



# The Geography of Mortgage Lending in Times of FinTech.

BIS-Bank of England-CEPR workshop

“Financial innovation: Implications for competition, regulation, and monetary policy “

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# Outline

0. Topic and Setup
- 1. Market Concentration**
- 2. Risk Management**
- 3. Automation**
4. Conclusion



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# 0. Topic and Setup



## A Web Platform for Mortgage Lending without Branches

- Study bank lending decisions on Swiss **Web Platform** Comparis
- In 2008-13 **households** could apply for mortgages, specifying household finances, object intended to buy, amount, fixation period
- Then **got responses from several banks** (including those with no branches there):
  - **Offer vs. Rejection**
  - Conditional on Offering, the **Price**
- **Analyze these 2 dimensions** to infer how this depends on, and affects:
  1. **Competition**
  2. Banks' **Risk Management / Portfolio Diversification**
  3. **Automation** and thereby operational costs



## What Dimension of “FinTech” is this?

- Recent overview by [Thakor \(2019\)](#) defines FinTech as “**use of technology to provide new and improved financial services**”  
(consistent with longer BCBS definition)
- Intermediation studied here fits into 1<sup>st</sup> of 4 areas he mentions:
  1. **Lower search costs of matching transacting parties**
  2. Economies of scale
  3. Cheaper information transmission
  4. Reduction in verification costs
- Type of online platform studied here can be and is run **non-banks** (as studied) **or banks** (as in recent CH plans by [GS](#) or [UBS](#))



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# 1. Market Concentration



## Hypothesis 1: Lower Prices to *More Concentrated* Markets

- In basic oligopolistic version of **Monti-Klein model of banking** (see [Freixas and Rochet, 2008](#)) banks optimize lending & deposit businesses separately, for 1 period
- More realistically, clients have **switching costs** ([Beggs and Klemperer, 1992](#); [Sharpe, 1990](#); [von Thadden, 2004](#); [Freixas&Rochet, 2008](#)) → clients get package for >1 period
- Then follow-on business more lucrative in less competitive local markets



*Hypothesis 1: Expect **Higher offer propensities**, and **lower margin** offers, the **more concentrated** (sic) the local mortgage market is so far.*



## Methodology 1: Instrument for Market Concentration

- **Unobservable regional attractiveness could bias** relation between prior concentration and current offer behaviour
- Response: **Instrument concentration** (HHI for mortgage growth in 2010) with 2009 market shares of “**Swiss Big Two**” UBS and CS from SNB website
- Both suffered severe losses in **US subprime crisis in 2007-8**
- Irritated Swiss households **withdrew many deposits**
- So Big Two **had to cut new lending**
- In cantons where Big 2 bigger, this **reduced market concentration** more ...





## Results 1 on Market Concentration

	(1)	(2)	(3)	(4)	(5)	(6)
	Offer	Price	Offer	Price	Offer	Price
<b>HHI</b>	<b>0.78***</b>	<b>-0.54***</b>	<b>1.20***</b>	<b>-0.57***</b>	<b>1.51***</b>	<b>-0.50***</b>
I(LTV≥67%)	-0.05*	0.05***	-0.05*	0.05***		
I(LTV≥80%)	-0.85***	0.03***	-0.86***	0.03***		
I(LTI≥4.5)	-0.18***	0.00	-0.18***	0.00		
I(LTI≥5.5)	-0.85***	0.03***	-0.86***	0.03***		
I(New Mortg.=1)	0.10***	0.02***	0.10***	0.02***		
House price growth	-1.40*	0.09	-0.92	-0.05		
Number of Web Providers	0.02***	-0.01***	0.02***	-0.01***		
Ln(Total Assets)	0.06***	-0.05***				
Mortgages/TA	0.02***	-0.00***				
Deposits/TA	-0.02***	0.00***				
Equity/TA	0.04***	0.02***				
Constant	-0.46*	1.67***	0.67**	1.20***		1.02***
<b>d(Offer)/d(HHI)</b>	<b>0.18***</b>		<b>0.28***</b>		<b>0.35***</b>	
Observations	25,125	20,583	25,113	20,583	24,428	20,583
Estimation	IV Probit	IV Probit	IV Probit	IV	2SRI Logit	IV
Bank FE	No	No	Yes	Yes	Yes	Yes
Year*Month FE	Yes	Yes	Yes	Yes	No	No
HH Group FE	No	No	No	No	Yes	Yes

2 outcomes, 3 specifications...

**Confirm H1:** 0.1 unit rise in HHI (US DoJ distinction of high vs. low concentration) raises offer propensities by 2-3% and cuts prices by 5bps



## Results 1 on Market Concentration

	(1)	(2)	(3)	(4)	(5)	(6)
	Offer	Price	Offer	Price	Offer	Price
HHI	0.71	-0.36***	1.60	-0.36***	2.17*	-0.42***
HHI*(Age<38)	0.60	-0.18*	0.13	-0.19**	1.31	-0.18*
HHI*(New)	-0.07	-0.23***	-0.14	-0.24***	-0.61	-0.16*
HHI*(Foreign Share)	-0.00	-0.00	-0.03	-0.00	0.00	-0.00
HHI*(Amount≥1 mio)	-0.65	-0.17	-0.88	-0.24*	-2.71	-0.17
...	...	...	...	...	...	...
Observations	25,125	20,583	25,113	20,583	24,428	20,583
Estimation	IV Probit	IV	IV Probit	IV	2SRI Logit	IV
Bank FE	No	No	Yes	Yes	Yes	Yes
Year*Month FE	Yes	Yes	Yes	Yes	No	No
HH Group FE	No	No	No	No	Yes	Yes

Interpretation of discounts to high-HHI regions is supported by larger effects for:

- Younger buyers
- First-time buyers
- Larger loans



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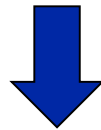
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## **2. Risk Management**



## Hypothesis 2 on Geographical Diversification

- **Pro diversification: Portfolio theory** says can **lower bank risk** by adding assets whose returns are imperfectly correlated with those of existing portfolio; Empirical evidence e.g.:
  - [Goetz-Laeven-Levine \(JFE, 2016\)](#): Banks more (deposit-)diversified have less volatile stock prices
  - [Quigly & Van Order \(JPubEc, 1991\)](#): Mortgage portfolios riskier if less **regionally diversified**
- **Con 1:** Concentration may allow better **screening** (e.g. [Loutskina & Strahan, RFS 2011](#))
- **Con 2:** Also allows internalizing **liquidation externalities** ([Favara & Giannetti, JF 2017](#))
- *But analyze **standardized market** where collateral value estimated with same **hedonic model** for entire **country** anyway, hence posit:*



**Hypothesis 2:** **Higher offer propensity and lower margin offers** when unemployment rates (hence PDs) or house prices (hence LGDs) in client canton **less correlated** with those in bank's canton.



## Methodology 2: Exploit N\*N Setup

- Regressions on Market Concentration HHI could use only HH Group FE (defined by LTV\*LTI\*New\*Year\*Month) due to collinearity with HHI
- But now can include both lender and borrower fixed effects
- Fairly unique to see responses from different lenders to each household...
- So may interpret correlations as exogenous and need no instrument



# Results 2 on Risk Management: Unemployment

	(1)	(2)	(3)	(4)	(5)	(6)
	Offer	Price	Offer	Price	Offer	Price
Unemp. Compl.	1.36***	-0.33***	0.64***	-0.24***	2.41***	-0.25***
HHI	0.17	-0.39***	0.49*	-0.43***		
I(LTV≥67%)	-0.05*	0.05***	-0.05*	0.05***		
I(LTV≥80%)	-0.84***	0.02***	-0.85***	0.03***		
I(LTI≥4.5)	-0.18***	-0.00	-0.17***	0.00		
I(LTI≥5.5)	-0.86***	0.03***	-0.86***	0.03***		
I(New Mortg.=1)	0.09***	0.02***	0.09***	0.02***		
Ln(Total Assets)	0.03**	-0.04***				
Mortgages/TA	0.02***	-0.00***				
Deposits/TA	-0.01***	0.00*				
Equity/TA	0.07***	0.01***				
Constant	0.90***	1.31***	1.67***	0.85***		0.72***
d(Offer)/d(Compl.)	0.32***		0.15***		0.10*	
Observations	25,060	20,533	25,048	20,533	9,689	20,533
Estimation	Probit	OLS	Probit	OLS	Logit	OLS
Bank FE	No	No	Yes	Yes	Yes	Yes
Year*Month FE	Yes	Yes	Yes	Yes	No	No
HH FE	No	No	No	No	Yes	Yes

## Confirm H2:

1SD (0.07 units) rise in unemployment complementarity

increases Pr(Offer) by 2% and cuts prices by 2bps



# Results 2 on Risk Management: House prices

	(1)	(2)	(3)	(4)	(5)	(6)
	Offer	Price	Offer	Price	Offer	Price
HP change complementarity	0.24***	-0.03***	0.05	-0.05***	-0.05	-0.06***
HHI	0.20	-0.40***	0.59**	-0.42***		
I(LTV>=67%)	-0.05*	0.05***	-0.05*	0.05***		
I(LTV>=80%)	-0.84***	0.02***	-0.85***	0.03***		
I(LTI>=4.5)	-0.17***	-0.00	-0.17***	0.00		
I(LTI>=5.5)	-0.86***	0.03***	-0.87***	0.03***		
I(New Mortg.=1)	0.09***	0.02***	0.09***	0.02***		
Ln(Total Assets)	0.03**	-0.04***				
Mortgages/TA	0.01***	-0.00***				
Deposits/TA	-0.01***	0.00***				
Equity/TA	0.05***	0.01***				
Constant	0.02	1.54***	1.05***	1.04***		0.90***
d(Offer)/d(Compl)	0.06***		0.01		-0.01	
Observations	25,125	20,583	25,113	20,583	9,759	20,583
Estimation	Probit	OLS	Probit	OLS	Logit	OLS
Bank FE	Yes	No	Yes	Yes	Yes	Yes
HH FE	Yes	No	Yes	No	Yes	Yes

**Confirm H2:**

Similar results for House price change complementarity.



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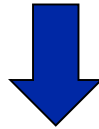
# 3. Automation





## Hypothesis 3 on Automation

- Following [Cerqueiro et al \(2011\)](#), can use [Harvey \(1976\)](#) model of *multiplicative heteroscedasticity* to analyze **how much bank decisions deviate from rules**
- Estimate (bank-specific) rules, then **relate squared deviations to correlates** of interest



Hypothesis 3: Expect **more automation** for offers ...

(a) ... to **safer applicants**: Lower LTV, lower LTI, more standard collateral.

(b) ... from banks which are **larger or more mortgage-specialized**.

(c) ... submitted by banks with **more web experience**.



## Strategy 3 on Automation

- Following Harvey (1976) and Cerqueiro et al (2011), we estimate:
  - **Mean Equation:** “*rule*” for offer and pricing decisions
  - **Variance Equation:** relate log of squared residuals (“*discretion*”) to regressors

$$\ln(u_{h,b}^2) = \alpha + \beta X_h + \gamma X_b + \delta(HHI_h) + \theta(\text{Complementarity}_{h,b}) + \mu(\text{Experience}_{h,b}) + \varepsilon_{h,b}$$



## Results 3 on Automation

	(1)	(2)	(3)	(4)	(5)	(6)
	Offer	Spread	Offer	Spread	Offer	Spread
	Discretion	Discretion	Discretion	Discretion	Discretion	Discretion
I(LTV≥67%)	0.05	0.53***	0.05	0.38***		
I(LTV≥80%)	0.62***	-0.01	0.70***	-0.00		
I(LTI≥4.5)	0.21***	0.03	0.24***	0.02		
I(LTI≥5.5)	0.56***	0.01	0.62***	0.06		
I(New Mortg.=1)	-0.20***	-0.04	-0.25***	-0.02		
Ln(Total Assets)	-0.05**	-0.15***				
Mortgages/TA	-0.02***	-0.03***				
Deposits/TA	0.02***	0.02***				
Equity/TA	-0.08***	0.03				
HHI	-0.80**	-0.66	-1.25***	-1.15	-1.34***	-0.77
HP Growth	-1.76***	-0.50	-1.78***	-1.86*	-0.10	0.00
Number Providers	-0.04***	-0.04**	-0.05***	-0.08***	-0.04***	-0.03*
Unemp. Compl.	-1.67***	-1.40*	-1.03***	1.25	-1.11***	-0.10
Experience	-0.02**	0.00	0.00	-0.11***	-0.08***	0.07
Constant	-1.61***	-1.80*	-2.29***	-2.28**	-1.99***	-3.12***
Bank FE	No	No	Yes	Yes	Yes	Yes
Year*Month FE	Yes	Yes	Yes	Yes	No	No
HH FE	No	No	No	No	Yes	Yes

**Confirm H3:** More automation for:

- Safer borrowers
- Bigger / more mortgage-focused lenders
- Each 1'000 responses sent out

√0.11 = 0.33% less offer and  
√0.08 = 0.28% less pricing discretion

Results shown here use one rule, but robust to bank-specific rules...



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# 4. Conclusion



## Conclusion

- FinTech web platforms **match banks with borrowers they would not meet else**
- **With unique data, show** how this changes lending behaviour
- Key findings:
  1. **Borrowers benefit** from more offers and lower prices
  2. **Banks improve regional diversification** of mortgage portfolio
  3. Business **more automated** (more efficient) for larger banks and safer clients
- NB: The **net benefits** of these changes are likely to **vary by setup**
- We deem them positive in our setup of standardized lending with good hard info, but they could be less positive the more soft information continues to matter