Household Bank **Stickiness**: Implications for Bank Deposit **Pricing** and **Monetary Policy**.

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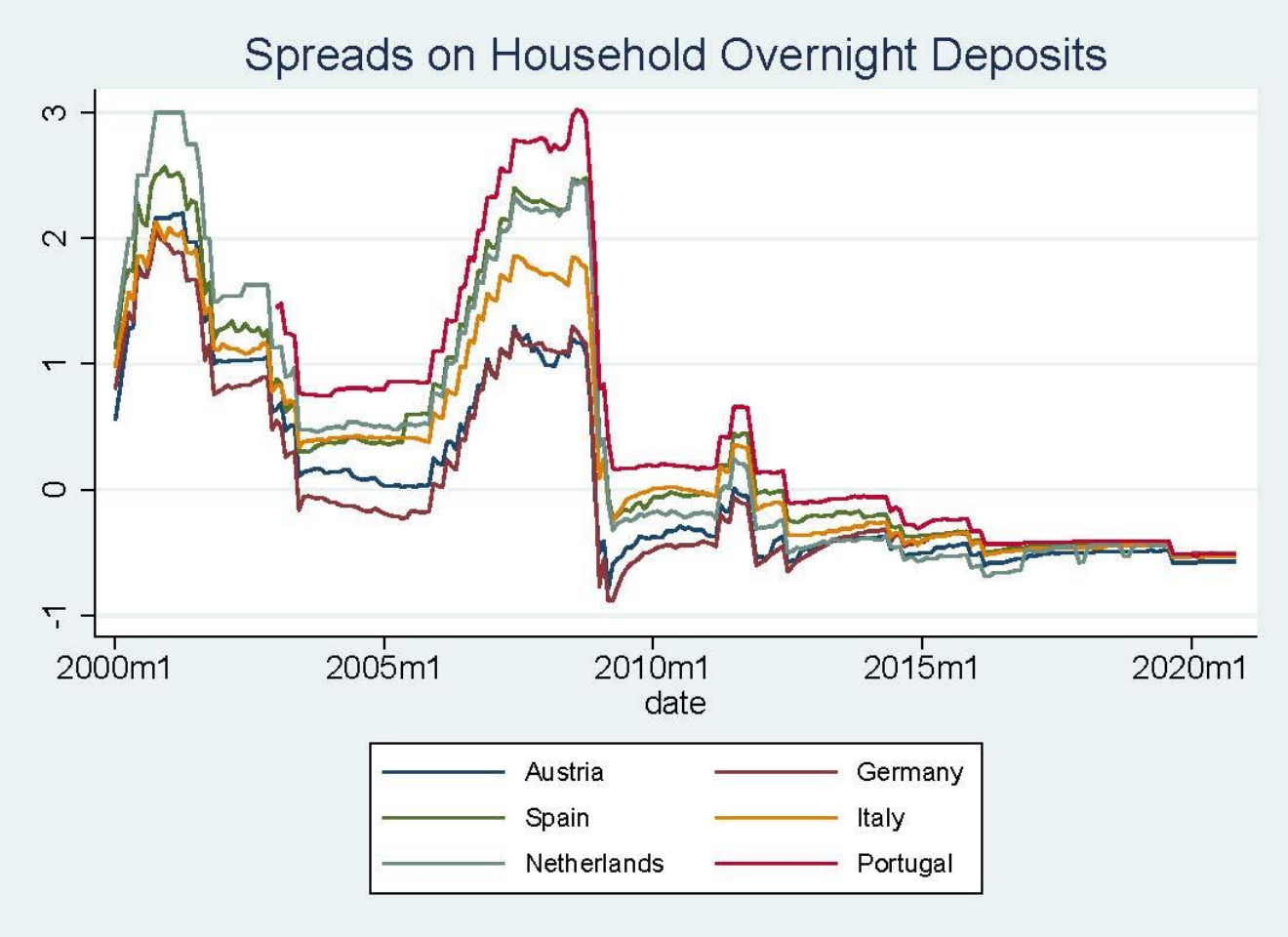
Outline

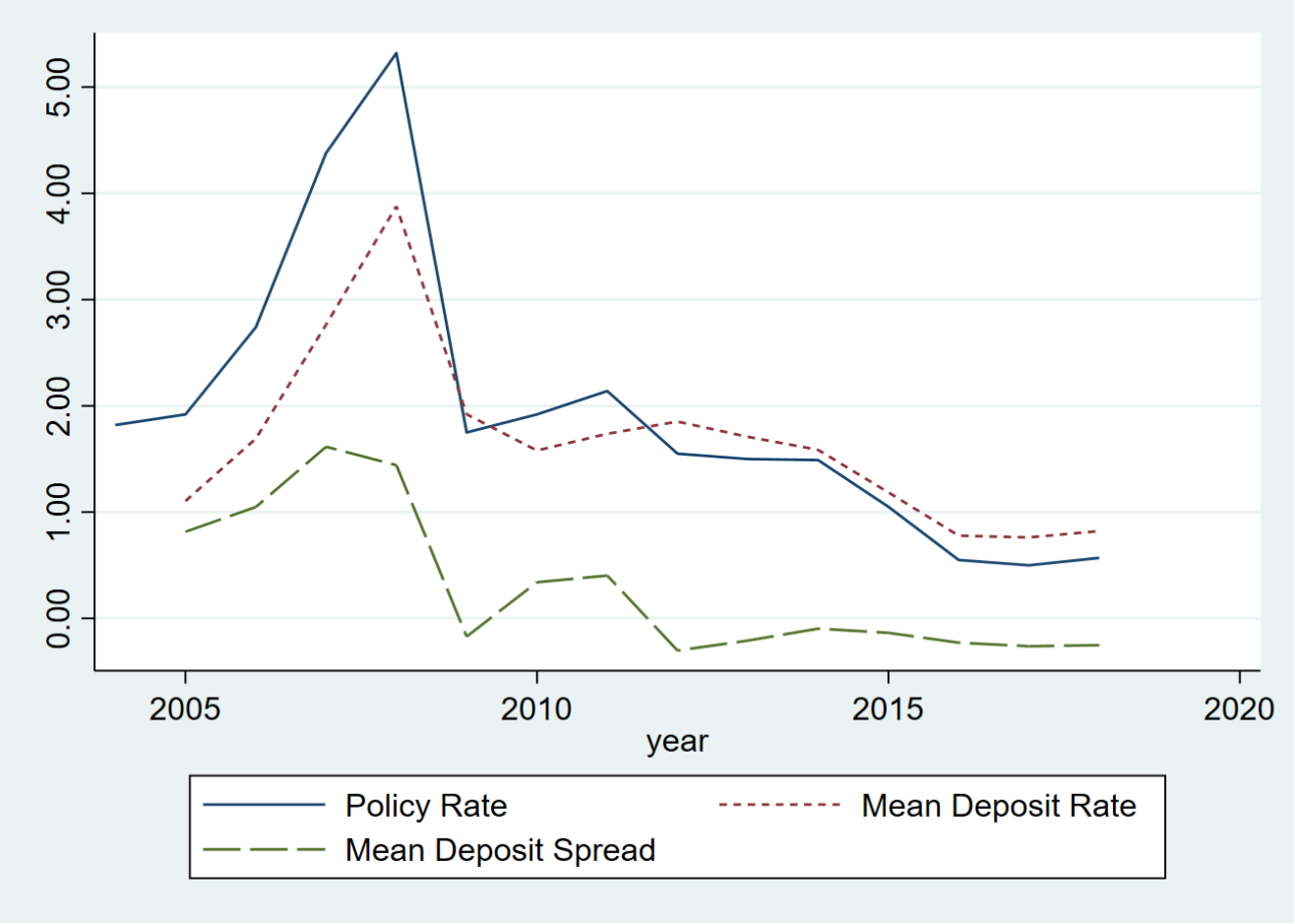
1. Motivation & Highlights
2. Data
3. **Bank Client Stickiness** (Cross-Selling)
4. **Deposit Pricing**
5. **Intertemporal Discounting**
6. Conclusion

1. Motivation & Highlights

Motivation 1: Negative Deposit Spread



Negative Deposit Spreads in Norway



Improving the Theory on Bank Deposit Pricing

- In *Monti-Klein model*, or in *Deposit Channel model* (DSS, 2017), banks with deposit market power set deposit spread *s* to maximize 1-period deposit profits:

$$\max_{s_i} D_i(s_i) * s_i$$

- In this model no reason to set negative spreads…

- We add to the optimization a 2nd period and a 2nd business (loans):

$$\max_{s_i^1} D_{i,t=1}\left(s_{i,t=1}\right) * s_{i,t=1}$$

$$+ \frac{1}{R} D_{i,t=2}(s_{i,t=1}, s_{i,t=2}) * s_{i,t=2}$$

$$+ \frac{1}{R} L_i(l_{i,t=2}, s_{i,t=1}) * l_{i,t=2}$$

Motivation 2: Linking Deposit and Loan Business

- Many papers see benefits to banks from having some deposits and some loans, as deposits are thought to provide …
  - … **cheaper** & more stable loan funding (Drechsler-Savov-Schnabl, QJE 2017)
  - … loan funding **less rate sensitive** (Berlin-Mester, RFS 1999; DSS, JF 2021)
  - … loan funding with **less liquidity risk** (Li-Loutskina-Strahan, NBER 2019)
  - … **economies of scope** with lending (Mester, JF 1987; Kashyap-Rajan-Stein, JF 2002)
- But: If deposits yield at best economies of scope or cheaper refinancing, then no need to sell deposit and loan products to the ***same* client**

Our Three Highlights

1. We show that many deposit relationships allow to **cross-sell loans**

2. We show that this affects **deposit pricing** also in one period

3. We show that later cross-selling profits are to be discounted less and hence induce **lower deposit spreads in periods of lower policy rates**
   - New micro foundation for negative deposit spreads in low policy rate periods
   - New micro foundation for “Deposit Channel of Monetary Policy”

2. Data

Tax Data on Universe of Norwegians

- Deposit & Loan Balances & Interest for each individual * bank * year for 2004-18
- Aggregate from individuals to **households (HH)** as:
  - Some spouses may take out e.g. mortgage jointly
  - Even where they don't, spousal bank relationships likely to matter also
- Use as cross-sectional unit **each HH*bank relationship** rather than each HH: for bank A does not matter whether no loan means no loan or a loan elsewhere..
- Relate mortgage and other business **only to deposit accounts that existed ≥ 1 year before** to exclude reverse causality from loans to deposits

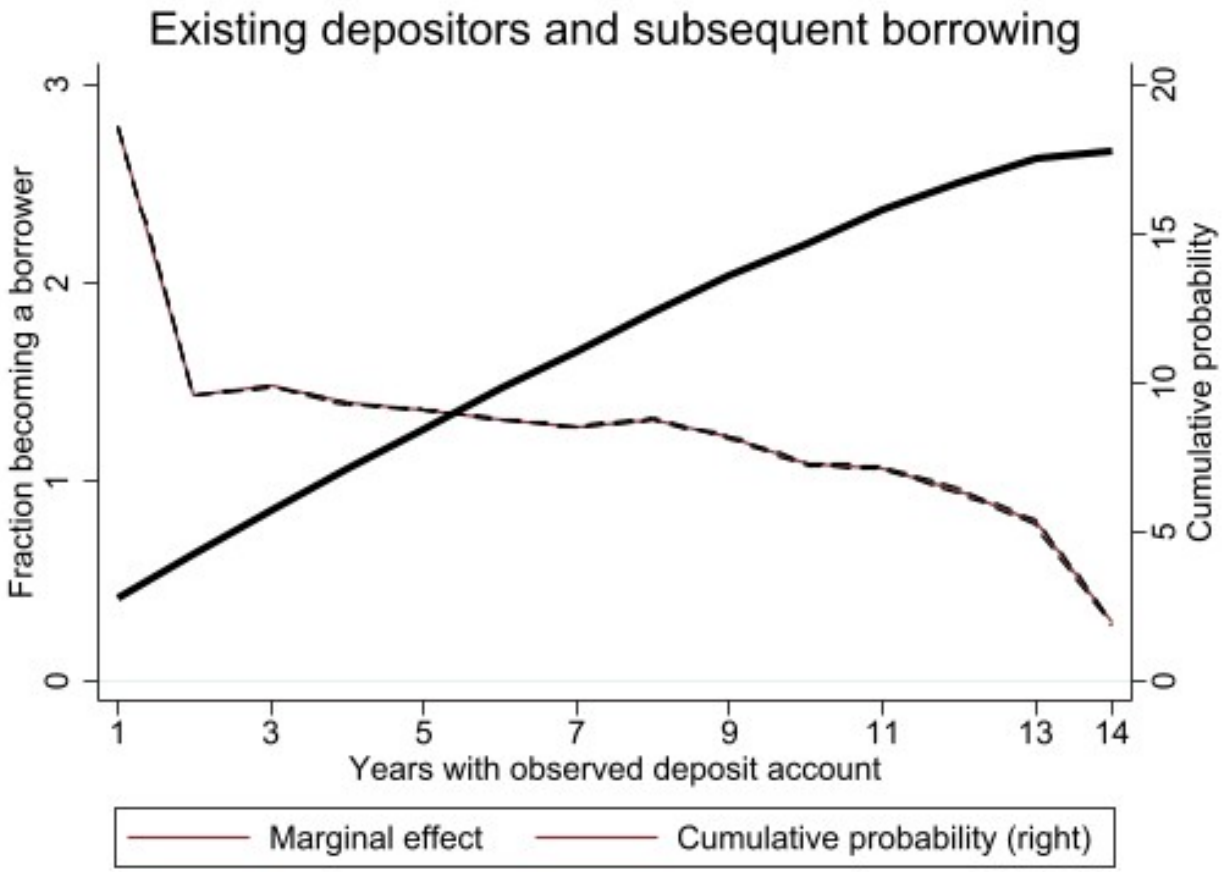
3. Bank Client Stickiness (Cross-Selling)

Cross-Selling Hypothesis

H1 on Depositor-Borrower Conversion: *An existing* ***deposit relationship*** *makes it more likely that the same household will* ***also borrow from the same bank*** *in later, due to some combination of:*

- *Supply complementarities*
- ***Demand complementarities*** *based on:*
  - *Time/financial bank switching costs*
  - *Psychological bank switching costs*

Key Result 1: Opening a Deposit Account and Borrowing Later



With Municipality*AgeGroup*SalaryGroup*EducationGroup FE

Methodology: Is Depositor-Borrower Conversion Causal?

- **Reverse Causality** from Planned Borrowing to a Deposit Account Opening?
- Exclude by dropping deposit account openings in same year as borrowing

- **Possible Omitted Variable Bias** due to:
  - Low number of banks in a municipality
  - Lifecycle considerations
  - Character traits
- Therefore we use fixed effects for interaction of:
  - Municipality
  - Age group
  - Salary group
  - Education group

Methodology: Addressing Remaining Omitted Variable Bias

- Comforting to see that the above conversion graph does not change much regardless of which sets of fixed effects we add

- Still not entirely impossible that, within the same municipality, both deposit and loan choice driven simply by **distance to bank's next branch**

- Hence two **robustness checks**:
  - Subset of **borrowers who changed postcode area** or even municipality between opening a deposit account and borrowing
  - Subset of borrowers in the **25% most densely populated** municipalities…

Lower Conversion following more Price Transparency with "Finansportalen"

	(1) I(Loan)	(2) I(Loan)	(3) I(Loan)	(4) I(Loan)
I(Dep)	0.13***	0.15***	0.13***	0.15***
I(Dep)*I(Post2008)		-0.04***		-0.04***
I(Post2008)		-0.02***		-0.02***
I(LowPopDen)*I(Dep)			0.01***	0.01***
I(LowPopDen)			0.02***	0.01***
I(LowPopDen)*I(Dep)*Post2008				-0.00**
Constant	0.01***	0.02***	0.01***	0.02***

- For space reasons focus on FE versions, and omit SEs
- Dep Rel makes later Loan Rel 15% more likely pre-2008 in high-density towns
- Effect falls by 4pp post-2008, and even (very slightly…) less in low-density towns

4. Pricing

Implications for Deposit Pricing

- Conversions and bank market power → **"Multi-Product Pricing"** (Tirole, 1988)
- Let banks take effect of s_i on deposit profits into account when setting s_i:

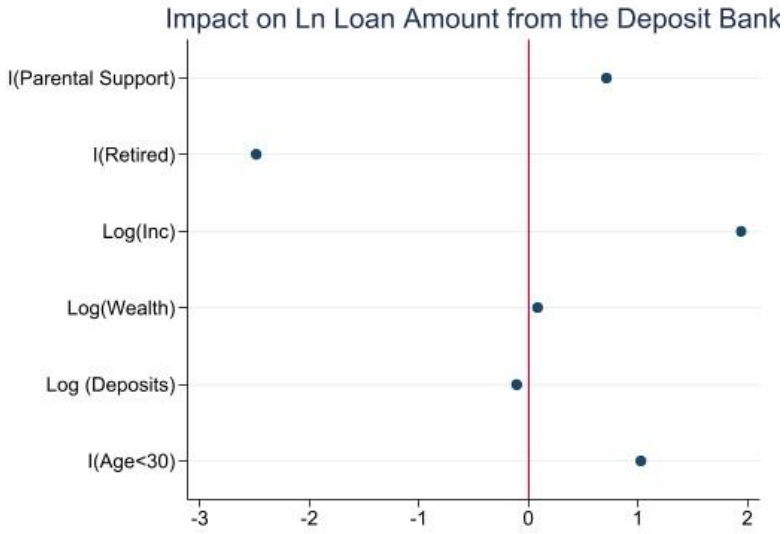
$$\max_{s_i} D_i(s_i) * s_i + \cdots + + L_i(l_i, s_i) * l_i$$

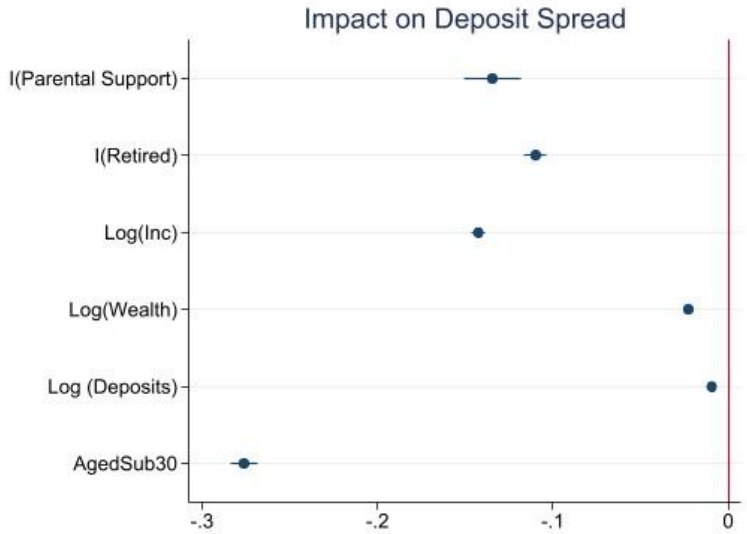
$$\rightarrow \left[\frac{dD_i}{ds_i} s_i + \frac{dL_i}{dl_i} l_i\right] * \frac{1}{D_i} = -1$$

H3 on Deposit Pricing Resulting from Demand Complementarities:

Bank b sets a lower deposit spread $s_{i,b}$ if client group i has an expected loan volume more responsive to the deposit rate, has a more negative $\frac{dL_i}{ds_i}$.

Depositor-Borrower Conversion & Pricing by Observables





- Increasing income by 1% increases the amount borrowed by about 2%
- Effects of wealth & deposits negligeable

- **Parent status increases amount 100%**
- **Age below 30, too**

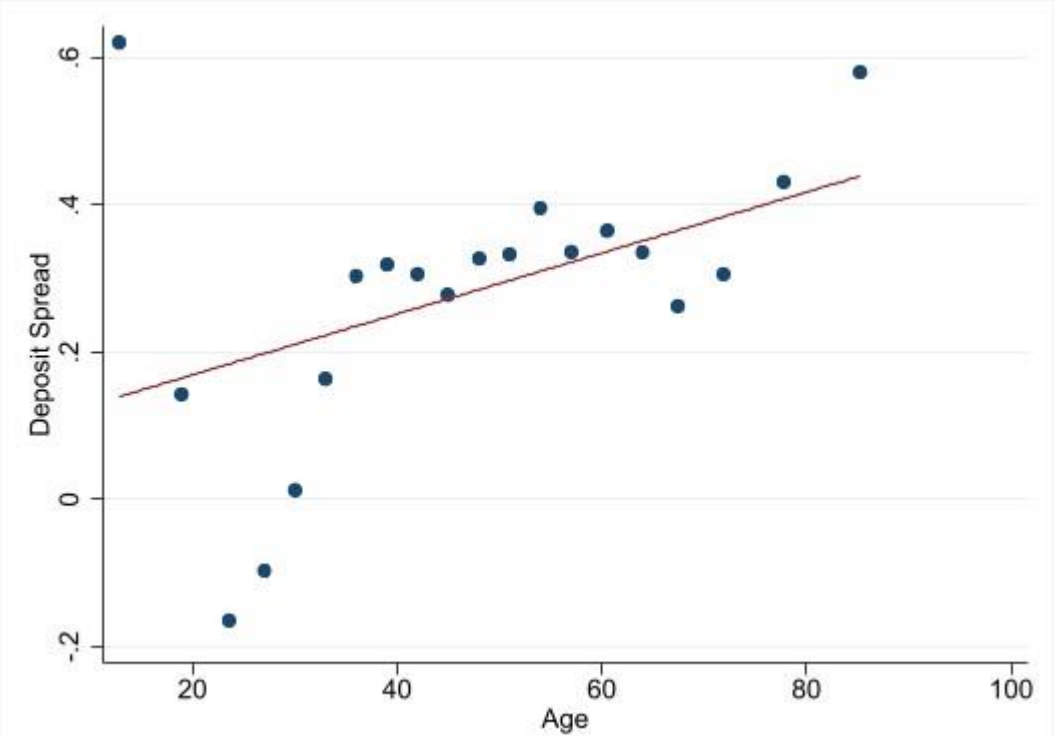
- 1% higher income (wealth) associated with 0.15bps (0.07bps) lower spread

- **Parents get 15bps lower spread**
- **Under30s get 27bps lower spread**

Not driven by Branch Distance

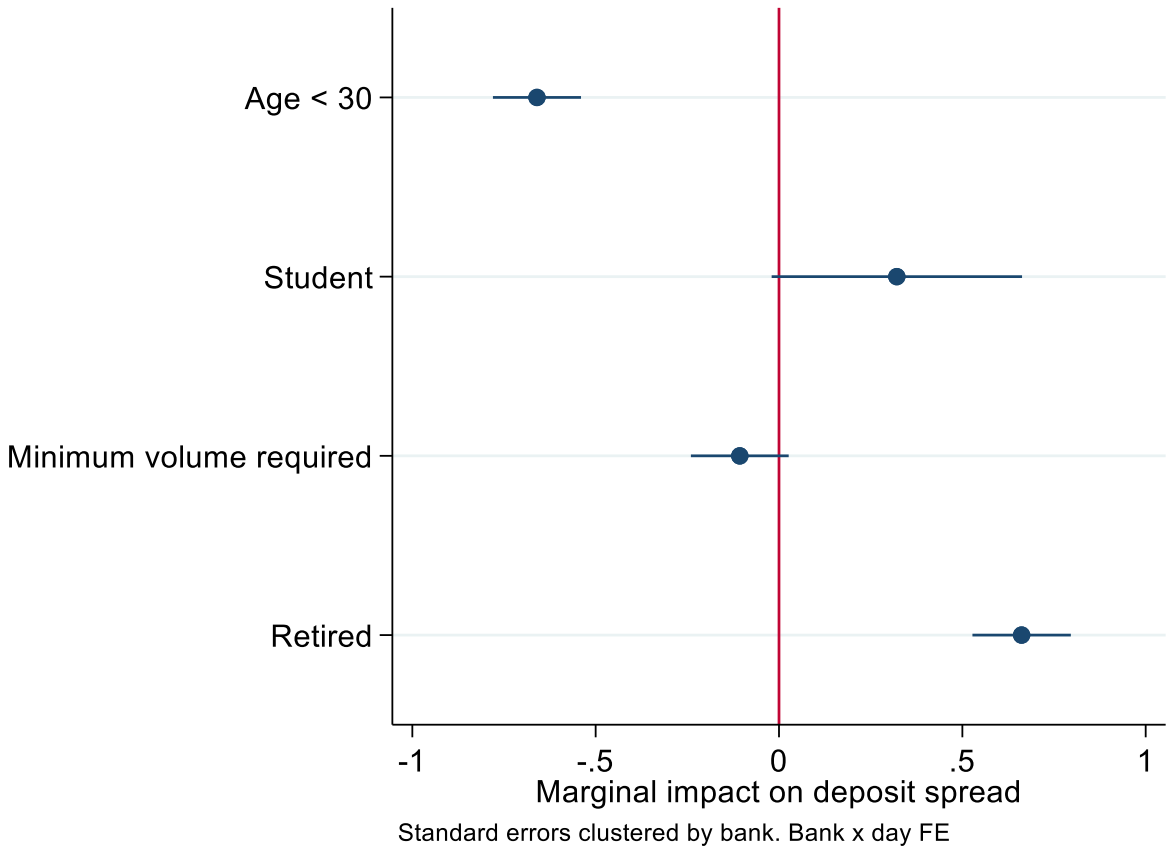
	Baseline				Movers				Municipality Density > P75			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	I(Loan)	Ln(Loan)	Dspread	Dspread	I(Loan)	Ln(Loan)	Dspread	Dspread	I(Loan)	Ln(Loan)	Dspread	Dspread
I(Parent)	-0.04***	0.58***	-0.15***	-0.15***	-0.05***	0.72***	-0.23***	-0.23***	-0.04***	0.58***	-0.17***	-0.17***
I(Retired)	0.04***	-1.19***	-0.06***	-0.06***	0.04***	-1.38***	-0.07***	-0.07***	0.04***	-1.15***	-0.07***	-0.07***
Ln(Inc)	0.01***	1.38***	-0.28***	-0.28***	0.01***	1.38***	-0.29***	-0.29***	0.01***	1.40***	-0.27***	-0.27***
Ln(Wealth)	0.00***	0.07***	0.07***	0.07***	0.00***	0.02***	0.07***	0.07***	0.00***	0.07***	0.06***	0.06***
Ln(Deposits)	0.01***	-0.10***	-0.01***	-0.01***	0.01***	-0.10***	-0.01***	-0.01***	0.01***	-0.10***	-0.01***	-0.01***
I(Age<30)	0.08***	0.80***	-0.18***	-0.16***	0.07***	0.96***	-0.20***	-0.18***	0.08***	0.80***	-0.21***	-0.18***
Conversion				0.25***				0.26***				0.36***
Constant	-0.04***	-7.68***	3.14***	2.99***	-0.05***	-7.26***	3.29***	3.12***	-0.04***	-7.87***	3.14***	2.91***
Observations	1'471'674	1'471'674	708'769	708'758	712'443	712'443	346'498	346'494	1'173'060	1'173'060	561'470	561'462
R2	0.071	0.243	0.020	0.020	0.077	0.252	0.029	0.029	0.073	0.241	0.021	0.022

Clearest: Lower Spreads for the Younger



NB: Not caused by earlier rate fixation, as >92% of Norwegian deposits have rate fixations <= 1 year

How? Lower Spreads on Accounts that Require Age < 30



Loan Pricing

	(1) Loan Rate New Loan	(2) Loan Spread New Loan	(3) Loan Rate Old Loan	(4) Loan Spread Old Loan
I(Deposit Rel in last 5 yrs)	0.41	0.95	0.22***	1.78**
Ln(Debt)	-0.75***	-1.00***	-0.33***	-0.59***
Ln(House Value)	0.13	0.38	0.07***	0.13
Ln(Salary)	-0.00	0.17	0.01	-0.09
Ln(Deposits)	0.01	0.00	0.00	-0.01
Year of Birth	-0.00	-0.02	0.00	0.00
Relationship Age	-0.00	-0.02	-0.01***	-0.02
1000Pop/km2 in Muni	-0.16***	-0.28	-0.11***	-0.24***
Constant	18.24	41.92	4.77***	4.03
Observations	1591	386	31487	1639
R2	0.408	0.502	0.269	0.324
Bank*Year FE	Y	Y	Y	Y

Existing depositors pay not lower but higher loan rates, after controlling for:

- Bank * year fixed effects
- Relationship age
- Loan amount
- Collateral value
- Salary
- Age
- Pop. density (competition proxy)

- Rationale for better deposit deals beyond depositor-borrower conversion
- Speaks for **demand complementarity** as main driver of conversion:
  - If supply complementarity, banks should pass on part of lower screening costs
  - Instead banks can charge households for preferences to not change banks

5. Intertemporal Discounting

Extension to Several Periods

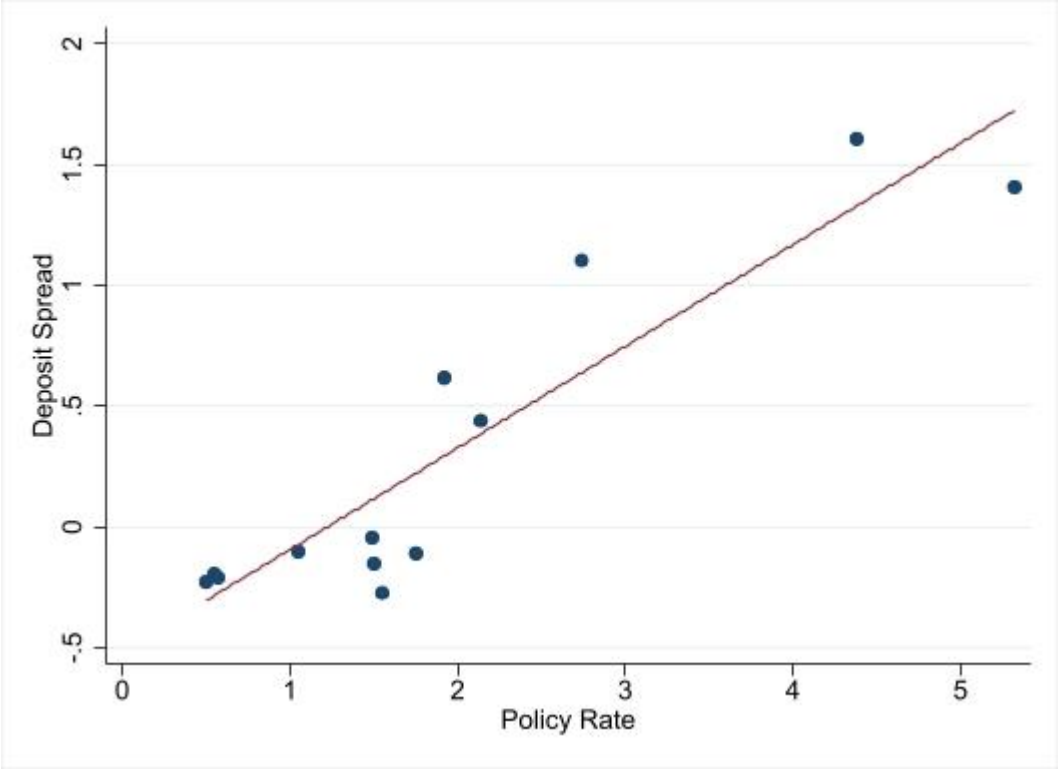
- Many profits from cross-sales (or from future deposit business) occur later and must be discounted at factors related to (…) current policy rates:

$$\max_{s_i^1}[D_{i,t=1}\left(s_{i,t=1}\right) * s_{i,t=1}]$$

$$+\left[\frac{1}{R} D_{i,t=2}\left(s'_{i,t=1} s_{i,t=2}\right) * s_{i,t=2}\right] + [\frac{1}{R}\mathrm{L}_{\mathrm{i,t=2}}(l_{i,t=2}, s_{i,t=1})^* l_{i,t=2}] \qquad (4)$$

H4 on the Link between Policy Rates and Deposit Spreads: *The bank will ceteris paribus accept a lower deposit spread the lower current interest rates and the lower therefore the discount factor for future deposit or cross-selling profits.*

Lower Spreads in Times of Lower Policy Rates



Cross-Selling Incentives vs. Market Power

H5 on Cross-Selling Incentives vs. Deposit Market Concentration:

Expect the link between deposit spreads and policy rates to be stronger the …

(a) … greater deposit market concentration, following DSS 2017.

(b) … greater banks' cross-selling incentives.

Measuring Cross-Selling Incentives

- $Conversion_b = \frac{1}{H}\sum_{h=1}^{H}\frac{LoanVolume_{h,b}}{DepositVolume_{h,b}}$
  - Look for each relationship at loan volume (in first loan year)
  - Scale by deposit volume (in average deposit year)
  - Average across all *h=1,…,H* households with which bank *b* interacts
  - Range 0 to 87, mean 42, so much greater loan than deposit volumes
  - Put differently: Mean deposit volume about 2.5% of mean loan volume
- Why volumes rather than just dummies?
  - A deposit spread discount is costlier the bigger the deposit volume
  - A positive loan spread yields greater profits the greater the loan volume

Deposit Spread β by Market Power and **Conversion**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dspread	Dspread	Dspread	Dspread	Dspread	Dspread	Dspread
Policy Rate (PR)	0.43***	0.36***	0.38***	0.25***	0.33***	0.28***	0.29***
PR*Conversion		0.27***	0.27***	0.42***	0.43***	0.65***	0.62***
PR*MC		0.11***	0.05***	0.48***	0.30***	0.29***	0.31***
Conversion		0.91***	0.96***	0.87***	0.97***	0.29***	0.94***
Market Concentration (MC)		-0.02	0.81***	-0.10**	0.72***	-0.53***	0.52***
Constant	-0.52***	-0.63***	-0.71***	-0.75***	-0.93***	-0.38***	-0.62***
Observations	709'112	709'112	709'112	709'112	709'112	709'112	709'112
R2	0.030	0.031	0.031	0.032	0.033	0.033	0.035
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MC metric	None	HHI(D)	HHI(L)	WHHI(D)	WHHI(L)	WMS(D)	WMS(L)
Age*Salary*Edu FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

- Effect of 1SD of WHHI(D) = 0.48*0.07 = 0.03
- Effect of 1SD (0.06) higher deposit-loan conversion = 0.42*0.06 = 0.03

Implications for Bank Level Deposit Spreads and Volumes

	(1) Deposit Spread	(2) Deposit Growth	(3) Loan Growth
DPR	0.27***	-1.64*	-1.41***
I(PR<2%)	-0.31***	-1.01	-8.62***
DPR*I(PR<2%)	-0.29***	0.39	2.04***
Constant	0.10	5.19*	12.38***
Observations	6'244	6'493	10'108

- In environments with policy rates ≥ 2%, confirm DSS 2017 prediction that positive policy rate changes come with:
  - Higher deposit spreads
  - Therefore lower deposit growth
  - Therefore lower loan growth

- Addendum: Tentative evidence that this channel breaks down for policy rates below 2%
- Why? Basten & Mariathasan show banks cross-subsidize deposit spreads with loan spreads
- But not all banks may have the leeway to do so

6. Conclusion

Conclusion

1. Cross-Selling / Conversion from Deposit to Loan Business;
   a. Loan Pricing suggests driver (for households) are demand complementarities

2. Therefore lower deposit spreads for those expected to borrow more

3. Due to discounting, see lower spreads when policy rate lower
   – and even negative spreads when policy rate is very low;
   Cross-selling explains deposit spread β beyond market concentration

Appendix

Some Summary Statistics

	Obs	Mean	SD	Min	Max
Panel A: Tax data at the relationship level					
Policy Rate	712'006	1.890	1.348	0.500	5.320
Deposit Rate	712006	1.643	3.646	0.000	30.349
Deposit Spread	712006	0.275	3.372	-25.029	5.072
Loan Rate	251612	2.128	2.709	0.000	16.192
Loan Spread	20501	1.209	4.579	-4.806	15.597
Deposits (NOK 1'000)	712'006	97	250	0.000	1'700
Loans (NOK (1'000)	712'006	100	410	0.000	3'400
I(Aged < 30)	712'006	0.238	0.426	0.000	1.000
Education Group 1	707'980	0.139	0.346	0.000	1.000
Education Group 2	707'980	0.416	0.493	0.000	1.000
Education Group 3	707'980	0.307	0.461	0.000	1.000
Education Group 4	707'980	0.138	0.345	0.000	1.000
HHI(D)	712'006	0.269	0.118	0.093	0.834
HHI(L)	712'006	0.133	0.064	0.058	0.654
Panel B: Tax data at the bank level					
Bank Level Deposits (NOK mio)	712'006	58'000	93'000	0	300'000
I(LoanFocus)	712'006	0.263	0.441	0.000	1.000
I(LoanIncFocus)	712'006	0.500	0.500	0.000	1.000
Conversion	712'006	0.166	0.059	0.000	0.202
WHHI(D)	712'006	0.271	0.065	0.100	0.814
WHHI(L)	712'006	0.111	0.054	0.000	0.634
WMS(D)	712'006	0.199	0.176	0.000	0.655
WMS(L)	712'006	0.086	0.088	0.000	0.412
Panel C: Finansportalen.no data					
Deposit spread	2'904'722	-0.46	1.5	-9.5	5.65
Student dummy	2'904'722	0.01	0.09	0	1
Retired dummy	2'904'722	0.04	0.19	0	1
Age <= 30 dummy	2'904'722	0.77	0.42	0	1
Minimum volume limit	2'904'722	0.18	0.38	0	1

Approximating the Profitability of Deposit Spread Discounts

- Data show average **deposit spreads (policy – deposit rates) of 28bps**
- Slightly more when benchmarking against 2- or 3-year government bond rate…

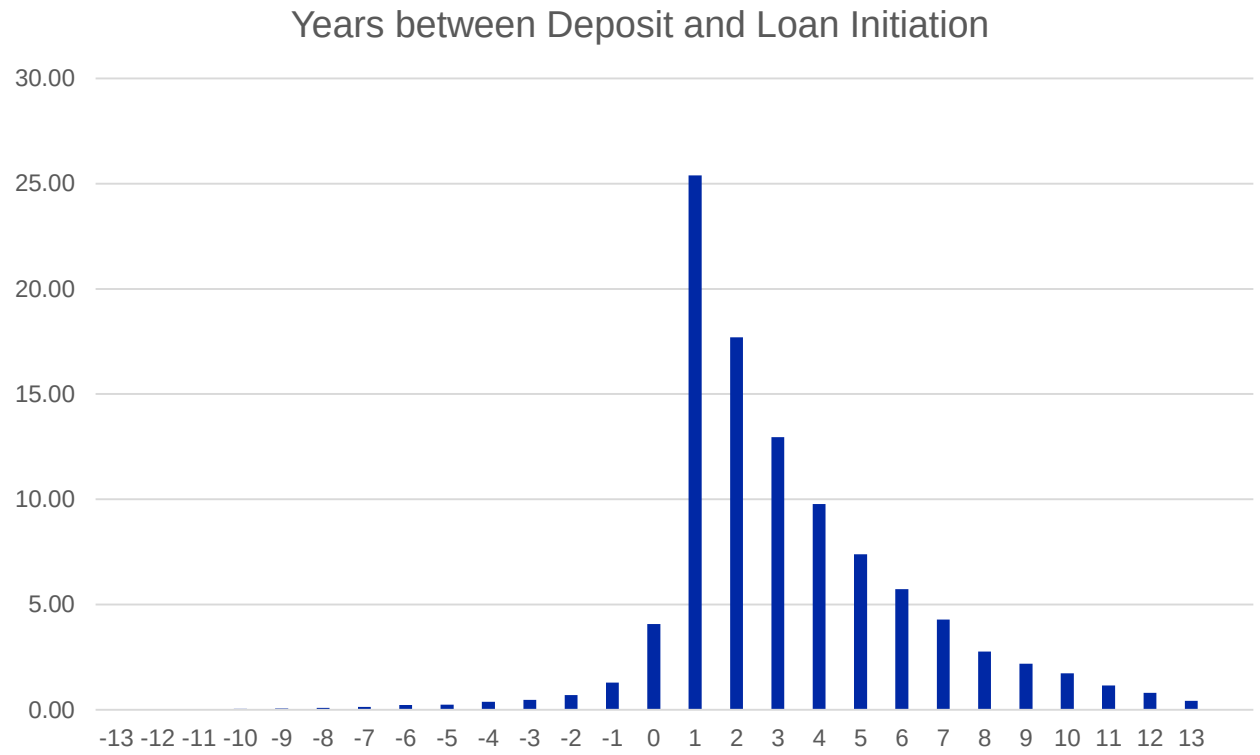
- For loans, **raw spread of loan less policy rate is about 120bps**
- No need for longer maturity benchmark, as 95% of mortgages adjustable rate
- But do need to **adjust for costs of credit risk**, for now
  - 50bps for cost of capital buffers against unexpected losses
  - 20bps for costs of provisions for expected losses
- **This yields average credit risk adjusted loan spreads of about 50bps**

- Even with these adjustments, suggests at first shot that **lending in expectation more profitable than deposit-taking on its own**

Approximating the Profitability of Deposit Spread Discounts 2

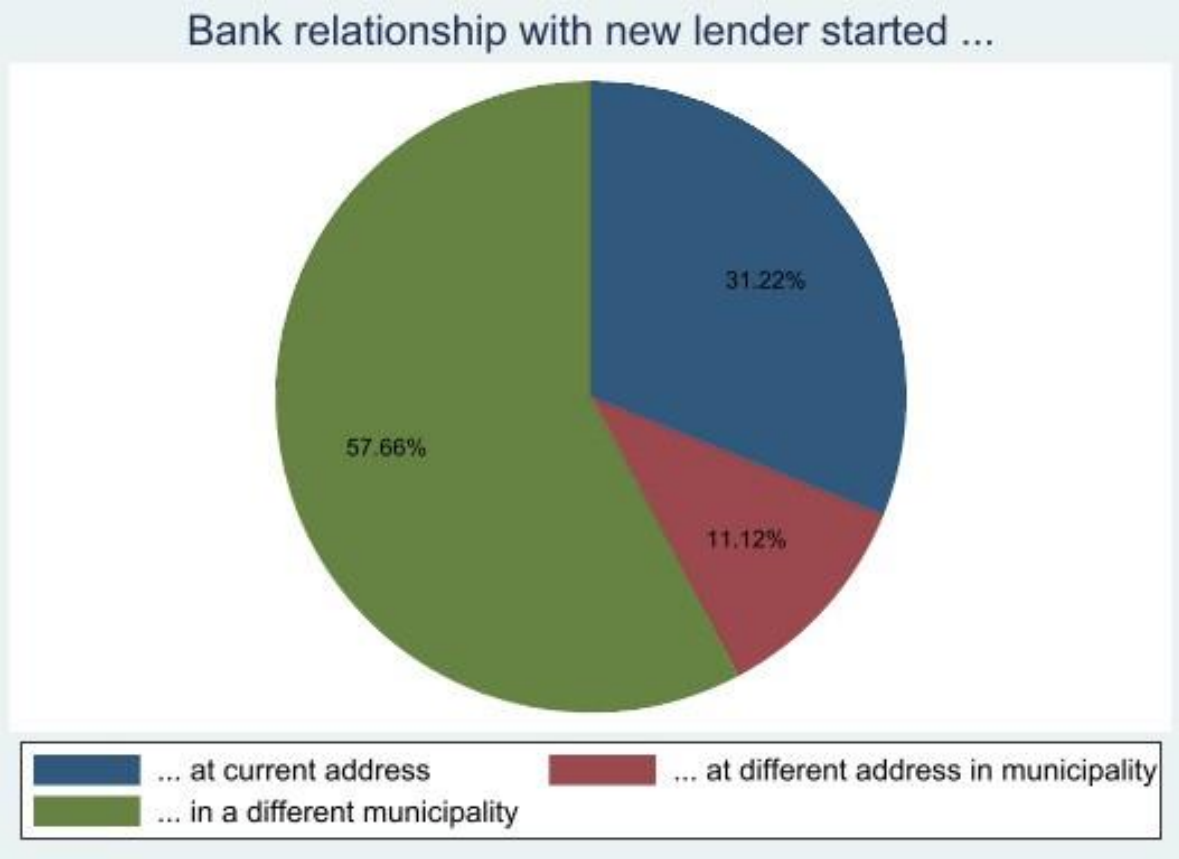
- To compute profitability of deposit spread discounts, consider specific example of discounts for clients aged below 30:
  - Estimate deposit spread discount of 27bps
  - With average deposits of 70k in that group, this costs about 190NOK p.a.
  - We estimate it to double the expected borrowing from 1 to 2 mio
  - At an adjusted loan spread of 50bps, yields profits of 5000 NOK

Years between deposit and loan start with the same bank



Distribution of deposit-loan lags for all deposit relationships started after 2004 to avoid left-censoring.
The average lag on these grounds is a bit over 3 years.
Note this does still not control for right-censoring, so actual average lag is likely a bit longer.

Many Bank Relationships Maintained When Moving



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