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By *Stefano Colonnello and Mariela Dal Borgo*

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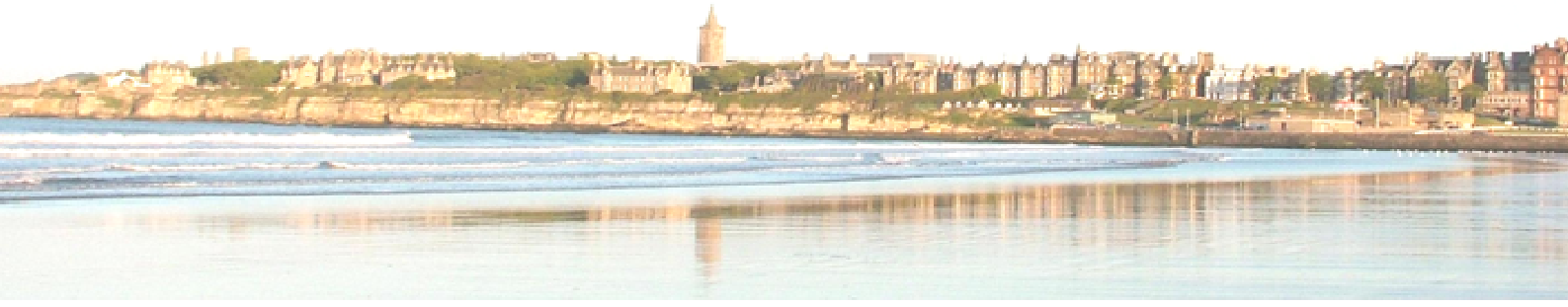

Raising Household Leverage: Evidence from Co-Financed Mortgages*

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Abstract

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1 Introduction

Housing is a primary need and, across numerous economies, also the single most important asset of households (Badarinza et al., 2016). Consequently, expanding access to home financing has become a public policy goal. Down payment constraints are a major barrier to home ownership and, by preventing the acquisition of valuable houses in more prosperous locations, to wealth accumulation (see, e.g., Linneman and Wachter, 1989; Duca and Rosenthal, 1994; Gete and Reher, 2018; Blickle and Brown, 2019; Fuster and Zafar, 2016, 2021; Gupta et al., 2021). In order to ease such constraints, a wide menu of policies exists that seeks to expand access and affordability of credit. Since raising borrowers' leverage can adversely impact individual default risk, regulators often impose demand- and supply-side restrictions on highly leveraged mortgages. Thus, the institutional setting is likely to influence the efficacy of financial products in improving borrowing conditions without deteriorating performance.

In this context, little empirical work has focused on home financing products from emerging markets, where private banks often co-exist with non-market-based institutions to serve a population with a very heterogeneous credit capacity. Building on evidence from Mexico, we study a co-financing scheme that pools resources from private banks and a so-called housing provident fund (HPF) that is the largest mortgage lender in Latin America. To differentiate itself from existing single-loan products, this scheme offers a greater loan amount, a reduced down payment, and a higher property value.

This paper starts by empirically examining which borrowers select co-financed mortgages over those solely funded by banks. Resorting to a loan-level dataset, we show that co-financed products are preferred by more liquidity- and borrowing-constrained formal workers, seeking to tap into their savings mandatorily held at a HPF's account. Conditional on product's choice, our central contribution is to compare origination conditions and performance across mortgage products. The equilibrium outcomes are determined by how banks' supply and borrowers' demand respond to their distinctive contractual features. We confirm that the combined amount of a co-financed mortgage is on average larger than that of a traditional. This additional funding is mainly used to reduce down payment rather than to increase the value of the purchased house, signaling the prevalence of borrowing constraints. Despite the higher combined loan-to-value (LTV) ratio—the counterpart of

a lower down payment—, differences in ex post default are small. Finally, we examine if co-financed products have distributional effects. We find that they relax down payment constraints more and increase property values less at lower incomes, where wealth buffers are likely lower as well.

HPFs are self-financing entities created to deal with the scarcity of long-term funding in countries such as Brazil, China, and Mexico. While differing along many dimensions, all are funded with mandatory contributions from employers and employees.[1] Given their complex design, most of them end up cross-subsidizing participants (Chiquier and Lea, 2009). The Mexican HPFs provide a retirement saving product and the option to take out a mortgage. By offering better borrowing conditions to low-income affiliates, they comply with their social mission. Yet, lending to more profitable segments is also necessary to improve returns on savers. Thus, the HPFs introduced co-financing schemes with banks for higher-income borrowers, which help to balance their saving and lending functions. Such schemes have been recommended for HPFs with poor lending performance and a regressive subsidy structure (Taffin et al., 2011).

Here, we analyze a product that the *Instituto del Fondo Nacional de la Vivienda para los Trabajadores* (Infonavit), the HPF for all formal private-sector workers in Mexico, introduced in 2004. This product, marketed as "Cofinavit", now represents 61% of Infonavit's portfolio of co-financed mortgages (Infonavit, 2017b).[2] It involves a loan from a bank and a smaller one from Infonavit, contracted at the same time but separately with each lender. Both loans have a first lien on the collateral. All borrower's savings held by Infonavit are unlocked to cover up to the entire amount of the down payment and other origination costs. To secure collection, mandatory employer contributions and wage discounts pay back the installments of the Infonavit loan and, after its repayment, a portion of the bank's installments. This means that borrowers cannot default on a portion of their payments while still employed in the formal sector.

The empirical analysis uses granular data from the Mexican banking supervisor on the universe of mortgages granted by commercial banks. Our sample comprises Cofinavit and traditional bank mortgages originated over the period 2016–2019 and restricts to borrowers eligible for and targeted

[1] In similar schemes from India, France, Germany, and Thailand, for example, contributions either are not compulsory or only come from employees (see Taffin et al. 2011).

[2] Henceforth, we refer to "Cofinavit" and "co-financing" and to "Infonavit" and "HPF" interchangeably.

by Cofinavit. We start by studying the drivers of product choice. Cofinavit eases the need for liquid, private savings at origination by unlocking mandatory savings. Consistent with that, our estimates show that co-financed mortgages are preferred by younger and poorer households—more liquidity- and borrowing-constrained, as documented by Jappelli (1990), Ortalo-Magné and Rady (1999), Chiuri and Jappelli (2002)—, and by those that benefit more from leveraging their mandatory savings, associated to a longer employment history and higher wages in the formal sector. Serving such formal-sector borrowers is attractive to banks, even if their ex ante risk is slightly higher as estimated for a subsample with available data.

Since mortgage products are not randomly assigned to borrowers, we adopt the coarsened exact matching (CEM) approach from Iacus et al. (2012) to compare their outcomes. This reduces selection bias by matching on a myriad of observable traits from borrowers and banks and by restricting the comparison to the region of common support. In the resulting sample, Cofinavit loans represent 41.5% out of 111,173 mortgages. Our matching estimates confirm that total (i.e., Infonavit plus bank) loan volume is larger, by 13.8% on average, when the mortgage is co-financed than when it is traditional. This implies that, as intended, Cofinavit does not lead to a full substitution of a portion of the bank loan for the Infonavit loan.

Additionally, we find that the down payment as a percentage of the purchase price experiences a large decline of 5.8 percentage points (pp) on average, which represents a 34.0% change relative to the sample standard deviation of the dependent variable. Thanks to the availability of mandatory savings, the percentage of private savings required upfront declines substantially more, by 15.8 pp. By contrast, the impact on property value is small: It only increases by 3.8% in a co-financed mortgage (a 6.9% of its standard deviation). In terms of pricing at origination, we find that the combined Cofinavit rate is 30.9 basis points [bp] higher on average than the rate of a traditional mortgage. This premium is large relative to the sample standard deviation of the dependent variable (0.7 pp) but not relative to its mean (10.4%). Since it is driven by the risk-insensitive rate of the Infonavit loan, it disappears after its repayment. In fact, banks charge a slightly lower rate under Cofinavit, which is in line with their lower *bank* LTV ratio, a key input of their pricing function.

Despite the higher leverage of co-financed bank mortgages, we estimate a slightly smaller prob-

ability of default on average for them.[3] Their probability is 0.13 pp and 10.15 pp lower than for traditional bank mortgages over the first two and three years after origination, respectively, and differences disappear by the fourth year (they represent less than 2% of the standard deviations of the dependent variables). Conditioning on the *combined* LTV ratio at origination, the differentials become more pronounced at all horizons. These findings suggest that features specific to the co-financing scheme—the greater liquidity relief to cover origination costs and loan payments, and a secure repayment system—overturn the effect of leverage at origination on credit risk.

Having documented the average co-financing effects, we examine its distributional consequences. Our estimates show that Cofinavit leads to a greater increase in loan size, a greater decline in down payment, and a smaller increase in property value at lower than at higher incomes. Thus, it is not a lower credit capacity but mainly the inability to afford a larger down payment by poorer borrowers what prevents the purchase of a better property under Cofinavit. Moreover, since they have a lower buffer of mandatory savings, their needs of private savings at origination are not substantially lower than at higher incomes. We also find that Cofinavit has a regressive feature: Its interest rate is slightly higher for poorer borrowers than that of a traditional mortgage. This is a consequence of the more expensive Infonavit loan taking a higher stake in poorer segments—banks actually reduce their exposure to them. Once the Infonavit loan is repaid, differences in loan rates should disappear. Finally, we find that the default rate of co-financed mortgages is smaller than that of traditional at higher incomes only, consistent with their smaller increase in leverage.

Our results could be biased if borrowers sort into co-financed mortgages on the basis of unobservables, and borrowers' ex ante credit risk is one main omitted variable. Reassuringly, we verify their robustness to controlling for the probability of default at origination, available for a subsample of mortgages. In addition, we assess the robustness of the findings to supply-side conditions. First, we examine their sensitivity to the terms of the Infonavit loan. In April 2017, the Institute introduced a new credit plan that modified its credit limits and interest rates differently at lower and higher incomes. We reestimate the average and heterogeneous effects under both credit plans and confirm their robustness. Yet, this could be attributed to the comparatively small share of

[3]Supervisory data do not track the loan portion granted by the HPF over time, on which default typically occurs later than in the bank portion.

the Infonavit loan in a co-financed mortgage; banks provide most of the funds. Thus, we further investigate whether the results persist across banks—different business models or lending strategies could lead to different adjustments in Cofinavit terms. We find that, in general, the main findings survive for each of the main five banks in the sample. Finally, we show that the estimates pass the test by Oster (2019) for selection on unobservables.

This study relates to the literature on financial innovations making mortgage markets deeper and more inclusive by targeting demand-side frictions. In a general equilibrium framework, Chambers et al. (2009) show that a generalized reduction of leverage constraints reduces home ownership by increasing interest rates (see, also, Ortalo-Magné and Rady, 2006; Halket and Vasudev, 2014). However, they also show that expanding the choice set by introducing a "combo" or "piggyback" loan with a reduced down payment requirement, along with a standard mortgage, does increase ownership by suppressing the general equilibrium effect.[4]

Our paper directly contributes to the empirical work that evaluates government policies seeking to increase housing affordability. For the Help-to-Buy program from the UK, which reduces down payment by combining bank loans with "equity loans" from the government, Tracey and Van Horen (2021) find that it stimulates house purchases by younger households.[5] Benetton et al. (2022) show that, under that program, borrowers treat public and private loans as complements and, thus, acquire more expensive properties. A crucial difference with Cofinavit is that equity loans are essentially shared equity, not debt (and are interest-free over the first five years). For a scheme that increases borrowers' leverage, our work adds evidence from a setting where borrowing constraints are tighter and the mortgage market is shallower. Also related is the literature evaluating the impact of macroprudential policies that *reduce* mortgage leverage (see, e.g., Kinghan et al., 2019; Acharya et al., 2022). Our findings are in line with their estimates of distributional effects by income.

This paper also contributes to the literature on mortgage market design and default, which received increasing attention after the 2008-2009 financial crisis (for an earlier contribution, see

[4]Government-sponsored enterprises (GSEs) launched piggyback loans in the US in the 1990s, and private lenders later adopted them. They involve two loans, where the second covers part or all of the down payment, avoiding to take mortgage insurance, and has lower priority and a higher interest rate than the main loan. Section 8 discusses the existing evidence on these mortgages.

[5]The Irish government launched a similar "First Home" scheme in 2022. The US also has had several down-payment assistance programs, such as the American Dream Downpayment Initiative.

Vandell, 1978). A branch focuses on mechanisms aimed at mitigating credit risk ex ante, considering the interaction between contractual features and market conditions (see Greenwald et al. 2021; Campbell et al. 2021; Guren et al. 2021, among many others). Directly related to ours are the empirical studies on second mortgages. Mian and Sufi (2011) find that "home equity loans", which are used to extract home equity after origination of the primary mortgage, increased both leverage and default in the US. Piggyback structures are more similar to Cofinavit in that both loans are simultaneously granted. The most recent evidence in Agarwal et al. (2020) shows that, conditioning on their combined LTV ratio, they have a lower default risk. The proposed mechanism—borrowers' selection by banks to circumvent insurance requirements—is less plausible in our setting. The contract that we study counterbalances default incentives with borrowers' greater liquidity throughout the mortgage's life and a secure repayment system. The role of liquidity on loan performance has also been studied empirically. Ganong and Noel, for instance, show that reducing short-term payments by extending maturity is effective in curbing defaults (see also Elul et al., 2010; Fuster and Willen, 2017; Defusco et al., 2019).

Finally, our work complements the findings from the growing literature on HPFs, which uses survey or aggregated data, or calibrated models, to study their impact on home ownership and prices (see, e.g., Tang and Coulson 2017 and Zhou 2020 on China; Phang and Wong 1997 on Singapore). While they focus on mortgages funded solely through HPFs, we provide novel evidence on products co-financed with private intermediaries. To this end, our dataset on bank loans allows overcoming, at least partially, the lack of granular data on HPF loans. On the other hand, the saving function of HPFs has been studied by the theoretical literature on socially optimal paternalistic policies, with mandates like Social Security. Moser and Olea de Souza e Silva (2019) find that mandatory savings at lower incomes can be welfare improving when both inadequate savings and income inequality are a concern. To the best of our knowledge, however, these studies do not consider the role of social planners in both home financing and savings.

2 Co-financed and traditional bank mortgages in Mexico[6]

2.1 Market and products overview

The Mexican mortgage market is split between private financial institutions and HPFs. Following the 1994 peso crisis, private institutions withdrew from this market and have retained a small role since their return. They comprise commercial banks (serving middle- to high-income households) and non-bank intermediaries, known as Sofoles and Sofomes (serving low- to middle-income households). HPFs, created in 1972 for workers contributing to social security, have the largest market share (Carballo-Huerta and González-Ibarra, 2009). The two main funds are Fovissste and Infonavit, for public and private sector workers, respectively.

Infonavit is a tripartite body with representation from government, employers, and trade unions. It has a dual mandate, acting as direct lender and providing retirement benefits. It collects mandatory savings from employer contributions, representing 5% of the employee's base salary, with a cap at 25 times the minimum wage (MW). These resources go to individual home accounts that the worker can use to top up the funds for a mortgage or can withdraw upon retirement. In addition to its funding advantage over other financing institutions, Infonavit has a captive customer base, a secure repayment system, and a less strict regulatory framework than banks or pension funds.

Traditional Infonavit mortgages finance social housing for low-income participants (Garcia Mora and Shabsigh, 2016). The terms of those mortgages are not attractive for mid- and high-income segments. For them, Infonavit offers products co-financed with private lenders. By lending to such segments, more profitable, it can pay better rates of return on workers' savings.[7] Specifically, Infonavit launched the product marketed as Cofinavit in 2004, which is the main co-financing scheme in the country. By 2018, Infonavit loans granted through Cofinavit represented 61% (MX$7,435 millions or USD378 millions) of Infonavit's co-financed loan portfolio (Infonavit, 2017b).

Cofinavit combines a mortgage from Infonavit and another from a bank, signed under two sep-

[6]Unless otherwise noted, this section and Appendix A are based on interviews with officers from Infonavit and private banks, information requested to Infonavit through the National Transparency Platform, the Infonavit Law (article 43 bis), and its implementation decrees (Official Journal of the Federation of February 22, 2008, and of April 5, 2017).

[7]Historically, Infonavit's priority has been to encourage borrowing over saving. Indeed, the return on workers' home accounts has generally been low (OECD, 2015).

arate contracts, to buy a new or second-hand property. It uses the home account balance as partial payment for the property and redirects future employer contributions to mortgage repayment. Figure 1 shows the standard funding structures of houses purchased through traditional and co-financed mortgages. Traditional bank mortgages usually do not cover the entire value of the property. Thus, borrowers need private savings for the down payment and other costs. Under Cofinavit, borrowers can cover with their mandatory savings part or all of the down payment and even other origination costs (e.g., the notary and home appraisal fees) that in Mexico represent between 7% to 9% of the property value.[8]

Theoretically, Cofinavit offers several benefits relative to a traditional (Infonavit or bank) mortgage. For borrowers, it promises to enhance their credit capacity, reduce or eliminate the down payment, and give access to a more expensive property. For Infonavit, it leads to higher returns while avoiding the liquidity strains that larger loans to higher-income borrowers impose—a bank funds the bulk of the property. For banks, it enables lending to otherwise down-payment constrained workers but with a continued employment history in the formal private sector. In addition, banks directly or indirectly benefit from Infonavit's secured servicing procedures. Finally, for both lenders the recovery risk is mitigated since either can take actions to seize the property, having to share the proceeds with the other. In practice, only Infonavit benefits from this feature because banks are more likely to undertake an eventual recovery process.

2.2 Comparison of mortgage characteristics

In this section, we compare the characteristics of traditional bank mortgages with those of Infonavit and bank loans in a Cofinavit scheme (see Table 1 for a summary). The characteristics of bank loans are similar across products, but the Infonavit loan has distinctive features. Some of these features changed in April 2017, when Infonavit introduced a new credit plan with the goal of increasing returns on the Cofinavit portfolio by shifting credit supply towards higher-income borrowers (Infonavit, 2017a, 2016) (see Appendix A for more details).[9]

[8] During the period of analysis, the sum of the Infonavit and bank loans plus the mandatory savings in a Cofinavit scheme could be larger than the lesser of the purchased price and appraised value.

[9] The more controversial aspect of the new plan was the increase in the amount of traditional Infonavit loans. BBVA Research (2018) argues that this could displace not only traditional but also co-financed bank lending, given

Screening. Each institution screens its portion of the Cofinavit mortgage separately. Banks use the same risk-based screening technologies for traditional and Cofinavit loans. In line with its social mission, Infonavit's approval standards are less strict and are not risk based. Applications only need to fulfill certain eligibility requirements, namely that the borrower should be currently employed and contributing to Infonavit, should not have had an Infonavit loan before, and should attain a minimum score (determined by a combination of age and salary, savings in the home account, and years of continued contribution to Infonavit).

Loan size. In a traditional mortgage, a risk-based credit assessment determines the approved amount, considering a payment-to-income (PTI) limit of around 30%. In a Cofinavit scheme, banks determine their loan size as a residual, after Infonavit, up to a 30% limit for the combined PTI. The bank loan represents around 90% of the total loan volume, on average. In turn, the size of the Infonavit loan is fixed: A credit assessment establishes the maximum fraction that the borrower *must* get of her credit limit, considering demographic characteristics, employer information, and, since October 2017, credit bureaus' reports (Infonavit, 2016). Under the old plan, these credit limits were decreasing in borrowers' age and generally increasing in income— they dropped discretely by at least 52% as income goes from 10.9 to 11 MWs and remained constant at incomes greater than 25 MWs (Panel A of Appendix Figure B.1). Under the new plan, these limits are increasing in loan's maturity and borrower's income, but only drop by 37% on average as income rises from 12.5 to 12.6 UMAs (the new indexation unit of Infonavit's loans) (Panel B). Thus, limits increased for higher-income borrowers substantially and for the poor did so more modestly or even declined at certain maturities (see Appendix Figure B.2). For married couples that borrow jointly, banks grant one loan considering the couple's total income. Infonavit grants two loans determined by the credit limits of the main borrower and her spouse—the spouse's loan was originally for up to 75% of her credit limit and, under the new plan, can be for the entire amount.

Maturity. Bank loans (traditional or co-financed) typically have a maturity of 20 years. The Infonavit loan's maturity is shorter and decreasing in the salary discount rate. It is normally repaid in about five to eight years.

that middle-income borrowers can resort to a larger traditional Infonavit loan.

Interest rate. In a Cofinavit scheme, the bank rate is smaller than the Infonavit rate (see Appendix Figure B.3). Banks set the interest rate on the basis of loan and borrower characteristics, such as the LTV ratio, income, and having a salary account or an insurance contracted with the lender (Banco de México, 2020). In particular, the bank rate is decreasing in income. Originally, the Infonavit rate was an increasing function of borrower's income only at the bottom of the distribution and remained constant at higher incomes (see Panel A of Figure B.1). Under the new credit plan, it was set at 12% for all borrowers. In pesos, the interest rate dropped by over 2 pp at higher incomes and declined by less, or even increased, at lower incomes (see Figure B.2). Thus, while high-income borrowers have to take out a larger Infonavit loan under the new Cofinavit, they do so at lower rates than under the old plan.

Loan repayment. In Cofinavit, the repayment of the two loans starts simultaneously and is separately monitored by each lender. Borrowers resort to cash on hand or private savings to amortize the Cofinavit bank loans, as in traditional mortgages. The Infonavit loan is repaid with employer contributions—5% of the employees' base salary—and salary discounts. The discounts vary between 1% to 7% of the salary, being higher for low-income borrowers to ensure a prompter repayment, given their greater job turnover and ensuing credit risk. This implies that, initially, the Infonavit loan de facto has priority on borrowers' cash flows that secure payments. Once it is repaid, the employer contributions can be redirected to pay the outstanding principal of the bank loan, which as a result will be paid down faster than a traditional mortgage.

Default. Default on a traditional mortgage occurs when the borrower has no willingness or ability to pay it. In Cofinavit, the borrower retains the option to stop paying the debt with the bank but not that with Infonavit while employed in the formal sector. Indeed, the employer is obliged to deduct the contributions and discounts from the worker's paycheck and transfer them to Infonavit. Thus, even though the Infonavit loan has the higher financial cost, default typically occurs first on the bank loan. In case of unemployment or of a move into an informal job, the borrower should directly pay to Infonavit the equivalent of the employer contributions plus wage discounts and, thus, recovers the option to default on that loan.

Non-performing status. In case of unemployment, banks may require an insurance that covers between three to nine monthly payments. After three months of delinquent payments, banks generally classify mortgages as non-performing. In turn, an insurance fund covers the first six installments

to Infonavit. Since the borrower can defer payments for up to a year and then has three months to start making payments, Infonavit takes about 15 months to recognize default.

Recovery. When a Cofinavit mortgage becomes non-performing, either the bank or Infonavit can start legal actions since both have a first lien on the property. In practice, given that the borrower usually defaults first on the bank loan and that the bank flags the loan as non-performing earlier, the bank initiates legal proceedings first (after about four to six months in default). Since Mexican mortgages are recourse loans, they are unlikely to go into foreclosure; deeds-in-lieu of foreclosure are more common. In the event of recovering the property, the bank sells it and pays to Infonavit its portion.[10]

3 Theoretical effects of co-financing on mortgage outcomes

To guide the empirical analysis, in this section we consider Cofinavit's advertised goals and contractual features to hypothesize how it may affect product choice, characteristics at origination, and ex post performance when compared to traditional bank mortgages.

3.1 Mortgage choice and characteristics at origination

Cofinavit eases the need for liquidity (i.e., for private savings) at origination because it unlocks borrowers' mandatory savings to cover the down payment and even other upfront costs. Thus, more liquidity constrained borrowers, defined as those with lower private savings, should prefer co-financed over traditional mortgages.

Conditional on product choice, we state predictions for mortgage characteristics at origination.[11] For this, we take into account Cofinavit's goals, which are set relative to traditional mortgages. First, it promises to enhance borrowers' credit capacity, which implies extending a larger (combined) loan. Second, it promises to enable the purchase of a more expensive property. Third, it seeks to reduce

[10] Since its loan usually remains performing for longer, Infonavit could have incentives to delay the bank's liquidation of a distressed mortgage, waiting for a self-cure. This would be similar to the holdup problem arising when a junior-lien holder has a conflict of interest with the first claimant and influences its loss-mitigation actions. However, such incentives are reduced here because the senior-lien claim gives Infonavit the same priority as the bank in the proceeds from the home sale. In turn, the first-lien of the bank gives it the same priority as Infonavit over the decision of whether to liquidate the mortgage.

[11] We do not study whether co-financing impacts home sales or homeownership, which would require a different empirical strategy.

the down payment (i.e., increase the combined LTV ratio), which requires that the property value increases less than the total loan amount.

To illustrate the possible equilibrium outcomes, in Figure 2 we sketch hypothetical funding structures for a traditional bank mortgage and for three co-financed mortgages. In the first co-financed structure, the goals are not achieved. The Infonavit loan fully crowds out an equivalent portion of the bank loan, and the total loan amount remains the same. Thus, the property value and the down payment are not expected to change either. For an increase in the combined loan, there should not be full substitution between loans. In the second case, the substitution is partial—the bank loan shrinks by less than the Infonavit loan's volume. In third case, there is no substitution at all—the bank loan size is inelastic—and the combined loan's increase equals the size of the Infonavit loan, which could lead to an excessive leverage.

Given a higher combined loan, there is a trade-off between reducing down payment and acquiring a better house. The second example illustrates a pure reduction in down payment that may arise when borrowing constraints are high for a Cofinavit borrower, that is, when her savings are low even after accounting for the mandatory ones. The third example corresponds to a pure increase in property value, more likely to arise in the absence of such constraints.

In terms of pricing, the higher Infonavit rate should increase the overall cost of a co-financed relative to a traditional bank mortgage. Yet, this effect will be mitigated by the small share of Infonavit in the combined loan amount and will only last until that loan's repayment. More important for the overall cost is the bank's pricing policy. Conditioning on borrower characteristics, banks may charge a lower rate in co-financed than in traditional mortgages if they set rates on the basis of the *bank* LTV ratio and that ratio is smaller for the former.[12] This will occur if the bank loan shrinks and/or if the property value is higher under Cofinavit.

The previous outcomes are expected to vary with borrowers' income. First, high-income borrowers have a greater credit capacity and, hence, should be able to take out a larger loan under Cofinavit. Since the PTI ratio declines with income, they have more room for an increase in the

[12]In fact, Mexican banks, at least those following the standardized approach, use the bank LTV ratio during this period to compute their capital requirements and loan loss provisions. This is despite that the overall LTV ratio is in principle a better measure of actual credit risk (see Section 3.2).

combined loan amount without violating the affordability constraint (i.e., the PTI limit). Second, affluent borrowers can use the additional funding from Cofinavit to buy a better property rather than to reduce the upfront costs. Indeed, their borrowing constraints should also be less tight. Even if the marginal propensity to save were lower in those segments, which would be at odds with the existing evidence (see, e.g., Dynan et al. 2004), at least mandatory savings should be higher. On top of these demand-side factors, contract characteristics may affect outcomes along the income distribution as well. In particular, the quantities and prices of the Infonavit and bank loans vary with income differently (see Section 2.2).

3.2 Bank mortgage performance

Next, we make conjectures about the performance of co-financed relative to that of traditional bank loans, which can be impacted by several conflicting forces. Even though we cannot track the performance of co-financed Infonavit loans in the data, we also discuss what features should affect their default, which can only occur when the borrower loses her formal job.

First, conditions at origination can lead to a worse performance of co-financed products. A higher LTV ratio at origination, by reducing the equity stake, leads to a higher probability of default (Mayer et al., 2009; Campbell and Cocco, 2015). If co-financed mortgages are taken out to reduce down payment and, hence, lead to a higher *combined* LTV ratio (as in the second case of Figure 2), their ex post performance can be worse. If the borrower loses her formal job, this channel should also affect the performance of the Infonavit loan. Importantly, what drives default on either loan is the burden that both loans combined place on a borrower's finances (Elul et al., 2010; Demyanyk and Van Hemert, 2011).

Second, Cofinavit reduces the risk of liquidity-driven defaults on the bank loan. Increasing borrowers' liquidity, by reducing payment size, has an important role in improving performance (see, e.g., Elul et al. 2010; Fuster and Willen 2017; Ganong and Noel). For the same combined PTI ratio, Cofinavit payments leave more disposable income because they are partly covered by employer contributions (even after the Infonavit loan is repaid, when they can be redirected to pay the bank loan). By contrast, payments of traditional bank mortgages are entirely drawn from borrower's cash on hand or private savings—contributions keep going to Infonavit's home account. In addition, the greater financial relief provided by Infonavit in case of unemployment should help

to avoid default on the bank loan. Indeed, after the insurance coverage ends, the borrower can defer the payments to Infonavit for more than a year. Naturally, this reduces the probability of defaulting on the Infonavit loan as well.

Finally, Infonavit's secure repayment system reduces credit risk not only of its own loan but also, indirectly, of the co-financed bank loan. If the borrower defaults on the bank loan while employed in the formal sector, the bank will eventually take actions to recover the collateral. Thus, the borrower risks losing the house while still paying to Infonavit. This inability to get back the full cash flow of payments should reduce the incentives to default on the bank portion.

4 Data

4.1 Data sources and sample selection

We use confidential mortgage-level data from the R04 H report, collected monthly by the banking regulator (*Comisión Nacional Bancaria y de Valores, CNBV*). This dataset covers the entire life of each mortgage granted by commercial banks in Mexico, except for the application stage. Among the characteristics reported are the lending institution, the loan's origination and expiration dates, its volume and interest rate, and the property value and municipality where it is located. Borrower characteristics at origination include employment sector, income, gender, age, marital status, and municipality where he or she works. From the sub-report on loans' monthly follow-up we extract their performance status. Products' names are used to identify Cofinavit mortgages. For them, we observe the amount granted at origination by both the bank and co-lender, but only for the bank loan we also observe all other characteristics in the dataset.[13]

House prices are from the SHF housing price index (*Sociedad Hipotecaria Federal, SHF*), measured quarterly for 74 municipalities, 8 metropolitan areas, and all states. We merge it to the credit data using the municipality where the property is located or higher-level geographical areas when the municipal index is not available. Finally, we obtain information at the municipality level on formal sector employment and wages from the Mexican Institute of Social Security (*Instituto Mex-*

[13]Infonavit's interest rate under the old credit plan is in the "Terms of Contract" (Official Journal of the Federation, 24 April 2008).

icano del Seguro Social, IMSS) and on population from the National Population Council (*Consejo Nacional de Población, CONAPO*).

We select a sample that only includes traditional and Cofinavit bank mortgages, granted to borrowers that are potentially eligible for either product. We exclude other bank mortgages granted through an arrangement with a HPF, development bank, or promotion agency, or that are not used to buy a new or second-hand property. Further, we restrict the sample to borrowers that work in the private sector, eligible for Cofinavit, and with an income in pesos between 3 and 65 MWs (MW as of March 2017) that covers the bulk of Cofinavit originations.[14] The origination period spans three years going from June 2016, when the enhanced version of the R04 H report begins, until June 2019. Monetary variables are expressed in CPI-adjusted Mexican pesos (second fortnight of July 2018 = 100). Continuous variables are winsorized at the top and bottom 1.5% of the distribution. Appendix Table B.1 provides variable definitions.

4.2 Data description

Table 2 reports the means by mortgage product of the main variables. The mortgage is the unit of analysis and most borrowers only have one mortgage. After applying the filters described above, Panel A reports the borrower- and municipality-level variables at origination considered for the study of product choice. Having a co-borrower is only reported since June 2017. The probability of default is only available for mortgages from a bank that adopted the Basel II internal ratings-based approach for credit risk in December 2018.[15] The sample in Panel A comprises 154,880 mortgages of which 35.4% are co-financed, granted by 17 banks.

In Panel B, the sample is further restricted by balancing a set of covariates across mortgage products, using the procedure described in section 6.2. It reports the main dependent variables, which comprise mortgage-level characteristics at origination and their ex-post performance. In this balanced sample, the number of mortgages, extended by ten banks, declines to 111,173, and

[14] Other data cleaning steps include the removal of possible reporting errors (co-financed loans with a combined LTV ratio and a bank PTI ratio greater than 100%, and loans from a bank that bunch at certain values of income), mortgages originated by development banks, mortgages originated by HPFs and acquired by banks, and loans with missing values in some key variables.

[15] For the remaining banks and time periods, only the regulatory measure of default obtained under the standardized approach is available, which captures actual credit risk less accurately.

the percentage co-financed amounts to 41.51%. Appendix Figure B.3 shows box plots for several percentiles and the mean of these variables in the same sample.

Panel B of Table 2 shows that the total volume is slightly larger and the bank portion is slightly smaller for co-financed than for traditional bank mortgages, on average. In Figure B.3 it becomes apparent that, within Cofinavit bundles, the Infonavit loan has a smaller volume than the bank loan—their distributions do not overlap. Relative to traditional loans, the co-financed have lower down payments but a similar property value on average. Differences between the (volume-weighted) average interest rate in a Cofinavit mortgage and that from a traditional bank mortgage are small. Within Cofinavit loans, Figure B.3 shows that the Infonavit rate is substantially higher than the bank rate and, not surprisingly, has very little dispersion. The average bank LTV ratio declines from 75.6% in a traditional mortgage to 64.2% in a co-financed one (the overall LTV ratio equals 100 minus the total down payment). Finally, using observations at the mortgage–month level, we select the cohorts from June 2016 to June 2017 over the first two, three, and four years. For these three time windows, the percentage of non-performing loans is slightly lower for co-financed than for traditional mortgages.

5 Mortgage choice

We start by providing evidence on the factors driving product choice. In Section 3.1, we predict that liquidity-constrained borrowers should prefer co-financed mortgages. To test for this, in the full sample we regress a dummy taking the value of 1 if the mortgage is co-financed and of 0 if it is traditional against loan, borrower, and municipal characteristics.[16] All specifications also account for time (i.e., cohort of origination) fixed effects and use robust standard errors. Table 3 reports estimates of marginal effects from probit models (columns 1 to 3) and, given the incidental parameter problem with the fixed effect probit, of linear probability models (columns 4 to 7). The latter include bank fixed effects and bank-specific linear time trends to absorb bank-level differences in mortgage supply. They also include fixed effects for borrower's income group as well as for municipalities of the borrower's workplace and of the purchased property to absorb time-invariant differences in

[16] Some of these variables serve as proxies for borrowers' private and mandatory savings, which unfortunately we do not observe (only for co-financed mortgages the dataset reports the home account balance at origination).

economic conditions affecting demand.

We find no robust evidence of differences in Cofinavit uptake by type of property acquired (new or second hand) across specifications. More compelling is the evidence that borrowers opt for co-financed mortgages when they have lower income—statistically insignificant as expected when adding income-group fixed effects—and are younger. Poorer and younger borrowers are more likely to be liquidity and borrowing constrained, as documented by Jappelli (1990), Ortalo-Magné and Rady (1999), Chiuri and Jappelli (2002). From column 4, the probability of co-financing declines by 0.1 pp ($-0.144 \times \log[1.01] = -0.001$) for a one-percent increase in income and by 1 pp for a one-year increase in borrower's age. Changes in standard-deviation units of these covariates (0.69 for log income and 10.5 for age) are economically meaningful, representing around 20% of the sample standard deviation of the dependent variable (48%). We also estimate a higher rate of co-financing among married borrowers and, especially, among those with a co-borrower (columns 2 and 6). This could reflect the possibility of pooling the mandatory savings of two accounts for the down payment, alleviating further the liquidity needs at origination. In addition, the estimates show that co-financed mortgages are in higher demand by men—even among single borrowers or those without co-borrower (not reported). We conjecture that this could reflect gender differences in formal employment history and in formal sector wages (OECD, 2017). Even though traditional bank mortgages are also restricted to formal workers, formality matters more for Cofinavit—having more mandatory savings and a longer history of formal employment reduces the need for private savings and contributes to ensure eligibility.

The specifications without municipality fixed effects render negative coefficients for indicators of the region where the property is located relative to the center region, which includes Mexico City. One interpretation is that properties in that region are more expensive, and borrowers seek Cofinavit to afford their down payment. The cross-sectional positive estimates for the house price level support this interpretation, but are not robust to controlling for bank fixed effects. Another explanation is the relative abundance of formal jobs in the center region. This is in line with the positive and significant coefficients on formal employment and wages of the municipality where the borrower works, even after accounting for bank fixed effects. They only become negative or insignificant when exploiting within-municipality variation, which could reflect the lower relevance of short-term changes in local formal employment for mortgage choice.

Finally, in columns 3 and 7, we uncover a positive association with the proxy for default probability at origination. For a 1 pp increase in that probability, the rate of co-financing increases by 0.7 pp and 0.8 pp, respectively, and the estimates are significant at the 5% and 10% level. This points to an ex ante riskier profile of borrowers opting for co-financed mortgages. The association, however, is quantitatively small: For a one-standard-deviation increase in the probability of default (1.5 pp), the probability of co-financing increases between 2.3% and 2.7% of its sample standard deviation (44%). All in all, the evidence in this section suggests that liquidity and borrowing constraints, along with the possibility to leverage mandatory savings, drive the choice for co-financed mortgages.

6 Empirical approach

This section presents the empirical strategy to examine mortgage conditions at origination and ex post performance. Conditional on the product choice and on lenders' approval, we first estimate OLS regressions controlling for borrower and municipal characteristics and a rich set of fixed effects. We then use a matching procedure to better account for selection on observables and lack of common support.

6.1 OLS estimation

To describe the association between co-financing and mortgage outcomes, we first estimate regressions for mortgage i of the form:

$$y_i = \alpha_0 + \alpha_1 \cdot \textit{Co-financed}_i + X'(i; m_p, c-1; m_w, c-1)\lambda + \Gamma' + \epsilon_i, \tag{1}$$

where the dependent variables, y_i, consist of conditions at origination (volume, down payment, property value, interest rate). For Cofinavit mortgages, these conditions are defined for both loans combined and for the bank loan only. The regressor of interest, $\textit{Co-financed}_i$, is equal to 1 if mortgage i is co-financed and to 0 if it is traditional.

The vector $X'(\cdot)$ controls for borrower characteristics at origination, which comprise income, age, gender, and marital status. $X'(\cdot)$ also controls for house prices of the municipality where the property is located (m_p) and for formal employment per capita and wages of the municipality

where the borrower works (m_w). These are measured with a one-period lag relative to the month of origination (or cohort), $c-1$. The more flexible specification includes the interaction between *Co-financed*$_i$ and the demeaned variables in $X'(\cdot)$. This allows estimating the differential effect of co-financed mortgages at the sample mean of the covariates. The vector Γ' includes the same structure of fixed effects described in the previous section. Thus, it absorbs variation in conditions affecting the entire cohort of mortgages originated in period c. In addition, it includes fixed effects for banks, bank-specific linear time (i.e., cohort) trends, and fixed effects for borrower's income group and for municipalities of the borrower's workplace and of the purchased property. ϵ_i denotes the error term. Standard errors are robust to heteroskedasticity.

To compare products in terms of performance, we reformulate the model as follows:

$$y_{i,t} = \beta_0 + \beta_1 \cdot \textit{Co-financed}_i + X'(i; m_p, t-1; m_w, t-1)\delta + \Gamma' + \upsilon_{i,t}, \tag{2}$$

where $y_{i,t}$, is defined as an indicator for whether mortgage i is classified as non-performing in period t within the first two, three, and four years after origination. In Cofinavit mortgages, equation (2) is estimated for the bank loan only. All regressors and fixed effects are the same as in equation (1), with the caveats that the municipality-level controls in $X'(\cdot)$ change with calendar time t (lagged one period) and the vector Γ' also includes calendar time fixed effects. Standard errors are clustered at the mortgage level since there are multiple time periods per mortgage.

6.2 Matching approach

Next, we match on a rich set of covariates and perform the analysis in a region of common support to approximate a causal interpretation of co-financing effects. In the absence of random assignment, the matching procedure allows selection of the mortgage product to be driven by observable characteristics. Specifically, we implement the CEM approach from Iacus et al. (2012) that involves pre-processing the data to reduce the imbalance between co-financed and traditional mortgages. This method allows to ex ante decide the level of imbalance by coarsening the predictors influencing mortgage choice. After discarding unmatched mortgages from the sample, the estimates give the average treatment effect (ATE) of co-financing in the resulting matched sample.

For the matching, we select the following covariates and coarsening levels:

1. Logarithm of borrower's income (34 bins defined by equally spaced cutpoints)
2. Borrower's gender (two bins)
3. Borrower's age (13 bins defined by five-year intervals)
4. Borrower's marital status (two bins)
5. Region where the borrower works (five bins)
6. Bank granting the mortgage (17 bins)
7. Infonavit credit plan (two bins defined by April 2017 as the cutoff date)

In practice, only income and age are coarsened. The first five (borrower) covariates are measured at origination and are determined before the mortgage choice. The CEM algorithm defines strata for all combinations of the covariates' bins and sorts observations into those strata (some may be empty). Then, it assigns a weight of 1 to co-financed mortgages and the stratum weight, which is increasing in the proportion of co-financed loans, to traditional bank mortgages. It assigns a weight of 0 to unmatched observations, that is, co-financed mortgages without at least one traditional mortgage in the same stratum, and vice versa. The algorithm matches 46,165 co-financed with 65,008 traditional bank mortgages, whereas 8,659 co-financed mortgages do not have a close match. A measure of global imbalance with respect to the full joint distribution of the covariates (including all interactions) is given by the statistic $\mathcal{L}_1$, which varies between 0 (perfect balance) and 1 (complete separation). We confirm that the algorithm increases balance since $\mathcal{L}_1$ declines from 0.77 to 0.65 after matching (its absolute value is less important).

Using the generated weights, we estimate equations (1) and (2). This procedure compares co-financed and traditional mortgages granted to borrowers with similar characteristics by the same bank, under the same (old or new) Infonavit credit plan. The parameters α_1 and β_1 provide estimates of the ATE of co-financing in the matched sample under certain assumptions.

One assumption is common support. This requires sufficient overlap in the distributions of the matching covariates, ex ante, across co-financed and traditional mortgages. An indication that this requirement is fulfilled is that 84.2% of the co-financed mortgages in the sample could be matched with traditional mortgages. Ex post, the distributions of these covariates should be balanced across the two products. In the sample of borrowers and mortgage characteristics eligible for (and targeted by) Cofinavit, the CEM approach automatically ensures that only strata with both co-financed and

traditional loans are used in the analysis.

Appendix Figure B.4 shows the distributions of the matching covariates in the full sample (Panel A) and after dropping unmatched observations (Panel B). The histograms in Panel A confirm that the distributions of all variables across co-financed and traditional mortgages generally overlap. In Panel B, all characteristics become more balanced across products. Appendix Table B.2 presents a balancing test with the means of the matching covariates and their differences across products. In the full sample, the t-tests indicate that differences for most variables are significant across products. In the balanced sample, mean differences become insignificant by construction. The number of banks declines from 17 to 10 in the balanced sample. In practice, loans are concentrated in only five banks (see Panel B in Figure B.4).

Another identifying assumption is ignorability of co-financing conditional on observable covariates. This means that, conditional on matched observables, the reason one borrower gets a co-financed and another a traditional loan is not due to an unobserved variable correlated with the outcomes. Since we cannot rule out that some unobserved variables potentially affect final outcomes, the matching estimates mitigate but might not fully eliminate the selection bias, as explained in the following section.

6.2.1 Omitted variables

To understand the main sources of selection, it is helpful to consider how borrower and lender actions determine product choice. As in most credit contracts, such choice is the result of a two-step selection process: application and approval.

In the first step, individuals apply to Cofinavit or traditional mortgages taking into account the contract characteristics and their own financial position. Two main unobservables from this stage are the level and composition of borrowers' savings, capturing liquidity and borrowing constraints. The findings in Table 3 suggest that co-financed borrowers have less total savings, given that they are poorer and younger, and that they resort to Cofinavit to mobilize their illiquid mandatory savings, which implies that their private savings are insufficient. Thus, conditional on income and socio-demographics, they may opt for a less expensive house to reduce disbursements at origination. This implies that demand-side constraints could bias downwards the estimates for the effects of co-financing on property value and down payment.

In the second step, banks screen applications and so does Infonavit, separately, in Cofinavit mortgages. Banks set the same eligibility conditions for traditional and Cofinavit mortgages and, therefore, they should not be a source of selection (Appendix Figure B.5 shows a bank's application form with its eligibility requirements). The bank loan officer screens applications using limited information from the application form and from the credit bureau on borrower's credit history. Conditional on that information and on meeting the eligibility requirements, the approval decision is somewhat discretionary and independent of borrowers' actual risk profile and financial position. Thus, matching on all the information available to the bank officer (e.g., the program and property value chosen originally, length of employment, or borrower's credit history) would enable us to identify the co-financing impact, even if some borrower characteristics are not observed.

In turn, Infonavit sets its own eligibility requirements for Cofinavit mortgages (see Section 2.2). Some of them are also required by banks—being currently employed and contributing to Infonavit—and others that could affect selection into Cofinavit are unlikely to affect loan outcomes after conditioning on observables—not having a previous Infonavit loan and achieving the minimum Infonavit score. The Infonavit loan officer generally does not reject Cofinavit applications that meet these requirements, and there is little room for discretion in determining eligibility. Thus, she plays a less crucial role in this approval stage than the bank officer.

Summarizing, the main unobservables that could bias the results—after conditioning and matching on income and demographics—are the level and composition of borrowers' savings. Since we do not observe all variables considered by bank officers for the approval decision, which could have eliminated potential biases, the estimates cannot be given a causal interpretation. Thus, we assess their sensitivity to potential unobserved confounders by estimating bounds for the actual effects.

7 Results

7.1 Conditions at origination

In this section, we examine how co-financing impacts credit conditions at origination. We start by looking at loan volume in Table 4. We first present OLS estimates of equation (1), controlling only for cohort and bank fixed effects, and then add the full set of controls and fixed effects. Next, we re-estimate these specifications using the CEM weights and further control for the interaction

between the *Co-financed* indicator and all the covariates.

For total volume, the OLS coefficient on the *Co-financed* indicator is insignificant in column 1 and becomes positive and significant when adding the controls in column 2. In turn, the matching coefficients, with and without controls and fixed effects, are positive and significant at the 1% level. Accounting for the interaction between the *Co-financed* indicator and the controls in column 5, we find that the total volume of Cofinavit mortgages is on average 13.8% ($\exp[0.129] - 1 = 0.138$) larger than that of traditional loans. This is a sizable effect: It represents a 25.5% change relative to the sample standard deviation of the dependent variable (0.54). This result implies that Cofinavit achieves its goal of enhancing borrowers' credit capacity. In columns 6 and 7, we look at bank's loan volume which, for traditional loans, equals the total volume. The estimated coefficients are negative and significant. From the more flexible matching specification in column 7, co-financed bank loans are on average 12.1% smaller than traditional loans. This partial substitution of bank for Infonavit lending prevents an excessive increase in household leverage.

Table 5 shows results for down payment and property value, the dimensions that ultimately matter more to borrowers. We find that down payment is substantially smaller for co-financed mortgages across all specifications (significant at the 1% level). The benchmark coefficient in column 5 represents a large reduction of 5.8 pp or 34.0% relative to the sample standard deviation of the dependent variable (17.17 pp). In columns 6 and 7, the dependent variable is the down payment that borrowers pay out of private savings, which represents their actual needs of liquidity to cover upfront costs. That is, for co-financed mortgages this is the *portion* not covered by mandatory savings, and for the traditional this equals the *total* down payment. The matching coefficient represents a substantial decline of 15.8 pp or 87.0% relative to the sample standard deviation of the dependent variable.

For property value, the OLS estimates render mixed results, switching from negative to positive (columns 8 and 9). In the matching specifications, the coefficients remain positive and significant (columns 10 to 12). They indicate that properties purchased with co-financed mortgages are only 3.8% more valuable—a 6.9% increase in terms of its standard deviation. This low elasticity of the purchased property value to total loan volume, which increases by 13.8%, enables a reduction in the average down payment. These results imply that Cofinavit is mainly used to reduce the need of savings at origination and, not surprisingly, of liquid savings in particular. Its impact on property

value is small on average.

In Table 6, we look at mortgage pricing. From columns 1 to 5, we find that the volume-weighted average interest rate in Cofinavit bundles is higher than the bank rate of traditional mortgages. While the differential estimated in column 5 of 30.9 bp represents a small change (3.0%) relative to the sample mean of the dependent variable (10.4%), it represents a large change (44.1%) relative to its standard deviation (0.70 pp). This premium results from the substantially higher and risk-sensitive Infonavit rate (see Appendix Figure B.3). Looking at the bank rate alone in columns 6 and 7, the estimates become negative and significant. The differential of 21.4 bp from the matching estimate is, again, economically modest in terms of the mean rate (10.2%) but large relative to its standard deviation (0.74 pp). The lower bank rate of co-financed mortgages is in line with their lower *bank* LTV ratio (see Appendix Table B.3), a key factor in banks' loan pricing function. It is unlikely to arise from borrower selection: There is no evidence that ex ante safer borrowers sort into Cofinavit—Table 3 actually shows the opposite—and it remains robust to controlling for ex ante risk, as we show below. These findings imply that, while the average Cofinavit rate is initially higher than the rate of traditional bank mortgages, it becomes smaller once the Infonavit loan is repaid.

One potential source of omitted variable bias is borrowers' ex ante credit risk. In Table 3 we find some evidence that co-financing is chosen by ex ante slightly riskier borrowers and it is unclear whether the matching procedure indirectly balances the sample along this dimension. To assess its role, in Appendix Table B.4 we re-estimate the previous models before and after controlling for the demeaned probability of default at origination and its interaction with the *Co-financed* indicator. These results are obtained for the subsample of mortgages originated by a bank that adopted the internal ratings-based approach in December 2018. Reassuringly, we find that the main estimates are not substantially altered when controlling for the risk measure (odd versus even columns). The only exception is the estimate for property value that switches from insignificant to marginally significant.

7.2 Heterogeneity by income

This section examines whether the baseline results vary with borrowers' income, as predicted in Section 3.1. Figure 3 plots the distribution of mortgage characteristics by income in the matched

sample. The left axes correspond to histograms for the density of new mortgages, where it becomes apparent that originations are denser for co-financed than for traditional mortgages at lower income segments (black dots correspond to traditional mortgages, red triangles to the combined volume of co-financed loans, if applicable, and green crosses to banks' co-financed volume). The right axes correspond to scatterplots for the average mortgage conditions at origination. Using the benchmark specification but excluding income from the set of controls in $X'(\cdot)$, Table 7 provides estimates of equation (1) for low- and high-income borrowers separately, where high and low levels are relative to the median income of Cofinavit borrowers in the original matched sample. We also re-estimate the CEM weights so that the distribution of covariates remains balanced in each subsample.

Table 7 shows that the differential in loan amount associated with co-financed mortgages is larger for poorer borrowers (column 1). This is driven by the greater Infonavit loans to those segments; banks actually downsize co-financed loans for the poorer (column 2). Moreover, these differences are statistically significant at the 1% level according to the reported p-values from t-tests for the null hypothesis that coefficients are equal across income levels. Figure 3 plots the average loan amounts by income. The red and black markers indicate that the different results for total volume are driven by the tails of the income distribution.[17] In turn, the green and black markers show the downsizing of co-financed bank loans at lower incomes.

Next, column 3 shows that the co-financing indicator loads more negatively on the total down payment for low- than for high-income borrowers. This implies that, at origination, Cofinavit substantially reduces the need of total savings as income declines. Column 4 documents a smaller magnitude of the differential in the portion paid out of private savings alone. The lower holdings of mandatory savings by the poorer means that Cofinavit cannot reduce their needs of private savings substantially more than for the rich. In both cases, however, differences across high- and low-income groups are statistically significant. The second graph of Figure 3 provides further insight into these findings. The down payment of traditional mortgages (black dots) hardly varies with income. In turn, that of co-financed mortgages (red triangles) is increasing in borrowers' income, driven by

[17] The required payments to compute the bank PTI ratio are not reported directly, and so we estimate them using the formula $P\frac{r(1+r)^n}{(1+r)^n-1}$, where P is the principal of the loan, r is the annual interest rate, and n is the total number of mortgage payments. Payments to Infonavit are set equal to the wage discount rate. It is unclear, though, why the ratios estimated at lower incomes are well above the 30% limit (even for single borrowers).

the portion paid with mandatory savings—indeed, the portion covered with private savings (green crosses) follows a less steep trajectory.

Next, we turn to property value, where column 5 shows a larger positive coefficient for the high-income group, significantly different from that estimated for the low-income group. The third graph in Figure 3 shows that property values are slightly higher for co-financed than for traditional mortgages at the top but similar the bottom of the income distribution. This larger positive effect, combined with the smaller effect on total loan volume, implies that the elasticity of property value to loan volume is increasing in income. Thus, it is not a greater credit capacity but mainly the ability to afford a larger down payment by high-income borrowers under Cofinavit what enables the purchase of a better property.

Finally, column 6 displays a smaller positive coefficient for the interest rate at higher incomes. In turn, there are no significant differences on the coefficients estimated for the bank rate in column 7. In line with this, Figure 3 shows that the differential between the traditional rate (black dots) narrows down at higher incomes with the combined but not with the bank co-financed rate. Thus, it is the Infonavit loan, more expensive and with a higher share at lower incomes, what explains why co-financed mortgages are slightly regressive in terms of pricing relative to traditional ones. Since its amount is fixed, borrowers cannot substitute it for a larger bank loan.

7.3 Mortgage performance

We then estimate equation (2) to examine differences in ex post performance. Results are presented in Table 8. The OLS specification includes cohort, calendar time, and bank fixed effects. It shows significantly lower probabilities that co-financed mortgages become non-performing over the three time windows. Coefficients' size becomes smaller (in absolute value) after adding control variables and weighting observations in the matched sample. In addition, the estimates become less precise as the time horizon grows, going from significant at the 5% level in the first two years to insignificant in the first four. From the benchmark results in columns 3 and 6, which control for the interaction between the coefficient of interest with the covariates in $X'(\cdot)$, the two- and three-year probabilities of default are 0.13 pp and 0.15 pp lower, respectively, if the mortgage is co-financed than if it is traditional. These represent small changes of 1.8% and 1.7% relative to the corresponding standard deviations (7.32 pp and 9.15 pp). Thus, not only ex ante but also ex post differences in credit

risk across products are small and, moreover, they go in opposite directions—that is, Cofinavit mortgages are riskier ex ante and less risky ex post.

To provide evidence on the channels driving the ability of co-financing in reducing defaults, we re-estimate the benchmark specifications adding fixed effects for the combined LTV ratio at origination, defined over 5 pp bins. Conditioning on overall mortgage leverage, these estimates should capture the impact of the lower liquidity requirements during the mortgage's life and of Infonavit's secured repayment system. Thus, the ex post default rate of co-financed mortgages should decline even further relative to that of the traditional. For the three horizons, Appendix Table B.5 confirms that the negative coefficients on the co-financing indicator become larger in absolute value and more significant than in the benchmark specification. The estimates in columns 2, 4, and 6 represent changes of 3.0%, 2.6%, and 2.0% relative to the sample standard deviations of the corresponding dependent variables.

Having uncovered heterogeneous effects by income at origination, we investigate if they are also present in terms of loan performance. In Table 9, the coefficients only show a significant decline in the probability of defaulting on co-financed relative to traditional mortgages at higher incomes. Moreover, the t-tests imply that differences across groups are statistically significant. This result is consistent with the smaller increase in the combined LTV ratio (or a smaller decline in down payment) at higher segments of the income distribution. In those segments, riskier origination conditions play a smaller role vis-à-vis the channels reducing credit risk (see Section 3.2). Indeed, the latter do not vary with income, at least not to the same extent that leverage at origination does.

7.4 Outcomes by supply-side conditions

So far, we have attributed the main differences in equilibrium outcomes between mortgage products to demand-side constraints and to Cofinavit-specific features (enhanced credit capacity, ability to tap into mandatory savings, and a secure repayment system). In this section, we assess whether our findings are driven by the particular pool of borrowers or credit conditions of one or a few single lenders. With that purpose, we first examine if the previous results remain robust to changes introduced by the new Infonavit credit plan. As explained in Section 2.2, since April 2017 Infonavit has modified the interest rates and credit limits of its Cofinavit loan with the goal of expanding credit supply towards more profitable segments. In particular, for higher-income borrowers, the

interest rate changes have been relatively beneficial, whereas the opposite occurs with changes in credit limits.

We re-estimate the results separately for mortgages originated under the old and new plans. First, in Appendix Table B.6 we present the estimates of the probit and linear probability models for mortgage choice using the same specifications as in columns 1 and 5 of Table 3. We generally confirm the main findings for each subperiod. One exception are the coefficients on house prices that under the old plan become negative in the probit estimate. In addition, in Appendix Table B.7 we re-estimate equation (1) for total loan volume, down payment, property value, and the average interest rate. The average effects remain significant and with the same sign during both periods. Columns 7 and 8 show that the differential in the interest rate across products becomes smaller under the new plan, consistent with the average decline in the Infonavit rate (see Figure B.2). Finally, Appendix Table B.8 shows that the estimates for loan performance under the old plan are the same as in the full sample. Yet, the estimates for performance have less power under the new plan since it comprises three months of originations only. All in all, the robustness of the main findings to changes in the Infonavit conditions is expected, given the small volume share, on average, of its loan in a Cofinavit mortgage.

Next, we examine whether the results vary by bank. Institutions with different business models or lending strategies could adjust their Cofinavit terms differently. Thus, we also re-estimate the main models separately for mortgages from each of the five banks with a higher representation—altogether, they grant 99.6% of the mortgages in the balanced sample (see Panel B in Figure B.4). They are among the seven largest banks in the country, known as the "G7". Larger banks tend to have lower collateral requirements than smaller banks (Banco de México, 2015). In addition, they are in a better position to reach low-income borrowers and to extend smaller loan volumes thanks to a wider brick-and-mortar branch network and a better screening technology (Banco de México, 2015, 2020).

First, we look at product choice in Appendix Table B.9. The findings on income and age persist for each bank in the sample. Only for two banks, the sign or significance of the estimates for being male and married changes. The probit estimates are less robust for house prices and formal employment and more robust for the region where the property is located and formal wages. Finally, Appendix Tables B.10 and B.11 report the estimates of equations (1) and (2) by bank. The main

findings persist in general, only those for default outcomes are less significant.

7.5 Sensitivity analysis

As a sensitivity analysis, we conduct the test by Oster (2019) for selection on unobservables. This approach requires computing an identified set of coefficients for the *Co-financed* indicator. That set is bounded by the estimates of α_1 and β_1 obtained from equations (1) and (2), respectively, and by the hypothetical coefficients obtained if unobservables were also accounted for.[18] The hypothetical coefficients also allow assessing the magnitude of the potential omitted variable bias. An estimate is considered robust when: a) the unobservables move the coefficient toward zero and the identified set excludes zero, or b) the unobservables move the coefficient away from zero and the identified set is within the 99.5% confidence interval. This test also provides the degree of selection on observables and unobservables ($\widetilde{\delta}$) such that the co-financing effect would be zero ($\alpha_1 = 0$ or $\beta_1 = 0$) for the assumed R-squared from the hypothetical regression (R^2_{max}).

The results for α_1, estimated in the full sample and by income level, are presented in Appendix Table B.12. If unobservable controls were considered, the identified set in column 1 shows that the coefficient for total volume moves towards zero: Co-financed mortgages would lead to loans that are 12.4% higher. This implies a small bias, considering the benchmark of 13.8%. Since that set does not include zero, the estimate is robust to the presence of unobservables. The estimates by income also pass the robustness test. The same holds for the estimates on down payment and property value. In the case of the interest rate, the coefficient moves away from zero and the upper bound of the identified set is just above that of the confidence interval. Thus, this estimate is slightly less robust to the presence of unobservables, as it is that for high-income borrowers (column 12). However, in all cases the values of $\widetilde{\delta}$ are well above one in absolute value. In particular, they imply that the correlation of the *Co-financed* indicator with unobservables should be five times or larger than that with observables to find a null effect. For the interest rate, the negative $\widetilde{\delta}$ indicates that such correlation should be of the opposite sign as that with observables for a null effect.

[18] To obtain the hypothetical coefficients, the approach assumes the same degree of selection on unobservables and observables ($\widetilde{\delta} = 1$). It also assumes that the R-squared from the hypothetical regression equals $R^2_{max} = 1.3 \times R^2$, where R^2 is the R-squared estimated including only observables.

Appendix Table B.13 presents the tests for default outcomes over the three horizons. In the full sample, unobservables move coefficients towards zero and the identified sets do not include zero, confirming the robustness of the estimates. For high-income borrowers, the same pattern arises. For poorer borrowers, unobservables move the coefficients away from zero, and the identified sets are all within their corresponding confidence intervals. The high values of $\widetilde{\delta}$ suggest a low probability that unobservables render null estimates.

8 Covinavit versus piggyback loan structures

Optimally designed mortgage products maximize access to affordable housing for a given level of risk. Our findings that co-financed mortgages increase access to home financing without leading to higher ex post risk imply that are closer to the efficient frontier than traditional mortgages. In this section, we compare their capacity to balance access versus risk with that from a similar product that proliferated in the US between 2004 and 2006, the so-called piggyback mortgages. As other second mortgages, they have been suspected of contributing to the housing bubble that preceded the market collapse in 2008.

Originated at the same time as the primary mortgage, the piggyback are second-lien mortgages that enable households to reduce or even eliminate down payment without having to take an insurance.[19] The first mortgage is 80% of the house price and the piggyback varies between 5% to 20%. Instead of an insurance premium, borrowers pay a higher rate on the piggyback loan.[20] Thus, it resembles the Infonavit loan from a Cofinavit scheme in that it is of smaller size and has higher interest rate than the bank loan, but it differs in its lower priority.

While it is apparent the potential of this product to expand access to home financing and ownership, its role in the subprime lending boom is less clear. In their model, Chambers et al. (2009) find that piggyback loans account for up to 70% of the increase in home ownership rates between 1994 and 2005. Lee et al. (2013) note that the combined LTV of piggyback mortgage structures is much higher than for single-loan mortgages. Furthermore, the authors argue that the

[19] Insurance contracts protect the lender from default risk when the LTV is above 80% and are required for the mortgage to qualify for purchase by, for instance, GSEs.

[20] The same lender would issue two loans with different priority and pricing, rather than a larger single loan, because loans with LTVs below 80% are easier to securitize under better terms (Kau et al., 2014).

piggyback potentially helped to fuel the housing bubble by enabling purchases of homes with prices exceeding their fundamental values. More recently, Bhutta and Keys (2022) present an alternative view: Such mortgages started to retrench in late 2006, replaced by private insured mortgages, as lenders and investors became reluctant to bear the risk of high-LTV contracts.

The early evidence suggested that piggyback schemes were riskier than other mortgages (see, e.g., Sherlund, 2008; Mayer et al., 2009). In that line, LaCour-Little et al. (2011) use state-level data and find higher default and foreclosure rates for subprime piggyback than for first-lien loans. Eriksen et al. (2013) also note that piggyback borrowers typically default on the second but not on the first loan since the junior lender does not have incentives to start a foreclosure. Hence, controlling for the current combined attributes of both loans, they are less likely to default on their primary loan than single-loan borrowers. In Cofinavit, such "performance mismatch" (Calem and Sarama Jr., 2017) may come from a higher default on the bank loan—Infonavit's payments are secured and its loan also has a first lien. Thus, it cannot account for the better performance of co-financed than of traditional bank loans. Matching on the combined LTV, Agarwal et al. (2020) find a lower ex post default rate on piggyback than on single-lien insured mortgages. They attribute it to banks steering low-risk borrowers into piggyback mortgages to avoid insurance and make higher profits. We attribute the better performance of co-financed bank loans, conditional on the combined LTV, to specific institutional features rather than to borrower selection—in fact, borrowers opting for Cofinavit are slightly riskier ex ante.

Beyond the individual risk of second-lien loans, incentives to misreport them can also affect the system's risk exposure. Griffin and Maturana (2016) find that both originators and securities underwriters did not report second liens with the intention of securitizing the first loan. Thus, the actual combined LTV ratio was under-reported, and misrepresentation was correlated with a worse loan performance. As a result, Piskorski et al. (2015) show that investors of mortgage-backed securities were taking more risk than that contractually agreed and suffered higher losses. In our setting, where securitization is virtually non-existent, incentives to misreport the Infonavit loan with the purpose of securitizing the bank loan are absent. Finally, the different priority of first- and second-lien mortgages commonly observed in the US market also gives rise to holdup problems that prevent loan modification (Agarwal et al., 2019, 2020). Such problems are mitigated in Cofinavit (see footnote 10).

According to this evidence, the main risks arising from piggyback loan structures come from misaligned supply-side incentives in the presence of risk-shifting tools such as securitization. Besides the possibility of performance mismatch, no intrinsic feature of these products increases borrower credit risk, conditional on combined leverage at origination. This implies that adding risk-reducing features, as in Cofinavit, should increase their efficiency relative to standard mortgages. Admittedly, the feasibility as well as the optimality of implementing such features deserve a separate analysis. Replicating them requires an institution with special mandates to collect savings and to enforce a secure repayment system. The optimality of a paternalistic saving scheme with a home financing option depends on its effects on households' welfare (see, e.g., Fadlon and Laibson 2022; Moser and Olea de Souza e Silva 2019). Its benefits may be reduced in settings where voluntary households' savings in the financial system are more adequate than in Mexico. The costs are born by workers contributing to the HPF, who lose the custody of a portion of their savings and, hence, the possibility to manage their returns. By taking a mortgage from the HPF, they have to accept the conditions of the loan offered, which may not be better than those from other lenders, and lose the capacity to manage its payments.

9 Conclusion

In developing countries, financial constraints that prevent access to home financing are pervasive. Against that backdrop, we study a co-financing scheme between banks and a HPF in Mexico that promises to enhance borrowers' credit capacity. We examine which borrowers opt for this product rather than for traditional bank mortgages and compare their equilibrium outcomes in terms of origination conditions as well as performance. In doing so, we disentangle the product features that can accommodate borrowers' constraints and preferences for reducing upfront costs versus acquiring a better property without raising default.

We find that the demand for co-financed mortgages is driven by younger and poorer borrowers that are more liquidity and down-payment constrained. Conditional on product choice, the evidence shows that providing larger, co-financed loans is effective to relax borrowing constraints. However, it has a limited impact on enabling access to better homes and, hence, on contributing to wealth accumulation. These responses are stronger among low-income borrowers, with tighter constraints,

who need to reduce down payment more and, hence, are less able to acquire better properties. Moreover, since they have less mandatory savings at the HPF, their needs of private savings at origination do not decline substantially despite the reduced down payments.

When looking at performance, on average we find a slightly smaller probability of default in co-financed than in traditional mortgages, which declines further after conditioning on the combined LTV ratio. This mitigation in credit risk comes from the greater liquidity relief to cover origination costs and loan payments and a secure repayment system. Thus, it suggests that a paternalistic institution, with special mandates over a portion of households' savings and over its loans' repayment mechanism, is necessary to expand leverage through a second mortgage without worsening credit risk. However, even in its absence, a substantial deterioration in performance is not expected, as also implied by the recent evidence on the similar piggyback mortgages that were popular in the US until 2006.

This paper is silent on the impact of co-financed mortgages on home sales and homeownership. In particular, by fostering homeownership of young people, they may contribute to raise the headship rate, that is, the rate of population heading their own household. Another open question is how consumption, saving, and investment decisions of formal sector workers that take out a mortgage from the HPF compare to those of workers that do not withdraw their mandatory savings until retirement. A broader topic for future research is the welfare implications of a paternalistic saving scheme with a home financing option, considering different levels of voluntary households' savings in the financial system.

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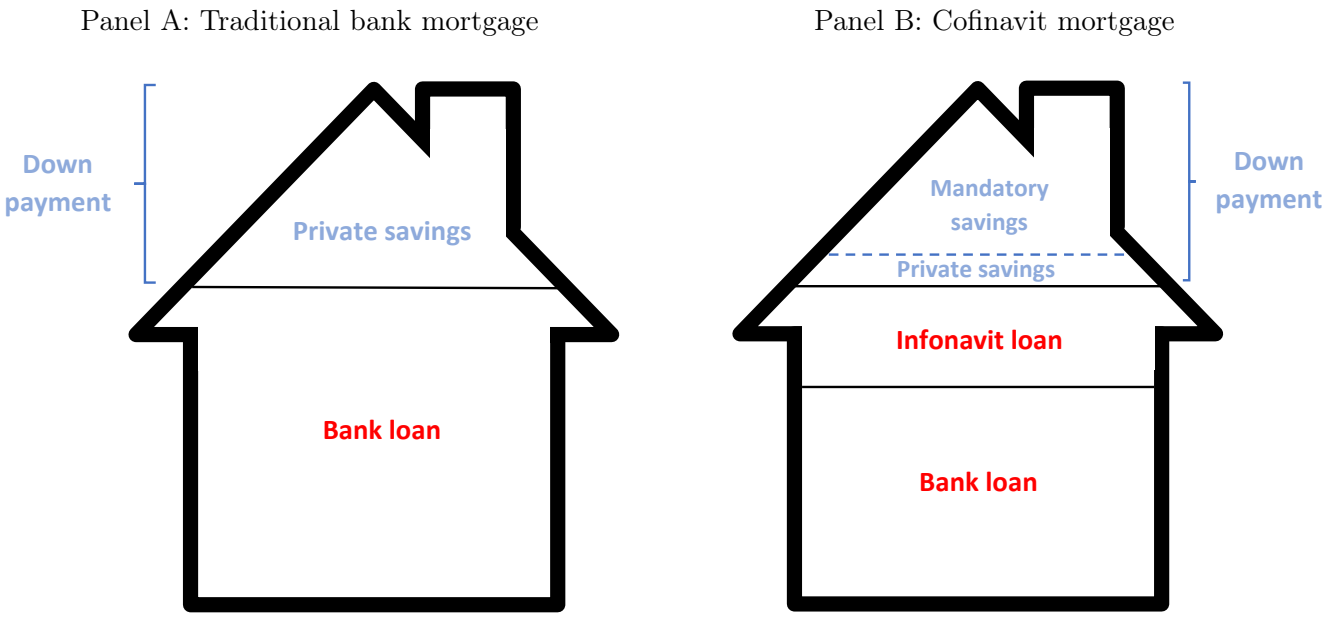
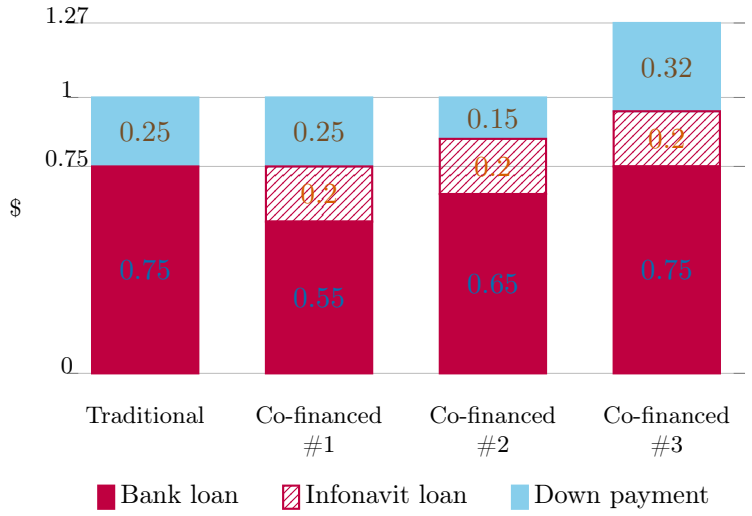
Figure 1: Funding structure in traditional and co-financed mortgages



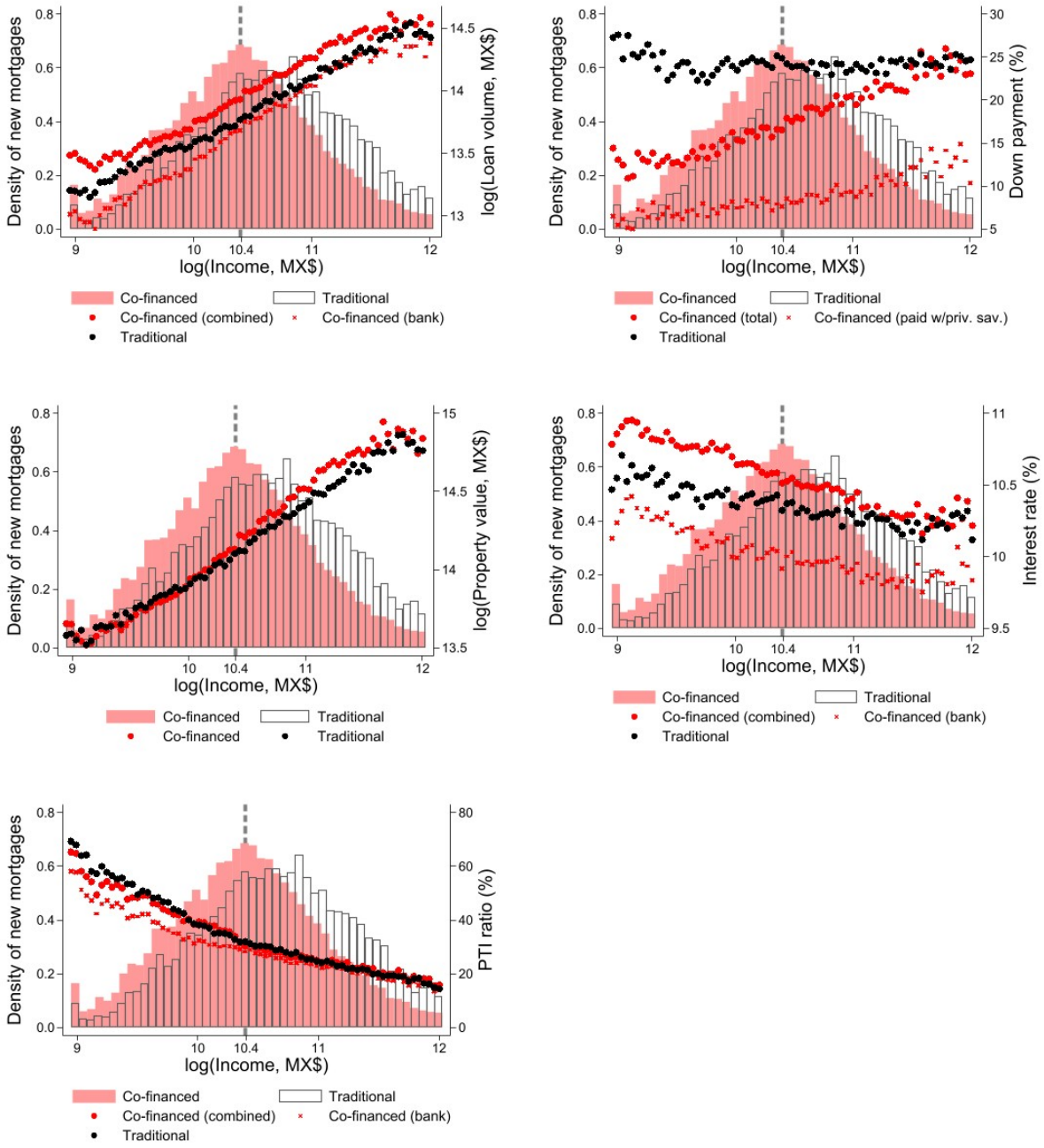
NOTE. This figure shows how alternative mortgage products finance a house purchase. Panel A shows a traditional bank mortgage that consists of a loan funded by the bank and a down payment paid out of private savings. Panel B shows a co-financed mortgage that consists of a loan from a bank and a smaller loan from Infonavit, both having a first lien on the property, and a down payment that is covered with all the mandatory savings in the home account at origination and, if also needed, private savings.

Figure 2: Theoretical effects on mortgage characteristics at origination



NOTE. This figure compares three hypothetical equilibrium outcomes in terms of total loan amount (red bars, both solid and with slanted lines), down payment (light blue bar), and property value (full bar) of co-financed relative to traditional bank mortgages, as discussed in Section 3.1. In the first co-financing case, none of the three outcomes changes because there is a full substitution of a portion of the bank loan for the Infonavit loan and, thus, the total loan amount does not increase. In the second case, there is a partial substitution between loans. This leads to some increase in total loan amount from 0.75 to 0.85 that is entirely used to reduce down payment from 0.25 to 0.15; the property value does not change. In the third case, there is no substitution between loans. This leads to a large increase in total loan amount from 0.75 to 0.95 that is entirely used to increase the property value from 1 to 1.27; the down payment as a percentage of the purchase price does not change.

Figure 3: Mortgage origination conditions by income



NOTE. This figure shows the density and characteristics of new traditional and Cofinavit mortgages, by income, to private sector workers originated by commercial banks between June 2016 and June 2019. All the left-hand axes correspond to histograms for co-financed and traditional bank mortgages (in red and transparent bars, respectively). For each mortgage product, the sum of the areas of the bars equals 1. In the right-hand axes, the figure shows scatterplots of the log of loan volume, down payment (as a percentage of the purchase price), the log of property value, loan interest rate, and the PTI ratio (in percentage). The averages of these characteristics are computed over income bins of MX$0.04 logarithmic length. For co-financed mortgages, the red dots correspond to the average combined characteristic of the co-financed loans and the red crosses to that of the bank portion (except for down payment, where the crosses correspond to the portion paid out of private savings). The black dots correspond to average characteristics of traditional bank mortgages. The horizontal axes represent the log of income in Mexican pesos deflated by the CPI (July 2018 = 100). The dashed vertical line indicates the sample median of Cofinavit borrowers' income.

Table 1: Main features of traditional versus Cofinavit mortgages

Mortgage:	**Traditional**	**Cofinavit**	
Lender:	**Bank**	**Bank**	**Infonavit**
Screening	Risk-based standards for approval	Risk-based standards for approval	Non-risk-based eligibility criteria (minimum score) for approval
Loan size	Determined by credit assessment and PTI limit	Determined by credit assessment and PTI limit, as a residual after Infonavit volume approved	Determined by credit limits (function of borrower's income and age or loan maturity) and simple credit assessment
Maturity	20 years	20 years	5 to 8 years
Interest rate	Depends on loan and borrower characteristics. Decreasing in income.	Depends on loan and borrower characteristics. Decreasing in income.	Increasing in income until March 2017, then fixed at 12%
Repayment	From cash on hand or private savings	From cash on hand or private savings and, once the Infonavit loan is repaid, also from employer contributions	From employer contributions (5% of employees' salary) and salary discounts (1% to 7% of the salary)
Default	Can occur when borrower has no willingness/ability to pay	Can occur when borrower has no willingness/ability to pay	Can occur when borrower loses formal job; usually later than on bank loan
Non-perform. status	After 3 months delinquent	After 3 months delinquent	After up to 15 months delinquent
Recovery	Bank starts legal actions after 4 to 6 months in default	Bank starts legal actions first, after 4 to 6 months in default, and pays to Infonavit its portion following home sale	Infonavit is less likely to start recovery given later default status; has same priority as bank in proceeds from home sale

NOTE. This table summarizes the main contractual features of traditional bank mortgages and Cofinavit mortgages in terms of screening, origination conditions, servicing, and default and post-default management. For Cofinavit, the table describes characteristics of the bank and Infonavit loans separately.

Table 2: Summary statistics

	Traditional		Cofinanced	
	Mean	**N**	**Mean**	**N**
Panel A: Full sample				
Borrower- and municipality-level variables at origination				
New property (%)	66.46	100,056	67.96	54,824
log(Income, MX$)	10.73	100,056	10.39	54,824
Age (years)	41.85	100,056	35.79	54,824
Male (%)	55.62	100,056	57.92	54,824
Married (%)	47.30	100,056	46.06	54,824
Borrower's workplace: North (%)	30.43	100,056	32.58	54,824
West (%)	13.27	100,056	13.21	54,824
East (%)	7.51	100,056	5.13	54,824
Center (%)	37.23	100,056	40.75	54,824
South (%)	11.57	100,056	8.32	54,824
log(House price)	4.63	100,056	4.62	54,824
log(Formal employment, per capita)	-1.54	100,056	-1.42	54,824
log(Average formal wages, MX$)	5.77	100,056	5.82	54,824
Co-borrower (%)	3.91	70,005	10.55	37,631
Probability of default (%)	1.26	10,195	1.34	3,673
Panel B: Balanced sample				
Mortgage-level variables at origination				
log(Total volume, MX$)	13.79	65,008	13.95	46,165
log(Bank volume, MX$)	13.79	65,008	13.68	46,165
Total down payment (%)	24.31	65,008	17.31	46,165
Down payment paid w/priv. savings (%)	24.29	65,008	8.39	46,165
log(Property value, MX$)	14.11	65,008	14.16	46,165
Average interest rate (%)	10.30	65,008	10.57	46,165
Bank interest rate (%)	10.30	65,008	10.01	46,165
Bank LTV ratio (%)	75.55	65,008	64.18	46,165
Mortgage-month level variables				
Non-performing in first 2 years (%)	0.63	369,763	0.44	322,974
Non-performing in first 3 years (%)	0.94	529,660	0.74	469,629
Non-performing in first 4 years (%)	1.15	678,338	0.99	611,042

NOTE. This table shows summary statistics (mean) for the full sample (Panel A) and the balanced sample (Panel B), where the unit of analysis is the mortgage. Statistics are presented separately for traditional and co-financed bank mortgages. The sample is restricted to mortgages for private sector workers originated by commercial banks between June 2016 and June 2019. In Panel A, borrower- and municipality-level variables are measured at origination. In Panel B, mortgages characteristics are measured at origination and, for the cohorts from June 2016 to June 2017, their performance is followed up monthly for the first two, three, and four years. Refer to Section 4.1 for data sources and sample selection and to Appendix Table B.1 for variable definitions.

Table 3: Determinants of mortgage choice

	Probit model			Linear probability model			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
New property	.037***	.014***	-.075***	.017***	.005	-.004	-.082***
	(.003)	(.003)	(.007)	(.003)	(.003)	(.004)	(.008)
log(Income)	-.135***	-.118***	-.130***	-.144***	-.005	-.053	.123
	(.002)	(.002)	(.005)	(.002)	(.089)	(.105)	(.307)
Age	-.011***	-.010***	-.011***	-.010***	-.009***	-.009***	-.009***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Male	.029***	.028***	.032***	.025***	.028***	.024***	.029***
	(.002)	(.003)	(.007)	(.002)	(.002)	(.003)	(.007)
Married	.035***	.015***	.025***	.037***	.027***	.017***	.022***
	(.002)	(.003)	(.007)	(.002)	(.002)	(.003)	(.008)
North	-.042***	-.047***	-.013	-.031***			
	(.003)	(.003)	(.009)	(.003)			
West	-.043***	-.053***	-.043***	-.036***			
	(.004)	(.004)	(.013)	(.004)			
East	-.077***	-.065***	-.078***	-.077***			
	(.005)	(.006)	(.018)	(.005)			
South	-.094***	-.098***	-.016	-.078***			
	(.004)	(.005)	(.012)	(.004)			
log(House price)	.194**	.641***	.646***	.084	.087	-.048	-2.125*
	(.088)	(.123)	(.250)	(.082)	(.084)	(.148)	(1.234)
log(Formal empl.)	.031***	.028***	.029***	.030***	-.015	-.001	.218
	(.002)	(.002)	(.007)	(.001)	(.013)	(.015)	(.206)
log(Formal wages)	.027***	.020***	.075***	.026***	-.042**	-.024	-.346*
	(.002)	(.003)	(.022)	(.002)	(.021)	(.024)	(.207)
Co-borrower		.154***				.067***	
		(.006)				(.006)	
Probability of default			.007**				.008*
			(.003)				(.004)
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	No	–	Yes	Yes	Yes	–
Bank time trends	No	No	–	No	Yes	Yes	–

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Income group FE	No	No	No	No	Yes	Yes	Yes
Workplace munic. FE	No	No	No	No	Yes	Yes	Yes
Property munic. FE	No	No	No	No	Yes	Yes	Yes
St. dev. dep. var.	.48	.48	.44	.48	.48	.48	.44
Observations	154,294	107,063	13,507	154,294	154,294	107,063	13,507

NOTE. This table reports estimates of marginal effects from probit models (columns 1 to 3) and from linear probability models (column 4 to 7), where the dependent variable is an indicator taking the value of 1 if the mortgage is co-financed and 0 if it is traditional. All specifications include loan, borrower, and municipal characteristics, and fixed effects for cohort of origination. As indicated, the linear probability models also include bank fixed effects and bank-specific linear time trends and fixed effects for borrower's income group (bins of MX$0.04 logarithmic length) and for municipalities of the borrower's workplace and of the purchased property. The main sample includes traditional and Cofinavit mortgages to private sector workers originated by commercial banks between June 2016 and June 2019. Columns 2 and 6 drop observations with missing values in the co-borrower indicator, only reported since June 2017. Columns 3 and 7 drop observations with missing values in the probability of default, only available from one bank after December 2018. Refer to Section 4.1 for data sources and sample selection and to Appendix Table B.1 for variable definitions. Robust standard errors are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table 4: Loan volume

Dependent variable:	log(Total volume)					log(Bank volume)	
	OLS		CEM			OLS	CEM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Co-financed	-.003	.127***	.142***	.143***	.129***	-.275***	-.129***
	(.003)	(.002)	(.003)	(.003)	(.003)	(.003)	(.003)
$X'(\cdot)$	No	Yes	No	Yes	Yes	No	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank time trends	No	Yes	No	Yes	Yes	No	Yes
Income group FE	No	Yes	No	Yes	Yes	No	Yes
Workplace munic. FE	No	Yes	No	Yes	Yes	No	Yes
Property munic. FE	No	Yes	No	Yes	Yes	No	Yes
Co-financed$\times X'(\cdot)$	No	No	No	No	Yes	No	Yes
St. dev. dep. var.	.57	.57	.54	.54	.54	.62	.58
Observations	154,294	154,294	110,617	110,617	110,617	154,294	110,617

NOTE. This table reports OLS and CEM estimates of equation (1) for the log of total (columns 1 to 5) and bank (columns 6 and 7) loan volume. *Co-financed* is an indicator taking the value of 1 if the mortgage is co-financed and 0 if it is traditional. All specifications control for cohort and bank fixed effects. As indicated, they also control for covariates in $X'(\cdot)$, that is, for characteristics at origination of the borrower (logarithm of income, age, and indicators for gender and marital status) and of the municipalities of the purchased property (house prices) and of the borrower's workplace (formal employment and wages), for bank-specific linear time trends, and add fixed effects for borrower's income group (bins of MX$0.04 logarithmic length) and for municipalities of the borrower's workplace and of the purchased property. The benchmark specifications also control for the interaction between the co-financing indicator and the demeaned controls in $X'(\cdot)$. The CEM estimates are obtained using the weights generated by the CEM algorithm in the common-support region. The sample includes traditional and Cofinavit mortgages to private sector workers originated by commercial banks between June 2016 and June 2019. Refer to Section 4.1 for data sources and sample selection and to Appendix Table B.1 for variable definitions. Robust standard errors are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table 5: Down payment and property value

Dep. variable:	Down payment							log(Property value)				
	Total					Paid w/priv. sav.						
	OLS		CEM			OLS	CEM	OLS		CEM		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Co-financed	-7.444***	-6.196***	-6.964***	-6.999***	-5.844***	-16.448***	-15.781***	-.121***	.031***	.035***	.035***	.038***
	(.088)	(.097)	(.123)	(.121)	(.120)	(.085)	(.121)	(.003)	(.002)	(.003)	(.003)	(.003)
$X'(\cdot)$	No	Yes	No	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank time trends	No	Yes	No	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes
Income group FE	No	Yes	No	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes
Workpl. munic. FE	No	Yes	No	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes
Prop. munic. FE	No	Yes	No	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes
Co-financed$\times X'(\cdot)$	No	No	No	No	Yes	No	Yes	No	No	No	No	Yes
St. dev. dep. var.	17.56	17.56	17.17	17.17	17.17	18.50	18.13	.58	.58	.55	.55	.55
Observations	154,294	154,294	110,617	110,617	110,617	154,294	110,617	154,294	154,294	110,617	110,617	110,617

NOTE. This table reports OLS and CEM estimates of equation (1) for total down payment (columns 1 to 5) and the portion paid out of private savings (columns 6 and 7), as a percentage of the purchase price, and the log of property value (columns 8 to 12). *Co-financed* is an indicator taking the value of 1 if the mortgage is co-financed and 0 if it is traditional. All specifications are described in Table 4. The sample includes traditional and Cofinavit mortgages to private sector workers originated by commercial banks between June 2016 and June 2019. Refer to Section 4.1 for data sources and sample selection and to Appendix Table B.1 for variable definitions. Robust standard errors are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table 6: Loan interest rate

Dependent variable:	Average rate					Bank rate	
	OLS		CEM			OLS	CEM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Co-financed	.336***	.335***	.342***	.342***	.309***	-.237***	-.214***
	(.003)	(.003)	(.004)	(.004)	(.004)	(.003)	(.004)
$X'(\cdot)$	No	Yes	No	Yes	Yes	No	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank time trends	No	Yes	No	Yes	Yes	No	Yes
Income group FE	No	Yes	No	Yes	Yes	No	Yes
Workplace munic. FE	No	Yes	No	Yes	Yes	No	Yes
Property munic. FE	No	Yes	No	Yes	Yes	No	Yes
Co-financed$\times X'(\cdot)$	No	No	No	No	Yes	No	Yes
St. dev. dep. var.	.72	.72	.70	.70	.70	.75	.74
Observations	154,294	154,294	110,617	110,617	110,617	154,294	110,617

NOTE. This table reports OLS and CEM estimates of equation (1) for the average (columns 1 to 5) and bank (columns 6 and 7) interest rates (in percentage). *Co-financed* is an indicator taking the value of 1 if the mortgage is co-financed and 0 if it is traditional. All specifications are described in Table 4. The sample includes traditional and Cofinavit mortgages to private sector workers originated by commercial banks between June 2016 and June 2019. Refer to Section 4.1 for data sources and sample selection and to Appendix Table B.1 for variable definitions. Robust standard errors are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table 7: Conditions at origination for low- and high-income borrowers

	log(Total volume)	log(Bank volume)	Down payment		log(Property value)	Average rate	Bank rate
			Total	w/priv. sav.			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Low income			
Co-financed	.157***	-.156***	-8.510***	-16.658***	.024***	.368***	-.213***
	(.004)	(.005)	(.186)	(.187)	(.004)	(.006)	(.006)
Observations	45,066	45,066	45,066	45,066	45,066	45,066	45,066
				High income			
Co-financed	.115***	-.109***	-4.141***	-15.334***	.052***	.273***	-.214***
	(.004)	(.005)	(.161)	(.161)	(.004)	(.006)	(.006)
Observations	65,494	65,494	65,494	65,494	65,494	65,494	65,494
$X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Income group FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Workplace munic. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Property munic. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Co-financed$\times X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H_0: Low = High income	0.000	0.000	0.000	0.000	0.000	0.000	0.912

NOTE. This table reports the benchmark CEM estimates of equation (1), after splitting the sample between low- and high-income borrowers, for the same outcomes and using the same specifications as in Tables 4 to 6. Income levels are defined relative to the median income of Cofinavit borrowers in the original matched sample. The CEM weights are re-estimated so that the distribution of covariates remains balanced within each subsample. The final row reports p-values for the null hypothesis that the estimated coefficients are equal for low- and high-income borrowers. Robust standard errors are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table 8: Default outcomes

Dependent variable:	Default: years after origination								
	first 2			first 3			first 4		
	OLS	CEM		OLS	CEM		OLS	CEM	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Co-financed	-.182***	-.140**	-.134**	-.206***	-.134*	-.154*	-.214***	-.082	-.129
	(.045)	(.066)	(.065)	(.057)	(.078)	(.079)	(.063)	(.084)	(.086)
$X'(\cdot)$	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank time trends	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Income group FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Workplace municipality FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Property municipality FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Co-financed$\times X'(\cdot)$	No	No	Yes	No	No	Yes	No	No	Yes
St. dev. dep. var.	7.99	7.32	7.32	9.92	9.15	9.15	11.17	10.31	10.31
Observations	1,298,502	692,735	692,735	1,865,795	999,287	999,287	2,398,929	1,289,378	1,289,378

NOTE. This table reports OLS and CEM estimates of equation (2) for indicators taking the value of 1 if a bank mortgage becomes non-performing within the first two years (columns 1 to 3), three years (columns 4 to 6), and four years (columns 7 to 9) after origination, and of 0 otherwise (multiplied by 100). *Co-financed* is an indicator taking the value of 1 if the mortgage is co-financed and 0 if it is traditional. All specifications are described in Table 4, and the only distinctions are that the municipality-level controls in $X'(\cdot)$ change with calendar time t (lagged one period) and that all specifications also add calendar time fixed effects. The sample includes traditional and Cofinavit mortgages to private sector workers originated by commercial banks in the period from June 2016 to June 2017, which are followed for two, three, and four years after origination. Observations are at the mortgage-month level. Refer to Section 4.1 for data sources and sample selection and to Appendix Table B.1 for variable definitions. Standard errors clustered at the mortgage level are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table 9: Default outcomes for low- and high-income borrowers

Dependent variable:	Default: years after origination					
	first 2		first 3		first 4	
Income:	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)
Co-financed	.052	-.223***	.095	-.329***	.192	-.403***
	(.107)	(.075)	(.133)	(.102)	(.142)	(.109)
$X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank time trends	Yes	Yes	Yes	Yes	Yes	Yes
Income group FE	Yes	Yes	Yes	Yes	Yes	Yes
Workplace munic. FE	Yes	Yes	Yes	Yes	Yes	Yes
Property munic. FE	Yes	Yes	Yes	Yes	Yes	Yes
Co-financed$\times X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes
Observations	283,396	408,661	410,409	587,867	531,475	756,516
H_0 : Low = High inc.	0.033		0.010		0.001	

NOTE. This table reports the benchmark CEM estimates of equation (2), after splitting the sample between low- and high-income borrowers, for the same outcomes and using the same specifications as in Table 8. Income levels are defined relative to the median income of Cofinavit borrowers in the original matched sample. The CEM weights are re-estimated so that the distribution of covariates remains balanced within each subsample. The final row reports p-values for the null hypothesis that the estimated coefficients are equal for low- and high-income borrowers. Standard errors clustered at the mortgage level are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Appendix for:

"Raising Household Leverage: Evidence from Co-Financed Mortgages"

Stefano Colonnello Mariela Dal Borgo

A The new Cofinavit scheme

This appendix provides additional details on how the terms of the Infonavit loan in a Cofinavit scheme have changed under the new credit plan.

Indexation. The Infonavit loan was originally indexed to the minimum wage, which tracks the rate of inflation. When a loan was originated, the amount in pesos was divided by the minimum wage and converted to "times the minimum wage". This implies that, following the annual increases in the minimum wage, the loan balance in pesos increased and this lengthened the repayment horizon. Since April 2017, the Infonavit loan is expressed in Mexican pesos, which prevents these changes in the loan balance. The loans already originated in minimum wages, will be indexed to a new CPI-linked index, the UMA (*Unidad de Medida y Actualización*).[1] In turn, bank loans are typically denominated in pesos during our sample period.

Interest rate. Before the reform, the advertised interest rate in minimum wages on the Infonavit loan entailed a cross-subsidy from high- to low-income borrowers: It varied from 4% to 9.5% for borrowers with income below 10 MWs (MX$24,332 in 2017) and equaled 10% for those with higher income (see Panel A of Appendix Figure B.1). Note that, because of the loan's indexation, the advertised interest rate was also indexed to the minimum wage. If the minimum wage increase tracks the inflation rate, the advertised rate resembles a real rate. The nominal interest rate (in pesos) approximately equals the advertised rate plus the minimum wage change. For instance, in 2016-2017 the minimum wage grew on average by 4%, and so the nominal interest rate in pesos varied between 8% and 14%.[2] The new credit plan set the interest rate at 12% across all income

[1] In January 2016, the UMA replaced the minimum wage as the indexation unit for obligations required by federal, state, and local laws. Cofinavit shifted to the UMA in April 2017, one of the latest Infonavit products to adopt it.

[2] The formula for the interest rate in pesos is: $i = (1 + i_{\text{MW}}) \times (1 + \Delta\text{MW}) - 1$, where i_{MW} is the advertised rate in minimum wages, and ΔMW is the expected annual variation in the minimum wage.

levels, eliminating the cross-subsidy (see Panel B of Appendix Figure B.1). As the reform removed the loan indexation to the minimum wage, the new advertised rate on the Infonavit loan is in pesos. In consequence, between March and April 2017 the interest rate in pesos dropped by over 2% at higher incomes, whereas it declined less or even increased at lower incomes, as shown in Appendix Figure B.2. On the other hand, the interest rate in pesos charged by the bank is typically smaller than that charged by Infonavit and is usually either fixed or increasing.

Credit limits.[3] Before the reform, the maximum loan amount granted by Infonavit, expressed in minimum wages, was a function of borrower's age and income, as shown in Panel A of Appendix Figure B.1. To target workers with income below 11 MWs, the credit limit dropped discretely by at least 52% as income increased from 10.9 to 11 MWs (from MX$26,522 to MX$26,765 in 2017). It then remained the same at incomes greater than or equal to 25 MWs (MX$60,830 in 2017), not targeted by Infonavit. In contrast, banks may offer differentiated conditions at all income levels, including at above 25 MW. After the 2017 reform, the maximum loan amount granted by Infonavit became a function of the loan's maturity, rather than of the borrower's age, and of her income, as shown in Panel B of Appendix Figure B.1. The new credit limits are expressed in UMAs and drop by 37% on average as income rises from 12.5 to 12.6 UMAs (from MX$28,686 to MX$28,916 in 2017). Appendix Figure B.2 shows the changes in credit limits under the new plan.

Salary discount rate. Under the old plan, the salary discounts were set at 7% for workers with a monthly wage of up to 10.9 MWs and at 1% for higher wage workers (Panel A of Appendix Figure B.1). After April 2017, the rate remained at 7% for borrowers with a wage of at most 12.5 UMAs and increased to 2.5% for those with higher wages (Panel B of Appendix Figure B.1). This implies that the salary discount rate has not changed for low-income borrowers but has increased from 1% to 2.5% for high-income borrowers (and from 1% to 7% for income segments near the thresholds of 11 MWs and 12.5 UMAs) (see Appendix Figure B.2). The increase in salary discounts at higher incomes is needed to avoid extending the time to repayment after the increase in credit limits—for a given salary discount rate, a larger loan will take longer to be repaid. By increasing the PTI ratio with Infonavit, a higher salary discount may lead to a reduction in the one with the bank, since the overall PTI ratio is set at about 30%. Ultimately, this could lead to a smaller bank loan, or to one with a lower interest rate or higher maturity.

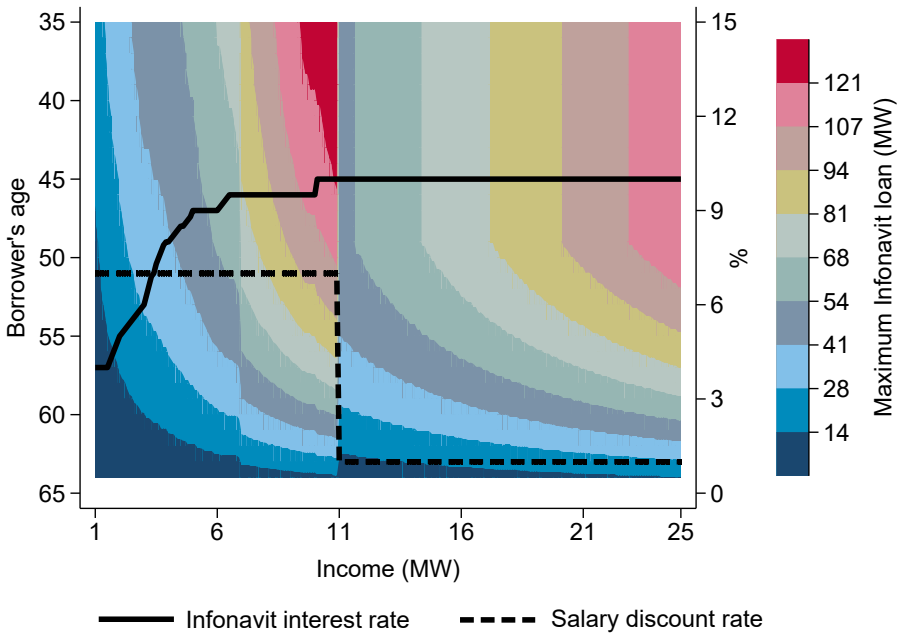
Administration fees. The 2017 reform also introduced a monthly administration fee for the Infonavit loan (equivalent to an annual 1% of its outstanding amount).

[3] A credit assessment establishes whether a borrower gets up to 100%, 90%, or 80% of her Infonavit credit limit (Infonavit, 2016). Since October 2017, this assessment is enhanced with credit bureaus reports and borrowers that do not authorize disclosing such information can only receive up to a 75% of the maximum amount.

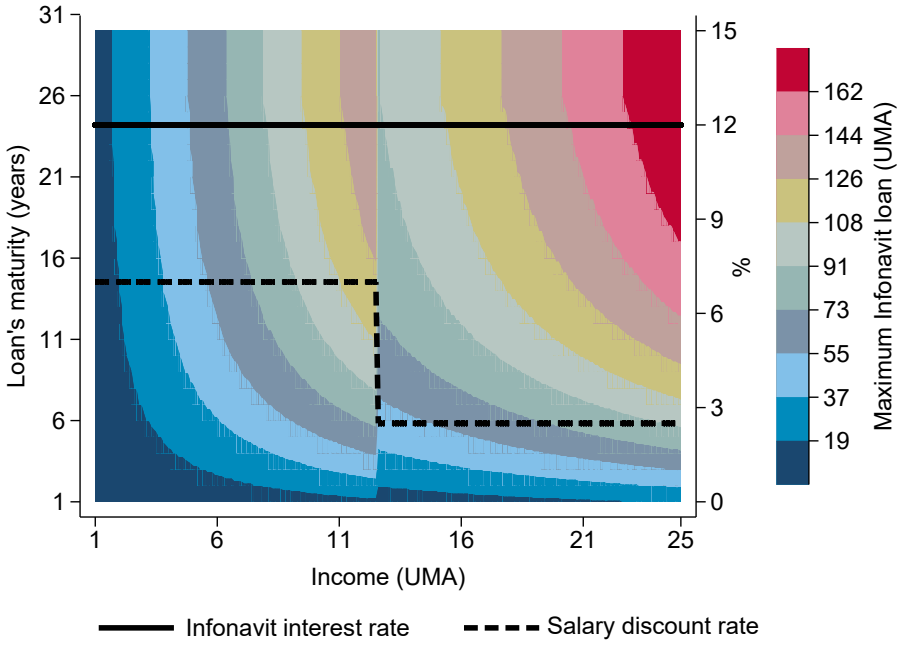
B Additional figures and tables

Figure B.1: Terms of Infonavit loans

Panel A: Loans originated before April 2017



Panel B: Loans originated after April 2017

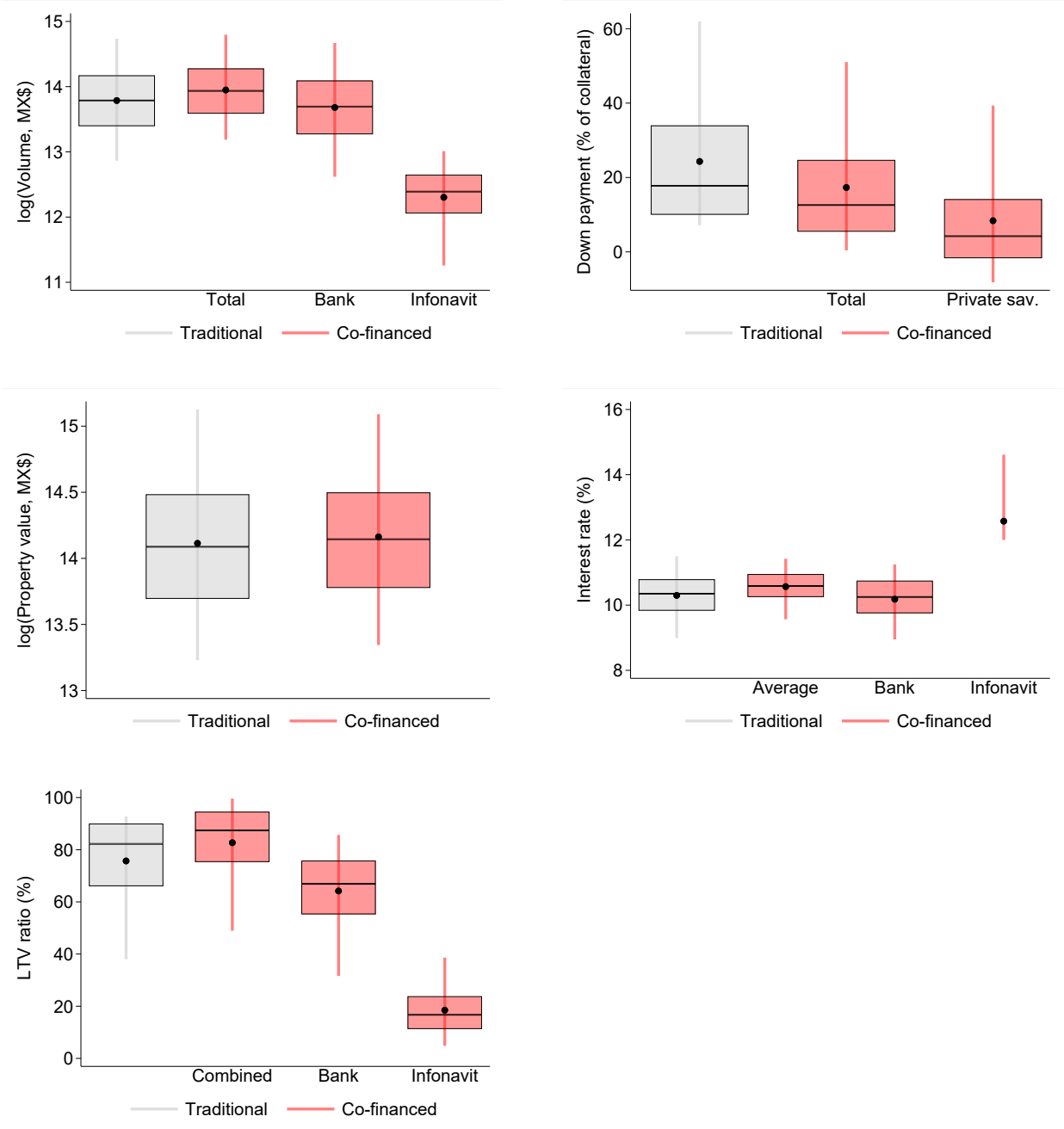


NOTE. This figure shows the credit limits, interest rates, and salary discount rates of Infonavit loans granted under the Cofinavit scheme, before (Panel A) and after (Panel B) April 2017. The credit limits are displayed as filled contours depending on borrower's age and income (Panel A) and loan's maturity and borrower's income (Panel B). Income and credit limits are expressed in minimum wages (Panel A) and UMAs (Panel B). The horizontal axes plot income for the bins defined by Infonavit. The left-hand side axis corresponds to borrower's age (Panel A) and loan's maturity (Panel B). The black solid line shows the nominal interest rates and the black dashed line shows the salary discount rates, as a function of borrower's income, using the scale on the right-hand side axes.

Figure B.2: Change in the terms of Infonavit loans under the new credit plan

NOTE. This figure shows the first difference in the logarithm of the credit limits and in the interest rates and salary discount rates of Infonavit loans granted under the Cofinavit scheme. The differences are computed between April and March 2017. The change in maximum loan amounts are displayed as filled contours depending on loan's maturity and borrower's income. They are computed from credit limits in Mexican pesos, deflated by the CPI (July 2018=100). The horizontal axis plots income in thousands of constant pesos (July 2018=100) for bins of width equal to MX$257. The left-hand side axis corresponds to loan's maturity, defined as 65 minus the borrower's age before April 2017. The black solid line shows the difference in interest rates (in Mexican pesos) and the black dashed line shows the difference in salary discount rates by income level, using the scale in the right-hand side axis.

Figure B.3: Mortgage characteristics at origination



NOTE. This figure shows box plots for characteristics at origination of co-financed and traditional mortgages. The sample is restricted to the common support region. When applicable, we report not only their combined value in a Cofinavit mortgage, but also discriminate between the values corresponding to the Infonavit and bank portions. The box plots report the 25th, 50th, and 75th percentiles of the distribution of each characteristic. The extremes of the whiskers indicate the 5th and 95th percentiles. The mean of each characteristic is marked by a black dot inside the boxes. Refer to Section 4.1 for data sources and sample selection and to Appendix Table B.1 for variable definitions.

Figure B.4: Support and balance of matching covariates

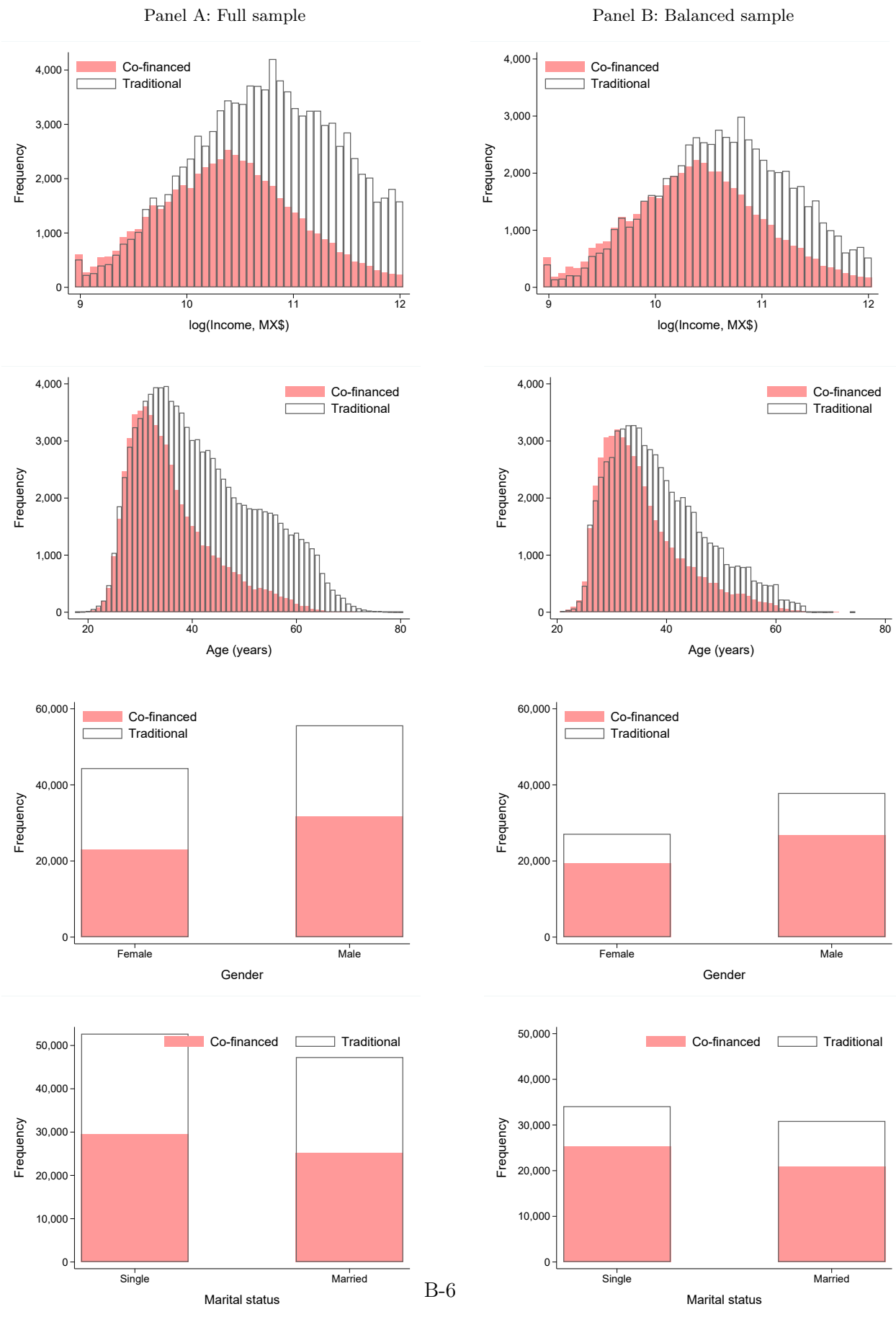
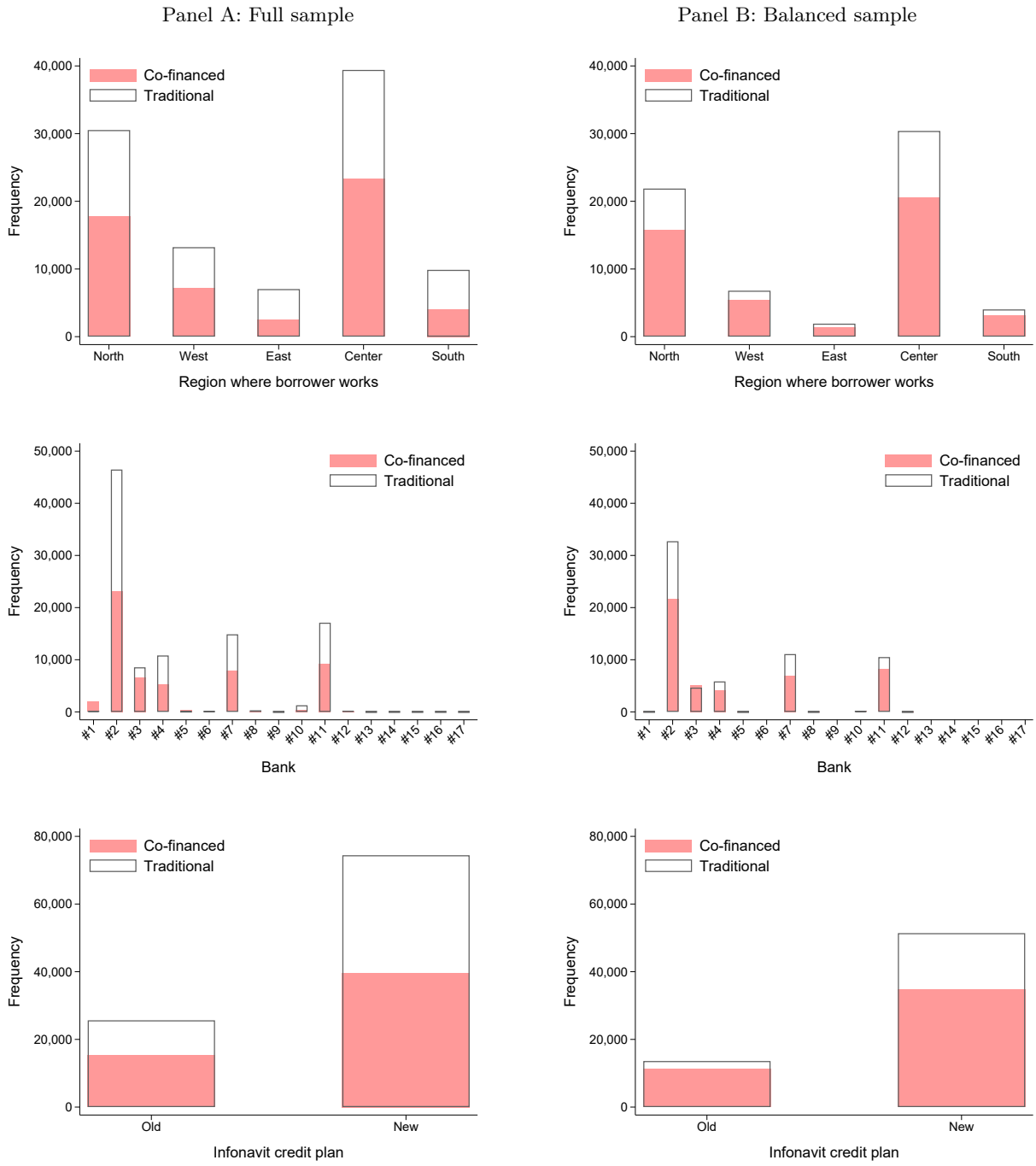
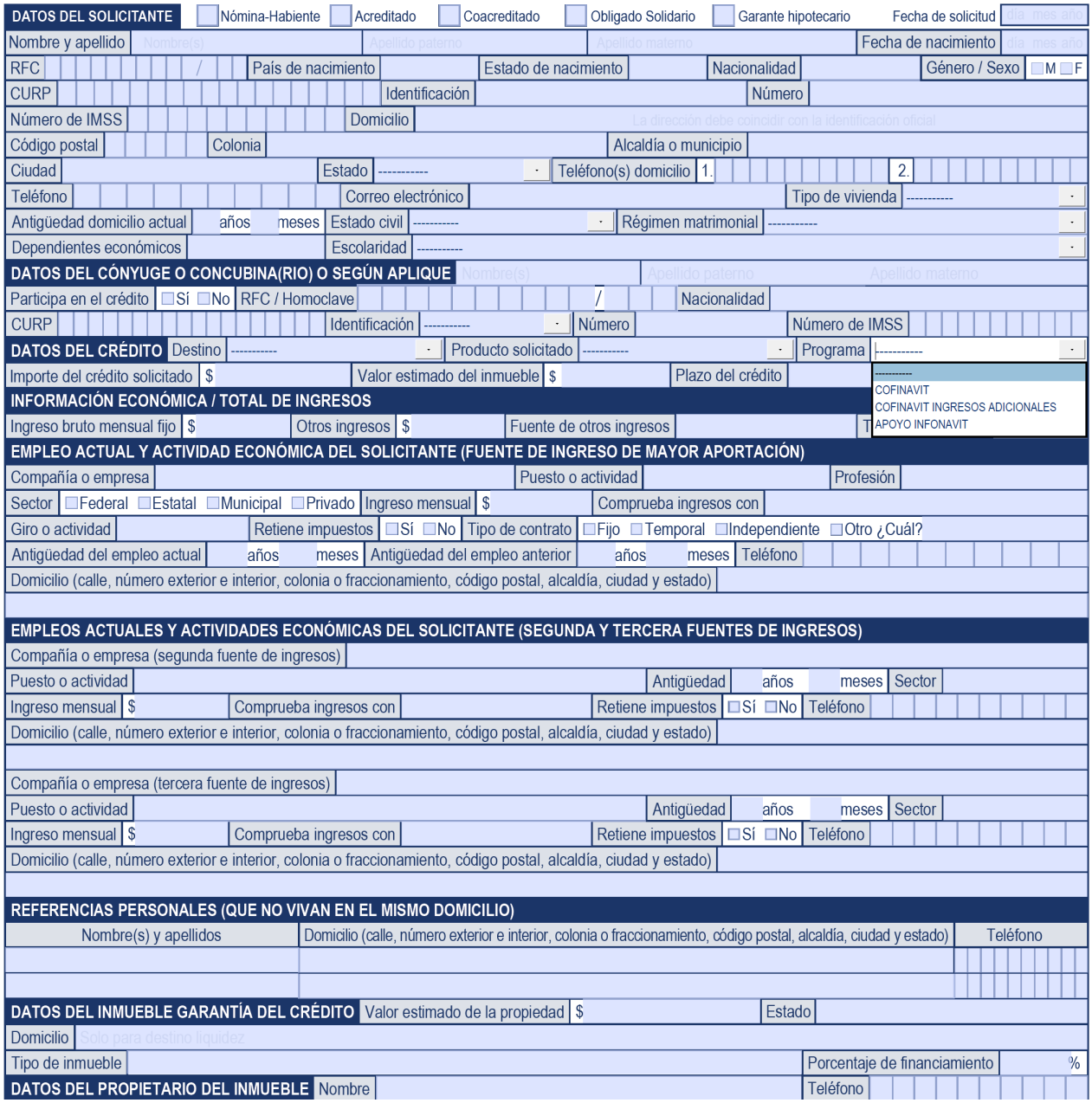


Figure B.4: Support and balance of matching covariates – *Continued*



NOTE. This figure plots histograms with the frequency of new co-financed and traditional mortgages by levels and categories of each matching covariate. Panel A plots distributions in the full (or unmatched) sample and Panel B plots those in the balanced (or matched) sample. The covariates are measured at origination and correspond to a sample of mortgages for private sector workers originated by commercial banks between June 2016 and June 2019. Refer to Section 4.1 for data sources and sample selection and to Appendix Table B.1 for variable definitions.

Figure B.5: Example of a mortgage application form



NOTE. This is an example of the actual form requested by a commercial bank to mortgage applicants. The entries displayed in the field "Programa" allow to select a specific co-financing program. Applicants not selecting Cofinavit or one of the other two programs are applying to a traditional bank loan. The form also specifies the following main requirements (not shown): 1. Be aged between 18 and 75 years old (depending on the product, the age plus the loan term cannot exceed 85 years old at origination). 2. Meet the insurance requirements set by the bank. 3. Have a lawful source of income. 4. Have a sound credit history and demonstrate sufficient economic solvency to repay the loan. 5. Verify minimum income and length of employment. The form further asks the authorization to request the applicant's credit history to the credit information societies for a period of three years.

Table B.1: Definition of variables

Variable	Definition
Borrower-level variables at origination	
New property	Indicator equal to 1 if the loan is used by the borrower to buy a new property and 0 if it is used to buy a second-hand property.
log(Income, MX$)	Log of borrower's gross monthly income as reported at origination. It includes all income sources considered for the loan decision (wages, business and professional activities, rents, interests, co-borrower's or other family members' income, etc.).
Age (years)	Borrower's age in years as reported at origination.
Male	Indicator equal to 1 if the borrower is male and 0 otherwise.
Married	Indicator equal to 1 if the borrower is married at the time of mortgage origination and 0 otherwise.
Borrower's workplace: North, West, East, Center, South	Indicators equal to 1 if the borrower works in the North, West, East, Center, or South region and 0 otherwise.
Co-borrower	Indicator equal to 1 if the borrower has a co-borrower and 0 otherwise. Only reported since June 2017.
Probability of default	Probability of default estimated at origination by a bank that adopted the Basel II internal ratings-based approach for credit risk in December 2018, when it starts to be reported.
Municipality-level variables at origination	
log(House price)	Log of the house price index from the municipality where the acquired property is located, lagged one quarter. When the municipal index is not available, the corresponding index from a higher-level geographical area is used.
log(Formal employment, per capita)	Log of formal employment normalized by population estimates from the municipality where the borrower works, lagged one month.
log(Average formal wages, MX$)	Log of formal wages normalized by formal employment from the municipality where the borrower works, lagged one month.
Mortgage-level variables at origination	
Co-financed	Indicator equal to 1 for Cofinavit mortgages and 0 for traditional bank mortgages.
log(Total volume, MX$)	Log of the total mortgage volume granted by the bank and, if co-financed, also by Infonavit.

(Continued)

Table B.1: – *Continued*

log(Bank volume, MX$)	Log of the mortgage volume granted by the bank (for traditional bank mortgages, it equals the total volume).
Total down payment (%)	Collateral value (the lesser of the purchase price and the appraised value) after subtracting the total loan volume, as a percentage of the collateral value.
Down payment paid with private savings (%)	Collateral value (the lesser of the purchase price and the appraised value) after subtracting the total loan volume and home account balance, as a percentage of the collateral value.
log(Property value, MX$)	Log of the purchase price of the house.
Average interest rate (%)	Volume-weighted average of the interest rates used by the bank and by Infonavit to compute the interest payments for the period. The Infonavit rate applied before April 2017 is extracted from the Terms of Contract in the Official Journal of the Federation, 24 April 2008, and converted to Mexican pesos using the formula in Appendix footnote 2. The rate applied after April 2017 is of 12%.
Bank interest rate (%)	Interest rate used by the bank to compute the interest payments for the period (for traditional bank mortgages, it equals the average interest rate).
Bank LTV ratio (%)	Bank loan volume as a percentage of the collateral value (the lesser of the purchase price and the appraised value).
Mortgage-month level variables	
Non-performing in first 2, 3, 4 years	Indicator equal to 1 if the bank loan is classified as non-performing (the payments of principal, interests, or both were not met as originally agreed or the borrower is in bankruptcy) within the first two, three, and four years after origination, and 0 if it remains performing.

NOTE. All borrower- and mortgage-level variables are extracted from the regulatory report R04 H collected by the CNBV. Municipality-level variables are from the Mexican Federal Society (SHF housing price index), from the Mexican Institute of Social Security (IMSS) (formal sector employment and wages), and from the National Population Council (CONAPO) (yearly population estimates). Monetary variables are expressed in CPI-adjusted Mexican pesos (second fortnight of July 2018 = 100). Continuous variables are winsorized at the top and bottom 1.5% of the distribution (except for the probability of default and for municipality-level variables).

Table B.2: Balance table

		Full sample			
		Traditional	**Cofinanced**	**Mean diff.**	***p*-value**
log(Income) (MX$)		10.729	10.389	-0.340	0.000
Male (%)		55.617	57.924	2.307	0.000
Age (years)		41.852	35.790	-6.062	0.000
Married (%)		47.301	46.056	-1.244	0.000
Borrower's workplace:	North (%)	30.510	32.446	1.936	0.000
	West (%)	13.213	13.076	-0.136	0.448
	East (%)	7.024	4.480	-2.544	0.000
	Center (%)	39.386	42.587	3.201	0.000
	South (%)	9.867	7.411	-2.456	0.000
Banks: #1 (%)		0.189	3.526	3.337	0.000
#2 (%)		46.445	42.201	-4.244	0.000
#3 (%)		8.544	12.044	3.500	0.000
#4 (%)		10.811	9.532	-1.279	0.000
#5 (%)		0.082	0.611	0.529	0.000
#6 (%)		0.130	0.000	-0.130	0.000
#7 (%)		14.867	14.315	-0.552	0.003
#8 (%)		0.300	0.153	-0.147	0.000
#9 (%)		0.002	0.000	-0.002	0.157
#10 (%)		1.262	0.686	-0.576	0.000
#11 (%)		17.092	16.856	-0.237	0.235
#12 (%)		0.233	0.077	-0.156	0.000
#13 (%)		0.004	0.000	-0.004	0.045
#14 (%)		0.012	0.000	-0.012	0.001
#15 (%)		0.011	0.000	-0.011	0.001
#16 (%)		0.012	0.000	-0.012	0.001
#17 (%)		0.004	0.000	-0.004	0.045
New credit plan (%)		74.376	72.302	-2.074	0.000
N		***100,056***	***54,824***		

Table B.2: Balance table – *Continued*

		Balanced sample			
		Traditional	**Cofinanced**	**Mean diff.**	***p*-value**
log(Income) (MX$)		10.406	10.406	0.000	0.923
Male (%)		57.975	57.975	0.000	1.000
Age (years)		35.552	35.495	-0.057	0.283
Married (%)		45.114	45.114	0.000	1.000
Borrower's workplace:	North (%)	34.084	34.084	0.000	1.000
	West (%)	11.749	11.749	0.000	1.000
	East (%)	2.998	2.998	0.000	1.000
	Center (%)	44.525	44.525	0.000	1.000
	South (%)	6.644	6.644	0.000	1.000
Banks: #1 (%)		0.108	0.108	0.000	1.000
#2 (%)		46.771	46.771	0.000	1.000
#3 (%)		11.047	11.047	0.000	1.000
#4 (%)		8.914	8.914	0.000	1.000
#5 (%)		0.007	0.007	0.000	1.000
#7 (%)		15.141	15.141	0.000	1.000
#8 (%)		0.013	0.013	0.000	1.000
#10 (%)		0.273	0.273	0.000	1.000
#11 (%)		17.715	17.715	0.000	1.000
#12 (%)		0.011	0.011	0.000	1.000
New credit plan (%)		75.421	75.421	0.000	1.000
N		***65,008***	***46,165***		

NOTE. This table shows a balancing test that includes the means of the matching covariates for traditional and Cofinavit mortgages, their difference, and p-values from difference-of-means t-tests. All statistics are reported first in the full (or unmatched) and then in the balanced (or matched) samples. In the balanced sample, the means are weighted using the weights generated by the CEM algorithm. The covariates are measured at origination and correspond to a sample of mortgages for private sector workers originated by commercial banks between June 2016 and June 2019. Refer to Section 4.1 for data sources and sample selection and to Appendix Table B.1 for variable definitions.

Table B.3: Bank LTV ratio

Dependent variable:	Bank LTV ratio				
	OLS		CEM		
	(1)	(2)	(3)	(4)	(5)
Co-financed	-11.111***	-11.363***	-11.503***	-11.476***	-11.451***
	(.090)	(.101)	(.126)	(.125)	(.125)
$X'(\cdot)$	No	Yes	No	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Bank time trends	No	Yes	No	Yes	Yes
Income group FE	No	Yes	No	Yes	Yes
Workpl. munic. FE	No	Yes	No	Yes	Yes
Prop. munic. FE	No	Yes	No	Yes	Yes
Co-financed$\times X'(\cdot)$	No	No	No	No	Yes
St. dev. dep. var.	18.12	18.12	17.79	17.79	17.79
Observations	154,294	154,294	110,617	110,617	110,617

NOTE. This table reports OLS and CEM estimates of equation (1) for the bank LTV ratio (in percentage). *Co-financed* is an indicator taking the value of 1 if the mortgage is co-financed and 0 if it is traditional. All specifications are described in Table 4. The sample includes traditional and Cofinavit mortgages to private sector workers originated by commercial banks between June 2016 and June 2019. Refer to Section 4.1 for data sources and sample selection and to Appendix Table B.1 for variable definitions. Robust standard errors are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table B.4: Conditions at origination accounting for ex ante credit risk

Dependent variables:	log(Total volume)		log(Bank volume)		Down payment				log(Property value)		Bank rate	
					Total		Paid w/ priv. sav.					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Co-financed	.105***	.106***	-.224***	-.224***	-6.353***	-6.301***	-15.325***	-15.307***	.016	.017*	-.282***	-.285***
	(.011)	(.011)	(.012)	(.012)	(.382)	(.382)	(.386)	(.386)	(.010)	(.010)	(.013)	(.013)
PD	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
$X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Income group FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Workplace munic. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Property munic. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Co-financed$\times X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Co-financed$\times$PD	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
St. dev. dep. var.	.50	.50	.55	.55	14.98	14.98	16.24	16.24	.50	.50	.53	.53
Observations	8,029	8,029	8,029	8,029	8,029	8,029	8,029	8,029	8,029	8,029	8,029	8,029

NOTE. This table reports the benchmark CEM estimates from Tables 4, 5, and 6, before and after controlling for the (demeaned) probability of default at origination computed under an internal ratings-based model and for its interaction with the *Co-financed* indicator. The sample includes traditional and Cofinavit mortgages to private sector workers originated by one bank using the internal ratings-based model between December 2018 and June 2019. Robust standard errors are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table B.5: Default outcomes controlling for the combined LTV

Dependent variable:	Defaults: years after origination					
	First 2		First 3		First 4	
	(1)	(2)	(3)	(4)	(5)	(6)
Co-financed	-.134**	-.208***	-.154*	-.251***	-.129	-.239***
	(.065)	(.068)	(.079)	(.081)	(.086)	(.087)
$X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank time trends	Yes	Yes	Yes	Yes	Yes	Yes
Income group FE	Yes	Yes	Yes	Yes	Yes	Yes
Workplace munic. FE	Yes	Yes	Yes	Yes	Yes	Yes
Property munic. FE	Yes	Yes	Yes	Yes	Yes	Yes
Co-financed$\times X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes
Combined LTV FE	No	Yes	No	Yes	No	Yes
St. dev. dep. var.	7.32	7.32	9.15	9.15	10.31	10.31
Observations	692,735	692,735	999,287	999,287	1,289,378	1,289,378

NOTE. This table reports the benchmark CEM estimates from Table 8, before and after adding fixed effects for 5 pp bins of the combined LTV ratio at origination. Standard errors clustered at the mortgage level are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table B.6: Determinants of mortgage choice under different credit plans

Credit plan:	Old		New	
	Probit	LPM	Probit	LPM
	(1)	(2)	(3)	(4)
New property	.050***	.017***	.030***	-.002
	(.005)	(.006)	(.003)	(.004)
log(Income)	-.175***	.116	-.124***	-.026
	(.003)	(.178)	(.002)	(.102)
Age	-.012***	-.011***	-.011***	-.009***
	(.000)	(.000)	(.000)	(.000)
Male	.041***	.035***	.024***	.023***
	(.005)	(.005)	(.003)	(.003)
Married	.039***	.026***	.034***	.024***
	(.005)	(.005)	(.003)	(.003)
North	-.007		-.047***	
	(.006)		(.003)	
West	-.016**		-.054***	
	(.007)		(.004)	
East	-.064***		-.068***	
	(.010)		(.006)	
South	-.046***		-.104***	
	(.008)		(.005)	
log(House price)	-1.016***	1.711***	.595***	-.087
	(.166)	(.646)	(.119)	(.132)
log(Formal empl.)	.018***	-.202**	.031***	.001
	(.004)	(.094)	(.002)	(.015)
log(Formal wages)	.067***	-.061	.024***	-.022
	(.012)	(.131)	(.003)	(.024)
Cohort FE	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes
Bank time trends	No	Yes	No	Yes
Income group FE	No	Yes	No	Yes
Workplace munic. FE	No	Yes	No	Yes
Property munic. FE	No	Yes	No	Yes

	Probit	LPM	Probit	LPM
	(1)	(2)	(3)	(4)
St. dev. dep. var.	.48	.48	.48	.48
Observations	40,316	40,316	113,489	113,489

NOTE. This table re-estimates the models of mortgage choice under the old (columns 1 and 2) and new (columns 3 and 4) Infonavit's credit plans, using the same specifications of the probit and linear probability as in columns 1 and 5 of Table 3, respectively. The old plan comprises mortgage originations going from June 2016 to March 2017 and the new plan those going from April 2017 to June 2019. Robust standard errors are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table B.7: Conditions at origination under different credit plans

Dependent variables:	log(Total volume)		Down payment		log(Property value)		Average rate	
Credit plan:	Old	New	Old	New	Old	New	Old	New
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Co-financed	.108***	.120***	-5.704***	-4.921***	.023***	.042***	.636***	.202***
	(.005)	(.003)	(.205)	(.127)	(.005)	(.003)	(.008)	(.004)
$X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Income group FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Workplace munic. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Property munic. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Co-financed$\times X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
St. dev. dep. var.	.53	.55	16.93	17.47	.55	.55	.86	.57
Observations	33,845	104,991	33,845	104,991	33,845	104,991	33,845	104,991

NOTE. This table reports estimates of the benchmark CEM specifications from Tables 4, 5, and 6, under the old (odd columns) and new (even columns) Infonavit's credit plans. The old plan comprises mortgage originations going from June 2016 to March 2017 and the new plan those going from April 2017 to June 2019. Robust standard errors are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table B.8: Default outcomes under different credit plans

Dependent variable:	Default: years after origination					
	first 2		first 3		first 4	
Credit plan:	Old	New	Old	New	Old	New
	(1)	(2)	(3)	(4)	(5)	(6)
Co-financed	-.137**	.031	-.135*	-.151	-.104	-.273
	(.064)	(.151)	(.081)	(.208)	(.089)	(.241)
$X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank time trends	Yes	Yes	Yes	Yes	Yes	Yes
Income group FE	Yes	Yes	Yes	Yes	Yes	Yes
Workplace munic. FE	Yes	Yes	Yes	Yes	Yes	Yes
Property munic. FE	Yes	Yes	Yes	Yes	Yes	Yes
Co-financed$\times X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes
St. dev. dep. var.	7.20	7.53	8.98	9.71	10.13	10.93
Observations	612,380	79,595	883,620	114,581	1,141,251	146,721

NOTE. This table reports estimates of the benchmark CEM specifications from Table 8, under the old (odd columns) and new (even columns) Infonavit's credit plans. The old plan comprises mortgage originations going from June 2016 to March 2017 and the new plan those going from April 2017 to June 2017. Standard errors clustered at the mortgage level are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table B.9: Determinants of mortgage choice by bank

	Bank #2		Bank #3		Bank #4		Bank #7		Bank #11	
	Probit	LPM	Probit	LPM	Probit	LPM	Probit	LPM	Probit	LPM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
New property	-.030***	-.045***	.046***	.049***			.104***	.107***		
	(.004)	(.004)	(.008)	(.009)			(.009)	(.010)		
log(Income)	-.162***	.136	-.125***	.340	-.152***	.208	-.172***	.084	-.158***	-.168
	(.002)	(.131)	(.006)	(.287)	(.005)	(.298)	(.007)	(.338)	(.004)	(.238)
Age	-.013***	-.011***	-.007***	-.006***	-.010***	-.009***	-.007***	-.007***	-.008***	-.008***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.001)	(.000)	(.000)
Male	.038***	.033***	.024***	.026***	.035***	.031***	.003	-.000	.011	.011
	(.003)	(.003)	(.007)	(.007)	(.008)	(.008)	(.008)	(.009)	(.007)	(.007)
Married	.024***	.017***	.009	.001	.034***	.028***	-.001	-.000	.076***	.082***
	(.003)	(.003)	(.007)	(.007)	(.007)	(.008)	(.008)	(.008)	(.006)	(.006)
North	-.022***		-.037***		-.027***		-.004		-.030***	
	(.004)		(.009)		(.009)		(.011)		(.007)	
West	.004		-.081***		-.048***		-.027**		-.125***	
	(.005)		(.012)		(.011)		(.012)		(.010)	
East	-.116***		-.069***		-.051***		-.013		-.101***	
	(.008)		(.013)		(.014)		(.019)		(.013)	
South	-.019***		-.111***		-.161***		-.156***		-.181***	
	(.005)		(.013)		(.013)		(.021)		(.014)	
log(House price)	-.153	-.290**	-1.394***	-1.143***	1.438***	1.095***	.426	.168	-.091	.003
	(.134)	(.133)	(.260)	(.303)	(.247)	(.285)	(.473)	(.527)	(.219)	(.224)

	Bank #2		Bank #3		Bank #4		Bank #7		Bank #11	
	Probit	LPM	Probit	LPM	Probit	LPM	Probit	LPM	Probit	LPM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log(Formal empl.)	.042***	-.050	-.002	-.449***	.009***	-.002	-.014	-.151	-.015**	.108
	(.003)	(.031)	(.005)	(.117)	(.003)	(.017)	(.012)	(.263)	(.007)	(.078)
log(Formal wages)	.066***	-.057	.030**	-.144	.004	-.008	.147***	.012	.185***	-.145
	(.010)	(.054)	(.013)	(.154)	(.003)	(.028)	(.034)	(.273)	(.020)	(.143)
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Income group FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Workplace munic. FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Property munic. FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
St. dev. dep. var.	.47	.47	.50	.50	.47	.47	.50	.50	.48	.48
Observations	69,104	69,104	14,957	14,957	15,146	15,146	13,921	13,921	24,690	24,690

NOTE. This table re-estimates the models of mortgage choice separately for mortgages from each of the five banks with a higher representation in the sample, using the same specifications of the probit and linear probability as in columns 1 and 5 of Table 3, respectively. The new property indicator is dropped from the estimates for banks #4 and #11 because of insufficient variation. Robust standard errors are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table B.10: Conditions at origination by bank

Dep. variable:	log(Total volume)	log(Bank volume)	Down payment	log(Prop. value)	Average rate	Bank rate
	(1)	(2)	(3)	(4)	(5)	(6)
			Bank #2			
Co-financed	.085***	-.193***	-5.040***	.010**	.298***	-.285***
	(.004)	(.005)	(.159)	(.004)	(.005)	(.005)
Observations	53,822	53,822	53,822	53,822	53,822	53,822
			Bank #3			
Co-financed	.302***	.033***	-10.116***	.150***	.499***	-.166***
	(.010)	(.011)	(.451)	(.010)	(.018)	(.018)
Observations	9,576	9,576	9,576	9,576	9,576	9,576
			Bank #4			
Co-financed	.071***	-.144***	-2.988***	.018*	.381***	-.054***
	(.010)	(.012)	(.402)	(.010)	(.012)	(.011)
Observations	9,647	9,647	9,647	9,647	9,647	9,647
			Bank #7			
Co-financed	.125***	-.117***	-3.014***	.072***	.252***	-.026**
	(.011)	(.012)	(.474)	(.010)	(.011)	(.011)
Observations	17,902	17,902	17,902	17,902	17,902	17,902
			Bank #11			
Co-financed	.125***	-.094***	-7.125***	.020***	.282***	-.258***
	(.007)	(.008)	(.286)	(.007)	(.010)	(.010)
Observations	18,381	18,381	18,381	18,381	18,381	18,381
$X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Income group FE	Yes	Yes	Yes	Yes	Yes	Yes
Workplace munic. FE	Yes	Yes	Yes	Yes	Yes	Yes
Property munic. FE	Yes	Yes	Yes	Yes	Yes	Yes
Co-financed$\times X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes

NOTE. This table reports estimates of the benchmark CEM specifications from Tables 4, 5, and 6, separately for mortgages from each of the five banks with a higher representation in the sample. Robust standard errors are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table B.11: Default outcomes by bank

Dependent variable:	Default: years after origination		
	first 2	first 3	first 4
	(1)	(2)	(3)
		Bank #2	
Co-financed	-.098	-.118	-.165
	(.102)	(.121)	(.130)
Observations	387,876	562,155	727,420
		Bank #3	
Co-financed	-.189	-.147	.122
	(.208)	(.301)	(.334)
Observations	88,497	126,767	162,575
		Bank #4	
Co-financed	-.454**	-.377*	-.335
	(.178)	(.207)	(.266)
Observations	43,640	61,762	79,641
		Bank #7	
Co-financed	-.124	-.291*	-.363*
	(.104)	(.155)	(.210)
Observations	11,763	17,006	21,841
		Bank #11	
Co-financed	-.047	-.040	-.053
	(.063)	(.070)	(.069)
Observations	153,120	220,246	283,238
$X'(\cdot)$	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Income group FE	Yes	Yes	Yes
Workplace munic. FE	Yes	Yes	Yes
Property munic. FE	Yes	Yes	Yes
Co-financed$\times X'(\cdot)$	Yes	Yes	Yes

NOTE. This table reports estimates of the benchmark CEM specifications from Table 8, separately for mortgages from each of the five banks with a higher representation in the sample. Standard errors clustered at the mortgage level are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table B.12: Oster's test for conditions at origination

Dependent variable:	log(Total volume)			Down payment		
Income:	All	Low	High	All	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)
Co-financed	.129***	.157***	.115***	-5.844***	-8.510***	-4.141***
	(.003)	(.004)	(.004)	(.120)	(.187)	(.162)
$X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank time trends	Yes	Yes	Yes	Yes	Yes	Yes
Income group FE	Yes	Yes	Yes	Yes	Yes	Yes
Workplace munic. FE	Yes	Yes	Yes	Yes	Yes	Yes
Property munic. FE	Yes	Yes	Yes	Yes	Yes	Yes
Co-financed$\times X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes
Identified set for $\widetilde{\delta} = 1$	[.117,.129]	[.154,.157]	[.098,.115]	[-5.844,-5.356]	[-8.510,-8.253]	[-4.141,-3.744]
99.5% conf. int. for α_1	[.120,.137]	[.145,.169]	[.104,.127]	[-6.182,-5.507]	[-9.033,-7.988]	[-4.594,-3.689]
$\widetilde{\delta}$ for $\alpha_1 = 0$ given R^2_{max}	7.696	14.347	4.935	6.481	8.332	6.329
R^2_{max}	.602	.433	.457	.279	.327	.265
R^2	.463	.333	.351	.215	.252	.203
Observations	111,173	45,580	65,958	111,173	45,580	65,958

Table B.12: Oster's test for conditions at origination - *Continued*

Dependent variable:	log(Property value)			Average rate		
Income:	All	Low	High	All	Low	High
	(7)	(8)	(9)	(10)	(11)	(12)
Co-financed	.038***	.024***	.052***	.309***	.368***	.273***
	(.003)	(.004)	(.004)	(.004)	(.006)	(.006)
$X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank time trends	Yes	Yes	Yes	Yes	Yes	Yes
Income group FE	Yes	Yes	Yes	Yes	Yes	Yes
Workplace munic. FE	Yes	Yes	Yes	Yes	Yes	Yes
Property munic. FE	Yes	Yes	Yes	Yes	Yes	Yes
Co-financed$\times X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes
Identified set for $\widetilde{\delta} = 1$	[.034,.038]	[.024,.025]	[.042,.052]	[.309,.324]	[.368,.385]	[.273,.297]
99.5% conf. int. for α_1	[.030,.046]	[.012,.036]	[.041,.063]	[.297,.320]	[.351,.386]	[.257,.289]
$\widetilde{\delta}$ for $\alpha_1 = 0$ given R^2_{max}	7.737	-711.848	4.542	-54.597	-113.667	-19.024
R^2_{max}	.700	.476	.594	.549	.516	.582
R^2	.539	.366	.457	.423	.397	.447
Observations	111,173	45,580	65,958	111,173	45,580	65,958

NOTE. Following the approach in Oster (2019), this table reports the sensitivity of the benchmark CEM estimates from Tables 4, 5, 6, and 7 to the presence of unobservables. The identified sets for $\widetilde{\delta} = 1$ are bounded by $\widehat{\alpha}_1$ and by the hypothetical $\widehat{\alpha}_1$ calculated based on R^2_{max} and on $\widetilde{\delta} = 1$. The "99.5% confidence interval" is defined as ± 2.8 standard errors around the reported values of $\widehat{\alpha}_1$. The value of $\widetilde{\delta}$ is the one that would produce $\alpha_1 = 0$ given the values of R^2_{max} reported. R^2_{max} is set equal to $1.3 \times R^2$. Robust standard errors are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table B.13: Oster's test for default outcomes

Dependent variable:	Default: years after origination								
	first 2			first 3			first 4		
Income:	All	Low	High	All	Low	High	All	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Co-financed	-.134**	.052	-.223***	-.154*	.095	-.329***	-.129	.192	-.403***
	(.065)	(.107)	(.075)	(.079)	(.133)	(.102)	(.086)	(.142)	(.109)
Identified set for $\widetilde{\delta} = 1$	[-.134,-.114]	[.052,.071]	[-.223,-.197]	[-.154,-.137]	[.095,.117]	[-.329,-.301]	[-.129,-.117]	[.192,.216]	[-.403,-.372]
99.5% conf. int. for β_1	[-.316,.048]	[-.248,.353]	[-.433,-.013]	[-.375,.068]	[-.277,.467]	[-.616,-.043]	[-.368,.111]	[-.207,.590]	[-.710,-.097]
$\widetilde{\delta}$ for $\beta_1 = 0$ given R^2_{max}	5.683	-3.532	6.165	7.871	-5.458	8.102	9.715	-11.891	8.934
R^2_{max}	.051	.067	.063	.055	.069	.070	.055	.069	.071
R^2	.039	.052	.048	.042	.053	.054	.042	.053	.055
Observations	692,737	283,398	408,664	999,289	410,411	587,870	1,289,380	531,477	756,519

NOTE. Following the approach in Oster (2019), this table reports the sensitivity of the benchmark CEM estimates from Tables 8 and 9 to the presence of unobservables. The identified sets for $\widetilde{\delta} = 1$ are bounded by $\widehat{\beta}_1$ and by the hypothetical $\widehat{\beta}_1$ calculated based on R^2_{max} and on $\widetilde{\delta} = 1$. The "99.5% confidence interval" is defined as ± 2.8 standard errors around the reported values of $\widehat{\beta}_1$. The value of $\widetilde{\delta}$ is the one that would produce $\beta_1 = 0$ given the values of R^2_{max} reported. R^2_{max} is set equal to $1.3 \times R^2$. Standard errors clustered at the mortgage level are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

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