

# Intergenerational mortgage financing - The Role of Co-signing Mortgages

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# Research Question

**Research Questions:** How prevalent is co-signing of mortgages? Who cosigns and why? What are the consequences of it?

**Key Mechanism:** Parents cosign a mortgage to offer security to banks in case of default of children. Improves access to mortgages.

## Motivation

- Can cosigning help financially constraint agents? Welfare?
- Consequences for macroprudential stability?
- Wealth inequality?

## Preview of Results

Does parental housing status affect children's housing status?

Empirics:

1. Direct Evidence on Co-Signing for US.
2. Positive correlation with house prices and income.
3. Descriptive evidence on better access to mortgages.
4. Cosigning parents have lower liquid assets.

Theory:

1. Quantitative model

# Outline

Literature

Empirics

Rationalize with a quantitative model

Appendix

# Literature

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- **Portfolio Choice with Housing:** Cocco 2005, Eichenbaum, Rebelo, and Wong 2022, Mian and Sufi 2011, Mian, Rao, and Sufi 2013, Mian and Sufi 2014, Mian, Sufi, and Trebbi 2015

⇒ **Intergenerational aspect of portfolio choice**

- **Intergenerational Wealth Transfers:** Black et al. 2022, De Nardi 2004, De Nardi and Fella 2017, Druedahl and Martinello 2022, Koltikoff and Summers 1981, Nekoei and Seim 2023, Modigliani 1988, Ohlsson, Roine, and Waldenström 2020, Saez and Zucman 2016,

⇒ **Co-signing as new channel?**

- **Parental Support and Housing Affordability:** Allen et al. 2024 and Benetton, Kudlyak, and Mondragon 2024

# Empirics

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- PSID data 2019-2021 (2 biennial waves).
- Connect parental households to children.
  - Household ID, Person ID, 1968 Family ID
  - Not always a direct link between parents and children
  - Go to 1968 and track movers
- Combine with household portfolio.
  1. Focus on prime-age children (25-42)
  2. No Businessowner
  3. No Cohabitation

# Home Mortgage Disclosure Act

- Near-universe of mortgage applications on loan level from 2018 to 2021
- Around 3.57 million mortgage applications, 2,767,961 originated, 377,639 rejected
- Rich information on
  - Mortgage, Borrower, Lender characteristics
  - Application level
- Focus on non-commercial, regular mortgages of first-time home buyers
- Identify cosigning via age structure of mortgagors
- At least 19 years of age difference
- Drawback: Only first two mortgagors listed

## Web-Scraped Data

- Universe of originated mortgages in a given county held by the county clerks.
  - Publicly accessible information on
    - Mortgagors
    - Mortgagees
    - Loan Amount
    - Geographic Area
    - Origination Date
1. Identify cosigning as more than two mortgagors
  2. Drawback: No age information

## The Mortgage Market

- Primary Mortgage Market
  1. Buy conforming loans from lenders.
  2. Banks, credit unions and mortgage lenders and brokers.
  3. Can keep or sell to...
- Secondary Mortgage Market - Freddie Mac and Fannie Mae
  1. Buy conforming loans from lenders to provide liquidity/risk reduction.
  2. Borrower must meet debt-to-income ratio (DTI), credit score, ...
  3. Hard limit at 50%, soft limit at 45% DTI.

### Co-signing

- "The Seller is not required to calculate or evaluate the occupant Borrower's monthly housing expense-to-income ratio or the occupant Borrower's monthly debt payment-to-income ratio" - *Freddie Mac*
- "Using only the income of the occupying borrower(s) to calculate the DTI ratio, the maximum allowable DTI ratio is 43%." - *Fannie Mae*
- Requirements on Loan-to-Value (LTV) somewhat modified.

## HMDA - Evidence on Cosigning

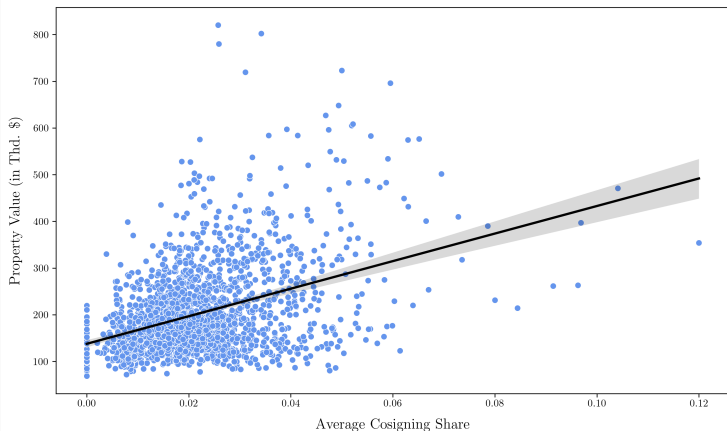
- 2.4% of mortgage applications are intergenerationally cosigned.
- 2.9% of denied applications are intergenerationally cosigned.
- 32% of mortgage applications with co-borrower are intergenerationally cosigned.

**Table 1:** Cosigning by Age:

Age Bin	Share Co-signed (%)
<25	6.39
25-34	2.46
35-44	1.24

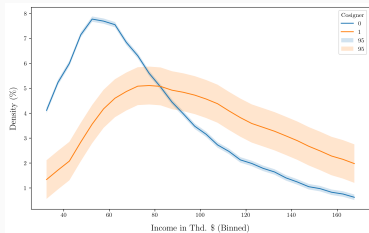
# Cosigning Correlates With House Prices

**Figure 1:** County-Level Scatterplot

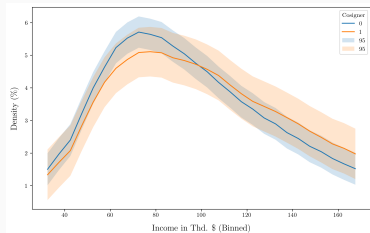


Only counties plotted with at least 100 mortgages over four years.

# Cosigning Correlates with Income



**(a)** Income Distribution by Cosigning Status



**(b)** Income Distribution - Double Signers Only

**Figure 2:** Combined Income Distribution Graphs



# Cosigning Correlates with Income II

## Stylized Life-Cycle Profile

**Table 2:** Average Income by Cosigner Age

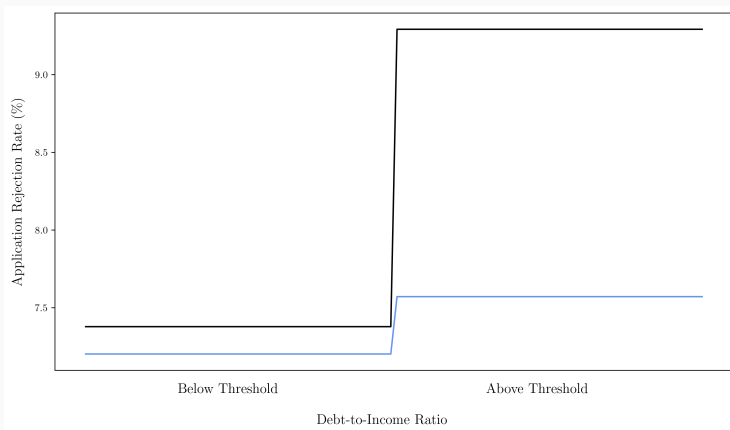
	<25	25-34	35-44	45-54	55-64	65-74	>74
Mean income (Thd. \$)	74.77	111.15	129.83	133.90	144.34	128.76	103.50

Mortgages without any Cosigner: 76.81

# Application Rejection Rates and Debt-to-Income Ratio

Assume no selection bias and groups were perfectly comparable:

**Figure 3:** Mean Application Rejection Rates



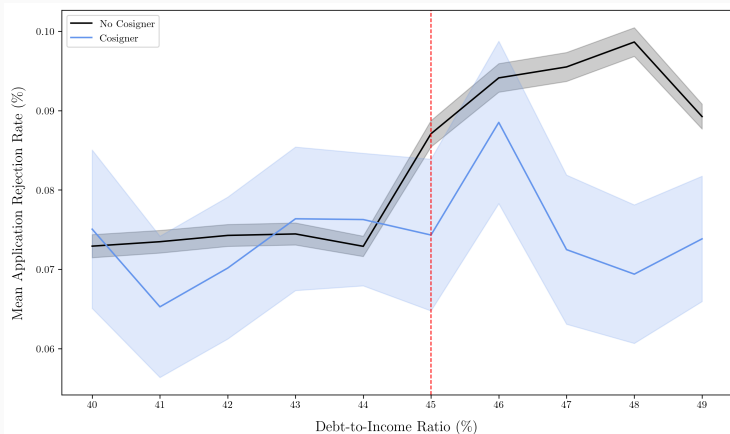
Younger people profit more:

**Table 3:** Difference in means around threshold

Age	$\Delta$ in Application Rejection Rates
Narrow Definition	
<25	2.09
25-34	1.87
35-44	2.31
Broad Definition	
<25	2.31
25-34	1.34
35-44	1.80

# Application Rejection Rates and Debt-to-Income Ratio

**Figure 4:** Mean Application Rejection Rates



Conditional on origination:

	Interest Rate (%)	Property Value (\$)	Loan Amount (\$)	Mortgage Payment (\$)	Debt-to-Income Ratio
No Cosigning	3.79	294,857	257,631	1,200	0.199
Cosigning	3.79	316,396	269,303	1,250	0.1407

	Downpayment (\$)	Total Gross Inc. (in Thd. \$)	Rel. House Price Index	Loan Term (Years)
No Cosigning	37,226	80.56	100	29.48
Cosigning	47,093	145.68	113.16	29.60

**Table 4:** Comparison of Mortgage Details with and without Cosigning

# Regression Model

$$Y_{icst} = \beta_0 + \beta_1 D_{icst} + \beta_2 \ln(Inc_{icst}) + \beta_3 (D_{icst} \times \ln(Inc_{icst})) + \\ Z\gamma + \alpha_t + \delta_s + \delta_c + \varepsilon_{icst}$$

where  $t$  = Year,  $s$  = State,  $c$  = county and  $i$  = mortgage

## Regression - Controlling for local housing demand

	Linear Probability			Logistic Regression		
	Application Rejection Rate					
Cosigning	0.02***	−0.04	−0.12**	0.02***	−0.07***	0.09***
Cosigning x Log Income		0.01***	0.02***		0.01***	0.02***
Controls	No	No	Yes	No	No	Yes
State & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
County x Year FE	Yes	Yes	Yes	No	No	No
N	3,145,600					

**Table 5:** Regression Results: Impact of Cosigning on Mortgage Application Rejection

# Regression - Controlling for local housing demand

## Conditional

	Loan Size (in 10k \$)	Property (in 10k \$)	Interest Rate	Loan Term
Cosigning	79.27***	83.08***	0.18	-2.59***
Cosigning x Log Income	-7.36***	-7.73***	-0.01	0.24***
Controls	Yes	Yes	Yes	Yes
State and Year FE	Yes	Yes	Yes	Yes
County x Year FE	Yes	Yes	Yes	Yes
N		2,767,961		

**Table 6:** Regression Results: Intensive Margins Measurements, Linear Probability Model



## Web Scraping - Evidence on Cosigning

True cosigning numbers likely higher as so far we don't observe (some) couples with third cosigner. Preliminary evidence from web-scraped county data.

**Table 7:** Comparison - Share of Mortgages Cosigned

	HMDA	Web scraping
Erie County	1.75	3.65
Albany County	2.3	7.76
Oneida County	2.21	7.65

Mostly three mortgagors but occasionally more.

## Connecting to PSID

- No direct connection from HMDA to PSID.
- Use Multiple Imputation Chain Equation (MICE) to impute cosigning in PSID
- Idea: Find N closest neighbours and match mean. Repeat N times for entire sample.
- Impute intergenerational
- Predicted share of cosigned mortgages 6.2%

# Who are the parents? Who are the children?

**Table 8:** Who are the parents? - Some Means

	Savings	Stocks	Total Wealth	Income	Share Owner	Years to Pay Mortgage	Share Retired	Years Education
Not Coigners	58,307	130,957	874,672	105,565	85.23 (%)	8.38	0.43	13.88
Coigners	46,614	108,903	739,702	104,997	80.29 (%)	8.47	0.32	13.77

# Who are the parents? Who are the children?

**Table 9:** Who are the children? - Some Means

	Savings	Stocks	Total Wealth	Income	Years Education
Not Cosigners	38,694	40,008	309,779	151,958	15.21
Cosigners	48,036	33,489	380,369	134,469	14.59

**Rationalize with a quantitative  
model**

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# Incomplete Markets

Hypothesis:

Financial frictions matter for children - parents can:

b) Help with downpayment via liquid assets

⇒ Parents have sufficient liquidity to help (conditional on rational behaviour)

a) Co-signing to reduce mortgage burden by children.

⇒ Parents are somewhat liquidity constraint and take on risk of paying mortgage

c) Do nothing

⇒ Parents are somewhat financially constraint

The model:

- Households rent or buy, given homeowner, can pay, or default
- Parents endogenously determine cosigning status/downpayment help of children.
- If cosigned: Payment-to-income ratio relaxed ⇒ lower

With  $S = (t, a, y; \theta)$  first decision:

$$V(S) = \max \{ V^{rent}(S), V^{buy}(S) \} \quad (1)$$

Having bought:

$$V^h(S, h^{own}, M) = \max \{ V^{pay}(S, h^{own}, M), V^{def}(S) \} \quad (2)$$

where  $\theta$  is the cosigner status.

$$V^{own}(S) = \max_{c, h^{own'}, k', M'} u(c, h^{own}) + \beta s_t \mathbf{E}_y V^h(S', h^{own'}, M') \quad (3)$$

It is subject to

$$\begin{aligned} c + k' + (1 - \iota)p^o h^{own} &= wy + (1 + r)k + M' \\ h^{rent'} &= 0 \\ h^{own} &\in \mathcal{H}^{own} \\ M' &\leq (1 - \iota)p^o h^{own} \\ k' &\geq 0 \end{aligned} \quad (4)$$



## Choice variable

- Duration: Fixed at 30 periods.
- Total amount borrowed:  $M = m \left[ \sum_{k=1}^{30} \frac{1}{(1+R^m)^k} \right]$
- Law of Motion:  $M' = M(1 + R^m) - m$
- Interest rate:  $R^m = \frac{1}{(M-\chi)^\sigma}$ , collateral  $\chi$
- $\chi = p^o(h^{own} + h^{own,p})$  sum of parents and children

# Making Payments

$$V^{pay}(S, h^{own}, M) = \max_{c, k'} u(c, (1 - \delta_h)h^{own}) + \beta s_t \mathbf{E}_y V^h(S', h^{own'}, M') \quad (5)$$

s.t.

$$c + k' + m = wy + (1 + r)k + (1 - \delta_h)p^{own}h^{own} \quad (6)$$

$$h^{own} \in \mathcal{H}^{own}$$

$$M' = M(1 + R^m) - m \quad (7)$$

$$h^{own'} = (1 - \delta_h)h^{own}$$

$$k' \geq -\lambda(p^o h^{own} - M)$$

$$h^{rent'} = 0$$

$$V^{def}(S, h^{own}, M) = \max_{c, k'} u(c, (1 - \delta_h)h^{rent}) + \beta s_t \mathbf{E}_y V^h(S')$$

s.t.

$$c + k' + p^r + m = wy + (1 + r)k$$

$$h^{own'} = 0$$

$$h^{rent} \in \mathcal{H}^{rent}$$

$$k' \geq 0$$

Renter

Firms & Government

Last Period

# Parental Support Decision

At a fixed age, parents have a once-in-a-lifetime chance to support inter-vivo:

$$V_{\emptyset}^{j=J^{\theta}}(S, \varsigma) = \max_{c, \varsigma', k'} u(c, \varsigma) + \beta s_t \mathbf{E}_y V^h(S', \varsigma') \quad (8)$$

$$V_{cos}^{j=J^{\theta}}(S, \varsigma) = \max_{c, \varsigma', k'} u(c, \varsigma) + \phi(a_{cos}) - \mathbf{E} p^{def} M' + \beta s_t \mathbf{E}_y V^h(S', \varsigma') \quad (9)$$

$$V_{cash}^{j=J^{\theta}}(S, \varsigma) = \max_{c, \varsigma', k'} u(c, \varsigma) + \beta \phi(a_{cos}) - a_{cos} + \beta s_t \mathbf{E}_y V^h(S', \varsigma') \quad (10)$$

where  $\varsigma = (h^{own}, h^{rent}, M)$  and  $a_{cos}$  is the equivalent utility

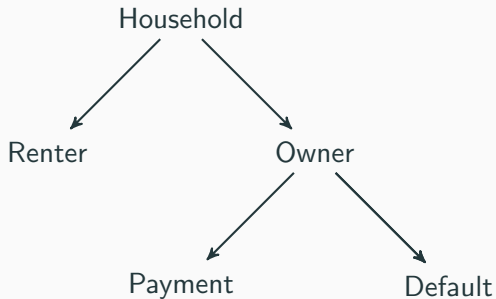
## Next Steps

- Continue Data Work
- Finish Numerical Solution
- Calibration to US data
- Policy experiments

# Appendix

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# Incomplete Markets: Households



$$V^{rent}(t, a, y) = \max_{c, h^{rent'}, k'} u(c, h^{rent}) + \beta s_t \mathbf{E}_y V(S') \quad (11)$$

It is subject to

$$c + k' + p^r h^{rent} = wy + (1 + r)k \quad (12)$$

$$h^{own'} = 0$$

$$h^{rent} \in \mathcal{H}^{rent}$$

$$k' \geq 0$$



Firms:

$$\Pi(K; L) = AK^\alpha L^{1-\alpha} - (r - \delta)K - wL \quad (13)$$

- $A$  - productivity,  $r$  - interest rate on capital,  $\delta$  - depreciation of capital

Government:

$$\tau_l wL + \tau_k rK + \tau_b^k b(k) = \Theta \sum_{t=T^{ret}}^T \mu_t \quad \forall t \quad (14)$$

$\tau_l$  labour income tax,  $\tau_k$  capital gains tax,  $\tau_b^k$  bequest tax

Parents, only collateral:  $V^{p,h,c} = V^h(t, k, y, \underline{h}^{own}, M)$

Parents, nothing:  $V^{p,h,n} = V^h(t, k, y, h^{own}, M)$

Parents, nothing:  $V^{p,n} = V(t, k, y)$

$$I_{\chi} = \begin{cases} \chi & \text{if } \max\{V^{p,h,c}, V^{p,h,b}\} \geq \max\{ \\ 0 & \text{if otherwise} \end{cases}$$

$$\begin{aligned} V^J(t, a, y) &= \max_{c, h^{rent'}, k'} u(c, h^{rent}) + \beta \phi(a_T, 0) \text{ s.t.} \\ c + k' + p^r h^{rent} &= (1 - \tau_l)wy + (1 + r(1 - \tau_k))k \\ h^{rent} &\in \mathcal{H}^{rent} \\ k' &\geq 0 \end{aligned} \tag{15}$$

# Correlation with Childrens Homeownership Status

**Table 10:** Sample Weights - Child Homeownership

	Dep. Var.: Child Homeowner	
	(I)	(II)
Parents Homeowner	0.206*** (0.021)	0.111*** (0.023)
Parents Stockholder	0.025 (0.019)	0.018 (0.018)
Parents Savers	0.025* (0.015)	0.01 (0.015)
Control Variables	No	Yes
Time & State FE	Yes	Yes
No. Observations	15244	11421
Entities	4470	2539
Time periods	9	9
R-squared	0.09	0.29

Standard error in parenthesis are clustered at the *1968 Family* Level

\*\*\*, \*\*, \* denote statistical significance at 1%, 5% and 10%, respectively

# Mortgage Share & Mortgage Interest Rates - Sample Weights

**Table 11:** Pooled OLS - Linear Probability Model II

Dep. Var.:	Has Mortgage		Interest Rate	
	(I)	(II)	(III)	(IV)
Parents Homeowner	0.037* (0.019)	0.001 (0.024)	-0.369* (0.22)	-0.7714*** (0.367)
Parents Stockholder	0.03** (0.013)	0.024* (0.014)	-0.031 (0.133)	-0.359 (0.228)
Parents Savers	0.039*** (0.013)	0.025* (0.015)	-0.365** (0.176)	-0.476* (0.251)
House Value	Yes	Yes	Yes	Yes
Mortgage Size	No	No	Yes	Yes
Other Control Variables	No	Yes	No	Yes
Time & State FE	Yes	Yes	Yes	Yes
No. Observations	7121	5802	5448	4566
Entities	4468	1623	1662	1372
Time periods	9	9	9	9
R-squared	0.1	0.18	0.06	0.11

Standard error in parenthesis are clustered at the 1968 Family Level

\*\*\*, \*\*, \* denote statistical significance at 1%, 5% and 10%, respectively

# Interaction with Income - Sample Weight

**Table 12:** Pooled OLS - Interaction with Income

Dep. Var.:	(I) Child Homeowner	(II) Has Mortgage	(III) Interest Rate
Parents Homeowner	0.173*** (0.034)	0.061 (0.042)	-0.971 (0.767)
Parents Homeowner x Fam. Income	-0.11** (0.044)	-0.063* (0.035)	0.069 (0.047)
Parents Stockholder	0.024 (0.03)	0.028 (0.024)	-0.433 (0.288)
Parents Stockholder x Fam. Income	-0.013 (0.028)	-0.003 (0.012)	-0.003 (0.014)
Parents Savers	0.028 (0.023)	0.031 (0.022)	-0.25 (0.378)
Parents Savers x Fam. Income	-0.02 (0.023)	-0.006 (0.012)	-0.037 (0.04)
House Value	No	Yes	Yes
Mortgage Size	No	No	Yes
Other Controls	Yes	Yes	Yes
State & Time FE	Yes	Yes	Yes
No. Observations	11421	5802	4653
Entities	2494	1623	1387
Time periods	9	9	9
R-squared	0.33	0.18	0.11

Standard error in parenthesis are clustered at the 1968 Family Level

\*\*\*, \*\*, \* denote statistical significance at 1%, 5% and 10%, respectively

Family Income is denoted in 10,000\$

**Table 13:** Probit at Median - Marginal Effects

	Dep. Var.: Child Homeowner	
	(I)	(II)
Parents Homeowner	0.211*** (0.013)	0.144*** (0.012)
Parents Stockholder	0.03*** (0.011)	0.005 (0.015)
Parents Savers	0.035*** (0.009)	0.01 (0.012)
Control Variables	No	Yes
Time & State FE	Yes	Yes
No. Observations	15244	11421
Entities	4470	2539
Time periods	9	9

Standard error in parenthesis are clustered at the 1968 Family Level

\*\*\*, \*\*, \* denote statistical significance at 1%, 5% and 10%, respectively

# Mortgage Share & Mortgage Interest Rates - Probit

**Table 14:** Probit At Median

Dep. Var.:	Has Mortgage	
	(I)	(II)
Parents Homeowner	0.046*** (0.016)	0.001 (0.018)
Parents Stockholder	0.042** (0.018)	0.019 (0.02)
Parents Savers	0.048*** (0.014)	0.048*** (0.016)
House Value	Yes	Yes
Other Control Variables	No	Yes
Time & State FE	Yes	Yes
No. Observations	7121	5802
Entities	4468	1623
Time periods	9	9

Standard error in parenthesis are clustered at the *1968 Family* Level

\*\*\*, \*\*, \* denote statistical significance at 1%, 5% and 10%, respectively



# Introducing Family Fixed Effects

**Table 15:** Pooled OLS - Linear Probability Model II

Dep. Var.:	Child Homeowner (I)	Has Mortgage (II)	Interest Rate (III)
Parents Homeowner	0.055** (0.025)	-0.049 (0.032)	-0.565 (0.581)
Parents Stockholder	-0.004 (0.015)	0.008 (0.014)	-0.03 (0.124)
Parents Savers	0.008 (0.011)	0.014 (0.012)	-0.35* (0.196)
House Value	No	Yes	Yes
Mortgage Size	No	No	Yes
Other Control Variables	Yes	Yes	Yes
Time & State FE	Yes	Yes	Yes
No. Observations	11421	5802	4566
Entities	2240	1483	1274
Time periods	9	9	9
R-squared	0.17	0.06	0.02

Standard error in parenthesis are clustered at the 1968 Family Level

\*\*\*, \*\*, \* denote statistical significance at 1%, 5% and 10%, respectively