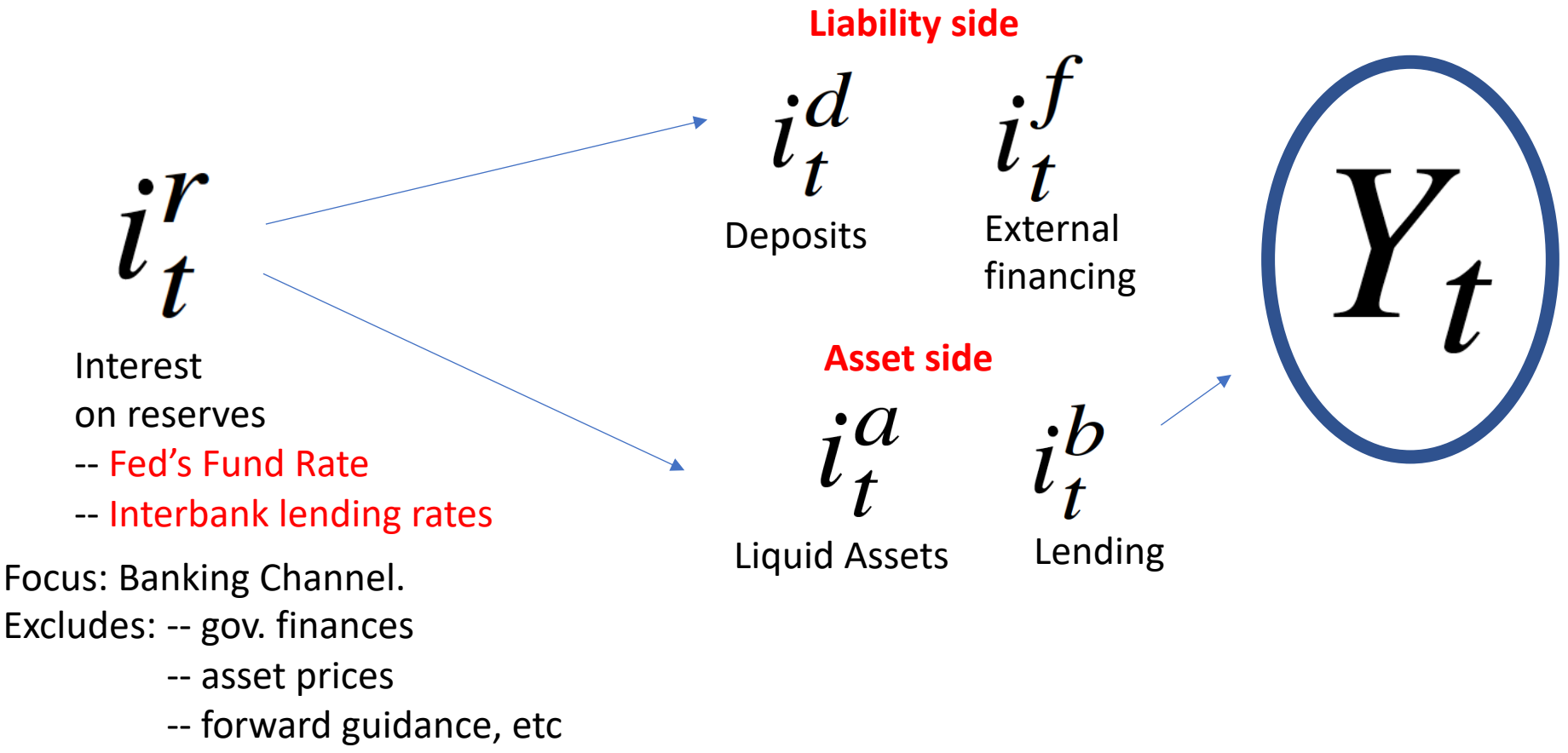
- Interest on ***reserves*** of commercial banks ***at the central bank.***

- Why hold reserves? Because the reduce bank intermediation costs (settle inter-bank transaction and as a source of liquid assets)

- No reason to think banks are not willing to pay for this service.

Key Question

- Has passthrough changed?



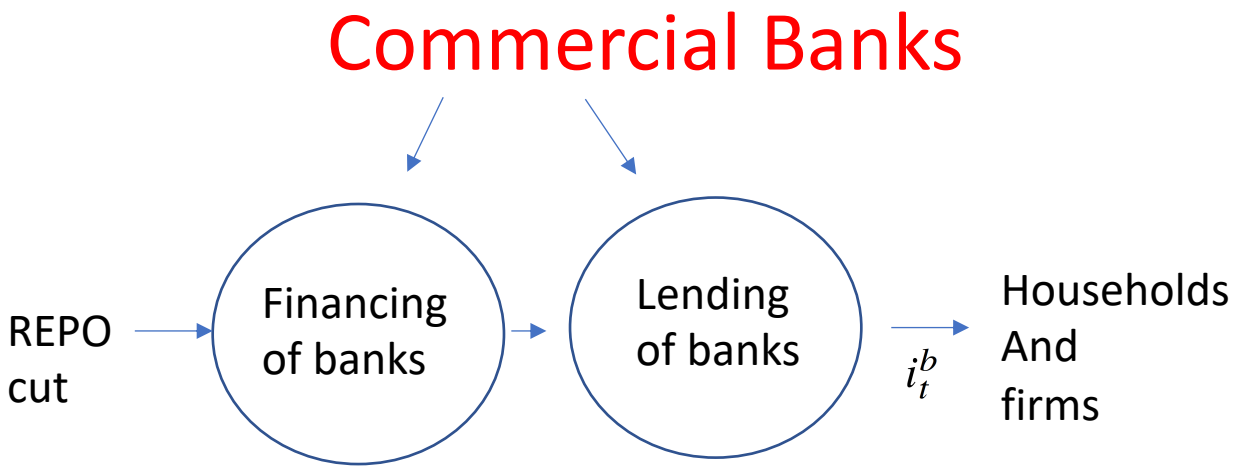
Focus: Banking Channel.
Excludes: -- gov. finances
-- asset prices
-- forward guidance, etc

Structure

1. Data

2. Theory

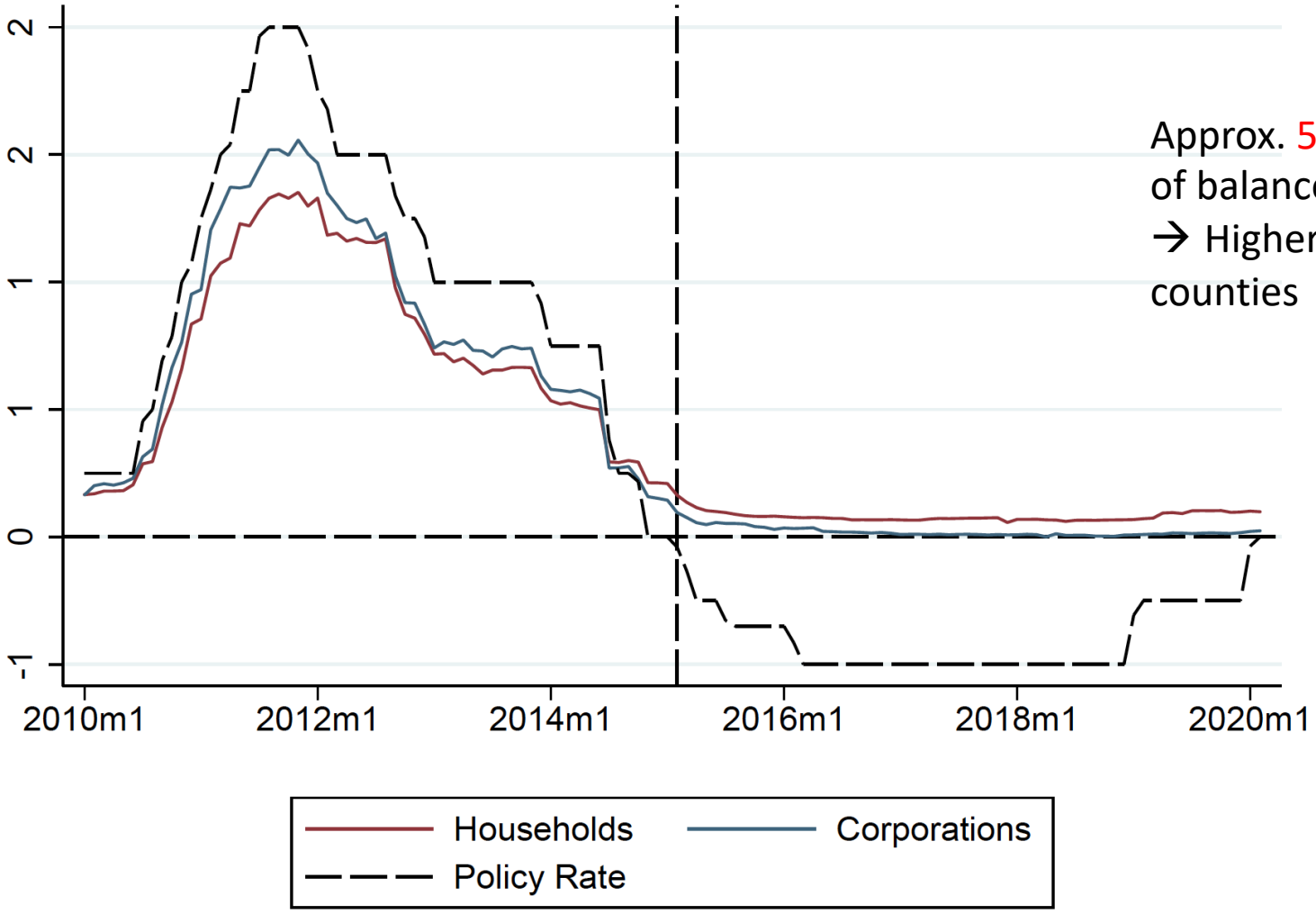
3. Conclusion



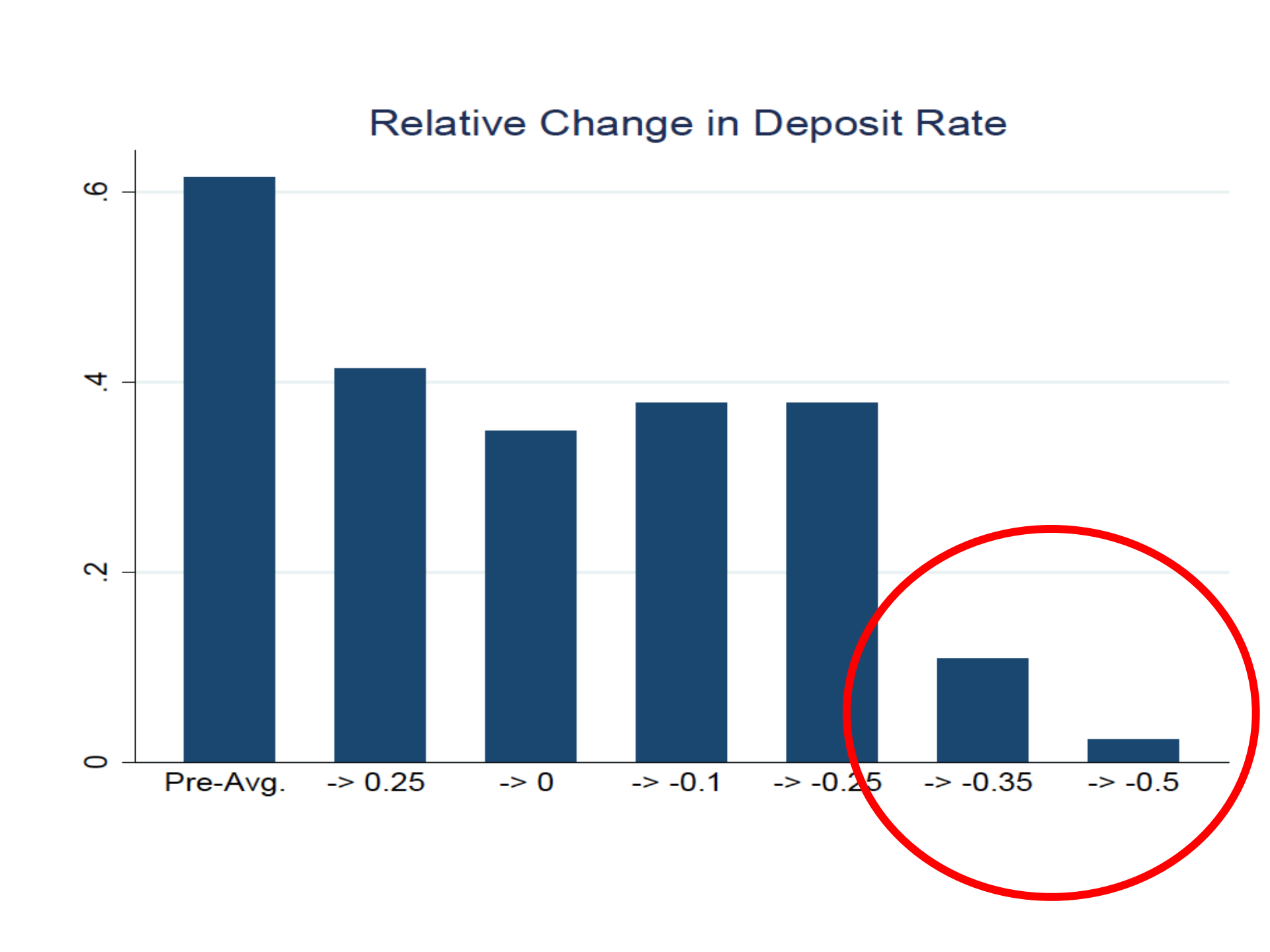
Focus on data from Sweden
-- but!
This is not a paper about Sweden!

Deposit rates in Sweden

$$i_t^r \rightarrow i_t^d$$



Approx. 50 percent
of balance sheet in Sweden
→ Higher in most
counties


Relative Change in Deposit Rate
0
.2
.4
.6
Pre-Avg.
-> 0.25
-> 0
-> -0.1
-> -0.25
-> -0.35
-> -0.5

International Evidence

- Evidence from Switzerland, Euro, Japan and Denmark consistent with Swedish experience

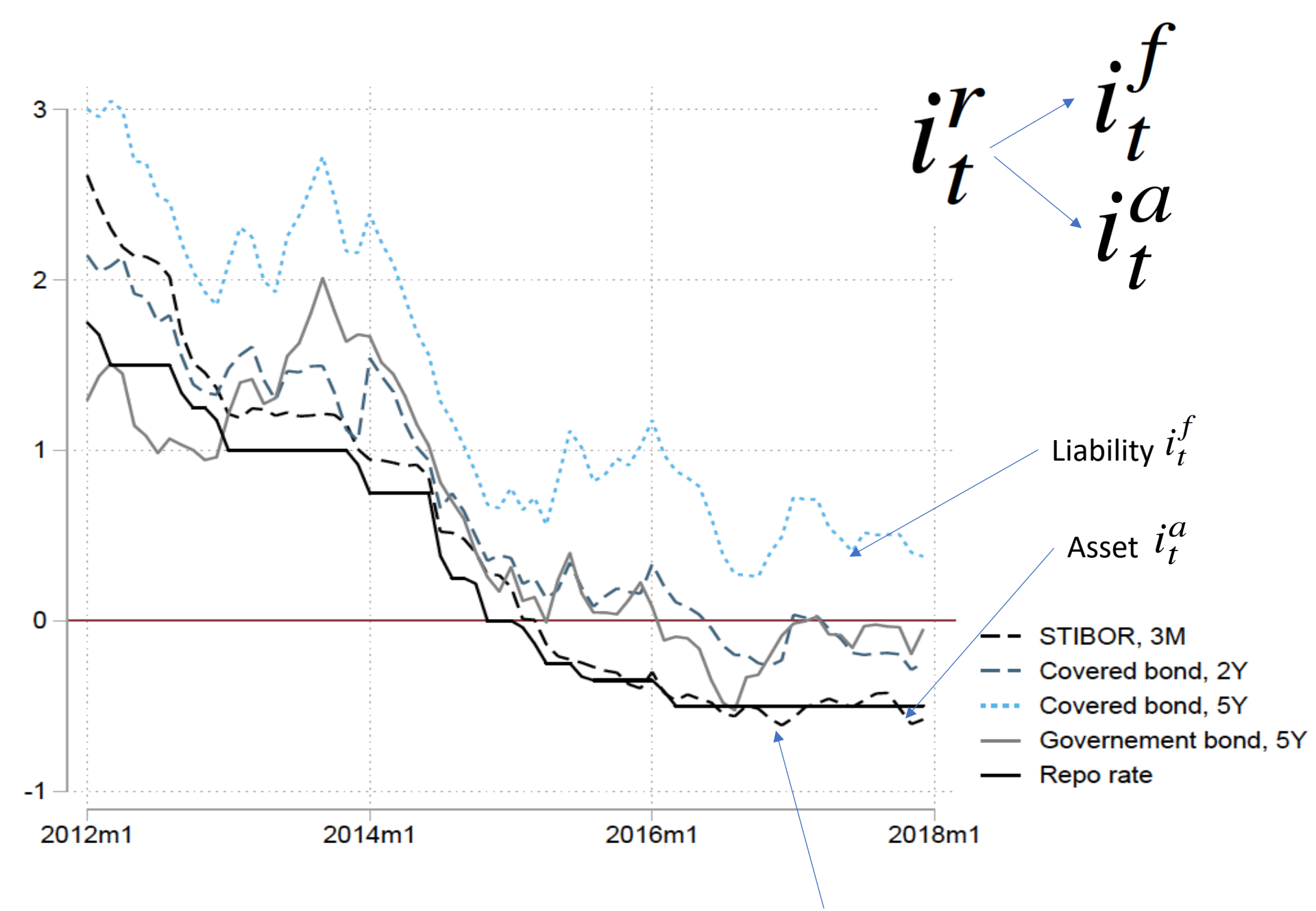
  → Negative rates not passed over to ***regular depositor accounts***

  → Stronger evidence of higher pass-through to large retail depositors outside Sweden (and non-financial corporations, NFC)

  → Highest estimate on the order of 50 percent passthrough for last ECB cut to NFC.

  → Will account for this in model i_t^f

- No evidence in Sweden or elsewhere that lack of passthrough made up with fees.



Reflects one bank lending reserve to another: Irrelevant for banking sector as a whole

Passthrough to lending rates $i_t^r \longrightarrow i_t^b$

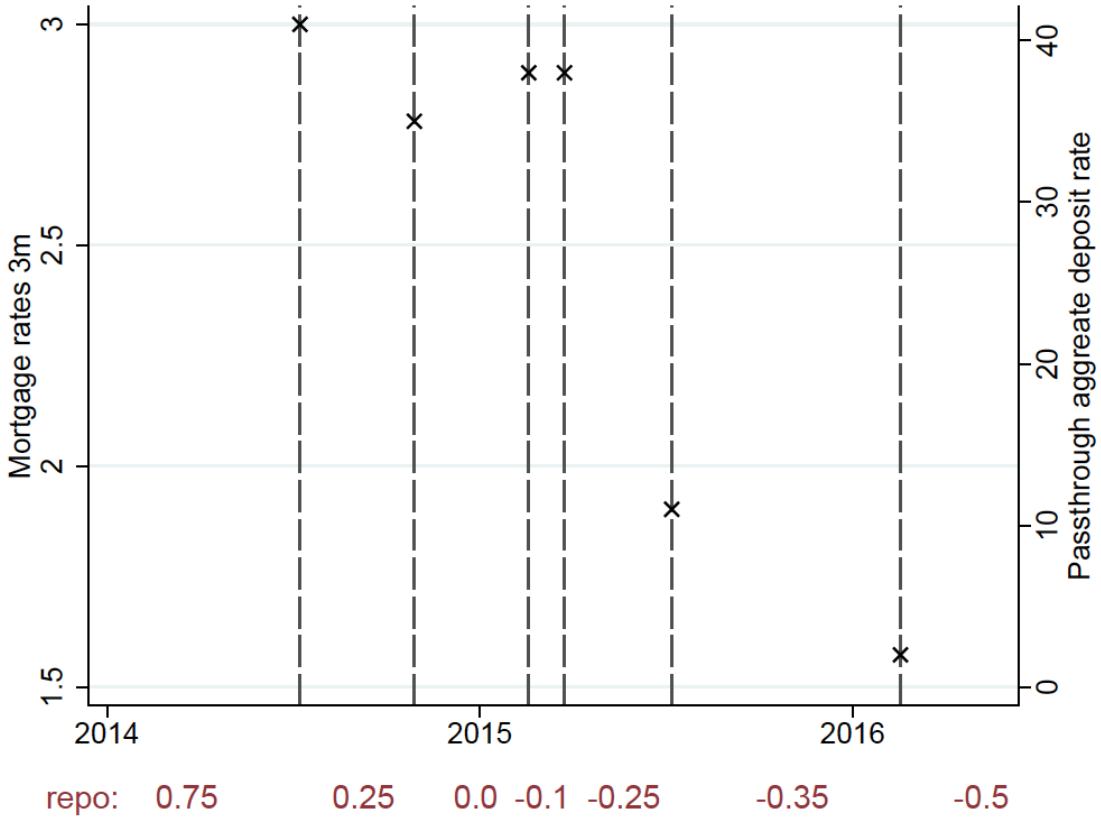
- Identifying pass-through to aggregate lending rates is difficult due to:
  - The composition of borrowers ***changes*** over time
  - Typically not high frequency

This paper:

- Data-set of listed mortgages of 12 Swedish banks at internet service called Compricer.se that lists ***daily mortgage rates.***
- Can identify passthrough via daily window, allowing tight identification of passthrough.
- Listed rates, so no compositional ***issues.***

The data:

- Daily listed bank level rates on 3m mortgages (floating rate)



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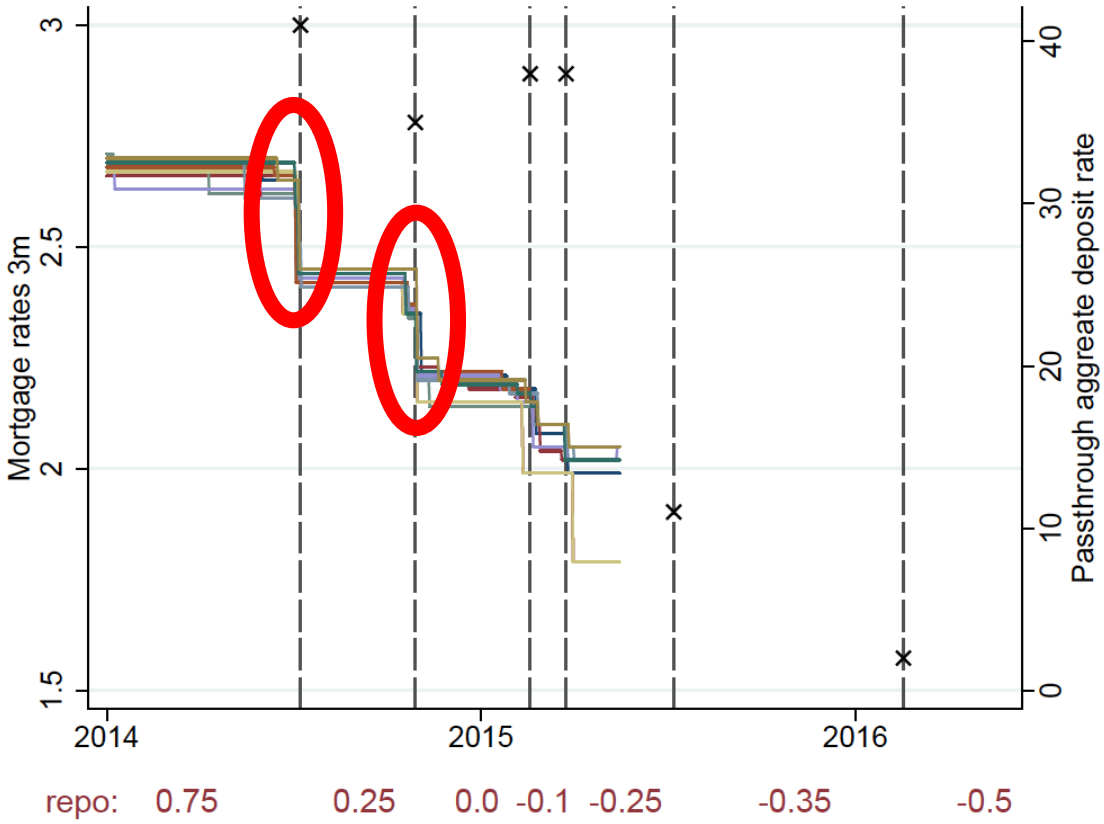

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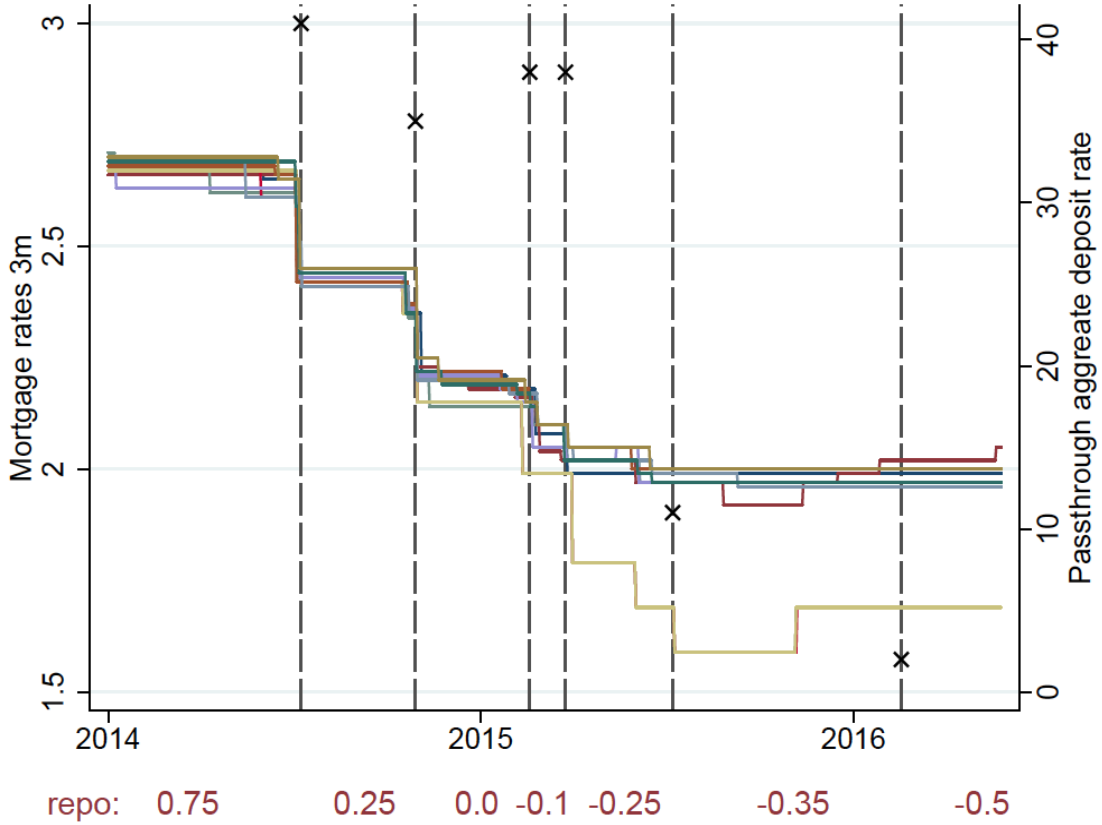
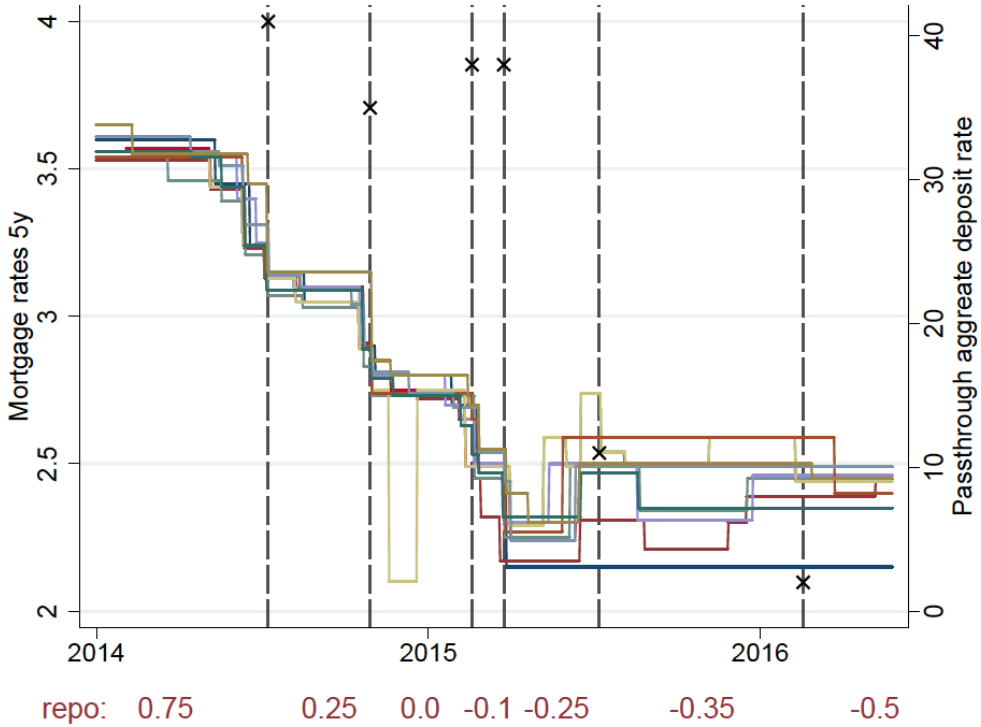


The data:

- Daily listed bank level rates on 5y mortgages
  - breakdown in pass-through stronger for fixed rate contracts
  - ... also larger increase in dispersion



Empirical Strategy

- 14 interest rate ***cuts*** since 2009
- Estimate the pass-through in a 60-day window around the policy rate cut (only one overlap)
- Scale the interest rate index so that -100 means 100 percent pass-through

$$\bar{i}_t^l = \alpha + \sum_{k=-30}^{30} \beta_k I_k + I_t^{post} \sum_{k=-30}^{30} \beta_k^{post} I_k + \epsilon_t$$

Regular interest cuts

Post bound

Results

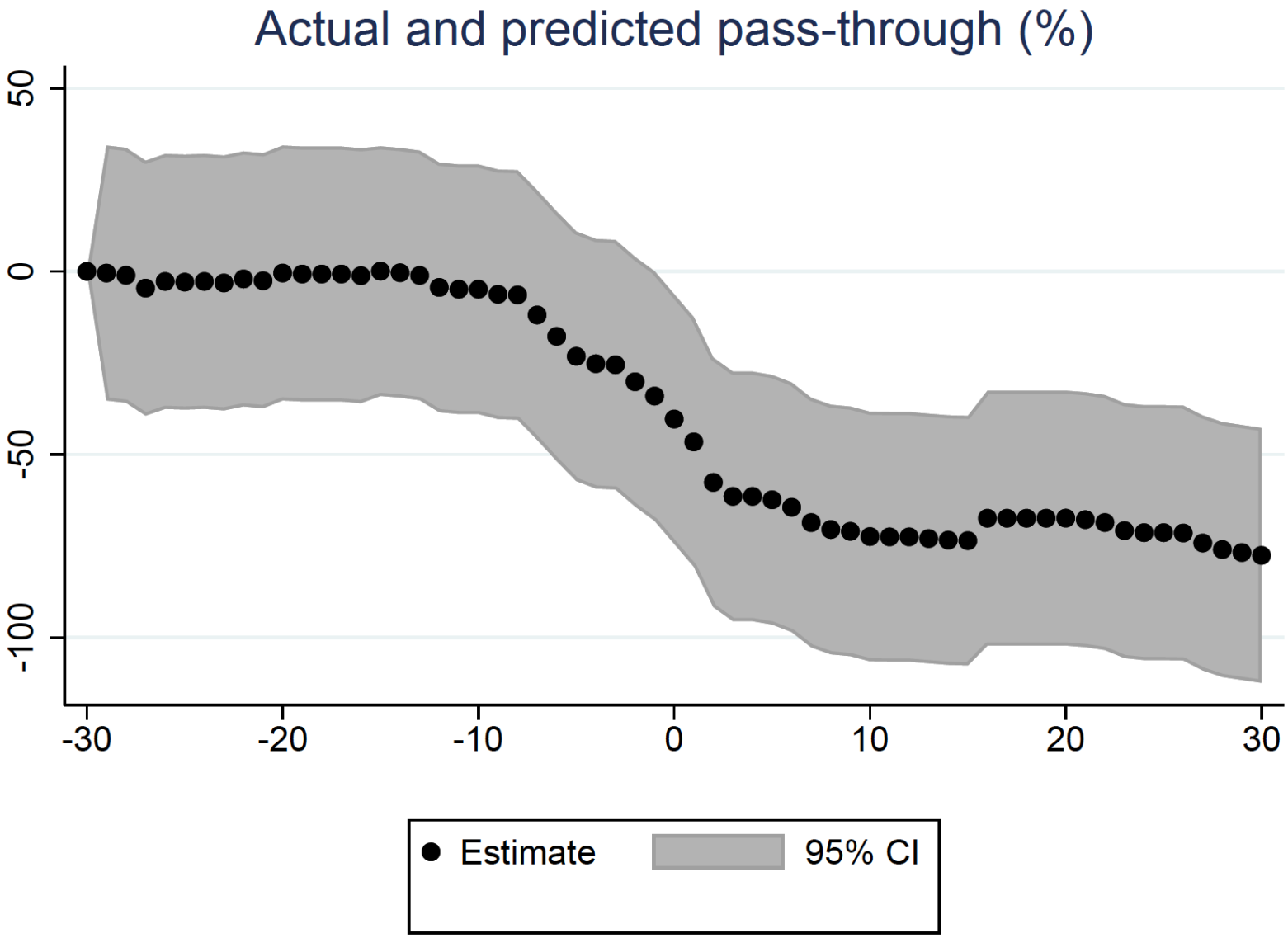
Anticipation of cuts

Event time	β_k	β_k^{post}	Pass-through post-bound: $\beta_k + \beta_k^{post}$
- 30	0.00	0.00	0.00
- 25	- 2.94	3.32	0.38
- 20	- 0.45	8.93	8.48
- 15	0.06	8.43	8.48
- 10	- 4.89	13.6	8.72
- 5	- 23.2*	31.5	8.33
0	- 40.3***	48.7*	8.33
5	- 62.4***	68.3***	5.92
10	- 72.4***	78.4***	5.92
15	- 73.6***	79.5***	5.92
20	- 67.4***	73.3***	5.92
25	- 71.4***	77.3***	5.92
30	- 77.6***	83.4***	5.82

73 percent passthrough within 10 days

Rates estimate to increase
in response to negative rates!

Key Empirical Conclusion



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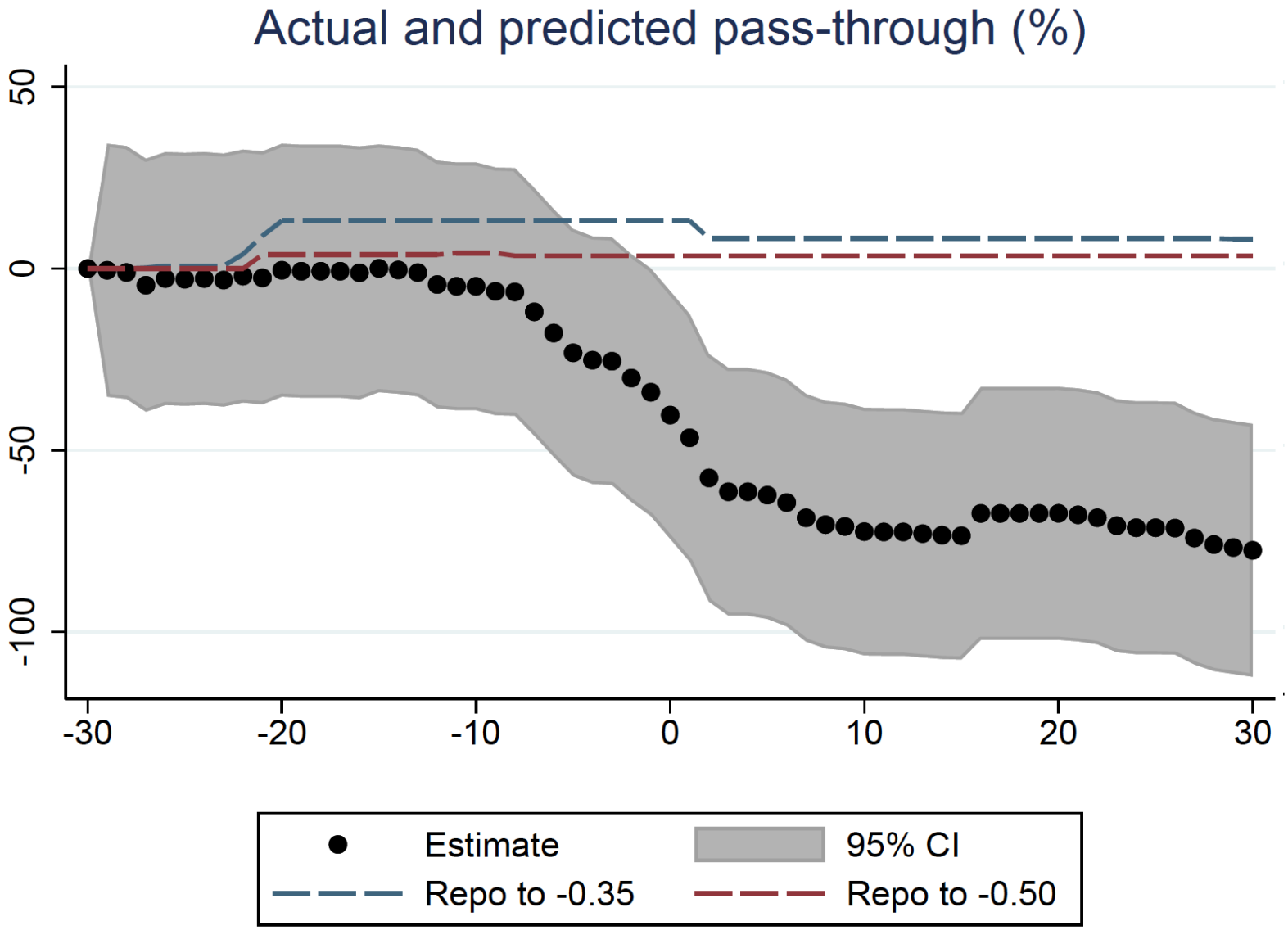
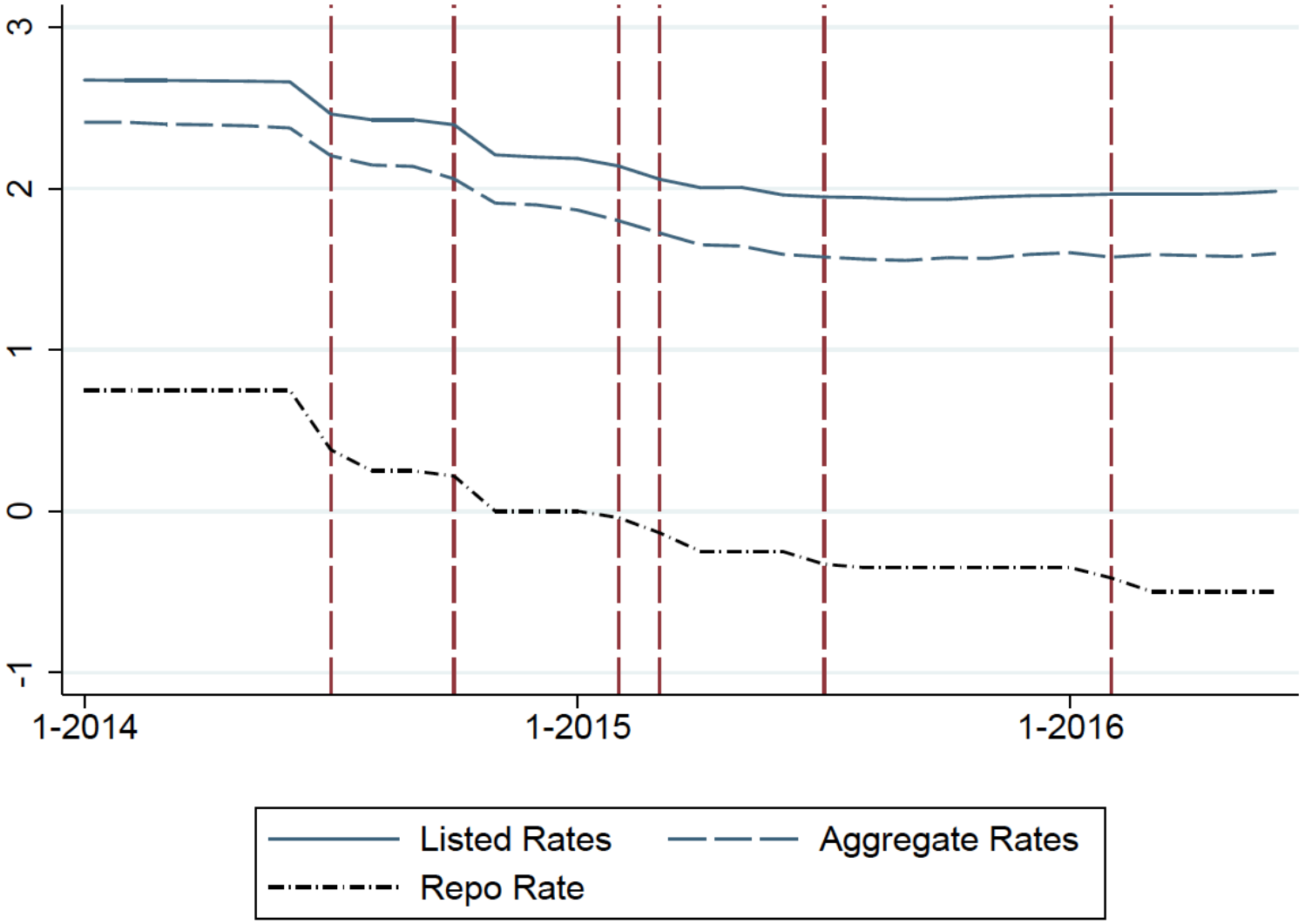


Listed vs. Transaction Rates



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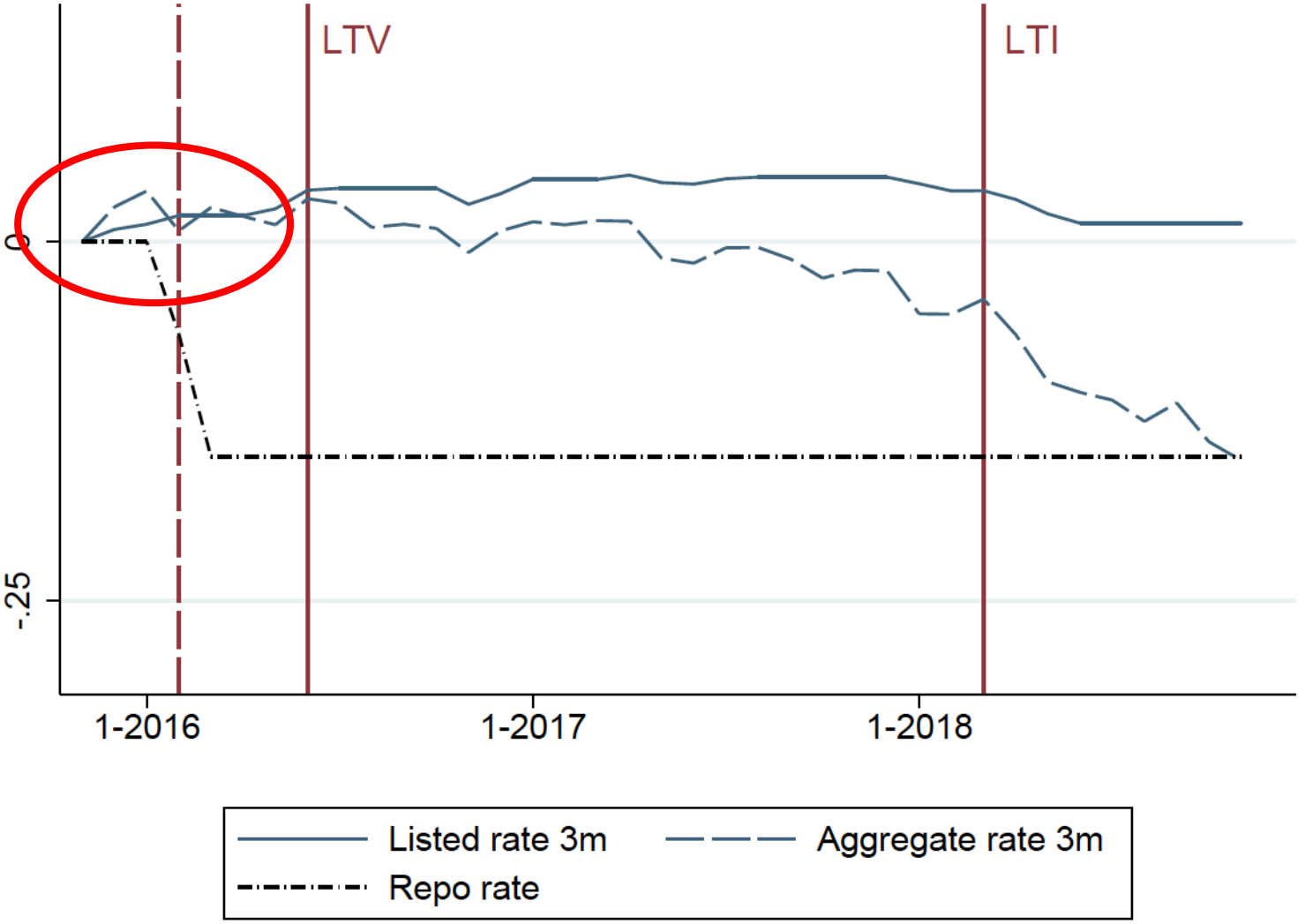
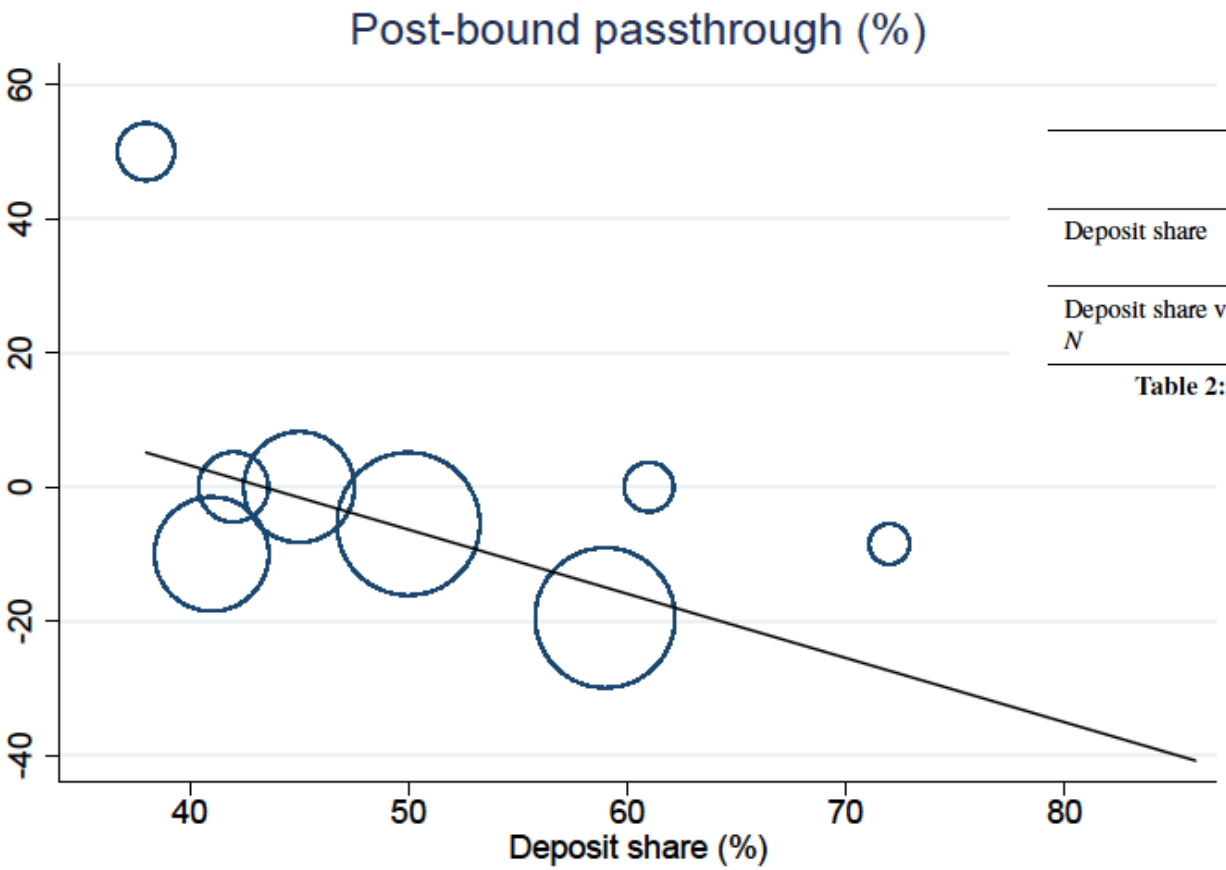


Dispersion in Lending Rates

$$\text{Pass through}_{ir} = \alpha + \text{Deposit share}_i + \epsilon_{ir}$$



	(1) Pass-through	(2) Pass-through
Deposit share	-0.957**	-12.49
	(-2.15)	(-1.68)
Deposit share variable:	continuous	high or low
N	18	18

Table 2: Pass-through and deposit shares.

Evidence from Loan Volumes

$$\Delta \log(\text{lending}_{it}) = \alpha_i + \delta_t + \beta_t \text{ Deposit share}_i \times I_t^{post-bound} + \epsilon_{it}$$

	(1) Δ log(loans)	(2) Δ log(loans)
Post × deposit share	-0.217** (0.0955)	
Post × deposit share		-3.235** (1.184)
N	361	361
No. of clusters	10	10
Mean of dependent variable	2.231	2.231
SD of dependent variable	7.052	7.052
Bank FE	Yes	Yes
Time FE	Yes	Yes
measure	Cont.	High or low

Same as Heider et al (2016) for Euro-zone

Evidence from Bank Equity Returns

$$\text{Excess Return}_{it} = \alpha + \gamma_k \,\text{Event Day}_k + \beta_k \,\text{Event Day}_k \times I_t^{\text{post-zero}} + \epsilon_{it}$$

International Evidence

Negative Rates and Bank Equity Returns

- Japan bank stock fell by -5 percent at the day of negative rates announced (other stocks rebounded)
- Ampudia and Van den Heuvel (2018): 25 cut in negative territory leads to -2 percent decrease in bank equity (EURO zone) compared to +1.3 at positive.

Lending rate and Passt-hrough

- Amzallag et al (2018): Use Italian mortgage data finding rates ***increased***
- Bech and Malkhozov (2016) show Switzerland mortgage ***increased.***
- Contrary Evidence: Eisenschmidt and Smets (2019) using aggregated ***quarterly data*** do not find statistically significant change in passthrough to lending rate.

Model

- Partial Equilibrium Model
- General Equilibrium

$$\max E_t \sum_{t=0}^{\infty} \delta^t DIV_t$$

Assets	Liabilities
Loans (B) -- i^b	Deposits (D) -- i^d
	External funding (F) -- i^f
L: Reserves (R) -- i^r	
L: Money (M) -- 0	
L: Other liquid Assets (A) -- i^a	Net worth (N)

$$Div = \omega N$$

Cost of Bank Intermediation 1

why do banks hold liquid assets?

D and *F* → liquidity risk

Higher for *F* than *D* (small deposits more stable)

Why include in the model?

→ Banks hold liquid asset (L=A+M+R) against external financing (*F*) due to liquidity risk.

Pass-through to these assets reduce profitability (cost of *F*)

$$C(F, L, N)$$

\+ - -

Cost of Bank Intermediation 2

why do banks hold money and reserves?

Apart from contributing to insuring against liquidity risk (L) bank hold money (M) and reserves (R) to:

→ facilitates interbank transaction.

$$\Psi(\underset{-}{R}, \underset{-}{M})$$

Reserves pay interest (i^r) money <u>does not</u>

Money has storage costs, reserves <u>do not</u>

$$S(\underset{+}{M})$$

Cost of Bank Intermediation 3

what is the cost of extending loans?

Banks extend "illiquid" loans

Monitoring cost (and default) increasing in lending

Cost of extending "illiquid" loans higher, the ***lower the net worth***

$$\Gamma(B, N) = \lambda_B B^{\nu} N^{-\iota}$$

Q1: Is there a limit on how low i_t^r can go? *Policy Rate Bound*

$$\frac{i_t^r - i_t^d}{1 + i_t^d} = C_L(F_t, L_t, N_t) + \Psi_R(R_t, M_t)$$

$$\frac{-i_t^d}{1 + i_t^d} = S_M + C_L + \Psi_M$$

Yes. For $i_t^r < i_t^{prb}$

banks exchange *R* for *M* and pay storage cost.

--> Settle interbank transactions themselves.

No evidence we are there yet.

Q2: How do interest rate cuts increase lending?

$$\frac{i_t^b - i_t^d}{1 + i_t^d} = \Gamma_B(B_t, N_t)$$

Spread between borrowing and deposit rate

Bank Intermediation Cost

Deposit rate sufficient statistic for financing cost. In equilibrium banks *indifferent* between deposit and external financing.

Q2: How do interest rate cuts increase lending? *A partial EQ. thought experiment*

$$\hat{\imath}_t^b = 0 \qquad \hat{\imath}_t^r = \begin{cases} \rho^d \hat{\imath}_t^d \\ \rho^f \hat{\imath}_t^f \\ \rho^a \hat{\imath}_t^a \end{cases}$$

$$\text{Case I: } \rho^d = \rho^a = \rho^f = 1$$ Positive Rate Cuts

$$\text{Case II: } \rho^d = 0$$ Negative Rate Cuts

Case I: Cutting rates *always* increases lending

$$\frac{i_t^b - i_t^d}{1 + i_t^d} = \Gamma_B(B_t, N_t)$$

$$\hat{B}_t = \frac{1}{\nu - 1}\left(\frac{1+\bar{\imath}^b}{\bar{\imath}^b - \bar{\imath}^d}\right)\left(\hat{\imath}_t^b - \hat{\imath}_t^d\right) + \frac{\iota}{\nu - \iota}\hat{N}_t$$

Reduces funding costs

Increases profitability

$$\hat{N}_t = \overset{+}{N}_N \hat{N}_{t-1} + \overset{+}{N}_{ib}\hat{\imath}_t^b + \overset{-}{\Omega}_\rho \hat{\imath}_t^r$$

Case II: Do negative rates increase lending?

$$\hat{B}_t = \frac{1}{\nu - 1}\left(\frac{1+\bar{\imath}^b}{\bar{\imath}^b - \bar{\imath}^d}\right)\left(\hat{\imath}_t^b - \hat{\imath}_t^d\right) + \frac{\iota}{\nu - \iota}\hat{N}_t$$

$\hat{\imath}_t^d$ = 0

$\frac{\iota}{\nu - \iota}\hat{N}_t$: Increases/decreases profitability?

$$\hat{N}_t = N_N \hat{N}_{t-1} + N_{ib}\hat{\imath}_t^b + \Omega_\rho \hat{\imath}_t^r$$

Ω_ρ: ?

-Expansionary if $\rho^a \bar{A} + \bar{R} < \rho^f \bar{F}$

$\rho^a \bar{A} + \bar{R}$: Assets

$\rho^f \bar{F}$: Liabilities

Negative rate exposure

Condition for negative rate expansionary

- Balance sheet exposure

$$\rho^a \bar{A} + \bar{R} < \rho^f \bar{F}$$

- Not satisfied in Sweden based on balance sheet data
  ---> Prediction of model matches diff-in-diff regression on loan volumes.
- Effect on net worth summarizes effect of negative rates
  --> consistent with stock market evidence

What about effect on lending rates?

→ *General Equilibrium*

General Equilibrium Model

- Borrowing Household → Borrow from Banks
- Lending Household → Deposit with Banks

  → Can hold money as asset – Zero Bound on Deposits (but a parameter in model)

- Embed Banks into Model
- Monopolistic competitive firms with staggered pricing as Calvo.
- Objective: Parsimonious generalization of standard NK model

IS curve

$$\hat{y}_t = E_t \hat{y}_{t+1} - \sigma\{\hat{i}_t^d - E_t \hat{\pi}_{t+1} - \hat{r}_t^n\}$$

AS curve

$$\hat{\pi}_t = \kappa \hat{y}_t + \beta E_t \hat{\pi}_{t+1}$$

Policy Rule

$$\hat{i}_t^r = \hat{r}_t^n + \phi_\pi \hat{\pi}_t + \phi_y \hat{y}_t$$

NEW

$$\hat{i}_t^d = \max(\bar{i}^{elb}, \hat{i}_t^r)$$

$$\hat{r}_t^n \equiv -\chi\{\hat{i}_t^b - \hat{i}_t^d\} + \hat{\zeta}_t - E_t \hat{\zeta}_{t+1}$$

Banking Model

$$\hat{\imath}_t^b - \hat{\imath}_t^d = (\nu - 1)\frac{\beta^s - \beta^b}{\beta^s}\hat{b}_t - \iota\frac{\beta^s - \beta^b}{\beta^s}\hat{n}_t$$

i) Net worth dynamics (n)

ii) Budget constraint of borrower + Consumption Euler Equation of borrower

Thought experiment

- Suppose there is a fall in the natural rate of interest

-- agnostic about source of crisis (preference shock)

→ fast moving: covid, finacial crisis

→ slow moving: aging, secular stagnation, global spillovers etc.

- What happens if
  - No ZLB?
  - ZLB on both i^r and i^d
  - Only ZLB on i^d

Numerical Values

- Literature σ κ χ

  0.66 0.02 0.61

Balance sheet $\frac{\bar{r}}{\bar{\Lambda}}$ $\frac{\bar{a}}{\bar{\Lambda}}$ > $\rho^f \frac{\bar{f}}{\bar{\Lambda}}$

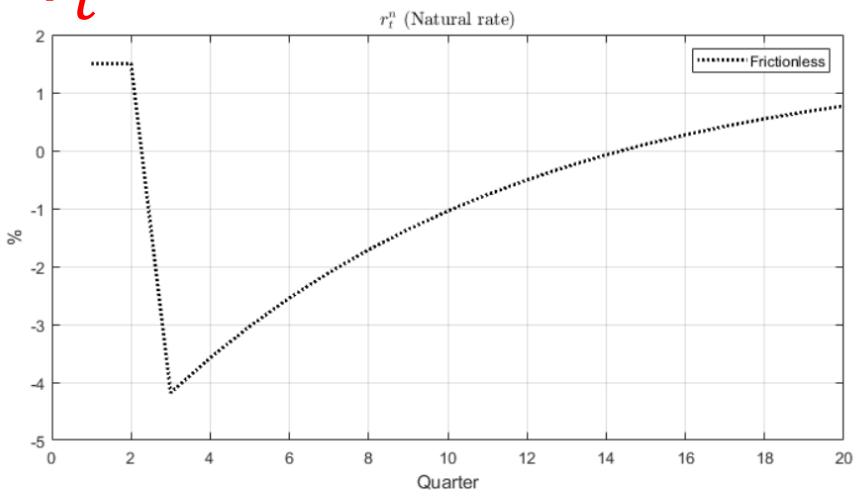
- New: ι ν

Use meta-study from BIS to relate ι to ν

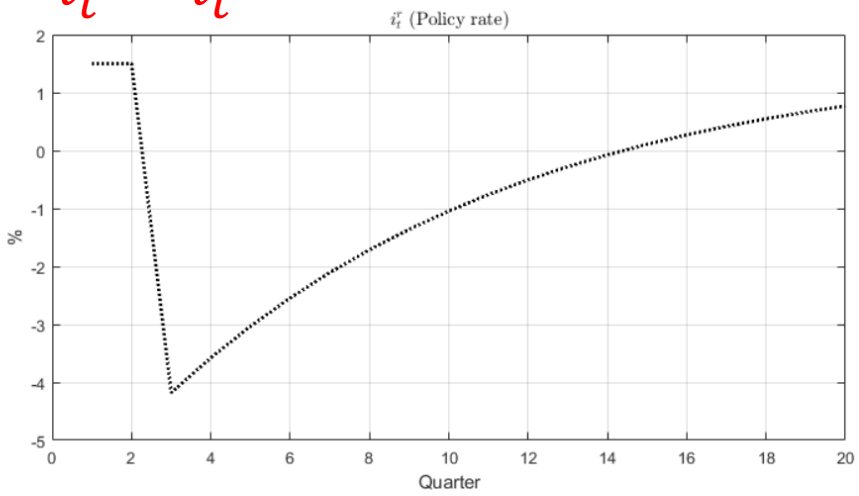
Pick ν to match increase in spreads according to evidence.

No ZLB

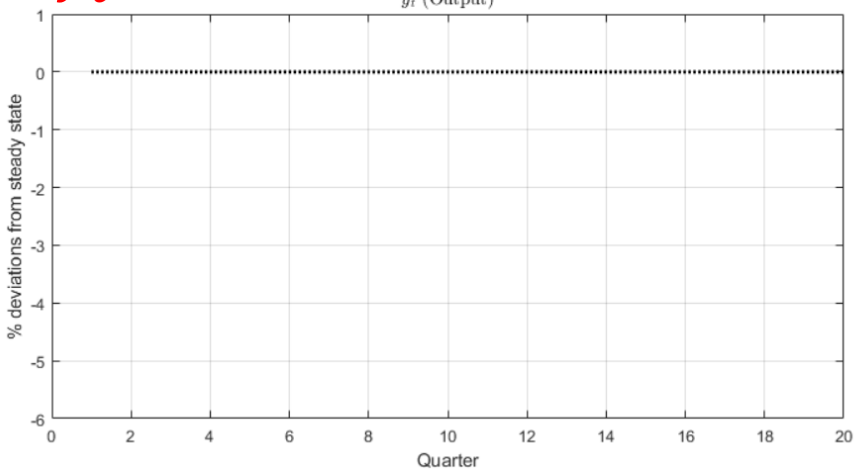
$\hat{r}_t^n$



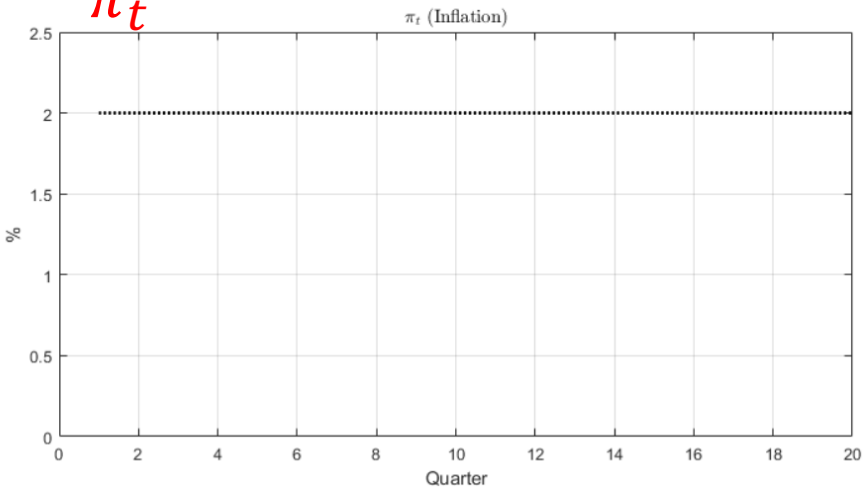
$\hat{\imath}_t^r = \hat{\imath}_t^d$



$\hat{y}_t$

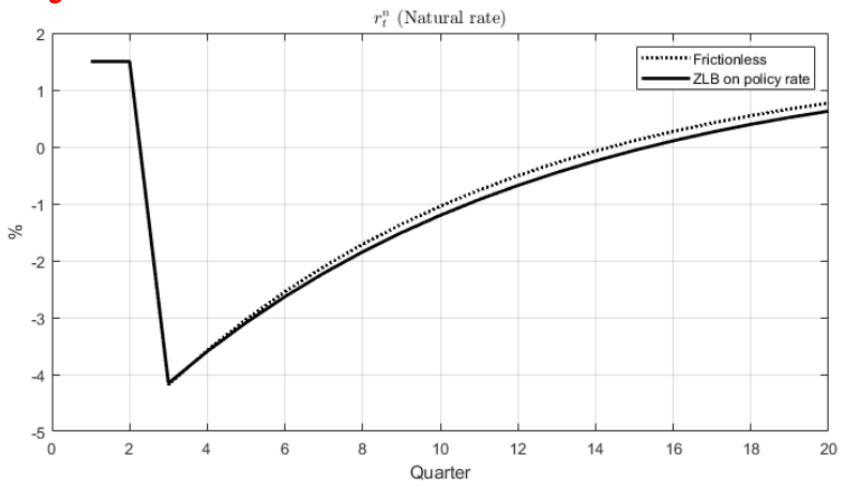


π_t

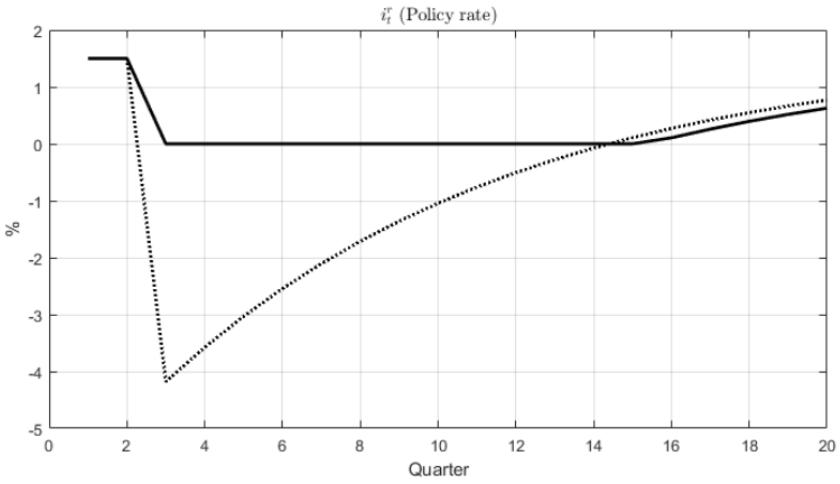


ZLB on both $\hat{\imath}_t^r$ and $\hat{\imath}_t^d$

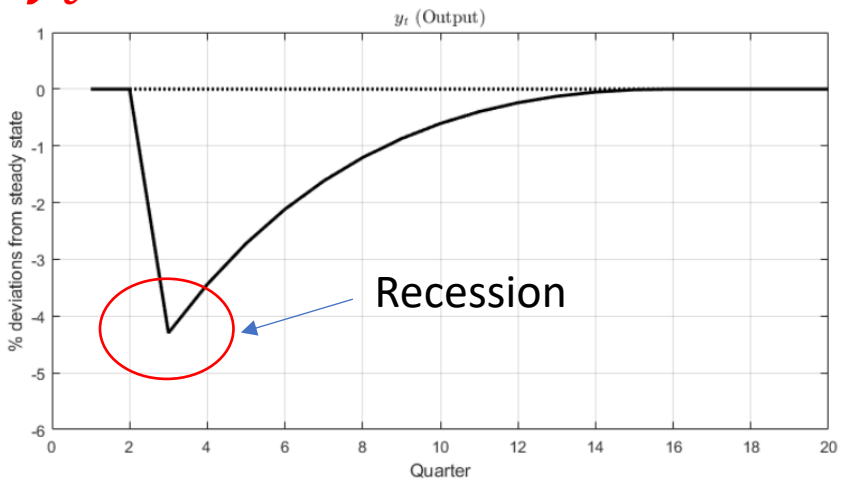
$\hat{r}_t^n$



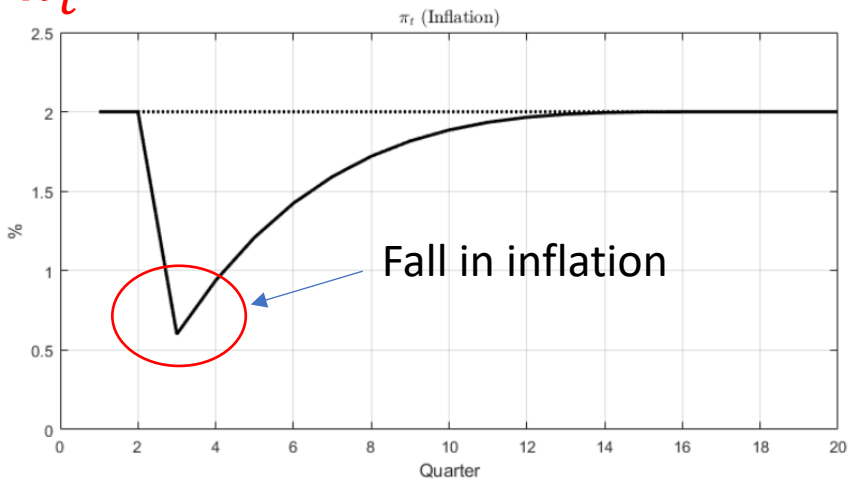
$\hat{\imath}_t^r = \hat{\imath}_t^d$



$\hat{y}_t$

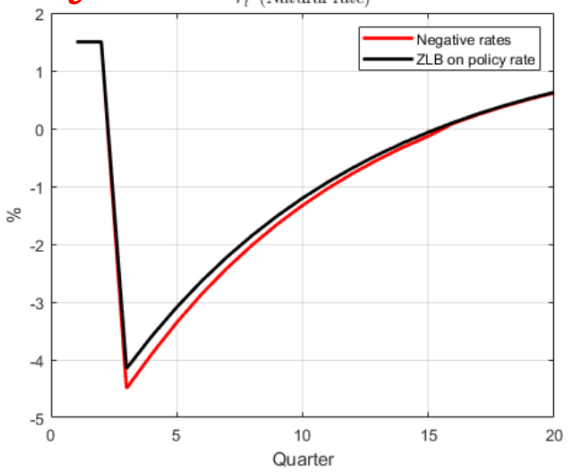


π_t

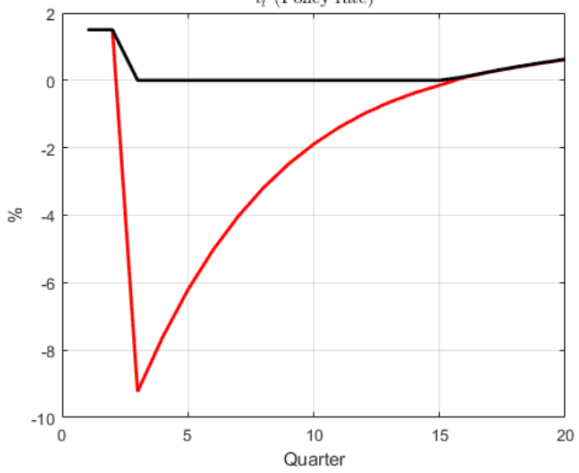


ZLB on i^d

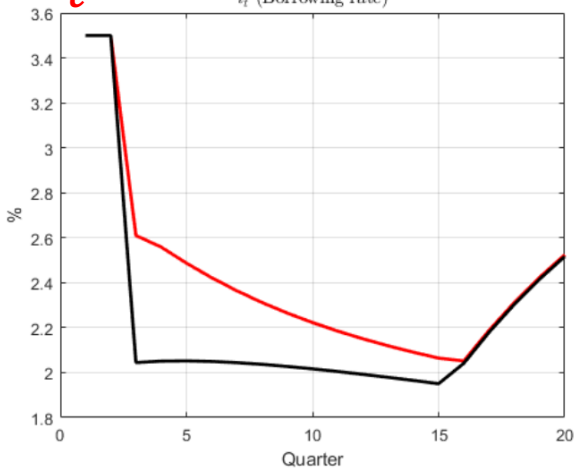
$\hat{r}_t^n$



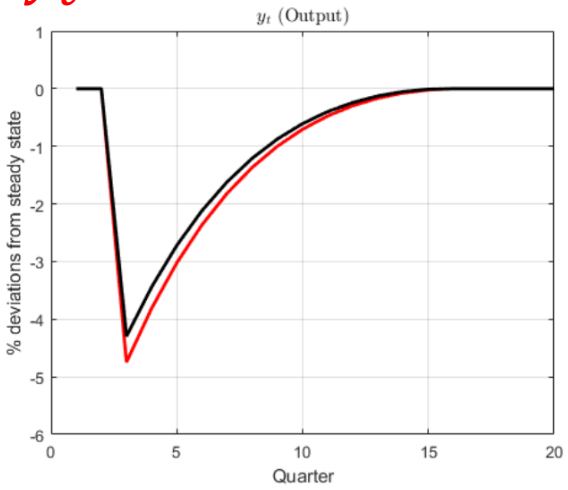
$\hat{i}_t^r$



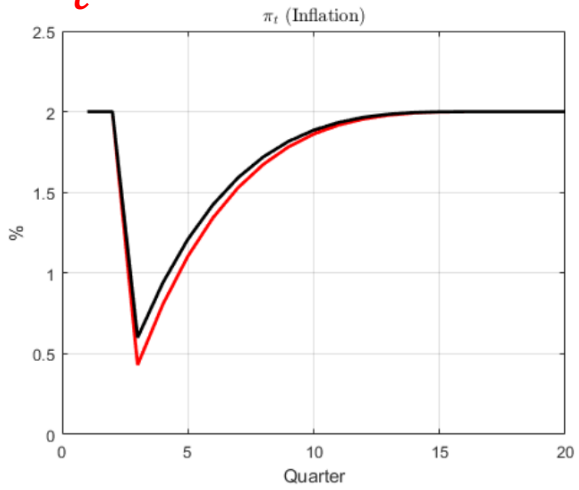
$\hat{i}_t^d$



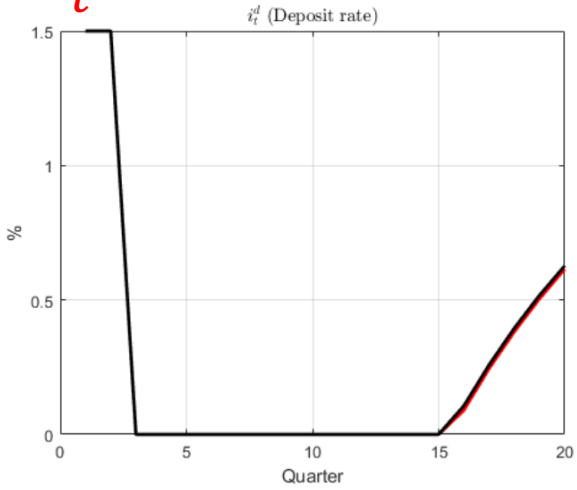
$\hat{y}_t$



π_t

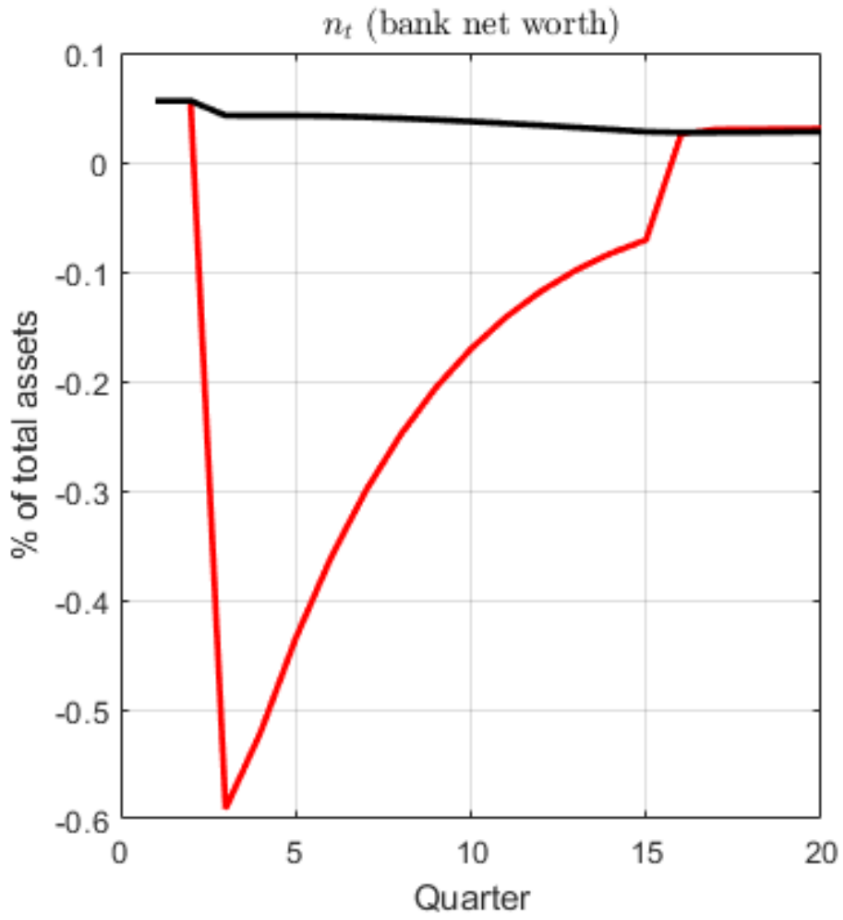


$\hat{i}_t^d$



ZLB on i^d

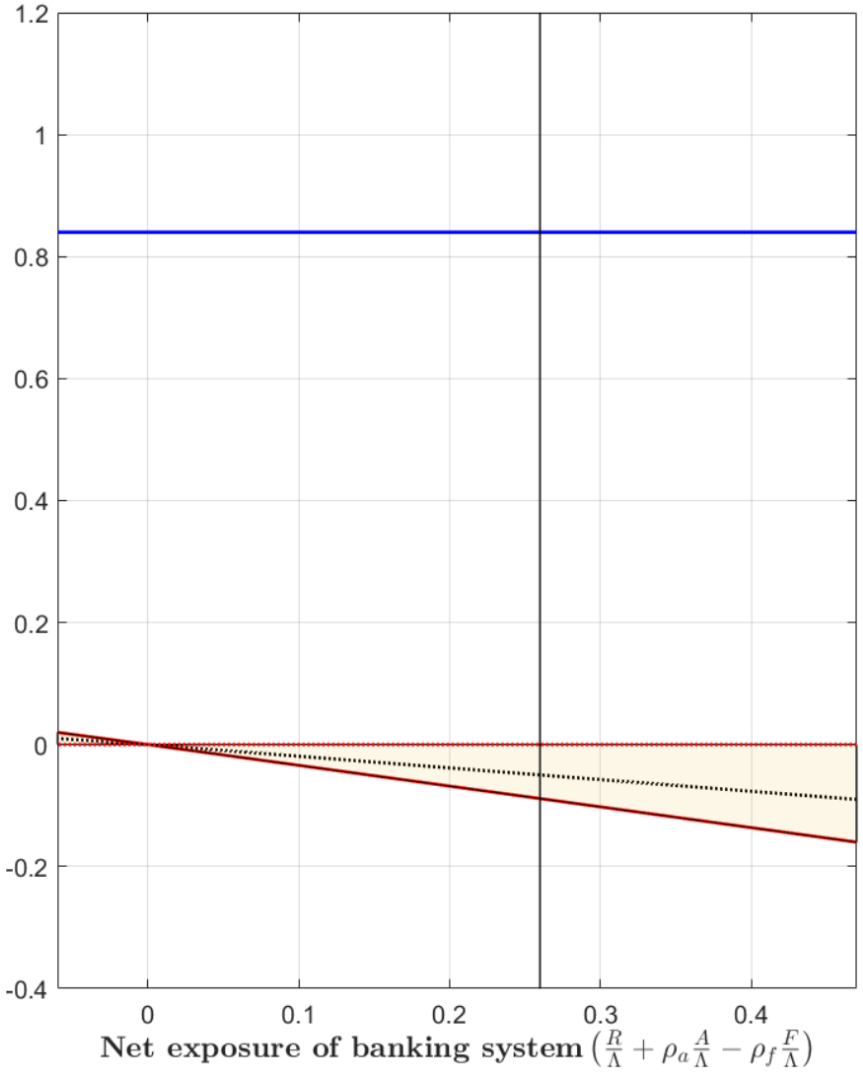
$\hat{n}_t$



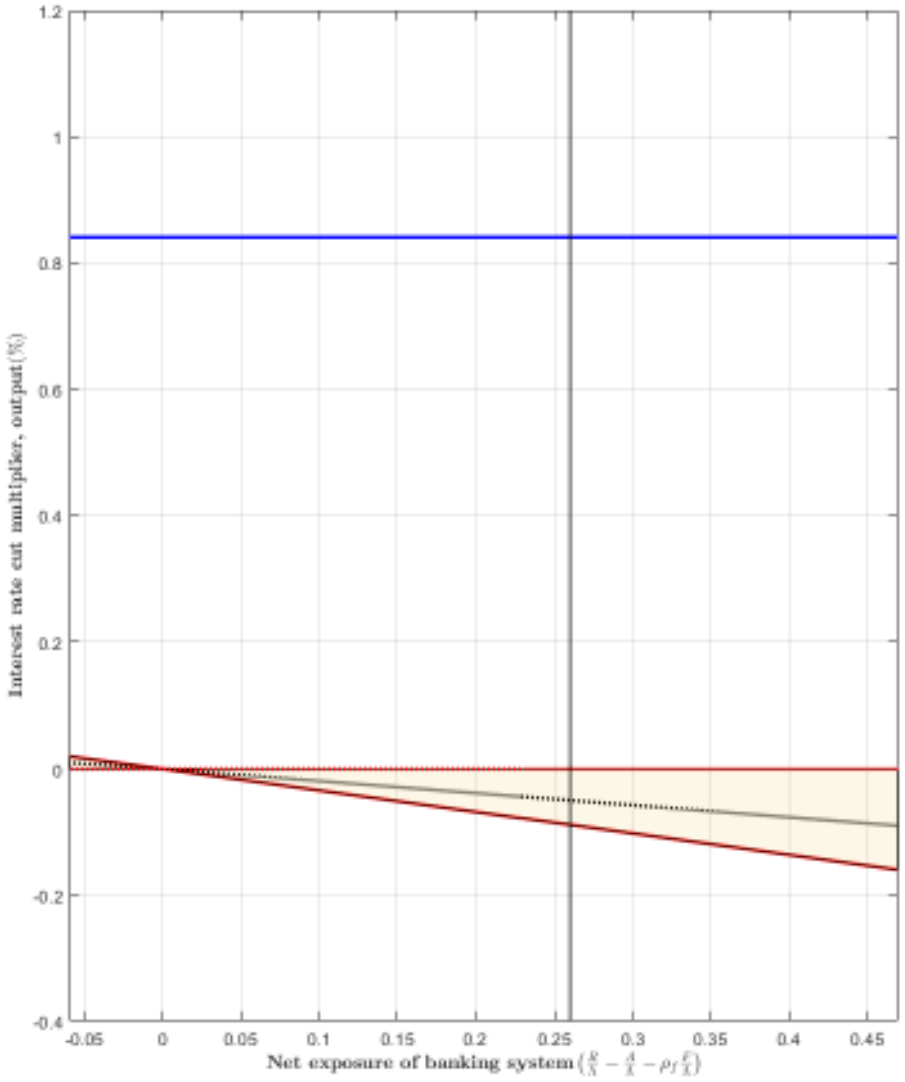
Central result

- Model rationalizes increase in borrowing rates in response to negative rates.
- Optimism by central bank that negative rates are ”business as usual” not warranted.
- Negative policy rates are ***NOT*** a substitute for interest rate cuts in positive territory.
- Interest rate cuts in negative territory work ***fundamentally different*** than regular interest rate cut -> work through net worth of the banking system.
- Negative policy rates in benchmark calibration relatively small negative effect on aggregate demand.

Sensitivity to ν and balance sheet



Sensitivity to ν and balance sheet



Conclusions

- Negative policy rates a poor substitute for regular cuts.
- Policy actions can in principle be taken to make passthrough to deposit rates stronger.
  - Increase cost of holding paper currency.
  - Prevent banks from hording cash
- Small aggregate demand effect opens the door negative rates may still have desirable effect via other mechanism
  - Exchange rates
  - Corporate bond market?

Additional Slides

Nothing special about zero?

comments from central bankers

"As this status report will show, the laws of economics do not change significantly when interest rates turn negative."

"Cutting the repo rate below zero, at least if the cuts **are in total not very large**, is expected to have similar effects to repo-rate cuts when the repo rate is positive, as all channels in the transmission mechanism can be expected to be active."

"This is exactly the mechanism that operates when Bank Rate is reduced in normal times; there is nothing special about going into negative territory."

No increase in issuance of bank bonds

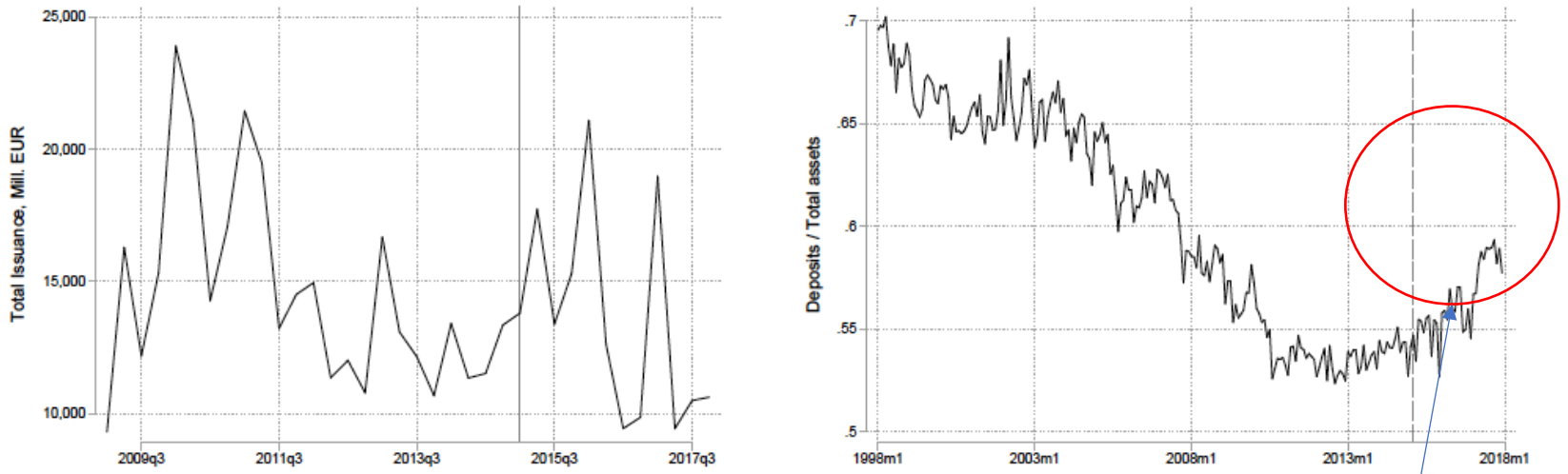
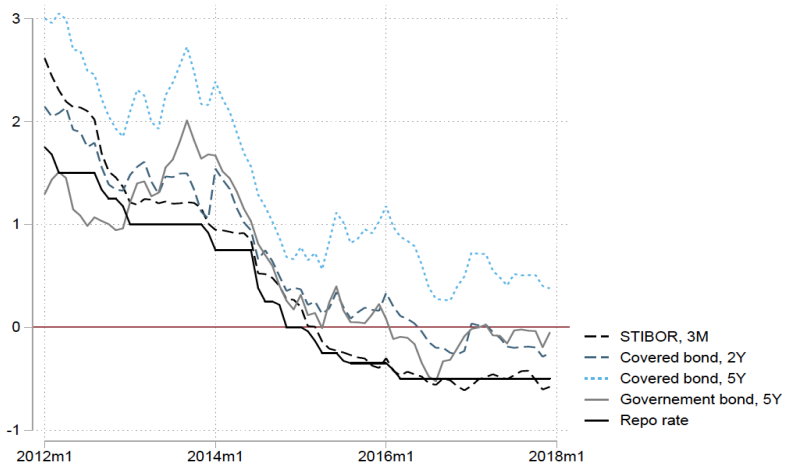


Figure 6: Left panel: Issuance of covered bonds, Swedish banks. Right panel: Deposit share, Swedish banks. Vertical lines correspond to the date negative interest rates were implemented. Source: Association of Swedish Covered Bond Issuers, Riksbank and Statistics Sweden

Consistent with people fleeing into ***cash-like assets***

Strong pass-through to government bonds and STIBOR



Good news?

STIBOR is **INTERBANK** Rates

- Transfer from one bank to the other

→ Irrelevant for the banking sector as whole and thus bank lending channel

- Government bonds are part of ***asset side*** held to insure against liquidity risk
- Lower returns ***bad for profitability***