

The Role of Technology in Mortgage Lending

Andreas Fuster[◇] Matthew Plosser[◇] Philipp Schnabl[†]
James Vickery[◇]

[◇]Federal Reserve Bank of New York [†]NYU Stern, CEPR, and NBER

FDIC Consumer Research Symposium
October 2018

The views expressed here are those of the authors and do not necessarily reflect the opinions of the Federal Reserve Bank of New York or the Federal Reserve System.

Technology and mortgage lending

Technology is rapidly changing the U.S. mortgage industry

- Traditional model: **branches and brokers** (physical location + personal interaction + labor-intensive underwriting)
- New business model ("**FinTech**"):
 - (i) end-to-end online application,
 - (ii) centralized and
 - (iii) automated underwriting
- Market share (based on our classification): 2% in 2010 (\$34bn in originations), 8% in 2016 (\$161bn)

Example: Rocket Mortgage by Quicken

- Quicken now **largest** U.S. mortgage lender
- No local branches. Centralized operations.
- **Fully online application** via website or app. Approval in as little as 8 minutes.



This paper

Is FinTech lending improving efficiency of U.S. mortgage market?

1. Faster processing?
2. Lower defaults?
3. More elastic?
4. Faster or more optimal refinancing?
5. Who borrows from FinTech lenders?

Alternative: Growth due to non-technology factors (e.g., regulation)

Why is this an important market to study?

1. mortgages 70% of household debt;
2. significant intermediation frictions (affects monetary transmission);
3. evidence of household mistakes & unequal access to finance.

The FinTech business model

FinTech: End-to-end online application platform and centralized underwriting and processing augmented by automation.

Key features:

Online application and document submission

Automated systems to process information and underwrite loan

- Log in to bank account to verify balances & income sources
- Automated checks against employment databases, divorce records, property deed records etc.
- Algorithms to identify patterns associated with fraud or misstatement

Centralized operations rather than individual branches or brokers

- Standardized, repeatable process: “pin factory” model

How do we classify FinTech lenders?

Test: Does lender enable fully online application? (e.g., Rocket)

- Proxy for automation, electronic document capture and processing.
- Important feature of FinTech model; systematically measurable for large number of lenders.

To measure, we submit “dummy” mortgage application on website. Evaluate how much can be done online (goal: pre-approval).

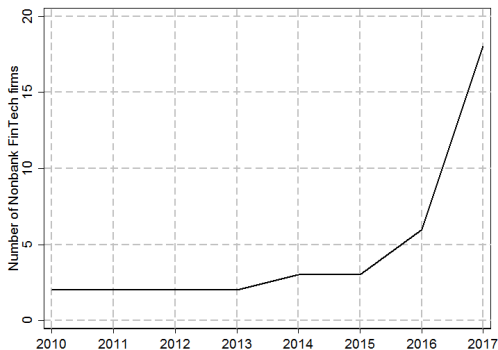
- Classify top 100 purchase + refi mortgage lenders in HMDA.
- Use Wayback Machine to classify lenders historically.

Classification mostly agrees with Buchak et al. (2017), as well as anecdotal sources of evidence.

Online lending diffusing rapidly (next slide). Window of opportunity.

- Through 2016, six FinTech lenders, all are **non-banks**.

Diffusion of online lending



Name	FinTech Since	2016 Originations (Bn)	Market Share (%)	Rank
Quicken Loans	2010	90.553	4.52	2
LoanDepot.com	2016	35.935	1.80	5
Guaranteed Rate	2010	18.444	0.92	12
Movement Mortgage	2014	11.607	0.58	23
Everett Financial (Supreme)	2016	7.620	0.38	39
Avex (Better.com)	2016	0.490	0.02	531

Data sources

1. Mortgage applications and originations from **Home Mortgage Disclosure Act (HMDA)**, 2010-2016
 - Confidential version includes application date and “action” date / processing time
2. Mortgage servicing data linked to credit records from **Equifax/McDash (CRISM)**
3. Segment-level FHA volume and default data from **FHA Neighborhood Watch System**
4. Loan-level information from **Ginnie Mae**
5. Internet Connectivity from **NTIA National Broadband Map and Federal Communications Commission**
6. Age and credit score distributions from **NY Fed/ Equifax Consumer Credit Panel**
7. Demographics from **U.S. Census and ACS**
8. Bank branch distance from **FDIC Summary of Deposits**
9. Home prices and macro data from **Zillow and FRED**

1) Is FinTech lending faster?

Loan-level data on originated mortgages in HMDA, 2010-2016

$$\text{Processing Time}_{ijct} = \delta_{ct} + \beta \text{FinTech}_j + \gamma \text{Controls}_{it} + \epsilon_{ijct}$$

- *ProcessingTime*_{ijct} : Days from mortgage application to closing.
- *FinTech*_j: dummy for FinTech lender. Hypothesis: $\beta < 0$.
- *Controls*_{it}: combinations of (i) loan and borrower characteristics (income, loan amount, gender, race, loan type, coapplicant, etc.) and (ii) census tract x month fixed effects.
- Estimated separately for purchase and refinance mortgages.

Processing time results

Assembly line around 10 days shorter for FinTech lenders, or 20%.

	(1)	(2)	(3)	(4)	(5)	(6)
	<i>Purchase Mtgs</i>			<i>Re nance Mtgs</i>		
FinTech	-7.93*** (0.52)	-9.24*** (0.48)	-7.46*** (0.45)	-9.99*** (0.59)	-14.61*** (0.71)	-9.32*** (0.53)
Census tr. Month FEs	No	Yes	Yes	No	Yes	Yes
Loan controls	No	Yes	Yes	No	Yes	Yes
R2	0.00	0.24	0.34	0.01	0.24	0.29
Observations	19.2M	18.6M	7.2M	30.6M	30.2M	8.0M
Sample	All	All	Nonbanks	All	All	Nonbanks

Processing time results

Assembly line around 10 days shorter for FinTech lenders, or 20%.

	(1)	(2)	(3)	(4)	(5)	(6)
	<i>Purchase Mtgs</i>			<i>Re nance Mtgs</i>		
FinTech	-7.93*** (0.52)	-9.24*** (0.48)	-7.46*** (0.45)	-9.99*** (0.59)	-14.61*** (0.71)	-9.32*** (0.53)
Census tr. Month FEs	No	Yes	Yes	No	Yes	Yes
Loan controls	No	Yes	Yes	No	Yes	Yes
R2	0.00	0.24	0.34	0.01	0.24	0.29
Observations	19.2M	18.6M	7.2M	30.6M	30.2M	8.0M
Sample	All	All	Nonbanks	All	All	Nonbanks

Not due to selection of “fast” borrowers into FinTech:

- Coefficient larger when we add controls (no selection on observables)
- FinTech growth concentrated in locations which previously had unusually *long* processing times
- Non-FinTech processing does not slow down with FT penetration.

2) Is FinTech lending riskier?

Is fast processing simply due to less careful screening?

Look at outcomes in riskiest market segment – FHA mortgages

- Buchak et al. study Fannie/Freddie data; find effect of 0.

Two novel data sources:

1. FHA Neighborhood Watch Early Warning System
2. Ginnie Mae MBS loan-level disclosures

Finding: In both data sets, FinTech associated with *fewer* ex-post defaults (magnitude: 25%).

Is FinTech riskier? Results

Ginnie Mae: Dependent variable ever 90+ days delinquent

	(1)	(2)	(3)	(4)	(5)
FinTech	-1.29*** (0.33)	-0.97*** (0.30)	-0.93*** (0.27)	-1.51*** (0.46)	-0.79*** (0.16)
Avg. P(default)	3.65	3.65	3.65	4.00	2.73
Loan Sample	All	All	All	Purch.	Refi
Purpose FE	No	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	No	No	No
MonthXState FE	No	No	Yes	Yes	Yes
Loan Controls	No	No	Yes	Yes	Yes
Observations	4097569	4097568	4097544	2966644	1130881

Standard errors clustered by issuer. Sample includes FHA 30-year FRMs originated 2013-2017.

Is FinTech riskier? Results

Ginnie Mae: Dependent variable ever 90+ days delinquent

	(1)	(2)	(3)	(4)	(5)
FinTech	-1.29*** (0.33)	-0.97*** (0.30)	-0.93*** (0.27)	-1.51*** (0.46)	-0.79*** (0.16)
Avg. P(default)	3.65	3.65	3.65	4.00	2.73
Loan Sample	All	All	All	Purch.	Refi
Purpose FE	No	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	No	No	No
MonthXState FE	No	No	Yes	Yes	Yes
Loan Controls	No	No	Yes	Yes	Yes
Observations	4097569	4097568	4097544	2966644	1130881

Standard errors clustered by issuer. Sample includes FHA 30-year FRMs originated 2013-2017.

“Cream skimming” likely not key issue here (b/c of guarantees).

- Mixed evidence from additional tests (see paper).

Is FinTech riskier? Results

Ginnie Mae: Dependent variable ever 90+ days delinquent

	(1)	(2)	(3)	(4)	(5)
FinTech	-1.29*** (0.33)	-0.97*** (0.30)	-0.93*** (0.27)	-1.51*** (0.46)	-0.79*** (0.16)
Avg. P(default)	3.65	3.65	3.65	4.00	2.73
Loan Sample	All	All	All	Purch.	Refi
Purpose FE	No	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	No	No	No
MonthXState FE	No	No	Yes	Yes	Yes
Loan Controls	No	No	Yes	Yes	Yes
Observations	4097569	4097568	4097544	2966644	1130881

Standard errors clustered by issuer. Sample includes FHA 30-year FRMs originated 2013-2017.

“Cream skimming” likely not key issue here (b/c of guarantees).

- Mixed evidence from additional tests (see paper).

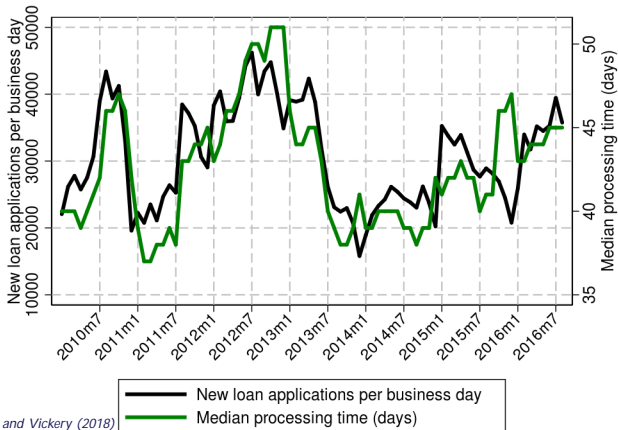
Summary: Lower default, consistent with view that automation and electronic record retrieval reduces fraud (e.g. Goodman, 2016).

3) Is FinTech lending more elastic?

Evidence of capacity constraints during peaks in mortgage demand

- Below, and Fuster-Lo-Willen (2017): higher mtg spreads; longer processing times. Demand volatile due to rate-driven refinancing.

Can technology help? FinTech lenders may better accommodate demand shocks due to more automated, less labor-intensive process.



Is FinTech lending more elastic?

Strategy: Is FinTech less sensitive to total application volume?

- Source of demand variation exogenous to individual lenders (since lender-specific applications are a mix of demand and supply)

Is FinTech lending more elastic?

Strategy: Is FinTech less sensitive to total application volume?

- Source of demand variation exogenous to individual lenders (since lender-specific applications are a mix of demand and supply)

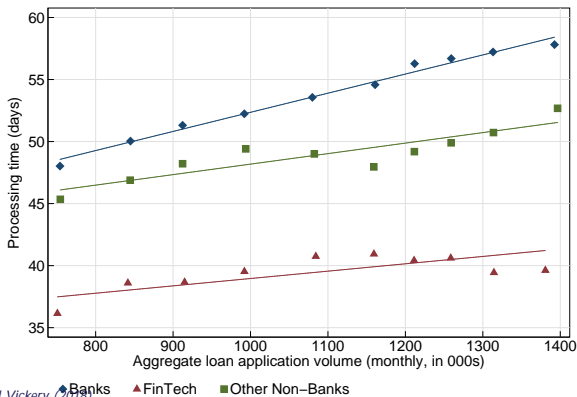
$$\text{Proc Time}_{ijct} = \delta_j + \alpha \text{AppVol}_t + \beta \text{FinTech}_j \text{AppVol}_t + \gamma \text{Controls}_{ict} + \epsilon_{ijct}$$

Is FinTech lending more elastic?

Strategy: Is FinTech less sensitive to total application volume?

- Source of demand variation exogenous to individual lenders (since lender-specific applications are a mix of demand and supply)

$$\text{Proc Time}_{ijct} = \delta_j + \alpha \text{AppVol}_t + \beta \text{FinTech}_j \text{ AppVol}_t + \gamma \text{Controls}_{ict} + \epsilon_{ijct}$$



Summary of elasticity results

FinTech **processing time less sensitive** to spikes in demand

- Especially relative to bank lenders.
- Results similar if use average refinance incentive as proxy (or instrument) for aggregate applications.

Not due to “rationing” by FinTech lenders when demand rises:

- HMDA application denial rates for FinTech *fall* relative to other lenders when application volume rises.
- No difference in origination volume (caveat: trend in market share makes measurement difficult here).

4) Does FinTech lending affect refinancing?

4) Does FinTech lending affect refinancing?

Many borrowers seem to refinance suboptimally (Keys et al., 2016).

Does FinTech lending increase refi speed or efficiency?

- Important issue e.g., for monetary policy transmission.
- Industry evidence (and Buchak et al., 2017): FinTech loans prepay faster. But is this just a selection effect?

Relate *overall* local refi propensity to FinTech share.

4) Does FinTech lending affect refinancing?

Many borrowers seem to refinance suboptimally (Keys et al., 2016).

Does FinTech lending increase refi speed or efficiency?

- Important issue e.g., for for monetary policy transmission.
- Industry evidence (and Buchak et al., 2017): FinTech loans prepay faster. But is this just a selection effect?

Relate *overall* local refi propensity to FinTech share.

$$\text{Refi Propensity}_{c,t} = \alpha_c + \alpha_t + \beta \text{ FinTechShare}_{c,t-s} + \Gamma \mathbf{X}_{c,t} + \epsilon_{c,t}$$

	(1)	(2)	(3)	(4)
	All	All	30yr FRM	30yr FRM
FinTech share _{MA,Q-1}	1.121*** (0.204)	0.689*** (0.142)	1.195*** (0.223)	0.706*** (0.157)
Local controls	No	Yes	No	Yes
County FEs	Yes	Yes	Yes	Yes
Date FEs	Yes	Yes	Yes	Yes
Average Y	0.56	0.56	0.61	0.61
Obs.	36000	36000	36000	36000

Note: standard errors clustered by county.

4) Does FinTech lending affect refinancing?

Many borrowers seem to refinance suboptimally (Keys et al., 2016).

Does FinTech lending increase refi speed or efficiency?

- Important issue e.g., for monetary policy transmission.
- Industry evidence (and Buchak et al., 2017): FinTech loans prepay faster. But is this just a selection effect?

Relate *overall* local refi propensity to FinTech share.

-) Higher overall local refinancing suggests fast FinTech prepay speeds not just due to selection of “fast” borrowers.
 - We also find FinTech has grown most in counties where prepay speeds were slow ex ante. These markets subsequently catch up.

More refinances = better refinances?

Are higher refinancing propensities due to

- More borrowers refinancing when they should (i.e. savings $>$ costs & option loss)?
- Or more borrowers refinancing “too soon”?

We evaluate based on optimality calculation from Agarwal-Driscoll-Laibson (2013). 30-year FRMs only.

We group borrowers based on difference between current mortgage rate and optimal “trigger rate” for refinancing:

- FinTech presence is associated with faster refinancing for most groups, but effect stronger among those that should refinance.
- Also higher prob(refi=optimal) when FinTech share is higher.

5) Who borrows from FinTech lenders?

Mixed evidence on FinTech lenders expanding access to finance

- Proxies: credit scores, FHA/VA dummy, minorities, female borrowers, presence of physical bank branches

FinTech market share tends to be higher in neighborhoods where borrowers are older and more educated

- Matches feedback from practitioners that online lending is more attractive to experienced/financially literate borrowers

Little evidence of “digital divide” playing a big role

- Case study in paper: roll-out of Google Fiber in Kansas City (which previously had limited high-speed internet) — does not increase FinTech share

Interpretation: FinTech mortgage lending more about improving the efficiency of the process for “mainstream” borrowers rather than expanding access to marginal households.

Summing up

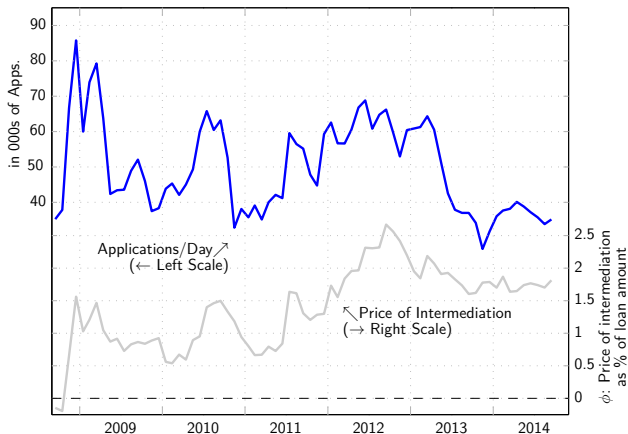
Punchline: Evidence supports view that technological change is reducing intermediation frictions and improving efficiency of the mortgage market.

1. Faster mortgage processing (20%)
2. Lower defaults (25%)
3. More elastic processing speeds (reduce bottlenecks)
4. Faster refinancing and fewer refi errors
5. Mixed evidence of expanding access to underserved borrowers.

Broader question: Is FinTech reducing frictions and raising productivity in lending markets? Or mainly about skimming, price discrimination etc.

- Our evidence mainly consistent with “bright side” of FinTech
- May shed light on future evolution of mortgage mkt, other loan mkts

Application volume and lender margins



Price of intermediation = \$ value of a mortgage in the MBS market
what lender pays to borrower

▶ back

Agarwal-Driscoll-Laibson (2013)

(Approximately) optimal to refinance when available mortgage rate is at least x below the current coupon rate.

x depends on the outstanding principal amount, and a number of parameters. Baseline calibration (also used in Keys-Pope-Pope, 2016):

Transaction cost $\kappa = 2000 + 0.01M$

Real discount rate $\rho = 0.05$

Marginal tax rate $\tau = 0.28$

Annual probability of moving $\mu = 0.1$

Standard deviation of mortgage rate $\sigma = 0.0109$

▶ back