# The Unrealized Potential of a Parent's Promise:

## Cosigned Mortgages and Access to Credit in the United States

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**Abstract**

This paper asks how altruistic third-party guarantees shape access to credit, and why they deliver less than they could in the U.S. mortgage market. Parents can make a child's mortgage safer by cosigning, but lenders charge the solo rate, so families overpay 25 basis points. This safety does not come from the parent's information advantage. Unlike a commercial guarantor, the parent also cares about the child's gain, making her not necessarily choose the safest. This introduces adverse selection that dominates the screening. The promise more than offsets the lower cosigning pool quality, as children miss fewer payments when a parent cosigns. Underwriting acknowledges cosigning only partially on admission but not for pricing. Cosigning raises homeownership among young Americans by 0.8 percentage points. Correcting for differences in pool quality and the guarantee nearly doubles access to homeownership without introducing more defaults. It raises welfare, mostly for lower-income children. These results come from a general-equilibrium model with asymmetric information, estimated on the first U.S. measure of parental cosigning, from web-scraped deeds and administrative data.

*Keywords*: Mortgage cosigning; Family guarantees; Adverse selection; Down-payment constraints; Homeownership; Intergenerational transfers; Mortgage default.

*JEL Codes*: D15; D64; D82; G21; G28; G51; R21.

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## 1 Introduction

A lender cannot be certain that a borrower will repay. The lender has two options to deal with it, rationing supply or charging an average price. As Stiglitz and Weiss (1981) point out, rationing turns away borrowers who would have repaid, because a higher rate would drive the safe borrowers away. Pricing the average pool quality means safe borrowers subsidise risky borrowers (Einav et al., 2010a). A commercial guarantor solves this by promising to pay if the borrower fails to do so. Therefore, it only guarantees when the borrowers are safe, requiring knowledge of the borrower's type (Thakor, 1982). The lender gets a promise and a screen, and the borrower gets access to credit. But what if the guarantor is family or friend? A parent can cosign a mortgage, a student loan, a car loan, or a lease. The family can provide collateral for starting a business. Like a commercial guarantor, the family knows the borrower. An altruistic guarantor has a different motive, as they care about the welfare of the borrower. They use that knowledge to guarantee the children who gain the most, not necessarily those who are safe. The guarantee remains untouched, but the screening changes. The new screen shifts who gets credit and how those loans perform.

Parents cosigning mortgages serves as a case study for altruistic guarantees, for three reasons. First, homeownership is crucial for households, with mortgages representing the largest household credit market and housing the primary asset for most families (Kuhn et al., 2020). House prices have risen faster than incomes in recent years (Knoll et al., 2017; Goodman and Mayer, 2018; Mabille, 2023), the share of first-time buyers has fallen (Green, 2022), and more young buyers rely on family help (Brandsaas, 2025). One way a parent can help is cosigning: the parent cosigns the loan and is legally liable for missed payments by their child. Second, cosigning can be quantified. Loan records carry the co-applicant and the loan's performance, and deed records carry the names, so parents can be distinguished from spouses. About 5% of purchases by buyers under 45 in the U.S. are cosigned by a parent, lower than the 10 to 19% of young buyers' purchases in Australia, Canada, and Norway. Third, the price is agnostic about it. Regulatory standards do acknowledge cosigners for admission but not for pricing, where cosigned and solo borrowers pay the same interest rate. Borrowers do not select into cosigning on price, so the differences in the data come from who cosigns, not from what it costs.

This paper asks how altruistic third-party guarantees shape access to credit, and why they deliver less than they could in the U.S. mortgage market. To answer these questions, I examine parental cosigning of mortgages and make three contributions. First, by combining 4.3 million web-scraped county deed records with administrative loan records, I provide the first U.S. measure of parental cosigning in mortgage markets, covering 2018 to 2024. Second, I show that the type of guarantor matters for the selection of cosigned loans. An altruistic parent also considers the child's potential gain, not only the child's risk. The pool of guaranteed borrowers is now a combination of safe borrowers with little gain and risky borrowers with high gains. It introduces adverse selection to the screening process. Third, a heterogeneous-agent lifecycle model with asymmetric information, estimated on U.S. data and solved in general equilibrium, quantifies the selection forces and the consequences of altruistic cosigning. Adverse selection outweighs the screen, so the parent's pool

is riskier than a commercial guarantor's would be, but the promise more than offsets it: the child misses fewer payments and the parent covers most of the rest, so cosigned mortgages perform better than solo mortgages. Yet the price is the solo rate, so families overpay about 25 basis points a year. Despite the premium, cosigning adds 0.8 percentage points of homeownership among young adults. In a policy experiment, pricing cosigned loans on their losses adds another 0.6 percentage points. At the same time, defaults stay constant and welfare rises by 0.4 percent of lifetime consumption, most for lower-income children.

Three rules govern admission and pricing of conforming mortgages in the U.S. The debt-to-income test counts the cosigner's income in full. The loan-to-value test, the minimum deposit, does not count the cosigner at all. The price comes from a combination of credit score and leverage, with the score the lower of the two signatories (Fannie Mae, 2026b), so a cosigner can raise the price but never lower it. Fannie Mae and Freddie Mac, which account for around 65% of the U.S. residential primary mortgage market (Consumer Financial Protection Bureau, 2024, Tables 1A–1D), set these standards. Default risk associated with a loan sold to either agency does not enter the lender's balance sheet. Incentives to price differently are small.

The theory in Section 3 puts these rules in a model of asymmetric information in which the informed party is the borrower's altruistic guarantor, the parent. It rests on two premises. First, the parent decides to cosign if the gain from seeing their child become a homeowner, obtained through altruism, outweighs the expected financial liability while knowing the child's type. Second, the risky types appreciate the guarantee more. As risky types end up in default more often, they gain more from the guarantee that lets them keep the house. An offer is good news about the child, but how much information a guarantee contains depends on the child's income. At low incomes, cosigning allows the child to buy a larger house than alone. Therefore, both types accept the cosigning offer and the screen works. At higher incomes, a safe child can get more or equal housing alone and declines the offer. Only the risky types cosign and the pool is adversely selected. The effect on the price is not ambiguous. As long as the parent covers more than a small share of missed payments, the lender faces lower losses on a cosigned loan than on a solo loan. The zero-profit interest rate on cosigned loans lies below the rate charged on solo loans.

Four facts in the matched deed and loan records are consistent with the model. Cosigning is more common where houses are expensive relative to local incomes. At the same debt-to-income ratio, lenders reject cosigned applications less often than solo ones, and at the same high loan-to-value ratio more often. Within a price cell, cosigned borrowers pay nearly the same rate as solo ones. The loans do not perform alike, though. At the same credit score, cosigned borrowers fall thirty days behind as often as solo borrowers, but half as many reach ninety days late.

The static model also makes an out-of-sample prediction: a higher fee should raise rejections, but less for cosigned than for solo borrowers. In 2022 the Federal Housing Finance Agency (FHFA) raised fees only for larger conforming loans (Federal Housing Finance Agency, 2022). Comparing both sides of the size threshold, before and after, I find that interest rates moved equally for solo and cosigned applicants. Denials due to the debt-to-income ratio rose +1.11 percentage points for

solo applicants, roughly doubling the pre-reform rate of about one percent. Denials of cosigned applications show no statistically significant change.

Neither this exercise nor the data can separate the promise from the two selection forces. The quantitative model can. In it, parents choose whether to cosign, give cash toward the deposit, do both, or do nothing, knowing the child's type. In each period of the mortgage, borrowers decide whether to pay or default, and a cosigning parent covers a missed payment if the budget net of housing allows. Cosigned loans are, on average, riskier. Treated as solo loans, they would default at 1.77 percent a year, compared to 0.38 percent for solo borrowers. Of that gap, 0.78 points are observable: cosigned buyers have lower incomes, buy more house and bring less savings. Adverse selection due to the altruistic motive adds 0.74 points, at the incomes where a safe child could buy alone. The screen, the only selection a commercial guarantor would bring, removes 0.13, at the low incomes where most defaults occur. Over the whole pool adverse selection dominates the screen, but the guarantee is even more powerful. In the model, cosigning changes the child's behaviour. The child misses fewer payments, worth 0.81 percentage points. Additionally, the parent covers 73 percent of the payments still missed, another 0.70 percentage points. Cosigned loans end up defaulting at 0.26 percent, less than solo loans.

The model can then change pricing, one step at a time, with each economy in general equilibrium. Pricing the cosigned pool separately, based solely on repayment probability without considering the guarantee, lets cosigning collapse. The cosigning pool is riskier, charged a higher interest rate, which drives out the safer children. Relative to today, cosigning shrinks and homeownership falls by 0.7 percentage points. When cosigned loans are priced on pool quality and guarantee, their interest rate drops 37 basis points below the solo rate, more than today's pool would earn, because safer children return and improve the pool. Cosigning triples to about 17% of buyers, the share Canada and Norway record today, and homeownership rises 1.3 percentage points from that trough, past today's level. Foreclosures remain unchanged. Pricing correctly eases a constraint on access to homeownership through cosigning.

Correct pricing doubles the welfare gains to a child in comparison to a world without cosigning. Children from the lower half of the income distribution gain most, because of the access gain for incomes where solo borrowing is out of reach. The overpayment is a transfer and the resulting loss in access is the welfare loss. If lenders could price children by type, the gain would be smaller: one price insures the risky child. Pricing the pool's risk without the guarantee lowers welfare. The promise and the pool should be priced to deliver the full potential of the parents' promise.

**Related Literature** Screening on collateral (Bester, 1985; Stroebel, 2016; Ioannidou et al., 2022), rationing credit (Stiglitz and Weiss, 1981), or reading a signal the borrower sends (Spence, 1973; Bisin and Gottardi, 1999) are ways for a lender to deal with asymmetric information. Empirical work on insurance (Einav et al., 2010b; Einav and Finkelstein, 2011) and on consumer and mortgage credit (Karlan and Zinman, 2009; Adams et al., 2009; Einav et al., 2012; Garmaise, 2015) assumes one informed party, the borrower, and tests for it with the positive correlation of Chiappori and

Salanié (2000), conditioning on the econometrician's observables. An informed third party changes what the lender can learn.

An informed third party can be different entities. It can be mutually liable borrowers (Besley and Coate, 1995; Ghatak, 1999, 2000) or one-sided liable borrowers (Gangopadhyay and Lensink, 2014). As Bond and Rai (2008) ask, it is not ex ante clear which contract a lender would prefer. In Thakor (1982) a debt insurer investigates the borrower and its premium reveals the risk to the lender while in Shan et al. (2025) banks outsource screening to guarantors who investigate more cheaply. In each case the guarantor is self-interested and unrelated, but this is not the case for a parent. Their knowledge reaches the lender only through who signs but is, by regulatory standards, not included for pricing. Often, guarantees do not directly affect prices. Personal guarantees ease Italian firms' access to credit but leave their rates unchanged (Calcagnini et al., 2014). That evidence does not model the guarantee. The closest model of family money, Lee and Persson (2016), has an altruistic family investor, not a guarantor. Garcia-Villegas (2026) prices a government guarantee under private information between originators and investors.

Parents have two major ways to help their children into homeownership. Cash transfers that allow for earlier homeownership and easier access to mortgages (Engelhardt and Mayer, 1998; Guiso and Jappelli, 2002; Blickle and Brown, 2019; Halvorsen and Lindquist, 2017; Lee et al., 2020). Brandsaas (2025) and Benetton et al. (2022) put numbers on the "bank of mom and dad". The family can also function as an insurer (Kotlikoff and Spivak, 1981; Kaplan, 2012; Boar, 2021). Cosigning is neither insurance nor a cash transfer but a contingent claim. Allen et al. (2026) are the closest measurement. In Canadian loan-level data they find marginal first-time buyers relying increasingly on parental cosigning, which in Canada relaxes the down-payment requirement; about three quarters of them would not qualify alone, yet pay about the same rate. I contribute to this literature by providing the first U.S. measurement of intergenerational cosigning.

The policy experiment borrows from the macroprudential literature. Jeske et al. (2013); Elenev et al. (2016) study a governmental mortgage guarantee and show it lowers interest rates and raises household debt. Winners and losers of such a scheme fall on different households as Gete and Zecchetto (2018) demonstrates. Here, the guarantee comes from the family. Hurst et al. (2016) show that the current pricing rules in the U.S. blind to regional default risk, redistribute across regions. Here, the pricing rule is blind to the family guarantee. The model's construction technology comes from Castellanos et al. (2024). They find that Ireland's 2015 loan caps cut homeownership among the young and the middle-income.

Section 2 describes the institutional setting, compares it internationally, and gives a definition of cosigning. Section 3 models the parent as an informed, altruistic guarantor and derives the two selection forces. Section 4 documents parental cosigning, and Section 5 tests the theory on the 2022 fee shock. Sections 6 and 7 build and estimate the quantitative model, which sizes the two forces. Section 8 prices the cosigned loan by the different aspects of cosigning, each in general equilibrium, and asks who gains and loses.

## 2 Institutional Setting

**Conforming Eligibility.** Whether a mortgage is eligible for purchase by the Government-Sponsored Enterprises (GSE) determines both its cost of credit and the underwriting standards applied to the borrower (Frame and White, 2005; Vickery and Wright, 2013). Eligibility depends on loan size: balances at or below the Conforming Loan Limit (CLL) are "conforming" and carry the implicit government guarantee that makes them liquid and cheap (Adelino et al., 2016). Conventional conforming loans are 65% of first-lien originations on principal residences in 2023, and between 65 and 75% in every year since 2018 (Consumer Financial Protection Bureau, 2024, Tables 1A–1D).

**Cosigning: Definition and Legal Structure.** Under GSE guidelines, a cosigner (typically a parent) is a non-occupant co-borrower. The third person who cosigns the mortgage note assumes full joint liability for the debt without occupying the property (Fannie Mae, 2020). The cosigner is jointly liable from the first missed payment. The lender does not have to pursue the child first, so the parent can cover a missed payment before it becomes a delinquency. The cosigner pledges no additional property.

**The Three Rules and the Cosigner.** A conforming borrower must clear three constraints at once, and failing any one means rejection or a more expensive non-conforming product; Table 1 states them with the Selling Guide topic each comes from. A cosigner relaxes one, leaves one untouched, and tightens one. Admission pools the family: qualifying income includes every borrower who signs, and Desktop Underwriter computes the debt-to-income ratio on the combined income and liabilities of child and cosigner (Fannie Mae, 2020), so a cosigner admits a child who could not qualify alone. Pricing discards the family: both enterprises take the lowest credit score across borrowers as the file's score and assess the upfront fee grid on it (Fannie Mae, 2026b; Freddie Mac, 2025), so a high-score parent buys no lower rate whenever the child's score is the lower, and the grid, indexed by score and leverage only, cannot read the income that admission turns on. The grid dates from March 2008, when the agencies repriced credit risk months before their rescue (Federal Housing Finance Agency, 2010; Frame et al., 2015). The deposit tightens: the non-occupant overlay caps the loan-to-value ratio at 95% (90% on a manual file) against 97% for a first-time solo purchase (Fannie Mae, 2025a), and no asset test reaches the cosigner, so the down payment stays the child's. Online Appendix OA4.9 gives the manual-track ceiling and the mid-sample loosening of the eligibility floor.

**The U.S. Rule in Comparative Perspective.** Table 2 compares U.S. cosigning to eight other countries. Two schemes are comparable to U.S. cosigning: the United Kingdom's joint borrower sole proprietor mortgage and Norway's *medlåntaker*. Each pools the parent's income for admission but leaves the price unchanged. Canada's co-borrowing also pools income for admission, but its national mortgage insurance charges a premium by loan-to-value ratio alone, so neither borrower's credit score sets the price. Norway's *realkausjon* lets the loan exceed the loan-to-value cap, allowing more

TABLE 1. The three conforming underwriting constraints

| Constraint | Threshold | Guide topic | Effect of a cosigner |
|---|---|---|---|
| Debt-to-income | 36% manual; 45% with the Eligibility Matrix profile; 50% under DU | B3-6-02 | **Relaxed.** Assessed on joint income; the occupant-only 43% ceiling is manual-track only |
| Credit score | 620 floor, fixed-rate; also the LLPA pricing axis | B3-5.1-01, B3-5.1-02 | **Not relaxed.** Priced on the *lowest* score across borrowers |
| Loan-to-value | 97% with mortgage insurance for a first-time buyer | B2-1.3-01, B2-2-04 | **Tightened.** Capped at 95% (90% manual) on non-occupant transactions |

*Notes:* Sources: Fannie Mae Selling Guide, topics in the third column: Fannie Mae (2025b), Fannie Mae (2026a), Fannie Mae (2026b), Fannie Mae (2025a) and Fannie Mae (2020), which give the quoted rules and the date each topic was last revised. "Manual": a file underwritten by a person rather than by Desktop Underwriter (DU). Loan-Level Price Adjustments (LLPAs) are the upfront fees the enterprises assess on a grid indexed by credit score and loan-to-value ratio.

leverage. Australia's guarantor loan avoids lenders' mortgage insurance, so the family's guarantee lowers the price. In Italy, Portugal, Spain and Finland the state, not the family, guarantees part of the loan, so the buyer can put down less.

## 3 Admitted on the Family, Priced on the Worse Borrower

This section models a rule that admits on the family but prices on the worse borrower. Cosigning grants two benefits to a borrower, access to credit that the borrower could not get herself, and insurance as the parent pays if the borrower cannot. Two selection forces determine the riskiness of the pool. The family knows what cosigning is worth to the child, and, at the same income, a riskier child gains more from the guarantee than a safe child. Altruism makes the pool that receives offers riskier. At the same time, a riskier child comes with larger financial liability for the parent, which makes the pool that receives offers safer.

Screening dominates in the cosigned pool as long as both types choose to accept a cosigning offer. Both types accept at low incomes, where cosigning buys more house than the child could get alone. Where good types prefer to go solo, only bad types remain and the cosigned pool is adversely selected. Good types go solo at higher incomes, where the child can get as much housing alone, so only the insurance is left, and the safe type values it little.

### 3.1 Environment and the Two Admission Tests

Households are a continuous set of young borrowers (the child) and their parent $p$. The borrower has income $y$, observed by all, and a hidden risk type $\theta \in \{G, B\}$ with repayment probability $\pi_\theta$ where $\pi_G > \pi_B$ and the gap $\Delta\pi \equiv \pi_G - \pi_B$. The probability of being a good type rises with income, $\Pr(\theta = G \mid y) = \lambda(y)$. Therefore, richer borrowers are, on average, safer. The parent knows $\theta$, has income $y_p$, and chooses whether to guarantee, $o \in \{0, 1\}$. The borrower then takes a menu

TABLE 2. Family-guarantee mortgages in the United States and eight peer markets

| Country | Share | Primary mechanism | Margin the guarantee reaches | Source |
|---|---|---|---|---|
| United States | 2.8–5.8% | Private (cosigning) | *Admission only: income pooled, priced on the lowest score* | This paper |
| Canada | 17% | Private (co-borrowing) | Admission: income pooled; national insurance priced on LTV, not on the borrower's score | Government of Canada (2024) |
| Norway | 18.5%[§] | Private (*medlåntaker*) | *Admission only: income pooled* | Finanstilsynet (2021) |
| Norway | 13.4%[§] | Private (*realkausjon*) | Deposit: the pledge counts toward the loan-to-value cap | Finanstilsynet (2021) |
| Australia | 10% | Private (guarantor) | Price and deposit: the pledge avoids mortgage insurance | Aussie Home Loans (2026) |
| United Kingdom | 7%[‡] | Private (JBSP) | *Admission only: income pooled* | Accord Mortgages (2026) |
| Italy | 20% | Public (*Consap* fund) | Guarantees the tranche above 80% LTV | Finizio (2026) |
| Portugal | 24% | Public + parental (*fiadores*) | State-backed; enables 100% financing | The Portugal Post (2026) |
| Spain | 15%[†] | Public (ICO *aval*) | Guarantees up to 20% of the price | López (2025) |
| Finland | 19%[*] | Public (ASP system) | Collateral substitution / state guarantee | State Treasury of Finland (2026) |

*Notes:* Share of first-time-buyer purchases backed by a family or public guarantee, recent-period averages. Definitions and sources are not harmonized across countries, so the shares are orders of magnitude rather than comparable statistics.

$k \in \{so, co\}$, cosigning only being an option if $o = 1$. The model is static where at the beginning of the period decisions are made and default is realized at the end. A loan has to clear two tests. The first is the debt-to-income constraint, which caps the payment at a maximum ratio $\overline{\text{dti}}$ of qualifying income $Y_k$,

$$(1 + r_k) \cdot L \;\leq\; \overline{\text{dti}}\, Y_k, \qquad Y_{so} = y, \quad Y_{co} = y + y_p. \tag{1}$$

The second is the loan-to-value test. The loan cannot exceed a fixed share of the price of the house, and the borrower pays the rest, the deposit, out of an endowment $a \sim F_a$ drawn by nature. The endowment pays the deposit and nothing else. A cosigner adds income to the first test but nothing to the loan-to-value test, whose cap is slightly tighter for cosigned loans (Table 1). The remainder of this section focuses on borrowers who pass the loan-to-value test. Proposition 4 in Appendix B.1.1 shows that no interest rate, however low, admits a borrower who fails it.

Lenders are risk neutral and price on the lowest income, as set by the regulator (Section 2). They see $y$, $y_p$ and $o$. The score is implied by the income, and the rule forms its prior on the lowest income $y_{\min} = \min\{y, y_p\}$, $\lambda(y_{\min})$. The parent has perfect commitment and pays whatever her

income allows. A loan is priced on the lowest income on its file, $y_{\min}$. On a solo loan the file holds only the child's income, so $y_{\min} = y$. The rate is break-even on all loans to borrowers with that income,

$$1 + r_k(y_{\min}) = \frac{1}{\bar{\pi}(y_{\min})}, \qquad \bar{\pi}(y_{\min}) \equiv \pi_B + \Delta\pi\, \lambda(y_{\min}), \tag{2}$$

where $\bar{\pi}(y_{\min})$ is the repayment probability of all borrowers with income $y_{\min}$. A solo loan thus pays $r_{so}(y)$ and a cosigned loan $r_{co}(y_{\min})$. A parent whose file is at least as good as the child's leaves the rate where it is. A parent with the worse file moves the loan to her score, and the family pays the score penalty $S(y, y_p) \equiv r_{co}(y_{\min}) - r_{so}(y) > 0$, although the default hazard is still the child's. Because default is a type hazard, the repayment rate of all borrowers at $y$ is the prior average $\bar{\pi}(y)$, whatever parents offer and however children sort. The interest rate, however, is determined only on income.

The borrower consumes two goods, non-durable consumption $c$ and housing services $h$. Let the utility function be of CRRA type and bounded with $\sigma > 1$. Parents have the same functional form in utility but with already fixed housing, so only non-durable consumption varies. The loan a borrower of income $y$ asks for, her desired loan $L^d(y)$, is a given schedule, the stand-in for the housing demand of the lifecycle model. Housing is a necessity, so the share of income its payment takes falls with income (Appendix B.1.3). Housing services are proportional to the loan, $h_k = \alpha L_k$ for a constant $\alpha > 0$, and each menu lends the lower of the desired loan and its cap. I assume that the combined income is enough to pass the income test, so the cosigned loan is capped by the loan-to-value test alone, at $L^*$. The child chooses only the menu. A type-$\theta$ borrower with an offer solves

$$\begin{aligned} \max_{k \in \{so, co\}} \; & V_k = \pi_\theta\, u(c_k, h_k) + (1 - \pi_\theta)\, \underline{u}_k - \phi_k \\ \text{s.t. } & c_k = y - (1 + r_k) L_k, \qquad h_k = \alpha L_k, \qquad L_k = \min\{L^d(y),\, \bar{L}_k\}, \end{aligned} \tag{3}$$

where $\bar{L}_{co} = L^*$ and $\bar{L}_{so}$ is the lower of the income-test cap and her own loan-to-value cap, above $L^*$ (Table 1). Both contracts are characterised by limited liability by the child. A defaulting borrower loses the home to foreclosure when borrowing solo and rents the floor $h_r$, below any house bought. The cosigned borrower is allowed to keep the home and the parent pays. Defining $\underline{u}_{so}$ and $\underline{u}_{co}$ as the two default payoffs (Appendix B.1.1), the default state is better under cosigning: $\Delta\underline{u}(y) \equiv \underline{u}_{co} - \underline{u}_{so} > 0$, where default is exogenously determined by type only. The cost of signing with the parent, $\phi_{so} = 0$ and $\phi_{co} = \phi > 0$, is the same in both states and for both types. There is no savings margin. She cosigns if and only if the gain from cosigning is non-negative.

This gain can be split into the two states,

$$\Delta V(y, \theta;\, r_{co}, r_{so}) \equiv V_{co} - V_{so} = \pi_\theta\, \Gamma(y;\, r_{co}, r_{so}) + (1 - \pi_\theta)\, \Delta\underline{u}(y) - \phi, \tag{4}$$

where $\Gamma \equiv u(c_{co}, h_{co}) - u(c_{so}, h_{so})$. The first term, $\Gamma$, is the benefit from cosigning under repayment. Whether this is net positive depends on the income of the child. As housing is a necessity, the share of income the desired payment takes falls with income and the income test binds below the income

$\hat{y}$ but not above (Appendix B.1.4). As households are constrained below it, cosigning buys housing and helps to achieve the desired consumption bundle. It eases a key friction of the model. From $\hat{y}$ on, the income test is not imposing a constraint and the utility terms for both options are the same. Once a borrower reaches the cap on cosigned mortgages, the housing term becomes smaller for cosigned mortgages and the sign flips to negative. A parent with a lower income than the child makes $\Gamma$ lower for cosigned borrowers regardless of the income. This effect is more pronounced for unconstrained children as they can borrow at least the same house alone. The second term, $\Delta\underline{u}$, is the insurance: the gain if she defaults. Given that all borrowers have some probability of default, this term is always positive, however, larger for the risky types. How the insurance moves with income is not obvious. Once cosigned housing is capped, the value of the guarantee is not increasing with income anymore. Below the cap it also falls, because the house grows slowly enough with income that the extra house adds less utility than the extra income takes away from the value of any house ((A1), Appendix B.1.3). The last term, the disutility of cosigning, is independent of type and income.

**Lemma 1** (A Riskier Child Gains More)**.** *Under (A1) of Appendix B.1.3, the gain from cosigning is larger for a bad type. This holds at every income and for any pair of rates,*

$$\Delta V(y, B) - \Delta V(y, G) = \Delta\pi \left(\Delta\underline{u} - \Gamma\right) > 0. \tag{5}$$

The equation follows from (4), where the cost of signing cancels. Online Appendix OA2 (p. 10) gives the proof for this result. Intuitively, cosigning turns default from the worst state into the best one: a solo borrower who defaults loses her house, while a cosigned borrower keeps it and stops paying. Cosigning is therefore worth more in default than in repayment, and the bad type, who defaults more often, gains more. If the parent has the lower income, the higher interest rate lowers the child's consumption in repayment but leaves the default state unchanged, which widens the gap between the bad and the good type.

Overall, there are two key margins of heterogeneity on the children's side that co-determine the selection into cosigning: income and type. Low income makes the borrower appreciate cosigning more, as the gains in terms of utility are large. High-income borrowers also pay the disutility, but the value of the guarantee to them is relatively little, so they, on average, prefer cosigning less. A riskier type appreciates cosigning more for the insurance motive regardless of income (Lemma 1).

### 3.2 The Fair Price and the Wedge

**The Parent's Cover.** When the child defaults, the parent pays the missed payment. If her income covers the payment on top of a minimum level of consumption, she pays the full amount. If not, she pays a fraction $\bar{p}(y_p) < 1$ and the lender misses out on the rest. Let the income at which she first covers the whole payment be the saturation income (Appendix B.1.1). Whatever the cover, it never enters the price, which is the source of the overpayment in Proposition 1.

**Pool Quality and Profits.** The repayment probability of the pool on menu $k$ is $\mu_k(y) = \pi_B + \Delta\pi \Pr(\theta = G \mid y, k)$, following Bayes' rule. It depends only on the child's repayment probability, not the guarantee. The cosigned pool depends on two margins, offers made and offers accepted, and through them on both incomes, $\mu_{co}(y, y_p)$. A loan earns a profit if and only if the lender is paid more often than the rule assumes: $\mu_{so}(y) > \bar{\pi}(y_{\min})$ on a solo loan, $\mu_{co}(y, y_p) + (1 - \mu_{co}(y, y_p))\bar{p}(y_p) > \bar{\pi}(y_{\min})$ on a cosigned one. Because the rule prices on the average child at each income, it breaks even only on that average, not menu by menu. The parent's cover and the possible score penalty are rent on top (profits by menu in Appendix B.1.2).

**The Fair Rate and the Wedge.** The rate at which a cosigned loan breaks even, $\Pi_{co} = 0$ in (B.14), is the fair cosigned interest rate

$$1 + \tilde{r}_{co}(y, y_p) \;=\; \frac{1}{\mu_{co}(y, y_p) + \big(1 - \mu_{co}(y, y_p)\big)\bar{p}(y_p)}. \tag{6}$$

Let the wedge between the two interest rates be defined as

$$W(y, y_p) \;\equiv\; r_{co}(y_{\min}) - \tilde{r}_{co}(y, y_p) \;=\; S(y, y_p) + \big[r_{so}(y) - \tilde{r}_{co}(y, y_p)\big], \tag{7}$$

which is what the family overpays, in two parts: the score penalty, where the rule reads the parent as a borrower, and the unpriced cover, where it never reads her as a guarantor (closed form (B.15) in Appendix B.1.2).

**Proposition 1** (The Unpriced Guarantee)**.** *Suppose cosigning and solo borrowing are taken at $(y, y_p)$. Under the pricing rule* (2)*, a cosigned loan is overcharged, $W(y, y_p) > 0$, if and only if*

$$\bar{p}(y_p) \;>\; \bar{p}_g(y, y_p) \;\equiv\; \frac{\bar{\pi}(y_{\min}) - \mu_{co}(y, y_p)}{1 - \mu_{co}(y, y_p)}, \tag{8}$$

*a threshold below one, and below zero, so that every cover overpays, where $\bar{\pi}(y_{\min}) < \mu_{co}(y, y_p)$: where the pool is safer than the average child at $y$, or where the parent's file is worse enough. $W$ is strictly increasing in the parental coverage and weakly decreasing in the default risk $1 - \mu_{co}$ at every $(y, y_p)$. In $y_p$ it is strictly increasing where the parent's file is at least the child's; where it is the worse one, a higher $y_p$ lowers the score penalty and raises the unpriced cover, and $W$ can move either way.*

The cosigning status of an application, $o$, reveals the pool's composition, and $y_p$ the quality of the guarantee. Let $\bar{d}(x) = 1 - \bar{\pi}(x)$ be the default rate that the rule prices at income $x$, and $d_{co} = 1 - \mu_{co}(y, y_p)$ the default rate of the cosigned pool. Condition (8) then says that the family overpays if and only if $[\bar{d}(y) - d_{co}] + [\bar{d}(y_{\min}) - \bar{d}(y)] + \bar{p}(y_p)\, d_{co} > 0$. Economically, this means that the performance of cosigned loans, having considered all factors, is better than the price implies. The first term is the pool, the second the score penalty, and the third the cover. Only the pool term can take either sign, as Section 3.3 shows. The other two terms never lower the overpayment.

If the parent brings a lower score, the lender charges a higher interest rate for a de facto safer loan, and the overpayment is positive. The sign of the guarantee itself is positive as long as the parent pays something. The families whose guarantee protects the lender most overpay the most. The family overpays for sure if the pool is safer than assumed. However, the family still overpays for a riskier pool if the cover outweighs the excess default introduced by self-selection into cosigning, $\bar{p} > \bar{p}_g = 1 - \bar{d}(y_{\min})/d_{co}$.

### 3.3 The Parental Screen

**The Parent's Offer.** The parent moves first and decides whether to offer to cosign. She offers if the altruistic gain exceeds the expected liability. There is a taste shock $\eta_p \sim F_\eta$ with full support on $\mathbb{R}$, so every parent offers with a probability strictly between zero and one. The probability that a parent of a type-$\theta$ child offers, the *offer propensity*, is

$$q_\theta(y, y_p) = \Pr\big[\, \beta\, \Delta V\big(y, \theta;\, r_{co}(y_{\min}), r_{so}(y)\big) - (1 - \pi_\theta)\, \Delta u_p(y_p) \;\geq\; \eta_p \,\big], \tag{9}$$

where $\beta$ is the altruism weight on the child's gain $\Delta V(y, \theta;\, r_{co}(y_{\min}), r_{so}(y))$ from cosigning. A parent with a lower income than the child raises the cosigned rate, which lowers this gain. The second term, $\Delta u_p \equiv u(y_p) - u(y_p - \bar{p}(y_p)\, m) > 0$, is the cost of covering $\bar{p}(y_p)\, m$ in default, with $m \equiv (1 + r_{co}(y_{\min}))L_{co}$ the payment due on the cosigned loan, higher where the parent has the lower income, and $\bar{p}(y_p)$ the share the parent can cover. Write $I_\theta$ for the term inside the brackets, the offer index, so that $q_\theta = F_\eta(I_\theta)$.

**Two Forces.** Two forces separate the offers the two types receive, one in each term of (9). The first is the child's need, $\Delta V$. A riskier child gains more from cosigning (Lemma 1) because she reaches the default state more often where the insurance part of cosigning is worth most. The second force is the parent's liability, $(1 - \pi_\theta)\, \Delta u_p$. A riskier child makes default more likely, increasing the chance that the parent has to step up and pay. The liability favors the good type's offer, and the need, weighted by altruism, favors the bad type's. If the parent has a worse income than the child, she will offer less, regardless of the type of the child. Two reasons stand behind this: first, the penalty on pricing lowers the expected gain; secondly, it also increases the payment on the mortgage, which drives up the liability.

**When Offers Screen.** A riskier child changes the parent's decision in two ways. A bad type defaults more implying more expected liability and, in turn, she expects to give up more consumption to cover. Each extra default also moves the child into the state where cosigning is worth most to her, a gain of $\Delta\underline{u} - \Gamma$ (Lemma 1), which the parent values at $\beta(\Delta\underline{u} - \Gamma)$. A parent will offer less to a risky child if the additional cost from liability outweighs the gains from altruism. Assumption 1 requires this at every pair of incomes.

**Assumption 1** (Marginal Cost Dominance)**.** *For all* $(y, y_p)$*, the parent's liability outweighs the child's need,*

$$\Delta u_p > \beta\,(\Delta \underline{u} - \Gamma). \tag{10}$$

**Lemma 2** (Informative Participation)**.** *Under Assumption 1, parents of good types are strictly more likely to offer than parents of bad types,* $q_G(y, y_p) > q_B(y, y_p)$ *for all* $(y, y_p)$*. Hence* $o = 1$ *is good news about the child.*

The taste shock keeps the screen imperfect, $q_B > 0$. Corollary 2 shows that if a parent is rich enough that the payment barely hurts her, the offer turns into bad news. Assumption 1 rules this out. A parent with a lower income than the child also works against the screen. The interest rate penalty lowers the child's consumption in repayment only, which raises the extra gain of a bad type. It also raises the payment, but that raises the parent's cost only if she can cover the payment in full. If the parent cannot pay without the extra interest rate penalty there is no increased liability with higher interest rate as she already pays all she can. As a result, only the first effect remains and the conditions are even harder to meet.

**What an Offer Tells the Lender.** Under Lemma 2, an offer is informative. An offer tells the lender that the child is more likely a good type, because parents are more likely to offer for good types ((B.12) in Appendix B.1.1). Conditional on $y$ and $o = 1$, the share of good types, $\Lambda_1(y)$, is higher than the share of good types at $y$ only. Therefore, the average child with an offer has a higher repayment probability. The lender sees cosigned loans, not offers. Where good types turn their offer down, the cosigned pool is worse than the pool of children with an offer (Section 3.4).

**Parental Income.** Parental income also changes the information an offer contains, $\Lambda_1(y, y_p) \equiv \Pr(\theta = G \mid y, y_p, o = 1)$. Where the parent's file is at least the child's, only the liability term in (9) depends on $y_p$. As long as paying is sufficiently expensive, below the saturation income, a marginally richer parent has to put any resources in paying the guarantee. By switching from a child of good type to one of bad type, the cost increase in income but consumption stays the same. A bad child also calls the guarantee with high probability. The screen can strengthen. Once paying is cheap and the parent is above the saturation income, the cost of cosigning does not increase in parental income anymore. By the concavity of the utility function a richer parent feels the cost of providing the guarantee less. As a result, $\Delta u_p$ falls and an offer from a richer parent says less about the child (Proposition 5(i) in Appendix B.1). Where the parent has the lower income, a richer parent also shrinks the score penalty that works against the screen. Below saturation this adds to the effect of the larger cover; above it, it works against the falling cost of paying. The interest rate does not represent this.

### 3.4 Equilibrium

**Equilibrium at the Offered Interest Rate.** Under the pricing rule (2), interest rates depend only on income. The equilibrium is the parents' offers (9) and the borrowers' choice of accepting

at those rates. The repayment probability of the average loan $\mu_k(y)$ is the loan performance after accounting for children's and parents' behaviour. It is a hypothetical object to determine the fair rate (6).

The borrower's menu choice is the model's incentive-compatibility constraint. A type-$\theta$ borrower with an offer cosigns if and only if $\Delta V(y, \theta; r_{co}(y_{\min}), r_{so}(y)) \geq 0$. Unlike in a standard screening model, the lender does not design the menus to separate the types as the pricing rule does not allow this. As in a screening model, borrowers sort themselves. Let $\tilde{y}_\theta(y_p)$ be the income at which a type-$\theta$ borrower with a parent of income $y_p$ is indifferent. Where the income of the parent is at or above the child's income, the two rates coincide, so the cutoff is the same for every such parent, $\tilde{y}_\theta$.

**Three Regions.** Lemma 1 orders the two cutoffs: where the good type is indifferent, the bad type still gains strictly, so $\tilde{y}_G(y_p) < \tilde{y}_B(y_p)$ at every $y_p$.

**Proposition 2** (Three Regions under the Pricing Rule)**.** *Suppose Assumption 1 and the regularity conditions (A1)–(A4) of Appendix B.1.3 hold, and both menus pay the posted rates* (2)*. Then there is a unique equilibrium. For every parental income $y_p$ there are cutoffs $\tilde{y}_G(y_p) < \tilde{y}_B(y_p) < \infty$ and three regions:*

*(i) Region 1 ($y < \tilde{y}_G(y_p)$): both types cosign when offered. The cosigned pool is the offered pool, $\mu_{co}(y, y_p) = \bar{\pi}_1(y, y_p) \equiv \pi_B + \Delta\pi\, \Lambda_1(y, y_p) > \bar{\pi}(y)$.*

*(ii) Region 2 ($\tilde{y}_G(y_p) \leq y < \tilde{y}_B(y_p)$): only bad types cosign, $\mu_{co}(y, y_p) = \pi_B$. The region is never empty.*

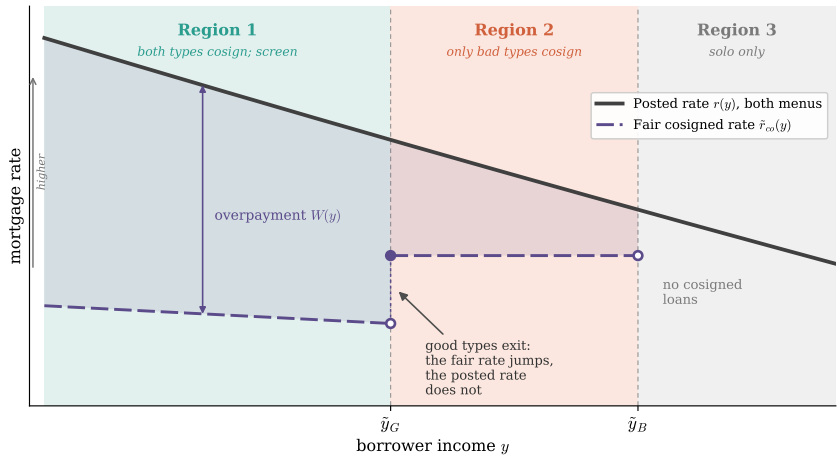
*(iii) Region 3 ($y \geq \tilde{y}_B(y_p)$): nobody cosigns.*

*A parent whose file is at least the child's at the cutoff leaves it where it is, $\tilde{y}_\theta(y_p) = \tilde{y}_\theta$ for $y_p \geq \tilde{y}_\theta$; a parent with the worse file brings it forward, to an income between her own and $\tilde{y}_\theta$, and the more so the worse her file.*

The regions follow the trade-off outlined in Section 3.1. When regulation constrains the borrower, cosigning allows her to buy the desired house size and a larger house than in the solo case. The insurance part of cosigning allows her to keep the house. At low incomes, these two factors make cosigning beneficial for either type and both types accept.

Good types benefit from the gain in housing, and bad types benefit additionally from the insurance. Since both types accept, the parent's decision to offer decides the pool's quality. By Lemma 2, the screen favours good types, so the pool is safer than the prior. With higher income, the gain in housing utility from cosigning declines and $\hat{y}$ marks where the gain disappears. Good and bad types still have to pay the disutility of cosigning. Given the equal costs but unequal gains, good types leave the cosigning pool at higher incomes than bad types. They stay for the insurance, and subsequently, the pool turns worse than the prior. In this middle region, the cosigned pool is adversely selected. Where the middle region reaches past $\hat{y}$, the guarantee buys no house, and

FIGURE 1. Mechanism under the pricing rule (schematic)




Both menus pay the posted rate $r(y)$ of (2), as they do where the parent's file is at least the child's, which the figure assumes. The fair cosigned rate $\tilde{r}_{co}(y)$ of (6) breaks even once the parent's coverage is counted; the shaded gap is the overpayment $W(y)$ of Proposition 1. The regions are those of Proposition 2.

whoever cosigns there does so for the guarantee alone. At high incomes, cosigning becomes less attractive as the constant utility payment stings more, the cap on house size binds, and the parental income is more likely to increase interest rates. Insurance and gains in house size, on the other hand, are relatively little. Cosigning becomes more scarce where parental income is lower than the main borrower's income, which is where the pricing rule actively uses the parent. The proof is in Online Appendix OA2.

**Overpayment by Region.** Figure 1 illustrates the schedule. Interest rates fall with the child's income on the solo menu, and on the cosigned menu until the child outearns the parent, from where the cosigned rate stays at the parent's score. In Region 1 the screen sets the pool, which is safer than the pricing rule assumes, $\mu_{co} = \bar{\pi}_1 > \bar{\pi}(y_{\min})$. Hence cosigned loans are overcharged even if the parent covered nothing. As good borrowers exit, the break-even rate for cosigned borrowers surges, as the pool now consists only of bad types. The posted rate does not move, but the lender's loss does. In Region 2, where $\mu_{co} = \pi_B$, a family overpays only when the parent covers enough, $\bar{p}(y_p) > \bar{p}_g(y, y_p) = \Delta\pi\, \lambda(y_{\min})/(1 - \pi_B)$, a lower bar where the parent has the worse file (Proposition 1).[1]

### 3.5 Pass-through: Equal on Rates, Different on Admission

After a rise $dK$ in the lender's cost of a dollar lent, the model predicts that cosigned and solo rates move by the same amount where the parent's file is at least the child's, and that cosigned rejections move less whatever the file. Section 5 tests this on the 2022 fee change. A common shock reaches borrowers in two ways: through the interest rate and through admission.

[1] In the extension of Remark 1, the posted rate jumps as well, to $r_{co}^{sep} = 1/\pi_B - 1$, at the exit (Proposition OA1, Online Appendix OA1).

**Rates.** As the interest rate is determined by the pricing rule, which reads the lowest income on the file, the lender recovers the extra cost from the borrowers who repay, and each rate moves by

$$dr_k = \frac{dK}{\bar{\pi}(y_{\min})}, \tag{11}$$

regardless of pool quality. Where the parent's file is at least the child's, the two rates move by the same amount. Where it is the worse one, the cosigned rate moves more, by $S(y, y_p)\, dK$, the score penalty times the shock (Online Appendix OA5.1 writes the fee into the rule and maps the 2022 fee change into the rate).

**Admission.** An application for a loan $L$, with debt-to-income ratio $DTI_k = (1 + r_k)L/Y_k$, is rejected with probability $H_k(DTI_k)$, which is increasing and is differentiable. The lender also anticipates the guarantee. At the same ratio, a cosigned file is rejected less, because the underwriter nets the parent's strength off the ratio,

$$H_k(d) = H\big(d - \tau_k\, \gamma(y_p)\big), \qquad \tau_{so} = 0 < \tau_{co} \equiv \tau, \tag{12}$$

where $\gamma(y_p) \geq 0$ increases with the parent's income and $\tau$ is the weight the underwriter puts on it (Section 2). The sharp cap of Section 2, which rejects every file above a fixed ratio, is the limit in which $H$ jumps from zero to one.

**Why Cosigned Rejections Move Less.** Higher costs lead to higher interest rates, which in turn lead to higher payments for borrowers. This shifts the debt-to-income ratio

$$dDTI_k = \frac{L}{Y_k}\, dr_k = DTI_k\, dK \;\equiv\; \sigma_k\, dK, \tag{13}$$

where $\sigma_k = DTI_k$ is the borrower-level DTI sensitivity. The shock raises every ratio by the same proportion, on both menus and whatever the parent's file, because the rate and the shock are scaled by the same repayment probability. A cosigned ratio rises less only if it is lower to begin with, which the parent's income in the denominator ensures for a given loan. Rejections respond through the slope of the rejection probability at each application's ratio,

$$\beta^k_{rej} \equiv \frac{\partial p_k}{\partial K} = \mathbb{E}^k\big[H'_k(DTI_k)\, \sigma_k\big] = \mathbb{E}^k\big[H'_k(DTI_k)\, DTI_k\big], \tag{14}$$

where $p_k$ is the rejection rate on menu $k$. Cosigned rejections can therefore respond less through two channels: a lower cosigned ratio, or a lenient underwriter, $\tau > 0$.

**Proposition 3** (Equal Rates, Smaller Rejection Response)**.** *Under the pricing rule* (2)*, a cost shock raises every ratio by the same proportion, on both menus and whatever the parent's file; it moves cosigned and solo rates by the same amount where the parent's file is at least the child's. Let $H$ be increasing and strictly convex on the range of effective ratios, and $\gamma(y_p) > 0$. Then:*

*(i) Without leniency, $\tau = 0$, cosigned rejections respond weakly less, $\beta^{co}_{rej} \leq \beta^{so}_{rej}$, if cosigned ratios are first-order stochastically lower than solo ratios, and weakly more if they are higher.*

*(ii) $\beta^{co}_{rej}$ is strictly decreasing in $\tau$. If cosigned ratios are higher, cosigned rejections respond less if and only if $\tau$ exceeds a threshold $\tau^* \geq 0$, which is finite if $H'(d) \to 0$ as $d$ falls below the cap.*

In the model, both channels point in the same direction. A solo borrower at the limit of the income test sits at the cap, and the parent's income pulls the cosigned ratio below it, so part (i) already delivers the prediction and leniency adds to it. In the data, however, cosigned applications concentrate at and above the cap on their raw ratios (Online Appendix OA5.9), so part (ii) applies and the prediction requires leniency.[2]

# 4 Data

## 4.1 HMDA Loan Application Register

The main dataset is the Home Mortgage Disclosure Act (HMDA) Loan Application Register (LAR) for the years 2018–2024. The LAR covers the near-universe of residential mortgage applications filed with U.S. lenders. It records loan-level information on applicant demographics, loan terms, property value, lender entity, location, and application outcome. I combined this with lender information from HMDA and county-level house prices indices from the Federal Housing Finance Agency (FHFA).

**Sample.** I restrict the sample to conventional, fixed-rate, first-lien, purchase-money mortgages on owner-occupied, single-unit properties, filed by a primary applicant under age 45. The result of the application must be known, and one of the following outcomes: originated, denied, or pre-approval denied. I apply standard quality filters, as described in detail in Online Appendix OA4.1. Online Appendix Table OA1 shows how much data is dropped for every filter. Since HMDA lacks a first-time-buyer flag, buyer age below 45 substitutes for the first-time margin.

**Outcome variables.** There are two main outcome variables: the application rejection decision and the interest rate. The application rejection decision is an indicator variable equal to one if a pre-approval was denied or the full application was rejected, and zero if the application was approved. The interest rate is taken from the HMDA as reported.

**Intergenerational cosigning indicator.** I define a cosigned mortgage application as cosigned if the age gap between borrowers is at least twenty years. HMDA provides age bins, and the full

[2] If the pricing rule were to consider cosigning, a cost shock would pass through at $1/\mu_k(y)$, more on the worse pool. This would add a counteracting force: a worse cosigned pool would pay a higher rate, and a higher rate means a higher ratio, which the same shock raises by more (Proposition OA3, Online Appendix OA1).

set of possible bin pairs classifying cosigning is in Online Appendix Table OA2. The twenty-year floor limits the influence of same-generation co-borrowers on the results.

### 4.2 Web-Scraped County Deed Records (New York State)

The HMDA data does not allow to identify a cosigner to a couple as only the first two signatories are listed. To measure that arrangement I collect mortgage deed records from the online land-records portals operated by New York State county clerks. These deeds name every party that it but not feature the age of signatories. The two measures are therefore complements rather than substitutes.

To address concerns about the validity of the measurement, I look at the deed-flagged loans that the HMDA classifier missed. HMDA records a co-applicant on 65.9% of those applications compared to a baseline of 44.9%. A third signature on the deed document is highly correlated with an older second borrower in HMDA. I report both measures, the HMDA and the combined series labelled *augmented*, for comparison. While the HMDA reports 2.79% of mortgages cosigned by parents, the combined dataset reports 5.79%.

The data has two main shortcomings. First, a deed is recorded only when a loan closes, so the deed records contain no rejected applications. This implies that the empirical results on the rejection margin are based on the HMDA data alone. Second, the scraped counties are all in the state of New York. The counties, however, track the New York HMDA cosigning trend closely and New York tracks the national series as the Online Appendix OA4 demonstrates. It also provide more details on web scraping, sample construction and performs additional comparisons.

### 4.3 Descriptive Statistics

Table 3 reports descriptive statistics for intergenerational cosigning. Panel A reports the average share of cosigned mortgages by applicant age while Panel B the mean cosigning rate by year. Two regularities stand out. First, cosigning is concentrated among the youngest borrowers. Second, the practice has grown. The HMDA cosigning rate rises from 2.43% in 2018 to 3.34% in 2024, and the web-scraped augmented mean increased from 5.43% to 6.34%.

### 4.4 Who Cosigns

Table 4 shows the application statistics of three distinct groups: solo borrowers (5,837,560 applications), two same-generation borrowers (4,403,026), and intergenerationally cosigned borrowers (294,333).

Cosigning boosts qualifying income, not equity. Reported income on a cosigned application averages $172.6k, compared to $94.2k on a solo application. This gap aligns with the institutional setting, where cosigning combines qualifying income, which is then used to calculate the DTI.

This is not the case for leverage, where cosigned loans are levered less than solo loans. Cosigned loans finance about 83.7% of their property with a mortgage. Solo borrowers, on the other hand,

TABLE 3. Prevalence of intergenerational cosigning

| | Loans | HMDA baseline (%) | Augmented (%) |
|---|---|---|---|
| *Panel A: by applicant age* | | | |
| <25 | 932,799 | 8.89 | 11.89 |
| 25–34 | 5,332,525 | 2.81 | 5.81 |
| 35–44 | 4,269,595 | 1.44 | 4.44 |
| *Panel B: by application year* | | | |
| 2018 | 1,392,389 | 2.43 | 5.43 |
| 2019 | 1,453,679 | 2.32 | 5.32 |
| 2020 | 1,760,139 | 2.45 | 5.45 |
| 2021 | 1,973,341 | 2.73 | 5.73 |
| 2022 | 1,542,093 | 3.20 | 6.20 |
| 2023 | 1,201,065 | 3.32 | 6.32 |
| 2024 | 1,212,213 | 3.34 | 6.34 |

*Notes:* HMDA LAR 2018–2024, 10,534,919 applications. *Augmented* adds a uniform +3.00-point New York deed uplift to the age-gap baseline; it is an estimate, not a count (Online Appendix OA4.5).

have an LTV of 86.9%. The difference comes mainly from high-leverage borrowers. Borrowers who finance more than 95% of their property constitute only 5.4% of the cosigned pool but 20.3% of the solo pool. Part of this is the different cap for non-occupant cosigners (95 against 97, Section 2). Conditional on approval, cosigned buyers purchase properties worth about $21,000 more than solo borrowers, with a corresponding loan about $7,000 larger. Most of both gaps is selection into counties: under county cells they turn slightly negative, while their difference, the equity at purchase, keeps its sign and shrinks to about $3,800 (Online Appendix Tables OA18 and OA14).

Second, I find little evidence that the scarcity of cosigning is driven by lenders. Only 2.9% of active lenders have never originated a cosigned loan. The share of cosigned mortgages originated by the largest lenders is comparable to the share of solo mortgages originated by the same lenders. The data does not suggest a link between cosigning and bank size or bank-market concentration. The re-selling behavior of lenders to Fannie Mae or Freddie Mac is comparable between cosigned and solo mortgages (Online Appendix OA4.7). If anything, cosigned mortgages are sold more often (58.7% against 53.1%).

Third, many families have the theoretical capacity to cosign. In the PSID's matched parent–child files for 2019 and 2021, 88.5% of young adults aged 25–44 have a parent with the income or the net worth to cosign (Online Appendix Table OA17). Even though these figures do not account for intra-family frictions and should be treated as an upper bound, they do not suggest that the average cosigning rate of 5.79% is driven by a capacity constraint on the parents' side.

Additional descriptive statistics can be found in Online Appendix OA4.7, and Online Appendix Table OA3 reports pooled means on applicants' characteristics.

TABLE 4. The credit position of cosigning households

| | Mean by application type | | | Difference | |
|---|---|---|---|---|---|
| | Solo (1) | Joint (2) | Cosigned (3) | Cos.−Solo (4) | Cos.−Joint (5) |
| Reported income (combined, $000s) | 94.2 | 143.1 | 172.6 | 78.4*** | 29.5*** |
| | (108.5) | (112.4) | (225.4) | (0.4) | (0.4) |
| Share with CLTV > 95 (%) | 20.30 | 11.60 | 5.42 | −14.88*** | −6.18*** |
| | (40.22) | (32.02) | (22.64) | (0.05) | (0.05) |
| Share with DTI ≥ 43% (%) | 32.35 | 24.30 | 39.74 | 7.39*** | 15.44*** |
| | (46.78) | (42.89) | (48.94) | (0.09) | (0.09) |
| Applications | 5,837,560 | 4,403,026 | 294,333 | | |

*Notes:* HMDA 2018–2024. Income is the combined figure the underwriter relied on, not the child's own. Parentheses: standard deviations under the group means in columns (1)–(3), standard errors under the differences in columns (4)–(5). Cosigned income has a long right tail, its standard deviation exceeding its mean. *** $p < 0.01$. Definitions, tests and every remaining characteristic: Online Appendix Table OA3.

### 4.5 Empirical Regularities in Cosigned Mortgages

Drawing on the HMDA sample, I document four stylized facts. The first links cosigning to the housing affordability challenges young homebuyers face. The second and third facts show that the institutional setting is used in practice. Lastly, I document that delinquency risks in the same pricing category are different across cosigner status. It is a direct link to the sign of the wedge stated in Proposition 1.

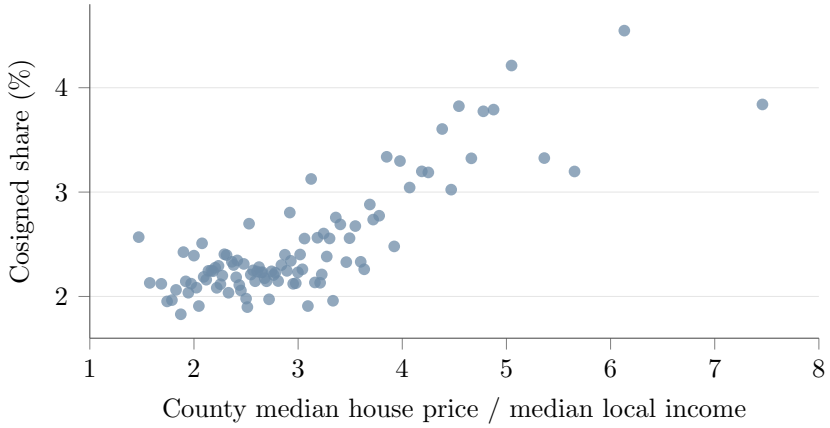
I make two general assumptions. Firstly, rejection and interest rates are unweighted averages across loan amount by property-value cells. Secondly, the comparison group is always the solo borrower. They are reported separately in Table 4.

**Fact 1: Cosigning is more common where houses are expensive relative to local incomes.** Figure 2 plots the county cosigning share against the county's median property value divided by its median family income, for 1,763 counties over several years. A strong positive trend can be observed. This fact is robust to using census tract measure as well as using the web-scraped merged dataset (Online Appendix Figure OA5).

**Fact 2: Cosigned applications are rejected less at the same DTI ratio while they are rejected more at the same LTV ratio.** Figure 3 plots rejection rates for the respective ratio that determines admission. Cosigning enters the debt-to-income admission test as a second income is added. For the same DTI ratio, cosigned loans are rejected less and the difference in the DTI ratio band of 45 to 49% is 7.1% against 9.8%. At the same LTV ratio, cosigners are rejected more frequently. At 96 or 97 percent LTV cosigners face an average rejection probability of 19.5% and solo borrowers 7.7%.

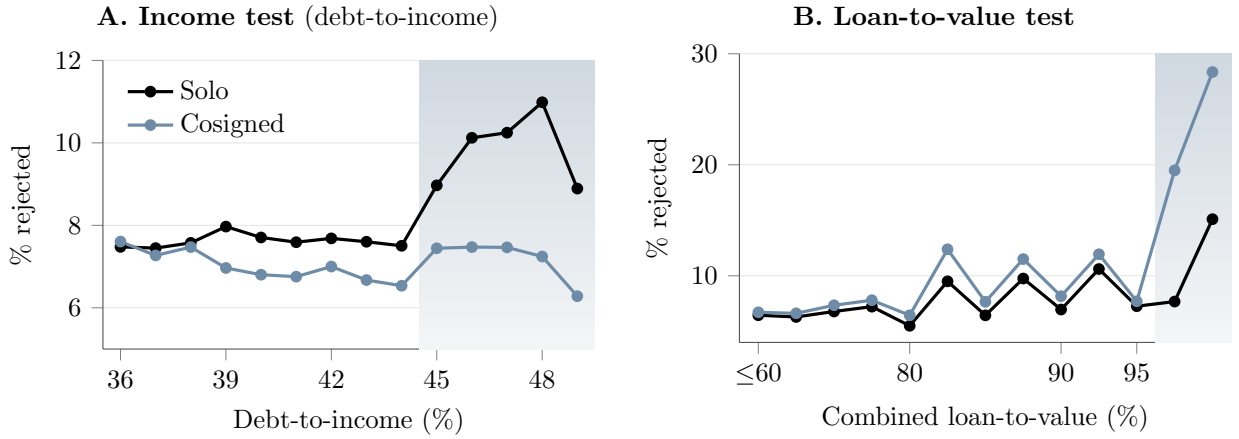
**Fact 3: Within a price cell, cosigned loans pay nearly the same rate as solo loans.** Unconditionally, cosigned loans pay +0.23 percentage points more than solo-borrower loans with

FIGURE 2. Cosigning and house prices relative to income




County intergenerational cosigning share (age-gap measure, HMDA 2018–2024) against the county's median property value among purchase applications divided by its ACS median family income, in one hundred equal-count bins of counties weighted by loans; 1,763 counties with at least 100 loans in some year.

FIGURE 3. Rejection rates under the two admission tests

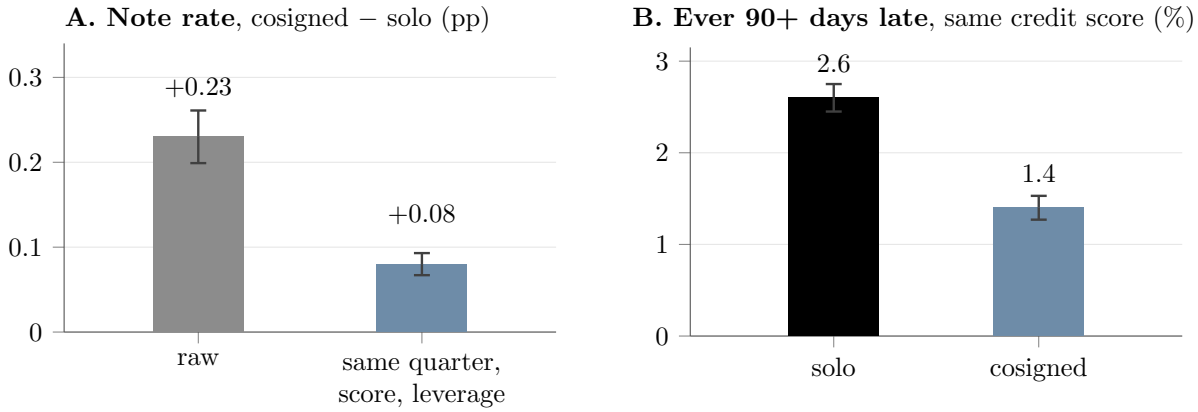



HMDA 2018–2024, conventional fixed-rate first-lien purchase applications, the sample of Section 4.4. Rejected applications as a share of applications in each bin of the ratio the lender relied on; on a cosigned file the debt-to-income ratio is computed on the pooled income, and the loan-to-value ratio is the combined one. Shading: debt-to-income of 45 and above (Panel A), and loan-to-value above 95 percent, the cap on loans with a non-occupant co-borrower (Panel B).

a baseline mean of 4.64%. Once leverage and credit score are fixed — the borrower is in a pricing group — there is little difference in the average interest rate. The gap is 0.08 pp, for both measures (Online Appendix Table OA15).

**Fact 4: At the same credit score, cosigned loans fall behind no more often, but serious delinquency is only half as likely.** In the same loans and at the same credit score, 10.9% of cosigned mortgages have been 30 or more days past due, against 11.5% of solo-borrower loans. They differ in how the performance continues. 1.4% of cosigned loans reach 90 days past due, against 2.6% for solo borrowers (Figure 4, Panel B) making cosigners less likely to become seriously delinquent. I interpret this as the effect of the guarantee.

FIGURE 4. Rates and serious delinquency of cosigned and solo-borrower loans




Fannie Mae Single-Family Loan Performance Data linked to HMDA: first-time purchases of one-unit principal residences originated 2018–2024, 71,819 cosigned and 1,294,290 solo-borrower loans. Panel A: the price cell is origination quarter × credit score band × loan-to-value. Panel B: the cosigned bar adds the within-band cosigned difference to the solo-borrower rate, using nine bands of the lower of the borrowers' scores. Months in forbearance, and arrears carried out of forbearance until the loan is next current, do not count. Whiskers are 95% intervals with standard errors clustered by state.

Online Appendix Table OA14 shows robustness results by conditioning on county and year fixed effects.

## 5 The 2022 Fee Shock: The Solo Door Tightens, the Price Does Not Move

The 2022 FHFA fee increase raised the cost of high-balance loans on the pricing grid. The theory in Section 3 predicts that cosigned applications with high DTI get rejected less than solo applicants in response to the reform. Interest rates should respond equally across both groups. Denials citing debt-to-income rose +1.11 pp (standard error 0.47) for solo applicants. Cosigned applicants do not respond significantly differently from zero, but statistical inference is limited by low power. Interest rates do respond equally for both pools.

### 5.1 The 2022 FHFA Pricing Reform

On January 5, 2022, the FHFA announced that from April 1 the upfront fee on high-balance loans sold to Fannie Mae or Freddie Mac would rise by 25 to 75 basis points of the loan amount (Federal Housing Finance Agency, 2022). It was tiered by loan-to-value ratio buckets. High-balance loans are loans in expensive counties that exceed the limit for regular mortgages but, given that they are in expensive areas, are treated as regular mortgages. In 2022 the high-balance threshold was $647,200 for a single-unit property. They are not jumbo loans which have a different threshold in the high-cost counties at $970,800 in 2022.

At the standard quarter point of rate per point of fee, the top tier is 0.19 pp of note rate, the upper bound on full pass-through.[3] As Section 4.4 demonstrates, cosigned and solo mortgages are

[3]The upfront fee is the risk-based leg of the guarantee fee (Section 2), paid once at delivery; its annualized

sold to the agencies in equally large parts. The reform itself was agnostic to the cosigning status as the pricing grid is, too. A response could manifest itself in either margin and is driven by the lenders' economic response to the reform.

### 5.2 Design

The design of the evaluation follows the structure of the reform. Fundamentally, we observe a change in fees over time. A change in fees over time is observed, but only for loans above a certain threshold. This design is known as a difference-in-discontinuities, introduced by Grembi et al. (2016) and formalized by Picchetti et al. (2024). The goal is to compare post-reform and pre-reform jump differences for cosigners and solo borrowers separately. The reform doesn't alter self-selection into cosigning status, but it allows us to see how lenders treat each group.

A difference-in-discontinuity design relies, as the standard regression discontinuity design, on a running variable that captures the distance to the threshold. Here, the running variable is the distance to the conforming loan limit ($647,200 in 2022), as stated by Federal Housing Finance Agency (2021). The sample consists of high-cost counties with loans that are not yet classified as jumbo loans. It covers 2018 to 2024, with 2022 to 2024 being the post-reform years. I take the announcement month, January, as the start of treatment. The distance between announcement and implementation was introduced on purpose to allow for a gradual adjustment to the practice (Federal Housing Finance Agency, 2021). I restrict the sample to applications with income above 120% of the area median income. First-time home buyers below that threshold were eligible for waiver of the fees.

Borrowers bunch below the limit to avoid the fees (Appendix Figure C.1), so a single discontinuity analysis post-reform would ignore sorting around the threshold. The intensity could be different by contract group, introducing a bias when comparing the estimated pass-through. In a difference-in-discontinuities design, sorting cancels out under four assumptions. (1) Without the reform, the jump at the limit would have stayed the same: the composition of borrowers on each side, the intensity of bunching below the limit, and the effect of the existing high-balance fee. This can be thought of as the analogue of the parallel trends assumption. (2) Continuity in differences: the common funding shock moves outcomes alike just above and just below the limit. (3) Additivity: the reform adds to the existing jump rather than scaling it. (4) No switching: the reform moves no applicant into or out of cosigning, and none out of the sample, to FHA or jumbo loans or out of applying. Under the four, the interaction coefficient is the reform's effect on each pool. On the rate, it is the fee as the pricing rule passes it through: equally for both pools under the common grid, and scaled by inverse pool quality if the rate also priced cosigning (Online Appendix OA5.3).

The design stacks seven different cutoff values as the threshold is determined annually by the FHFA. Following Cattaneo et al. (2016), I normalize each loan amount to its year's limit and pool the seven cutoffs at a common zero, so the estimate is a weighted average of the year-specific effects. The cutoffs sit at different points of a rate cycle that moved three hundred basis points, so each

equivalent is the fee $g$ that Online Appendix OA5.1 writes into the pricing rule (2).

year carries its own intercept. I estimate, for each pool $k \in \{co, so\}$ separately,

$$Y_{ilt}^k = \alpha_{y(t)}^k + \beta_1^k D_{it} + \beta_2^k Post_t + \beta_3^k (D_{it} \times Post_t) + f_{y(t)}^k(\tilde{X}_{it})\, D_{it} + Z_{it}\gamma^k + \delta_l^k + \epsilon_{ilt}^k, \tag{15}$$

where $i$ indexes loans, $l$ lenders, and $t$ time periods, and $Y_{ilt}^k$ is the outcome.

The running variable is defined as $\tilde{X}_{it} = L_{it} - \bar{L}_{y(t)} - c$, the loan amount less the year's baseline limit and an offset $c = \$2{,}500$. That is because HMDA rounds loan amounts.[4] $D_{it} = \mathbf{1}\{\tilde{X}_{it} \geq 0\}$ marks a loan as above the cutoff. The year effects $\alpha_{y(t)}^k$ absorb the main effect $\beta_2^k$ of $Post_t$. $\phi_{y(t)}^k$ and $\psi_{y(t)}^k$ give each year its own slope on each side of the limit. $Z_{it}$ are demographic controls and income, and $\delta_l^k$ captures lender fixed effects. $\beta_1^k$ represents the jump at the limit before the reform, and $\beta_3^k$ is how much that jump changed after it, the parameter of interest.

### 5.3 The Admission Margin: The Solo Door Tightens

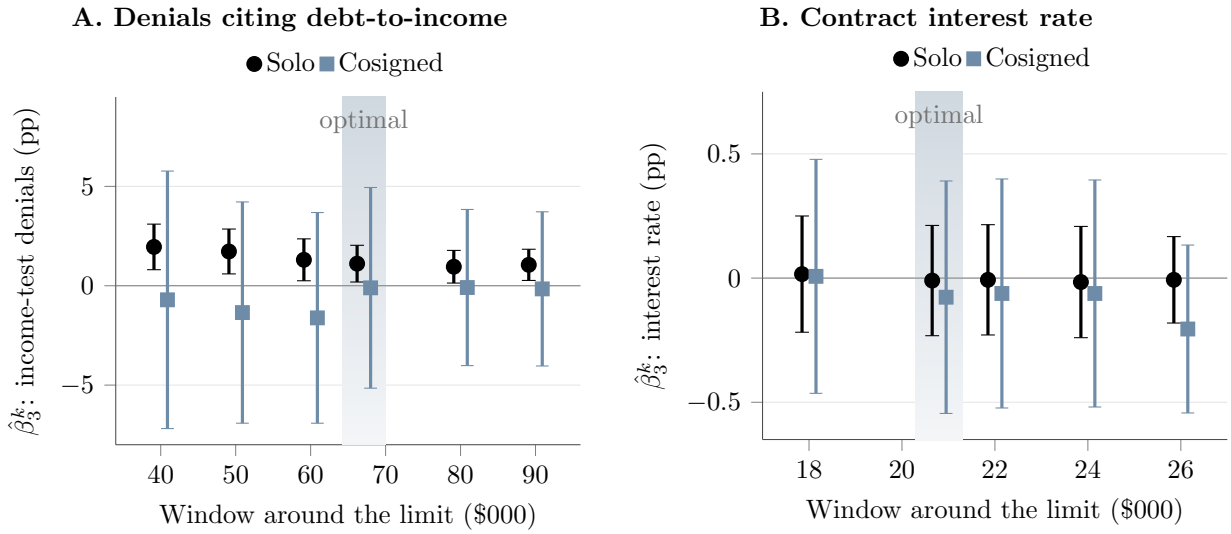
The reform made admission harder for solo applicants. Denials due to high debt-to-income increased by 1.11 percentage points ($p = 0.018$) at the optimal bandwidth of 67.1k. This roughly doubled denials for solo applicants relative to the pre-reform baseline of 0.98%. The pattern is robust across various bandwidths (+0.96–+1.95 percentage points) and statistically significant at the 5% level throughout. No cosigned estimate is statistically different from zero. Panel A of Figure 5 plots the estimated coefficients for both groups across different bandwidth specifications. Online Appendix Table OA25 reports the full regression results. Overall rejections, including DTI-cited denials, moved in the same direction (Online Appendix Table OA26).

In the HMDA, loan amounts are heaped to \$5,000 reporting brackets, creating discrete running variables. Heaping can introduce bias in a regression discontinuity design, as (Barreca et al., 2016) shows, and conventional confidence intervals overestimate the precision of the estimates (Kolesár and Rothe, 2018). To adapt the bias-aware inference of Kolesár and Rothe (2018) to a difference-in-discontinuity design, I apply their procedure separately pre- and post-reform at the same bandwidth and curvature bound. The resulting difference between pre- and post-reform estimates is the sum of the worst-case biases. The bias-aware estimator residualises the outcome on the controls, estimating a different object. At the same bandwidth, the estimate for solo applications is +1.56 percentage points. I continue to exclude zero from the 95% confidence interval until the curvature exceeds about three times the largest pre-reform curvature on either side of the threshold, where the interval becomes $[0.00, +3.12]$. After the reform, the solo denial rate above the limit bends about 1.8 times as much as that breakdown value, though the estimate is imprecise ($t = 1.8$).

To interpret the magnitude of the effects, I apply a back-of-the-envelope calculation (Online Appendix OA5.10). At the multiplier of four the enterprises use to annualise upfront fees (Federal Housing Finance Agency, 2025, fn. 7), the loan-to-value composition of the sample implies a rate

[4] HMDA reports loan amounts in \$5,000 brackets, and the bracket containing the limit straddles it. The offset puts the cutoff at the first bracket wholly above the limit, so straddling loans count as untreated; the donut row of Table C.2 drops them instead.

FIGURE 5. The admission and price margins, by group and bandwidth




Year-FE difference-in-discontinuities estimates (15) on the above-AMI primary sample, with 95% confidence intervals clustered by lender. Panel A: Online Appendix Table OA25; Panel B: Appendix Table C.1. Shading marks the solo pool's MSE-optimal window for each outcome. The denial grid starts wider because the cosigned denial cell is too thin at narrow windows.

increase of about 0.18 pp. This, in turn, raises payments on a 30-year mortgage by about 1.9%. Assuming the mortgage as the only debt, initial ratios just above 49% would be pushed above the 50% cap. In 2022–24, 5.3% of solo applications just above the limit reported a ratio of 49, up from 2.5% before the reform as interest rates climbed. As the rounding rule in the HMDA is not clearly stated, so between 45 (48.5–49.5) and 95 (49–49.99) percent of that bin cross the cap. This gives the mechanical bounds of 2.4 to 5.0 percentage points under full pass-through implying that between 0.22 and 0.47 of the solo applicants pushed over the cap were denied. By the same logic, cosigned applicants should be affected more, as 8.9% of them report a DTI of 49. Yet, they show no rejection response in the data.

### 5.4 The Price Margin: Rates Move Together

Interest rates do not move differently for the two pools (Panel B of Figure 5). At the optimal bandwidth, $20.8k, cosigners respond 7 basis points differently than solo borrowers (95% CI: −0.52 to 0.39, Appendix Table C.1). This remains true under various bandwidths, solo rates drop 0.01 percentage point, while cosigned rates fall 0.08 percentage point. The conversion from upfront fees to interest rate differentials spans 0.03 to 0.12 basis points. Subsequently, the rate estimate is consistent with the pricing rule and the prediction well within the confidence interval.

**Validity.** As stated earlier, the validity of the design relies on four key assumptions. (1) No change occurs in the absence of the reform, (2) continuity in differences, (3) additivity, and (4) constant group composition.

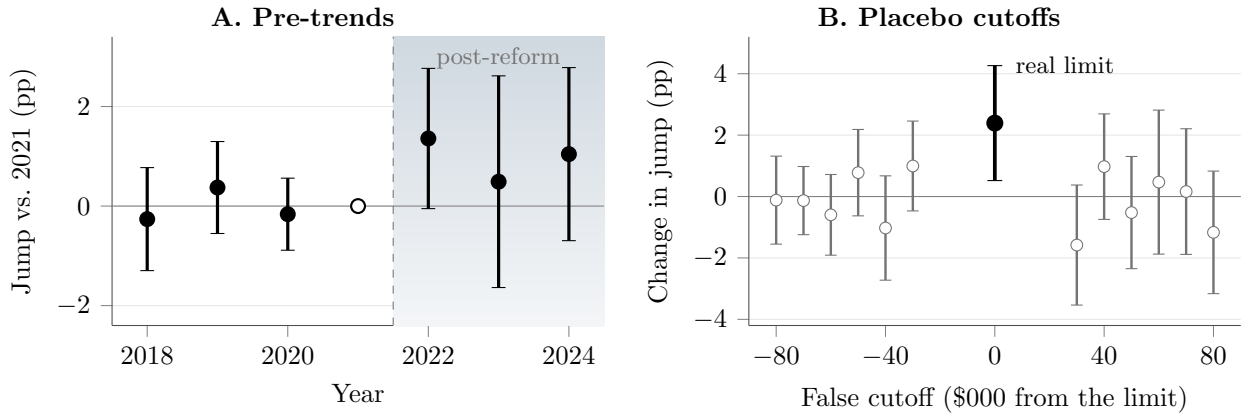
The first assumption is tested by running a placebo test the reform in every pre- and post-

TABLE 5. No switching into cosigning or out of the sample

| | Into cosigning | Out of the sample | |
|---|---|---|---|
| | (1) Application cosigned | (2) Loan density, solo | (3) Loan density, cosigned |
| $\hat{\beta}_3$ (above × post) | −0.26 | −2.07 | −1.95 |
| | (1.05) | (3.40) | (3.50) |
| Unit | pp | share of loans per $1,000 bin | |
| Standard errors | lender-clustered | HC3 | |

*Notes:* Difference-in-discontinuities estimates of the change in the jump at the conforming limit after the 2022 reform. Column 1: indicator for a cosigned application, applications above 120% of area median income within ±$67.1k of the limit, the specification of the denial result; the controls omit the co-applicant's age, which defines the indicator, and income, which includes the co-applicant's. Columns 2–3: the Difference-in-McCrary of Appendix C.3. $p$-values: 0.81, 0.54, 0.58.

FIGURE 6. Validity of the solo denial response: pre-trends and placebo cutoffs




95% intervals, standard errors clustered by lender. Panel A: the discontinuity at the limit, estimated year by year relative to 2021 (hollow), at the MSE-optimal $h$ = $67.1k. Panel B: the difference-in-discontinuities (15) re-estimated at the 12 placebo cutoffs (hollow) and at the real limit (solid).

reform period and a McCrary test in differences (Online Appendix OA5.13). Unlike the standard difference-in-difference, the parallel trends assumption is necessary but not sufficient, requiring no change in bunching intensity at the threshold.

Figure 6, Panel A shows estimated coefficients for solo denials. No pre-reform year yields statistically significant estimates. The pre-reform trend line within the insignificant area shows no indication of pre-trends, with too little power to detect. The McCrary test in differences finds no change in bunching intensity in either pool (Table 5, columns 2–3). (2) I test continuity in differences with a placebo test. Replacing the reform threshold with 12 different, placebo cutoffs in a range of $30–80,000 around the true threshold shows no statistical significance. (3) Additivity cannot be tested on its own. For the interest rate, it holds by construction. For denials, it is assumed. (4) The probability that an application is cosigned shows no detectable change at the cutoff with the reform (Table 5, column 1). Applicant income, age, and gender also show no differential response to the reform at the threshold (Online Appendix OA5.4).

## 6 Quantitative Model

This section builds a heterogeneous-agent, overlapping-generations economy with intergenerational altruism, default as a choice under limited commitment. It is in general equilibrium with asymmetric information as the lender cannot see the borrower's type. Agents live $J = 70$ periods, surviving from $j$ to $j + 1$ with probability $s_j$.

Parents are 25 years older than their children. The three rules from Section 2 apply. Five ages are important. At $j = 18$, after drawing productivity, the child learns what help its parent has offered for the mortgage, and chooses tenure and house size. At $j = 19$ the mortgage originates and is priced. For the next $M = 30$ years, the borrower chooses each period to repay or default. Default for the solo borrower means foreclosure but the cosigned can be saved by the parents. At $j = 43$ the same agent is a parent, observes its child's type, and then chooses whether to cosign, give cash, both, or not help at all. At $j = 45$ it receives an inheritance. The same agent is first the child, possibly receives a guarantee, and later the parent who may offer one.

Two things change relative to the stylized model. The income cutoffs of Proposition 2 become a cross-section in house size $h$ and child income $z_c$. As a result, the regions are house-by-income cells. And the previously exogenous repayment probability $\pi_\theta$ becomes a default choice under limited commitment (Online Appendix Table OA37). Second, as long as the parental guarantee covers the payment, the lender will not observe it. Therefore, it never enters the price.

At the same time, the parent expects to pay more for a bad child. The parental liability now depends on the future actions of the child and directly depends on the type. Appendix A.8 states both, at (OA44) and (A.16).

### 6.1 The Household Decision Problem

A household's state is the vector $\mathbf{s} \equiv \{j, a, z, z_p, \omega, \kappa, \zeta, h\}$: age, liquid assets, own and parental productivity, tenure status, the help type $\kappa \in \{1, 2, 3, 4\}$ (None, Cosigned, Cash-assisted, Both) received at the buying stage, a post-default credit-market exclusion flag, and the discrete housing stock. Appendix A.1 defines each component in more detail.

**General Lifecycle Stage** Besides the tenure and helping ages ($j \notin \{18, 43\}$), the household solves a standard consumption–savings problem under survival risk. Preferences are Cobb-Douglas over nondurable consumption and housing services with CRRA curvature, an ownership premium $\nu > 1$. In the final period, a warm-glow motive following De Nardi (2004) encourages bequests. Owners pay the mortgage payment while the loan runs and a depreciation cost $\delta_h p_{own} h$ throughout. Renters pay $p_r h$ every period. The inheritance arrives at $j = 45$. Appendices A.2 and A.3 show the function forms of utility function, bequest function as well the recursive formulation of the standard household problem with the budget constraints.

**The Buying Decision ($j = 18$)** At age 18 the household chooses to rent or to buy. Renting is an option that is not available in the static model but functions as an outside option in the

quantitative model. Agents have one opportunity when buying a house. That opportunity is at age 18 and is made under Type-I extreme-value taste shock with scale $\sigma_{rb}$[5]:

$$V_{18}(\mathbf{s}_{18}) = \sigma_{rb} \ln\Big(e^{V_{18}^{rent}(\mathbf{s}_{18})/\sigma_{rb}} + e^{V_{18}^{buy}(\mathbf{s}_{18})/\sigma_{rb}}\Big), \qquad V_{18}^{d}(\mathbf{s}_{18}) = \max_{h \in \mathcal{H}_d} \mathcal{V}_{18}(\mathbf{s}_{18}, d, h), \tag{16}$$

where $\mathcal{V}_{18}(\mathbf{s}_{18}, d, h)$ is the value of tenure $d$ at house size $h$. Buying is subject to the down-payment and income tests. A child offered a guarantee makes one further choice inside $V_{18}^{buy}$, whether to take it, described under take-up below. Renters can adjust the house size every period while owner can't change the size of the house once bought.

**The Mortgage Default Decision** ($19 \leq j \leq 18 + M$) Default has two margins: involuntary and voluntary (Corbae and Quintin, 2015). The type primitive $\pi_\theta$ is a repayment probability over the life of the loan, so the per-period repayment probability is

$$\tilde{\pi}_\theta \equiv \pi_\theta^{1/M}, \qquad \theta \in \{G, B\}, \tag{17}$$

which enters the household's problem and the pricing condition. With probability $1 - \tilde{\pi}_\theta$ the borrower defaults. Even when not defaulting involuntarily, the borrower can still choose to default or repay, smoothed by the taste shock $\sigma_{def}$.

$$V_j^{PD}(\mathbf{s}_j) = (1 - \tilde{\pi}_\theta)\, V_j^{def}(\mathbf{s}_j) \;+\; \tilde{\pi}_\theta\, \sigma_{def} \ln\left(\exp\left(\frac{V_j^{pay}(\mathbf{s}_j)}{\sigma_{def}}\right) + \exp\left(\frac{V_j^{def}(\mathbf{s}_j)}{\sigma_{def}}\right)\right). \tag{18}$$

Realized default is the minimum, involuntary default $1 - \tilde{\pi}_\theta$ plus the choice $\tilde{\pi}_\theta \Pr(def)$. The borrower repays when $V_j^{pay}$ exceeds $V_j^{def}$ under taste shocks. Voluntary default is primarily driven by $\xi_\theta$, the default stigma. It ensures incentive-compatibility for most borrowers and enters via $V_j^{def}$. It takes the form $\xi_{G,B} = \bar{\xi} \pm \Delta\xi/2$, where $\bar{\xi}$ is the average default cost across types and $\Delta\xi > 0$ the gap between them, so $\xi_G > \xi_B$.

The consequences of default are different for cosigned and solo borrowers. Upon default, both pay the stigma cost that is different in intensity. Additionally, a solo borrower ($\kappa \in \{1, 3\}$) gets evicted and can only rent from there on ($\zeta = 1$). A cosigned borrower ($\kappa \in \{2, 4\}$) invokes the guarantee. If the parent pay, the borrower can stay in the home and continues paying the mortgage in the next period, the choice recurs. Each invocation costs $\xi_\theta^{inv} = \xi_\theta/\text{div}$ instead of $\xi_\theta$. If the parent cannot pay, the is child foreclosed and evicted just as the solo borrower. The parent has no decision to repay or not. If the resources, labour income and savings net of her own housing $R_p = y(z_p) + (1 + r)\, a_p - H_p$, are sufficient, she pays. If not, the child goes into foreclosure. Borrowing against her own home in this case is not possible. The probability of covering that the

[5]The model carries four logit scales: $\sigma_{rb}$ over renting against buying here, $\sigma_{def}$ at the default decision, $\sigma_{help}$ at the parental stage and $\sigma_{menu}$ at take-up. All four are set rather than estimated, and only $\sigma_{help}$ carries economic content, as dispersion in parental willingness to help. Online Appendix Table OA38 gives the values.

child uses to evaluate the quality of the guarantee is the share of parents at income $z_p$ who can,

$$p_{cover}(h, z_p, z_c) = \Pr\big(R_p \geq m(h, z_c) \,\big|\, z_p\big). \tag{19}$$

Note that the income of parents is not restricted to cosigning parents but all parents in the same age. Depending on cash holdings of cosigners and non-cosigning parents this over- or understates the true coverage quality. However, children can estimate the quality of the guarantee based on the parental income which is observed.

**The Parental Helping Decision ($j = 43$)** At age 43, the parent can make a decision to help the child with the purchase of a house. She does so by observing the entire state space of the child. There are four options $\kappa \in \{1, 2, 3, 4\}$ (none, cosign, cash, both) to choose from under a taste shock with scale $\sigma_{help}$:

$$V_{43}(\mathbf{s}_{43}, \theta) = \sigma_{help} \ln \left( \sum_{\kappa=1}^{4} \exp \left( \frac{V_{43}^{p}(\mathbf{s}_{43}, \theta, \kappa) + \lambda_{\kappa}(z_p)\, \Delta V_c(\theta, z_p, \kappa) + \eta_{\kappa}}{\sigma_{help}} \right) \right). \tag{20}$$

The first term is the parent's own continuation value. It includes the loss from reduced liquid assets after helping or, in case of cosigning, the expected liability. Not helping, $\kappa = 1$, is the outside option, so the logit nests the parent's participation constraint of Section 3, with the type-specific liability (OA44).

The second term is the child's gain from the help:

$$\Delta V_c(\theta, z_p, \kappa) = \mathbb{E}_{z_c \sim W_\theta}\, \mathbb{E}_{a_c} \big[ V_{18}(a_c, z_c, z_p, \kappa) - V_{18}(a_c, z_c, z_p, 1) \big], \tag{21}$$

taken over the parent's beliefs about the child's income, $W_\theta(z_c)$ (Appendix A.4), and initial assets $a_c$, and scaled by $\lambda_\kappa(z_p)$, an altruism weight proportional to the parent's income. The third term, $\eta_\kappa \leq 0$, is the utility cost of helping, such as legal exposure or strain on the relationship. Both terms anticipate the child's probability to accept. The child's continuation value includes the take-up chances that contain the option to reject.

Tracking the child's entire distribution over the duration of the mortgage to compute a true child-parent specific cost of cosigning is computationally infeasible. Instead, I calculate the expected cost for each mortgage period based on the child's type and the parent's income (Appendix A.8). This approach comes at a cost: the guarantee is equivalent in means but not in risk, where a single large shock might prompt different decisions than a cost equivalence with certainty. Therefore, the risk reluctance of parents appears only in the cost of cosigning, $\eta_{cosign}$.

**Cosigning Take-Up ($j = 18$)** The origination of a guarantee, however, is not solely determined by the offer but also by the child's decision to accept or reject the offer. After receiving an offer, the child compares the two options available at the buying age and takes up the offer with a probability smoothed by taste shocks $\sigma_{menu}$. For a child of type $\theta$ offered cosigning $\kappa \in \{2, 4\}$, the value of

buying and the probability of taking the guarantee are

$$V_{18}^{buy}(\mathbf{s}_{18},\theta) = \sigma_{menu}\ln\Big(e^{V_\theta^{co}/\sigma_{menu}} + e^{V_\theta^{so}/\sigma_{menu}}\Big),$$
$$\Pr(\text{accept} \mid \mathbf{s}_{18},\theta) = \Big[1 + e^{(V_\theta^{so}-V_\theta^{co})/\sigma_{menu}}\Big]^{-1}, \tag{22}$$

where $V_\theta^{co}$ is the continuation value under the guarantee and $V_\theta^{so}$ that without guarantee. For the case of cash, the child receives the cash gift and can use it to pay the down payment, but must pass the debt-to-income test alone. Equation (22) can be understood as the incentive-compatibility constraint of Section 3, $\Delta V \geq 0$, only in a smoothed fashion. As $\sigma_{menu} \to 0$ the child takes the guarantee if and only if $V_\theta^{co} \geq V_\theta^{so}$, and the same comparison is the child's participation constraint for the cosigned contract. Take-up is parental income- and type-specific. The two types value the cosigning option differently due to differences in involuntary default and potentially voluntary default. Therefore, the chances of default are different. The lender cannot separate between the two margins and sees only the realized offers

$$q_\theta(z_p) = \underbrace{\Pr(\text{offer} \mid \theta, z_p)}_{\text{parent, } j=43} \times \underbrace{\Pr(\text{accept} \mid \theta, z_p)}_{\text{child, } j=18}, \tag{23}$$

This implies that both sides, children and parents, contribute to the selection problem. Any theoretical cosigning premium that is small could potentially originate from an offset of the two effects. If the offer is rejected, the parent has no liability.

**Income and Productivity** Productivity is independent across generations. A child's draw comes from the stationary distribution. Parental productivity affects the child only through the helping decision and, later, inheritance. Appendix A.5 states the process.

### 6.2 The Mortgage Market

**Asymmetric Information** As in Section 3, the lender sees income $z_c$ and menu $k \in \{so, co\}$ but not hidden type $\theta$. It holds the prior $\lambda(z_c)$ which is increasing in income (Appendix A.4). The realized share of good types $q_G^k(h, z_c)$ of cosigning status $k$ in a house-size by income cell is determined by four margins: the parent's offer, the child's acceptance, the chosen house, and the debt-to-income screen. It is, therefore, an equilibrium result.

**The Pricing Rule** Pricing follows the institutional setting in the United States. Every loan pays the base schedule $r_{base}(z_c)$ of its income cell, taken from the data and detailed below. Due to the life-cycle component of income, children tend to have lower incomes and are therefore considered for the pricing grid. While the pricing grid in Section 2 uses credit score and leverage, I use income instead of credit score for simplicity, and leverage is fixed. The model contains a premium for cosigning, set to zero in the baseline result but allowing differences in pricing for counterfactuals. The pool mix in terms of types is ignored, and pool-specific break-even is not realized (Proposition 1).

The lender's break-even condition of Section 3 enters in the counterfactuals of Section 8. There, the lender can add a cosigning premium that is house-size and parental income specific. The size and direction of the wedge are equilibrium outcomes, and the premium is such that the expected gross return between both pools equals

$$\sum_{z_c} \omega_{co}(z_c \mid h, z_p)\left(1 + r_{base}(z_c) + P(h, z_p)\right)\mu_{co}(h, z_p, z_c) \;=\; \sum_{z_c} \omega_{so}(z_c \mid h)\left(1 + r_{base}(z_c)\right)\mu_{so}(h, z_c), \tag{24}$$

where $\omega_k(z_c \mid \cdot)$ is the share of loans in menu $k$ held by children of income $z_c$, and $\mu_k$ is the weighted average of the repayment rates of good and bad types. The parental cover is not included, and the interest rate is considered fixed, with no refinancing possible.

**Risk-Based Rate Schedule** The base rate $r_{base}(z_c)$ is calibrated by rank-mapping the stationary distribution of $z_c$ to the NSMO rate-by-FICO gradient. All tests are evaluated at the base rate without cosigning premium. This is in line with the pricing grid and also avoids a feedback loop of approval into pricing. Only the child's income $z_c$ is used to determine the baseline interest rate.

### 6.3 Regulator and Banks: the Credit Constraints

The regulator sets a down payment of $1 - \lambda_m$ of the purchase price and enforces debt-to-income limits by loan type. The income test is applied to the joint income of parents and children, which raises the likelihood of clearing it. The down payment does not depend on cosigning. So, as in Proposition 4, a guarantee relaxes only the income constraint. Here, $\lambda_m$ is the same for both contract types, which seemingly contradicts the LTV cap in Section 2. However, the NSMO shows no realized gap in CLTV across the two contract options.

$m \equiv m(r_{base}(z_c), h)$ is the annual payment on a loan of $\lambda_m p_{own} h$ at the base rate. A solo mortgage is approved when $m/y(z_c) \leq \bar{\omega}_{solo} = 0.40$. A cosigned mortgage is approved on joint income:

$$\Omega_{cos} = \left\{(h, z_c, z_p) : \frac{m}{y(z_c) + y(z_p)} \leq \bar{\omega}_{joint} \;\text{ and }\; \frac{m}{y(z_c)} \leq \bar{\omega}_{own}\right\}, \;\; \bar{\omega}_{joint} = 0.42, \;\; \bar{\omega}_{own} = 1.0. \tag{25}$$

Under cosigning, children still face a DTI requirement they must clear on their own. Their income must be above the mortgage payments to avoid certain default in every period. All requirements are set, not optimized by the regulator for any benefit.

There are four actors in this economy. Households, split into parents and children, a regulator that sets the down payment and the debt-to-income limits, lenders that post interest rates, in the counterfactual by cosigning status (Appendix A.8), and construction firms (Appendix OA6.3). Households form rational beliefs about parental help through cash and cosigning, as well as the inheritance. These beliefs are rational, in that they match the realized population counterparts. Housing markets clear, and the cross-section of households across the state space is stable. Appendix A.7 states the stationary recursive competitive equilibrium formally, the consistency condi-

tions, and damping rules each block is solved for.

The interest rates are exogenously given and not solved for in the general equilibrium. The general-equilibrium counterfactual sets the supply elasticity for housing, calibrated from the data, and clears both rental price and the price for buying, jointly (Appendix A.8).

## 7 Structural Estimation

Seven parameters are estimated by simulated method of moments (SMM) on seven moments. Everything else is calibrated outside or drawn from the existing literature. Online Appendix Tables OA38 and OA39 list every such parameter. The level of the default penalty, $\bar{\xi}$, is held at 4.40. Moving it changes little but the cosigned share, which the cosigning cost absorbs, so it only sets the scale of the default penalty. The estimate reproduces who cosigns. Cosigning is decreasing in intensity with the borrower's income at a rate of $-0.748$, the same as in the data ($-0.738$). The cosigned pool is adversely selected, with a good-type share of 0.51 compared to 0.76 among solo borrowers. Despite this, cosigned loans default less than their solo counterparts which is clearly the work of the guarantee (Section 7.3).

### 7.1 Estimation Strategy

The SMM estimates seven parameters. Two of the seven are parameters linked to the riskiness of borrowers. $\pi_B$, the probability that a Bad type repays at all, and the gap $\Delta\pi = \pi_G - \pi_B$. Together, they pin down $\pi_G$. The type-specific default penalties $\xi_\theta = \bar{\xi} \pm \Delta\xi/2$ are determined by the estimated spread parameter $\Delta\xi$. It defines how costly voluntary default for each type is. Conditional on cosigning, the penalty gets different with $\xi_\theta^{inv} = \xi_\theta/\text{div}$. This is applied every time the cosigner invoke the guarantee and reflects the intra-family costs the borrower imposes on the parents. The house-price-to-income ratio $p_{own}$ and the helping costs $\eta_{cosign}$ and $\eta_{cash}$ complete the vector. I minimises

$$\hat{\theta} = \arg\min_{\theta} [m(\theta) - m_{data}]' \mathbf{W} [m(\theta) - m_{data}]. \tag{26}$$

with $\mathbf{W}$ being the weighting matrix and using the inverse squared standard error of its target. Appendix D.1 shows details on standard error computation and the weighting tolerance for each parameter. There are seven moments that pin down the parameter. The homeownership rate, the default rate, the cosigned and the cash-gifted shares of purchases, the cosign gradient by credit score, the default ratio between low- and high-score borrowers, and the cosign–solo default wedge below a credit score of 750. Table 6 compares the model results to the data target for every moment. Appendix D.2 shows the Jacobian for the full set of parameters and model moments.

**The untargeted moments.** Table 7 shows some untargeted moments. The share of guarantee-covered missed payments in the model ($U_1$) is too low (0.73 vs 0.86–0.95). However, the model moments also capture the times where the parent has already died and finds herself unable to pay in these conditions. In the data, this does not happen. The raw rate gap, $U_4$, is right in sign but

TABLE 6. SMM targeted moments

| | Moment | Target | Model |
|---|---|---|---|
| $M_1$ | Homeownership rate at 37 (data: ages 30–36) | 0.412 | 0.398 |
| $M_2$ | Mortgage default rate | 0.0085 | 0.0037 |
| $M_3$ | Cosigned share of purchases | 0.0547 | 0.0646 |
| $M_4$ | Cash-gifted share of purchases | 0.250 | 0.248 |
| $M_5$ | Cosign gradient by credit score | −0.738 | −0.748 |
| $M_6$ | Typed default ratio, low-/high-FICO | 6.93 | 4.12 |
| $M_7$ | Cosign–solo default wedge, low score | −0.0048 | −0.0009 |

*Notes:* Model column evaluated at the estimate. Targets and weights in Appendix D.1. $M_1$–$M_4$ are fractions, $M_5$ is a relative difference in cosigning shares across credit-score quartiles, $M_6$ is a ratio of default rates (targeted in logs), and $M_7$ is a difference in default rates below a credit score of 750. In the model, $M_6$ compares the two hidden types, which stand in for the credit score.

TABLE 7. Untargeted moments

| | Moment | Target | Model |
|---|---|---|---|
| $U_1$ | Guarantee absorption (parental coverage) | ≈ 0.86–0.94 | 0.73 |
| $U_2$ | Terminal (post-cure) default wedge (NSMO) | +0.0008 | −0.0012 |
| $U_3$ | Cosign–solo default wedge, high score (Fannie Mae × HMDA) | +0.0019 (0.0006) | +0.0004 |
| $U_4$ | Cosign–solo rate gap, no controls (Fannie Mae) | +0.0023 (0.0002) | +0.0007 |

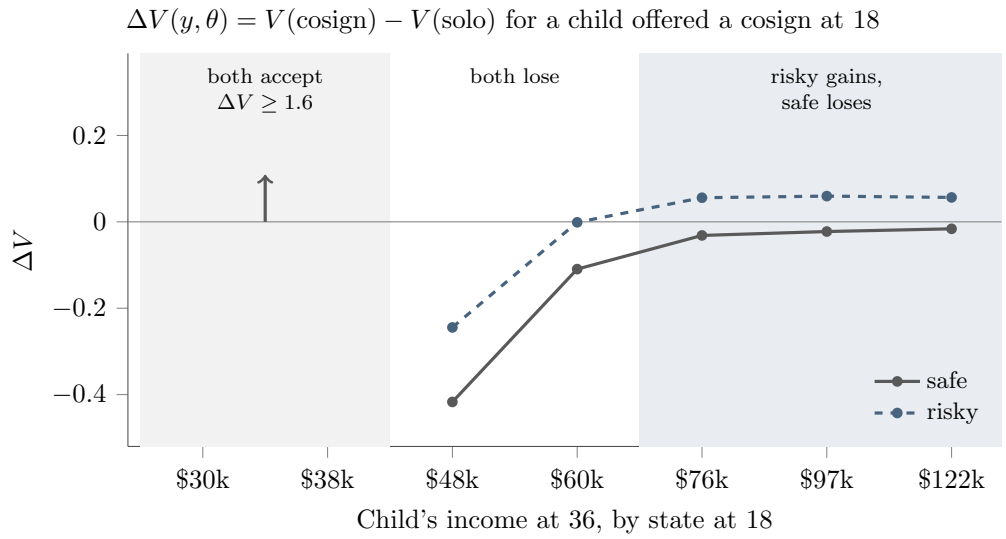
*Notes:* $U_2$–$U_4$ are differences in rates, as fractions (0.0019 is 0.19 percentage points); $U_1$ is a probability, its target the range across data measures. Standard errors of the data targets in parentheses where one exists. Construction and sources in Online Appendix OA7.3. $U_3$ entered the objective with a loose tolerance, but no parameter moves it: across the search it stays between 0.0000 and +0.0008.

smaller in magnitude. The final default wedge after the guarantee is about zero in both NSMO and the model. It also gets the pool composition at high incomes right ($U_3$). The model targets the lower end of the distribution assures that the selection at low income is favorable. However, the theory predicts that this changes with income such that eventually the screening becomes less important and adverse selection introduced by altruism of the guarantee grows. $U_3$ shows that for rich borrowers using cosigning the adverse selection dominates, untargeted, confirming a key result from the theory.

### 7.2 Estimation Results

A Bad type repays with a probability of $\pi_B = 0.878$ and a Good type with $\pi_G = 0.986$, the equivalent of an involuntary default probability of 0.43% per year for the bad type against 0.05% for the good type. The spread $\Delta\xi = 4.13$ sets the default penalties at $\xi_G = 6.46$ and $\xi_B = 2.33$. The cosigning-specific divisor is smaller than one (div = 0.48). The house-price ratio $p_{own} = 14.61$ and the helping costs $\eta_{cosign} = -0.86$ and $\eta_{cash} = -0.55$ complete the vector (Appendix Table D.2). $\eta_{cosign}$ is at −0.97, bringing the share of cosigned mortgages to 5.4%. Three moments, the cosign gradient (−0.2 standard errors), the cash-gifted share (−0.1), and the cosigned share (−0.1) are matched closely. Homeownership at age 37 falls short, 39.8% against 41.2% (−2.4%). The default

FIGURE 7. The two children's gains from a cosigned loan, in the estimated model




For a buying child, averaged over the age-18 population. The gain is read off the child's logit choice between the two menus, with noise $\sigma_{menu} = 0.1$. Where every offered child accepts (left band), the choice only bounds the gain from below; in the middle band, children who accept do so through the choice noise. Income states without buyers are left off the axis. The axis shows each income state at 36, in thousands of dollars a year: its multiple of mean income times the PSID age-profile level at 36, $41.6k.

rate is 0.37% against 0.85% per year. The type ratio is 4.1 against 6.9 (−2.0), and the wedge below a score of 750 has a fifth of the data's sign, −0.09 against −0.48 points per year (+4.6).

### 7.3 A Riskier Pool, and a Guarantee That More Than Offsets It

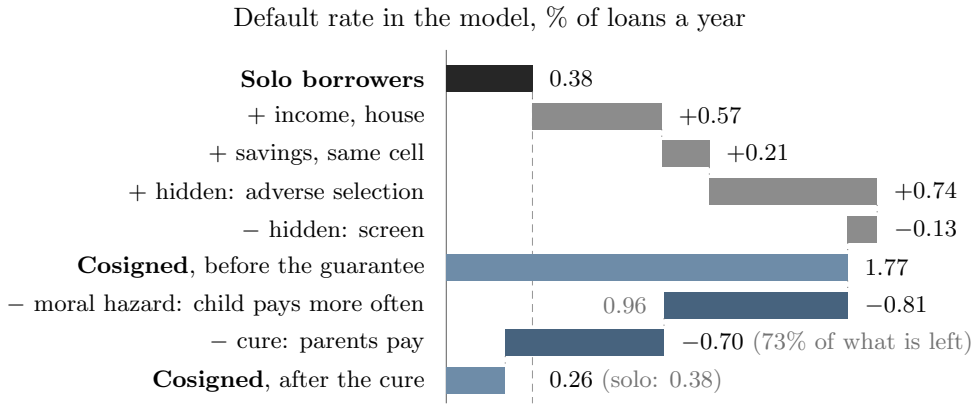
Figure 7 shows why the cosigned pool is riskier. A family knows what a cosigned loan is worth to the child, and it is worth most to the child likely to miss a payment. For borrowers in income states 5 and 6, both types accept the offer because the gain of becoming a homeowner outweighs any other argument. Especially in state 6, the child fails the income test alone only marginally, so a cosigner is the ticket to homeownership. In income states 7 and 8, cosigning brings no gain in access, as children are rich enough to pass the test by themselves and can afford the payments, on average. If struck by a sequence of bad shocks, these children are vulnerable to default, and default is more expensive under cosigning, which lowers the continuation value of a cosigned loan. All of these income states have a pooling equilibrium. From state 7 up, the gain is larger for the risky child than for the safe one, as in the static model of Section 3. From income state 9 up, only the risky child gains, and the predicted separating equilibrium exists.

The default rate of cosigned loans splits exactly into the solo rate and six separate forces:

$$d^{co} \;=\; d^{so} \;+\; \underbrace{\Delta_{cell} + \Delta_{state}}_{\text{observable}} \;+\; \underbrace{\Delta_{need} + \Delta_{screen}}_{\text{hidden type}} \;+\; \underbrace{\Delta_{MH} + \Delta_{cure}}_{\text{the guarantee}}. \tag{27}$$

$\Delta_{cell}$ captures the selection on the observables the lender sees, income and house size. $\Delta_{state}$ is

FIGURE 8. A riskier cosigned pool, and a guarantee that more than offsets it




The steps of equation (27), per loan and year over the whole life of the mortgage; each change bar starts where the bar above it ends. Down to *Cosigned, before the guarantee*, every borrower behaves as a solo borrower would. *Income, house*: the solo default rate in the cells where cosigners buy. *Savings, same cell*: the cosigned borrowers' savings within a cell, loan age by loan age. *Adverse selection*: the hidden-type mix moves from the solo pool's to the population's. *Screen*: from the population's mix to the cosigned pool's. *Moral hazard*: a cosigned child misses fewer payments than a solo borrower in the same state. *Cure*: a living parent pays 73% of the payments the child still misses. Dashed line: the solo rate.

savings within a cell and corrects for the different age structures of the loans. $\Delta_{need}$ is the adverse selection introduced by altruism, and $\Delta_{screen}$ is the parental screening by type due to the financial liability the guarantee imposes. Both rest on the borrower's hidden type and hold each type's default rate fixed (Bennet, 1920). The last two terms are behaviour after origination. $\Delta_{MH}$ is moral hazard, how default behaviour changes under the guarantee. How often parents cure a payment the child misses is expressed in $\Delta_{cure}$. Rates are per loan and year, averaged over the whole life of the mortgage (Appendix Table D.4 lists them).

Cosigners are riskier on observable characteristics, as Figure 8 shows. The observables state that the pool of cosigned borrowers sits at income-by-house states where solo borrowers are more likely to default, as these are the default-prone states (0.57 percentage points). The same holds for the savings. Cosigned loans sit at saving points that are associated with higher default within the solo pool (0.21 points). Adverse selection adds almost as much as the previous two combined, 0.74 percentage points. Parents select children that are more likely to be marginal homebuyers and thereby more likely to be of the risky type. The same sorting leaves the solo pool safer at the same time. The screen offsets little of it (−0.13 points). If they behaved as solo borrowers, cosigned children would default on 1.77% of loans a year, more than four times the solo rate.

This is counteracted by the guarantee. Moral hazard runs the other way, as invoking the guarantee costs the child about 2.1 times what a default costs a solo borrower. Cosigned borrowers reduce voluntary default by 0.81 percentage points. Of the remaining default rate of 0.96%, the guarantee covers 73% (0.70 percentage points). Taking all factors into account, cosigners end up safer than solo borrowers, with a default rate of 0.26% a year against 0.38%.

None of this reaches the price. The pricing grid charges a cosigned loan its cell's solo rate, so the lender neither charges for the riskier pool nor credits the guarantee. Section 8 prices both.

TABLE 8. Pricing cosigned loans one step at a time, in general equilibrium

| | Home-ownership (pp) | Fore-closures (pp) | Cosigned share (pp) | Cosigned premium (bp) | Welfare (CEV) (%) |
|---|---|---|---|---|---|
| *Panel A. The price* | | | | | |
| Pool's risk priced, cover ignored | −0.69 | +0.003 | −4.98 | prohibitive | −0.219 |
| + the cover priced in | +1.33 | −0.030 | +16.86 | | +0.650 |
| **Priced on losses: the reform** | **+0.64** | −0.027 | +11.88 | −37.2 | **+0.431** |
| *Panel B. Information* | | | | | |
| Parent cannot tell the type, today | −0.02 | +0.000 | +0.01 | +0.0 | −0.004 |
| Parent cannot tell the type, the reform | −0.03 | +0.000 | +0.23 | −0.3 | −0.000 |
| Lender sees the type, the reform | −0.05 | +0.000 | −0.64 | −30.1 | −0.118 |
| *Panel C. The deposit, and no cosigning* | | | | | |
| Guarantee counted in the deposit, the reform | +0.37 | +0.035 | −2.33 | +331.5 | −0.041 |
| No cosigning | −0.79 | −0.007 | −5.44 | | −0.363 |

*Notes:* Each row is a change against the economy it starts from: today for the rows that end in "today", the pool's-risk row and no cosigning; the row above for the cover; the reform for the rows that end in "the reform". Today homeownership is 39.6%, foreclosures 0.36% of loans a year, the cosigned share 5.4% of buyers, and the cosigned premium zero. *Pool's risk priced, cover ignored*: the lender counts only what the child repays; the premium has no cap, and at that price the cosigned market unravels. *The reform*: the lender also counts what the parents pay. *Guarantee counted in the deposit*: cosigned loans may go to 97.5% of the price. Welfare is the consumption-equivalent variation of lifetime value at entry (Online Appendix OA8.1). Appendix Table E.1 gives every step.

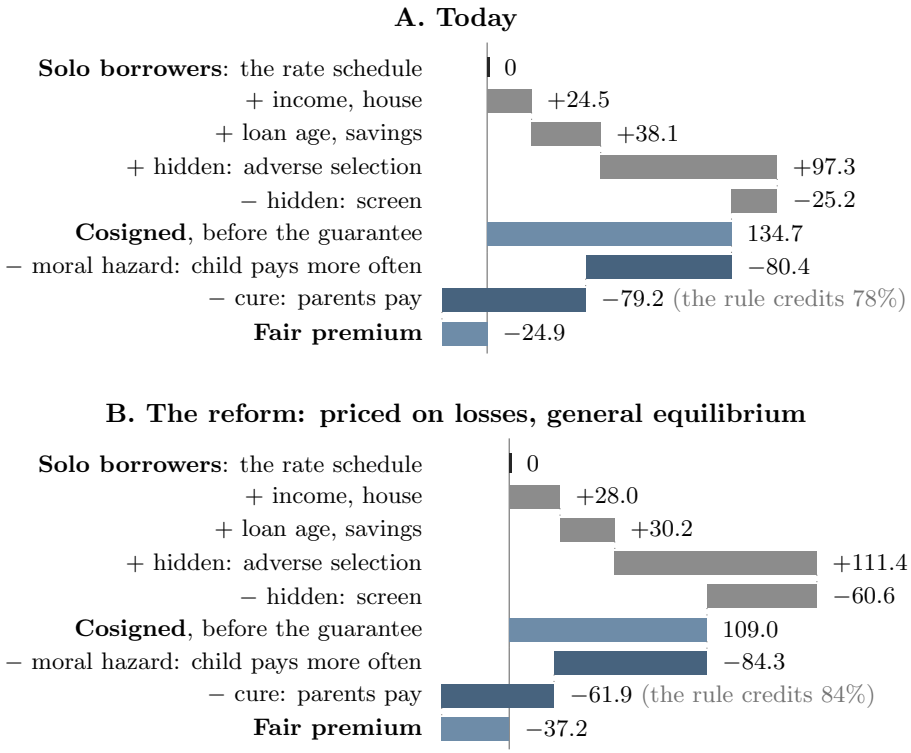
**Parental coverage.** Parental coverage kicks in when parents can afford to pay (19). The coverage this implies, 0.73, is not targeted and sits below the floor the NSMO sets ($U_1$), so the model, if anything, understates what the guarantee is worth.

## 8 Counterfactuals: Pricing Cosigned Loans One Step at a Time

Under the pricing grid, a cosigned loan pays its cell's solo rate. The lender charges nothing for the riskier pool of Section 7.3 and credits nothing for parental coverage. This section changes the pricing rule one step at a time, solving each economy in general equilibrium, each at its own market-clearing house price and rent. The lender sets a premium for cosigned loans that varies by house size and parental income. The premium prices cosigned default risk separately, such that the lender's cosigned loans earn the same expected return as its solo loans on the same house. With cosigning status and parental income now part of the pricing, the guarantee, adverse selection, and screening can enter heterogeneously along the parental income spectrum. Table 8 lists each step against the economy it starts from. Appendix Table E.1 shows some additional and intermediate steps.

FIGURE 9. The premium on a cosigned loan, stage by stage, today and under the reform

Premium over the solo rate, basis points a year, by the lender's pricing rule




Averaged over cosigned originations. Rows as in Figure 8, but the cure credits the share of missed payments the rule expects parents to cover, not the share they pay. Panel A: today, where the grid charges a cosigned loan the solo rate. Panel B: the reform, where the lender charges the fair premium; its price also changes which children accept a cosign, so the screen row is not the parents' choice alone.

### 8.1 Today's Price: Families Overpay

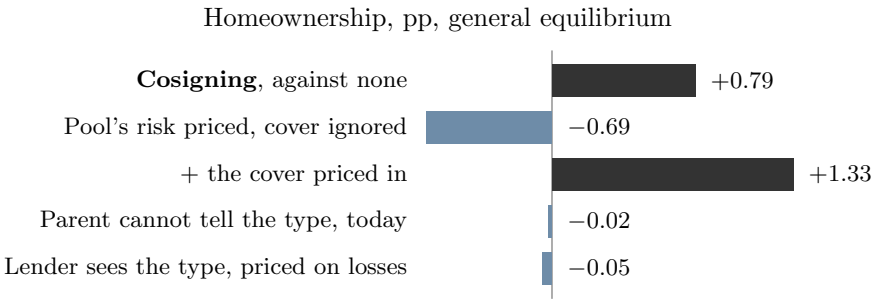
Panel A of Figure 9 deconstructs the premium stage by stage, the pricing equivalent of Figure 8. The riskier pool alone would justify 134.7 basis points over the solo rate. Observables combined would add 62.6 basis points to the solo rate. Adverse selection dominates the screening also in pricing, adding 97.3 basis points, while screening subtracts only 25.2. The guarantee takes away more than that. Moral hazard reduces the premium by about 80 basis points and, on top of that, the cover the parents provide takes off another 79.2 basis points.

The fair premium is −24.9 basis points. Because the grid charges cosigners the solo rate, families overpay 25 basis points annually with respect to their risk profile. The beneficiary is the lender.

### 8.2 Pricing One Step at a Time

The first policy experiment lets lenders consider only the child's repayment probability. This implies ignoring the guarantee. At the emerging cosigning premium, the market for cosigning collapses. The premium rises, the share of cosigned borrowers drops below half a percent, resulting in 0.7

FIGURE 10. Homeownership, one friction at a time




General equilibrium. First row: today's economy against one in which no parent can cosign. Second and third rows: the price of a cosigned loan, in two steps, each from the row above. The lender first prices the cosigned pool's risk and ignores the parents' cover; it then prices the cover in as well, which is the reform. Moral hazard and the cure are both inside the cover. Fourth row: under today's rules, the parent cannot tell the child's type. Fifth row: under the reform's pricing, the lender sees the child's type.

percentage points less homeownership (Figure 10).

The second step prices the guarantee as well. This is referred to as the reform for the remainder of the paper. The cosigned premium falls to 37 basis points below the solo rate, safer children enter, raising the good-type share of the cosigned pool by 10.3 points, and cosigning triples to 17.3 percent of buyers. Homeownership rises by 0.64 points compared to today's level without additional foreclosures (−0.027 points). Panel B of Figure 9 shows the decomposition of the reform effect into its components. Marginal buyers enter at lower income, driving up where cosigners borrow (28.0 against 24.5 bp today). These marginal buyers are where screening is effective, which becomes more relevant (−60.6 vs. −25.2), on average. However, adverse selection also increases by about 14 bp to 111.4 bp in total.

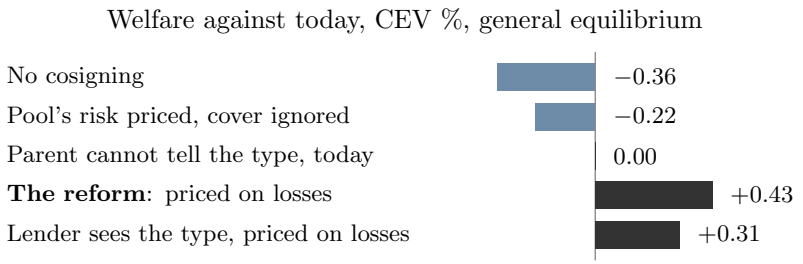
Pricing the guarantee relaxes borrowing constraints more than pricing the information advantage. If parents did not know the type of the child, homeownership would decrease by 0.02 points under today's rules and by 0.03 in the reform setting. A lender observing only the type would lower homeownership by only 0.05 points. The difference in responses comes from the guarantee.

A separate reform design is to let cosigning come with a higher loan-to-value ratio, which is designed in some countries (Table 2). This functions as a deposit relief. Letting cosigned loans go to 97.5 percent of the price, adds 0.37 points of homeownership on top of the reform. However, it comes at a clear trade-off. The cosigned premium rises 332 basis points, foreclosures rise 0.035 percentage points, and welfare falls (−0.041%).

### 8.3 Who Gains

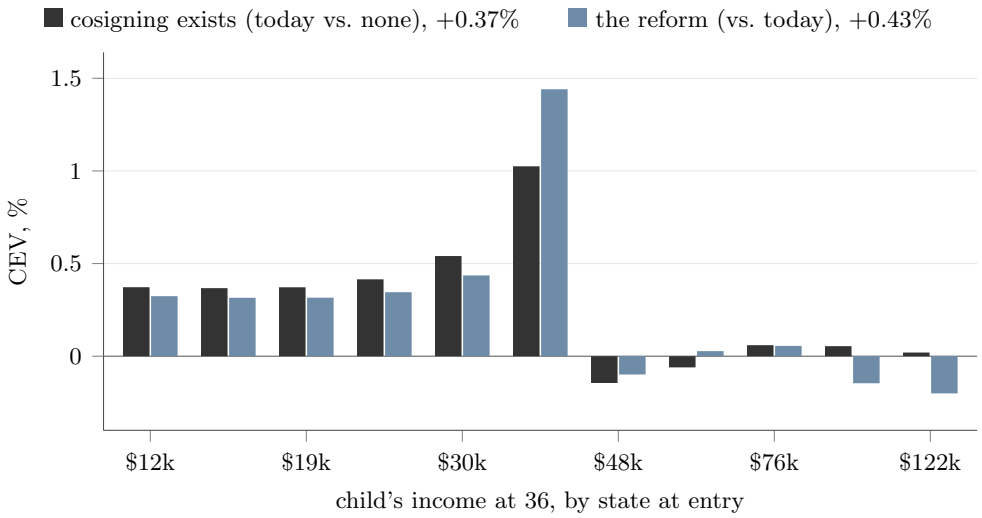
Figure 11 sets each economy against today, in lifetime consumption at entry. An economy without cosigning is worse by 0.36 percent. Pricing the pool's risk without the cover lowers welfare (−0.22%); pricing it on losses raises it by 0.43 percent. A lender that also priced the type would give less, +0.31%: one price for both types insures the risky child, and pricing the type takes that insurance away. Whether the parent knows the type does not move welfare (0.00%).

FIGURE 11. Welfare across the economies




Aggregate consumption-equivalent variation of lifetime value at entry ($j = 18$) against today's economy, in percent, in general equilibrium; Online Appendix OA8.1 defines the measure. The economies are those of Figure 10; the reform prices cosigned loans on the lender's expected losses net of the parents' cover.

FIGURE 12. Welfare by the child's income: cosigning, and the reform




Consumption-equivalent variation at entry, as in Figure 11, by the child's income state at entry; the legend gives each comparison's aggregate over the stationary income distribution. Income axis as in Figure 7.

Most of the gain goes to children in the lower half of the income distribution, in both comparisons (Figure 12). In the two lowest income states with buyers, no child can buy alone, so the guarantee is what lets them own, and pricing it makes that cheaper. Above them, cosigning under the reform mostly replaces solo borrowing, and for the richest children the higher house price outweighs the cheaper rate. By the parent's income the two orderings differ: today's cosigning helps the children of poorer parents more, the reform the children of richer ones, because the discount grows with the parent's capacity to cover a missed payment (Appendix E.2).

The gain is of the order the literature finds for mortgage-pricing reforms that reach every borrower. Jeske et al. (2013) find that eliminating a tax-financed 30 basis point interest subsidy on every US mortgage raises steady-state welfare by 0.5% of consumption, with poorer households gaining more. Elenev et al. (2016) put a full phase-out of the GSE guarantee, a repricing of 255 basis points, at 0.68%, and a bank leverage cap that leaves the underpricing in place at 0.11%. Pricing the guarantee reprices 37 basis points on the 17.3 percent of purchases that are cosigned,

with a change in a pricing rule rather than a transfer.

## 9 Conclusion

A commercial guarantor provides a lender with a promise to pay and a screening mechanism. It only signs for borrowers it expects to repay. This is different from an altruistic guarantor, such as a parent or a friend. A parent who cosigns gives the same promise but signs for the children who gain most, not necessarily the safest. In the U.S. mortgage market, this guarantee raises homeownership among young adults by 0.8 percentage points, and the price keeps it from doing more.

Linking deed records, with all signatories on the document, to loan records measures parental cosigning in the United States for the first time. Lenders admit cosigned applications at high debt-to-income ratios relatively more than solo applicants at the same ratio. Pricing is done on loan-to-value ratio and lowest credit score of all applicants, otherwise ignoring the cosigning dimension, even though the chance that cosigned loans reach ninety days late is only about half.

Because the guarantee is insurance, it is worth most to a child likely to miss payments. In the estimated model, adverse selection therefore adds more to the cosigned default rate than the screen removes, and the pool is riskier than a commercial guarantor's would be. The parents' coverage counteracts it. Upon cosigning, children miss fewer payments than they would have alone, and parents pay the majority of outstanding missed payments. While the cosigned borrowers are riskier, their loans are safer.

The interest rate does not acknowledge either factor. Cosigning families pay about 25 basis points a year more than their loans cost. Pricing the riskier pool alone drives the safe children out, and the cosigned market collapses. Priced on expected losses, parents' payments included, cosigned loans become cheaper than solo ones. Cosigning triples, to about the share Canada and Norway record today. Homeownership rises a further 0.6 percentage points after house prices adjust, with no more defaults.

A child entering the economy, would sacrifice 0.4 percent of lifetime consumption to allow break-even pricing of cosigned borrower pool. This is about as much as cosigning is worth as currently implemented. Cosigning families overpay, resulting in lower access to homeownership through too little cosigning. As the main beneficiaries of such a reform are marginal homebuyers, the bulk of welfare gains are concentrated in the lower-middle part of the income distribution.

Cosigned mortgages are not the only market where family guarantees can function as an access tool. Other examples are cosigned student loans, car loans, or leases on the household side, or a family pledging collateral for entrepreneurial children. Whenever a guarantor selects also on the gain of the borrower, the screening might not primarily select for safety. The unrealized potential of each tool lies in the institutional details regulating the market.

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## Appendix A: Quantitative Model: Value Functions and Equilibrium

### A.1 State Space

An individual household's state is the vector

$$\mathbf{s} \equiv \{j, a, z, z_p, \omega, \kappa, \zeta, h\}, \tag{A.1}$$

with components defined as follows:

- $j \in \{1, \ldots, J\}$ is the agent's age.
- $a \in \mathcal{A} \subset \mathbb{R}_+$ represents liquid financial assets.
- $z \in \mathcal{Z}$ is the agent's idiosyncratic labor productivity.
- $z_p \in \mathcal{Z}$ is the productivity of the agent's parent, which determines the parent's capacity for altruistic transfers.
- $\omega \in \{RB, PD\}$ is the housing tenure status, where $RB$ denotes a renter or prospective buyer and $PD$ denotes a homeowner.
- $\kappa \in \{1, 2, 3, 4\}$ is the help type received by the agent during the buying stage ($j = 18$), where the indices represent {None, Cosigned, Cash-assisted, Both}.
- $\zeta \in \{0, 1\}$ is a credit-market exclusion flag. Agents with $\zeta = 1$ previously defaulted on a solo mortgage and are permanently restricted to the rental market.
- $h \in \mathcal{H} \cup \{0\}$ is the discrete housing stock. $h = 0$ for renters, while $h \in \{h_1, \ldots, h_N\}$ for owners, where $N$ is the number of discrete house sizes.

### A.2 The General Lifecycle Stage

In periods without discrete tenure or helping decisions ($j \notin \{18, 43\}$), the household solves

$$V_j(\mathbf{s}_j) = \max_{a' \geq 0} \Big\{ u(c_j, h_j, \mathbb{I}_{own}) + \beta s_j \mathbb{E}_{z', z_p'}[V_{j+1}(\mathbf{s}_{j+1})] + \beta(1 - s_j)\Psi(b_{j+1}) \Big\} \tag{A.2}$$

subject to

$$c_j + a' + \Gamma(h_j, \kappa_j, \mathbf{s}_j) = we(z_j, j) + (1 + r)a_j + Tr_j(z_{p,j}), \tag{A.3}$$

where $\Gamma(\cdot)$ is the housing cost (rent $p_r h$, mortgage payment $m$, or maintenance $\delta_h p_{own} h$) and $Tr_j(z_{p,j})$ the inheritance transfer, non-zero only at $j = 48$ when the parent's generation exits the model. The period utility $u(\cdot)$ and the warm-glow bequest function $\Psi(\cdot)$ are stated next.

### A.3 Preferences and Bequests

Agents derive utility from consumption $c$ and housing services $h$. The period utility function is Cobb-Douglas with CRRA curvature $\sigma$:

$$u(c, h, \mathbb{I}_{own}) = \frac{([c^{1-\alpha}(\nu(\mathbb{I}_{own})h)^{\alpha}]^{1-\sigma} - 1)}{1-\sigma} \tag{A.4}$$

where $\alpha \in (0,1)$ is the housing expenditure share and $\nu(\mathbb{I}_{own}) = \nu > 1$ if the agent owns, $\nu(\mathbb{I}_{own}) = 1$ if the agent rents, capturing a preference for homeownership. Agents maximize expected discounted lifetime utility $\mathbb{E}\sum_{j=1}^{J} \beta^j \left(\prod_{\ell=1}^{j} s_\ell\right) u(c_j, h_j)$.

Agents also derive utility from leaving wealth to their offspring, representing a mixture of intentional and accidental bequests. The utility from bequests $\Psi(b)$ follows the functional form of De Nardi (2004):

$$\Psi(b) = \phi_1 \frac{(b + \phi_2)^{1-\sigma} - 1}{1-\sigma} \tag{A.5}$$

where $\phi_1$ represents the strength of the bequest motive and $\phi_2$ determines the curvature, effectively making bequests a luxury good. The bequest $b$ is composed of the agent's total net worth at the time of death:

$$b = a' + (1 - \delta_h) p_{own} h_j \tag{A.6}$$

where $a'$ are end-of-period financial assets and $(1-\delta_h)p_{own}h_j$ is the depreciated value of the housing stock. In a stationary equilibrium, the total flow of inheritances $Tr_{inherit}(z_p, z_c)$ received by a child at age $j = 48$ is the aggregate wealth of parents who die at any age $j \in [G, J]$, weighted by the mortality hazard $(1 - s_j)$.

### A.4 Type and Income, $\lambda(z_c)$

The link from income to type does more work than any other primitive in the model: it is the lender's prior in the pricing problem, the likelihood in the parent's belief $W_\theta$ over the child's income (A.8), and through both it anchors the selection mechanism. in log income relative to the median of the age-18 income profile,

$$\lambda(z_c) \;=\; \Pr(\theta = G \mid z_c) \;=\; \frac{1}{1 + \exp\!\big(-\lambda_\alpha \, \log\!\big[e(z_c, 18)/\tilde{e}\big]\big)}, \qquad \tilde{e} = \text{median}_z \, e(z, 18), \tag{A.7}$$

so $\lambda' > 0$ as the theory requires, and $\lambda(\tilde{e}) = \frac{1}{2}$ by construction: the median earner is equally likely to be either type, and $\lambda$ is informative only through *relative* position in the income distribution.

The steepness is not free. Setting $\lambda_\alpha = \sqrt{1-\rho_z^2}/\sigma_\varepsilon$ normalises the logistic to the dispersion of the income process itself, so that a one-standard- deviation move in permanent log income shifts the log-odds of being a Good type by one unit whatever $(\rho_z, \sigma_\varepsilon)$ are. At the calibrated income process this gives $\lambda_\alpha \approx 2.55$. The normalisation matters because $\lambda$ and the income grid are not separately meaningful: a steeper $\lambda$ on a narrower grid is the same object as a flatter $\lambda$ on a wider

one, and tying $\lambda_\alpha$ to $\sigma_\varepsilon$ fixes the units. The two information primitives are $\lambda_\alpha$, which scales how sharply income sorts types and is set outside the estimation (Table OA39), and the repayment gap $\Delta\pi$, which scales how much riskier a Bad type is and is estimated (Table D.2).

**The parent's belief.** The parent decides at age 43 knowing the child's type but not its income. It weights the child's possible incomes by Bayes' rule: the share of children at each income, $\Phi(z_c)$, the stationary distribution of productivity (Appendix A.5), times the probability that a child at that income has the type the parent knows,

$$W_\theta(z_c) \;\propto\; \Phi(z_c)\,\lambda(z_c)^{\mathbb{I}\{\theta=G\}}\big(1-\lambda(z_c)\big)^{\mathbb{I}\{\theta=B\}}. \tag{A.8}$$

For a good child the weights are $\Phi\lambda$ and for a bad child $\Phi(1-\lambda)$, each normalised to sum to one. The child's gain from help in the parent's problem averages over $z_c$ with these weights.

### A.5 The Income Process

Labor income is $w\,e(z,j)$, the product of a deterministic age profile $P_j$ and a stochastic productivity component $z$. The age profile is measured in the PSID: head labor income by three-year age group, net of year means, in the 2003–2021 family files, for heads who do not report being retired (the model has no retirement). Model age $j$ is age minus 18. Relative to the purchase age of 36, income is 0.24 at entry, roughly flat between 36 and 60 (1.07 at 53), 0.92 at 66, and 0.54 from age 71, where thin age groups are pooled. The wage $w$ is normalized at $j = 18$, so $P_j$ sets the shape of income over the life cycle, not its level at purchase.Log productivity follows an AR(1) with persistence $\rho_z = 0.96$ and innovation standard deviation $\sigma_\varepsilon = 0.11$, discretized by Tauchen (1986) into an eleven-state chain with transition matrix $\Pi$ and stationary distribution $\Phi$. Productivity is independent across generations: a child's draw comes from $\Phi$ rather than from $\Pi(z_p,\cdot)$, and parent and child then evolve on separate chains, so $z \perp z_p$ in the stationary measure at every age (Section 6 sets out what that restriction buys and what it costs).

### A.6 Risk-Based Rate Schedule

The base rate is a schedule on the persistent income state, $r_{base}(z_c)$. Under the pricing grid solo and cosigned borrowers both pay it, a cosigned loan priced on the child's state alone (the weakest-link rule); in the counterfactuals of Section 8 a cosigned loan adds the premium $P(h, z_p)$ of (24).

**Calibration from the NSMO rate-by-FICO gradient.** The schedule is estimated on conventional first-time solo borrowers in the NSMO (fixed-rate, single-family, primary-residence loans; $N = 4{,}272$). The outcome is the note rate's spread to the Freddie Mac PMMS survey rate in the origination week, which nets out the rate cycle; the specification carries survey-wave fixed effects and LTV-bucket controls, and the gradient is estimated across nine LLPA-style FICO buckets. Each model state $z_c$ is then mapped by its stationary population rank onto the FICO-bucket rank

intervals (a mass-weighted average of the bucket steps over the state's rank interval), and the level is anchored so that the buyer-mass-weighted mean equals 4.36%, the mean of the superseded DTI-priced schedule — aggregate mortgage payments are unchanged by the revision; only the cross-section is repriced. The resulting schedule is

$$r_{base}(z_c) = \begin{cases} 4.75\% & z_c \in \{z_1, \ldots, z_4\} \\ 4.73\% & z_c = z_5 \\ 4.44\% & z_c = z_6 \\ 4.31\% & z_c = z_7 \\ 4.28\% & z_c = z_8 \\ 4.26\% & z_c \in \{z_9, z_{10}, z_{11}\}, \end{cases} \tag{A.9}$$

where the bottom states ($z_1$–$z_4$) carry essentially no buyer mass and inherit the bottom bucket.

**Why $z_c$ stands in for the credit score.** The LLPA grid that prices conforming loans is indexed by credit score and LTV and has *no income dimension*; the model, in turn, has no separate credit-score state — $z_c$ is its only persistent observable quality state. The schedule therefore maps the two by *rank*, with the level anchored: $z_c$ plays the role of the persistent, priced observable, a deliberate and documented modeling liberty. Debt-to-income enters approval only (Section 6), matching the two-track institutional rule: DTI gates admission, the score prices the loan. The reference rate $r^{ref} = 5\%$ survives solely as the classifier of the superseded DTI-priced schedule below, where it avoids bucketing borrowers at their own equilibrium rate.

**Robustness: the DTI-priced schedule.** The pre-revision rule priced the base rate on reference DTI, $\text{DTI}^{ref}(z_c, h) \equiv m(r^{ref}, h)/y(z_c)$, through five buckets (4.35% below 0.36 rising to 5.23% above 0.60). It is retained as a robustness leg: re-solving at the final estimate under the DTI-priced schedule shows the results are not driven by the schedule choice. Institutionally, however, the conforming market does not price DTI (the 2023 FHFA DTI-based LLPA was rescinded before implementation), and in equilibrium the DTI buckets are nearly inert — at the smallest house roughly 95% of both pools sit in the bottom bucket, so observable selection transmits almost nothing into rates — which is why the score-based schedule is the baseline.

### A.7 Equilibrium Definition

A stationary recursive competitive equilibrium consists of value functions and policy functions for consumption, savings, housing choices, default, parental help and cosign take-up, construction plans, $H_s^{own}$ and $H_s^{rent}$, the rate schedule $r_{base}(z_c)$ and, in a priced counterfactual, the premium $P(h, z_p)$, house prices $p_{own}$ and $p_{rent}$, beliefs over parental help, cash gifts and inheritances, and a cross-sectional distribution $\mathcal{M}_j$ over the age-$j$ state, such that

(i) given prices, rates and beliefs, the household policies solve the household's problem at every age: the parent's participation at $j = 43$, the child's tenure and take-up choices at $j = 18$, and the repayment choice at every mortgage age are all policies under this condition;

(ii) a representative competitive construction firm in each housing market maximises profits taking the price as given;

(iii) lenders post $r_{base}(z_c)$ on every loan, solo or cosigned; in a priced counterfactual they add $P(h, z_p)$ to cosigned loans, set by (24) on the books that $\mathcal{M}_j$ implies;

(iv) beliefs are rational: the help probabilities, cash gifts and inheritances children expect at $j = 18$ equal their realized population counterparts at $j = 43$ and $j = 48$;

(v) the markets for owned and for rental housing clear at $p_{own}$ and $p_{rent}$;

(vi) $\mathcal{M}_j$ is generated by the policies and the exogenous processes, with the age profile that survival and population growth imply, so the cross-section reproduces itself.

Condition (iii) is the pricing grid, not a zero-profit condition: in the estimated economy the rate neither charges for the cosigned pool's type mix nor credits the parent's payments (Section 6). In a priced counterfactual it becomes the lender's participation constraint on its book of cosigned loans.

The help beliefs in (iv) are evaluated at the same equilibrium default policy that generates the transfers parents make, so what parents budget for and what is paid on defaulting children's behalf are the same object.

### A.8 Market Clearing and Consistency Conditions

The stopping rule that decides when the fixed point below is treated as solved, and what the reported equilibrium actually meets, is Appendix OA6.2.

Let $\mathcal{M}_j(\mathbf{s}_j)$ denote the cross-sectional distribution of households in state $\mathbf{s}_j$ at age $j$, so that $\mu$ is reserved throughout for the pool repayment probability $\mu_k$. The stationary equilibrium imposes the following consistency conditions.

**Credit market clearing.** In the estimated economy the mortgage market has nothing to clear: the pricing grid posts $r_{base}(z_c)$ on every loan, solo or cosigned (Appendix A.6). The Good-type share $q_G^k(h, z_c)$ of each pool is still computed from the equilibrium measure, for *both* pools, but it is reported rather than priced. In a priced counterfactual the lender sets the premium $P(h, z_p)$ of (24) on its book of cosigned loans for each house size and parental income. The survival $\mu_k$ a book is priced at mixes each type's default rate in a house and income cell with the share of Good types among the owners actually in that cell, so a book's expected return is the return its loans have. A thin book takes its wider book's income profile, continuously: a parental-income group that of its house, a house that of the whole economy. The premium matrix $\{P(h, z_p)\}$ is updated by a damped step toward the rule's target, and the fixed point is an equilibrium in which premiums are consistent with the books they induce.

**Housing market clearing.** In the counterfactual general equilibrium the price vector $(p_{own}, p_{rent})$ adjusts until both housing markets clear against the supply curves (OA43):

$$H_d^{own}(p_{own}, p_{rent}) = C_{own}\, p_{own}^{\varepsilon}, \qquad H_d^{rent}(p_{own}, p_{rent}) = C_{rent}\, p_{rent}^{\varepsilon}, \tag{A.10}$$

where $H_d^{own}$ and $H_d^{rent}$ are the aggregate owned- and rental-housing demands implied by the stationary distribution of households.

Every evaluation of excess demand is a full solution of the household problem at the trial prices, so the algorithm is chosen for the number of solves it costs rather than for its elegance. I solve the two markets *jointly* in log prices. Writing $x = (\log p_{own}, \log p_{rent})$ and

$$F(x) = \big(\log H_d^{own} - \log H_s^{own},\ \ \log H_d^{rent} - \log H_s^{rent}\big), \tag{A.11}$$

supply is exactly linear in these coordinates, $\log H_s = \log C + \varepsilon \log p$, so the system is close to linear and its Jacobian is well conditioned: the supply side contributes $-\varepsilon$ to each diagonal whatever demand does. I seed a $2\times 2$ Jacobian with two one-sided finite differences and then take safeguarded Broyden steps. The safeguard matters because Broyden is not a descent method and its superlinear convergence is only local: each step is taken from the best point visited rather than the latest, so the accepted iterates are monotone non-increasing in $\|F\|_\infty$ by construction, and a step that fails to improve halves the trust radius for the next one. The Broyden update itself still uses the pair just evaluated, so rejecting a point for stepping purposes does not discard its curvature information. Every solve is warm-started from the preceding one, which matters because adjacent price trials differ by a few percent.

The system clears to $\|F\|_\infty < 10^{-3}$ in roughly seven to nine solves. The natural alternative — Gauss–Seidel over the two markets, each cleared by bisection — is retained in the code as a cross-check but is not the method of record: bisection is linearly convergent, one bit per full model solve, on a residual that is smooth and monotone, and the nested scheme costs on the order of two hundred cold solves rather than nine warm ones. That difference is what makes the general-equilibrium leg feasible at all.

The baseline stationary equilibrium of Section A.8 is the special case in which prices are held fixed.

**Rational expectations of parental help.** The belief objects children use at age 18 must be consistent with what parents actually do at age 43. The first condition is on the help type. For $\kappa \in \{2, 3, 4\}$ (Cosign, Cash, Both),

$$\pi_\kappa(z_p, z_c) = \frac{\int \mathbb{I}\{\text{Parent chooses help type } \kappa\}\, d\mu_{43}(\mathbf{s}_{43} \mid z_p, z_c)}{\int d\mu_{43}(\mathbf{s}_{43} \mid z_p, z_c)}, \tag{A.12}$$

so the subjective probability of receiving a guarantee or a gift matches its realized frequency.

That is not the whole fixed point, and the remainder is not decorative. Each help type

also carries a *house-size* distribution, $\pi^h_\kappa(z_p, z_c, \cdot)$, normalised over $h$ and computed from the same forward simulation; for cosigning it is additionally resolved by type, $\pi^h_{cos,\theta}$, because the two types buy differently. These are the integration weights in the typed liability (OA44), so the parent's screening incentive and the distribution of houses it is evaluated over are determined jointly rather than in sequence. Alongside them the parent's budgeted cash cost and the expected liability (A.16) are themselves iterated to consistency with the policies they induce. The equilibrium is therefore a joint fixed point over the help probabilities, their house-size distributions, the typed cosigning distributions, the expected cash cost, the expected liability, and, in a priced counterfactual, the premium matrix $\{P(h, z_p)\}$ of the credit-market condition above. Every block is updated with damping rather than by full replacement — the premium at rate $\frac{1}{2}$, the belief and cost blocks at $\omega_{outer}$ and $\omega_{help}$ — because the pool-composition block in particular has an unstable best response, and an undamped update cycles rather than converging.

**Inheritance consistency.** The inheritance market clears when the flow of wealth from deceased parents matches the windfall received by children at $j = 48$:

$$Tr_{inherit}(z_p, z_c) = \frac{1}{\Omega} \sum_{j=G}^{J} \int (1 - s_j) b_j(\mathbf{s}_j) \mathbb{I}\{z_{c,j} = z_c\} \, d\mathcal{M}_j(\mathbf{s}_j \mid z_p), \tag{A.13}$$

where $\Omega$ is a normalization constant and $z_{c,j}$ denotes the child's productivity in the lineage of a parent in state $\mathbf{s}_j$. This condition ensures that all accidental and intentional bequests are fully redistributed: estates are pooled by the $(z_p, z_c)$ cell of the deceased and received by children carrying that same pair. Since productivity is independent across generations, the pairing redistributes wealth without inducing any correlation between a child's own earnings and the size of the estate they receive — the inheritance channel transmits *resources* across generations, not earning ability.

**Cash transfer aggregation.** For a parent of productivity $z_p$, the expected cash transfer conditional on choosing to help is

$$\bar{\psi}_{cash}(z_p, h) = \psi_{cash} \cdot w \cdot e(z_p, 43) \cdot h, \tag{A.14}$$

where $\psi_{cash}$ is a fixed fraction of the *parent's* income at the helping age, scaled by the size of the house the child buys — not a fraction of the house value. The distinction matters for magnitude: because $w\, e(z_p, 43)$ is an order of magnitude below $p_{own}$, the resulting gift covers a few percent of the purchase price rather than a few tens of percent (Table OA39).

**Cosigning liability.** At the decision age $j = 43$ the parent prices the expected liability of future child defaults, approximated as the product of the pool-average default probability and the mortgage payment:

$$L(z_p, z_c, h) \approx \bar{d}(z_p, z_c, h) \cdot m(h, z_p, z_c), \tag{A.15}$$

where $\bar{d}(z_p, z_c, h)$ is the stationary probability of child default conditional on parent income $z_p$, child income $z_c$, and house size $h$, computed from the forward simulation of the child's mortgage decisions over the horizon $j \in [19, 18 + M]$.

The parent's *budget* carries this liability in expectation rather than as a realized transfer. Because the parent's state does not include a specific child, the child's productivity and house size are integrated out and the parent pays

$$L(z_p) = \mathbb{E}_{z_c,h}\big[\, \varphi\, \bar{d}(z_p, z_c, h)\; p_{cover}(h, z_p, z_c)\; m(h, z_p, z_c)\,\big] \tag{A.16}$$

in every period of the child's mortgage that falls within the parent's life, i.e. at parent ages 44 through $J = 70$ (the loan itself runs until the parent would be $43 + M = 73$), where $\varphi$ is the recourse fraction ($\varphi = 1$ in the baseline).

# Appendix B: Theoretical Framework

## B.1 Payoffs, Equilibrium and Predictions

### B.1.1 Preferences, payoffs, timing and the parental screen

**Preferences and Payoffs. The Borrower.** The borrower's problem is (3) in Section 3.1: she chooses the menu, and the loan $L_k = \min\{L^d(y), \bar{L}_k\}$, the house $h_k = \alpha L_k$ and consumption $c_k = y - (1 + r_k)L_k$ follow from it; the gain from cosigning is (4). A defaulting borrower loses the home to foreclosure when borrowing solo and rents the floor $h_r$, while the cosigned borrower keeps the home and the parent pays,

$$\underline{u}_{so} = u(y,\ h_r), \tag{B.1}$$

$$\underline{u}_{co} = u(y,\ h_{co}(y)). \tag{B.2}$$

The gap $\Delta\underline{u} > 0$ in the default state makes the cosigned mortgage an insurance contract, worth more to Bad types, who default more often.

**The Parent.** The parent is tied to the borrower through altruism and legal liability. Define:

$$m \;\equiv\; (1 + r_{co}(y_{\min}))\, L_{co}(y) \;\le\; (1 + r_{co}(y_{\min}))\, L^* \tag{B.3}$$

for the payment due in the event of default on the cosigned loan of Appendix B.1.4, the same object Section 6 writes $m$. The parent covers the share of it that her income leaves above a floor $\underline{c}_p > 0$ on her own consumption,

$$\bar{p}(y_p) \;\equiv\; \min\Big\{1,\ \frac{y_p - \underline{c}_p}{m}\Big\} \;\in\; [0, 1], \tag{B.4}$$

non-decreasing in parental income and equal to one from the saturation income $\underline{c}_p + m$ on. The floor is the consumption she keeps in any event. It keeps her loss from covering finite: the composite of (A1) is unbounded below at zero consumption, and without the floor no parent below the payment

would ever offer. The same coverage enters the lender's receipt in (B.14), so the guarantor's liability is limited by income, the parent's outlay is $\bar{p}(y_p)\, m$ and:

$$\Delta u_p \;\equiv\; u(y_p) - u\big(y_p - \bar{p}(y_p)\, m\big) \;>\; 0 \tag{B.5}$$

as the utility loss from covering it. Coverage enters the parent's problem and the lender's break-even through the same $\bar{p}$; the posted price (2) is the one place it does not appear, which is the content of Proposition 1. The parent's payoff from each action, anticipating the child's choice, is:

$$\mathcal{U}_p(o) = \begin{cases} \pi_\theta\, u(y_p) + (1-\pi_\theta)\, u(y_p - \bar{p}(y_p)m) + \beta\, V_{co}(y,\theta;\, r_{co}(y_{\min})) - \eta_p & o = 1, \\ u(y_p) + \beta\, V_{so}(y,\theta;\, r_{so}(y)) & o = 0, \end{cases} \tag{B.6}$$

where $\beta > 0$ is the altruism weight and $\eta_p$ is an idiosyncratic taste shock, positive for a parent who dislikes providing the guarantee and negative for one who likes to help. Using (B.5), the net gain from cosigning is:

$$\mathcal{U}_p(1) - \mathcal{U}_p(0) \;=\; \beta\, \Delta V(y,\theta;\, r_{co}(y_{\min}), r_{so}(y)) - (1-\pi_\theta)\, \Delta u_p - \eta_p, \tag{B.7}$$

where $\Delta V \equiv V_{co} - V_{so}$ is the child's utility gain from accessing the cosigned contract.

**The Two Admission Tests.** An application under menu $k$ is admitted if and only if it passes both tests of Section 3.1. Under the loan-to-value test the loan cannot exceed the fraction $\overline{\text{ltv}}^{k}$ of the property value $P$, so the borrower pays the deposit $(1 - \overline{\text{ltv}}^{k})P$ out of her endowment $a \sim F_a$. The feasible set is the intersection

$$\mathcal{F}_k(y,a) \;=\; \underbrace{\big\{(1+r_k)\, L \le \overline{\text{dti}}\, Y_k\big\}}_{\text{income test}} \;\cap\; \underbrace{\big\{(1-\overline{\text{ltv}}^{k})\, P \le a\big\}}_{\text{loan-to-value test}}. \tag{B.8}$$

The loan-to-value test reads neither income nor the interest rate, and its cap is slightly tighter for cosigned loans, $\overline{\text{ltv}}^{co} = 0.95 \le \overline{\text{ltv}}^{so} = 0.97$ (Table 1).

**Proposition 4** (Two Margins, Only One Affected)**.** *Let $\mathcal{F}_k$ be as in* (B.8)*, write $A_{co}(r_{co}, \overline{ltv}^{co})$ for the mass admitted under the cosigned menu, and let $\mathcal{E}(\overline{ltv}^{co}) \equiv \{(y,a) : a < (1-\overline{ltv}^{co})P\}$ be the households the loan-to-value test excludes. Then*

*(i) For a household in $\mathcal{E}(\overline{ltv}^{co})$ admission under the cosigned menu is zero at every cosigned rate, $\partial A_{co}/\partial r_{co}|_{\mathcal{E}} = 0$: no price, however favourable, admits a borrower the deposit excludes.*

*(ii) A guarantee permitted to substitute for a part of the deposit admits a positive mass of exactly those households, provided $F_a$ has positive density at the threshold and the income test still holds at the enlarged loan.*

**Loan-to-Value Constraints and the Cosign Target.** Both menus face the loan-to-value test of (B.8), with $\overline{\text{ltv}}^{co} \leq \overline{\text{ltv}}^{so} \leq 1$ from the non-occupant overlay (Fannie Mae, 2020), so the maximum loan under each menu is

$$L_{so} \leq \overline{\text{ltv}}^{so} P, \qquad L_{co} \leq L^* \equiv \overline{\text{ltv}}^{co} P. \tag{B.9}$$

Housing services are proportional to the loan, $h_k = \alpha L_k$ for a constant $\alpha > 0$, and I treat $P$, and hence the cosign cap $L^*$, as fixed.[6] Solo capacity grows with income until the income test goes slack at $\hat{y}$, from where the solo buyer takes her desired loan, as the cosigned buyer does up to $L^*$; the house the signature buys shrinks with income and is gone from $\hat{y}$ on.

**Timeline.** The interaction is a sequential game with full information inside the household and asymmetric information between the household and the lender. The timing is:

1. **Nature** draws the state $\Omega = \{\theta, y, y_p, a, \eta_p\}$. The household observes $\Omega$; the lender observes $y$ and $y_p$, and at Step 3 the offer $o$, but never $\theta$. The loan under each menu is the lower of the desired loan and the cap of the menu, as in Section 3.1, and is not drawn.

2. **Rules:** the pricing rule (2) fixes the posted rates, which read the child's income on the solo menu and the lower of the two incomes on the cosigned one, and the two tests of (B.8) fix admission on each menu. Parental income enters admission through the qualifying income in (1) and never the rate.

3. **Participation:** the parent chooses whether to offer a guarantee, $o \in \{0, 1\}$.

4. **Sorting:** the borrower chooses a menu $k \in \{so, co\}$ ($k = co$ only if $o = 1$) to maximise expected utility.

The lender takes no decision. When the rate reads the menu, the lender posts a schedule that must be consistent with the pools it reads and becomes a player; that extension is Online Appendix OA1.

**The Parental Participation Decision.** The parent moves at Step 3, knowing the posted rate, and anticipates the child's Step 4 choice; where the child prefers the solo menu ($\Delta V \leq 0$) the guarantee goes unused. Where it does not, (B.6)–(B.7) give the parent's participation constraint, the offer ($o = 1$) if and only if:

$$\beta\, \Delta V(y, \theta;\, r_{co}(y_{\min}), r_{so}(y)) - (1 - \pi_\theta)\, \Delta u_p \;\geq\; \eta_p. \tag{B.10}$$

Integrating over the distribution of taste shocks yields the offer propensity $q_\theta(y, y_p)$ of equation (9) in the main text.

[6] Taking the local property value $P$ as given abstracts from general-equilibrium effects on house prices, a standard simplification in partial-equilibrium analyses of credit frictions (Chatterjee and Eyigungor, 2015; Corbae and Quintin, 2015), and it ensures the DTI feasibility condition $(1+r_{co}(y_{\min}))L^*/Y_{co} \leq \overline{\text{dti}}$ is non-binding for parents with sufficient income. Section 6 relaxes the fixed price.

**Informativeness of the Guarantee.** Assumption 1, Lemma 1 and Lemma 2 are stated in Section 3.3. Differencing the offer index of (9) across types,

$$I_G - I_B = \Delta\pi \left[ \Delta u_p - \beta \left( \Delta \underline{u} - \Gamma \right) \right], \tag{B.11}$$

so the assumption is the sign of this difference; the proofs are in Online Appendix OA2. With $\bar{q}_\theta(y) \equiv \int q_\theta(y, y_p)\, dF(y_p \mid y)$, the offer rate at income $y$, Bayes' rule gives the posterior that a borrower with income $y$ and an offer $o = 1$ is a good type,

$$\Lambda_1(y) \;\equiv\; \Pr(\theta = G \mid y, o = 1) \;=\; \frac{\lambda(y)\, \bar{q}_G(y)}{\lambda(y)\, \bar{q}_G(y) + (1 - \lambda(y))\, \bar{q}_B(y)}, \tag{B.12}$$

which the second lemma orders above the prior. The posterior without an offer, $\Lambda_0(y) \equiv \Pr(\theta = G \mid y, o = 0)$, is (B.12) with the complements $1 - \bar{q}_\theta(y)$ in place of $\bar{q}_\theta(y)$. Writing $\bar{\pi}_o(y) \equiv \pi_B + \Delta\pi\, \Lambda_o(y)$ for $o \in \{0, 1\}$, the second lemma delivers $\Lambda_1(y) > \lambda(y) > \Lambda_0(y)$ and hence $\bar{\pi}_1(y) > \bar{\pi}(y) > \bar{\pi}_0(y)$ for all $y$.

### B.1.2 Profits, the Wedge and the Menu-Reading Rate

**Profits by Menu.** With $\mu_{so}(y)$ and $\mu_{co}(y, y_p)$ the repayment rates of the pools (Section 3.2) and $\bar{p}(y_p)$ the cover of (B.4), profits are

$$\Pi_{so} = \mu_{so}(y)\, (1 + r_{so}(y))\, L_{so} - L_{so}, \tag{B.13}$$

$$\Pi_{co} = \left[ \mu_{co}(y, y_p) + \big(1 - \mu_{co}(y, y_p)\big) \bar{p}(y_p) \right] (1 + r_{co}(y_{\min}))\, L^* - L^*. \tag{B.14}$$

A loan earns if and only if the lender is paid more often than the rule assumes: $\mu_{so}(y) > \bar{\pi}(y_{\min})$ on a solo loan, $\mu_{co}(y, y_p) + (1 - \mu_{co}(y, y_p))\bar{p}(y_p) > \bar{\pi}(y_{\min})$ on a cosigned one, where the parent's cover, and her score when it is the worse one, can make up for a worse pool. By menu, the rule does not break even. Where only children without an offer borrow alone, the solo pool is worse than the prior and the solo menu loses per dollar lent; where good types decline their offers, it earns. The rule breaks even on the average child at each income; the parent's cover is rent on top, and so is the score penalty where she has the worse file.

**The Wedge in Closed Form.** Setting $\Pi_{co} = 0$ gives the fair cosigned rate (6), and the wedge (7) is

$$W(y, y_p) \;=\; \frac{\mu_{co}(y, y_p) + \big(1 - \mu_{co}(y, y_p)\big) \bar{p}(y_p) - \bar{\pi}(y_{\min})}{\bar{\pi}(y_{\min}) \left[ \mu_{co}(y, y_p) + \big(1 - \mu_{co}(y, y_p)\big) \bar{p}(y_p) \right]}, \tag{B.15}$$

positive exactly when the lender is paid more often than the rule assumes; the score penalty $S = r_{co}(y_{\min}) - r_{so}(y)$ and the unpriced cover $r_{so}(y) - \tilde{r}_{co}(y, y_p)$ of (7) add up to it.

**The Menu-Reading Rate.**

**Corollary 1** (The Unpriced Guarantee under the Menu-Reading Rate)**.** *Suppose* $\mu_{co}(y, y_p) < \mu_{so}(y) < 1$*, with cosigning and solo borrowing taken at* $(y, y_p)$*, and assume the lender also prices the cosigning status,* (B.17) *in Remark 1 below. Every cosigned loan is overcharged, by an amount strictly increasing in the pool's default risk, and the* fair *cosigned rate is less than the solo rate,* $\tilde{r}_{co}(y, y_p) < r_{so}(y)$*, if and only if*

$$\bar{p}(y_p) \;>\; \bar{p}^*(y, y_p) \;\equiv\; \frac{\mu_{so}(y) - \mu_{co}(y, y_p)}{1 - \mu_{co}(y, y_p)} \;\in\; (0, 1). \tag{B.16}$$

**Remark 1** (Extension: a rate that uses pool quality)**.** *A rule could instead price each pool separately, as lenders do have the information at hand,*

$$1 + r_k(y) = \frac{1}{\mu_k(y)}, \tag{B.17}$$

*with the cosigned pool read at both incomes,* $\mu_{co} = \mu_{co}(y, y_p)$*, such that the cosigned pool pays more when* $\mu_{co}(y, y_p) < \mu_{so}(y)$*. Each menu breaks even on the borrower's own payments. The lender's participation constraint binds on the solo menu,* $\Pi_{so} = 0$*, but not on the cosigned menu. Let* $\alpha \in [0, 1]$ *be the weight on pool quality in pricing,*

$$1 + r_k^{\alpha} = \frac{1}{\alpha\, \mu_k + (1 - \alpha)\, \bar{\pi}(y_{\min})}.$$

*This nests the pricing rule* (2) *at* $\alpha = 0$ *and* (B.17) *at* $\alpha = 1$*. The fair rate* (6) *is constant across* $\alpha$*, and below the posted rate if and only if* $\bar{p}(y_p) > (1 - \alpha)\, \bar{p}_g(y, y_p)$*. The threshold falls from* $\bar{p}_g$ *under the pricing rule to zero once cosigning is taken into account, which is Corollary 1. While* $\alpha$ *does not fix the mispricing, it creates a feedback loop from the pool to the interest rate, allowing a separating interest rate (Online Appendix OA1).*

### B.1.3 Regularity Assumptions

This block states the regularity conditions that Proposition 2 and the lemmas of Section 3.3 use.

All of what follows is stated on the borrowers who pass the loan-to-value test, $\{(y, a) : a \geq (1 - \overline{\text{ltv}}^k)P\}$ of (B.8). Because the loan-to-value test does not depend on $r_k(y)$, it restricts who is in the analysis without entering any object in it, so no statement below is affected by it.

Each of the four does one job: (A1) fixes the preference class behind the need of Lemma 1 and the limit of Lemma 3; (A2) makes the cutoffs interior; (A3) gives the taste shock full support and a log-concave distribution; and (A4) keeps parental liability non-trivial, without which the guarantee conveys nothing.

(A1) **Preferences, the Loan Schedule, and Participation.** $u(c, h)$ is $C^2$, strictly increasing, strictly concave and bounded above, and consumption alone reaches the bound at every level of housing, $\lim_{c \to \infty} u(c, h) = \sup u$ for every $h \geq h_r$. The CRRA curvature $\sigma > 1$ over the consumption–housing composite of Section 6 satisfies this; a separable bounded $v(c) + w(h)$

does not reach the bound. The same $u$ serves the parent, with her housing fixed. The desired loan $L^d(y)$ is a primitive, the loan a borrower of income $y$ asks for, the stand-in for the housing policy of the lifecycle model: it rises with income without bound, and housing is a necessity, so the share of income its solo payment takes, $(1 + r_{so}(y))L^d(y)/y$, falls with income and crosses the cap $\overline{\text{dti}}$ once, at the income $\hat{y}$ inside the support (Appendix B.1.4). The schedule also grows slowly enough that the house it buys outweighs its growth: writing $\theta_u$ for the housing share of the composite and $y_F$ for the lower end of the income support, at every income below the cosigned cap its income elasticity satisfies

$$\frac{d\ln L^d(y)}{d\ln y} \;<\; \frac{1-\theta_u}{\theta_u}\Big[\Big(\frac{h_{co}(y_F)}{h_r}\Big)^{\theta_u(\sigma-1)} - 1\Big].$$

Under the composite the insurance term is $\Delta\underline{u}(y) = \big[h_r^{-b} - h_{co}(y)^{-b}\big]\, y^{-a}/(\sigma-1)$ with $a = (1-\theta_u)(\sigma-1)$ and $b = \theta_u(\sigma-1)$, so $d\ln\Delta\underline{u}/d\ln y = b\,\varepsilon_L\,\rho/(1-\rho) - a$, where $\varepsilon_L$ is the elasticity of the schedule and $\rho = (h_r/h_{co}(y))^b$; the bound makes this negative at $y_F$, and its right side rises with the house, so the insurance term falls with income on the whole support, below the cosigned cap as well as above it, where the house is fixed. At every income in the support a solo buyer prefers her bundle to renting the floor at full income,

$$u\big(c_{so}(y), h_{so}(y)\big) \;\geq\; u(y, h_r),$$

and the test goes slack before either cap binds, $h^d(\hat{y}) < h^*$. The inequality is the participation condition of a buyer; it is used in Lemma 1, and the saturation of the bound in Lemma 3. The ordering of $\hat{y}$ and the caps keeps the house gain to three stretches, positive, zero, negative; no proof uses it. See Remark 2.

(A2) **Boundary Conditions.** For both $\theta \in \{G, B\}$, under the posted rates (2) at every parental income $y_p$, and under equal rates on both menus, $\Delta V(y_F, \theta; y_p) > 0$ and $\Delta V(\cdot, \theta; y_p)$ crosses zero at most once on $(y_F, \infty)$, where $\Delta V(y, \theta; y_p) \equiv \Delta V(y, \theta;\, r_{co}(y_{\min}), r_{so}(y))$ is the gain (4) at the posted rates. Poor borrowers prefer cosigning, and once a type prefers solo, it does so at every higher income. That rich borrowers prefer solo is not assumed: Lemma 3 gives $\lim_{y\to\infty}\Delta V(y, \theta) = -\phi < 0$. Together these give interior, unique cutoffs and rule out corner equilibria.

(A3) **Taste Shock.** The support of $F_\eta$ is $\mathbb{R}$, and $F_\eta$ is log-concave, so that $\varphi \equiv f_\eta/F_\eta$ is strictly decreasing, as for the normal, logistic, extreme-value and Laplace families. The log-concavity is used only in Proposition 5, where it signs how the guarantee's informational content varies with parental income.

(A4) **Non-Trivial Parental Liability.** $\Delta u_p \geq \underline{\delta} > 0$ uniformly over the support of $y_p$, which requires coverage $\bar{p}(y_p) > 0$, so a support that starts strictly above the floor $\underline{c}_p$ of (B.4), and, because $\Delta u_p$ is strictly decreasing in $y_p$ above saturation under the concavity of (A1),

a *bounded* support for $y_p$. The corollary to Proposition 5 states what is being ruled out by that boundedness, and it is not innocuous.

### B.1.4 Value Functions and the Income Floor

**Value functions and sorting.** Borrowers with $o = 1$ choose $k \in \{so, co\}$ to maximise expected utility (3); the loan is not chosen, it is read off the schedule. The desired loan $L^d(y)$ is the loan a borrower of income $y$ asks for, a primitive of (A1) that stands in for the housing policy of the lifecycle model: it rises with income, and the share of income its solo payment takes falls with income and crosses the cap once, at the income $\hat{y}$ with

$$(1 + r_{so}(\hat{y}))\, L^d(\hat{y}) \;=\; \overline{\text{dti}}\,\hat{y}, \tag{B.18}$$

so the share of buyers the test binds for is a parameter. Each menu lends the lower of the desired loan and its cap,

$$L_{so}(y) = \min\Big\{L^d(y),\ \frac{\overline{\text{dti}}\,y}{1 + r_{so}(y)},\ \overline{\text{ltv}}^{so} P\Big\}, \qquad L_{co}(y) = \min\big\{L^d(y),\ L^*\big\}, \tag{B.19}$$

so that below $\hat{y}$ the solo loan is the income-test loan and consumption in the repayment state is $c_{so}(y) = (1 - \overline{\text{dti}})y$, independently of $r_{so}(y)$; from $\hat{y}$ on it is the desired loan.

The value functions then specialise to:

$$V_{so}(y, \theta;\, r_{so}(y)) = \pi_\theta\, u(c_{so}(y),\, h_{so}(y)) + (1 - \pi_\theta)\, \underline{u}_{so}, \tag{B.20}$$

$$V_{co}(y, \theta;\, r_{co}(y_{\min})) = \pi_\theta\, u(y - (1 + r_{co}(y_{\min}))L_{co}(y),\, h_{co}(y)) + (1 - \pi_\theta)\, \underline{u}_{co} - \phi, \tag{B.21}$$

where $h_{so}(y) \equiv \alpha L_{so}(y)$ and $h_{co}(y) \equiv \alpha L_{co}(y)$ are the housing services bought under each menu, $h_{co}(y) = h^* \equiv \alpha L^*$ once the cap binds, and $\underline{u}_{co} = u(y, h_{co}(y))$ by (B.2).

The repayment-state gain $\Gamma$ in the net gain from cosigning (4) is

$$\Gamma(y;\, r_{co}(y_{\min}), r_{so}(y)) \equiv u(y - (1 + r_{co}(y_{\min}))L_{co}(y),\, h_{co}(y)) - u(c_{so}(y),\, h_{so}(y)) \tag{B.22}$$

where $c_{so}(y) = y - (1 + r_{so}(y))L_{so}(y)$, equal to $(1 - \overline{\text{dti}})y$ below $\hat{y}$, and $h_{so}(y)$ are the solo bundle above. At the posted rate, where both menus share the desired loan, the gain has three stretches: below $\hat{y}$ the cosigned bundle is the unconstrained choice and the solo bundle is not, so $\Gamma > 0$; between $\hat{y}$ and the income at which the desired house reaches $h^*$ the two bundles coincide and $\Gamma = 0$; above it the solo bundle is the less constrained one and $\Gamma < 0$.

Because $\pi_\theta$ cannot be factored from (4), the indifference threshold is type-specific. With $\Delta V(y, \theta; y_p)$ the gain at the posted rates, as in (A2), the type-$\theta$ indifference threshold $\tilde{y}_\theta(y_p)$ is defined implicitly by:

$$\Delta V(\tilde{y}_\theta(y_p), \theta;\, y_p) = 0. \tag{B.23}$$

Bad types default more frequently and therefore weight $\Delta\underline{u}$ more heavily, sorting into cosigning over a wider income range. At the posted rates the two thresholds are ranked $\tilde{y}_G(y_p) < \tilde{y}_B(y_p)$ at every $y_p$ (Lemma 1); they are the cutoffs of Proposition 2.

**The Income Floor.** Let $y_F$ denote the lower end of the income support. It lies where a solo buyer's bundle already beats the rental floor, the participation condition of (A1), so both menus buy a house and a borrower who repays has positive consumption on the whole support. Since each loan is sized to its menu's tests, no borrower in the sample is rejected; $y_F$ only bounds the domain of (A2), and $\hat{y}$ lies above it.

**Lemma 3** (The Gain Vanishes at the Top)**.** *Under* (A1), $\Gamma(y, y_p) \to 0$ *for every* $y_p$ *and* $\Delta\underline{u}(y) \to 0$ *as* $y \to \infty$, *hence* $\lim_{y\to\infty} \Delta V(y, \theta; y_p) = -\phi < 0$ *for both types.*

The economics: a rich borrower cares little which house she keeps after a miss, and little for the house the signature buys her, which is at most the gap between the two caps once the solo loan has reached its own, and the score penalty, a finite payment gap, vanishes in utility as well. What remains is the cost of signing. This is why rich borrowers go solo whatever their type, and why the exit needs no house to outgrow another.

### B.1.5 The Cost of the Split

Proposition 1 concerns one thing the price does not read, the guarantee's recovery. There is a second, and it is the variable admission turns on. With the offer index $I_\theta$ of (9), so that $q_\theta = F_\eta(I_\theta)$, let

$$\Lambda_1(y, y_p) \;\equiv\; \Pr(\theta = G \mid y, y_p, o = 1) \;=\; \frac{\lambda(y)\, q_G(y, y_p)}{\lambda(y)\, q_G(y, y_p) + (1 - \lambda(y))\, q_B(y, y_p)} \tag{B.24}$$

denote the belief a lender permitted to read parental income would hold. By the law of total probability $\Lambda_1(y) = \mathbb{E}[\Lambda_1(y, y_p) \mid y, o = 1]$: the schedule the rule posts prices the average of a belief that is not constant in $y_p$.

The prior $\lambda(y)$ conditions on the child's income alone. A residual channel from $y_p$ to $\theta$ would push $\Lambda_1(y, y_p)$ up in $y_p$ where the screen pushes it down; the two enter posterior odds additively, so part (i) below survives whenever the screen term dominates.

**Proposition 5** (The Cost of the Split)**.** *Under* (A1)–(A4) *and Assumption 1, on the region where the parent's file is at least the child's and the obligation no longer grows with parental income,* $\{y_p \geq y : \bar{p}(y_p) = 1\}$*:*

*(i)* ***Informational content falls with parental income.*** $I_G - I_B = \Delta\pi\big[\Delta u_p(y_p) - \beta(\Delta\underline{u} - \Gamma)\big]$ *is strictly decreasing in* $y_p$*, and under* (A3) *so is the likelihood ratio* $q_G/q_B$*. Hence* $\Lambda_1(y, y_p)$ *is strictly decreasing in* $y_p$*: a guarantee from a poor parent is stronger news about the child than a guarantee from a rich one. Below saturation* $\bar{p}(y_p)$ *is still rising, the obligation rises with it, and the screen strengthens in* $y_p$ *instead; the profile over* $y_p \geq y$ *is hump-shaped, with the peak at saturation.*

*(ii)* ***The rule cross-subsidizes along*** $y_p$**.** *Let* $\hat{r}_{co}(y, y_p) \equiv 1/\mu_{co}(y, y_p) - 1$ *be the price the* same *rule would post if permitted to read* $y_p$*, with* $\mu_{co}(y, y_p) = \pi_B + \Delta\pi\Lambda_1(y, y_p)$*, and* $\hat{r}_{co}(y) \equiv 1/\mu_{co}(y) - 1$ *the price it posts on the pool averaged over* $y_p$*. The first is strictly increasing in* $y_p$*, while the second is constant in it. There is therefore a threshold* $y_p^0(y)$ *such that cosigners with* $y_p < y_p^0$ *are overcharged and those with* $y_p > y_p^0$ *undercharged, relative to what the rule itself would charge on the fuller information set.*

*(iii)* ***The cross-subsidy degrades the pool.*** *Since* $\partial q_\theta/\partial r_{co} < 0$ *through* $\Delta V$*, moving from* $y_p$*-conditional to pooled pricing lowers participation among the overcharged low-*$y_p$ *families and raises it among the undercharged high-*$y_p$ *families. Evaluated at the initial schedule, the cosign pool is thereby reweighted toward the* $y_p$ *at which* $\Lambda_1(y, \cdot)$ *is lowest, so* $\Lambda_1(y)$ *is strictly lower than under* $y_p$*-conditional pricing.*

Where the parent has the worse file, $y_p < y$, her income enters the child's gain as well: a better file lowers the score penalty and raises $\Gamma$, so $I_G - I_B$ rises in $y_p$ through the gain. Below saturation this adds to the cover's effect; above it, it works against the falling $\Delta u_p$; and the posted rate reads her score there (Section 3.3).

**Corollary 2** (The screen reverses at the top)**.** *Suppose the support of* $y_p$ *is unbounded. Under (A1)* $u'(c) \to 0$*, so* $\Delta u_p(y_p) \to 0$ *and* $I_G - I_B \to -\beta\,\Delta\pi\,(\Delta\underline{u} - \Gamma) < 0$ *at every income, by Lemma 1. There is therefore a threshold* $\bar{y}_p(y)$ *above which* $q_G < q_B$ *and the guarantee is* negative *news,* $\Lambda_1(y, y_p) < \lambda(y)$*. Assumption 1 holds only below* $\bar{y}_p$*, and* (A4) *excludes the region by assuming a bounded support for* $y_p$*.*

This is a different unpriced object from Proposition 1: there the price misses the guarantee's recovery, here its *informativeness*, and Section 7 measures them as separate terms of the wedge. Part (i) also implies that cosigned default should rise with parental income conditional on child income, which Section 7 tests as an untargeted moment and does not find.

The proofs are in Online Appendix OA2.

**Remark 2** (Preference class: stylized and quantitative model)**.** *The two models share the preference class: CRRA curvature over a consumption–housing composite, bounded above, with a rental floor in default. What the stylized model adds is the fixed cost of signing* $\phi$*, the stand-in for the cost the quantitative model of Section 6 attaches to a cosigned default, where the exit of good types from cosigning comes from the debt-to-income constraint and the default option. The stylized model takes the loan schedule as given, with a payment share that falls in income so that the income test binds only at the bottom. In the quantitative model the schedule is the housing policy itself, and its house grid starts at a fixed smallest owned house, which does the same work at the bottom of the income distribution.*

## Appendix C: Natural Experiment: Robustness and Validity

## C.1 The Rate Margin

Table C.1 reports the year-FE rate margin in full: the per-group discontinuity responses and the cosigned-minus-solo differential across the bandwidth grid, with the confidence intervals Section 5 quotes.

TABLE C.1. Pass-Through to Interest Rates

| $h$ (**\$000s**) | **Solo** $\hat{\beta}_3$ | **Cosigned** $\hat{\beta}_3$ | **DiDisc** $\hat{\Delta}$ | $p_{\Delta}^{WCB}$ | $N_{\text{non}}$ | $N_{\text{cos}}$ |
|---|---|---|---|---|---|---|
| 18 | +0.0162 | +0.0075 | −0.0087 | 0.97 | 22,453 | 2,433 |
| | (0.1192) | (0.2403) | (0.2271) | | | |
| 20 | −0.0097 | −0.0661 | −0.0563 | 0.82 | 23,985 | 2,586 |
| | (0.1136) | (0.2389) | (0.2331) | | | |
| 20.8† | −0.0098 | −0.0772 | −0.0674 | 0.78 | 24,809 | 2,676 |
| | (0.1133) | (0.2388) | (0.2318) | | | |
| 22 | −0.0071 | −0.0623 | −0.0552 | 0.82 | 25,682 | 2,768 |
| | (0.1133) | (0.2351) | (0.2301) | | | |
| 24 | −0.0162 | −0.0625 | −0.0463 | 0.84 | 26,882 | 2,880 |
| | (0.1145) | (0.2332) | (0.2297) | | | |
| 26 | −0.0073 | −0.2047 | −0.1974 | 0.28 | 30,751 | 3,328 |
| | (0.0888) | (0.1724) | (0.1813) | | | |
| 28 | +0.0004 | −0.1630 | −0.1634 | 0.31 | 32,037 | 3,476 |
| | (0.0863) | (0.1650) | (0.1593) | | | |

*Notes:* Specification (15) on the above-AMI primary sample (Online Appendix OA5.7). Covariates and lender fixed effects as in Online Appendix OA5.15.1. Standard errors in parentheses, clustered by lender; $p_{\Delta}^{WCB}$ is the differential's score wild cluster bootstrap p-value. †: the solo pool's covariate-adjusted MSE-optimal bandwidth, a benchmark on a heaped support (Online Appendix OA5.12).

## C.2 Robustness and Validity: What Each Check Returns

The validity of the difference-in-discontinuities design rests on the four assumptions of Section 5.2; the central one is that the 2022 FHFA cost shock was a supply-side event that did not simultaneously alter the sorting behavior of borrowers. If the reform caused riskier households to bunch more aggressively than safer ones, a heterogeneous pass-through estimate would be an artifact of changing pool composition rather than lender risk perception. Table C.2 reports the checks in two panels. Panel A collects the design-validity tests; sorting, manipulation, balance, pre-trends and placebos are properties of the design rather than of the time controls, so they hold for any specification. Panel B re-estimates the year-FE primary itself with one design choice changed at a time; the full ladder is Online Appendix Table OA20 (Online Appendix OA5.2). Checks that only ever described the retired pooled-intercept specification are collected, dated, in Online Appendix OA5.15.

Three of the checks bear on the identifying assumptions themselves rather than on functional form, and the design turns on them. The *Difference-in-McCrary* tests the heap-invariant object

TABLE C.2. Robustness and validity checks: what each tests, and what it returns

| Check | What it tests | Result (cosigned − solo) | Ref. |
|---|---|---|---|
| *Panel A. The identifying assumptions (specification-invariant)* | | | |
| Difference-in-McCrary | constant manipulation intensity | fails to reject: $\hat{\beta}_3 = -1.95$ ($p = 0.58$) cosigned, $-2.07$ ($p = 0.54$) solo | C.3 |
| Event study | pre-reform divergence | pre-reform estimates flat; joint Wald fails to reject parallel trends on both margins | OA5.5 |
| Covariate balance | composition shifting at the cutoff | no differential jump in income, age or gender ($p > 0.10$); solo income alone shifts ($-0.05$, $p < 0.05$) | OA5.4 |
| Sorting into contracts | switching into cosigned status | no detectable change in the probability that an application is cosigned: $\hat{\beta}_3 = -0.26$ pp ($p = 0.81$) | OA5.4 |
| Temporal placebo | a differential at a date with no shock | none: $-0.01$ ($p = 0.93$) and $+0.03$ ($p = 0.79$) | OA5.13 |
| Placebo cutoffs, rate and rejection differential | a generic loan-size divergence | insignificant at all ten, but standard errors at the upper cutoffs are large: this fails to find one rather than ruling it out | OA5.6 |
| Event study, denial response | pre-reform divergence in solo DTI denials | flat 2018–21, joint Wald $p = 0.76$ (differential $p = 0.90$); response from 2022 (Figure 6A) | OA5.9 |
| Placebo cutoffs, denial response | a false jump in solo DTI denials | none at ±\$30–80k: the real cutoff ranks first of thirteen ($p = 0.077$); pseudo-effects appear only at ±\$70–160k | OA5.9 |
| Untreated jumbo boundary | a differential where the fee did not apply | insignificant throughout, on standard errors two to three times the treated design's: uninformative, not passed | OA5.8 |
| *Panel B. The year-FE primary under design variants (rate margin, Online Appendix Table OA20)* | | | |
| Donut (straddle bin dropped) | contamination from the reporting heap | $-0.09$–$-0.01$ pp (smallest $p = 0.72$) | OA5.2 |
| Polynomial order | residual curvature | $-0.10$–$-0.06$ pp (smallest $p = 0.71$) | OA5.2 |
| Triangular kernel | kernel choice | $-0.09$–$-0.07$ pp (smallest $p = 0.71$) | OA5.2 |
| No covariates | the covariate convention | $-0.10$–$-0.06$ pp (smallest $p = 0.66$) | OA5.2 |
| Full sample | the first-time-buyer fee waiver | $+0.03$–$+0.06$ pp (smallest $p = 0.80$) | OA5.2 |
| Post window to end-2022 | the January-2023 LLPA re-grid | $-0.11$–$-0.07$ pp (smallest $p = 0.74$) | OA5.2 |
| LTV reweighting | a fee-dose imbalance across pools | $-0.03$–$+0.02$ pp (smallest $p = 0.91$) | OA5.2 |
| Rejection, full sample | the waiver on the rationing margin | $-0.053$–$-0.024$, negative at 9 of 9 windows (smallest $p = 0.26$) | OA5.7 |

*Notes:* Ref.: the appendix section with each check's specification, table and figure. Panel B: the range of the cosigned-minus-solo year-FE differential across $h$ = \$18–24k (rejection row: the wide grid of Online Appendix Table OA26), and the smallest $p$-value across those windows.

— whether manipulation *intensity* changed at the reform — and fails to reject constant intensity in both pools (Appendix C.3 sets out why the difference, and not the level, is the object a heaped support permits). The event study finds no pre-reform divergence between the two pools on either margin, which is the validity check Picchetti et al. (2024) propose for this design (Online Appendix OA5.5). And the probability of cosigning at the cutoff shows no detectable change ($-0.26$ pp, standard error 1.05), which is a direct test of assumption (4), no switching into cosigning, rather than a balance check alone, because the model predicts a composition response precisely there (Online Appendix OA5.4).

### C.3 Manipulation of the Running Variable: The Difference-in-McCrary Test

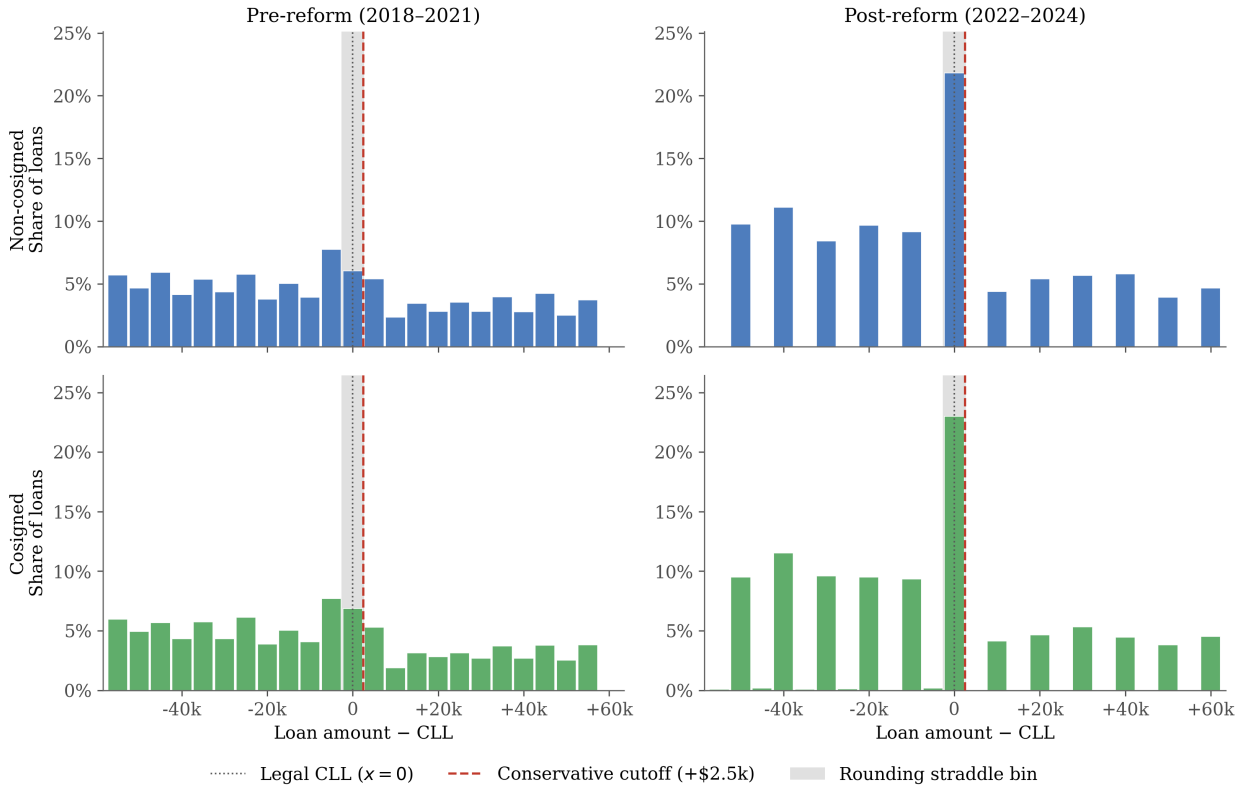
In the presence of the Conforming Loan Limit (CLL), the running variable (loan amount) is inherently endogenous. Figure C.1 provides visual evidence of significant density mass shifted from just above to just below the threshold. To ensure this bunching does not bias my DiD estimator, I must verify that the *intensity* of this manipulation is time-invariant. A single-period McCrary test is unreliable here for the same reason the continuity-based bandwidth selectors are: the \$5,000 reporting heap distorts the estimated *level* of the density discontinuity at the cutoff. That heap is a fixed property of the HMDA brackets, however, common to the pre- and post-reform density alike, so it cancels in the *difference*. The cancellation is the density-side analogue of taking the outcome design from RD to difference-in-discontinuities: the Difference-in-McCrary tests only the heap-invariant object — whether manipulation *intensity* changed at the reform — and not the heap-contaminated level.

I formalize this using a *Difference-in-McCrary* test, a reform-differenced version of the density-continuity test of McCrary (2008). I bin the centered loan amount into \$1,000 intervals and, within each cosigning group $k$, regress the local loan share $s_{bt}^k$ — bin $b$'s count expressed as a percentage of the group–year total within the estimation window — on the discontinuity indicator, the post-reform indicator, their interaction, a fully interacted local-linear slope in the running variable, and year fixed effects:

$$s_{bt}^k = \alpha^k + \beta_1^k D_b + \beta_2^k Post_t + \beta_3^k (D_b \times Post_t) + \left(\gamma_0^k + \gamma_1^k D_b + \gamma_2^k Post_t + \gamma_3^k D_b Post_t\right)\tilde{X}_b + \lambda_t^k + \epsilon_{bt}^k \quad \text{(C.1)}$$

where $D_b = \mathbf{1}\{\tilde{X}_b > 0\}$ classifies bin $b$ as above the limit (its midpoint exceeding the conservative cutoff +\$2,500) and $\lambda_t^k$ are year fixed effects. The difference-in-discontinuities coefficient $\beta_3^k$ measures the change in the density jump at the limit post-reform. My identifying assumption, **Constant Manipulation Intensity**, requires $\beta_3^k = 0$. As reported in Table C.3, I fail to reject the null for both non-cosigned ($\hat{\beta}_3 = -2.07$, $p = 0.54$) and cosigned ($\hat{\beta}_3 = -1.95$, $p = 0.58$) applications. The stability of the density jump suggests that the "incentive to bunch" remained constant despite the increase in g-fees, likely because the 2022 reform targeted a range of high-balance loans rather than shifting the threshold itself.

FIGURE C.1. Density of the running variable around the conforming loan limit




Share of loans per $5,000 bin, by cosigning status (rows) and reform period (columns). The shaded band is the $5,000 rounding straddle bin centred on the legal limit.

TABLE C.3. Difference-in-McCrary Test — Stability of Bunching at the Conforming Loan Limit

| **Group** | $\hat{\beta}_3$ **(above × post)** | **SE** | $p$**-value** |
|---|---|---|---|
| Non-cosigned | −2.07 | 3.40 | 0.542 |
| Cosigned | −1.95 | 3.50 | 0.576 |

*Notes:* The change in the density jump at the limit after the reform, by group; standard errors from the binned-density regression.

## Appendix D: Structural Estimation: Moments and Identification

### D.1 Targeted Moments: Sources, Construction, and Weights

Table D.1 gives, for each targeted moment of Table 6, the data source and the standard error that sets its weight in $\mathbf{W}$.

TABLE D.1. Targeted moments: source and weighting tolerance

| | Moment | Source | SE in $\mathbf{W}$ |
|---|---|---|---|
| $M_1$ | Homeownership rate at 37 | CPS ASEC | 2.5 pp |
| $M_2$ | Mortgage default rate | NSMO | 0.28 pp |
| $M_3$ | Cosigned share of purchases | HMDA + deed records | 1.8 pp |
| $M_4$ | Cash-gifted share of purchases | SHED | 3.5 pp |
| $M_5$ | Cosign gradient by credit score | Fannie Mae × HMDA | 0.044 |
| $M_6$ | Typed default ratio | NSMO PUF | 0.254 (log scale) |
| $M_7$ | Cosign–solo wedge, score $< 750$ | Fannie Mae × HMDA | 0.5 pp |
| $U_3$ | Cosign–solo wedge, score $\geq 750$ | Fannie Mae × HMDA | 0.5 pp |

*Notes:* $M_5$ and $M_6$ enter at their sampling standard errors. The others carry weighting tolerances: $0.33 \times |\text{target}|$ for $M_2$ and $M_3$, absolute percentage points for $M_1$ and $M_4$, and a floor of 0.5 points for the two wedges, whose sampling standard errors are 0.09 and 0.06. $U_3$ is in the objective, but no parameter moves it (Table 7).

$M_1$ and $M_4$ take absolute rather than relative tolerances because pure relative weighting gave the two small-target shares most of the weight and let homeownership collapse. The two score-split wedges enter at a floor rather than at their sampling standard errors: at those errors either one would own the objective, and the search would trade homeownership, default and the cosign share away to close it. Weight is not the same as realized criterion. At $\hat{\theta}$ the type ratio carries 49 percent of the criterion and the default rate 34 percent, the two misses of Section 7.

$M_1$ is the CPS ASEC share of adults aged 30–36 who are the reference person or spouse of an owner-occupied unit, pooled over 2024 and 2025 (41.2%). Every model agent makes one purchase decision, at entry, and that one date stands in for the first purchases people make over their early thirties, so the model's ownership just after it is matched to average ownership over the window. The person-level construction is deliberate: the model has no co-residence, so each adult is one model agent, and an adult living in a parent's home is a non-owner, the model's renter state.

$M_2$ is the NSMO exposure-corrected annual hazard of a first 30-day delinquency on the paper universe — conventional, first-time, solo borrowers — at 0.85% per loan-year. It replaces an all-market series (FRED `DRSFRMACBS`) that measures a *stock* of delinquent balances rather than an annual *hazard*, covers every vintage and product rather than the pool the model's $M_2$ describes, and counts delinquencies that cure while the model's solo default is absorbing.

$M_3$, 5.47%, is the pooled augmented prevalence of Section 4: the HMDA age-gap rate over the estimation sample plus the +3.00-point New York deed uplift (Online Appendix OA4.5). It was set before the HMDA estimation sample was rebuilt; on the rebuilt sample of Table 3 the same construction gives 5.79%, 0.32 points higher and under a fifth of $M_3$'s weighting tolerance, and the

target was not moved. That tolerance is a construction band rather than a sampling error: HMDA is a census, and the deed rule measures third signatories rather than parents alone.

$M_4$ is the share of first-time buyers who funded the purchase partly with a loan or gift from family or friends, from the 2015 and 2016 waves of the Federal Reserve's Survey of Household Economics and Decisionmaking — the only waves that fielded the down-payment-source battery alongside a first-time-ownership indicator — restricted to purchases from 2009 and buyers under 45 at purchase. The previous target, 35.0%, came from an industry survey and is not reproducible from the SHED at any population definition: the pooled post-2009 figure is 25%. The 20–40% range reported by Brandsaas (2025) is the span of *year-specific* estimates across 2009–16 purchase cohorts, whose upper end rests on forty-five respondents, and it is not a pooled magnitude that 35.0% could sit inside.

$M_5$ is the gradient of cosigning in the borrower's credit score: the intergenerational share of first-time buyers in the top quartile of the borrower's own score, less that share in the bottom quartile, over the mean share, on Fannie Mae loans matched to HMDA, 2018–2024 ($-0.738$; the standard error is a state-clustered bootstrap). The model has income rather than a score, so its counterpart is the same ratio across quartiles of income at purchase.

$M_6$ is measured on the same rung as $M_2$: the NSMO PUF ratio of ever-30-day delinquency for conventional first-time purchase borrowers with FICO $< 740$ versus $\geq 740$, against the model's survival-weighted Bad-/Good-type default-rate ratio among solo mortgage holders. Putting it on the 30-day rung leaves the point estimate almost unchanged (6.9× against 7.06× at 90 days) but roughly halves its standard error, because that rung carries about three times the events.

$M_7$ and its twin above the cut, $U_3$, are the cosign–solo gap in the annual hazard of a first 30-day delinquency within the price cell, intergenerational against solo first-time buyers on the same matched Fannie Mae and HMDA loans, below and above a credit score of 750 ($-0.48$ and $+0.19$ points a year). Both are lower bounds: a parent who pays within the month leaves no record. The cut splits the matched buyers in half; the model splits its buyers at the income state that comes closest to that share and measures the wedge on the cosigned pool's own repayment, before any parent pays, which is what the data see.

### D.2 Heuristic Identification

The estimated vector is $\theta = \{\pi_B, \Delta\pi, \Delta\xi, \text{div}, p_{own}, \eta_{cosign}, \eta_{cash}\}$ ($K = 7$), fitted to the seven targeted moments of Table D.1. The level of the default penalty is held at $\bar{\xi} = 4.40$: scaling every default penalty together leaves the targeted moments flat, so the data do not pin it. Table D.2 reports the estimate. Table D.3 shows how each parameter moves the moments. The search starts from a simplex whose vertices each move one parameter away from the starting point, so its first evaluations are one-at-a-time responses at that point. The map is local and indicative, not a substitute for the joint estimation.

TABLE D.2. Parameter estimates

| Parameter | Symbol | Estimate |
|---|---|---|
| Repayment probability, Bad type | $\pi_B$ | 0.878 |
| Repayment gap | $\Delta\pi$ | 0.108 |
| implied, Good type | $\pi_G$ | 0.986 |
| Default-penalty spread | $\Delta\xi$ | 4.13 |
| implied type penalties | $\xi_G,\ \xi_B$ | 6.46, 2.33 |
| Cosign-default penalty divisor | div | 0.48 |
| implied invocation penalty | $\bar{\xi}^{inv}$ | 9.13 |
| House price–income ratio | $p_{own}$ | 14.61 |
| Cosigning cost | $\eta_{cosign}$ | −0.86 |
| Cash-gift cost | $\eta_{cash}$ | −0.55 |
| Default-penalty level (held) | $\bar{\xi}$ | 4.40 |

*Notes:* The estimate $\hat{\theta}$ at which the model column of Table 6 is evaluated, the best point of the search. The counterfactuals start from $\hat{\theta}$ with $\eta_{cosign} = -0.97$ (Section 7). Standard errors are not reported for this estimate.

TABLE D.3. How each parameter moves the moments: one-at-a-time steps from the starting point

| Step from the start | HO (pp) | Default (pp) | Cosign (pp) | Cash (pp) | $M_5$ | $M_7$ (pp) | $q_G^{co}$ | Coverage |
|---|---|---|---|---|---|---|---|---|
| $\pi_B$: 0.900 → 0.850, $\pi_G$ held | −0.13 | +0.044 | −0.16 | −0.09 | +0.10 | +0.07 | +0.01 | 0.00 |
| $p_{own}$: 14.28 → 13.48 | +1.24 | −0.038 | +3.10 | +0.24 | −0.58 | −0.19 | +0.01 | +0.11 |
| $\eta_{cosign}$: −0.97 → −0.72 | +0.63 | +0.001 | +2.73 | +0.09 | 0.00 | +0.01 | 0.00 | 0.00 |
| $\eta_{cash}$: −0.57 → −0.52 | +0.01 | 0.000 | +0.01 | +1.85 | 0.00 | 0.00 | 0.00 | 0.00 |
| $\Delta\xi$: 4.83 → 5.43 | +0.14 | +0.002 | +0.54 | +0.02 | −0.11 | +0.22 | −0.05 | +0.04 |
| $\Delta\pi$: 0.082 → 0.092 | +0.07 | −0.025 | +0.41 | +0.06 | +0.17 | 0.00 | +0.04 | 0.00 |
| div: 0.40 → 0.60 | +0.61 | −0.004 | +3.97 | +0.15 | 0.00 | +0.55 | −0.02 | +0.11 |

*Notes:* Change in each moment from the starting point to one vertex of the starting simplex, both solved in full. $M_5$ is the cosign gradient and $M_7$ the low-score wedge of Table 6; $q_G^{co}$ is the good-type share of the cosigned pool, and coverage the share of missed payments parents pay. $M_6$ is not recorded at each evaluation. In the $\pi_B$ step, $\Delta\pi$ moves with $\pi_B$.

TABLE D.4. The default rate of cosigned loans, step by step

| | % of loans a year |
|---|---|
| Solo borrowers | 0.38 |
| + income and house: where cosigners buy | +0.57 |
| + savings, same cell and loan age | +0.21 |
| + hidden type: adverse selection | +0.74 |
| + hidden type: screen | −0.13 |
| Cosigned, if they behaved as solo borrowers | 1.77 |
| + moral hazard: the child misses less often | −0.81 |
| Cosigned, missed by the child | 0.96 |
| + the cure: parents pay 73% of it | −0.70 |
| Cosigned, after the cure | 0.26 |
| *Memo:* cosigned after the cure − solo | −0.12 |

*Notes:* The steps of equation (27), at the point the counterfactuals start from, over the whole life of the mortgage; the rows add up as printed.

**Reading the map.** The helping costs are the cleanest levers. $\eta_{cash}$ moves the cash-gifted share and nothing else, and $\eta_{cosign}$ moves the cosigned share and, through it, a little homeownership, but not who cosigns: the gradient, the low-score wedge and the pool's type mix stay where they are. That is why the counterfactuals can start from a lower cosigning cost without moving any other moment. The house price moves homeownership, and with it the cosigned share and the gradient: cheaper houses bring in cosigners from lower incomes and steepen the gradient, so $p_{own}$ trades homeownership against $M_5$.

Who cosigns is pinned by the type parameters. A larger $\Delta\pi$ makes Good types safer, lowers the default rate and flattens the gradient, and so does a lower $\pi_B$ for the gradient while it raises the default rate. A probe along each parameter at an earlier point of the search finds that the two involuntary-repayment probabilities are the only parameters that move the default rate and the type ratio; the default penalties move cosigning instead. The low-score wedge is moved by div and $\Delta\xi$. A larger divisor makes invoking the guarantee cheaper and opens the wedge, and it also raises the cosigned share; a wider penalty spread worsens the cosigned pool's type mix and opens the wedge too. The default rate is the moment no parameter moves on its own: each of $\pi_B$, $\Delta\pi$ and $p_{own}$ shifts it by a few hundredths of a point per step, and each pulls the gradient or homeownership away, the miss of Section 7.

### D.3 The Default Rate at the Estimate

Table D.4 lists the steps of Figure 8, equation (27), as numbers.

## Appendix E: Counterfactual: The Designs

### E.1 The Pricing Ladder in Full

Table E.1 reports every economy solved for Section 8, each in general equilibrium at its own market-clearing house price and rent, as a change against the economy it starts from. Table 8 in the main text is a selection of its rows. Beyond those, it gives the default rate of solo borrowers and the rate at which cosigned children invoke the guarantee; the order in which the lender's information and the price enter (the reverse path, through R1 and R2); the parent without knowledge of the type on the deposit rule (D2); and the state guarantee, on the deposit rule (S3) and at the reform's pricing (SP).

## Table E.1. The pricing ladder in full, general equilibrium

| | CEV (%) | Homeownership (pp) | Solo default (pp) | Foreclosure (pp) | Guaranteed share (pp) | Premium (bp) | Invocation (pp) |
|---|---|---|---|---|---|---|---|
| L1: guarantee priced (reference) | +0.431 | +0.64 | +0.006 | -0.027 | +11.88 | -37.2 | -0.017 |
| of which: the pool's risk priced, cover ignored (L0 to L0') | -0.219 | -0.69 | -0.013 | +0.003 | -4.98 | +65413.4 | +5.881 |
| of which: the parent's cover credited (L0' to L1) | +0.650 | +1.33 | +0.019 | -0.030 | +16.86 | -65450.6 | -5.898 |
| L2: + counted in the deposit | -0.041 | +0.37 | -0.002 | +0.035 | -2.33 | +331.5 | +0.511 |
| L3: + lender sees type (yardstick) | -0.117 | -0.01 | -0.008 | +0.004 | +0.42 | -22.7 | -0.675 |
| S3: the state guarantee (L2 to S3) | -0.390 | +2.61 | +0.042 | -0.316 | +70.81 | -348.3 | -0.232 |
| SP: the state instead of the parent (L1 to SP) | +0.075 | +2.55 | +0.030 | -0.310 | +75.51 | -20.4 | -0.069 |
| SP to S3: + counted in the deposit, under the state | -0.506 | +0.43 | +0.010 | +0.029 | -7.04 | +3.5 | +0.349 |
| N0: no cosigning (vs L0) | -0.363 | -0.79 | -0.013 | -0.007 | -5.44 | +0.0 | – |
| D2: uninformed parent (vs L2) | +0.003 | -0.05 | +0.003 | -0.002 | +0.50 | -40.6 | +0.016 |
| D2 under today's rules (vs L0) | -0.004 | -0.02 | +0.000 | +0.000 | +0.01 | +0.0 | +0.031 |
| D2 at the reform's pricing (vs L1) | -0.000 | -0.03 | +0.002 | +0.000 | +0.23 | -0.3 | +0.026 |
| Reverse: information first (L0 to R1) | +0.000 | +0.00 | +0.000 | +0.000 | +0.00 | +0.0 | +0.000 |
| Reverse: + priced (R1 to R2) | +0.313 | +0.59 | +0.001 | -0.027 | +11.24 | -67.3 | -0.864 |
| Reverse: + counted (R2 to L3) | -0.039 | +0.41 | -0.004 | +0.039 | -1.27 | +338.9 | +0.684 |

*Notes:* Each row is a change against the economy named in parentheses. L0: today. L0′: the lender prices the cosigned pool's risk and ignores the parents' cover; the premium has no cap and the cosigned market unravels, so its premium entries describe the few loans that remain. L1: priced on losses, the reform of Section 8. L2: L1 with the guarantee counted in the deposit (cosigned loans to 97.5% of the price). L3: L2 with a lender who sees the child's type. R1, R2: the lender sees the type first, then prices on losses. D2: the parent cannot tell the child's type. N0: no parent can cosign. S3: the state guarantees every buyer on L2's deposit rule; SP: at the reform's pricing; both are financed by a balanced lump-sum tax, and their welfare includes the cosigning cost the solution charges every parent although no parent signs. Welfare as in Table 8.

## E.2 Distributional Effects in General Equilibrium

Table E.2 measures who gains, in three comparisons solved in general equilibrium: today's economy against one in which no parent can cosign, the reform against today, and a state guarantee against today. Cosigning raises the wealth children hold at 40, before their inheritance arrives, because it moves some of them across the ownership margin and raises house prices. Today it helps the children of poorer parents more, in welfare and in ownership. Pricing the guarantee on the lender's losses reverses that ordering: the discount grows with the parent's capacity to cover a missed payment, so the reform's gains rise with parental income. The state's gains are larger in every row, and its welfare gain falls only slightly with parental income.

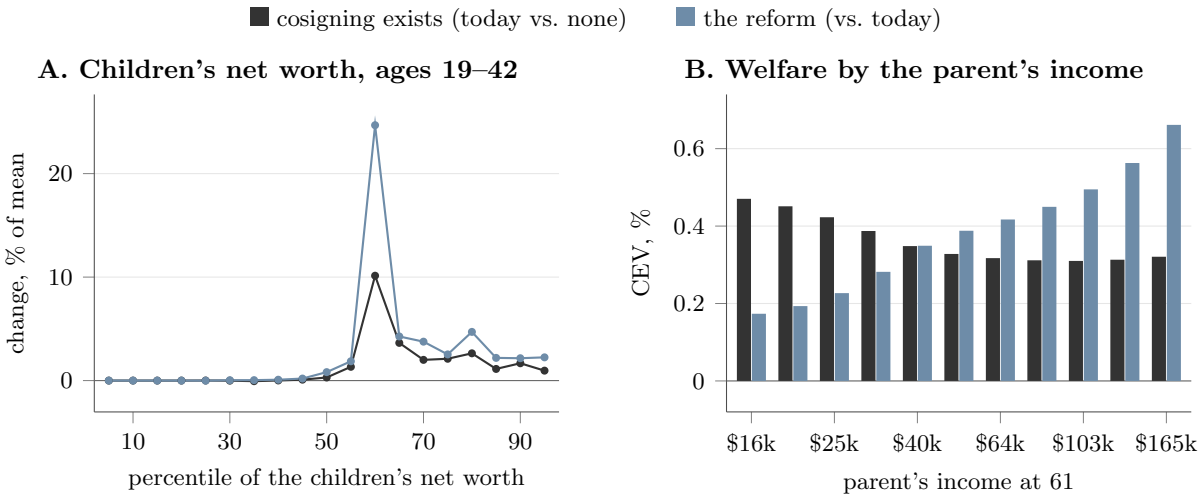
Figures E.1 to E.3 show the same comparisons income state by income state. The change in the children's net worth is concentrated where children turn from renters into owners; below that percentile it barely moves.

TABLE E.2. Distributional effects in general equilibrium

| | Cosigning exists *vs. no cosigning* | The reform *vs. today* | The state *vs. today* |
|---|---|---|---|
| *Panel A. Wealth of the children (%)* | | | |
| Total wealth at 40, before the inheritance | +1.44 | +1.87 | +13.12 |
| Mean wealth, ages 19–42 | +1.62 | +2.04 | +13.56 |
| *Panel B. Welfare, consumption-equivalent at entry (%)* | | | |
| All children | +0.37 | +0.43 | +1.90 |
| Bottom fifth of parent income | +0.41 | +0.25 | +2.11 |
| Top fifth of parent income | +0.31 | +0.48 | +1.93 |
| *Panel C. Homeownership at 19 (pp)* | | | |
| Bottom fifth of parent income | +1.20 | +0.10 | +3.27 |
| Top fifth of parent income | +0.61 | +1.15 | +3.78 |

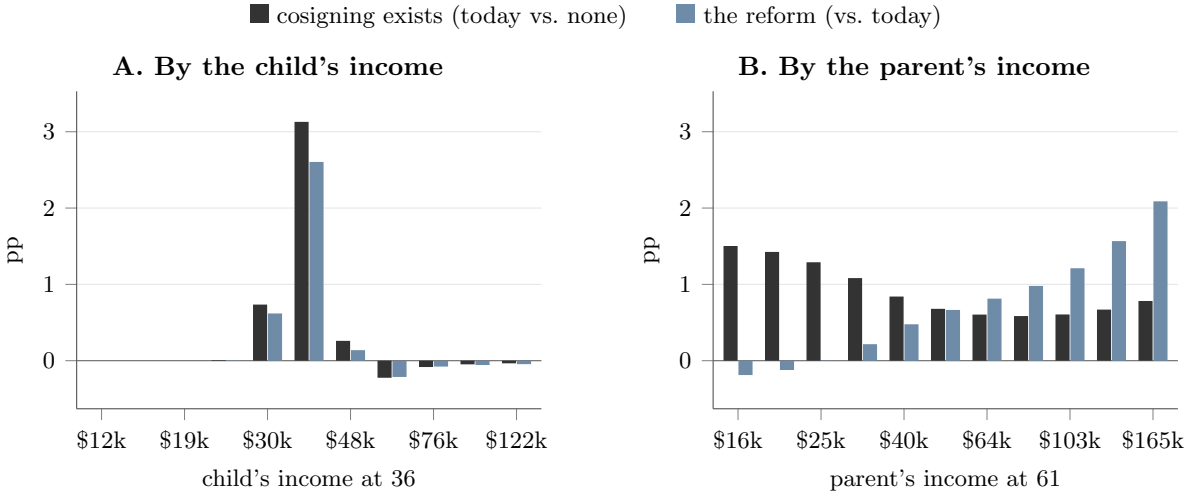
*Notes: The state* guarantees every buyer, counts the guarantee toward the deposit, and is financed by a balanced lump-sum tax, its welfare measured without the cosigning cost that the solution charges every parent although no parent signs. Wealth is net worth: assets plus the house at its price, less the outstanding mortgage; the inheritance arrives at 45. The fifths of parent income are the parent's income states 1–4 and 8–11 when the child is 18, each holding 22% of children, with the states weighted by their population.

FIGURE E.1. Children's net worth, and welfare by the parent's income



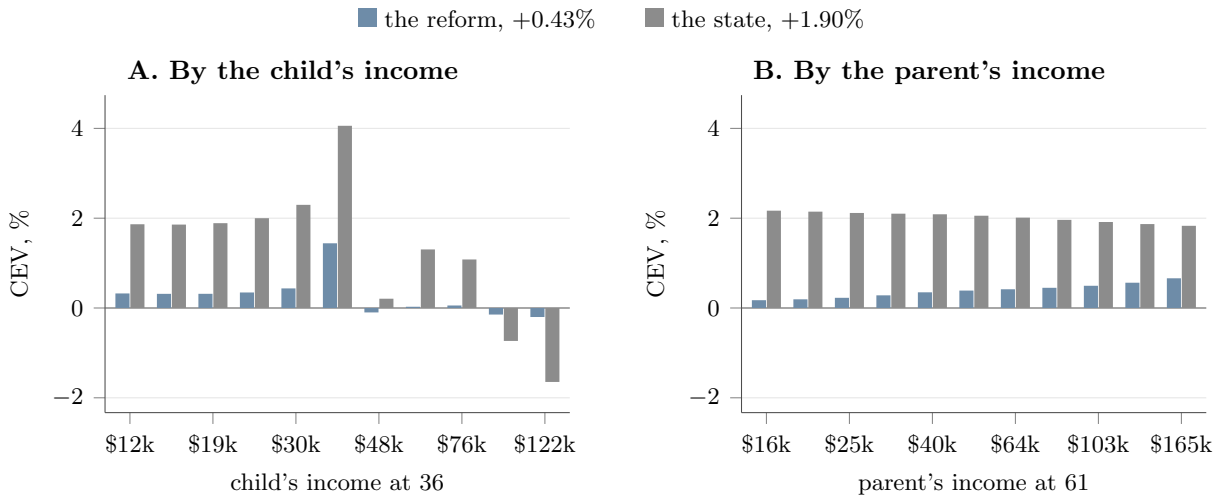

General equilibrium, as in Table E.2. Panel A: the change in the children's net worth at each percentile, within age and averaged over ages 19–42, in percent of today's mean child net worth; net worth is assets plus the house at its price, less the outstanding mortgage. Panel B: consumption-equivalent variation at entry, by the parent's income state when the child is 18. Income axis as in Figure 7; parents at 61, where the level is $56.0k.

FIGURE E.2. Homeownership at 19, by the child's and the parent's income




Change in the share of the age-19 cohort that owns, in percentage points, in general equilibrium, by income state at entry. Income axis as in Figure 7; parents at 61, where the level is $56.0k.

FIGURE E.3. The reform and the state, by the child's and the parent's income




Consumption-equivalent variation at entry against today, in percent, in general equilibrium, by income state at entry; the legend gives the aggregates. The state guarantees every buyer, counts the guarantee toward the deposit, and is financed by a balanced lump-sum tax; its welfare leaves out the cosigning cost that its solution charges every parent although no parent signs. Income axis as in Figure 7; parents at 61, where the level is $56.0k.