Raising household leverage: Evidence from co-financed mortgages*

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This Draft: February 23, 2022

Abstract

This article studies the impact on mortgage origination conditions and performance of a product that aims at raising household leverage: bank mortgages co-financed with a housing provident fund (HPF), a compulsory saving scheme for all private sector workers in Mexico. Relative to traditional bank mortgages, our estimates show that down payment of the co-financed declines substantially, by 7.6 percentage points, whereas purchased properties are not more expensive. Despite their higher leverage, co-financed bank mortgages do not exhibit higher default rates—their lower liquidity needs to cover upfront costs and monthly payments reduce credit risk. We also find distributional effects: The scheme alleviates borrowing constraints more at lower incomes, especially when banks are smaller. Larger banks, with a greater share of low-income borrowers, use co-financing to reduce the amount lent to those segments. Thus, when the HPF's lending conditions become relatively less generous at lower incomes, we find that larger banks neutralize the substitution between traditional and co-financed mortgages that is found on smaller banks' portfolios.

JEL Classification: D04, D14, G21, G51, H81, O16

Keywords: Residential Mortgages, Co-Financing, Housing Provident Fund, Household Leverage, Default

*We thank Kirill Borusyak, Hans Degryse, Miguel Faria-e-Castro, Angela Gallo, Iftekhar Hasan, and Marco Pagano for helpful comments and discussions. We are especially indebted to Andrés Felipe García-Suaza for his involvement in the early stages of the project. We also thank participants at the University of Siena seminar and at the 4th Conference on Contemporary Issues in Banking. Officers from Infonavit and commercial banks provided valuable insights surrounding mortgage markets. The views in the paper are those of the authors and do not necessarily reflect those of the Banco de México or its staff. All errors are our own.

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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 salient public policy goal. To deal with demand frictions, a wide menu of policies seek to increase household leverage. Borrowing constraints are a major barrier to home ownership as shown, for instance, by Linneman and Wachter (1989); Duca and Rosenthal (1994); Gete and Reher (2018); Blickle and Brown (2019); Fuster and Zafar (2016, 2021). For households with a latent demand for larger, better-quality homes, the possibility of obtaining additional funding can also spur home ownership (Gete and Reher, 2016). However, a higher leverage can have negative implications for financial stability by affecting individual default risk. This trade-off poses a challenge for lenders, policymakers, and regulators alike. Their response is reflected in new products that expand access and affordability of credit along with leverage limits and higher regulatory costs for riskier loans. Thus, the institutional setting and market structure will impact on the efficacy of mortgage innovations, as determined by their effects on borrowing conditions and performance.

Relatively little empirical work has dealt with innovations from underdeveloped mortgage markets, where private banks often co-exist with public ones and with institutions not integrated into the market-based financial system. In such setting, we focus on a product that aims at increasing mortgage leverage by pooling resources from a private bank and a so-called housing provident fund (HPF). HPFs are self-financing entities that governments created to deal with the scarcity of long-term funding. They act as compulsory saving schemes and play a prominent role in mortgage provision in several countries, including Brazil, China, and Mexico. Mortgages co-financed with banks are primarily seen as a device to balance the credit and savings functions when both are undertaken by the HPF. In order to attract borrowers eligible for a bank loan, co-financed mortgages need to differentiate from existing bank products. Yet, it is an empirical question how these mortgage products compare in terms of borrowing conditions and ex post performance, particularly when the co-financed offer more funding. The equilibrium effects will depend on distinctive features of the program and on how private lenders' supply and borrowers' demand respond to it.

Leveraging a comprehensive loan-level dataset, this article provides evidence on bank mortgages co-financed with a Mexican HPF that is the largest mortgage lender in Latin America. First, we examine if, thanks to a larger combined loan volume, co-financing leads to a reduced down payment and to the purchase of a better house than mortgages funded solely by banks, as advertised. Secondly, we study differences in default between co-financed and traditional mortgages that may arise if the program increases the combined loan-to-value (LTV) ratio, the counterpart of a lower down payment. Third, we

provide evidence on the distributional implications of extending larger, co-financed loans. They are expected because leverage constraints and the underlying demand for housing, as well as some program characteristics, vary with income. Finally, we use a battery of tests to elucidate to which extent our findings depend on banks' business models and lending strategies—specifically, those of larger versus smaller banks.

HPFs differ along many dimensions, but a shared trait is being funded with mandatory contributions from employers and employees.[1] In exchange, HPFs offer a saving product and the option to take a mortgage. Given their complex design, most of these funds end up cross-subsidizing participants (Chiquier and Lea, 2009). By offering better borrowing conditions to low-income contributors, the Mexican HPFs comply with their social mission. However, lending to more profitable segments is necessary to improve returns on savers. To this end, co-financing schemes with banks target higher-income borrowers, demanding larger loans, than the standard HPF mortgage. They offer the possibility to leverage the existing savings in the HPF by mobilizing private funding, while reducing the HPF loan. Therefore, co-financing has been recommended for HPFs with poor lending performance and a regressive subsidy structure (Taffin et al., 2011).

Our analysis centers on a co-financing scheme by the *Instituto del Fondo Nacional de la Vivienda para los Trabajadores* (Infonavit), which serves all formal workers in the private sector and is the main HPF and mortgage lender in Mexico. The scheme studied here, marketed as "Cofinavit", was launched in 2004 and 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 and administered separately. The borrower's savings held by Infonavit are used to cover up to the entire amount of the down payment. To secure debt collection, the Infonavit loan and, after its repayment, a portion of the bank loan are paid with mandatory employer contributions and wage discounts.

For the empirical analysis, we use granular data from the Mexican banking supervisor on the universe of mortgages granted by commercial banks. We restrict the sample to Cofinavit mortgages and to traditional ones with borrowers eligible for and targeted by Cofinavit over the period 2016–2021. Given that the two mortgage products are not randomly assigned, we compare them by implementing the coarsened exact matching (CEM) approach from Iacus et al. (2012). This reduces a potential selection bias by matching on a myriad of observable characteristics from borrowers and banks and by restricting the comparison to the region of common support.[3] In the final sample, Cofinavit loans represent 45% from a total of 92,294 mortgages.

[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.

[3] Our results could be biased if borrowers sort into co-financed mortgages on the basis of unobservables such as a borrower's ex ante risk profile. Thus, in a subsample we verify the robustness of the main results to controlling for an ex ante risk proxy, the probability of default at origination computed under the internal ratings-based approach.

Our baseline estimates confirm that total (i.e., Infonavit plus bank) loan volume is larger, by 15% on average, when the mortgage is co-financed than when it is traditional. Given that the down payment and the property value are positively correlated, the two Cofinavit goals are somewhat in conflict and only one may prevail in equilibrium. Indeed, we find little evidence that the property value is higher on average in a co-financed than in a traditional bank mortgage, whereas the down payment (as a percentage of the purchase price) is 7.6 percentage points (pp) lower. This is a large decline of 32% relative to the average down payment of a traditional mortgage (24%). Moreover, since Cofinavit borrowers use all their mandatory savings to cover the upfront costs of buying a property, the down payment paid with their private liquid assets is actually 15.9 pp lower. Hence, not only Cofinavit relaxes leverage constraints substantially, but the implied decline in households' liquidity needs is even larger, representing a 66% change relative to a traditional mortgage. Differences in the cost of credit across products are small: The combined Cofinavit rate is slightly higher (36 bp) according to our estimates and the premium is driven by the Infonavit rate that is not risk sensitive. Banks actually charge a rate that is 21 basis point smaller, which represents a 2% decline relative to the average interest rate of traditional mortgages. This is in line with the lower *bank* LTV ratio of co-financed mortgages.

Given their higher *combined* LTV ratio, co-financed bank mortgages are riskier than traditional ones ex ante.[4] However, looking at the probability of becoming non-performing for up to four years after origination, we find no significant differences across products. Moreover, conditioning on the combined LTV ratio at origination, the co-financed are less likely to default. Thus, features specific to the co-financing scheme may contribute to overturn the effect on credit risk of a higher leverage. These include the lower consumption of liquidity to cover the down payment and the loan payments, Infonavit's secure repayment system, and a longer deferral period for the Infonavit loan in case of unemployment.

Having documented the average effects of co-financing on origination conditions and performance, we next examine if they have any distributional consequences. On the demand side, we build on the premise that low-income households have lower savings to afford the down payment of a traditional mortgage and are less able to afford the larger loan payments of a more expensive house (i.e., their payment-to-income [PTI] constraint binds). On the supply side, Cofinavit design gives a differential treatment to low-income borrowers, who benefit from higher credit limits (and, in some periods, lower interest rates) from Infonavit but also are subject to a higher wage discount to reduce the risk of default. We find that, compared to traditional mortgages, the co-financed contribute to reduce down payments more at lower incomes, consistent with the expected demand and

[4]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.

supply effects. They also lead to purchase more expensive properties at higher incomes, where PTI constraints are looser. Given the relatively higher leverage of co-financed mortgages at lower incomes, we estimate a greater probability of default. The demand side is plausibly their main driver of these distributional effects, since they do not change significantly under the more generous terms of the HPF loan for high-income borrowers introduced in 2017.

Since banks provide most of the funds in a co-financed mortgage, we further investigate whether our results differ across larger versus smaller banks. The business models of the former are reliant on an extensive network of branches that allows capturing more low-income borrowers than smaller banks. Consistent with this, the most striking differences appear in the results by income. In particular, the finding that the down payment of a co-financed mortgage declines more at lower than at higher incomes is stronger among smaller banks. This reflects that, relative to traditional mortgages, the volume of co-financed loans from larger banks declines considerably more at the bottom of the income distribution. Hence, in order to reduce exposure to low-income, riskier borrowers, larger banks down size their co-financed loans in those segments. Moreover, they also grant more co-financed loans, which are smaller than traditional ones.

We confirm this interpretation by studying the impact of a new credit plan, launched by Infonavit in 2017, that tilts co-financing supply towards higher-income households through adjustments in the interest rate and credit limits of the Infonavit loan. By means of a difference-in-differences strategy, we find that groups that benefit more from the new plan exhibit a sizable increase of 9 pp in the probability of having a co-financed mortgage relative to other groups. Such intended substitution effect, however, only takes place among smaller banks. For larger banks, the plan is in conflict with their strategy of relying on a more generous lending partner at lower incomes. Thus, they have greater incentives, as well as greater ability, to offset any undesired effect of changes in Infonavit's lending policies on their portfolios. Finally, regardless of bank size, we do not find evidence that the new plan affects the down payment or property value of co-financed mortgages. This implies that Infonavit contractual terms affect product selection but are less relevant in determining the main intensive-margin outcomes of co-financed mortgages, more dependent on banks' lending conditions.

This study contributes to the literature on financial innovations in mortgage markets. A substantive body of work considers interventions dealing with supply-side frictions, such as securitization by GSEs that lower the funding costs of private lenders (see, e.g., Loutskina and Strahan, 2009; Mian and Sufi, 2009; Keys et al., 2010). More related is the literature on innovations that make 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 mortgage 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.[5]

Our paper more directly relates to the empirical strand that evaluates government policies seeking to ease borrowing constraints and increase housing affordability. An example is the Help-to-Buy program in the UK that reduces down payment by topping up bank loans with "equity loans" from the government.[6] Tracey and Van Horen (2021) study the effect of the program on house purchases and household consumption. Benetton et al. (Forthcoming) find that the program prompted the purchase of more expensive properties given that borrowers treat public and private loans as complements. Crucial for their finding is that equity loans do not increase households' leverage—they are essentially shared equity, not debt—and are interest-free over the first five years. In the Cofinavit scheme, the Infonavit loan does increase leverage and its interest rate is not subsidized, being actually higher than the bank rate. For such a program, our work provides evidence on its effects on borrowing conditions in a shallower private mortgage market. We further estimate distributional effects by income that are in line (but of the opposite sign) with those from the literature on macroprudential policies that *reduce* mortgage leverage (see, e.g., Kinghan et al., 2019; Acharya et al., Forthcoming).

This paper also relates to the literature on mortgage market design and default, which received increasing attention after the 2008-2009 financial crisis (for an earlier contribution, see Vandell, 1978). A branch focuses on mechanisms aimed at mitigating credit risk ex ante, considering the interaction between contractual features and market conditions. Among many others, some recent contributions are Greenwald et al. (2021); Campbell et al. (2021); Guren et al. (2021). More directly related to ours are the empirical studies on household leverage and default. Mian and Sufi (2011) show that home-equity based borrowing increased both leverage and default in the US. For piggyback second liens, Sherlund (2008) finds a higher default as well, even conditioning on their combined LTV ratio. Some of the main risks of combining loans are absent when all are first lien and, therefore, have priority over the collateral, as in Cofinavit. Another related branch studies empirically the role of liquidity on mortgage performance. Ganong and Noel (2020), for instance, show that reducing short-term payments by extending maturity is effective in reducing default (see also Elul et al., 2010; Fuster and Willen, 2017; Defusco et al., 2019). We contribute to the literature by studying a contract that, to curb default incentives, counterbalances higher leverage at origination with a secure repayment system and lower liquidity needs for borrowers throughout the mortgage's life.

[5]GSEs launched piggyback loans in the US in the 1990s and private lenders later adopted them. They involve two loans, where the second one covers part or all of the down payment with a higher interest rate than the main loan. This scheme allows households to avoid mortgage insurance.

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

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 instead provide novel evidence on products co-financed with private intermediaries. To this end, we resort to a unique supervisory dataset from commercial banks in Mexico that offers one source to, at least partially, circumvent the lack of loan-level data on HPFs.

2 The Mexican co-financing program[7]

Following the 1994 peso crisis, private financial institutions withdrew from the Mexican mortgage market, retaining a small role since then. Such institutions comprise commercial banks (focused on middle- to high-income households) and non-bank intermediaries, known as Sofoles and Sofomes (focused on low- to middle-income households). By contrast, HPFs have a major market share. Created in 1972, the two main funds are Fovissste and Infonavit, for public and private sector workers, respectively, contributing to social security (Carballo-Huerta and González-Ibarra, 2009).

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. Historically, Infonavit's priority has been to encourage borrowing over saving. It enjoys a funding advantage over other financing institutions because it obtains resources from mandatory employer contributions, representing 5% of the employee's base salary, with a cap at 25 times the minimum wage (MW). These mandatory savings, collected in individual home accounts, can only be used by the worker to top up the funds for a mortgage or can be withdrawn upon retirement. Other advantages include 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). Banks typically lend to mid- and high-income segments, for which the traditional Infonavit loans offer too low credit limits and high interest rates to be attractive. However, Infonavit is also interested in extending mortgages to higher-income segments, which render a higher net return and, ultimately, allow paying better rates to workers' savings.[8] Thus, it introduced co-financed products as a means

[7] 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).

[8] For the (large) fraction of workers who never take a mortgage from Infonavit, the return on their home accounts has generally been low (OECD, 2015).

to serve more profitable segments through cooperation with private lenders. Specifically, we study a product marketed as Cofinavit, which was launched in 2004 and is the main co-financing scheme in the country. By 2018, Infonavit loans granted through Cofinavit amount to MX$7,435 millions (USD378 millions), representing 61% of Infonavit's co-financed loan portfolio (Infonavit, 2017b).

Cofinavit can be used to buy a new or second-hand property. It is advertised as enabling to enhance borrowers' credit capacity, to reduce or eliminate the down payment, and to give access to a property of higher value relative to a traditional (Infonavit or bank) mortgage. The scheme combines a mortgage from Infonavit and another from a private bank, signed under two separate contracts, and uses the home account balance as partial payment for the property. Future employer contributions are redirected to mortgage repayment. Figure 1 displays the standard funding structures of houses purchased through traditional bank mortgages and co-financed ones. Whereas the down payment has to be fully covered with borrowers' private savings in a traditional mortgage, Cofinavit leverages the borrowers' mandatory savings to cover part or all of the down payment.

In addition to contributing to the Infonavit's savings function via higher returns, Cofinavit avoids the liquidity strains that larger loans impose—the bulk of the property is funded by the bank. For banks, Cofinavit 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. For both lenders there are risk-sharing benefits as well, since the same asset is pledged as collateral and either can seize it upon default of its loan. In practice, however, Infonavit benefits more given that banks start legal action first.

2.1 Origination, servicing, and termination of Cofinavit mortgages

Next, we describe the main characteristics of the bank and Infonavit loans in a Cofinavit mortgage, highlighting any differences with traditional bank mortgages (see Table 1 for a summary).

Screening. Each institution screens its portion of the Cofinavit mortgage separately. Banks use the same risk-based screening technologies as for traditional loans. Infonavit has less strict approval standards. In line with its social mission, it is unlikely to reject an application that fulfills the eligibility requirements, which include being currently employed and contributing to Infonavit, not having had an Infonavit loan before, and having a certain minimum score (determined by a combination of age and salary, the amount of savings in the home account, and the number of years of continued contribution to Infonavit). On the basis of demographic characteristics, employer information, and, since October 2017, credit bureaus reports, a credit assessment establishes the maximum fraction of her Infonavit credit limit that the borrower can get (Infonavit, 2016).

Loan repayment. The repayment of the two loans starts simultaneously and is monitored separately by each lender. The Infonavit loan is repaid with employer contributions (i.e., 5% of the employees' base salary) and salary discounts (between 1% to 7% of the salary). Low-income borrowers, given their higher job turnover and the ensuing credit risk, are subject to a higher discount rate than high-income borrowers to ensure a prompter loan repayment. Normally, the Infonavit loan is repaid in about five to eight years. By contrast, the amortization of the bank debt initially relies on borrowers' cash on hand or private savings, as in any traditional mortgage. Once the Infonavit loan is fully 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. This implies that, until being fully repaid, the Infonavit loan de facto has higher priority on the borrowers' cash flows that secure payments.

Default. Even though the debt with Infonavit has the higher financial cost, default typically occurs first on the bank loan. This reflects that, while remaining employed in the formal sector, the borrower retains the option to stop paying the debt with the bank but not that with Infonavit. The employer is obliged to deduct the contributions and discounts from the worker's paycheck and transfer them to Infonavit as payment for the mortgage. Consequently, most defaults on Infonavit loans occur when workers lose their formal job (OECD, 2015). If workers become unemployed or move to the informal sector, they should pay to Infonavit directly, which increases credit risk.

Non-performing status. Infonavit and commercials banks also follow different procedures to classify mortgages as non-performing. In case of unemployment, the insurance required by some banks covers between three to nine monthly installments, whereas an insurance fund covers the first six monthly installments to Infonavit. Banks generally classify mortgages as non-performing after three months of delinquent payments. In turn, Infonavit takes about 15 months, since the borrower can defer payments for up to a year and then has three months to start paying the equivalent of the employer contributions plus wage discounts.

Post-default actions. When a Cofinavit mortgage becomes non-performing, either the bank or Infonavit can start legal actions since both institutions 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 is likely to initiate legal proceedings first (after about four to six months in delinquency). In the event of foreclosure, the bank sells the house and pays to Infonavit its portion. Yet, since Mexican mortgages are recourse loans, they are unlikely to go into foreclosure; deeds-in-lieu of foreclosure are more common.

2.2 Cofinavit terms around Infonavit's 2017 credit plan

A new Infonavit credit plan was announced on 30th November 2016, becoming effective on 5th April 2017 (Infonavit, 2017a). In relation to Cofinavit, it implied a shift in Infonavit credit supply towards higher-income (as well as older and married) borrowers, with the purpose of increasing the returns on workers' savings (Infonavit, 2016).[9] In order to achieve that goal, it adjusted the interest rates and credit limits of the Infonavit loan. The advertised interest rate, which originally entailed a cross-subsidy from high- to low-income borrowers, became the same across all income levels under the new plan (see Panels A and B of Appendix Figure A.1). 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 Figure A.2.

In turn, the maximum loan amounts granted by Infonavit before and after the reform can be seen in Panels A and B of Figure A.1, respectively. To target low-income workers, the old credit limits dropped discretely by at least 52% as income increased from MX$26,522 to MX$26,765 (in pesos of 2017). The new credit limits drop less, by 37% on average, as income rises from MX$28,686 to MX$28,916. Appendix Figure A.2 plots the changes in credit limits between plans, which entail substantial increases for high-income borrowers. For low-income borrowers, the limits increased more modestly and even declined at certain maturities. Another modification related to credit limits affects joint schemes for married couples, where Infonavit grants one loan for the main borrower and another for the spouse (banks instead grant only one loan based on the total income). The spouse, who could only take an Infonavit loan for up to 75% of her credit limit under the old plan, can take the entire amount after April 2017.

Appendix A describes more in detail these aspects of the new Cofinavit program, as well as other changes concerning loan indexation, salary discounts, and administrative fees.

3 Theoretical effects of co-financing on mortgage outcomes

To guide the empirical analysis, here we present our conjectures about how Cofinavit potentially affects mortgage characteristics at origination and, for the bank portion only, performance. This discussion focuses on aspects derived from the contractual features of Cofinavit, as compared to those of traditional bank mortgages. We abstract from borrower selection issues that will be addressed in the empirical analysis.

[9]The more controversial aspect of the new plan is 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 that middle-income borrowers can resort to a larger traditional Infonavit loan.

3.1 Mortgage characteristics at origination

Cofinavit promises to enhance borrowers' credit capacity, meaning that its combined loan volume should be larger than that of a traditional bank mortgage. The size of the Infonavit loan is determined by the credit limit corresponding to borrower's income and age, along with the credit assessment. In the absence of any substitution between the Infonavit and bank loans within a Cofinavit bundle, the total volume will increase by an amount equivalent to that of the Infonavit loan. This, however, could lead to an excessive mortgage leverage. Banks, in fact, adjust their loan volume so that the overall PTI is at most 30%. Hence, a partial downsize of the bank loan is expected so that the combined volume increases but without exceeding the PTI limit. Higher income borrowers, less constrained to afford higher mortgage payments, will have more room to benefit from a larger loan volume.

Cofinavit also promises to enable the purchase of a more expensive property with a reduced down payment. These goals are somewhat in conflict because a larger property value increases down payment, all else constant. For the down payment to decline, the property value needs to increase by less than the total loan size. We expect that demand-side constraints determine the equilibrium outcome. If borrowers are constrained to afford the down payment of a traditional mortgage, the additional funding will be primarily used to reduce the upfront payment whereas the property value may not increase. Alternatively, if borrowers seek to buy a more expensive property than that funded by a traditional loan, but lack the savings for its larger down payment, the property value will increase whereas the down payment may not decline. These borrowers are still down-payment constrained but have more savings than those in the first scenario.

In terms of pricing, ex ante it is uncertain how the volume-weighted average interest rate of a co-financed mortgage compares to the rate of a traditional bank mortgage. The co-financed rate will depend not only on the rate charged by each lender, but also on the volume of each loan. On the one hand, the Infonavit rate in a Cofinavit mortgage has been a function of the borrower's income alone until April 2017 and, since then, equals 12% for all borrowers. In both periods it has been higher than the rate of a traditional bank mortgage (see Panel D in Appendix Figure A.3). Its impact on the overall cost of credit will be mitigated by the small share of Infonavit in total loan volume, especially at higher incomes. On the other hand, the bank rate is set by banks discretionary and depends on loan and borrower characteristics, such as the LTV and having an account for wage payments or an insurance contracted with the lender (Banco de México, 2020).

3.2 Bank mortgage performance

We center the discussion here around the probability of default of a co-financed bank loan, that is, the probability that the bank portion is formally classified as non-performing.

On the one hand, origination conditions can lead to a worse performance of co-financed products. It is well known that mortgages with a higher LTV ratio at origination have a higher probability of default (Mayer et al., 2009; Campbell and Cocco, 2015). If co-financed mortgages effectively lead to a lower down payment, their *combined* LTV ratio will be higher. The lower equity stake at origination could translate into a worse performance ex post. It needs to be stressed that what drives default on the bank loan is the burden that both loans combined, not only the bank portion, places on a borrower's finances (Elul et al., 2010; Demyanyk and Van Hemert, 2011). Naturally, this channel will be muted if co-financing does not lead to a reduced down payment.

On the other hand, several features of Infonavit's lending system, also present in Cofinavit, reduce the risk of liquidity-driven defaults on the bank portion (see Elul et al. 2010; Fuster and Willen 2017; Ganong and Noel 2020 for the role of borrowers' liquidity on mortgage default). First, borrowers require less private savings at origination to cover the (potentially smaller) down payment of a co-financed mortgage since their mandatory savings are unlocked with that purpose. Second, for the same combined PTI ratio, a Cofinavit mortgage leaves more disposable income since its payments are partly covered by employer contributions. Payments of a traditional mortgage are entirely drawn from the borrower's cash on hand (or private savings), while the employer contributions are still deposited into Infonavit's home account. Third, while employed in the formal sector, the borrower will get a smaller cash flow upon defaulting on a Cofinavit mortgage if its bank portion is smaller than a traditional mortgage. Finally, if becoming unemployed, the borrower has the option to defer the payments of the Infonavit loan for more than a year after the insurance coverage ends. The ensuing financial relief should have a positive impact on the payment of the bank mortgage.

Since our dataset does not follow the Infonavit loan over time, we cannot study its performance. Theoretically, it should be affected by origination conditions in the same way as the bank loan. However, the stronger effect is expected from Infonavit's repayment system that suppresses the option to default while the borrower remains employed in the formal sector. For this reason, the Infonavit loan typically defaults later than the bank loan (see Section 2.1 for more details).

4 Data

4.1 Data sources and sample selection

We use mortgage-level data from the R04 H report, collected monthly by the banking regulator (*Comisión Nacional Bancaria y de Valores, CNBV*). This confidential dataset covers the entire life of each mortgage granted by commercial banks in Mexico, except for

the application stage.[10] Among other mortgage characteristics, it contains data on the lending institution, the loan's origination and expiration dates, its volume and interest rate, and the value and municipality of the property used as collateral. We extract data on borrower characteristics at origination from the R04 H-0491 sub-report, which includes the employment sector, income, gender, age, marital status, and the municipality where she is employed. Loans' non-performing status is obtained from monthly follow-up of mortgages in the R04 H-0492 sub-report.

While the dataset does not cover loans entirely funded by HPFs, it allows identifying Cofinavit bank mortgages through the names of the co-financing institution and of the mortgage product. For such loans, the dataset reports the amount granted at origination by both the bank and the co-lender as well as other characteristics corresponding to the bank portion only, such as the maturity or the delinquency status. The Infonavit rate applied to Cofinavit loans prior to April 2017 is extracted from the "Terms of Contract" in the Official Journal of the Federation, 24 April 2008.

We select a sample that only includes traditional and Cofinavit bank mortgages, granted to borrowers that are potentially eligible for either product. We exclude any other bank mortgage granted through an arrangement with a HPF, development bank, or promotion agency. We restrict the dataset to mortgages taken by private sector workers eligible for a Cofinavit mortgage and with an income in pesos between 3 and 25 MWs (MW defined as of March 2017). Few bank customers have an income below 3 MWs and Infonavit does not target borrowers with an income above 25 MWs (even if some also take Cofinavit mortgages). Then, we select mortgages originated to purchase a new or a second-hand property, which are the only possible uses admitted for a Cofinavit loan.[11] The origination period spans three years going from June 2016—the first month in which the enhanced version of the R04 H report is available—until June 2019. Monetary variables are expressed in CPI-adjusted Mexican pesos (second fortnight of July 2018 = 100) and, along with the LTV ratios, are winsorized at the top and bottom 1.5% of the distribution. Appendix Table A.1 provides detailed variable definitions.

4.2 Data description

Table 2 reports the mean for several characteristics of traditional and Cofinavit mortgages. The mortgage is the unit of analysis and, generally, each borrower in the sample only takes one mortgage. The sample in the first two columns is obtained after applying the filters described in the previous section, whereas in the last two columns it is further

[10] This is a supervisory report, not a credit registry that refers to a network exchange of credit information and records queries from loan applications.

[11] Other data cleaning steps include the removal of co-financed loans with a combined LTV ratio greater than 100% (possible reporting errors), mortgages originated by development banks, mortgages originated by HPFs and acquired by banks, banks with less than 200 loans in the sample, and loans with missing values in some key variables.

restricted to the common support region, using a matching procedure described below. The sample in Panel A contains 116,845 mortgages, whose characteristics are measured at origination. These mortgages are extended by ten banks, each granting both product types. Appendix Figures A.3 and A.4 allow visualizing the empirical distribution of these characteristics, using box plots for several percentiles and the mean.

Co-financed mortgages represent 40.9% and 44.9% of the entire and common support samples, respectively. In both samples, Table 2 shows that, relative to traditional bank mortgages, the total (i.e., Infonavit plus bank) volume is slightly larger and the volume of the bank portion is slightly smaller on average for co-financed mortgages. Appendix Figure A.3 further shows in Panel A that, within Cofinavit bundles, the Infonavit loan is substantially smaller than the bank loan. Relative to traditional loans, the co-financed ones exhibit lower down payments and a similar mean property value. Differences between the (volume-weighted) average interest rate in a Cofinavit mortgage and that charged by the bank in a traditional mortgage are small. However, within Cofinavit loans, the Infonavit rate is substantially higher than the bank rate and exhibits very little dispersion (Panel D of Appendix Figure A.3). Columns 1 and 2 of Table 2 show that co-financed borrowers on average earn less and are younger than borrowers with traditional mortgages (also apparent in Panels A and C of Appendix Figure A.4). Finally, in Panel B of Table 2, we take the same mortgages as in Panel A and follow them over two, three, and four years after origination (observations are at the mortgage–month level). In all cases, the percentage of co-financed loans that are non-performing is only slightly lower than that of traditional loans.

5 Co-financed versus traditional bank mortgages

This section evaluates the impact of co-financing on credit conditions at origination and ex post performance. The analysis focuses on the intensive margin of mortgage loans for households that apply for a Cofinavit or a traditional bank mortgage and get lenders' approval. Formal, private sector workers that have not taken either of these products during the sample period are not part of our dataset. Thus, conditional on the borrowing choice, we first estimate OLS regressions that control for observable borrower characteristics and unobservable bank-level factors. We then use a matching procedure to better account for borrowers' self-selection into one of the two mortgage products.

5.1 Empirical approach

OLS estimation

We begin with a descriptive analysis of how co-financing relates to mortgage outcomes by running OLS regressions of the form:

$$y_i = \alpha_0 + \alpha_1 \cdot \textit{Co-financed}_i + X_i'\lambda + \gamma_l + \gamma_t + \Gamma' + \epsilon_i, \tag{1}$$

where i and t denote the mortgage and the time period (i.e., the cohort of origination of the mortgage), respectively. We consider several mortgage-level outcomes as dependent variables, y_i, comprising terms at origination (down payment, property value, volume, and interest rate) and performance (default). The regressor of interest, $\textit{Co-financed}_i$, is equal to 1 for Cofinavit mortgages and to 0 for traditional bank mortgages.

We control for borrower characteristics at mortgage origination in the vector X_i, which comprises a restricted cubic spline of the logarithm of income and age, gender, and marital status. In addition, we progressively augment equation (1) with a rich structure of fixed effects. Through γ_l we control for borrower's income group (50 bins of MX\$0.04 logarithmic length) to compare mortgages within the same income segment. γ_t accounts for time (i.e., cohort of origination) fixed effects to absorb variation in macroeconomic conditions. The vector Γ includes fixed effects for banks and for municipalities of the purchased property and of the borrower's workplace, which capture unobservable time-invariant differences across private lenders and across local economic conditions affecting mortgage demand. Γ further includes bank-specific linear time trends. ϵ_i denotes the error term. Standard errors are clustered by income group.

Whereas equation (1) helps to uncover a set of stylized facts about co-financing, it is not informative in terms of causation. Endogeneity most prominently stems from potential omitted variables that could bias the estimates in either direction. For example, younger and low-income borrowers tend to apply more for Cofinavit, as described in the previous section. If they are also more likely to buy a smaller property and to default, the OLS estimates would attribute the age and income effects to co-financing. This would lead to a downward and upward bias in the estimates for property value and default, respectively. Thus, we resort to a matching approach to move closer to a causal interpretation of co-financing effects.

Matching approach

Unconditional differences in mean outcomes between co-financed and traditional mortgages may not arise primarily from selection on unobservables, but from selection on observables and lack of common support. In that case, matching on a rich set of covariates and performing the analysis in a region of common support can substantially reduce

bias. With that purpose, we employ a matching procedure to estimate the average treatment effect (ATE) of co-financing. In the absence of random assignment, we allow the selection of the mortgage product to be driven by borrower and lender characteristics.

Specifically, we implement the CEM approach described in Iacus et al. (2012). This approach involves pre-processing the data to reduce the imbalance between co-financed (i.e., treated) and traditional (i.e., control) mortgages. One advantage of this method is that we can ex ante decide the level of imbalance by coarsening the predictors influencing the mortgage choice. To perform the matching, we select the following covariates and their corresponding coarsening levels:

1. Logarithm of borrower's income (20 bins defined using equally spaced cutpoints)
2. Borrower's gender (two bins)
3. Borrower's age (13 bins defined for five-year intervals)
4. Borrower's marital status (two bins)
5. Region where the borrower works (five bins for North, South, East, West, Center)
6. Bank granting the mortgage (ten bins for each bank in the sample)
7. Whether the mortgage is granted under the old or the new Infonavit credit plan (two bins defined before and after April 2017)

For some of the covariates (e.g., borrower's gender or marital status) we actually preserve the original classification, without further coarsening them. The first five (borrower) covariates are determined before the mortgage choice. The sixth variable captures the different propensity across banks to approve applications for co-financed versus traditional mortgages. The last variable is included because, under the new Infonavit plan of 2017, the distribution of borrower characteristics across co-financed and traditional mortgages may change.

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 to traditional bank mortgages—the stratum weight is increasing in the proportion of co-financed loans in that stratum. It assigns a weight of 0 to unmatched observations, that is, co-financed mortgages for which there is not at least one traditional mortgage in the same stratum, and vice versa. After running the algorithm, we find that it matches 41,580 co-financed mortgages with 55,426 traditional bank mortgages, whereas 27,574 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 (largest imbalance, i.e., complete separation). We confirm an increase in balance resulting from the matching algorithm, since $\mathcal{L}_1$ declines from 0.77 in the unmatched data to 0.66 after matching (its absolute value is less important).

After running this algorithm, we estimate equation (1) using the weights generated

by the CEM algorithm. 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 parameter α_1 provides an estimate of the ATE of co-financing in the population as long as two identifying assumptions are met.

One assumption is common support, which requires that there is sufficient overlap in the characteristics of co-financed and traditional mortgages to find adequate matches. To attain overlap, we use multiple filtering criteria that restrict the sample to borrowers and mortgage characteristics eligible for (and targeted by) Cofinavit (see Section 4.1). In this filtered sample, the CEM approach further reduces the data to common support by ensuring that only strata with both co-financed and traditional loans are used in the analysis. Columns 3 and 4 of Table 2 confirm that the mean differences in borrower characteristics disappear by construction. Appendix Figure A.4 also shows that the percentiles for borrower's income and age get closer across mortgage products in the balanced sample.

The second 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—especially from the loan approval stage—potentially affect final outcomes, the matching estimates mitigate but might not fully eliminate the selection bias.

It is then useful to discuss how borrower and lender actions affect the choice of mortgage products. Such a choice is the result of a two-step selection process that characterizes most credit contracts. In the first step, households self-select into Cofinavit or traditional mortgages based on their financing needs and eligibility conditions. On the one hand, the bank eligibility conditions are the same for traditional and Cofinavit mortgages and, therefore, should not be an important source of self-selection (see Appendix Figure A.5 for an application form model with the eligibility requirements). On the other hand, Infonavit has more specific eligibility requirements, described in Section 2. Some of them are also required by banks (being currently employed and contributing to Infonavit) and others that could affect selection are unlikely to affect loan outcomes after conditioning on observables (not having a previous Infonavit loan and achieving the minimum Infonavit score). In addition, the level of mandatory savings, which we only observe for co-financed mortgages, may affect selection since they are used as payment for the property only under a Cofinavit mortgage. While total household savings are expected to affect loan outcomes, it is less clear whether their composition (i.e., the share of mandatory savings) could also affect them.

In the second step, banks and, when applicable, Infonavit separately screen applications and approve the ones that are deemed creditworthy and meet the eligibility conditions. The bank loan officer approves the application for a specific mortgage product

using limited information from the application form and from the credit bureau on borrower's credit history. Conditional on that information, the final approval decision is somewhat discretionary and independent of borrowers' actual risk profile and financing needs. Thus, matching on such variables would increase the plausibility that our estimates indeed identify the co-financing impact.

Not accounting for all factors influencing the bank's approval decision (e.g., the program originally chosen, length of employment, or borrower's credit history) could therefore bias the estimates. Since ex ante credit risk is potentially the main source of omitted variable bias, we check the robustness of our results to controlling for a bank's internal measure of default risk. In turn, it should be mentioned that the Infonavit loan officer plays a less crucial role in this approval stage. Infonavit is unlikely to reject an application for a co-financed loan if the borrower meets the eligibility requirements, and there is little room for discretion in determining eligibility.

5.2 Results

5.2.1 Mortgage characteristics at origination

In this section, we study how co-financing impacts on credit conditions at origination. We start by looking at loan volume in Table 3. Column 1 shows the OLS estimate of equation (1), controlling only for time and bank fixed effects. Column 2 further includes borrower socio-demographic controls and the full set of fixed effects. For total (i.e., Infonavit plus bank) loan volume as the dependent variable, the coefficient for the *Co-financed* indicator is statistically significant at the 1% level and goes from 0.09 in column 1 to 0.12 in column 2. We then re-estimate the two specifications using the weights generated by the CEM algorithm, which restricts the sample to the region of common support. These specifications render coefficients of 0.14, implying that the total volume of Cofinavit mortgages is on average 15% ($\exp[0.14] - 1 = 0.15$) larger than that of traditional loans, which is a sizable effect.

Columns 5 to 8 focus on the volume of the bank loan, which, for traditional loans, equals total volume. The estimated coefficients are negative and significant and decline only slightly with the addition of controls and fixed effects and with use of the CEM approach. In particular, the estimates go from -0.20 in the simplest model to -0.15 in the fully saturated. From column 8, co-financed bank loans are on average 14% smaller than traditional loans. This confirms that there is a partial substitution of bank for Infonavit lending within co-financed mortgages, which prevents that the overall PTI ratio goes beyond the standard prudential limit.

Table 4 investigates the effect of co-financing on down payment and property value, the dimensions that ultimately determine whether a mortgage is attainable and attractive for borrowers. In column 1, the point estimate of -8.3 pp for the *Co-financed* indicator

implies that the down payment is substantially smaller for borrowers taking a co-financed loan. The coefficient is significant at the 1% level and remains similar in the remaining specifications, reaching -7.6 pp in the CEM estimates. This represents a 32% reduction relative to the average down payment of a traditional mortgage (24%).

In columns 5 and 6, the dependent variable is the down payment that borrowers need to pay out of private savings, which captures their actual consumption of liquidity at origination. For traditional mortgages, this equals the *total* down payment, whereas for co-financed ones it equals the *portion* not covered by mandatory savings. The matching coefficient of -15.9 pp in column 6 represents a substantial change of 66%, relative to the average down payment of traditional mortgages.

In columns 7 to 10, we investigate the impact of co-financing on property value. OLS estimates provide mixed results (columns 7 and 8). The coefficient becomes positive and significant in the matching estimates (columns 9 and 10), suggesting that properties purchased with co-financed mortgages are only 2% more valuable.[12] Such increase is smaller than the 15% increase in total loan volume and, hence, it enables a reduction in the average down payment.

In Table 5, we compare mortgages in terms of pricing at origination. From the estimates in columns 1 to 3, we observe that for Cofinavit bundles the volume-weighted average of the Infonavit and bank interest rates is between 34 and 36 basis points (bp) higher than the bank rate of traditional mortgages. The benchmark specification points to a 3% increase relative to the sample mean of the dependent variable (10.5%). This premium results from the substantially higher Infonavit rate (see Panel D in Appendix Figure A.3). Looking at the bank rate alone in columns 4 to 6, the estimates become negative and significant. The differential, however, is economically modest (only 21 bp according to the matching result). The lower bank rate of co-financed mortgages is consistent with their lower *bank* LTV ratio.

Across all models estimated in Tables 3 to 5, the inclusion of additional controls does not affect the OLS coefficients in a meaningful way. In turn, the more refined CEM approach does not substantially alter the results relative to the OLS ones either. The only exception are the results for property value that switch from negative to positive. The stability of the estimated coefficients in general gives us confidence that omitted variables are not playing an important role.

Nonetheless, one crucial factor for which we do not explicitly control borrowers' ex ante risk. To ease this concern, we re-estimate the models in this section by controlling for the probability of default computed under the internal ratings-based approach to credit risk introduced by Basel II. The results in Appendix Table A.2 are obtained for the subsample of mortgages originated by the only bank that adopted such approach during

[12]Because excluding controls virtually does not alter the CEM estimates, in the remainder of the paper we report CEM results with the full set of controls only.

the sample period (specifically, after December 2018). Reassuringly, the coefficients on the probability of default are significant and have the expected signs in the models for down payment and bank interest rate. The results for co-financing are not substantially altered when controlling for this risk measure, which suggests that it is not an important source of omitted variable bias. Moreover, the estimates are qualitatively similar to those from the main sample, except for the coefficient of co-financing on property value that is negative and insignificant. Summing up, we confirm that Cofinavit leads to an increase in total loan volume. However, we also find a shrinkage in the size of the bank loan within Cofinavit bundles, which hints at some substitution between Infonavit and private lending. The higher funding is used to lower the upfront payment required to buy a house rather than to purchase a more expensive property. The slightly higher average interest rate reflects the differential in the rate charged by Infonavit, which varies only with income. The risk-sensitive bank rate is actually lower for a co-financed than for a traditional mortgage, in line with the lower bank LTV ratio.

5.2.2 Mortgage performance

We then examine differences in ex post performance across the two mortgage products. To this end, in Table 6 we estimate equation (1) for an indicator of whether a mortgage becomes non-performing in the first two years (columns 1 to 3), three years (columns 4 to 6), and four years (columns 7 to 9) after origination as the dependent variable (in percentage). Generally, the results show no significant differences between co-financed and traditional mortgages. Only for the three-year horizon we find a negative effect of co-financed loans, but small and marginally significant (column 6). In the estimates for the four-year window, all coefficients become positive and insignificant. These findings indicate that the conflicting forces affecting the probability of default of co-financed mortgages tend to even out in equilibrium. Adding control variables to the OLS estimates generally leaves the coefficients of interest qualitatively unchanged. In addition, the benchmark CEM estimates are similar to the OLS ones, implying that the results are stable.

Next, we re-estimate the previous models controlling for the probability of default at origination computed under the internal model, for the same single-bank sample as in Appendix Table A.2. Because this should capture differences in loan and borrower risk at origination, any estimated differential in ex post risk is likely to reflect the impact of Cofinavit contractual features on borrowers' liquidity (assuming banks' monitoring is the same across products). In Appendix Table A.3, column 1 shows that, in this sample, co-financed mortgages are 0.26 pp more likely to default than the traditional ones over the first two years (longer horizons are not observed) when not controlling for ex ante risk. Interestingly, after accounting for the probability of default in column 2, they become less

likely to default by 0.8 pp; this is a 10% change relative to the mean of the dependent variable. In that specification, the estimated coefficient for the ex ante probability of default confirm its positive correlation with ex post default.

To provide further evidence on the effect of co-financing in reducing liquidity-driven defaults, we estimate the benchmark specifications adding fixed effects for the combined LTV ratio at origination, defined over 5% bins. We expect that, conditional on overall mortgage leverage, the co-financed ones are less likely to default. Columns 3 to 5 of Table A.3 confirm that, indeed, the coefficients on the co-financing indicator are negative and significant at the 1% level in the first two and three years and at the 10% level in the first four years.

All in all, we find no substantial differences in terms of default rates between co-financed and traditional mortgages in the main sample. We also find that, when conditioning on ex ante risk and on LTV at origination, co-financed mortgages perform better ex post. We interpret this as reflecting the impact of the lower liquidity requirements during the mortgage's life, which curbs the incentives to default arising from the riskier origination conditions of co-financed mortgages.

5.2.3 The role of borrower income

This section examines whether the baseline results differ depending on borrower's income, considering that mortgage demand and supply vary along the income distribution. On the one hand, borrowers at the top of the distribution have more space to benefit from an increase in loan volume before the PTI ratio starts to bind. In addition, they have potentially more savings for the down payment, especially considering that the saving rate increases with income (Dynan et al., 2004). On the other hand, given the greater borrowing constraints of poorer households, some conditions of the Infonavit loan in a Cofinavit, such as the credit limit and interest rate, are more generous with them (see Appendix A).

We start in Figure 2 with a graphical representation of the distribution of co-financed and traditional mortgages, and their characteristics, by income. The left axes of all Panels presents histograms for the density of new mortgages, where it is apparent that co-financing shifts originations towards lower income segments relative to traditional mortgages. The right axes present scatterplots for the average mortgage conditions at origination. Panel A shows that total loan volume increases slightly more with income for a co-financed than for a traditional bank mortgage, but the bank volume exhibits an even steeper increase. In other words, it is Infonavit credit, more generous at lower incomes, that flattens the slope of total loan volume.

Table 7 provides regression-based estimates of these heterogeneous effects. Specifically, we estimate the benchmark specification of equation (1) interacting the *Co-financed*

indicator with the logarithm of income. For total loan volume, column 1 shows that the interaction coefficient is positive and significant at the 1% level. This implies that for a 10% increase in income, total volume increases by 0.3% ($1.1^{.034} = 1.003$) more for a co-financed than for a traditional mortgage. Column 2 shows a larger increase with income in the volume of the bank loan (1.3%), which confirms the equalizing role of the Infonavit loan described above.

Figure 2 shows in Panel B that the down payment of traditional mortgages varies little along the income distribution. By contrast, for co-financed mortgages, it is increasing in borrowers' income. This is consistent with low-income borrowers having lower savings and, hence, using Cofinavit to relax down payment constraints more than high-income borrowers. In turn, Panel C shows a steeper increase of property values with income for co-financed mortgages. This suggests that, to a larger extent, higher income segments use the additional funding from co-financed schemes to buy a more expensive property.

In the model estimated for down payment, column 3 of Table 7 confirms that the interaction coefficient is positive and significant. Following a 10% increase in income, the down payment increases by .24 pp ($2.552 \times \log[1.1] = .243$) more for co-financed relative to traditional bank mortgages. For the portion of down payment that is paid out of private savings alone, the interaction term in column 4 reveals no significant differences. This implies that the mandatory savings are larger for higher- than for lower-income borrowers and, therefore, finance their larger Cofinavit down payment. It also implies that, at origination, Cofinavit does not lower liquidity needs more at lower incomes, despite relaxing down payment constraints more. In turn, column 5 shows that, for a 10% increase in income, the property value increases by 0.7% more for a co-financed than for a traditional mortgage. This differential is larger than that estimated for total loan volume and explains why the differential on down payment is also increasing in income.

Finally, Panel D of Figure 2 plots the interest rates, where the differential between the combined co-financed rate and the traditional rate seems to become smaller at higher incomes. In line with this, column 6 of Table 7 displays a negative but small (only -.4 bp) interaction coefficient for the volume-weighted average rate. Thus, co-financed mortgages turn out to be slightly more regressive in terms of pricing relative to traditional ones. Since the coefficient on the bank rate in column 7 is positive and insignificant, one can infer that the regressive rate is a consequence of the Infonavit loan, which has a higher share at lower incomes and is more expensive than the bank loan.

Table 8 presents the heterogeneous effects of co-financing on loan performance. The interaction coefficient shows a decline in the probability of defaulting on co-financed relative to traditional mortgages at higher incomes (columns 1 to 3). For a 10% increase in income, such probability declines by .03, .04, and .07 pp over the first 2, 3, and 4 years after origination, respectively. This result is consistent with the greater increase in the combined LTV ratio (equivalent to a greater decline in down payment) as income

declines. Moreover, the previous findings for private savings required to cover upfront costs, indicate that lower income borrowers do not experience a greater decline in liquidity requirements at origination to offset their higher leverage.

The results presented so far may be sensitive to the introduction of the new Infonavit plan in April 2017, which altered the supply of credit across income groups. In Appendix Tables A.4 and A.5 we re-estimate the benchmark models interacting all regressors and fixed effects with a dummy taking the value of 1 for mortgages originated under the new plan and of 0 otherwise. The results confirm that our main findings hold for mortgages originated during both subperiods. Differences are found on the portion of the down payment paid out of private savings and the average bank rate became slightly smaller for co-financed mortgages under the new plan. Importantly, no significant differences by income are found between the new and old credit plans.

The previous estimates uncover a series of distributional effects. First, low-income borrowers receive a relatively smaller loan volume through co-financed mortgages, and the differential is mitigated by the Infonavit loan. Second, low-income households, more borrowing constrained, reduce the down payment more and increase the value of the purchased property less when taking a co-financed mortgage. Third, co-financed mortgages are slightly more expensive for lower-income borrowers given the higher share of the Infonavit loan. Finally, low-income co-financed borrowers are riskier ex post than the high-income ones, which is consistent with their higher LTV ratio (but similar liquidity needs at origination).

5.2.4 The role of banks

After documenting the differences in borrowing conditions, on average and by income levels, we consider variation across lender types to understand how the supply side affects the results. If the findings mainly reflect Cofinavit's design—in particular, the characteristics of the Infonavit loan—, we expect that they remain similar across different types of private lenders. Alternatively, the results could be dependent on banks' lending strategies under the program. In that case, the findings may differ between institutions with different business models, such as larger and smaller banks. Smaller banks' business models lead to higher collateral requirements for credit to small and medium enterprises (Banco de México, 2015). For mortgage products, they also tend to have lower LTV ratios at every income level. On the other hand, the business models of larger banks put them in a better position to reach low-income borrowers and extend smaller loan volumes. Indeed, they have a wider brick-and-mortar branch network, which leads to economies of scale and scope, and also have a better screening technology (Banco de México, 2015, 2020).

Specifically, we distinguish between the three largest banks in the sample—proxied by total assets as of June 2016—and the rest. Table 9 reports the estimated differences in

the main mortgage characteristics, where all the regressors and fixed effects are interacted with an indicator for smaller banks. Some differences emerge for smaller banks, whose Cofinavit loans exhibit a lower substitution with Infonavit credit (column 3) and whose average co-financed down payment presents a smaller reduction, by almost 1 pp, than that of traditional mortgages (column 5). The differentials, however, are small and the main findings hold across both sets of private lenders.

We then look at the interplay between bank size and borrower income in the provision of co-financed as opposed to traditional mortgages. Figure 3 shows the distribution of mortgage originations, as well as their main characteristics, across income groups for larger (left graphs) and smaller (right graph) banks. The histograms confirm that larger banks' portfolios have a greater share of low-income borrowers and, in those segments, we find a greater share of co-financed mortgages.

Moving to mortgage terms at origination, Panel A of Figure 3 shows, for larger banks, that the co-financed volume is larger than the traditional (red and black markers) at higher incomes. However, the differential disappears at lower incomes, where co-financed bank credit (green markers) experience a downsize, compensated by a greater Infonavit share, whereas traditional loans are enlarged. In turn, smaller banks exhibit a more constant differential by income in total and bank volume across products. To formally assess these differentials, we estimate the baseline model adding the triple interaction between a smaller-bank indicator, the co-financing indicator, and borrower income. The corresponding coefficient in Table 9 is negative in the models for total and bank volume (columns 2 and 4). Consistent with the graphs, this implies that smaller banks extend comparatively larger co-financed loans to low-income borrowers. In consequence, when lenders are smaller, we find that co-financing alleviates borrowing constraints at low incomes comparatively more (column 6). For a 10% increase in income, down payment increases by .29 pp more for smaller versus larger banks when the mortgage is co-financed rather than traditional. Relative to the coefficients for the interaction between the co-financed indicator and income, the triple interaction terms in columns 2, 4, and 6 are large. Finally, for the property value we find no differences by income (column 8).

The previous findings suggest that banks' business models do not impact greatly on the average co-financing effects but do matter for the effects by income, especially those on loan volume and down payment. In addition, they shed light on banks' lending strategies when co-financing with a HPF. Larger banks, with an edge in lending to lower-income segments, extend more co-financed mortgages with a higher share of Infonavit financing to those segments. Hence, from their perspective, a co-financing scheme that is more generous with lower income borrowers is desirable. This allows serving riskier segments without increasing exposure excessively—that is, larger banks may trade-off a higher probability of default for a lower exposure at default. In turn, smaller banks' portfolios have a smaller share of co-financed mortgages at lower income segments. Conditional

on co-financing, the share of Infonavit financing does not vary much along the income distribution. Given their lower exposure to low-income borrowers, risk-sharing strategies are less needed for smaller banks.

6 The impact of changes in Infonavit lending conditions

The effectiveness of Cofinavit in achieving its goals depends on the design of the Infonavit loan as well as on banks' lending strategies and, crucially, on households' demand. The introduction of a new credit plan in April 2017, by changing the relative attractiveness of the Infonavit loan across different income and demographic groups, can provide further insights into both banks' lending strategies and borrowers' response. Thus, exploiting the quasi-natural experiment offered by the launch of the new plan, we estimate the effect of changes in the terms of the Infonavit loan on the probability of co-financing as well as on the down payment and property value of co-financed mortgages.

The new plan made Infonavit's supply of Cofinavit credit more generous with high- relative to low-income borrowers. This could lead to a substitution between mortgage products, with the co-financed being relatively more demanded than the traditional by higher income borrowers, and vice versa for lower income borrowers. In addition, households' leverage or the property value could increase more for high- relative to low-income groups taking a co-financed mortgage. Such responses at the extensive and intensive margins are expected if banks do not offset the Infonavit changes. In particular, according to our previous results, the new plan is in conflict with the lending strategy of large lenders, which rely on a more generous lending partner at the bottom of the income distribution. For smaller banks, the new plan is likely more neutral. Hence, larger banks have greater incentives—and arguably more market power—to offset any undesired effects of the new Cofinavit. For instance, they could alter their approval decisions for co-financed versus traditional loans or could change the terms of their own loans along the income distribution. While we are unable to tease out banks' and borrowers' response separately, we study the equilibrium outcomes resulting from the interaction of demand and supply, also distinguishing between larger and smaller lenders.

6.1 Empirical approach

To estimate the effects of the plan, we build on cross-sectional heterogeneity in borrowers' exposure to the changes in Infonavit terms within Cofinavit bundles. Appendix Figures A.1 and A.2 show that, after April 2017, the Infonavit interest rate has declined by less, or even increased, for low- relative to high-income groups. Moreover, Infonavit credit limits have increased by less for low- relative to high-income borrowers—for younger low-income borrowers, they have even declined. In turn, such limits have increased under the

new Cofinavit for married couples relative to single borrowers.[13]

The data structure consists of repeated cross sections of mortgages, where the cohort of origination plays the role of time. Our baseline identification strategy exploits the fact that exposure to Infonavit's new credit plan varies by borrower characteristics and mortgage origination date. The changes in interest rates vary by income and, in the case of credit limits, also by age and marital status. In turn, only cohorts of mortgages originated after April 2017 are exposed to the new credit plan. Thus, we use a difference-in-differences design that exploits the combination of the cross-sectional variation and the variation across cohorts in loan outcomes.

Given that the changes in Infonavit interest rates and credit limits took place concurrently, we define two groups with high and low exposure intensity to these two sources of variation. The high-intensity group experiences a decline equal to 2.3 pp in the interest rate and a change in credit limits in the top half of the distribution. In turn, the low-intensity group faces a decline smaller than 2.3 pp or an increase in the interest rate and a change in credit limits in the bottom half of the distribution.[14] We remove from the sample borrowers that do not fall into any of these two groups, because they would lead to a mitigation bias and complicate the interpretation of the results.

The econometric model compares outcomes across borrowers with high and low exposure intensity around the introduction of the new Infonavit plan. Specifically, we estimate regressions of the form:

$$\begin{aligned} y_i =& \beta_0 + \beta_1 \cdot \textit{High intensity}_d + \beta_2 \cdot \textit{High intensity}_d \times Post_t + \beta_3 \cdot \Delta Z_d \\ &+ \beta_4 \cdot \Delta Z_d \times Post_t + X_i'\lambda + \gamma_l + \gamma_a + \gamma_b + \gamma_t + \nu_i, \end{aligned} \tag{2}$$

where y_i is defined alternatively as an indicator for whether the bank mortgage i is co-financed and, for co-financed mortgages, as the down payment or log of property value. $\textit{High intensity}_d$ is a dummy taking the value of 1 if a borrower in demographic group d (i.e., with a given income, age, and marital status) is subject to a high treatment intensity under the new credit plan and of 0 if the borrower is subject to a low treatment intensity.[15] $Post_t$ is an indicator taking the value of 1 if the mortgage originates on April

[13] We do not exploit the increase in the salary discount rate, which has raised only for high-income borrowers. Its purpose is to lead to a faster repayment of the Infonavit loan, in light of its higher limit, rather than to make it more generous with high income borrowers. Other new features, such as the removal of the loan's indexation or the introduction of an administration fee, do not vary in the cross section and, hence, their effect cannot be identified with our empirical strategy.

[14] We select arbitrary cutoffs for the interest rates to balance the number of observations across groups. 62% of the observations experience a decline of 2.3 pp in the Infonavit rate. Moreover, it is worth noting that credit limits on the Infonavit part of Cofinavit bundles are not strictly enforced neither in the pre- nor in the post-reform period (Appendix Figure A.6). This lack of enforcement may mitigate the effect of changes in credit limits on the margins of interest.

[15] The change in credit limits slightly varies over time because of the yearly changes in the minimum wage or UMA. However, for simplicity we suppress the t subscript.

2017 or later, and of 0 otherwise.

As a *control* variable, we include the change between the new and old credit plans in credit limits of *traditional* Infonavit loans (in logarithm) granted to demographic group d (ΔZ_d), and its interaction with the $Post_t$ indicator. Such limits could confound the effect of the changes in Cofinavit terms, as they were introduced at the same time and also have increased more for high-income borrowers. The control variables in X_i include borrower's gender and marital status. We also control for income-group (γ_l), age-group (γ_a), bank (γ_b), and time (i.e., cohort of origination) (γ_t) fixed effects.[16] We cluster the standard errors by categories defined for every combination of income group, age group, and marital status, given that these are the determinants of treatment intensity (Abadie et al., 2017).

If there is substitution between the two mortgage products, we expect that borrowers facing more generous conditions from Infonavit (i.e., lower rates and higher credit limits) under the new Cofinavit plan demand less traditional loans. For them, the probability of a mortgage being co-financed should increase. They may also experience a larger reduction in down payment and a greater increase in the property value of a co-financed mortgage thanks to the larger and cheaper Infonavit loan. Thus, the coefficient of interest in equation (2), β_2, should take a positive sign in the model for the co-financing choice and in that for the property value and a negative sign in the model for the down payment.

6.2 Results

Table 10 reports the estimates of equation (2) to assess the impact of Infonavit's new credit plan on the co-financing probability. Only the interaction coefficient of interest is reported, but all specifications also include the standalone term on the high-intensity indicator. Odd columns report specifications with fixed effects for time, bank, and age and income groups, whereas even columns include also linear time trends specific to age and income groups and marital status. We find that the changes in Infonavit terms modify the choice of the mortgage product in the predicted direction after April 2017 in the entire sample (columns 1 and 2) and in the sample of smaller banks (columns 5 and 6). The interaction coefficients are positive and statistically significant at the 1% level. For high- relative to low-intensity groups, the probability of co-financing increases by 5 pp and 9 pp from columns 2 and 6 respectively. These are sizable effects that represent changes of 13% ($0.05/0.42 = 0.13$) and 21% ($0.09/0.41 = 0.21$) relative to the sample means of the dependent variable. The coefficients for the larger banks switch from positive to negative after adding time trends, implying no robust effect for this group.

[16]The actual demographic groups used by Infonavit result in some bins with too few observations. Thus, we define age groups by coarsening the categories used by Infonavit to determine credit limits (going from 35 to 65 years old) into seven categories of five-year intervals. Income groups correspond to the same 50 bins of MX$0.04 logarithmic length defined in Section 5.1.

In Table 11, we estimate the same specifications for the down payment of co-financed mortgages. The first two columns show that it significantly declines for the high- relative to the low-intensity group after April 2017 in either specification. The benchmark estimate implies a decline of 1.2 pp, which amounts to a 7% relative to the sample mean of the dependent variable (17%). In the two subsamples the estimates remain negative, but only those for the smaller banks are statistically significant at the 5% level at least. For that group, the decline in down payment is of 1.9 pp. Finally, in Table 12 we look at the effect on the log of property value. The coefficients of interest are insignificant across the different specifications and samples.

Households subject to different treatment intensities have different demographic characteristics and, hence, may not be comparable. The causal interpretation of our results therefore rests on the identifying assumption of parallel trends after conditioning on a host of covariates. This amounts to assuming that in the absence of the new Infonavit plan, the average mortgage outcomes of borrowers subject to high and low treatment intensities would have followed similar trajectories over time after conditioning on the full set of controls and fixed effects. As a falsification test of the *conditional* parallel-trend assumption, Figure 4 plots the evolution over time of the coefficient estimate for the *High intensity* dummy. By normalizing to zero the coefficient for March 2017, the monthly estimates can be interpreted as the mean differences from the average value of the outcome in the month prior to the implementation of the new plan. Panel A shows the coefficient estimates for the co-financing probability. Reassuringly, these are mostly insignificant in the pre-April 2017 period, except for two months. Moreover, we observe a declining trend in co-financing among high- relative to low-intensity borrowers that reverted under the new plan. For both bank subsamples, the middle and right graphs do not show significant trends before March 2017. For down payment in Panel B, the pre-April 2017 coefficients are negative, but generally insignificant in the full sample and for larger banks (left and middle graphs) and close to zero for smaller banks (right graph). For the property value in Panel C, there are no pre-trends generally except for a large negative spike in an estimate between announcement and implementation dates. In each panel, the post-March 2017 patterns of coefficient estimates are generally consistent with the regression-based results of Tables 10 to 12.

When difference-in-differences are estimated in repeated cross-sections rather than in panel data, another threat to validity comes from changes in the composition of the sample between the pre- and post-treatment period (Abadie 2005). Thus, a second identifying assumption is that the distribution of borrowers subject to different treatment intensities, and their characteristics, are similar under the old and new credit plan. If they differ in dimensions that lead to a different propensity to take certain types of mortgages, our estimates will reflect this compositional changes. Because such changes are in fact quite plausible, we verify the robustness of our results to using a flexible specification that

allows treatment effects to vary by demographic characteristics and by bank. To this end, we augment equation (2) with the interaction terms of *High intensity* $\times$ $Post_t$ with demeaned control variables (including ΔZ_d and its interaction with the $Post_t$ indicator) and with demeaned dummies for the fixed effects. With this adjustment, β_2 gives an estimate of the average treatment effect at the sample mean of the covariates. Appendix Table A.6 shows that the effect of the new plan on the probability of co-financing remains similar to the baseline over the whole sample and over the subsample of mortgages by smaller banks. For larger banks, the effect becomes positive and significant at the 1% level. Focusing on co-financed mortgages, the effects on down payment turn insignificant in all samples and those on property value remain insignificant.

In Appendix Table A.7, we then modify the baseline specification by replacing the *High intensity* indicator with the actual changes in each Cofinavit term around April 2017. For the probability of co-financing, the coefficients for the change in Infonavit rates and credit limits have the expected signs for the whole sample and for smaller banks, but only the interest rate changes are significant at the 5% level (columns 1 to 3). The lack of an effect from Infonavit's credit limits is consistent with their seemingly weak enforcement. Moreover, since the Infonavit loan has a higher interest rate than the bank loan, even under the new credit plan, an increase in its credit limits may not effectively create a higher demand for co-financed mortgages. For other outcomes, changes in both interest rates and credit limits are insignificant (columns 4 to 9).

Since the new plan was announced on 30th November 2016, some anticipation effects may have taken place before it became effective, potentially biasing the estimates. Indeed, Figure 4 shows some differential patterns across treatment groups in the period between the announcement and implementation dates. In Appendix Table A.8 we re-estimate the baseline models redefining the $Post_t$ indicator so that it takes the value of 1 if the mortgage originates on or after the announcement date (December 2016), and of 0 otherwise. Compared to the benchmark results, only the effects on co-financing probability for smaller banks appear to remain robust but the estimated effect declines from 9 pp to 7 pp.

To sum up, the quasi-experimental design provides evidence that the main effect of the new credit plan has been a substitution between co-financed and traditional mortgages concentrated on smaller banks. This substitution mostly stems from the change in the Infonavit rate rather than in credit limits. Since the new plan is in conflict with larger banks' lending strategies, it is possible that they have adopted measures seeking to prevent any unintended effect of Infonavit policies. Given their higher market power and lower costs of long-term funding, they can more easily adjust the approval conditions or terms of their loans than smaller banks. For co-financed mortgages, there is no robust evidence that the new plan has affected down payment or property value. These quantities depend more directly on the total loan volume, in which banks have a greater share than Infonavit.

Moreover, loan volumes cannot expand beyond the limit set by PTI constraints, which implies that a larger Infonavit loan may simply crowd out bank credit.

7 Conclusion

In this paper we focus on bank mortgages co-financed with HPFs, which offer an opportunity to understand the demand frictions prevailing in less developed mortgage markets. Drawing on evidence from the main co-financing scheme in Mexico, we study how it affects the conditions and performance of bank mortgages by increasing leverage.

Our estimates show that the additional funds are used to reduce the down payment substantially relative to that of traditional bank mortgages. Borrowers' consumption of private savings to cover upfront costs declines even more, since down payment is at least partially covered with the mandatory savings held by the HPF. We do not find that co-financing leads to buy a more expensive home on average, since many households may not have the income to afford higher payments. This suggests that insufficient private savings for the down payment of a traditional bank mortgage is the main barrier to acquire a home among those opting for a co-financed product. Despite the higher combined LTV ratio of co-financed mortgages, we find no greater default or worse post-default outcomes, which can be attributed to several program features that mitigate credit risk. These results differ along the income distribution, in line with the underlying demand frictions. At the bottom, where borrowing constraints are more binding, down payment declines more and, since the affordability constraint is more tight, the property value increases less.

The distributional effects vary across banks with different business models. In particular, we estimate a smaller decline in down payment at lower incomes among larger banks. They serve relatively more low-income borrowers through their extensive network of branches. Thus, to offset the exposure to such riskier groups, they grant more co-financed and, hence, smaller loans and reduce further their volume in those segments. This implies that larger banks rely on a co-financing scheme where the HPF takes a higher stake at lower incomes. This interpretation is supported by the impact of a new credit plan, launched by the HPF, that is in conflict with such strategy: It makes the HPF loan relatively more generous with higher-income segments. Only for smaller banks we find that the new plan leads to a greater probability of extending co-financed rather than traditional mortgages at higher incomes. Larger banks seem more able to offset the substitution effect pursued by the new plan.

Our findings imply that providing additional financing is an effective tool to expand access to bank mortgages by relaxing down payment constraints, especially among poorer borrowers. From that perspective, it has desirable distributional implications. One caveat is that an expansion in mortgage leverage may have more negative implications for credit risk when borrowers are not subject to mandatory savings and a secure loan collection

system—reproducing these features may not be justified in other settings. From a policy perspective, changes in the co-financing scheme to attract high-income borrowers seem only effective when the private lender is not large. Larger banks prefer to extend larger, traditional mortgages to more affluent borrowers. A topic for future research is the impact of co-financed mortgages on home ownership, which will depend on their degree of substitution with products offered by bank and non-bank lenders. Another interesting avenue is to investigate how the lower liquidity needs for down payment and loan repayment in a co-financed mortgage (equal to the mandatory savings at origination and future employer contributions) affect future consumption and investment decisions. If the borrower had instead taken a traditional bank mortgage, the HPF would have managed such funds until retirement.

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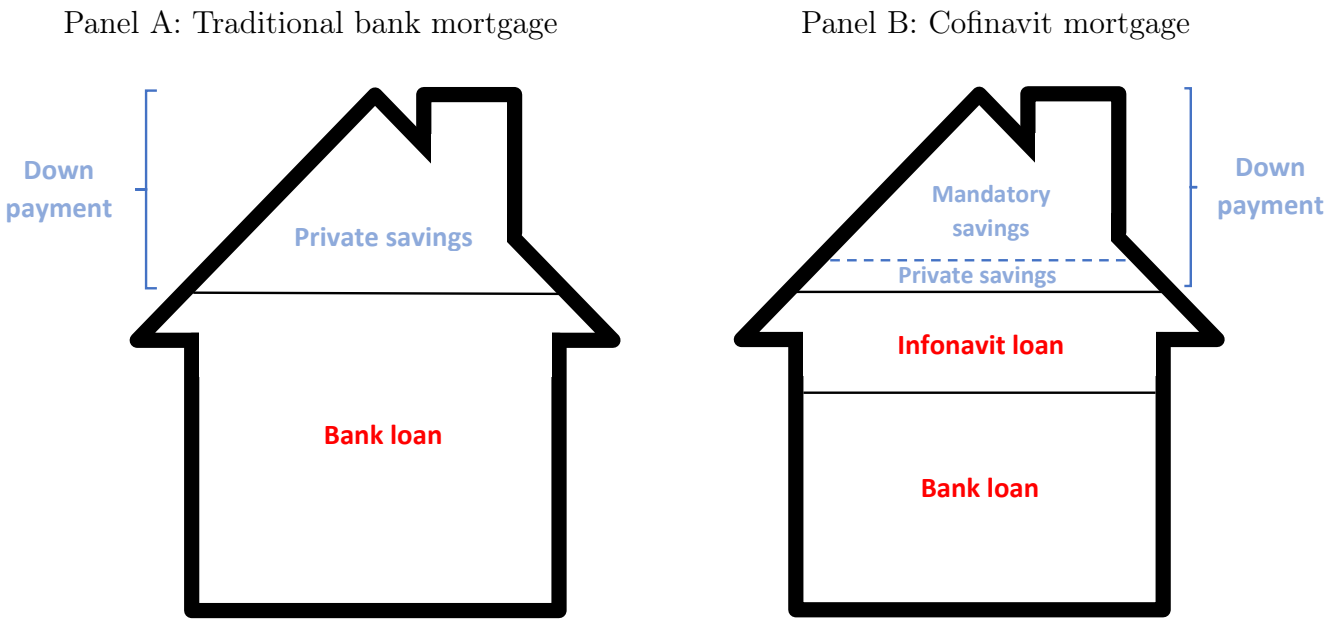
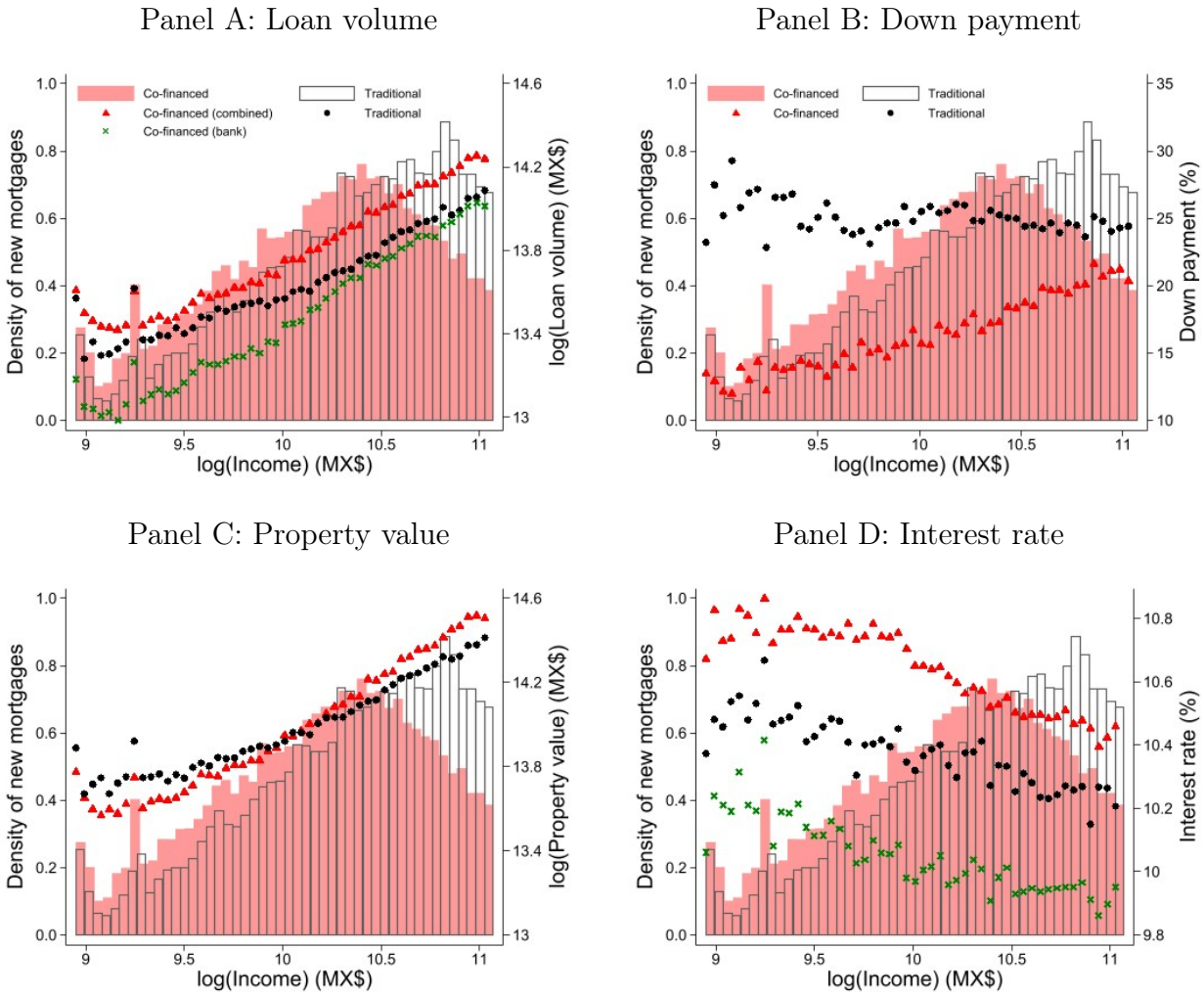
Figure 1: Funding structure in traditional and co-financed mortgages



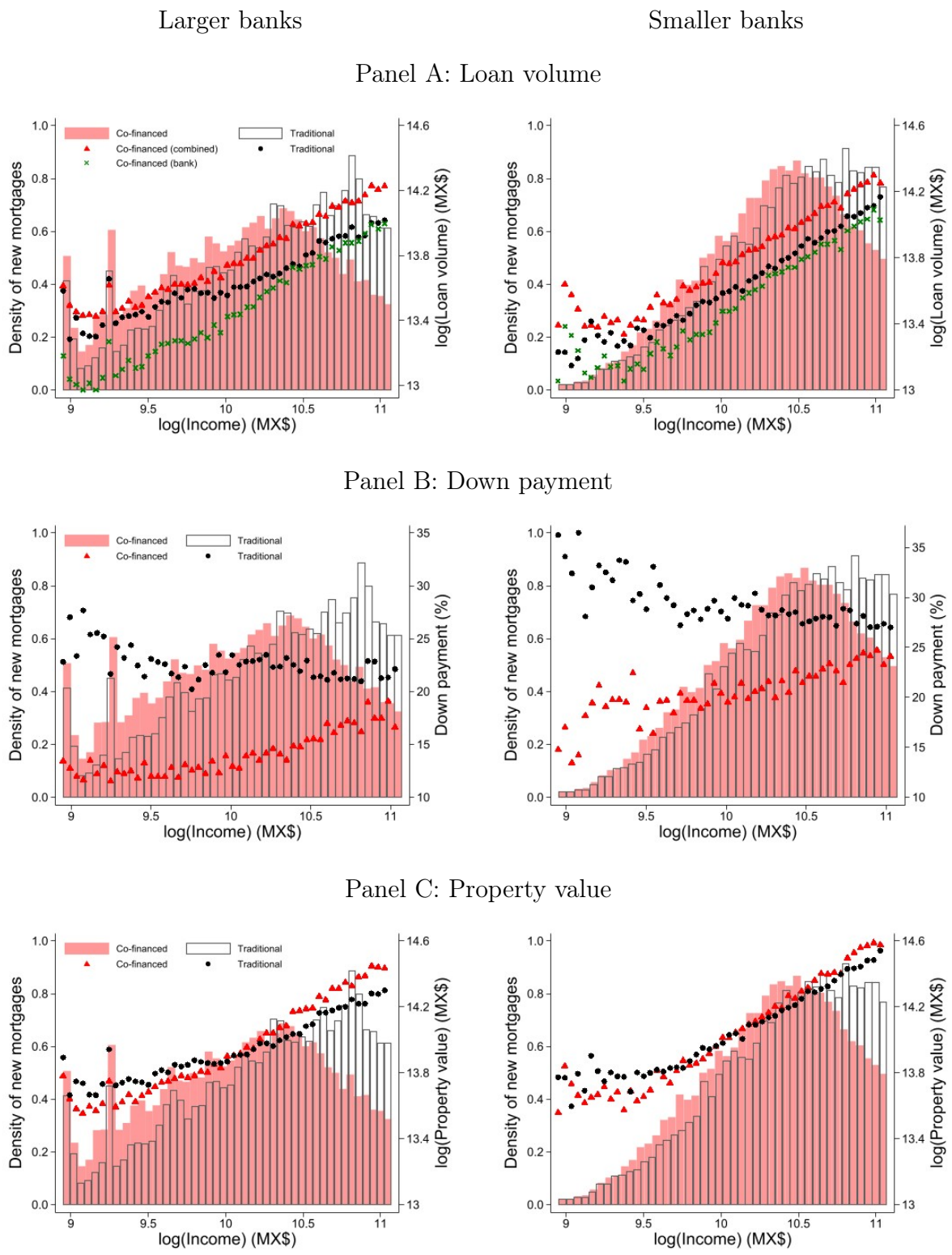
NOTE. This figure shows how a borrower can buy a house using two different products. Under a traditional mortgage (Panel A), the borrower takes a bank loan and pays the entire down payment out of private savings. Under a co-financed mortgage (Panel B), the borrower takes a bank and an Infonavit loan, both collateralized with the property, and covers the down payment with her mandatory savings in the home account and, if insufficient, some private savings for the remaining portion.

Figure 2: Origination conditions of mortgages by income



NOTE. This figure shows the density and characteristics of new mortgages by income. All the left-hand axes correspond to histograms for new 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 for the logarithm of loan volume (Panel A), down payment (Panel B), the logarithm of property value (Panel C), and interest rate (Panel D) whose averages are computed for logarithmic income bins of MX$0.04. For co-financed mortgages, the red triangles correspond to the total or average characteristic of the Infonavit and bank loans and the green crosses in Panels A and D to the loan granted by the bank only. The black dots correspond to characteristics of traditional mortgages. The horizontal axes represent the logarithm of income in Mexican pesos deflated by the CPI (July 2018 = 100). The sample includes all traditional and Cofinavit mortgages to private sector workers originated by all commercial banks between June 2016 and June 2019.

Figure 3: Origination conditions of mortgages by income: larger versus smaller banks



NOTE. This figure shows the same graphs as in Panels A, B, and C of Figure 2, computed separately for the top three banks (lefts Panels) and the remaining banks (right Panels), where bank size is determined by total assets as of June 2016. The sample includes all traditional and Cofinavit mortgages to private sector workers originated by all commercial banks between June 2016 and June 2019.

Figure 4: Conditional trends in mortgage characteristics around the introduction of Infonavit's new credit plan

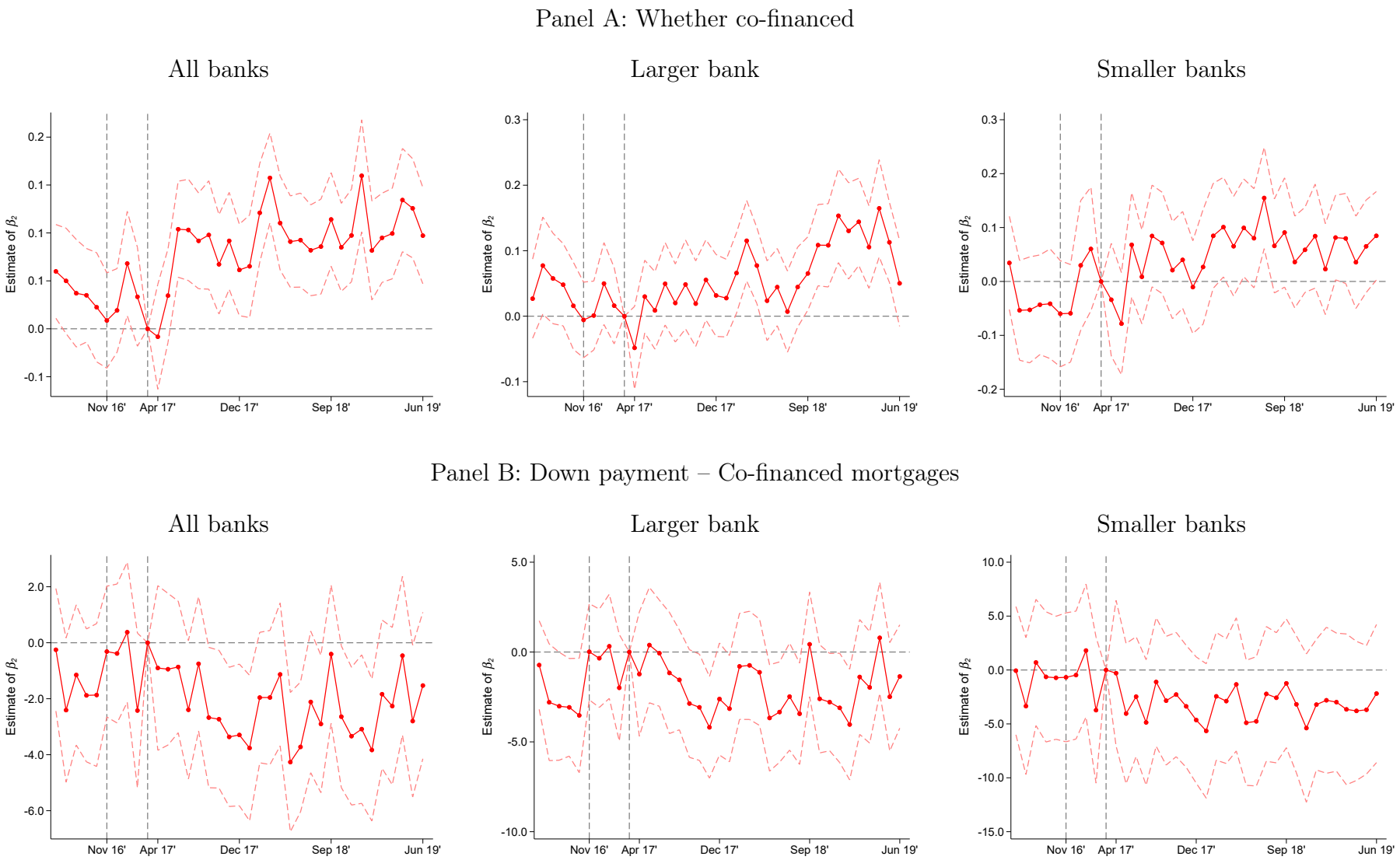
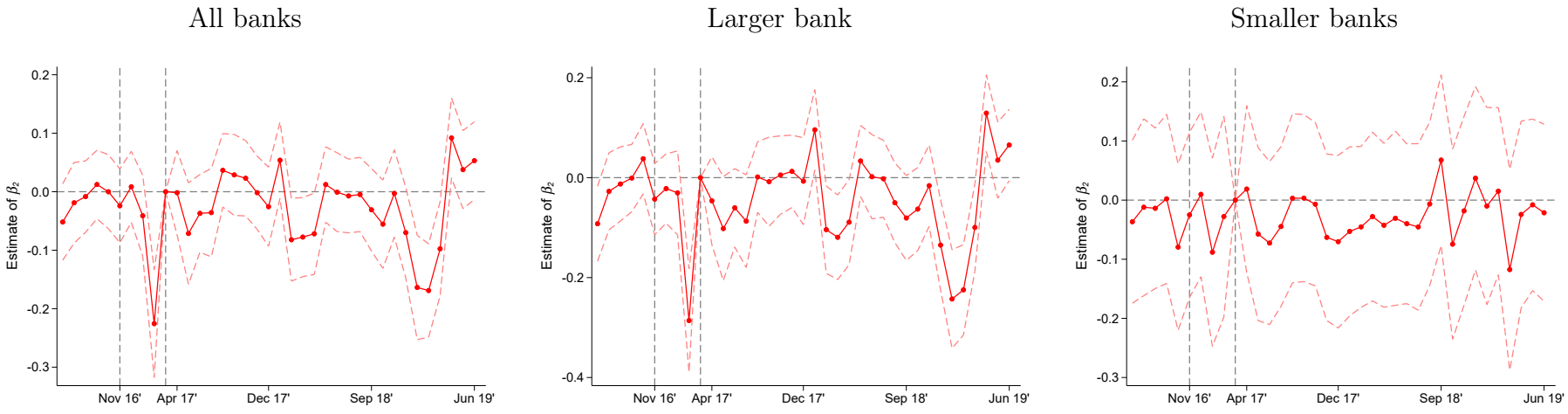


Figure 4: – *Continued*

Panel C: log(Property value) – Co-financed mortgages



NOTE. This figure shows the coefficients and 95% confidence intervals from regression models for the probability of co-financing (Panel A), down payment (Panel B), and the log property value (Panel C) on the treatment intensity indicator. The estimates are presented for all banks (left graphs), the top three banks (middle graph), and the remaining banks (right graphs), where bank size is determined by total assets as of June 2016. Each dot corresponds to the coefficient $\hat{\beta}_{2j}$ estimated from: $y_i = \beta_0 + \beta_1 \cdot \textit{High intensity}_d + \sum_{j=0}^{j=T} \beta_{2j} \cdot \textit{High intensity}_d \times I_{jt} + ... + \nu_i$, where y_i denotes, for a bank mortgage to borrower i, an indicator taking the value of 1 if it is co-financed and of 0 if it is traditional (Panel A) and the down payment and log property value (Panels B and C) of co-financed mortgages. $\textit{High intensity}_d$ is an indicator taking the value of 1 if a borrower in demographic group d (i.e., with a given income, age, and marital status) is subject to a high treatment intensity under the new credit plan and of 0 if is subject to a low treatment intensity, and I_{jt} is a full set of dummy variables for each time period. The rest of the regression is specified as in equation (2). The first vertical dashed gray line corresponds to the announcement month (November 2016) and the second one to the month prior to the implementation of the new credit plan (March 2017). The value of $\hat{\beta}_{2j}$ in March 2017 is normalized to zero. The 95% confidence intervals are obtained by clustering the standard errors by income group×age group×marital status. The sample includes all traditional and Cofinavit mortgages to private sector workers originated by all commercial banks between June 2016 and June 2019. Borrowers not subject to a high or low treatment intensity are removed from the sample.

Table 1: Main features of traditional versus Cofinavit mortgages

	Traditional bank mortgage	Cofinavit mortgage	
		Bank	**Infonavit**
Screening	Risk-based standards for approval and to determine credit amount	As in a traditional mortgage	Eligibility criteria for loan approval (non risk-based minimum score). Simple assessment and credit limits to determine credit amount
Repayment	From cash on hand or private savings	As in a traditional mortgage. Once the Infonavit loan is repaid (around 5 to 8 years), partly repaid from employer contributions	From employer contributions and salary discounts
Default	No willingness or ability to pay	As in a traditional mortgage; usually earlier than on Infonavit loan	Option to default only if borrower loses formal job
Non-performing status	After three months delinquent	As in a traditional mortgage	After up to 15 months delinquent
Post-default actions	The bank can start legal actions	As in a traditional mortgage (first lien on the property)	Infonavit can start legal actions (first lien on the property), but usually the bank starts them first

NOTE. This table summarizes the key differences between traditional bank mortgages and Cofinavit mortgages in terms of origination, servicing, and (post-)default practices as well as contractual features. For Cofinavit mortgages, characteristics of the bank and Infonavit loans are presented separately.

Table 2: Summary statistics

	Full sample		Common support	
	Traditional	**Cofinanced**	**Traditional**	**Cofinanced**
Panel A: New mortgages (mortgage level)				
Mortgage and property characteristics				
log(Total loan volume) (MX$)	13.75	13.84	13.71	13.86
log(Bank loan volume) (MX$)	13.75	13.55	13.71	13.57
Down payment (% of collateral value)	24.82	17.01	24.02	16.37
Down payment minus home acc. (% of collateral value)	24.79	8.24	23.99	7.90
log(Property value) (MX$)	14.08	14.05	14.03	14.06
Average interest rate (%)	10.33	10.61	10.31	10.61
Bank interest rate (%)	10.33	10.01	10.31	10.03
Bank LTV ratio (%)	75.02	63.22	75.84	63.92
Borrower characteristics				
log(Income) (MX$)	10.32	10.18	10.20	10.20
Male (%)	52.45	56.35	56.47	56.47
Age (years)	41.12	34.97	34.81	34.74
Married (%)	44.75	44.28	43.37	43.37
N	***69,012***	***47,833***	***50,865***	***41,429***

Table 2: – *Continued*

	Full sample		Common support	
	Traditional	**Cofinanced**	**Traditional**	**Cofinanced**
Panel B: Mortgages followed after origination (mortgage-month level)				
Non-performing in the first two years (%)	0.76	0.59	0.70	0.56
N	***1,685,128***	***1,292,619***	***1,224,334***	***1,019,137***
Non-performing in the first three years (%)	1.09	0.91	1.03	0.83
N	***1,496,481***	***1,420,191***	***1,028,220***	***1,055,095***
Non-performing in the first four years (%)	1.28	1.22	1.22	1.05
N	***1,019,540***	***1,023,621***	***617,506***	***614,832***

NOTE. This table shows summary statistics (mean) for the final sample, where the unit of analysis is the mortgage. Statistics are presented separately for traditional and co-financed bank mortgages, both before (columns 1 and 2) and after (columns 3 and 4) the sample is restricted to the common support region. The sample includes traditional and Cofinavit mortgages for private sector workers originated by commercial banks between June 2016 and June 2019. In Panel A, characteristics are measured at origination. In Panel B, mortgages are followed monthly for two, three, and four years after origination, with the samples covering originations between June 2016 and June 2019, June 2018, and June 2017, respectively. Refer to Section 4.1 for data sources and sample selection and to Appendix Table A.1 for variable definitions.

Table 3: Loan volume: co-financed versus traditional mortgages

Dependent variable:	log(Total volume)				log(Bank volume)			
	OLS		CEM		OLS		CEM	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Co-financed	.086***	.122***	.136***	.137***	-.202***	-.159***	-.150***	-.149***
	(.013)	(.005)	(.006)	(.006)	(.017)	(.009)	(.010)	(.010)
Borrower controls	No	Yes	No	Yes	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Workplace munic. FE	No	Yes	No	Yes	No	Yes	No	Yes
Property munic. FE	No	Yes	No	Yes	No	Yes	No	Yes
Income group FE	No	Yes	No	Yes	No	Yes	No	Yes
Bank time trends	No	Yes	No	Yes	No	Yes	No	Yes
Mean dep. var.	13.8	13.8	13.8	13.8	13.7	13.7	13.6	13.6
Observations	116,327	116,327	91,764	91,764	116,327	116,327	91,764	91,764

NOTE. This table reports OLS and CEM estimates from regressions of the log of total (columns 1 to 4) and bank (columns 5 to 6) mortgage volume on *Co-financed*, an indicator taking the value of 1 if the mortgage is co-financed and 0 if it is traditional. As indicated, specifications control for borrower characteristics at mortgage origination (a restricted cubic spline of the logarithm of income, age, and indicators for gender and marital status) and add fixed effects for time, borrower's income group (50 bins of MX$0.04 logarithmic length), municipalities where the borrower works and where the property is located, and lending bank, and bank-specific linear time trends. The CEM estimates are obtained using the weights generated by the CEM algorithm, restricting the sample to 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 A.1 for variable definitions. Standard errors clustered by income group are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table 4: Down payment and property value: co-financed versus traditional mortgages

Dependent variable:	Down payment									
	Total				Paid w/ private savings		log(Property value)			
	OLS		CEM		OLS	CEM	OLS		CEM	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Co-financed	-8.281***	-8.419***	-7.565***	-7.610***	-16.822***	-15.936***	-.045***	.006	.021***	.021***
	(.301)	(.292)	(.279)	(.274)	(.151)	(.170)	(.013)	(.006)	(.007)	(.007)
Borrower controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	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
Income group FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Bank time trends	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Mean dep. var.	21.6	21.6	20.6	20.6	18.0	16.8	14.1	14.1	14.0	14.0
Observations	116,327	116,327	91,764	91,764	116,327	91,764	116,327	116,327	91,764	91,764

NOTE. This table reports OLS and CEM estimates from regressions of the total mortgage down payment (columns 1 to 4) and the portion paid out of private savings (columns 5 and 6), as a percentage of the collateral value, and the log of property value (columns 7 to 10) on *Co-financed*, 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 3. The sample includes all 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 A.1 for variable definitions. Standard errors clustered by income group are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table 5: Loan interest rate: co-financed versus traditional mortgages

Dependent variable:	Average rate			Bank rate		
	OLS		CEM	OLS		CEM
	(1)	(2)	(3)	(4)	(5)	(6)
Co-financed	.339***	.356***	.364***	-.246***	-.221***	-.213***
	(.010)	(.008)	(.009)	(.006)	(.005)	(.005)
Borrower controls	No	Yes	Yes	No	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Workplace municipality FE	No	Yes	Yes	No	Yes	Yes
Property municipality FE	No	Yes	Yes	No	Yes	Yes
Income group FE	No	Yes	Yes	No	Yes	Yes
Bank time trends	No	Yes	Yes	No	Yes	Yes
Mean dependent variable	10.4	10.4	10.5	10.2	10.2	10.2
Observations	116,327	116,327	91,764	116,327	116,327	91,764

NOTE. This table reports OLS and CEM estimates from regressions of the average (columns 1 to 3) and the bank (columns 4 to 6) mortgage rates (in percentage) on *Co-financed*, 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 3. The sample includes all 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 A.1 for variable definitions. Standard errors clustered by income group are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table 6: Default outcomes: co-financed versus traditional mortgages

	first 2 yrs after origination			first 3 yrs after origination			first 4 yrs after origination		
	OLS		CEM	OLS		CEM	OLS		CEM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Co-financed	-.070	-.004	-.044	-.120**	-.066	-.108*	.019	.026	.018
	(.044)	(.034)	(.040)	(.056)	(.049)	(.059)	(.074)	(.063)	(.088)
Borrower controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	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
Income group FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Bank time trends	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Mean dependent variable	.7	.7	.6	1.0	1.0	.9	1.2	1.2	1.1
Observations	2,972,089	2,972,089	2,238,733	2,913,654	2,913,654	2,081,691	2,038,867	2,038,867	1,230,197

NOTE. This table reports OLS and CEM estimates from regressions of indicators taking the value of 100 if a 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 on *Co-financed*, 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 3. The sample includes all traditional and Cofinavit mortgages to private sector workers originated by commercial banks in the period from June 2016 to June 2019, June 2018, and June 2017, which are followed for two, three, and four years after origination, respectively. Observations are at the mortgage-month level. Refer to Section 4.1 for data sources and sample selection and to Appendix Table A.1 for variable definitions. Standard errors clustered by income group are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table 7: Conditions at origination by income level: co-financed versus traditional mortgages

Dependent variable:	log(Total volume)	log(Bank volume)	Down payment		log(Property value)	Average rate	Bank rate
			Total	Paid w/ priv. sav.			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Co-financed × log(Income)	.034***	.131***	2.552***	-.187	.074***	-.040**	.007
	(.012)	(.012)	(.366)	(.349)	(.009)	(.019)	(.010)
Co-financed	-.207*	-1.483***	-33.618***	-14.030***	-.732***	.774***	-.280***
	(.123)	(.124)	(3.762)	(3.600)	(.095)	(.194)	(.104)
log(Income)	-.009	-.039	-.497	-.206	.039	-.016	-.017
	(.170)	(.178)	(4.837)	(4.884)	(.172)	(.194)	(.187)
Borrower controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Workplace municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Property municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Income group FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dependent variable	13.8	13.6	20.6	16.8	14.0	10.5	10.2
Observations	91,764	91,764	91,764	91,764	91,764	91,764	91,764

NOTE. This table reports the benchmark CEM estimates from Tables 3 to 5, where the indicator for whether the mortgage is co-financed is interacted with the log of borrowers' income. Borrowers controls only include age and indicators for gender and marital status. Standard errors clustered by income group are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table 8: Default outcomes by income level: co-financed versus traditional mortgages

Dependent var.:	Default: years after origination		
	first 2	first 3	first 4
	(1)	(2)	(3)
Co-financed × log(Income)	-.365***	-.418***	-.724***
	(.060)	(.107)	(.166)
Co-financed	3.667***	4.135***	7.363***
	(.611)	(1.082)	(1.680)
log(Income)	.240	-.461	-.496
	(.870)	(1.111)	(1.627)
Borrower controls	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
Workplace municipality FE	Yes	Yes	Yes
Property municipality FE	Yes	Yes	Yes
Income group FE	Yes	Yes	Yes
Bank time trends	Yes	Yes	Yes
Mean dependent variable	.6	.9	1.1
Observations	2,238,733	2,081,691	1,230,197

NOTE. This table reports the benchmark CEM estimates from Table 6, where the indicator for whether the mortgage is co-financed is interacted with the log of borrowers' income. Borrowers controls only include age and indicators for gender and marital status. Standard errors clustered by income group are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table 9: Conditions at origination by bank size: co-financed versus traditional mortgages

Dependent variable:	log(Total volume)		log(Bank volume)		Down payment		log(Property value)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Smaller bank×Co-financed	.002	.686***	.066***	1.221***	.940**	-31.303***	.009	.221
	(.010)	(.203)	(.015)	(.204)	(.458)	(6.796)	(.010)	(.194)
Smaller bank×Co-financed		-.068***		-.116***		3.064***		-.023
×log(Income)		(.020)		(.020)		(.657)		(.019)
Co-financed	.137***	-.392***	-.172***	-1.726***	-7.942***	-25.413***	.018**	-.809***
	(.008)	(.143)	(.013)	(.122)	(.242)	(4.160)	(.008)	(.115)
Co-financed ×log(Income)		.052***		.154***		1.732***		.082***
		(.014)		(.012)		(.408)		(.011)
Smaller bank×Borrower controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Smaller bank×Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Smaller bank×Workplace munic. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Smaller bank×Property munic. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Smaller bank×Income group FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dependent variable	13.8	13.8	13.6	13.6	20.6	20.6	14.0	14.0
Observations	91,410	91,410	91,410	91,410	91,410	91,410	91,410	91,410

NOTE. This table reports the benchmark CEM estimates from Tables 3, 4, and 7, where the indicator for whether the mortgage is co-financed (and its interaction with log income, as indicated) is interacted with *Smaller bank*, an indicator taking the value of 0 for the top three banks banks and of 1 for the remaining banks (bank size is determined by total assets as of June 2016). Specifications include the full set of double interaction and standalone terms that are not reported. All controls and fixed effects are interacted with the *Smaller bank* indicator. Standard errors clustered by smaller bank×income group are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table 10: Impact of Infonavit's new credit plan on the probability of co-financing

	Whether co-financed					
	All banks		Larger banks		Smaller banks	
	(1)	(2)	(3)	(4)	(5)	(6)
High intensity × Post	.063***	.054***	.040***	-.029*	.084***	.086***
	(.008)	(.014)	(.010)	(.016)	(.015)	(.022)
ΔTraditional credit limit credit limit (× Post)	Yes	Yes	Yes	Yes	Yes	Yes
Borrower controls	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Income and age group FE	Yes	Yes	Yes	Yes	Yes	Yes
Marital status, age and income group linear trends	No	Yes	No	Yes	No	Yes
Mean dependent variable	.42	.42	.43	.43	.41	.41
Observations	103,119	103,119	61,297	61,297	41,822	41,822

NOTE. This table reports estimates of the effect of Infonavit's new credit plan on the probability of co-financing for mortgages granted by all banks (columns 1 and 2), the top three larger banks (columns 3 and 4), and the remaining banks (columns 5 and 6), where bank size is determined by total assets as of June 2016. The dependent variable is an indicator taking the value of 1 if a bank mortgage is co-financed and 0 if it is traditional. *High intensity* is a dummy taking the value of 1 if a borrower is subject to a high treatment intensity under the new credit plan and of 0 if is subject to a low treatment intensity. *Post* is an indicator taking the value of 1 from April 2017 onward and of 0 before. All specifications control for the standalone *High intensity* dummy, for the change in credit limits of traditional Infonavit mortgages and its interaction with the *Post* indicator, for borrower characteristics (gender and marital status), and for time, bank, income-group, and age-group fixed effects. Where indicated, the specifications add linear time trends for marital status and age and income groups. The sample includes all traditional and Cofinavit mortgages to private sector workers originated by commercial banks between June 2016 and June 2019. Borrowers not subject to a high or low treatment intensity are removed from the sample. Refer to Section 4.1 for data sources and sample selection and to Appendix Table A.1 for variable definitions. Standard errors clustered by income group×age group×marital status are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table 11: Impact of Infonavit's new credit plan on down payment: co-financed mortgages

Dependent variable:	Down payment – Co-financed mortgages					
	All banks		Larger banks		Smaller banks	
	(1)	(2)	(3)	(4)	(5)	(6)
High intensity × Post	-1.359***	-1.232**	-.715	-1.291*	-2.444***	-1.938**
	(.352)	(.527)	(.453)	(.762)	(.636)	(.907)
ΔTraditional credit limit (× Post)	Yes	Yes	Yes	Yes	Yes	Yes
Borrower controls	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Income and age group FE	Yes	Yes	Yes	Yes	Yes	Yes
Marital status, age and income group linear trends	No	Yes	No	Yes	No	Yes
Mean dependent variable	16.67	16.67	13.88	13.88	21.03	21.03
Observations	43,409	43,409	26,435	26,435	16,974	16,974

NOTE. This table reports estimates of the effect of Infonavit's new credit plan on the total down payment of co-financed mortgages granted by all banks (columns 1 and 2), the top three larger banks (columns 3 and 4), and the remaining banks (columns 5 and 6), where bank size is determined by total assets as of June 2016. All specifications are described in Table 10. The sample includes all Cofinavit mortgages to private sector workers originated by the smaller commercial banks between June 2016 and June 2019. Borrowers not subject to a high or low treatment intensity are removed from the sample. Refer to Section 4.1 for data sources and sample selection and to Appendix Table A.1 for variable definitions. Standard errors clustered by income group×age group×marital status are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table 12: Impact of Infonavit's new credit plan on property value: co-financed mortgages

Dependent variable:	log(Property value) - Co-financed mortgages					
	All banks		Larger banks		Smaller banks	
	(1)	(2)	(3)	(4)	(5)	(6)
High intensity × Post	.006	.006	.008	.004	-.007	-.034
	(.011)	(.017)	(.014)	(.021)	(.017)	(.026)
ΔTraditional credit limit (× Post)	Yes	Yes	Yes	Yes	Yes	Yes
Borrower controls	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Income and age group FE	Yes	Yes	Yes	Yes	Yes	Yes
Marital status, age and income group linear trends	No	Yes	No	Yes	No	Yes
Mean dependent variable	14.04	14.04	13.96	13.96	14.16	14.16
Observations	43,409	43,409	26,435	26,435	16,974	16,974

NOTE. This table reports estimates of the effect of Infonavit's new credit plan on the log of property value of co-financed mortgages granted by all banks (columns 1 and 2), the top three larger banks (columns 3 and 4), and the remaining banks (columns 5 and 6), where bank size is determined by total assets as of June 2016. All specifications are described in Table 10. The sample includes all traditional and Cofinavit mortgages to private sector workers originated by the smaller commercial banks between June 2016 and June 2019. Borrowers not subject to a high or low treatment intensity are removed from the sample. Refer to Section 4.1 for data sources and sample selection and to Appendix Table A.1 for variable definitions. Standard errors clustered by income group×age group×marital status 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 Further details on the new Cofinavit scheme

Here we provide additional details on how the terms of the Infonavit loan in a Cofinavit scheme have changed under the new credit plan, comparing them to the terms of a bank loan.

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*).[17] 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 Figure A.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

[17] 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.

average by 4%, and so the nominal interest rate in pesos varied between 8% and 14%.[18] The new credit plan set the interest rate at 12% across all income levels, eliminating the cross-subsidy (see Panel B of Figure A.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 Figure A.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.[19] 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 A.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 A.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 A.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 Figure A.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 Figure A.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 Figure A.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

[18] 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.

[19] 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.

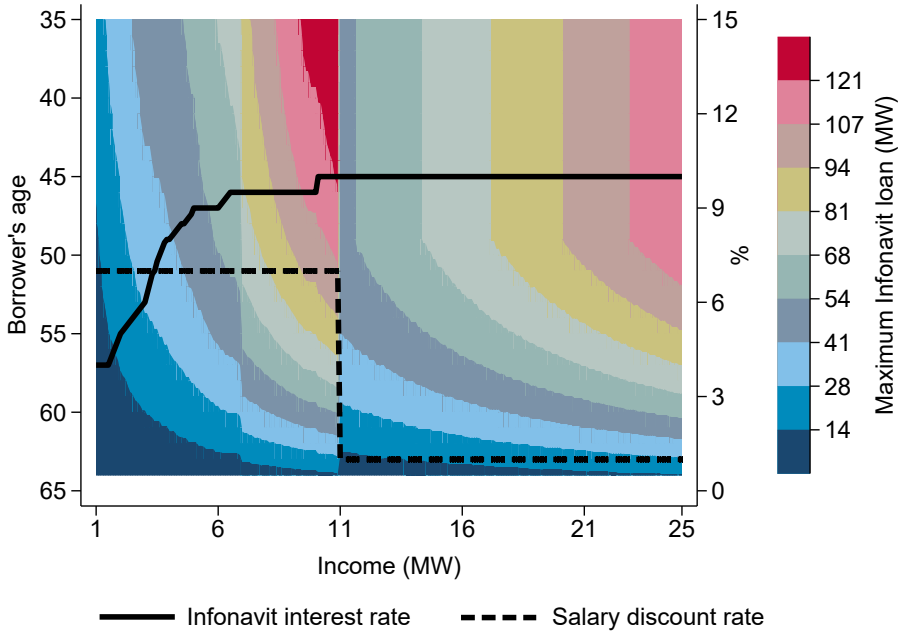
PTI ratio is set at about 30%. Ultimately, this could lead to a smaller bank loan, or to one with a lower interest rate or higher maturity.

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

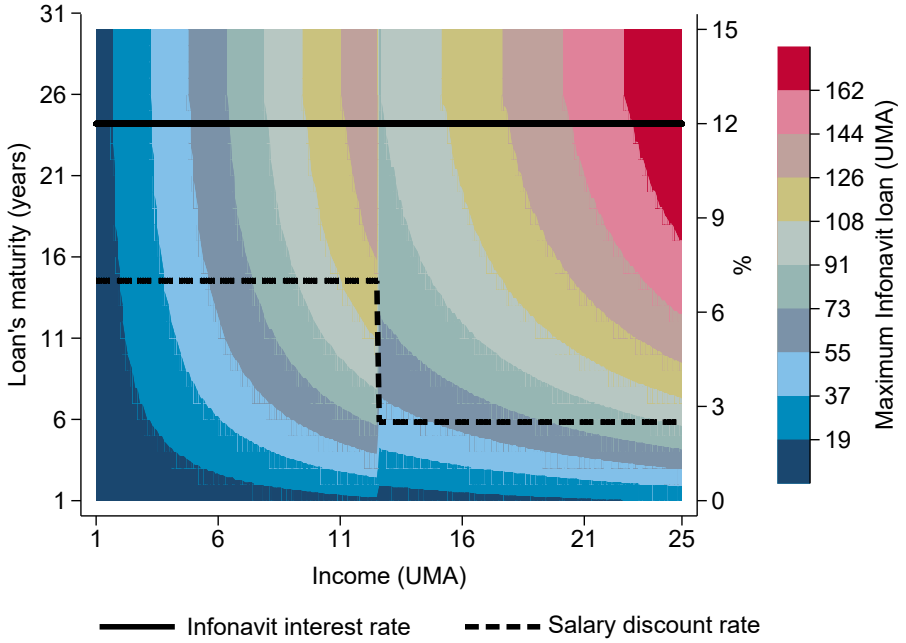
B Further results

Figure A.1: Terms of Infonavit loans

Panel A: Loans originated before April 2017

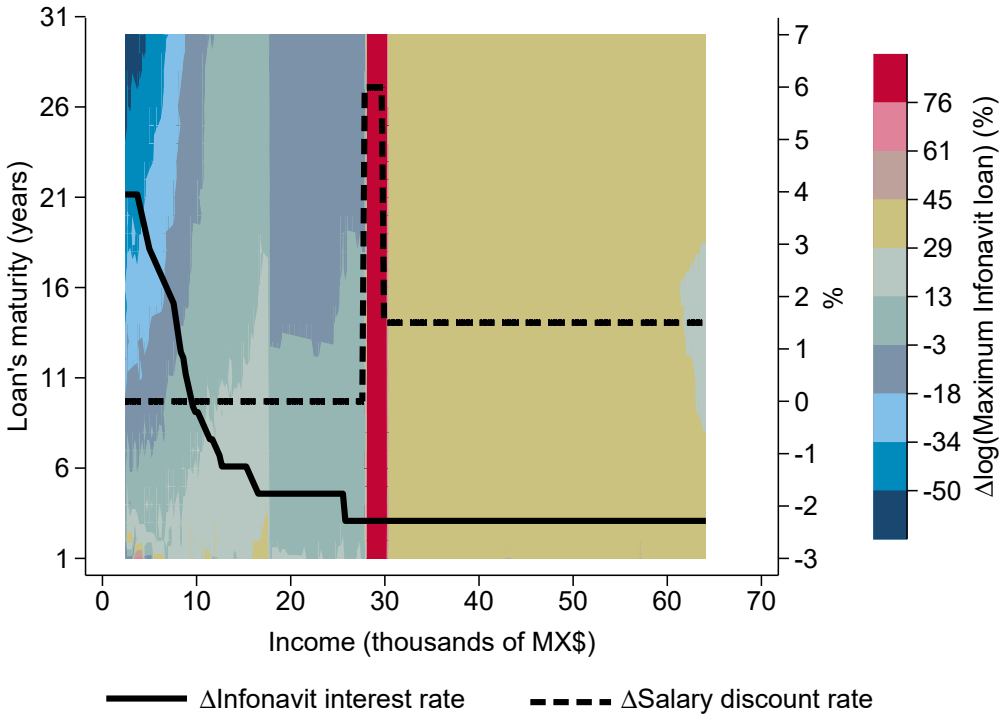


Panel B: Loans originated after April 2017



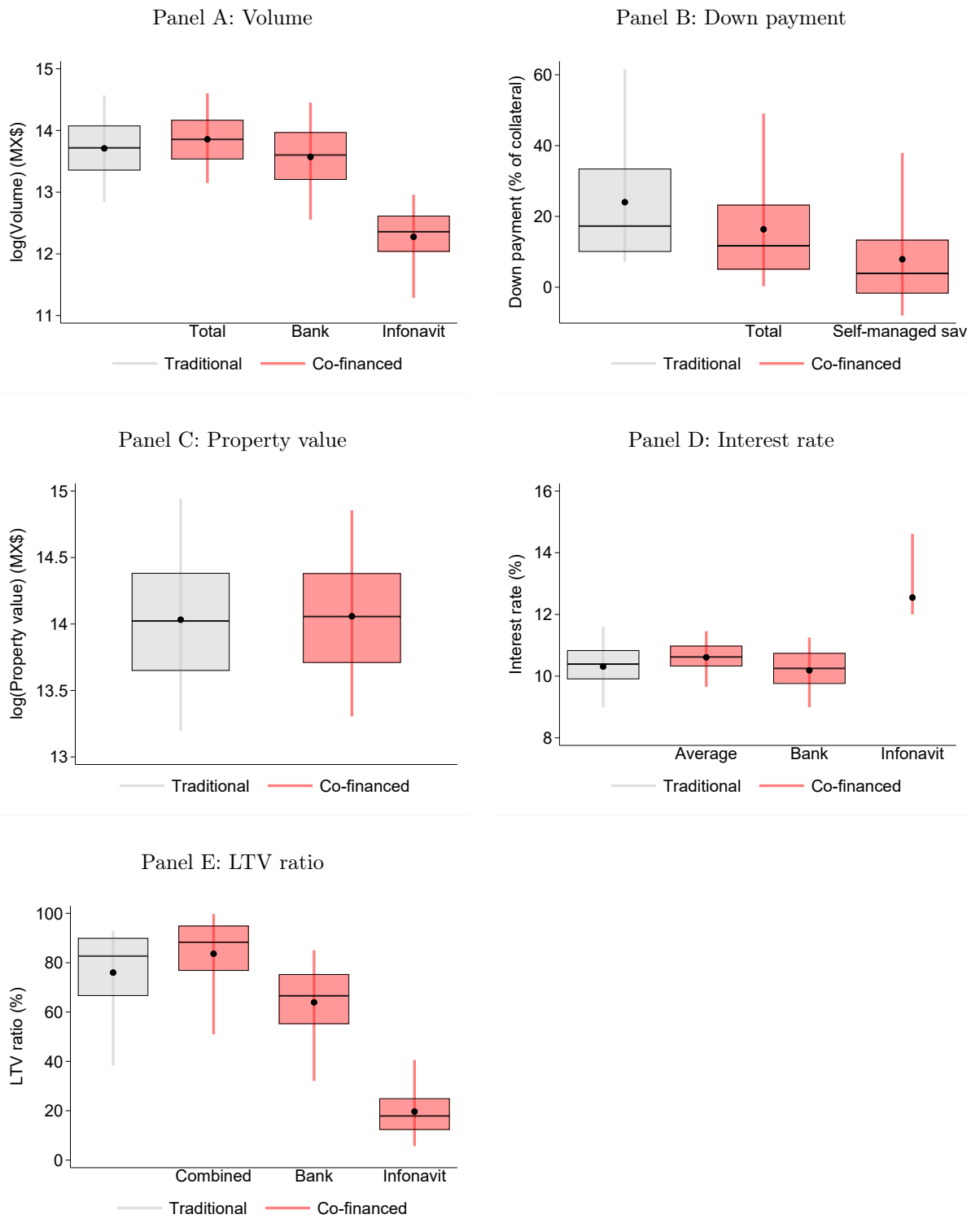
NOTE. This figure shows the credit limits, interest rates, and salary discount rates of Infonavit loans granted under the Cofinavit scheme, before (Panel A) and after (Panel B) April 2017. The credit limits are displayed as filled contours depending on borrower's age and income (Panel A) and loan's maturity 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 A.2: Change in the terms of Infonavit loans under the new credit plan



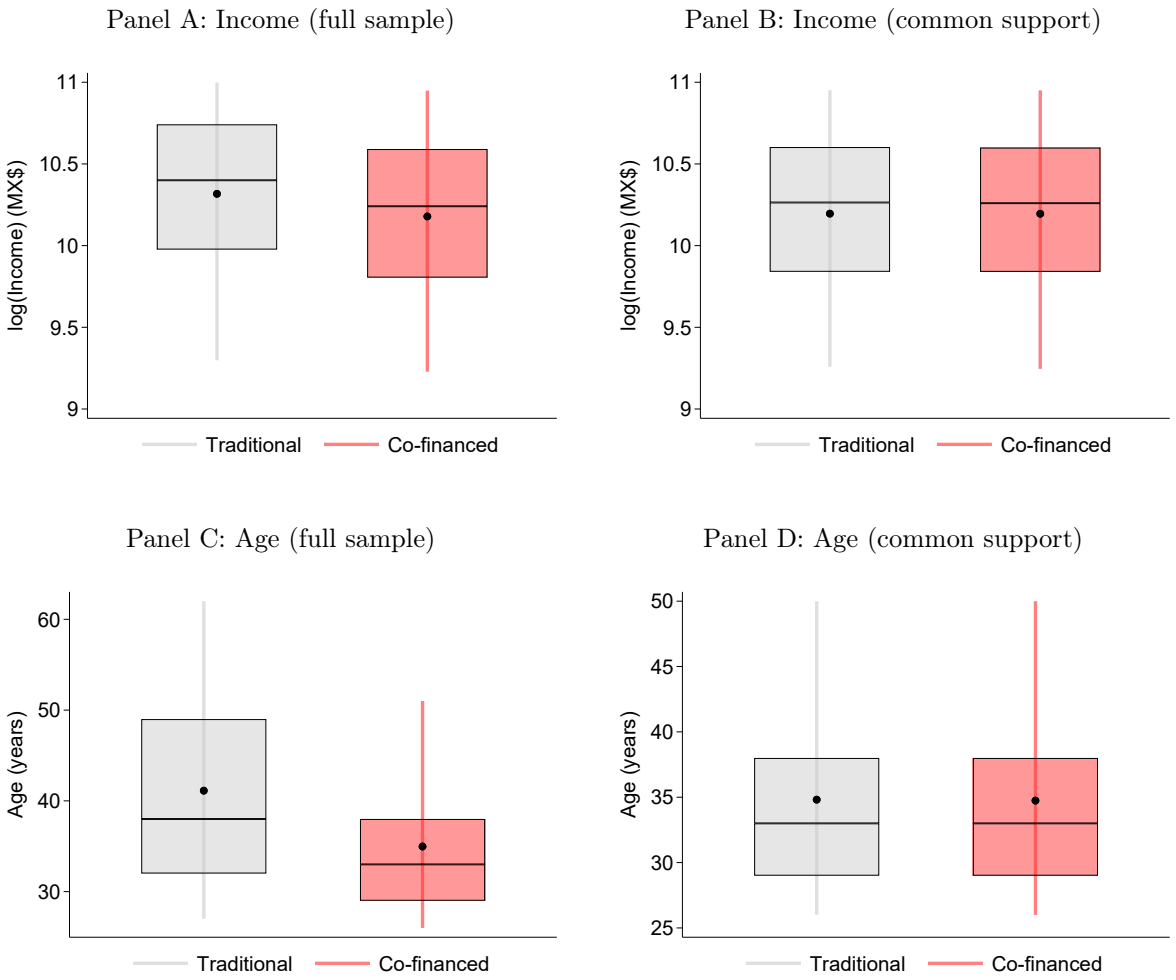
NOTE. This figure shows the first difference in the logarithm of the credit limits and in the interest rates and salary discount rates of Infonavit loans granted under the Cofinavit scheme. The differences are computed between April and March 2017. The change in maximum loan amounts are displayed as 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 A.3: Mortgage and property characteristics at origination



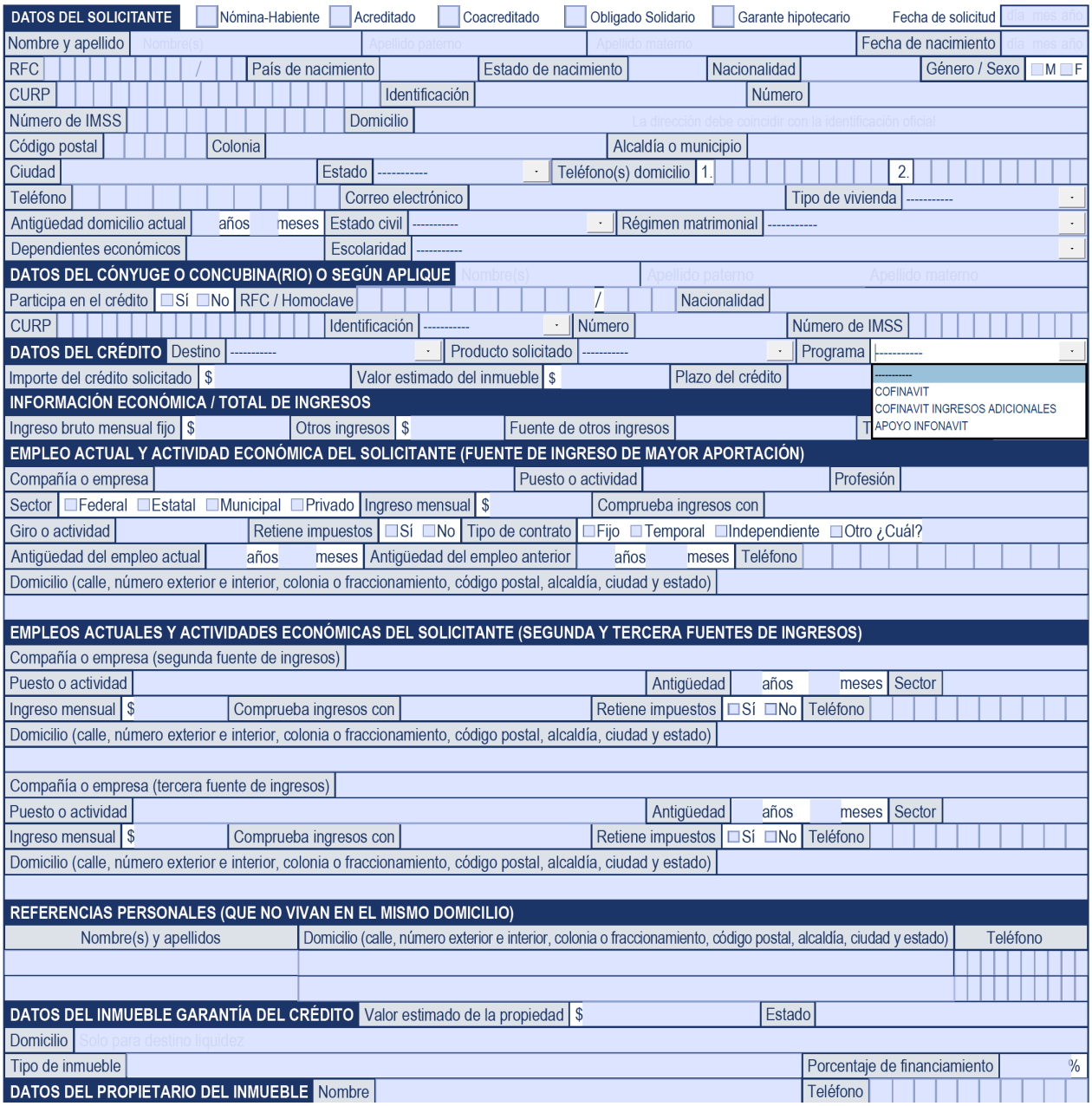
NOTE. This figure shows box plots for characteristics at origination of co-financed and traditional mortgages. The sample is restricted to the common support region. For characteristics in Panels A, D, and E, we report not only their combined value in a Cofinavit mortgage, but also discriminate between 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 A.1 for variable definitions.

Figure A.4: Borrower characteristics at origination



NOTE. This figure shows box plots for borrower's income and age corresponding to co-financed and traditional mortgages at origination. Statistics are presented both before (Panels A and C) and after (Panels B and D) the sample is restricted to the common support region. 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 A.1 for variable definitions.

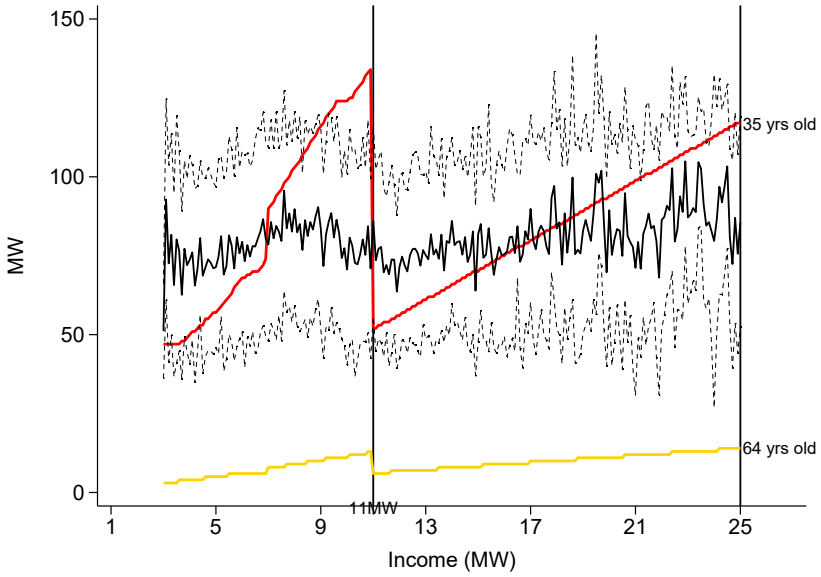
Figure A.5: Example of a mortgage application form



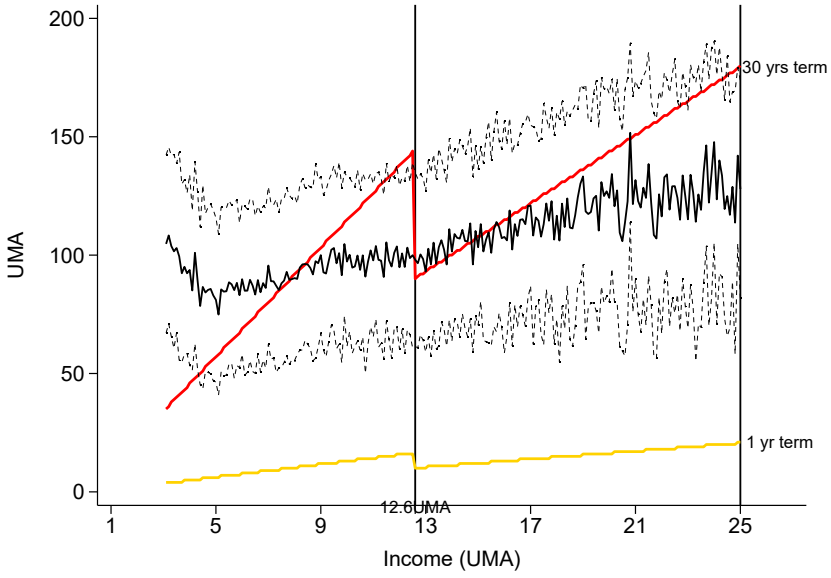
NOTE. This is an example of the actual form requested by a commercial bank to mortgage applicants. The entries displayed in the field "Programa" allow to select a specific co-financing program. Applicants not selecting Cofinavit or one of the other two programs are applying to a traditional bank loan. 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.

Figure A.6: Credit limits versus actual amounts of Infonavit loans

Panel A: Loans originated before April 2017



Panel B: Loans originated after April 2017



NOTE. This figure shows the credit limits and the average Infonavit loan volumes granted under the Cofinavit scheme, before (Panel A) and after (Panel B) April 2017. The income bins are those defined by Infonavit in minimum wages (Panel A) and UMAs (Panel B). The red lines plot the highest credit limits, corresponding to 35-year-old borrowers (Panel A) and to 30-year mortgages (Panel B), and the yellow lines plot the lowest limits, corresponding to 64-year-old borrowers and 1-year mortgages. The black lines plot the average Infonavit loan with one-standard deviation bounds using data between June 2016 and March 2017 (Panel A) and between April 2017 and June 2019 (Panel B). The vertical lines indicate income levels of 11 and 25 MWs (Panel A) and 12.6 and 25 UMAs (Panel B). Only loans granted to single borrowers, with no co-borrower, are included in the sample.

Table A.1: Definition of variables

Variable	Definition
Mortgage and property characteristics	
Co-financed	Indicator equal to 1 for Cofinavit mortgages (i.e., co-financed between Infonavit and a commercial bank) and 0 for traditional bank mortgages.
log(Total loan volume) (MX$)	Logarithm of the total mortgage volume granted by the bank and, if co-financed, also by Infonavit.
log(Bank loan volume) (MX$)	Logarithm of the mortgage volume granted by the bank (for traditional bank mortgages, it is equal to the total loan volume).
Down payment (% of collateral value)	Collateral value (the lesser of the purchase price and the appraised value) minus total loan volume, as a percentage of the collateral value.
Down payment minus home account (% of collateral value)	Collateral value (the lesser of the purchase price and the appraised value) minus total loan volume, as a percentage of the collateral value, after subtracting the home account balance.
log(Property value) (MX$)	Logarithm of the property value, given by 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 footnote 18. The rate applied after April 2017 is set equal to 12%.
Bank interest rate (%)	Interest rate used by the bank to compute the interest payments for the period (for traditional bank mortgages, it is equal to 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).
Non-performing in the first two, three, four years	Indicator equal to 100 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.

(Continued)

Table A.1: – *Continued*

Borrower characteristics	
log(Income) (MX$)	Logarithm of the borrower's gross monthly income as reported at origination. It includes all sources of income considered for the loan decision (wages, business and professional activities, rents, interests, co-borrower's or other family members' income, etc.).
Male	Indicator equal to 1 if the borrower is male and 0 otherwise.
Age (years)	Borrower's age at the time of mortgage origination.
Married	Indicator equal to 1 if the borrower is married at the time of mortgage origination and 0 otherwise.

NOTE. All mortgage- and borrower-level variables are extracted from the regulatory report R04 H collected by the CNBV.

Table A.2: Characteristics at origination accounting for ex ante credit risk: co-financed versus traditional mortgages

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	.087***	.086***	-.270***	-.271***	-7.117***	-7.035***	-15.267***	-15.232***	-.011	-.010	-.285***	-.289***
	(.013)	(.013)	(.021)	(.021)	(.437)	(.432)	(.383)	(.384)	(.012)	(.012)	(.014)	(.013)
Probability of default		.006		.010		-.851***		-.370*		-.006		.034***
		(.006)		(.006)		(.179)		(.201)		(.006)		(.009)
Borrower controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time 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
Income group FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep. var.	13.8	13.8	13.6	13.6	16.9	16.9	13.6	13.6	14.0	14.0	10.2	10.2
Observations	7,813	7,813	7,813	7,813	7,813	7,813	7,813	7,813	7,813	7,813	7,813	7,813

NOTE. This table reports the benchmark CEM estimates from Tables 3, 4, and 5, before and after controlling for the probability of default at origination computed by a bank using an internal ratings-based model. The sample includes traditional and Cofinavit mortgages to private sector workers originated by the bank using the internal ratings-based model between December 2018 and June 2019. Standard errors clustered by income group are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table A.3: Default outcomes controlling for ex ante credit risk and LTV: co-financed versus traditional mortgages

Dependent variable:	Defaults: years after origination				
	first 2			first 3	first 4
	(1)	(2)	(3)	(4)	(5)
Co-financed	.255**	-.076**	-.124***	-.260***	-.158*
	(.107)	(.034)	(.038)	(.054)	(.080)
Probability of default		.865***			
		(.010)			
Borrower controls	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Workplace munic. FE	Yes	Yes	Yes	Yes	Yes
Property munic. FE	Yes	Yes	Yes	Yes	Yes
Income group FE	Yes	Yes	Yes	Yes	Yes
Combined LVT FE	No	No	Yes	Yes	Yes
Mean dependent variable	.8	.8	.6	.9	1.1
Observations	193,639	193,420	2,238,733	2,081,691	1,230,197

NOTE. This table reports the benchmark CEM estimates from Table 6, before and after controlling for the probability of default at origination computed by a bank using an internal ratings-based model (columns 1 and 2) and adding fixed effects for 5%-combined-LTV bins (columns 3 to 5). The sample in columns 1 and 2 includes traditional and Cofinavit mortgages to private sector workers originated by the bank using the internal ratings-based model between December 2018 and June 2019, which are followed for two years after origination. The sample in columns 3 to 5 is the same as in Table 6. Standard errors clustered by income group are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table A.4: Conditions at origination under different credit plans: co-financed versus traditional mortgages

Dependent variables:	log(Total volume)		Down payment: Total		Down payment: Paid w/ priv. sav.		log(Property value)		Average rate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Post × Co-financed	.008	-.134	.531	7.833	-1.448***	3.535	.014	.054	-.463***	-.851
	(.011)	(.238)	(.511)	(7.656)	(.394)	(8.072)	(.011)	(.205)	(0.021)	(.546)
Post × Co-financed		.014		-.688		-.488		-.003		.037
× log(Income)		(.023)		(.740)		(.775)		(.020)		(.052)
Co-financed	.124***	-.051	-7.873***	-42.149***	-14.665***	-18.082**	.006	-.763***	.704***	1.705***
	(.009)	(.206)	(.429)	(6.268)	(.357)	(6.968)	(.009)	(.183)	(0.020)	(.534)
Post×Borrower controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Post×Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Post×Workplace munic. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Post×Property munic. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Post×Income group FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dependent variable	13.8	13.8	20.6	20.6	16.7	16.7	14.0	14.0	10.5	10.5
Observations	91,382	91,382	91,382	91,382	91,382	91,382	91,382	91,382	91,382	91,382

NOTE. This table reports the benchmark CEM estimates from Tables 3, 4 5, and 7, where the indicator for whether the mortgage is co-financed (and its interaction with log income, as indicated) is interacted with *Post*, an indicator taking the value of 1 after April 2017 and of 0 otherwise. Specifications include the full set of double interaction and standalone terms that are not reported. All controls and fixed effects are interacted with the *Post* indicator. Standard errors clustered by post×income group are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table A.5: Default outcomes under different credit plans: co-financed versus traditional mortgages

Dependent variable:	Default: years after origination					
	first 2		first 3		first 4	
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Co-financed	.111	.907	-.013	-.062	-.005	-2.223
	(.077)	(1.458)	(.101)	(2.039)	(.195)	(4.318)
Post × Co-financed		-.081		.001		.212
×log(Income)		(.142)		(.200)		(.421)
Co-financed	-.114*	3.097**	-.090	4.724***	.001	7.913***
	(.064)	(1.298)	(.076)	(1.541)	(.087)	(1.363)
Post×Borrower controls	Yes	Yes	Yes	Yes	Yes	Yes
Post×Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Post×Workplace munic. FE	Yes	Yes	Yes	Yes	Yes	Yes
Post×Property munic. FE	Yes	Yes	Yes	Yes	Yes	Yes
Post×Income group FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean dependent variable	.6	.6	.9	.9	1.1	1.1
Observations	2,238,731	2,238,731	2,081,689	2,081,689	1,230,195	1,230,195

NOTE. This table reports the benchmark CEM estimates from Tables 6 and 8, where the indicator for whether the mortgage is co-financed (and its interaction with log income, as indicated) is interacted with *Post*, an indicator taking the value of 1 after April 2017 and of 0 otherwise. Specifications include the full set of double interaction and standalone terms that are not reported. All controls and fixed effects are interacted with the *Post* indicator. Standard errors clustered by post×income group are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table A.6: Estimates of the impact of Infonavit's new credit plan when treatment effects vary with covariates

Dependent variables:	Whether co-financed			Down payment (co-financed)			log(Property value) (co-financed)		
Banks:	All	Larger	Smaller	All	Larger	Smaller	All	Larger	Smaller
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
High intensity × Post	.076***	.050***	.094***	-1.115	-2.914	-1.169	.007	.016	-.063
	(.018)	(.019)	(.028)	(1.349)	(2.410)	(1.580)	(.042)	(.059)	(.043)
ΔTraditional credit limit (× Post)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Borrower controls	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
Income and age group FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
High intensity × Post × Demeaned controls and FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dependent variable	.42	.43	.41	16.67	13.88	21.03	14.04	13.96	14.16
Observations	103,119	61,297	41,822	43,409	26,435	16,974	43,409	26,435	16,974

NOTE. This table reports estimates of the benchmark models of Tables 10, 11, and 12 after adding as controls the interactions between *High intensity* × *Post* and all demeaned controls and dummies for fixed effects. For the demeaning, we subtract the corresponding sample means from the original variables. Standard errors clustered by income group×age group×marital status are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table A.7: Estimates of the impact of each mortgage term modified under the new credit plan

Dependent variables:	Whether co-financed			Down payment (co-financed)			log(Property value) (co-financed)		
Banks:	All	Larger	Smaller	All	Larger	Smaller	All	Larger	Smaller
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ΔInfonavit interest rate × Post	-.021**	.035***	-.048**	.247	.317	.853	-.017	-.008	-.012
	(.010)	(.011)	(.021)	(.402)	(.442)	(1.154)	(.015)	(.016)	(.030)
ΔInfonavit credit limit × Post	.019	-.009	.048*	-.682	-.166	-1.329	-.004	.007	-.052
	(.022)	(.026)	(.029)	(.736)	(.947)	(1.401)	(.022)	(.028)	(.039)
ΔTraditional credit limit × Post	-.017	.024	-.111**	-.756	1.211	-3.633	.058	-.015	.050
	(.026)	(.031)	(.049)	(1.897)	(2.670)	(2.987)	(.054)	(.071)	(.079)
Borrower controls	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
Income and age group FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Marital status, age and income group linear trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dependent variable	.41	.42	.40	17.01	14.14	21.40	14.05	13.97	14.17
Observations	116,845	69,322	47,523	47,833	28,898	18,935	47,833	28,898	18,935

NOTE. This table reports estimates of the benchmark models of Tables 10, 11, and 12, where the *High intensity* dummy is replaced by Δ*Infonavit interest rate* and Δ*Infonavit credit limit*, which denote the change in the corresponding characteristic of the Infonavit portion of a Cofinavit loan between the new and old credit plans. Standard errors clustered by income group×age group×marital status are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table A.8: Effects of Infonavit's new credit plan after announcement date

Dependent variables:	Whether co-financed			Down payment – Co-financed			log(Property value) – Co-financed		
Banks:	All	Larger	Smaller	All	Larger	Smaller	All	Larger	Smaller
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
High intensity × Post	.013	-.047***	.068***	.141	.514	-.406	-.008	.002	-.015
	(.013)	(.016)	(.023)	(.558)	(.751)	(.977)	(.017)	(.018)	(.019)
ΔTraditional credit limit (× Post)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Borrower controls	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
Income and age group FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Marital status, age and income group linear trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dependent variable	.42	.43	.41	16.67	13.88	21.03	14.04	13.96	14.17
Observations	103,119	61,297	41,822	43,409	26,435	16,974	43,409	26,435	41,822

NOTE. This table reports estimates of the benchmark models of Tables 10, 11, and 12, where *Post* is an indicator taking the value of 1 after December 2016 and of 0 otherwise. Standard errors clustered by income group×age group×marital status are reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.