Raising Household Leverage:
Evidence from Co-Financed Mortgages

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The views expressed do not necessarily reflect the position of Banco de México.

The importance of mortgage design

- Wide array of mortgage contracts across different markets

- Products that raise leverage $\rightarrow$ Used by public interventions to alleviate borrowing constraints

  - **Borrowing constraints**: Major barrier to home ownership (Gete and Reher, 2018; Blickle and Brown, 2019; Fuster and Zafar, 2016, 2021)

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- However, higher leverage may have unintended consequences

    - for **wealth accumulation**: Constrained borrowers may only afford less costly houses (Gupta et al., 2021)

    - for **loan performance**: ↑ risk of default (Mayer et al., 2009; Campbell and Cocco, 2015)

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    - for **loan performance**: $\uparrow$ risk of default (Mayer et al., 2009; Campbell and Cocco, 2015)

- The institutional setting matters to improve borrowing conditions without affecting performance $\rightarrow$ Yet, little research on mortgage innovations from emerging markets

This paper

- **Mortgage product: Cofinavit**

    - Main Mexican co-financing program between a housing provident fund (HPF) and banks

    - **Goals:** i) enhance borrower's credit capacity, ii) reduce down payment, iii) enable purchase of a better house

This paper

- **Mortgage product: Cofinavit**

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- **Research question**

    - Which borrowers select co-financed over traditional bank mortgages?

    - Relative to traditional, how do co-financed mortgages balance access vs. risk?

        - **Origination conditions**: Are borrowers able to take a larger combined loan? If so, do they increase leverage and/or buy a better home?

        - **Performance**: What are the implications for ex post performance?

        - **Heterogeneity by income**: Are there distributional effects?

Preview of results

- Which borrowers opt for a co-financed rather than a traditional bank mortgage?
    - Younger & poorer; w/longer employment history & higher formal wages

- How do co-financed compare to traditional mortgages?

- **Terms at origination**
    - Total (HPF + bank) loan volume: 13.8% larger (25.5% of SD)
    - Down payment: 5.8 pp smaller (34.0% of SD)
    - Property value: 3.8% higher (6.9% of SD)
    - Combined interest rate: 30.9 bp higher (44.1% of SD) (HPF higher; bank lower)

- **Performance**
    - Prob. of default: 0.13 pp & 0.15 pp lower after 2 & 3 yrs (< 2% of SD), no diff. after 4 yrs
        - Higher leverage offset by lower liquidity needs

- **Distributional effects**
    - At low incomes: Down payment declines more; property value increases less

Related literature

- **Financial innovations** that improve access to **housing finance** by targeting demand-side frictions:
    - Theoretical: Chambers et al. (2009); Ortalo-Magné and Rady (2006)
    - Empirical: Tracey and Van Horen (2022); Benetton et al. (2022)

- **I**mpact of **mortgage market design** on **default**
    - Equilibrium models linking contractual features & market conditions: Greenwald et al. (2021); Campbell et al. (2021); Guren et al. (2021)
    - Second mortgages: Mian and Sufi (2011); Agarwal et al. (2020)
    - Liquidity: Ganong and Noel (2020); Elul et al. (2010); Fuster and Willen (2017); Defusco et al. (2019)

- Lending and saving functions of **HPFs**
    - Impact on home ownership and prices: Phang and Wong (1997); Tang and Coulson (2017); Zhou (2020)
    - Optimal paternalistic policies: Moser and Olea de Souza e Silva (2019)

Some institutional background

- **HPFs**: Institutions not in the market-based financial system. Grant **residential mortgages** & retirement benefits

- **Infonavit**

  - Mexico's largest HPF. Largest mortgage lender in Latin America.

  - Funded w/**mandatory savings from all formal private-sector workers**
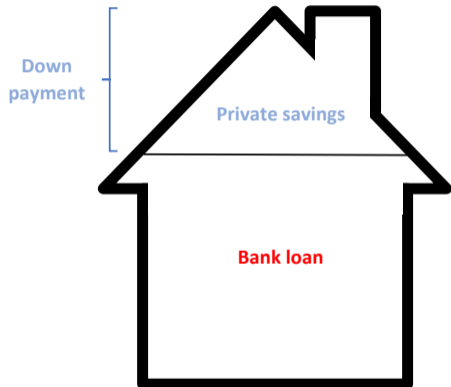   - Employer contributions (5% of salary) going into individual home accounts

- **Cofinavit**

  - Pools two loans granted & administered separately by each lender (Infonavit & bank)

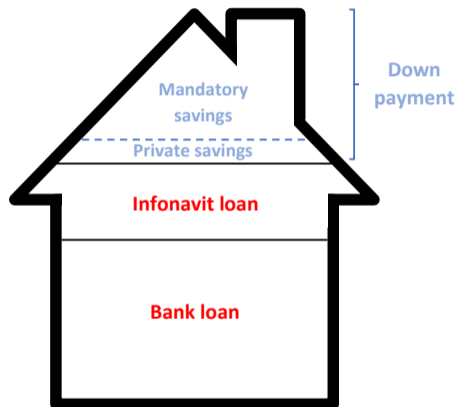 - Cross-collateralization: Both lenders have first lien on the property

Traditional versus Cofinavit mortgages

Traditional bank mortgage

Down payment

Private savings

Bank loan

Cofinavit mortgage

Down payment

Mandatory savings

Private savings

Infonavit loan

Bank loan

Traditional versus Cofinavit mortgages

	Traditional	Cofinavit	
	Bank	**Bank**	**Infonavit**
Screening	Risk based	Same	Non risk based (minimum score)
Loan size	Determined by credit assessment and PTI limit	Same (residual after Infonavit volume approved)	Determined by credit limits + simple credit assessment
Maturity	20 years	Same	5 to 8 years
Interest rate	Depends on loan & borrower characteristics (decreasing in income)	Same	Increasing in income until Mar 17'; then fixed
Repayment	From cash on hand or private savings	Same. After Infonavit is repaid, also from employer contributions	From employer contributions & salary discounts
Default	No willingness or ability to pay	Same	Only if loses formal job; usually later than on bank
Non-performing status	3 months delinquent	Same	Up to 15 months delinquent

Data and sample

- **Data**

    - R04 H report from banking regulator (CNBV) $\rightarrow$ each mortgage granted by banks

    - <u>Covered:</u> Loan terms + borrower characteristics at origination + monthly follow up

    - <u>Not covered:</u> Mortgage applications, follow up of co-financed loans granted by HPFs

- **Sample selection**

    - Traditional bank mortgages & Cofinavit mortgages

    - Borrowers working in private sector with income $> 3MW$ and $< 25MW$

    - <u>Purpose:</u> purchase of new or second-hand property

    - <u>Origination period:</u> June 2016 to June 2019

    - Ten banks granting both products

Mortgage choice

- Dependent variable:
  - = 1 if co-financed mortgage;
  - = 0 if traditional mortgage

	(1)	(2)	(3)	(4)
New property	.017***	.005	-.004	-.082***
	(.003)	(.003)	(.004)	(.008)
log(Income)	-.144***	-.005	-.053	.123
	(.002)	(.089)	(.105)	(.307)
Age	-.010***	-.009***	-.009***	-.009***
	(.000)	(.000)	(.000)	(.000)
Male	.025***	.028***	.024***	.029***
	(.002)	(.002)	(.003)	(.007)
Married	.037***	.027***	.017***	.022***
	(.002)	(.002)	(.003)	(.008)
log(House price)	.084	.087	-.048	-2.125*
	(.082)	(.084)	(.148)	(1.234)
log(Formal empl.)	.030***	-.015	-.001	.218
	(.001)	(.013)	(.015)	(.206)
log(Formal wages)	.026***	-.042**	-.024	-.346*
	(.002)	(.021)	(.024)	(.207)
Co-borrower			.067***	
			(.006)	
Probability of default				.008*
				(.004)
Property region FE	Yes	–	–	–
Cohort FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	–
Bank time trends	No	Yes	Yes	–
Income group FE	No	Yes	Yes	Yes
Workplace & property munic. FE	No	Yes	Yes	Yes
St. dev. dep. var.	.48	.48	.48	.44
Observations	154,294	154,294	107,063	13,507

Empirical approach

OLS estimation

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

- y_i: Terms of mortgage i at origination

- $\textit{Co-financed}_i$: = 1 if co-financed mortgage; = 0 if traditional

- Covariates and fixed effects:
    - $X'(\cdot)$: borrower characteristics (income, age, gender, marital status),
        house prices of property's municipality in period $c-1$ (m_p),
        formal employment & wages of workplace municipality in period $c-1$ (m_w)
    - Γ': time (i.e., cohort) FE,
        bank FE & bank-specific linear time trends,
        borrower's income group FE,
        workplace & property municipalities FEs

Empirical approach

OLS estimation

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

- y_i: Terms of mortgage i at origination

- $\textit{Co-financed}_i$: = 1 if co-financed mortgage; = 0 if traditional

- Covariates and fixed effects:
    - $X'(\cdot)$
    - Γ'

- Regression adjustment: Control for $\textit{Co-financed}_i \times X'(\cdot)$ (demeaned covariates)

Empirical approach (cont.)

Coarsened exact matching (CEM) approach by Iacus et al. (2012)

- Pre-process data to ↓ imbalance between co-financed & traditional mortgages

- Compares mortgages granted to borrowers with similar characteristics, by the same bank, under same Infonavit plan

- α_1: ATE of co-financing in the population → **Assumptions:**

  1. Common support of co-financed & traditional mortgages
     - Select borrowers & mortgages eligible for and targeted by Cofinavit
     - CEM only uses strata with both loan types

  2. Ignorability of co-financing conditional on observables
     - Results robust to controlling for a bank's internal measure of default risk
     - Unobserved savings correlated with outcomes could also affect product choice

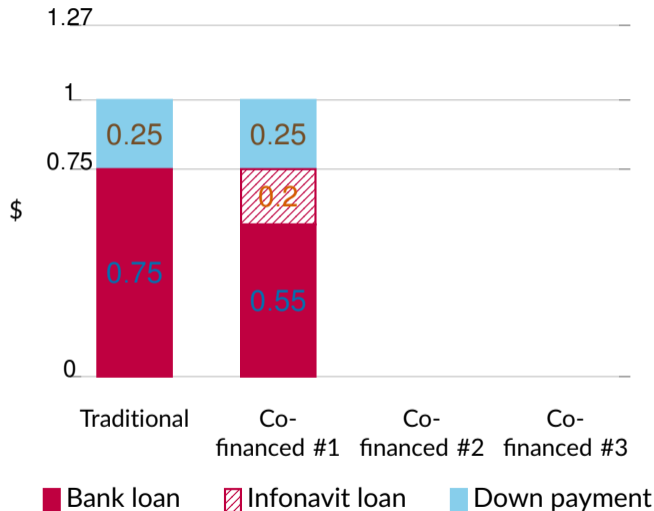- Results not causal, interpreted as expected bounds for actual effects
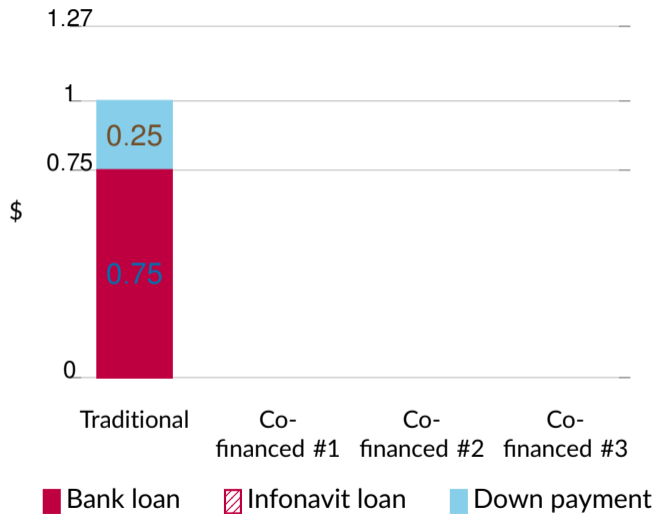
▸ CEM algorithm

Theoretical effects: Origination conditions

- **Cofinavit goals**:
  - total mortgage loan ↑
  - down payment ↓
  - property value ↑

Theoretical effects: Origination conditions

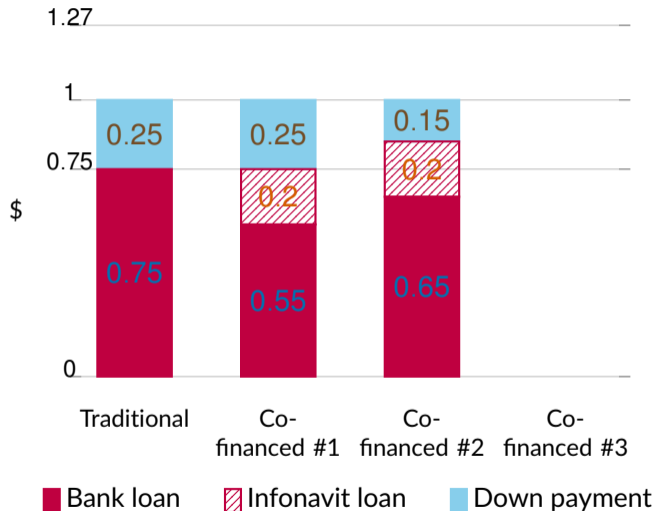- **Cofinavit goals**:
  - total mortgage loan ↑
  - down payment ↓
  - property value ↑

- **Case #1**: No goal achieved
  - bank loan ↓ (full substitution)
  - total mortgage loan ≃
  - down payment ≃
  - property value ≃

Theoretical effects: Origination conditions

- **Cofinavit goals**:
  - total mortgage loan ↑
  - down payment ↓
  - property value ↑

- **Case #1**: No goal achieved

- **Case #2**: Pure down payment ↓
  - bank loan ↓ (no full substitution)
  - total mortgage loan ↑
  - down payment ↓
  - property value ≃

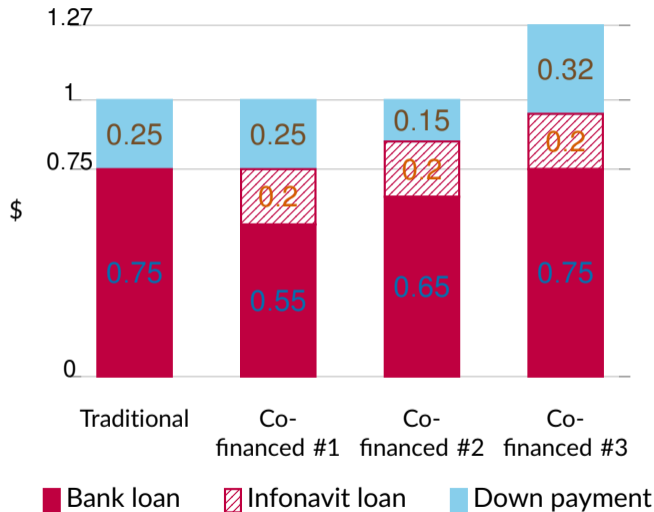# Theoretical effects: Origination conditions

- **Cofinavit goals**:
  - total mortgage loan ↑
  - down payment ↓
  - property value ↑

- **Case #1**: No goal achieved

- **Case #2**: Pure down payment ↓

- **Case #3**: Pure property value ↑
  - bank loan ≃ (no full substitution)
  - total mortgage loan ↑
  - down payment ≃
  - property value ↑

Theoretical effects: Origination conditions

- **Cofinavit goals**:
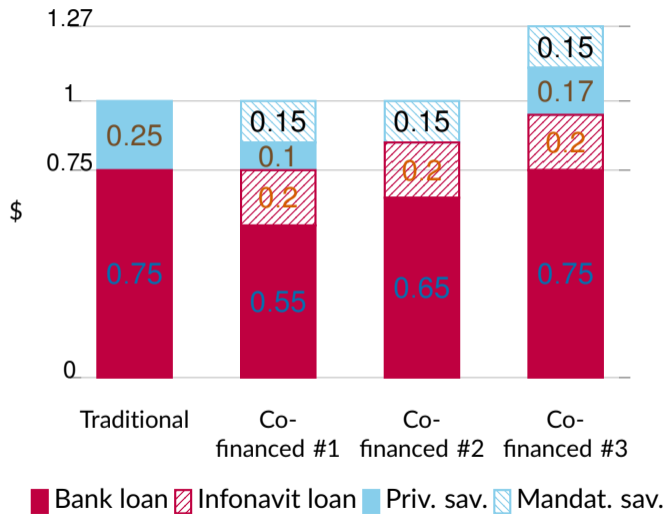 - total mortgage loan ↑
  - down payment ↓
  - property value ↑

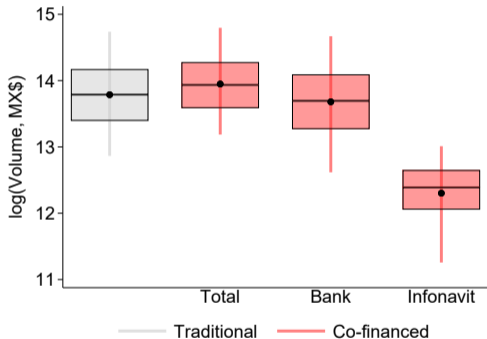- **Case #1**: No goal achieved

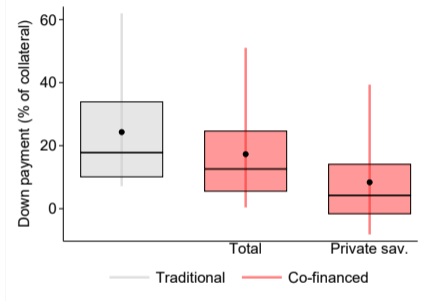- **Case #2**: Pure down payment ↓

- **Case #3**: Pure property value ↑

- All cases: ↓ **liquidity needs**

Mortgage volume

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

Down payment and property value

Dependent variable:	Down payment				log(Property value)	
	Total		Paid w/ private savings			
	OLS	CEM	OLS	CEM	OLS	CEM
	(1)	(2)	(3)	(4)	(5)	(6)
Co-financed	-7.444***	-5.844***	-16.448***	-15.781***	-.121***	.038***
	(.088)	(.120)	(.085)	(.121)	(.003)	(.003)
$X'(\cdot)$	No	Yes	No	Yes	No	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank time trends	No	Yes	No	Yes	No	Yes
Income group FE	No	Yes	No	Yes	No	Yes
Workplace munic. FE	No	Yes	No	Yes	No	Yes
Property munic. FE	No	Yes	No	Yes	No	Yes
Co-financed$\times X'(\cdot)$	No	Yes	No	Yes	No	Yes
St. dev. dep. var.	17.56	17.17	18.50	18.13	.58	.55
Observations	154,294	110,617	154,294	110,617	154,294	110,617

Down payment and property value

Dependent variable:	Down payment				log(Property value)	
	Total		Paid w/ private savings			
	OLS	CEM	OLS	CEM	OLS	CEM
	(1)	(2)	(3)	(4)	(5)	(6)
Co-financed	-7.444***	-5.844***	-16.448***	-15.781***	-.121***	.038***
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Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank time trends	No	Yes	No	Yes	No	Yes
Income group FE	No	Yes	No	Yes	No	Yes
Workplace munic. FE	No	Yes	No	Yes	No	Yes
Property munic. FE	No	Yes	No	Yes	No	Yes
Co-financed $\times X'(\cdot)$	No	Yes	No	Yes	No	Yes
St. dev. dep. var.	17.56	17.17	18.50	18.13	.58	.55
Observations	154,294	110,617	154,294	110,617	154,294	110,617

- Interest rates ▸ Go

Heterogeneity by income

- Both demand and supply forces vary with income:

- **Demand**
    - At higher incomes:
        - More PTI ratio slack $\rightarrow$ higher capacity to increase debt
        - More (mandatory and, very likely, private) savings (Dynan et al., 2004) $\rightarrow$ less need for a reduced down payment

- **Supply**
    - Conditions of Infonavit and bank loans (interest rates, credit limits) vary differently with income

Mortgage origination conditions by income
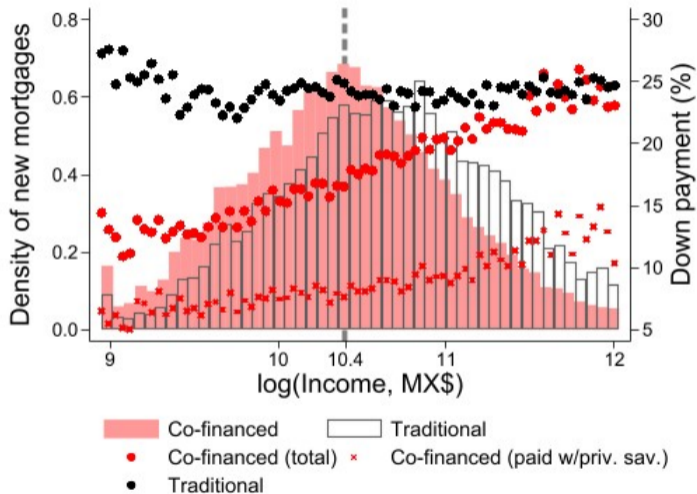
Origination conditions by income

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

Theoretical effects: Loan performance

- Opposing forces affecting probability of default of the **bank portion** of a Cofinavit:

  1. **Leverage at origination** $\rightarrow$ $\uparrow$ default
     - Previous evidence: $\downarrow$ down payment $\rightarrow$ $\uparrow$ combined LTV

  2. **Liquidity** $\rightarrow$ $\downarrow$ default
     - Regular payments: Partly covered by employer contributions $\rightarrow$ $\downarrow$ liquidity needs
     - If unemployed: Borrower can defer payments to Infonavit for > 1 year $\rightarrow$ $\uparrow$ financial relief

  3. **Infonavit's secure repayment system** $\rightarrow$ $\downarrow$ default
     - If employed, borrower can default on bank but not on Infonavit $\rightarrow$ $\downarrow$ cash flow & bank starts foreclosure

Loan performance

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

Loan performance controlling for combined LTV

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

Loan performance by income

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

Robustness checks

- Conditions at origination accounting for ex ante credit risk ▸ Go

- Outcomes by supply-side conditions

  - Examine if results depend on Infonavit loan conditions ▸ Go

    - Reestimate results for mortgages originated under old and new Infonavit credit plans separately (new plan since April 2017)

  - Examine if results vary by bank

    - Reestimate results for each of the 5 more represented, larger banks

- Sensitivity analysis

  - Oster's (2019) test for selection on unobservables

Cofinavit vs. piggyback loan structures

- **Piggyback mortgages:** Second-lien mortgages taken out to reduce down-payment & avoid insurance

- Suspected of contributing to pre-2008 housing bubble in US (Lee et al., 2013)
    - Succesful in expanding home ownership (Chambers et al., 2009), but recent evidence dismisses its role in subprime crisis (Bhutta and Keys, 2022)

- Main risks: Misaligned banks' incentives (e.g. underreporting of 2nd loan) when securitization available

- **Cofinavit:** Increases efficiency by reducing individual risks. No risk-shifting via securitization.
    - Requires paternalistic saving scheme + home financing option w/secure repayment
    - $\rightarrow$ When is it optimal? (see Fadlon and Laibson, 2022; Moser and Olea de Souza e Silva, 2019)

Conclusions

- Co-financing w/HPF: Opportunity to study mortgage demand in developing country

- **Main findings:**

    - Co-financing is effective to relax borrowing constraints: $\uparrow$ total funding; $\downarrow$ down payments

    - Less potential to $\uparrow$ wealth accumulation & $\downarrow$ inequality: Limited effect on property value; stronger $\uparrow$ at high incomes

    - Despite $\uparrow$ leverage, not worsening of credit risk: $\downarrow$ liquidity needs & secure repayment

- **Policy implications:**

    - Paternalistic institutions, managing a portion of employees' wages, can relax borrowing constraints without increasing credit risk through products co-financed with banks

- **Ongoing work:** Counterfactual analysis of financial gain or loss under Cofinavit

    - Determine break-even rate of return on mandatory savings, below which Cofinavit leads to financial gains relative to traditional mortgages

Banks will benefit from the law; they will be able to collect direct credit from your salary

By **Aurora Writes** — March 18, 2022 · No Comments · 4 Mins Read

What are payroll credits with delegated collection and what risks would they entail for the worker

This reform would jeopardize the legitimate right of workers to receive their full wage; the Senate is reflecting on the consequences this would entail

Newsroom Infobae
March 22, 2022

Morena revive iniciativa para que bancos "se cobren a lo chino"

La nueva iniciativa consiste en que los créditos vigentes, estén o no siendo pagados, se mantienen intactos, mientras que la figura de cobranza delegada aplicará para los nuevos préstamos a través de la firma de un contrato

Literature I

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Applying for a mortgage

DATOS DEL SOLICITANTE ☐ Nómina-Habiente ☐ Acreditado ☐ Coacreditado ☐ Obligado Solidario ☐ Garante hipotecario   Fecha de solicitud

Nombre y apellido	Nombre(s)	Apellido paterno	Apellido materno	Fecha de nacimiento

RFC / País de nacimiento   Estado de nacimiento   Nacionalidad   Género / Sexo ☐ M ☐ F

CURP   Identificación   Número

Número de IMSS   Domicilio   *La dirección debe coincidir con la identificación oficial*

Código postal   Colonia   Alcaldía o municipio

Ciudad   Estado ----------   Teléfono(s) domicilio 1.   2.

Teléfono   Correo electrónico   Tipo de vivienda ----------

Antigüedad domicilio actual   años   meses   Estado civil ----------   Régimen matrimonial ----------

Dependientes económicos   Escolaridad ----------

DATOS DEL CÓNYUGE O CONCUBINA(RIO) O SEGÚN APLIQUE Nombre(s) Apellido paterno Apellido materno

Participa en el crédito ☐ Sí ☐ No   RFC / Homoclave   Nacionalidad

CURP   Identificación ----------   Número   Número de IMSS

DATOS DEL CRÉDITO Destino ----------   Producto solicitado ----------   Programa ----------

----------	
COFINAVIT	
COFINAVIT INGRESOS ADICIONALES	
APOYO INFONAVIT	

Importe del crédito solicitado $ Valor estimado del inmueble $ Plazo del crédito

INFORMACIÓN ECONÓMICA / TOTAL DE INGRESOS

Ingreso bruto mensual fijo $ Otros ingresos $ Fuente de otros ingresos   T

EMPLEO ACTUAL Y ACTIVIDAD ECONÓMICA DEL SOLICITANTE (FUENTE DE INGRESO DE MAYOR APORTACIÓN)

Compañía o empresa   Puesto o actividad   Profesión

Sector ☐ Federal ☐ Estatal ☐ Municipal ☐ Privado   Ingreso mensual $ Comprueba ingresos con

Giro o actividad   Retiene impuestos ☐ Sí ☐ No   Tipo de contrato ☐ Fijo ☐ Temporal ☐ Independiente ☐ Otro ¿Cuál?

Antigüedad del empleo actual   años   meses   Antigüedad del empleo anterior   años   meses   Teléfono

Domicilio (calle, número exterior e interior, colonia o fraccionamiento, código postal, alcaldía, ciudad y estado)

CEM algorithm and estimation

- Variables and coarsening levels used for the matching:
    1. log income (20 bins, equally spaced)
    2. gender (2 bins)
    3. age (13 bins, 5-year intervals)
    4. marital status (2 bins)
    5. region where borrower works (5 bins)
    6. bank granting the mortgage (10 bins)
    7. whether granted under the old or new credit plan (2 bins)

- Define strata for all combinations of covariates' bins
- Assign weights:
    - $1 \rightarrow$ co-financed mortgages
    - stratum weight $\rightarrow$ traditional mortgages
        - increasing in proportion of co-financed mortgages
    - $0 \rightarrow$ unmatched observations

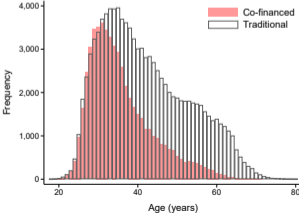- Estimate equation (1) using CEM weights
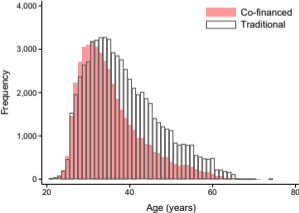
Support and balance of matching covariates
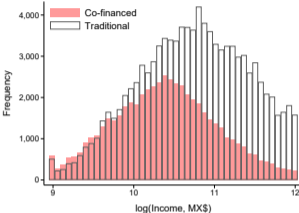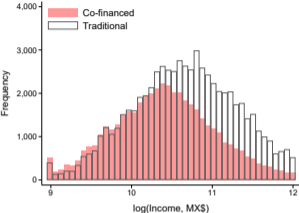
Empirical approach (cont.)

- Main sources of bias from 2-stage selection of borrowers into mortgage products:

  1. **Households' application**: Self-select into products according to

     - *Financial needs:* Level & composition of savings not observed (i.e., borrowing & liquidity constraints)

     - *Bank eligibility conditions:* Same for both products

     - *Infonavit eligibility conditions:* Specific requirements unlikely to affect loan outcomes

  2. **Lenders' approval**:

     - *Bank loan officer:* Unobserved factors, e.g., applicant's length of employment, credit history

     - *Infonavit loan officer* (if Cofinavit): No crucial role

Mortgage interest rate at origination
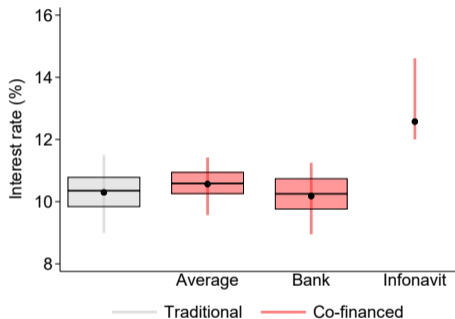
Mortgage interest rate at origination

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

Robustness: Origination conditions accounting for ex ante credit risk

- Ex ante credit risk → potentially important **omitted variable**

Dependent variable:	log(Total volume)	log(Bank volume)	Down payment	Down pay. w/ priv. sav.	log(Property value)	Bank rate
	(1)	(2)	(3)	(4)	(5)	(6)
Co-financed	.106***	-.224***	-6.301***	-15.307***	.017*	-.285***
	(.013)	(.021)	(.432)	(.384)	(.012)	(.013)
PD	Yes	Yes	Yes	Yes	Yes	Yes
$X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Income group FE	Yes	Yes	Yes	Yes	Yes	Yes
Workplace munic. FE	Yes	Yes	Yes	Yes	Yes	Yes
Property munic. FE	Yes	Yes	Yes	Yes	Yes	Yes
Co-financed×$X'(\cdot)$	Yes	Yes	Yes	Yes	Yes	Yes
Co-financed×PD	Yes	Yes	Yes	Yes	Yes	Yes
St. dev. dep. var.	.50	.55	14.98	16.24	.50	.53
Observations	8,029	8,029	8,029	8,029	8,029	8,029

# Contractual changes in Infonavit loan conditions
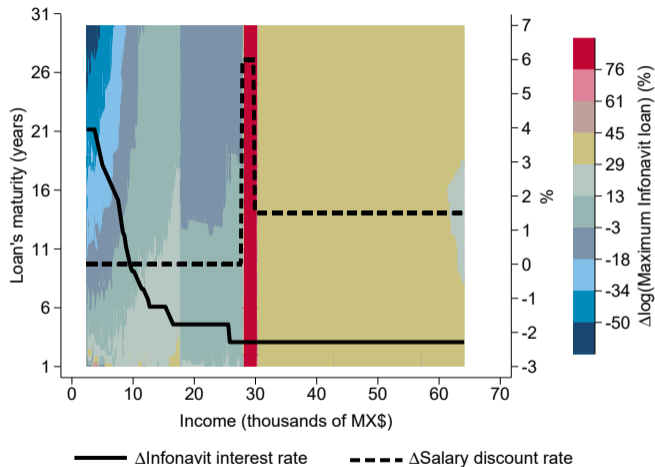
- April 2017 → New credit plan changes **Infonavit loan** conditions in a Cofinavit

- For high- relative to low-income borrowers:

    - **Interest rates:** More generous

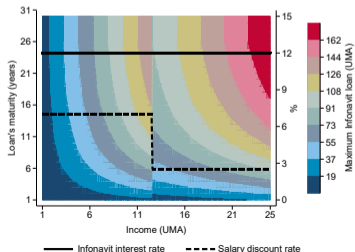   - **Credit limits:** Less generous

    ▸ Terms before and after

Infonavit loans: Credit limits, interest rates, salary discount rates ▸ Back

Panel A: Loans originated before April 2017
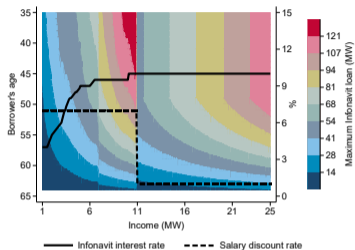
Panel B: Loans originated after April 2017

Conditions at origination under different credit plans ▸ Back

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