Credit Supply and Homeownership

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December 30, 2019

Banking Deregulation in the U.S. since 1970s

- Banking was highly regulated in the U.S. before 1970s
  - ▶ Geographic expansion of banks was restricted by laws, such as the 1927 McFadden Act and the 1956 Banking Holding Company Act

- Banking restrictions were removed from 1970s to early 1990s, with two types of deregulations:
  - ▶ **Intra-state deregulation** permits branching within states via M&A
  - ▶ **Inter-state deregulation** allows banks to expand beyond state boundaries

- Banking deregulations happened at different times in different states
  - ▶ The cross-state and cross-time variation in the timing of deregulations provide a perfect laboratory to study how the deregulations affected the economy and household behaviours

Intra-State Banking Deregulations by States in 1984
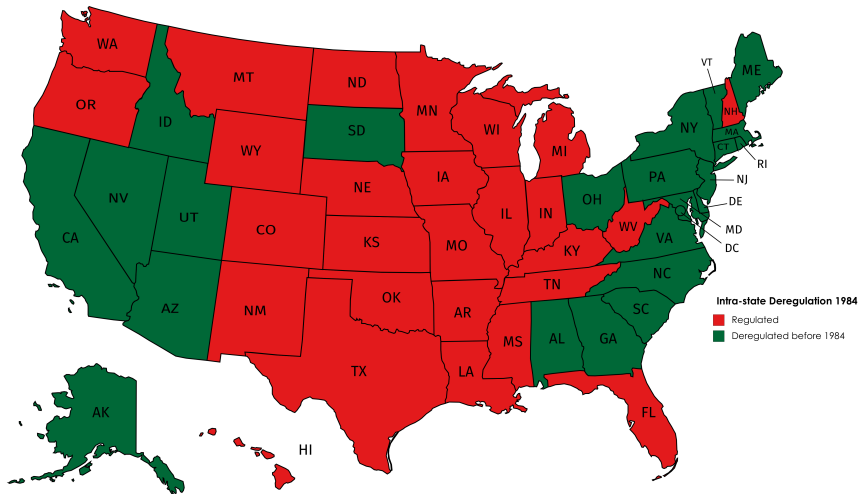
Intra-state Deregulation 1984
- 🟥 Regulated
- 🟩 Deregulated before 1984

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Intra-State Banking Deregulations by States in 1989

Intra-state Deregulation 1989
- Regulated
- Deregulated before 1984
- Deregulated 1984-1989

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Intra-State Banking Deregulations by States in 1994

Intra-state Deregulation 1994
- Regulated
- Deregulated before 1984
- Deregulated 1984-1989
- Deregulated 1989-1994

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Inter-State Banking Deregulations by States in 1984

Inter-state Deregulation 1984
- Regulated
- Deregulated before 1984

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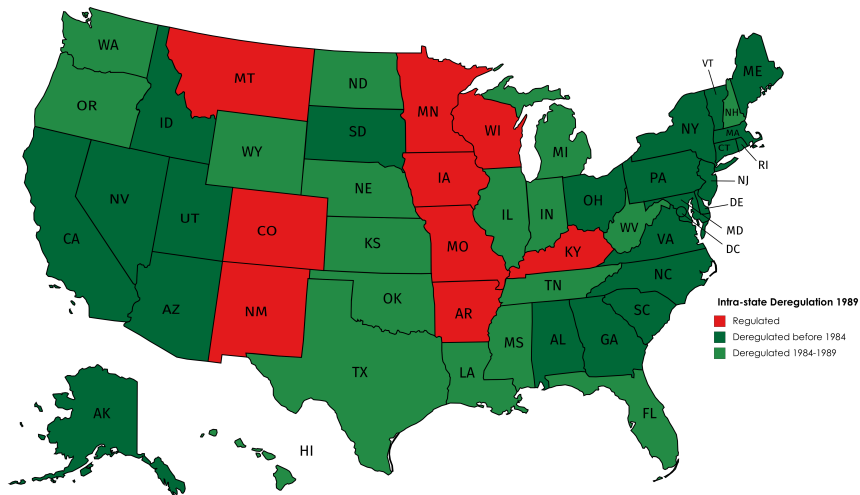
Inter-State Banking Deregulations by States in 1989

Inter-state Deregulation 1989
- Regulated
- Deregulated before 1984
- Deregulated 1984-1989
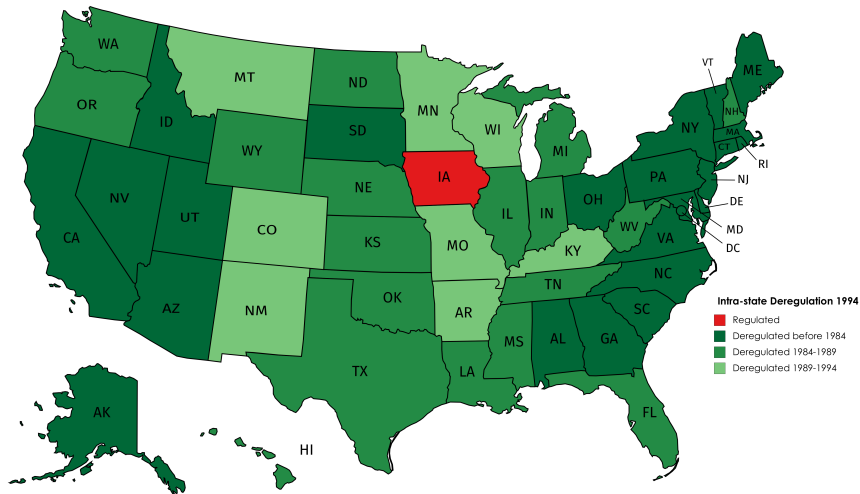
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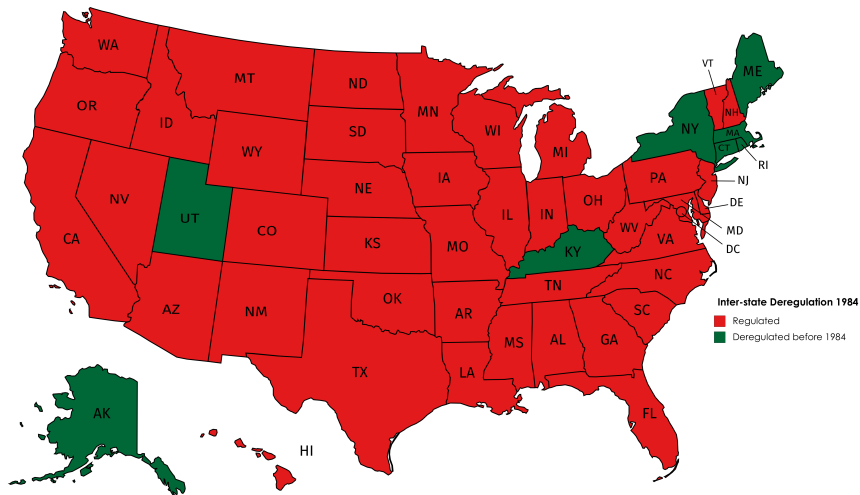
Inter-State Banking Deregulations by States in 1994

Inter-state Deregulation 1994
- Regulated
- Deregulated before 1984
- Deregulated 1984-1989
- Deregulated 1989-1994
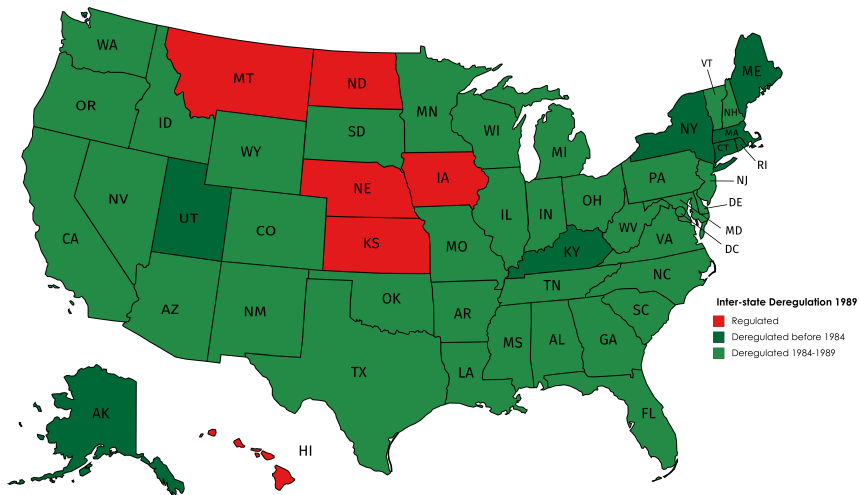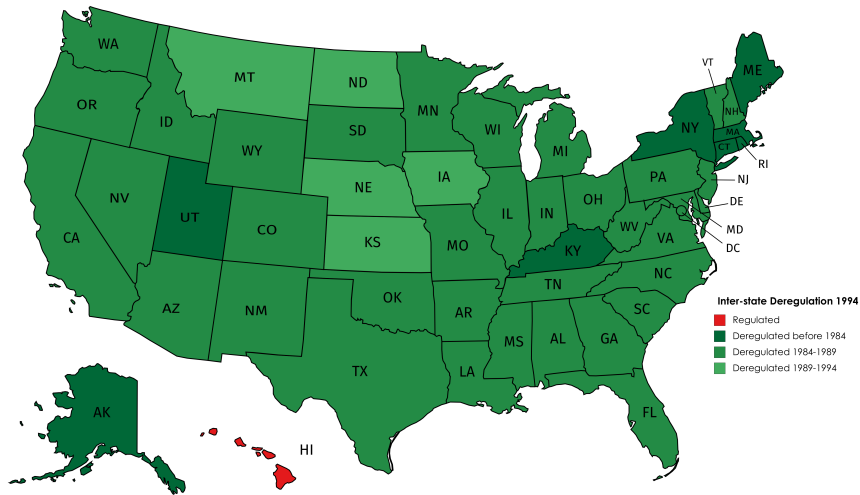
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The Motivation: Transition Rate of Renters to Home Owners also Increased during 1984-1994

Transition rate of renters to homeowners (1984-1994)
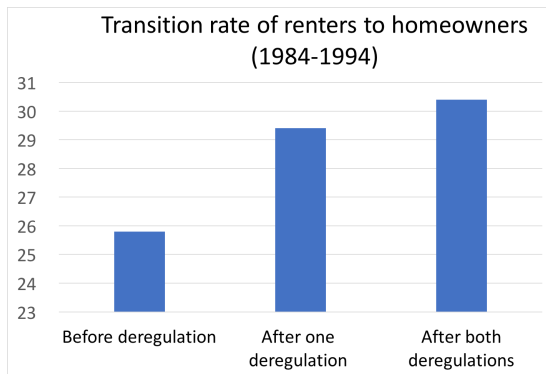
- Transition rate is defined as the share/probability of renters becoming home owners in the next 5 years
- Is this a coincidence or causality?

Two Research Questions

- What is the impact of banking deregulations on the transition rate of renters to homeowners?

- What are the potential explanations of the impact?

Our paper is the first to study these two questions.

Our Approach

- Use the Panel Study of Income Dynamics (PSID) data
  - A panel data of household balance sheet information

- Follow a sample of renters over time, and separate them into two groups:
  - One group experienced banking deregulations
  - The other group did not

- We then estimate the difference between these two groups in their transition rates to homeowners

- The following estimation models are used:
  - Logit models: Pooled, random effect, fixed effect, Heckman copula
  - Probit models: Pooled, random effect, Heckman
  - Propensity score matching (PSM)

The Take-Away Findings

- **Intra- and inter-state banking deregulations together can explain a 8.7 percentage-point (33%) increase in the transition rate from renters to homeowners**
  - Inter-state banking deregulation has a larger impact

- **Two potential explanations:**
  - **The income explanation**: banking deregulations increase income for low-income households, making homes more affordable for them
  - **The technology explanation**: banking deregulations promote technology innovation, with which lenders can identify and offer credit to "high-risk" but creditworthy households

The Literature on Homeownership

For decades, home ownership has been an essential element of the American Dream. It has various individual and social benefits:

- A mechanism for family wealth creation (even during the recent housing crisis)
  - Herbert, McCue and Sanchez-Moyanno (2013)
- Improves children's education and success in later life
  - Green and White (1997); Haurin, Parcel and Haurin (2002); Harkness and Newman (2003)
- Improves political activity
  - Glaeser and DiPasquale (1998)
- Lowers crime rate
  - Alba, Logan and Bellair (1984); Glaeser and Sacerdote (1999)

The Literature on Homeownership

Due to its importance, there is an extensive literature on the determinants of homeownership:

- Household income and wealth
  - ▶ Gyourko et al. (1999); Charles and Hurst (2002); Hilber and Liu (2008)
- Race of household
  - ▶ Kain and Quigley (1972); Yinger (1995); and Munnell et al. (1996)
- Tax-shelter effect
  - ▶ Charles and Hurst (2002)
- Immigration
  - ▶ Coulson (1999)
- Credit Supply
  - ▶ This paper

The Literature on Banking Deregulation

There is also a large literature on the U.S. banking deregulation and its impact on the economy:

- Households income
  - Beck, Levine and Levkov (2010); Strahan (2002)
- Personal bankruptcy
  - Dick and Lehnert (2010)
- Market structure of non-financial sectors
  - Cetorelli and Strahan (2006)
- Entrepreneurship
  - Black and Strahan (2002)
- Corporate innovation
  - Amore, Schneider and Zaldokas (2013)

Paper Closest to This Study

- *Vigdor (JPubE, 2006)* examines the impact of credit supply on both home price and home ownership
  - He uses another instrument of credit supply–*mortgage product innovations*
  - He finds that mortgage innovations increased house prices rather than home ownership

The Agenda

- The Data
- The Empirical Model and Results
- The Conclusion

The Data

- The PSID (Panel Study of Income Dynamics)
  - ▶ A panel data of household balance sheet information
  - ▶ Started in 1968 with a sample of over 5,000 families in the U.S.
  - ▶ Annual from 1968-1997 and biannual after 1997

- Features of the PSID:
  - ▶ Household-level data (vs. state-level data used in the literature)
  - ▶ Panel data, so we can follow each household over time
  - ▶ Nationally representative

- Time-varying state-level variables from other data sources:
  - ▶ *Median house price* from the Federal Housing Finance Agency
  - ▶ *Median household income* from the Federal Reserve Bank of St. Louis
  - ▶ *Unemployment rate* from the Bureau of Labor Statistics

The Data

We use the 1984, 1989 and 1994 waves of the PSID data, for two reasons:

- U.S. banking deregulations mainly happened between 1970s to early 1990s
  - Before 1970s, banking deregulations were static
  - In 1994, banking deregulations culminated with the passage of the Riegle-Neal Interstate Banking and Branching Efficiency Act

- The household wealth information is only available in 1984, 1989 and 1994, and then biannually since 1999

The Data

- We focus on a sample of renters in 1984 and 1989, and classify them into two groups:
  - ▶ One group experienced banking deregulations in the next 5 years
  - ▶ The other group did not

- We then estimate the difference in the likelihood of becoming home owners in the next 5 years between these two groups of renters, controlling for the following factors:
  - ▶ State and year fixed effects
  - ▶ Time-varying state-level variables
  - ▶ Household characteristics

- We drop households who moved across states during the sample period, to eliminate the impact from change of states.

- The final data have 4,060 observations (renters).

Summary Statistics

	Intra-state deregulations		Inter-state deregulations	
	No	Yes	No	Yes
Share of renters becoming homeowners in next 5 years	26.3%	32.5%	27.0%	28.4%
Selected household characteristics				
# of children	0.62	0.65	0.58	0.70
Education (yrs)	12.28	11.92	12.42	11.88
Unemployed	0.06	0.08	0.05	0.08
Family income ($1,000)	21.67	16.70	22.62	17.59
Wealth ($1,000)	21.51	15.65	23.01	16.07
Time-varying state-level variables				
Median house price ($1,000)	83.68	60.67	88.27	64.43
Median household income ($1,000)	26.95	22.91	28.31	22.65
Unemployment rate (%)	6.03	7.72	5.51	7.75
Number of observations	3,224	836	2,212	1,848

The Pooled Logit Model

$$transfer_{i,t}^* = \alpha \, intra_{i,t} + \beta \, inter_{i,t} + \gamma' X_{i,t} + \epsilon_{i,t} \qquad (1)$$

$$transfer_{i,t} = \begin{cases} 1, & \text{if } Y_{i,t}^* > 0; \\ 0, & \text{otherwise}. \end{cases} \qquad (2)$$

- $transfer_{i,t}^*$ is a latent variable, and $transfer_{i,t}$ is the indicator variable of renter transferring to home owners in next 5 years
- $intra_{i,t}$ is the indicator variable of intra-state deregulations in next 5 years. Similarly for $inter_{i,t}$
- $X_{i,t}$ are the other controls including
  - State and year fixed effects
  - Time-varying state-level variables
  - Household age, race, gender, married, # of children, education, health status, unemployed, family income, wealth
- $\epsilon_{i,t}$ is the error term following a logistic distribution

Main Empirical Results

Dependent variable: Indicator variable of renters becoming home owners
(Pooled Logit Model)

	(1)			(2)		
	Marg. effect	Coef.	Sig. level	Marg. effect	Coef.	Sig. level
Intra-state	0.033	0.170	**	0.030	0.187	**
		(0.074)			(0.095)	
Inter-state	0.046	0.235	***	0.057	0.354	***
		(0.037)			(0.040)	
Other controls:						
State & year fixed eff.		Yes			Yes	
Time-varying state var.		Yes			Yes	
Hhld characteristics		No			Yes	

Implications of the Main Results

- Intra- and inter-state deregulations together explain a 33% increase in the transition rate from renters to homeowners
  - Impact of Intra-state deregulation is 3.0%
  - Impact of Inter-state deregulation is 5.7%
  - The unconditional transition rate from renters to owners is 26.5%
  - (3.0%+5.7%)/26.5%=33%

- The heterogeneous effects among households are important. Estimations using state-level data are potentially biased

Results on Other Controls Are Sensible

	Marg. effect	Coef.	Sig. level		Marg. effect	Coef.	Sig. level
Age	0.007	0.046 (0.023)	**	Education			
Race				High school degree	0.024	0.152 (0.108)	
Black	-0.085	-0.528 (0.217)	**	College degree	0.060	0.373 (0.096)	***
Other	-0.086	-0.533 (0.297)	*	Log(family income)	0.031	0.193 (0.055)	***
Female	-0.102	-0.633 (0.148)	***	Quartile of wealth			
Married	0.061	0.378 (0.107)	***	2nd quartile	0.029	0.183 (0.134)	
# of children	0.018	0.113 (0.045)	**	3rd quartile	0.114	0.706 (0.194)	***
Unemployed	-0.110	-0.686 (0.285)	**	4th quartile	0.103	0.637 (0.438)	

Issue 1: Endogeneity of Banking Deregulation

Banking deregulation is an endogenous decision affected by state-level factors. However, our results are unlikely to be driven by the endogeneity, for three reasons:

- We have controlled for state fixed effects, i.e., all time-constant state-level factors

- We have controlled for some time-varying state factors

- Following Altonji et al. (2005, 2008), we can calculate the relative amount of selection on unobservables that is needed to explain the estimated coefficients by endogeneity
  - The amount is relative to selection on observables

Issue 1: Endogeneity of Deregulations–Altonji's method

We apply Altonji's method to *intra* and *inter* separately:

- For *intra*, selection on unobservables needs to be 1.4 times of selection on observables, which is unlikely
  - Coefficient of *intra* would be *0.133*, if selection on unobservables is the same as selection on observables:

  $$\frac{E(\epsilon|Intra=1) - E(\epsilon|Intra=0)}{Var(\epsilon)} = \frac{E(\gamma'X|Intra=1) - E(\gamma'X|Intra=0)}{Var(\gamma'X)}$$

  - In reality, the estimated coefficient of *intra* is *0.187*
  - 0.187/0.133=1.4

- For *inter*, selection on unobservables needs to be 8.7 times of selection on observables, which is more unlikely the case

- Therefore, the impacts of *intra* and *inter* can not be explained by endogeneity

Issue 2: Unobservable Household Characteristics

$$transfer_{i,t}^* = \alpha\, intra_{i,t} + \beta\, inter_{i,t} + \gamma\, X_{i,t} + U_i + \epsilon_{i,t}, \qquad (3)$$

- U_i includes all time-constant unobservable household characteristics
- We estimate (3) and (2) by *random effect logit model* and *fixed effect logit model*
- The other controls are the same as in the pooled logit model

	Random effect logit			Fixed effect logit			Pooled logit		
	Marg. eff.	Coef.	Sig. level	Marg eff.	Coef.	Sig. level	Marg eff.	Coef.	Sig. level
intra	0.047	0.374 (0.046)	***	0.036	0.355 (0.039)	***	0.030	0.187 (0.095)	**
inter	0.062	0.490 (0.054)	***	0.043	0.422 (0.031)	***	0.057	0.354 (0.040)	***

Issue 3: Sample Selection Bias

The subsample of renters may not be a random sample; renters are very different from home owners!

Comparative statistics for renters and homeowners

	Renters	Homeowners
Age	40.24	50.42
Race		
White	0.75	0.90
Black	0.23	0.08
Other	0.02	0.02
Female	0.42	0.19
Married	0.28	0.74
Unemployed	0.06	0.02
Family income ($)	20,705	42,062
Number of observations	4,060	5,270

Issue 3: The Heckman Copula Model

$$
renter_{i,t} = \begin{cases} 1, & \text{if } renter_{i,t}^* = \lambda' \tilde{X}_{i,t} + \xi_{i,t} > 0, \\ 0, & \text{if } renter_{i,t}^* = \lambda' \tilde{X}_{i,t} + \xi_{i,t} \leq 0, \end{cases} \tag{4}
$$

$$
transfer_{i,t} = \begin{cases} \alpha Intra_{i,t} + \beta\, Inter_{i,t} + \gamma' X_{i,t} + \epsilon_{i,t}, & \text{if } renter_{i,t} = 1, \\ ., & \text{if } renter_{i,t} = 0. \end{cases} \tag{5}
$$

- $renter_{i,t}$ is the indicator variable of renters
- Both $\xi_{i,t}$ and $\epsilon_{i,t}$ follow logistic distributions
- Joint distribution of ξ and ϵ is determined by a Joe copula function
- We estimate (4) and (5) by the maximum likelihood method:

	Heckman copula			Pooled logit		
	Marg. eff.	Coef.	Sig. level	Marg. eff.	Coef.	Sig. level
intra	0.027	0.027	***	0.030	0.187	**
		(0.005)			(0.095)	
inter	0.049	0.049	***	0.057	0.354	***
		(0.006)			(0.040)	

Issue 4: Model Misspecification I –The Probit Models

If $\epsilon_{i,t}$ follows a normal distribution (instead of logistic distribution), then Probit estimation models are more efficient

	Main			Unobservable hhld charac.			Sample selection bias		
	Pooled Probit			Random effect Probit			Heckman Probit		
	Marg. effect	Coef.	Sig. level	Marg. effect	Coef.	Sig. level	Marg. effect	Coef.	Sig. level
Intra	0.029	0.104 (0.049)	**	0.048	0.222 (0.027)	***	0.031	0.086 (0.015)	***
Inter	0.059	0.214 (0.022)	***	0.062	0.291 (0.032)	***	0.067	0.186 (0.018)	***
ρ								-0.676 (0.037)	***

Issue 4: Model Misspecification 2–Propensity Score Matching (PSM)

- The logit and probit models assume linear impacts of covariates on the latent variable. Bias is resulted if this assumption is violated. The PSM estimation does not rely this assumption
- The matching process is as follows:
  - ▸ For a given state, we match renters before deregulation (comparison group) to renters after deregulation (treatment group)
  - ▸ Match on the propensity score using the nearest-neighbor algorithm
  - ▸ Then we repeat this matching process for each state
- We report the Average Treatment effect on the Treated (ATT), which has a similar interpretation as the marginal effects

	PSM		Pooled logit		
	ATT	Sign. level	Marg. eff.	Coef.	Sign. level
Intra	0.023	***	0.030	0.187	***
	(0.003)			(0.095)	
Inter	0.049	***	0.057	0.354	***
	(0.002)			(0.040)	

High Matching Quality

Identification of the PSM relies on the *common support* assumption:

- The distributions of the propensity scores for the treatment and the comparison groups overlap with each other

Our PSM estimation is well identified, as this assumption is likely satisfied:

Renters in the state-year combination with intra-state deregulation

Renters not in the state-year combination of intra-state deregulation (on support)

Renters not in the state-year combination of intra-state deregulation (off support)

Renters in the state-year combination with inter-state deregulation

Renters not in the state-year combination of inter-state deregulation (on support)

Renters not in the state-year combination of inter-state deregulation (off support)

Potential Explanations

We find evidence of two possible explanations:

- **The income explanation**: Banking deregulations increase household income, especially for low income households, making homes more affordable for them.

- **The technology channel**: Bank deregulations improve financial technology innovation, with which lenders can identify and offer credit to "higher-risk" but creditworthy households.

Testing the Income Channel

$$log(family\ income)_{i,t} = \alpha\ intra_{i,t} + \beta\ inter_{i,t} + \gamma' X_{i,t} + \epsilon_{i,t}$$

Dependent variable: log(family income)

	(1) OLS		(2) 25th percentile		(3) 50th percentile		(4) 75th percentile	
	Coef.	Sig. level	Coef.	Sig. level	Coef.	Sig. level	Coef.	Sig. level
Intra	0.025 (0.037)		N/A		N/A		N/A	
Inter	0.230 (0.010)	***	0.193 (0.064)	***	0.064 (0.049)		0.005 (0.029)	

Testing the Technology Channel

$$transfer^*_{i,t} = \alpha\, intra_{i,t} + \beta\, inter_{i,t} + \gamma\, X_{i,t}$$
$$+ \lambda\, intra_{i,t} * high\_risk_{i,t} + \mu\, inter_{i,t} * high\_risk_{i,t} + \epsilon_{i,t},$$

where $high\_risk = 1$ for renters with debt-to-income ratios>20%, and 0 otherwise.

	Marginal effects	Coef.	Sig. level
Lower-risk renters			
Intra-state	0.026	0.165	
		(0.116)	
Inter-state	0.053	0.333	***
		(0.074)	
Higher-risk renters			
Intra-state	0.054	0.337	***
		(0.069)	
Inter-state	0.111	0.696	***
		(0.066)	

The Take-Away Findings

- **Banking deregulations can explain as high as a 8.7 percentage-point increase in the probability of renters becoming homeowners**
  - That is a 33% increase
  - Our results are robust to
    - Endogeneity of banking deregulations
    - Unobservable household characteristics
    - Sample selection
    - Functional mispecification

- **We find evidence for two explanations: the income explanation and the technology explanation**

Implications

- In June 2017, the S&P Case-Shiller home price index set a new record high, surpassing the previous high from July 2006.
  - Home owners enjoy an ongoing boost in wealth from home price appreciation

- However, the homeownership rate has been dropping from 69.2% in 2004 to 62.9% in 2016Q2–the same level of the mid-1960s

- In other words, *home prices set a new record, but fewer home owners benefited*

- Questions: What are the reasons for the recent drop of homeownership rate? How can we improve home ownership?

Implications (continued)

Our results suggest that

- Besides default, the worsening credit market conditions may have played roles in the drop of the homeownership rate

- Government policy aiming to increase credit supply will help to improve the homeownership rate
    - There is an on-going debate whether the Dodd-Frank Act should be dismantled
    - With the economy continuing to heal and the U.S. unemployment rate dropping to 3.5% in Nov 2019 - the lowest level since Dec 1969, the deregulation will likely help more American families to fulfill their dreams.

THANK YOU!