

Credit Access and Housing Quality

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Abstract

Housing is the largest asset most households hold, and it shapes both their quality of life and their accumulation of wealth. Acquiring or upgrading it typically requires financing, and access to that financing is often limited by institutions rather than by income or wealth alone. This paper asks how limited mortgage-credit access, tied to a large informal labor market without verified income, shapes household housing outcomes. We study this question in Mexico, where the principal mortgage-credit institutions extend financing only to workers registered in the formal social-security system, while roughly half the workforce remains informally employed. In the lowest income decile, the imputed rental value of a formal worker's home is roughly 60% higher than an informal worker's in the same decile, and only about 10% of informal workers in that decile have ever used a housing loan, compared with 55% of formal workers. We then quantitatively assess how limited credit access shapes both the distribution and the aggregate level of housing demand. We build a structural life-cycle model that separately identifies the income process and credit access of formal and informal workers, and use it to show that extending credit access universally raises the mid-quality housing share from 26.8% to 29.9%. By expanding who can convert income into housing, formal credit access raises not only housing quality but the quality of life and wealth these households can accumulate through it.

Keywords: Housing Quality, Heterogeneous Agents, Borrowing Constraint

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1 Introduction

Housing is the largest durable asset most households will ever hold and, for owners and renters alike, the largest recurring claim on income. In developing economies this dual role is sharper still: housing quality is not just a consumption amenity but a store of wealth in the frequent absence of deep financial markets for saving. Access to financing therefore does more than smooth the timing of a purchase — it can determine whether a household ever occupies adequate housing at all, and it does so on top of, not merely in proportion to, income. A household with sufficient lifetime income but no way to convert that income into an up-front lump sum is, for practical purposes, shut out of the housing ladder.

In much of Latin America, and in Mexico specifically, the sharpest such financing margin is not wealth or collateral in the abstract — it is formal employment. Mexico's principal mortgage-credit institutions for low- and middle-income households, the Institute of the National Housing Fund for Workers (INFONAVIT) and the Housing Fund of the Institute for Social Security and Services for State Workers (FOVISSSTE), extend credit only to workers registered in the formal social-security system (IMSS), with eligibility built directly into payroll contributions. Their expansion shifted Mexican housing production toward formal, developer-built housing while the funds' eligibility rules also shaped urban expansion and socioeconomic segregation [Monkkonen \(2011a,b, 2012\)](#).¹ Roughly half of Mexican workers are informally employed, and informality is not simply low income by another name: even in the top income decile, a large share of workers remain informal (Section 2.1). Credit access in Mexico is therefore gated by a labor-market status only loosely tied to income — a financing margin orthogonal to, not redundant with, the income-based constraints studied in most housing-finance research.

We ask how much this formality-gated credit exclusion costs, along two distinct dimensions. First, an unequal access problem: at a given income level, households without formal-sector credit access live in systematically lower-quality housing than those with it, and the gap is concentrated exactly where a financing constraint should bind — low- and middle-income households — vanishing by roughly the seventh income decile. Second, a weak aggregate demand problem: because roughly half the workforce is excluded from the primary credit channel, economy-wide demand for housing upgrades is structurally suppressed, not merely redistributed toward those with access.

We study this using Mexican household survey data (ENVI, ENIGH), labor-market panel data (ENOE), and loan-level mortgage origination data (CNBV) to document the housing-quality gap by formality and credit access, and to show what credit is actually used for — overwhelmingly remodeling at the bottom of the income distribution, acquisition at the top. We then build a structural life-cycle model in which

¹INFONAVIT accounted for about 82 percent of Mexican mortgage value and 71 percent of mortgage loans in 2000; subsidized borrowers in its administrative records did not default more frequently than unsubsidized borrowers and took longer to reach first default [Lopez-Silva et al. \(2011\)](#).

formal and informal workers differ both in their income process and in their access to credit, which lets us separate the part of the housing-quality gap attributable to credit exclusion from the part that simply reflects informal workers facing riskier income. Using the model, we run a counterfactual that extends credit access universally while leaving the income process untouched.

Universal credit access raises the mid-quality housing share from 26.8% to 29.9%. Because the counterfactual holds the income process fixed and widens only credit access, this increase implies that formality-gated exclusion is suppressing total demand for housing upgrades, not simply reallocating who receives them — the same financing margin identified above, now shown to bind in aggregate, not only at the household level.

Together, these results speak to the broader question of how financial-market incompleteness shapes living standards in developing economies, and specifically to how labor-market institutions — not just credit-market ones — can be the binding financial friction. Where mortgage eligibility gates on employment status rather than on wealth or credit history, expanding formal contracting can matter for housing outcomes as much as expanding credit supply itself.

This connects two literatures that have largely developed separately. The housing-and-credit literature has mostly studied developed-economy mortgage markets, where the relevant constraint is wealth- or collateral-based and access itself is close to universal [Landvoigt *et al.* \(2015\)](#). We extend this quality-ladder approach to a setting where access is not universal and is instead gated by a discrete labor-market status. Separately, a macro-development literature on financial frictions and informality has modeled how credit-market exclusion shapes informal firms' production and entry decisions and, in equilibrium, the size and composition of the informal sector [Amaral and Quintin \(2006\)](#); [Antunes and Cavalcanti \(2007\)](#); [D'Erasmus and Moscoso Boedo \(2012\)](#). We take formality as given and bring the same logic to its downstream consequence for household durable-consumption choice: informality is not just a friction on firms' access to working capital, it is a friction on households' access to the housing ladder. If credit access widens while high-quality housing supply remains fixed, the price of high-quality housing can rise and blunt the effect on the overall quality composition [Kaplan *et al.* \(2020\)](#); the supply-side setup behind this point — an elastic low-to mid-quality margin financed by remodeling alongside a genuinely fixed high-quality margin financed by acquisition — is institutional context for the intensive/extensive margin distinction documented in Sections [2.4](#) and [2.5](#), not a channel independently defended here. More broadly, this paper is also related to the literature on financial constraints in developing economies, where credit-market imperfections have been shown to generate resource misallocation and productivity losses [Moll \(2014\)](#); as in [Manysheva \(2022\)](#), we use micro-data to discipline a heterogeneous-agent model to answer a development-economics question.

Three further housing-macro studies clarify the object of our counterfactual. [Garriga and Hedlund \(2020\)](#) study the mirror case of tighter down-payment requirements in a developed market with near-

universal access, whereas our policy removes a labor-market-status gate where access was never universal. [Sommer and Sullivan \(2018\)](#) show how a housing-policy instrument can be capitalized into prices and redistribute its demand response; the same general-equilibrium logic appears here through a different instrument, credit eligibility. Relaxing credit constraints need not always be beneficial: [Corbae and Quintin \(2015\)](#) show that easier leverage can increase default and foreclosure. Our exercise instead relaxes a verification and eligibility friction tied to payroll status, not underwriting standards, and the model does not treat that distinction as a formal claim about lender screening or default risk.

1.1 Prior Literature

Research on housing and credit uses heterogeneous-household models to study how financing constraints, tenure choice, and illiquidity shape housing demand and macroeconomic adjustment. Quality-tiered demand and mortgage-market fluctuations in this literature are largely situated in developed markets, with constraints operating through wealth, collateral, down payments, or tax policy rather than access itself [Corbae and Quintin \(2015\)](#); [Garriga and Hedlund \(2020\)](#); [Kaplan *et al.* \(2020\)](#); [Landvoigt *et al.* \(2015\)](#); [Sommer and Sullivan \(2018\)](#). This paper brings the same discrete-choice and general-equilibrium tools to a developing-country market in which formal-employment status determines whether a household can use the principal mortgage channel at all.

A second literature studies financial exclusion and informality through firms' production, entry, and occupational choices. Limited enforcement and external-finance constraints can generate systematic differences between formal and informal firms without imposing exogenous productivity differences [Amaral and Quintin \(2006\)](#); [Antunes and Cavalcanti \(2007\)](#); [D'Erasmo and Moscoso Boedo \(2012\)](#). That literature makes credit differentials part of the equilibrium determination of the informal sector. We instead take a household's formality state as given at the housing decision and study the downstream durable-consumption and investment consequences of the resulting credit exclusion.

Property-rights and home-improvement studies show that institutional status can alter investment in the dwelling. Titling raises renovation and housing investment by strengthening tenure security, with evidence that this response need not operate through borrowing [Field \(2005\)](#); [Galiani and Schargrodsky \(2010\)](#). Mexican interventions further show that incremental improvements have meaningful health and welfare consequences and that improvements to the housing asset can expand collateral-based borrowing [Cattaneo *et al.* \(2009\)](#); [Gonzalez-Navarro and Quintana-Domeque \(2016\)](#). We distinguish this tenure-security and collateral channel from a credit-access channel created directly by employment-linked eligibility.

The Mexican housing-finance literature documents how INFONAVIT and FOVISSSTE expansion moved production toward developer-built mortgage housing and affected urban form and segregation [Monkkonen \(2011a,b, 2012\)](#). Institutional work also documents INFONAVIT's market share and borrower performance

Lopez-Silva *et al.* (2011). We complement these accounts by measuring how the eligibility gate maps into housing quality across income and by quantifying the aggregate effect of removing it.

Finally, our measurement follows the hedonic tradition that values differentiated housing through its bundle of characteristics Malpezzi (2002); Rosen (1974); Sheppard (1999). We use hedonic-imputed rent because owner reports can contain systematic valuation errors and because rental equivalence measures the housing services received by owners as well as renters Frick *et al.* (2010); Goodman and Ittner (1992); Kiel and Zabel (1999). This makes the outcome comparable across surveys and interpretable as a market-weighted measure of housing quality.

Relative to these literatures, the paper's contribution is to study a developing-country credit gate based on formal-employment status rather than wealth or collateral; to move from firms' production and entry decisions to households' durable-consumption choice; and to isolate the credit-access channel from the tenure-security channel studied in the property-rights literature. The structural model additionally separates differences in the income process from differences in credit access, and Chapter 4 decomposes the observed housing-quality gap into those two model channels. None of the papers surveyed above combines this institutional gate, household housing-quality choice, and structural decomposition.

The rest of the paper proceeds as follows. Section 2.1 describes the data and defines formality and credit access. Section 2.2 lays out why both channels could independently predict housing quality. Section 2.3 documents the housing-quality gap by formality and credit access. Section 2.4 shows what mortgage credit is actually used for. Section 2.5 develops a simple model in which credit access and income risk are separately identified. Section 3 extends this to a quantitative structural model, and Section 4 presents the universal-access counterfactual. Section 5 concludes.

2 Empirical Section

Accumulating housing wealth typically requires external finance, but the income verification and payroll deductions used by Mexico's public housing funds are available only through formal employment. Given the size of Mexico's informal sector, this institutional restriction may generate substantial differences in housing conditions. We quantify those differences by comparing dwelling values across formal and informal workers and across households with and without credit access. Our objective is descriptive: we document the size and distribution of these gaps rather than claim causal identification of either formality or credit access.

2.1 Data

We combine four sources that provide complementary views of employment, housing, and housing finance in Mexico. The 2020 National Housing Survey (ENVI) records unusually detailed dwelling characteristics, housing values, and access to job-linked housing credit. The 2020 National Household Income and Expenditure Survey (ENIGH) contains richer measures of income and employment and, crucially, distinguishes current formality from past use of public housing finance. The National Survey on Occupation and Employment (ENOE), Mexico's principal labor-force survey, provides repeated observations on employment, income, and formality that we use to estimate their joint dynamics for the quantitative model. Finally, loan-level records from the National Banking and Securities Commission (CNBV) describe mortgages originated by regulated financial institutions, including their purpose, amount, maturity, interest rate, borrower income, and property value.

Table 1 compares harmonized household-head characteristics across the three surveys. Their income, demographic, and labor-market patterns are mutually consistent despite differences in questionnaire design. The table also highlights Mexico's high homeownership rate, which makes access to housing finance consequential for both current living conditions and household wealth accumulation.

Table 1. Household-Head Characteristics across Surveys

	ENVI 2020	ENIGH 2020	ENOE 2019
Monthly labor income (MXN)	8,424	7,937	7,171
Monthly total income (MXN)	–	8,896	–
Median monthly labor income (MXN)	6,500	5,840	6,000
Median monthly total income (MXN)	–	5,870	–
Age	50.1	51.2	46.3
College educated (%)	19.8	14.1	16.4
Married or in union (%)	67.4	66.4	75.3
Urban (%)	79.2	78.4	77.9
Unemployment rate (%)	–	–	2.1
Homeowner (%)	66.9	69.6	–
Family size	3.5	3.5	–

Notes: Survey-weighted statistics for household heads. Income statistics condition on a positive reported monthly amount. Urban denotes a locality with at least 2,500 residents. A dash indicates that a survey lacks an equivalent head-level measure. ENOE uses the latest pre-pandemic wave available in the panel.

Formality and Credit Access

We define a formal worker as one registered with the Mexican Social Security Institute (IMSS), using the closest available survey proxy when direct registration is unavailable. We define credit access as eligibility for, or realized financing from, the Institute of the National Housing Fund for Workers (INFONAVIT) or the Housing Fund of the Institute for Social Security and Services for State Workers (FOVISSSTE). Formal employment is a prerequisite for both programs because eligibility is accumulated through employer contributions. Other job-linked sources account for only about 1% of measured credit access.

The surveys capture different points in the credit relationship. ENVI asks currently employed respondents whether their job gives them access to INFONAVIT, FOVISSSTE, or another institution. We use INFONAVIT/FOVISSSTE eligibility as ENVI's credit-access measure; it necessarily combines current formality with eligibility. ENIGH instead asks how the dwelling was financed and identifies whether INFONAVIT, FOVISSSTE, or FONHAPO financing was actually used. It also measures current formality separately, so ENIGH records credit history rather than current eligibility and allows the two constructs to be analyzed jointly.

More precisely, ENVI asks each income earner which housing-credit institution, if any, is available through the respondent's job; the response categories distinguish INFONAVIT, FOVISSSTE, another institution, no institution, and an unknown response. Our indicator equals one only for INFONAVIT or FOVISSSTE. ENIGH asks whether financing used to pay for, build, expand, or modify the dwelling came from INFONAVIT, FOVISSSTE, or FONHAPO; a bank, limited-purpose financial company, or savings fund;

another institution; family, friends, or a moneylender; or the household's own resources. We classify only the first category as realized public housing finance. Separately, ENIGH asks whether the household head has a written contract in the head's main job, which is the formality measure reported here. Thus the ENVI indicator is a current employment benefit, whereas the ENIGH indicator is a dwelling-level financing history that need not describe the head's current job.

The private-market contrast is mortgage lending by CNBV-regulated financial institutions, overwhelmingly commercial banks, with small shares from other regulated lenders. The CNBV records used later in the paper exclude INFONAVIT and FOVISSSTE issuers and report whether borrowers are salaried, but salaried status is not a direct measure of IMSS registration or legal formality. Accordingly, neither these records nor our survey definitions imply that eligibility for public job-linked credit precludes private borrowing: the two can coexist, but the available measures do not identify every household's full set of simultaneous borrowing options. The surveys also record own resources and financing from family, friends, moneylenders, and nonprofit organizations. We do not treat these informal or non-collateralized sources as credit access because the paper's definition concerns eligibility for, or realized use of, institutional housing finance.

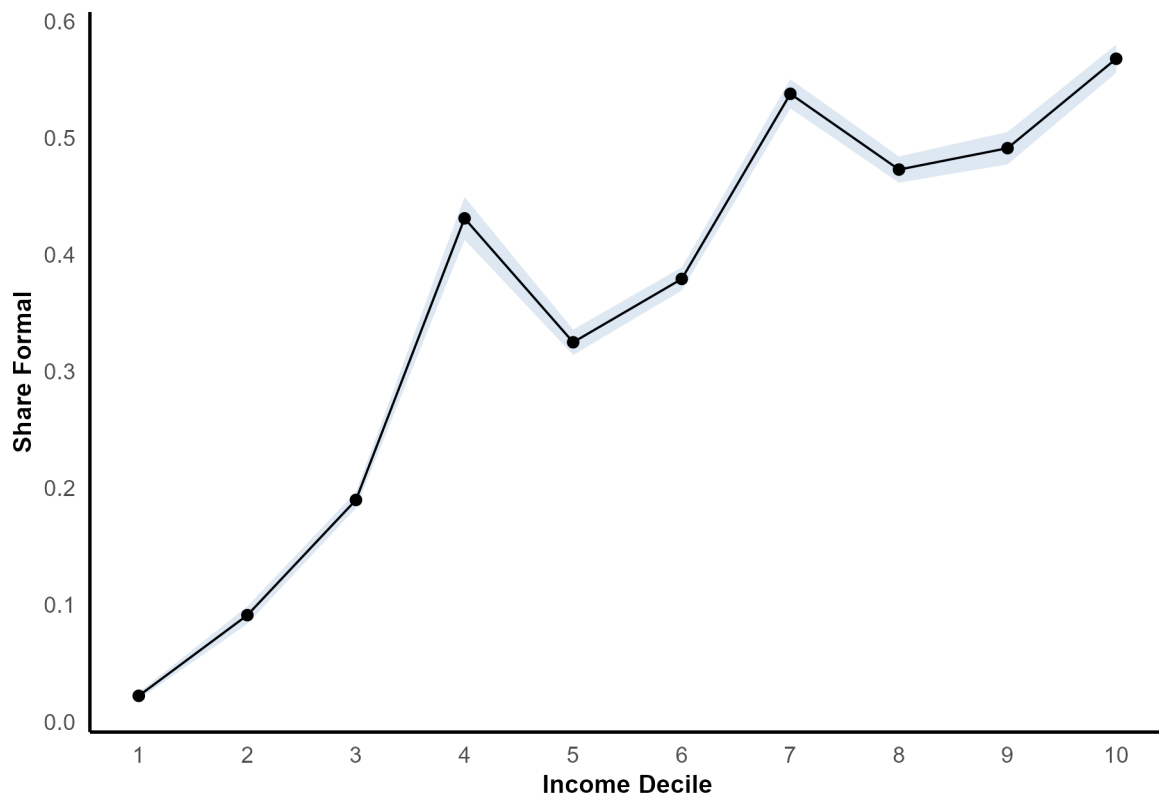
Table 2. Formality and Credit Access across Surveys

	ENVI 2020	ENIGH 2020	ENOE 2019
Formality share (%)	–	51.1	43.3
Credit-access share (%)	33.6	28.2	–

Notes: Survey-weighted shares. ENVI credit access denotes current job-based eligibility for INFONAVIT or FOVISSSTE. ENIGH credit access denotes realized public housing finance, and its formality measure uses the household head's written-contract status. ENOE formality uses social-security registration. A dash indicates that the survey does not measure the corresponding concept.

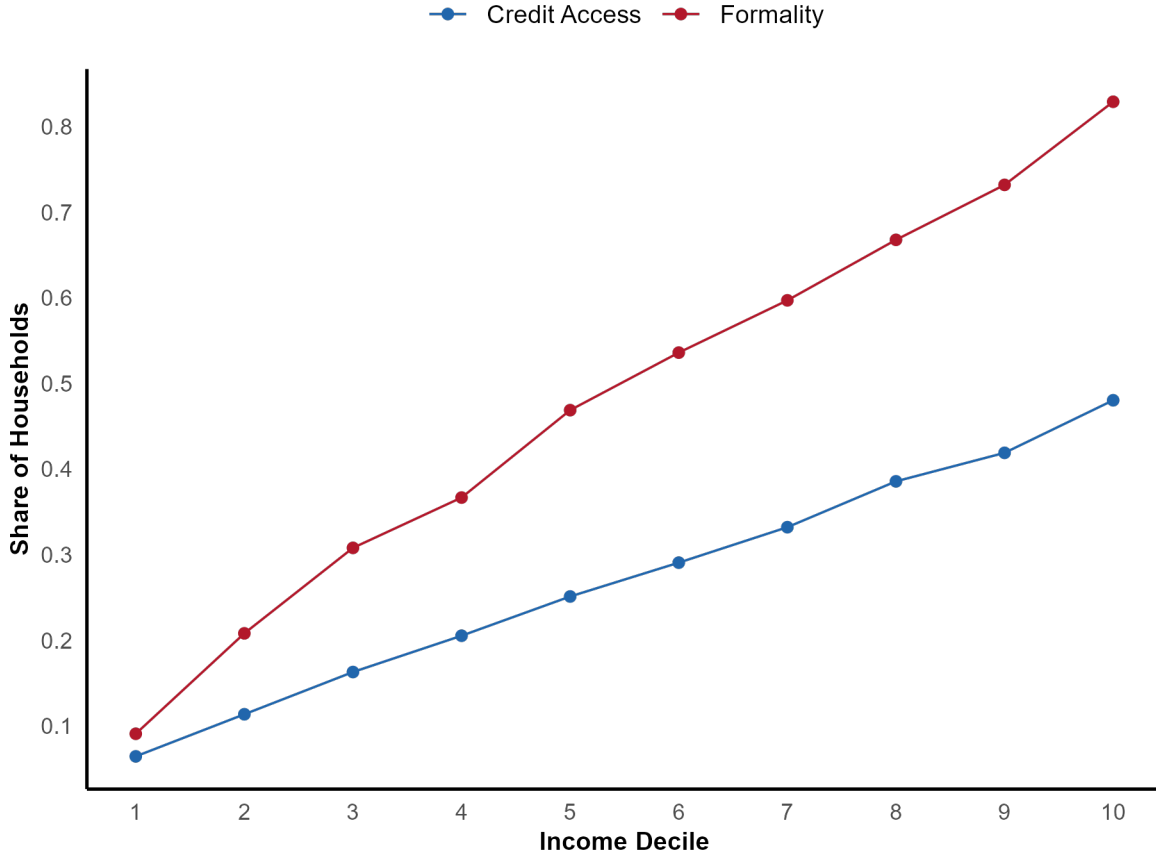
Table 2 shows that both formality and credit access are limited. Credit access covers roughly one-third of workers in ENVI and ENIGH, while the formality measures cover less than half of workers in ENOE and about half of household heads in ENIGH. Figures 1 and 2 show how these shares vary with income. Informality remains common even among high-income households, so formality is not simply another name for low current income.

Figure 1. Credit Access by Income Decile, ENVI



Notes: Source: 2020 ENVI, workers only, survey-weighted. Credit access denotes job-based eligibility for INFONAVIT or FOVISSSTE. The shaded band is a 95% confidence interval.

Figure 2. Formality and Credit Access by Income Decile, ENIGH



Notes: Source: 2020 ENIGH, survey-weighted. Formality denotes a written contract in the household head's main job. Credit access denotes realized financing through INFONAVIT, FOVISSSTE, or FONHAPO.

Measuring Housing Quality

Our primary outcome is imputed rental value rather than a household's self-reported dwelling value. Owner-reported values can differ systematically from subsequent sale prices, so their errors need not average out across the housing-value distribution [Goodman and Ittner \(1992\)](#); [Kiel and Zabel \(1999\)](#). Rents instead reveal market valuations of dwelling characteristics. Following the hedonic-pricing approach developed by [Rosen \(1974\)](#) and applied to housing by [Malpezzi \(2002\)](#); [Sheppard \(1999\)](#), among renter dwellings we estimate

$$\log(\text{rent}_d) = \gamma' X_d + \kappa' Z_d + \varepsilon_d, \quad (1)$$

where X_d contains dwelling characteristics and Z_d contains geographic controls, including urban status and state. We then apply the estimated coefficients to the characteristics of every dwelling. Applying rental equivalence to owners as well as renters is consistent with the use of imputed rent as a measure of housing

services and household welfare [Frick *et al.* \(2010\)](#). This procedure yields a market-weighted measure of housing quality.

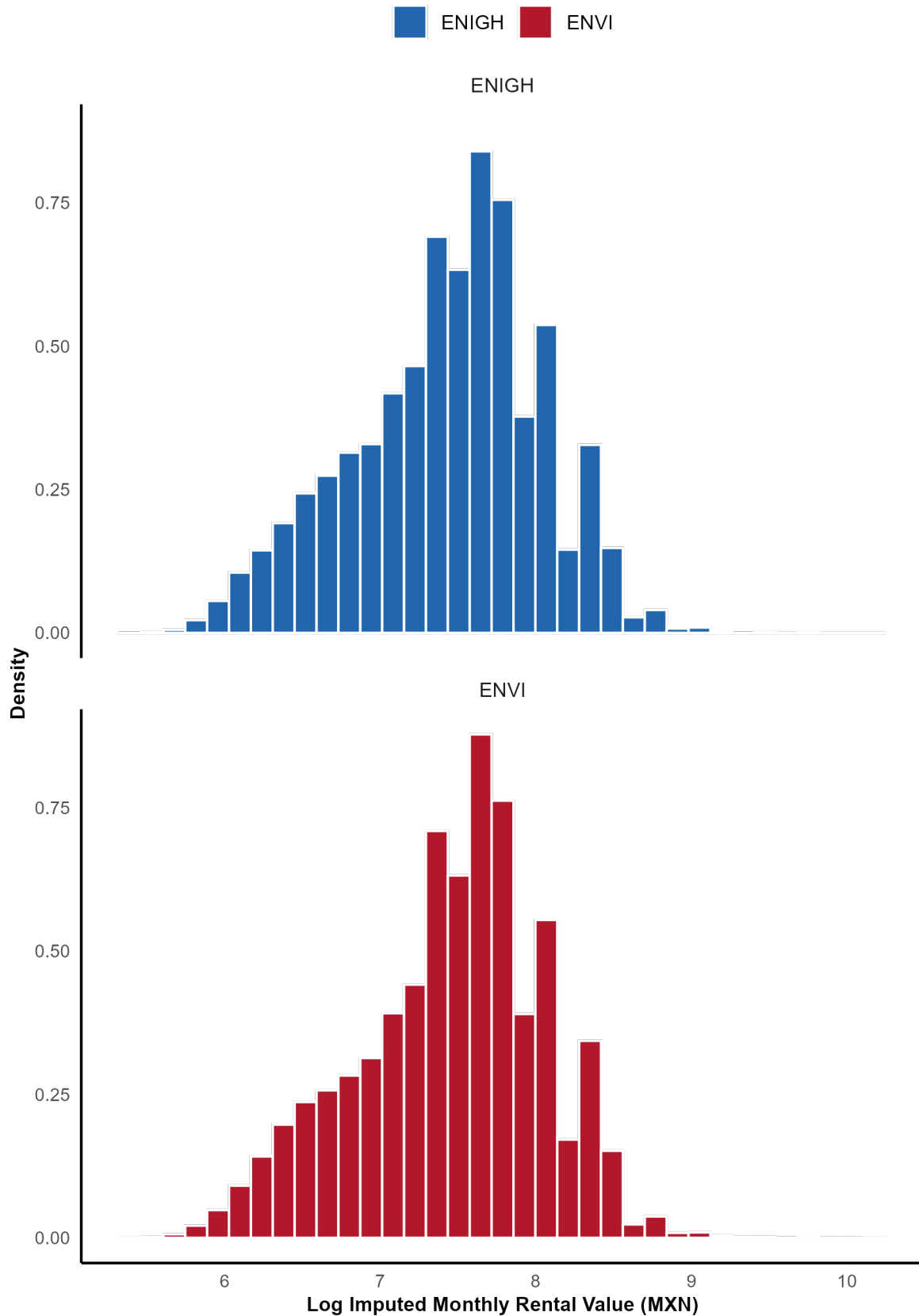
We estimate three versions of this hedonic regression: an ENVI-only specification, an ENIGH-only specification, and a pooled specification using characteristics common to both surveys. The pooled measure is our primary outcome and is called *Imputed Rent (Common)* throughout. Applying one valuation function in both surveys makes the resulting values directly comparable. We call the separate ENVI sale-price hedonic *Imputed Sale Value (ENVI)* and use it only as a robustness check.

Table 3. Housing Value Summary across Surveys

	ENVI 2020	ENIGH 2020
Number of characteristics asked	43	22
Dwelling value, self-reported (MXN)	874,198	–
Actual rent, renters (MXN)	2,856	2,703
Self-assessed rent, owners (MXN)	2,930	2,778
Imputed rent (MXN)	2,035	2,003
Imputed rent, common (MXN)	2,045	2,004
Bedrooms	2.13	2.09
Size (sq. m)	101.60	–
Family size	3.51	3.55

Notes: Survey-weighted summary statistics. Imputed rental values apply hedonic coefficients estimated among renters to the characteristics of all dwellings. Imputed Rent (Common) uses the pooled ENVI–ENIGH renter specification.

Figure 3. Distribution of Imputed Rental Value across Surveys



Notes: Sources: 2020 ENVI and 2020 ENIGH. The figure compares the distribution of log Imputed Rent (Common) across the two surveys.

Table 3 and Figure 3 show that the harmonized measure produces comparable levels and distributions across ENVI and ENIGH. The appendix reports four alternatives: equal-weighted and common-question equal-weighted indices, an American Housing Survey-weighted index, and a principal-component index. Because the equal-weighted indices contain different components across surveys, they are less directly comparable than Imputed Rent (Common). We next explain why formality and credit access can each predict this outcome before measuring their respective gaps.

2.2 Why Formality or Credit Access Could Predict Housing Quality

Improving a dwelling or purchasing a higher-quality home requires a lump-sum outlay that most households cannot finance from current income. Formality and credit access can affect this decision through separate channels. Formal employment provides a more stable income stream, reducing the risk of committing resources to an illiquid durable. Credit access through INFONAVIT or FOVISSSTE relaxes the financing constraint independently of that income-stability channel by allowing an eligible household to transfer resources across time.

The institutional connection between formality and public housing finance does not make the two channels identical. A worker could, in principle, move temporarily into formal employment to qualify for a loan and later return to informal work. If switching were immediate and costless, current formality and credit access need not remain correlated with housing quality.

In practice, switching is costly along three margins. Employers often determine whether a position is formal, so obtaining formal status may require changing jobs. INFONAVIT and FOVISSSTE eligibility also requires a contribution history that can range from six months to two years rather than current formal status alone. Finally, a borrower who moves back to informal employment retains the loan but loses the convenience of automatic payroll deductions. Table 4 confirms that previously financed dwellings among currently informal workers are a minority, regardless of the formality proxy used.

Table 4. Credit Access Conditional on Employment Formality, ENIGH

Formality Proxy	Share Formal (%)	Credit Access Formal (%)	Credit Access Informal (%)
Contract	51.1%	41.5%	12.7%
IMSS Benefit	44.2%	43.7%	15.1%
Housing Credit Benefit	40.7%	47.4%	13.0%

Notes: Source: 2020 ENIGH, survey-weighted. Credit access denotes realized public housing finance. The rows use a written contract, IMSS benefit coverage, and a job-based housing-credit benefit as alternative formality proxies.

These frictions preserve an empirical distinction between current formality and prior credit access.

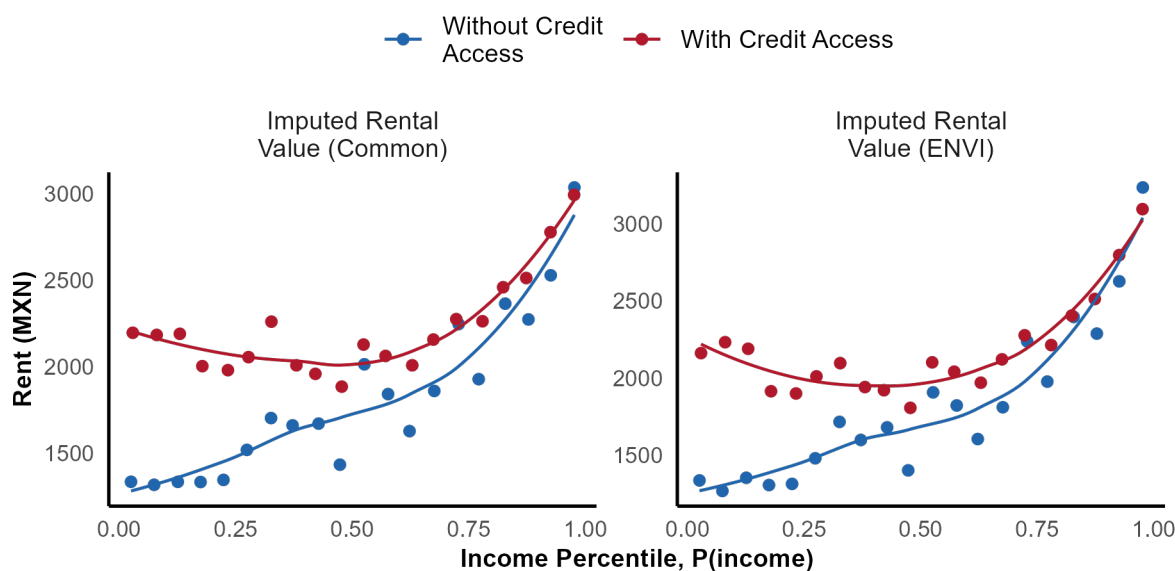
ENVI's eligibility measure cannot separate them, but ENIGH observes both. We use that distinction to ask whether housing quality varies with income stability and financing ability independently.

This descriptive framing leaves two distinct threats to a causal reading of what follows, not one. The first is selection on unobservables correlated with formality through the income-stability channel already described above: a stable, verifiable income stream lowering precautionary-saving needs is observationally equivalent to selection on an unobserved stability trait. Whether the link is causal or reflects a correlated trait, the paper is already naming and describing this channel rather than silently omitting it. The second threat is selection on housing-quality preference itself, independent of income stability – a household that simply values low-quality or more flexible housing regardless of formality, income risk, or financing access. No instrument or exclusion restriction available here separates this preference channel from the formality and credit-access channels, and a formal Roy-style selection model is out of scope for this paper. Because this second channel remains open, the formality and credit-access effects reported below – and Chapter 4's counterfactual demand response, which shares the same common-preference assumption across formality-income types – should be read as an upper bound on the response attributable to relaxing the financing constraint, net of preference heterogeneity uncorrelated with income stability.

2.3 The Housing Gap by Formality and Credit Access

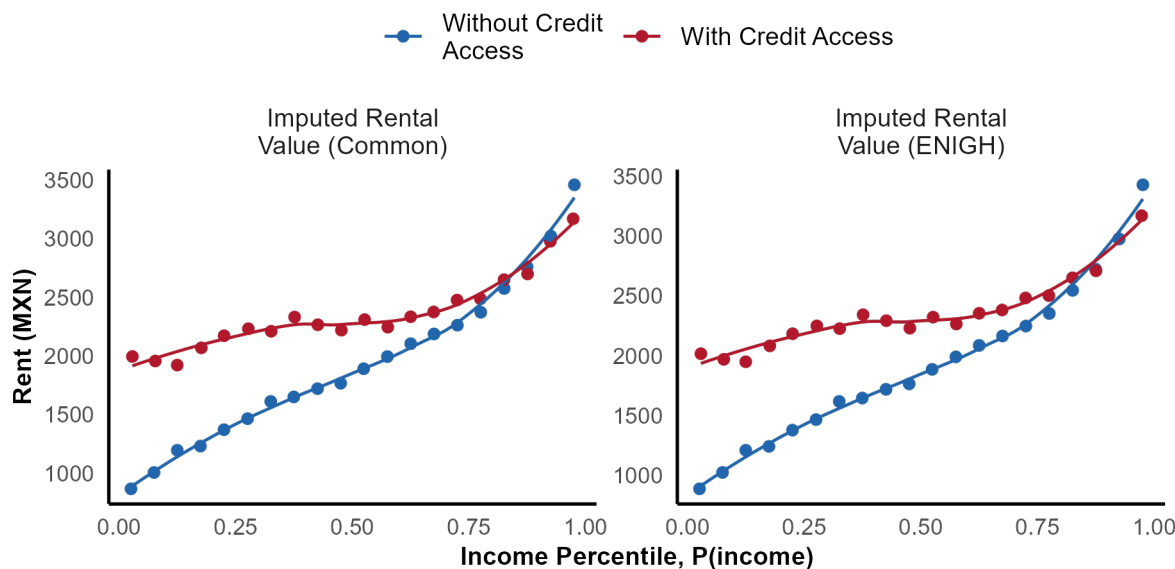
We begin with the raw pattern because the evidence in this section is descriptive rather than causal. Figures 4–6 show that imputed rental value rises with household income rank. In both surveys, households with credit access occupy higher-rent dwellings than households without access at a given rank; in ENIGH, formal workers also occupy higher-rent dwellings than informal workers. The gaps are widest at the bottom of the income distribution and narrow as income rises. These correlations discipline the model; Section 2.5 and Chapter 3 separately parameterize the income process and borrowing constraint to interpret them.

Figure 4. Imputed Rental Value by Income Percentile and Credit Access, ENVI



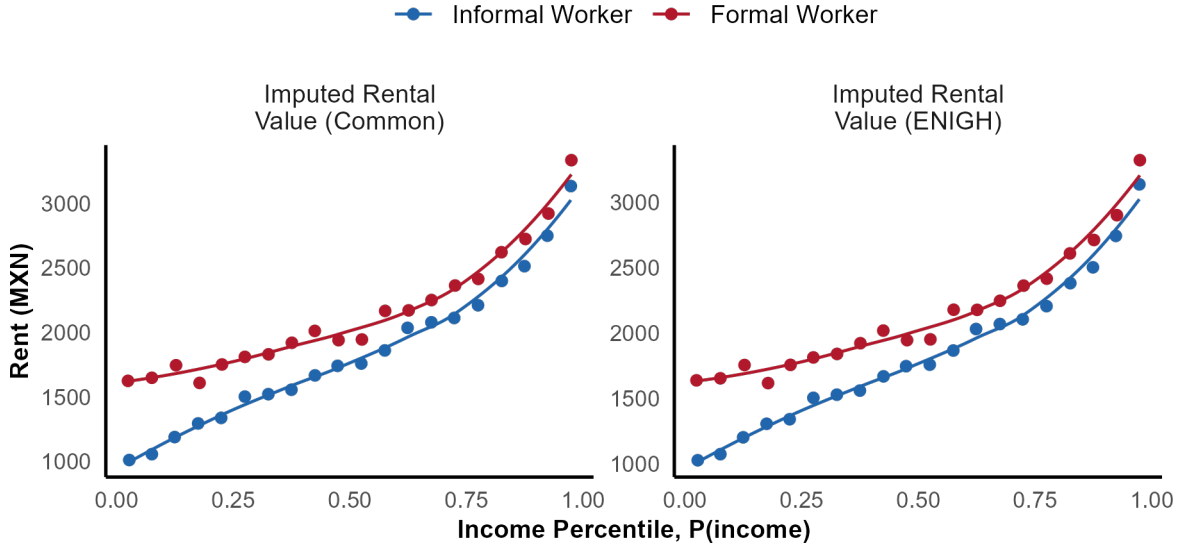
Notes: Source: 2020 ENVI, head-of-household sample. The figure plots Imputed Rent (Common) and Imputed Rent (ENVI) against the household's survey-weighted income percentile, separately by job-based eligibility for INFONAVIT or FOVISSSTE.

Figure 5. Imputed Rental Value by Income Percentile and Credit Access, ENIGH



Notes: Source: 2020 ENIGH. The figure plots Imputed Rent (Common) and Imputed Rent (ENIGH) against the household's survey-weighted income percentile, separately by realized public housing finance.

Figure 6. Imputed Rental Value by Income Percentile and Formality, ENIGH



Notes: Source: 2020 ENIGH. The figure plots Imputed Rent (Common) and Imputed Rent (ENIGH) against the household's survey-weighted income percentile, separately by the household head's written-contract status.

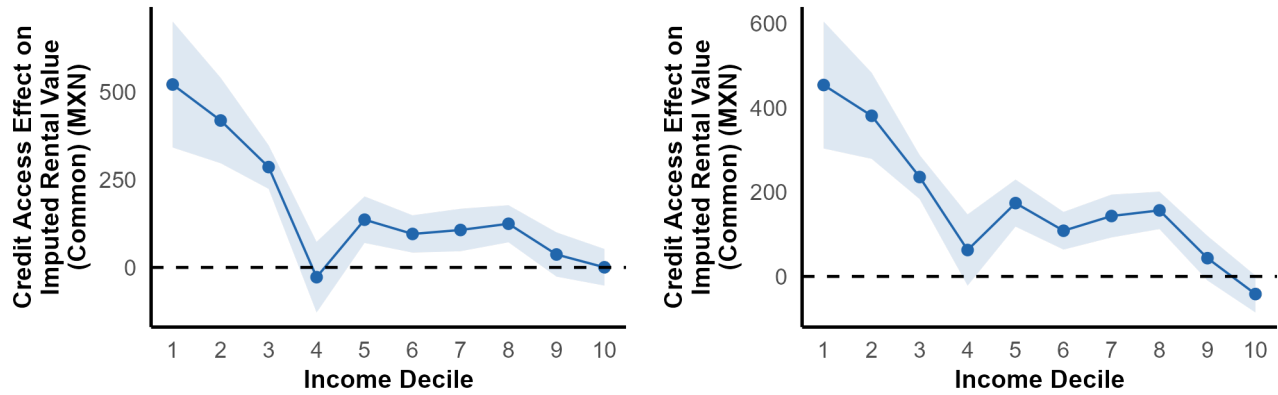
Income and the two labor-market characteristics can matter independently. Current income captures only part of lifetime resources. Formality also carries information about income stability, while credit access determines whether a household can finance a housing outlay. ENIGH separates these objects; ENVI's combined eligibility measure does not. We therefore estimate the decile-interaction specification

$$\begin{aligned} \log(\text{rent}_i) = & \sum_p \beta_{0p} \mathbb{1}\{i \in p\} + \sum_p \beta_{1p} \mathbb{1}\{i \in p\} \mathbb{1}\{\text{formal}_i\} \\ & + \sum_p \beta_{2p} \mathbb{1}\{i \in p\} \mathbb{1}\{\text{credit}_i\} + X'_i \delta + \alpha_{s(i)} + \varepsilon_i, \end{aligned} \quad (2)$$

where p indexes income deciles, X_i includes age, college education, and urban status, and $\alpha_{s(i)}$ denotes state fixed effects. ENIGH includes both interactions; ENVI includes only the credit-access interaction. Adding the human-capital controls leaves the formality and credit-access profiles close to their uncontrolled magnitudes, so age and education do not explain away the gap.

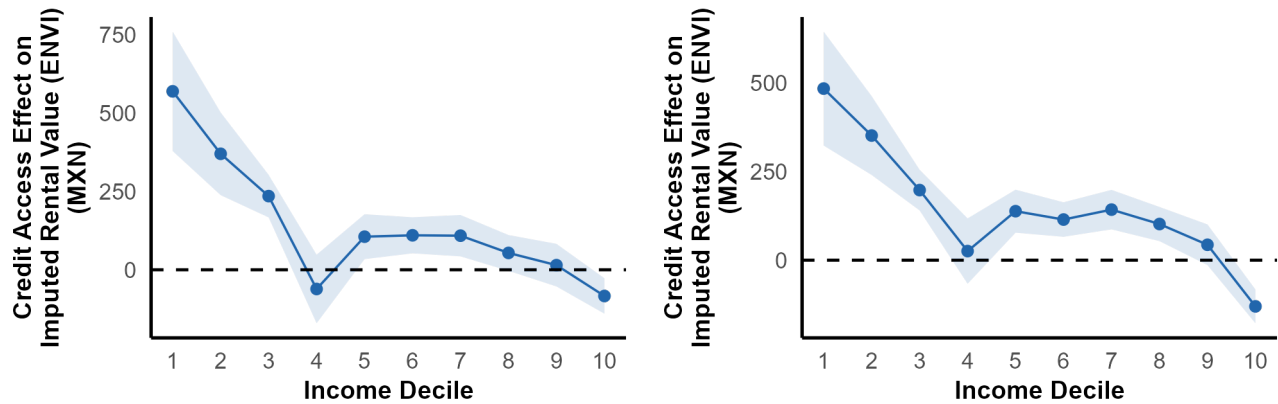
Figures 7–10 report the interaction coefficients with and without state fixed effects. In both surveys and under both rental-value measures, the credit-access coefficients are largest among low-income households and fall toward zero by approximately the seventh decile. The ENIGH figures also show that credit access has a larger marginal association than formality at the bottom of the distribution.

Figure 7. Credit-Access Gap in Imputed Rent (Common) by Income Decile, ENVI



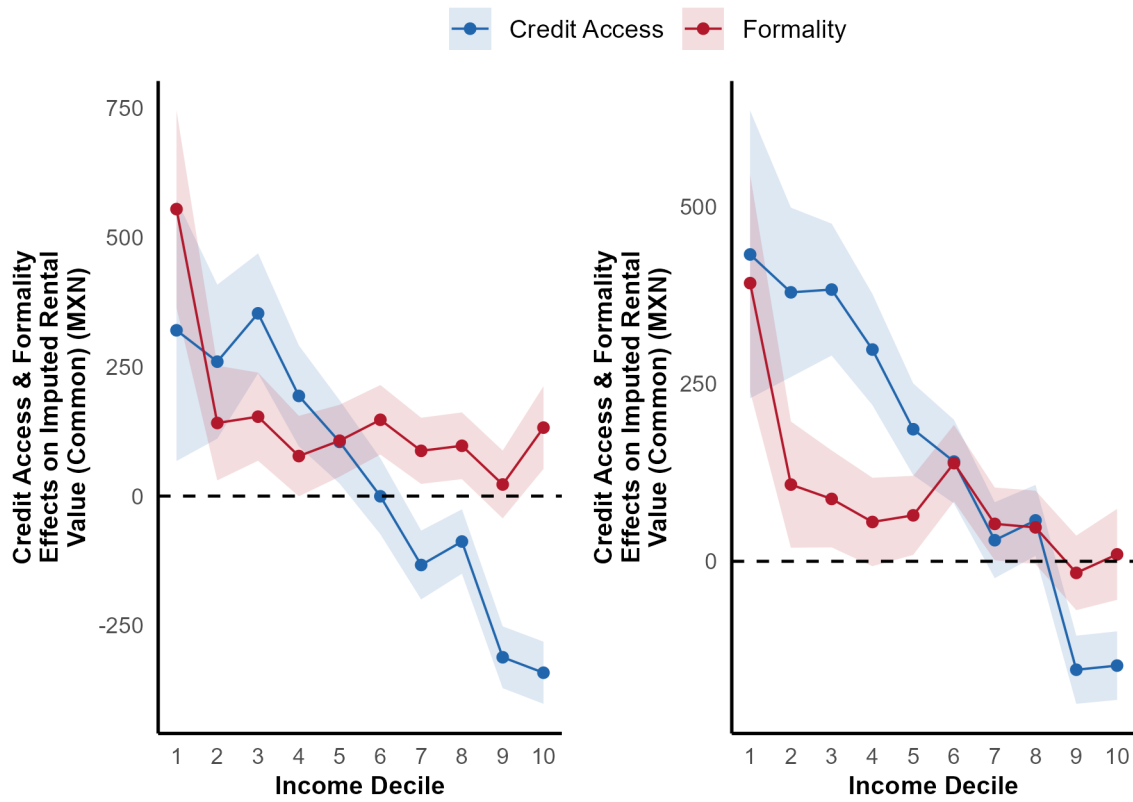
Notes: Source: 2020 ENVI. Points are decile-specific credit-access interaction coefficients; the right panel includes state fixed effects. Bars report 95% confidence intervals.

Figure 8. Credit-Access Gap in Imputed Rent (ENVI) by Income Decile



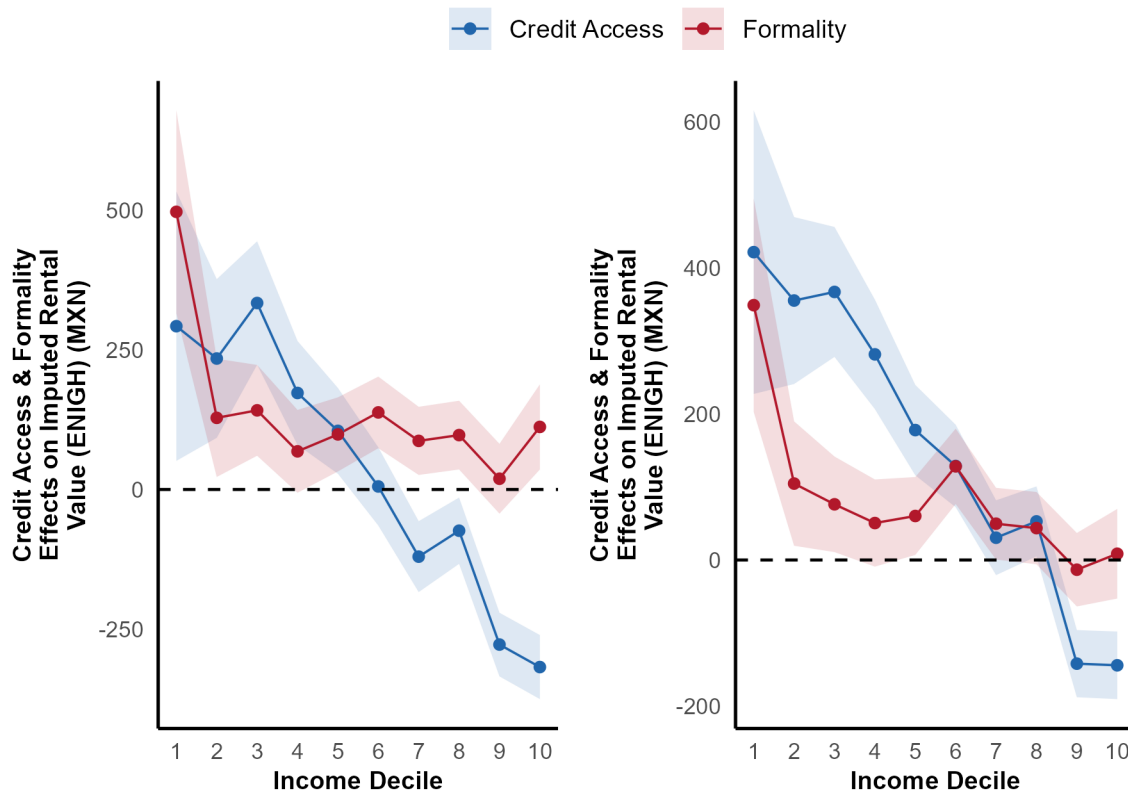
Notes: Source: 2020 ENVI. Points are decile-specific credit-access interaction coefficients; the right panel includes state fixed effects. Bars report 95% confidence intervals.

Figure 9. Credit-Access and Formality Gaps in Imputed Rent (Common) by Income Decile, ENIGH



Notes: Source: 2020 ENIGH. Points are decile-specific credit-access and formality interaction coefficients; the right panel includes state fixed effects. Bars report 95% confidence intervals.

Figure 10. Credit-Access and Formality Gaps in Imputed Rent (ENIGH) by Income Decile



Notes: Source: 2020 ENIGH. Points are decile-specific credit-access and formality interaction coefficients; the right panel includes state fixed effects. Bars report 95% confidence intervals.

The bottom decile clarifies why the formality coefficient is itself economically meaningful. Even among households without credit access, formal workers exhibit a large housing-value gap relative to informal workers. A stable, verifiable income stream reduces precautionary-saving needs and can raise durable housing consumption even when external finance remains unavailable. Credit access then produces an additional jump by relaxing the financing constraint. That both gaps are largest near the bottom and vanish around the seventh decile supports a binding-constraint interpretation: households farther from the constraint show little gap, unlike what a fixed compositional difference between formal and informal households would predict.

Table 5. Aggregate Rental-Value Gap by Income Decile

Survey/channel	Decile	Estimated log gap	Applied log gap	Excluded HH (millions)	Aggregate gap (MXN millions)	Excluded stock (%)	All stock (%)
ENVI – Credit access	1	0.357	0.357	2.24	1,264	42.8	40.9
	2	0.308	0.308	1.47	706	36.1	31.1
	3	0.178	0.178	2.65	782	19.4	14.6
	4	0.083	0.083	0.44	75	8.6	4.7
	5	0.148	0.148	1.39	340	16.0	10.0
	6	0.097	0.097	1.87	340	10.1	6.0
	7	0.086	0.000	1.01	0	0.0	0.0
	8	0.094	0.000	1.52	0	0.0	0.0
	9	0.020	0.000	1.02	0	0.0	0.0
	10	-0.007	0.000	1.27	0	0.0	0.0
ENIGH – Credit access	1	0.466	0.466	2.08	1,157	59.4	29.5
	2	0.368	0.368	1.98	1,066	44.4	21.9
	3	0.311	0.311	1.85	956	36.5	17.0
	4	0.233	0.233	1.81	774	26.3	12.3
	5	0.163	0.163	1.78	548	17.7	8.2
	6	0.127	0.127	1.75	460	13.5	6.4
	7	0.054	0.000	1.75	0	0.0	0.0
	8	0.051	0.000	1.73	0	0.0	0.0
	9	-0.044	0.000	1.81	0	0.0	0.0
	10	-0.042	0.000	1.99	0	0.0	0.0
ENIGH – Formality	1	0.274	0.274	0.99	322	31.5	8.2
	2	0.108	0.108	1.22	172	11.4	3.5
	3	0.081	0.081	1.21	146	8.5	2.6
	4	0.066	0.066	1.17	122	6.8	1.9
	5	0.060	0.060	1.05	111	6.2	1.7
	6	0.081	0.081	0.95	146	8.5	2.0
	7	0.064	0.000	0.83	0	0.0	0.0
	8	0.037	0.000	0.69	0	0.0	0.0
	9	0.019	0.000	0.57	0	0.0	0.0
	10	0.008	0.000	0.33	0	0.0	0.0
<i>Aggregate totals</i>							
ENVI – Credit access	–	–	–	14.87	3,507	13.3	7.8
ENIGH – Credit access	–	–	–	18.52	4,961	14.0	6.9
ENIGH – Formality	–	–	–	9.00	1,020	6.8	1.4

Notes: Estimated log gaps are the decile-specific regression coefficients. Applied gaps set deciles 7–10 to zero. Excluded households are survey expansion-weighted counts. Aggregate gaps are monthly MXN rental-value equivalents under a partial-equilibrium calculation that holds prices, supply, and dwelling characteristics fixed. The final columns scale the gap by the excluded group's housing stock and by the full housing stock.

Table 5 translates these household-level gaps into rental-value terms by weighting the decile-specific coefficients by the survey-weighted population without formality or credit access. It provides the paper's first quantitative anchor for weak aggregate housing demand: exclusion is sufficiently widespread that the associated household gaps cumulate to a meaningful share of the housing market. This calculation

is explicitly partial-equilibrium. It holds prices, housing supply, and dwelling characteristics fixed and therefore differs from Chapter 4, where the structural counterfactual allows household choices and market outcomes to respond. The next section documents how households use housing loans, linking the observed financing gap to the margin of housing investment.

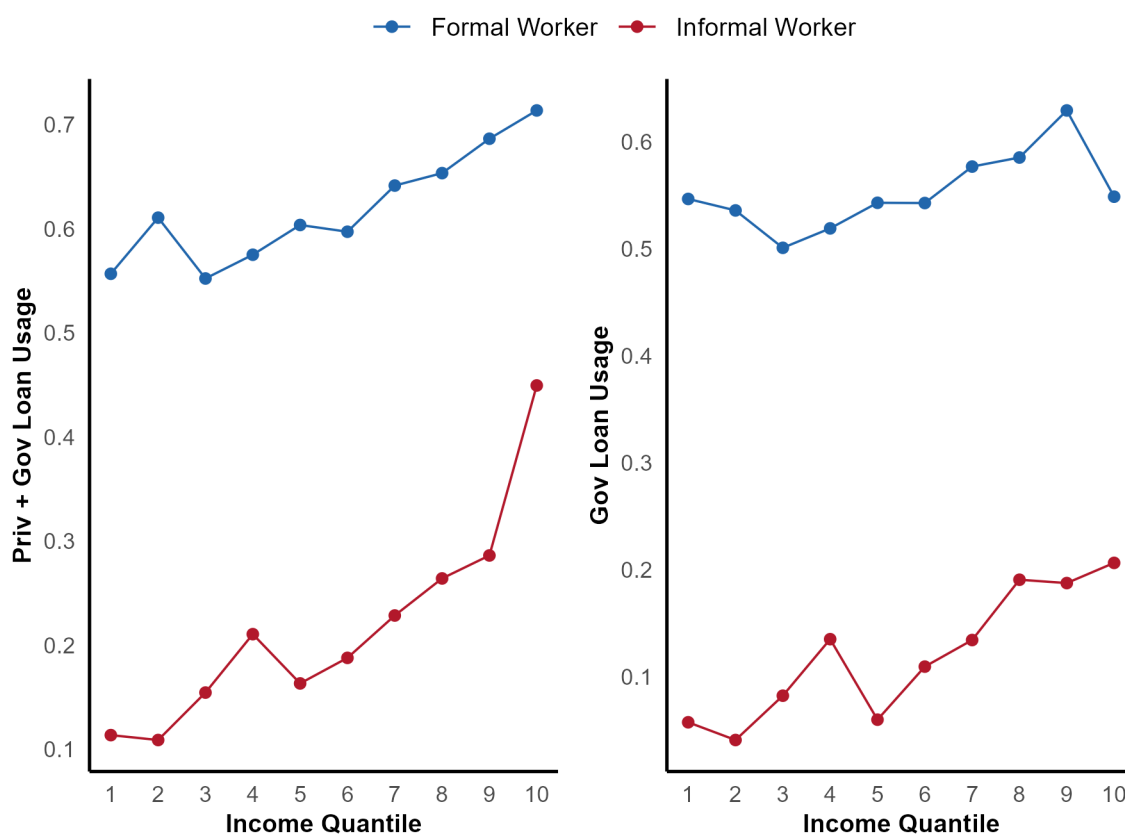
2.4 How Are Loans Used?

Institutional changes that relax constraints on housing investment can improve dwellings through several distinct channels. Titling programs raise home improvement by strengthening tenure security [Field \(2005\)](#); notably, [Galiani and Schargrodsky \(2010\)](#) find greater housing investment after land titling while explicitly ruling out improved credit access as the operative channel in their setting. Other interventions demonstrate both the welfare stakes of small-scale improvements and the role of collateral: Mexico's Piso Firme program improves health and well-being by replacing dirt floors [Cattaneo *et al.* \(2009\)](#), while street paving raises housing values, home improvement, durable purchases, and collateral-based borrowing [Gonzalez-Navarro and Quintana-Domeque \(2016\)](#). Our setting isolates a different institutional margin. We study credit access gated by formal-employment status rather than tenure security or an increase in collateral value, and ask whether households use that access to improve an existing dwelling or acquire another one.

Section 2.3 establishes that credit access predicts housing quality. We now ask what that access finances. Housing loans can support quality accumulation through two distinct choices: households can improve the dwelling they already occupy or acquire another home. The evidence shows that the relative importance of these choices changes sharply with income. Low-income borrowers predominantly use loans to remodel, whereas high-income borrowers predominantly use them to acquire homes.

We begin with households' cumulative loan-use histories in the ENVI. Figure 11 compares the share of households that have ever used any housing loan and the share that have ever used a government housing loan, by income decile and credit access. Credit-access households are much more likely to have used a housing loan at every income decile. At the bottom of the income distribution, their loan-use rate is roughly three to five times that of households without access; even at the top, it remains about one-and-a-half times as high. The government-loan series displays the same pattern, consistent with INFONAVIT and FOVISSSTE eligibility accounting for an important part of the cumulative access gap.

Figure 11. Housing loan use by income and credit access



Notes: Source: 2020 ENVI. The left panel reports the share of households that have ever used a housing loan from any source; the right panel reports the share that have ever used a government housing loan. Credit access is defined as INFONAVIT or FOVISSSTE eligibility.

Loan-level originations from the CNBV clarify what these loans finance. Table 6 shows that remodeling and acquisition loans are comparable in frequency: remodeling accounts for 52.2% of originations and acquisition for 47.8%. Remodeling is therefore not a residual use of housing credit. Yet Table 7 shows that the two loan types differ dramatically in size. Acquisition accounts for 96.0% of originated value; the mean acquisition loan is 1,748,419 MXN, compared with 67,375 MXN for remodeling. Remodeling loans are common in count but small in value, while fewer, much larger acquisition loans dominate aggregate lending volume.

Table 6. CNBV loan originations by usage

Loan Usage	Share (%)	N
Remodelling	52.2%	592,436
Home Acquisition	47.8%	541,487

Notes: Source: CNBV loan-level microdata. Shares are calculated over loans classified as remodeling or home acquisition.

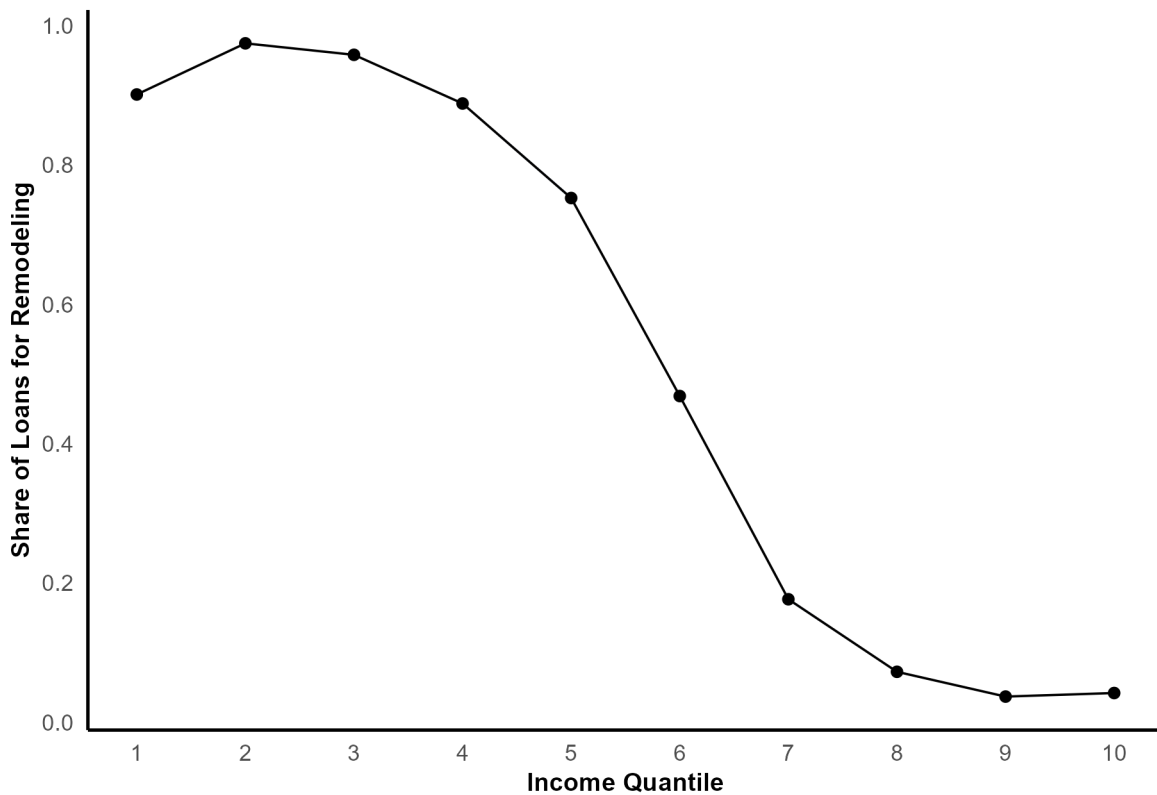
Table 7. CNBV loan amounts by usage

Loan Usage	Mean Amount (MXN)	Median Amount (MXN)	Total Amount (MXN)	Share of Total Value (%)	N
Home Acquisition	1,748,419	1,317,500	946,746,315,076	96.0%	541,487
Remodelling	67,375	31,298	39,915,145,397	4.0%	592,436

Notes: Source: CNBV loan-level microdata. Amounts are in Mexican pesos; total-value shares are calculated over loans classified as remodeling or home acquisition.

The count–value contrast reflects a pronounced income gradient in loan use. Figure 12 plots the remodeling and acquisition shares by borrower income decile. Remodeling represents roughly 90–98% of loans in the bottom three deciles, but only about 4–7% in the top three. Read together with the ENVI evidence, this pattern shows that low-income households who obtain credit overwhelmingly use it to improve an existing home, whereas higher-income households primarily use credit to acquire one.

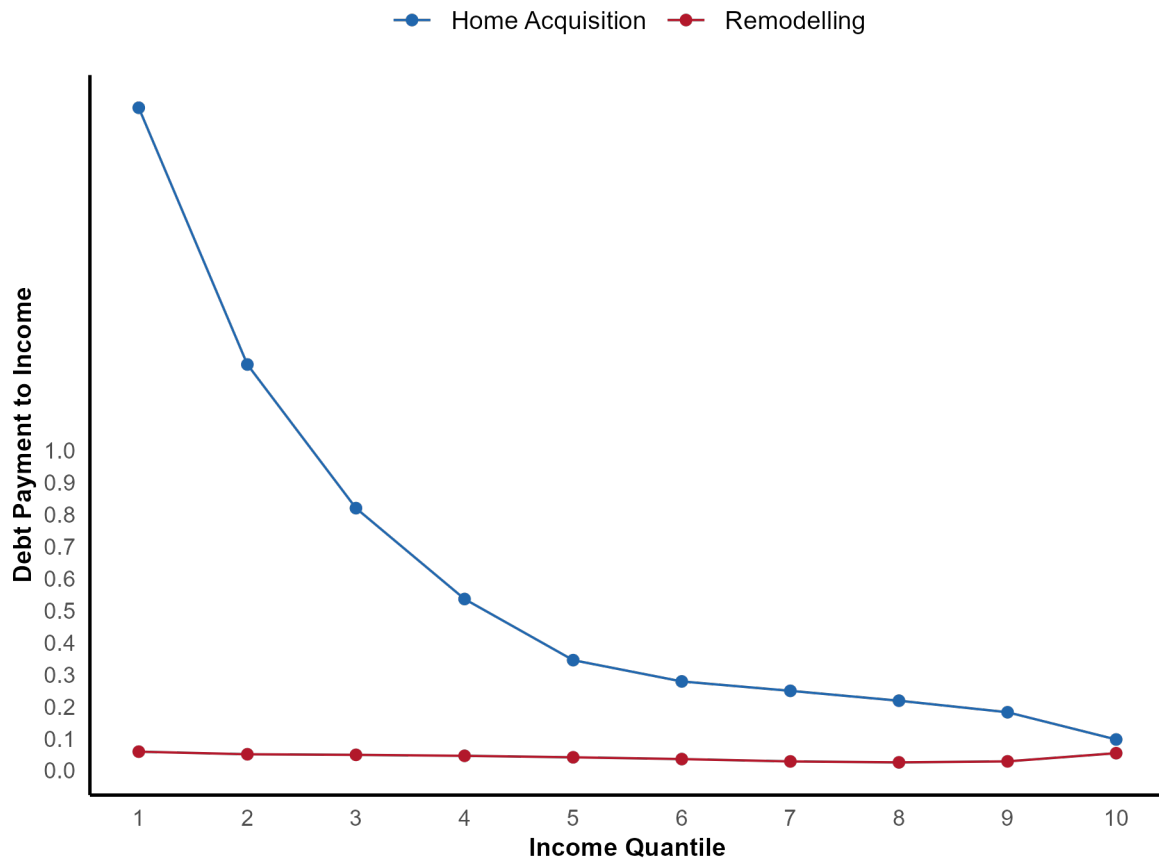
Figure 12. Housing loan usage by income decile



Notes: Source: CNBV loan-level microdata. Bars report the share of loans classified as remodeling or home acquisition within each borrower-income decile.

The distinction also appears in borrowers' financing burdens. Figure 13 reports debt-to-income ratios by income decile and loan use. Remodeling loans have a low, nearly flat debt-to-income ratio; their mean and median are both approximately 0.05. Acquisition loans instead require financing on the scale of the dwelling: their mean loan-to-value ratio is 0.71 and their median is 0.76, as reported in Table 8. At low incomes, acquisition-loan debt is near or above annual income, while its relative burden declines with income. Thus, the remodeling and acquisition margins differ not only in who uses them but also in the constraint they place on households. Section 2.5 formalizes this distinction through an income-based borrowing limit for improving the current dwelling and a collateral-based limit for purchasing another home.

Figure 13. Debt-to-income ratios by income decile and loan usage



Notes: Source: CNBV loan-level microdata. The figure reports average debt-to-income ratios by borrower-income decile and loan usage. Debt-to-income is the loan amount divided by annual borrower income.

Table 8. Summary statistics for CNBV housing loans

	Mean	Std. Dev.	Median	Min	Max
Loan Amount (MXN)	870,131	1,536,018	103,403	2,962	148,000,000
Home Value (MXN)	1,270,258	2,774,028	111,830	2	1,289,838,665
Monthly Income (MXN)	137,217	7,531,002	17,415	1	2,014,557,789
Age	39.89	10.17	38.00	18.00	82.00
Interest Rate (%)	12.96	3.66	13.10	0.00	1,430.00
DTI (Pooled)	0.16	0.36	0.06	0.00	47.14
DTI (Remodeling Loans Only)	0.05	0.05	0.05	0.00	14.02
LTV (Pooled)	0.86	0.20	1.00	0.00	8.04
LTV (Purchase Loans Only)	0.71	0.20	0.76	0.00	8.04

Notes: Source: CNBV loan-level microdata. DTI denotes the loan amount divided by annual borrower income; LTV denotes the loan amount divided by home value.

2.5 Simple Model

Section 2.3 shows that housing value rises with income and with credit access, and that the credit-access gap is largest at low income and narrows toward zero by roughly the seventh decile. This section builds a simple discrete-choice consumption-savings model to account for that pattern qualitatively: households consider whether to accumulate more housing wealth given their income and the borrowing constraint they face. We build the model up in two stages. A two-tier version first isolates the remodeling margin, in which households choose between keeping their existing low-quality home and remodeling it into a mid-quality one, financed by a debt-to-income (DTI) constraint. A three-tier extension then adds the option to sell and purchase a high-quality home, financed separately by a loan-to-value (LTV) constraint, matching the two financing margins documented in Section 2.4.

Two-Tier Housing Choice

At the start of period 1, households own a low-quality house h^L and choose whether to (i) keep h^L or (ii) remodel and upgrade to a mid-quality house h^M . The mid-quality house yields higher utility and can be financed. The prices of the two houses, p^L and $p^M > p^L$, are exogenous. Households hold a single credit-access parameter θ , described below.

The housing choice is discrete but not deterministic: each tier $i \in \{L, M\}$ carries an i.i.d. taste shock ν^i

drawn from a Type-I extreme value distribution with common shape parameter σ , so that

$$V(y, \theta) = \max\{V^L(y, \theta) + \nu^L, V^M(y, \theta) + \nu^M\}. \quad (3)$$

The taste shock smooths the household's choice into a selection probability rather than a deterministic cutoff in (y, θ) : the probability of upgrading to h^M is the binary logit

$$P^M(y, \theta) = \frac{\exp(V^M(y, \theta)/\sigma)}{\exp(V^L(y, \theta)/\sigma) + \exp(V^M(y, \theta)/\sigma)} = \frac{1}{1 + \exp((V^L(y, \theta) - V^M(y, \theta))/\sigma)}. \quad (4)$$

Conditional on the tier choice $i \in \{L, M\}$, the household solves a two-period consumption-savings problem,

$$\begin{aligned} V^i(y, \theta) = \max_{c_1, c_2, a} \quad & \log(c_1) + \beta \log(c_2) + \psi \log(h^i) \\ \text{s.t.} \quad & c_1 + a + p(h^i) = y + p(h^L) \\ & c_2 = y + (1 + r) a \\ & a \geq -B(h^i, y, \theta), \end{aligned}$$

where c_j is consumption in period j , a is savings, β is the discount factor, and ψ is the marginal utility of housing. We assume $\beta(1 + r) = 1$ throughout. $B(h^i, y, \theta)$ is the borrowing constraint. Households who keep h^L need no financing at all, while households who remodel to h^M borrow against their income under a DTI constraint:

$$B(h^L, y, \theta) = 0, \quad (5)$$

$$B(h^M, y, \theta) = \theta y / (1 + r). \quad (6)$$

Because income is constant across the two periods, a household remodeling to h^M optimally borrows against its future income to smooth consumption around the one-time cost of the upgrade. The optimal borrowing conditional on choosing M is

$$a^M(y, \theta) = \begin{cases} -\theta y / (1 + r) & \text{if } \theta \leq \bar{\theta} \\ -\frac{\beta}{1 + \beta} (p^M - p^L) & \text{otherwise,} \end{cases} \quad (7)$$

where $\bar{\theta} = \frac{p^M - p^L}{(1 + \beta)y}$ is the credit-access level at which the DTI constraint stops binding. This gives the value

functions

$$V^L(y, \theta) = (1 + \beta) \log(y) + \psi \log(h^L), \quad (8)$$

$$V^M(y, \theta) = \begin{cases} \log(y + p^L - p^M + \theta\beta y) + \beta \log((1 - \theta)y) + \psi \log(h^M) & \text{if } \theta \leq \bar{\theta} \\ (1 + \beta) \log\left(y - \frac{p^M - p^L}{1 + \beta}\right) + \psi \log(h^M) & \text{otherwise.} \end{cases} \quad (9)$$

How does income and credit access shape the remodeling decision? The following proposition answers this while the DTI constraint binds.

Proposition 1 (Comparative statics, L vs. M) *While the borrowing constraint binds, i.e. $\bar{\theta} > \theta \geq 0$, the selection probability satisfies*

(i) $\partial P^M(y, \theta) / \partial y > 0$ for every (y, θ) .

(ii) $\partial P^M(y, \theta) / \partial \theta > 0$ for every (y, θ) .

(iii) At $\theta = 0$, $\partial P^M(y, \theta) / \partial \theta \rightarrow 0$ as $y \rightarrow \infty$.

Proof. Since $P^M(y, \theta) = [1 + \exp((V^L(y, \theta) - V^M(y, \theta)) / \sigma)]^{-1}$, for any parameter $z \in \{y, \theta\}$ the chain rule gives

$$\frac{\partial P^M}{\partial z} = \frac{P^M(1 - P^M)}{\sigma} \left[\frac{\partial V^M}{\partial z} - \frac{\partial V^L}{\partial z} \right],$$

and since $P^M(1 - P^M) / \sigma > 0$ always, it suffices to sign the bracketed term.

For (i): in the constrained region ($\theta \leq \bar{\theta}$),

$$\frac{\partial V^M}{\partial y} - \frac{\partial V^L}{\partial y} = \frac{1 + \theta\beta}{y + p^L - p^M + \theta\beta y} - \frac{1}{y} > 0,$$

using $p^M > p^L$. In the unconstrained region ($\theta > \bar{\theta}$),

$$\frac{\partial V^M}{\partial y} - \frac{\partial V^L}{\partial y} = (1 + \beta) \left[\frac{1}{y - \frac{p^M - p^L}{1 + \beta}} - \frac{1}{y} \right] > 0$$

again since $p^M > p^L$. Both branches positive gives (i).

For (ii): differentiating $V^M(y, \theta) = \log(y + p^L - p^M + \theta\beta y) + \beta \log((1 - \theta)y) + \psi \log(h^M)$ with respect to θ ,

$$\frac{\partial V^M(y, \theta)}{\partial \theta} = \frac{\beta y}{y + \theta\beta y + p^L - p^M} - \frac{\beta}{1 - \theta}.$$

Since $\bar{\theta} > \theta$, $p^L - p^M < -\theta(1 + \beta)y$, so

$$\frac{\beta y}{y + \theta\beta y + p^L - p^M} > \frac{\beta y}{y + \theta\beta y - \theta(1 + \beta)y} = \frac{\beta}{1 - \theta},$$

hence $\partial V^M(y, \theta)/\partial\theta > 0$, giving (ii).

For (iii): at $\theta = 0$, $\bar{\theta} = (p^M - p^L)/((1 + \beta)y) > 0$ for every finite y , so the maintained hypothesis holds along the whole path $y \rightarrow \infty$. From (ii)'s formula at $\theta = 0$,

$$\left. \frac{\partial V^M(y, \theta)}{\partial\theta} \right|_{\theta=0} = \frac{\beta(p^M - p^L)}{y - (p^M - p^L)} \xrightarrow{y \rightarrow \infty} 0.$$

Since V^L does not depend on θ and $P^M(1 - P^M)/\sigma$ is bounded, $\partial P^M(y, \theta)/\partial\theta|_{\theta=0} \rightarrow 0$ as $y \rightarrow \infty$. ■

The DTI constraint is not the only way to finance the remodeling margin; Appendix A states and proves the analogous proposition for a two-tier problem in which h^M is instead financed by an LTV constraint, confirming the qualitative result does not depend on which constraint type governs the margin.

Parts (i) and (ii) say that a household is more likely to remodel the higher its income and the more credit it can access, as long as the DTI constraint still binds. Part (iii) says that this second effect fades out: the marginal value of an additional unit of credit access vanishes as income grows without bound at $\theta = 0$, because a sufficiently high-income household can eventually self-finance the remodel regardless of how tight credit access is. This is the model's account of Section 2.3's empirical pattern: a credit-access effect on housing quality concentrated among low-income households and close to zero by roughly the seventh income decile. Households far enough above the constraint are unaffected by how much credit is available, exactly as the constraint stops binding in the proposition above.

Three-Tier Housing Choice

The two-tier model isolates the remodeling margin, but Section 2.4's loan-level evidence shows the financing constraint also governs a second, distinct margin: buying into a higher-quality tier outright, typically financed by a separate collateral-based loan rather than an income-based one. We extend the model with a high-quality house h^H , priced above h^M and yielding higher utility ($p^H > p^M > p^L$, $h^H > h^M > h^L$), financed by an LTV constraint on top of the DTI-financed h^M . Households now hold two credit-access parameters, $\Theta \equiv (\theta^{DTI}, \theta^{LTV})$, one per constraint, replacing the single θ of the two-tier stage.

Considering the housing choice $i \in \{L, M, H\}$, the value function and selection probabilities generalize

directly to the three-way case,

$$V(y, \Theta) = \max\{V^L(y, \Theta) + \nu^L, V^M(y, \Theta) + \nu^M, V^H(y, \Theta) + \nu^H\}, \quad (10)$$

$$P^i(y, \Theta) = \frac{\exp(V^i(y, \Theta)/\sigma)}{\sum_{j \in \{L, M, H\}} \exp(V^j(y, \Theta)/\sigma)}, \quad i \in \{L, M, H\}, \quad (11)$$

with (ν^L, ν^M, ν^H) i.i.d. Type-I extreme value shocks with the same shape parameter σ as before; the two-tier binary logit above is the special case restricted to $\{L, M\}$. Conditional on the tier choice, the consumption-savings problem is unchanged in form,

$$\begin{aligned} V^i(y, \Theta) = \max_{c_1, c_2, a} \quad & \log(c_1) + \beta \log(c_2) + \psi \log(h^i) \\ \text{s.t.} \quad & c_1 + a + p(h^i) = y + p(h^L) \\ & c_2 = y + (1 + r) a \\ & a \geq -B(h^i, y, \Theta), \end{aligned}$$

but the borrowing constraint is now tier-specific:

$$B(h^L, y, \Theta) = 0, \quad (12)$$

$$B(h^M, y, \Theta) = \theta^{DTI} y / (1 + r), \quad (13)$$

$$B(h^H, y, \Theta) = \theta^{LTV} p^H. \quad (14)$$

Keeping h^L still requires no financing, remodeling to h^M is DTI-constrained exactly as in the two-tier problem, and buying h^H is LTV-constrained in the same way as the appendix's LTV variant of the two-tier problem, with p^M replaced by p^H . As a result, $V^L(y, \Theta)$ does not depend on Θ at all, $V^M(y, \Theta)$ depends only on θ^{DTI} , and $V^H(y, \Theta)$ depends only on θ^{LTV} : each is literally the two-tier value function derived for its own constraint,

$$V^L(y, \Theta) = (1 + \beta) \log(y) + \psi \log(h^L), \quad (15)$$

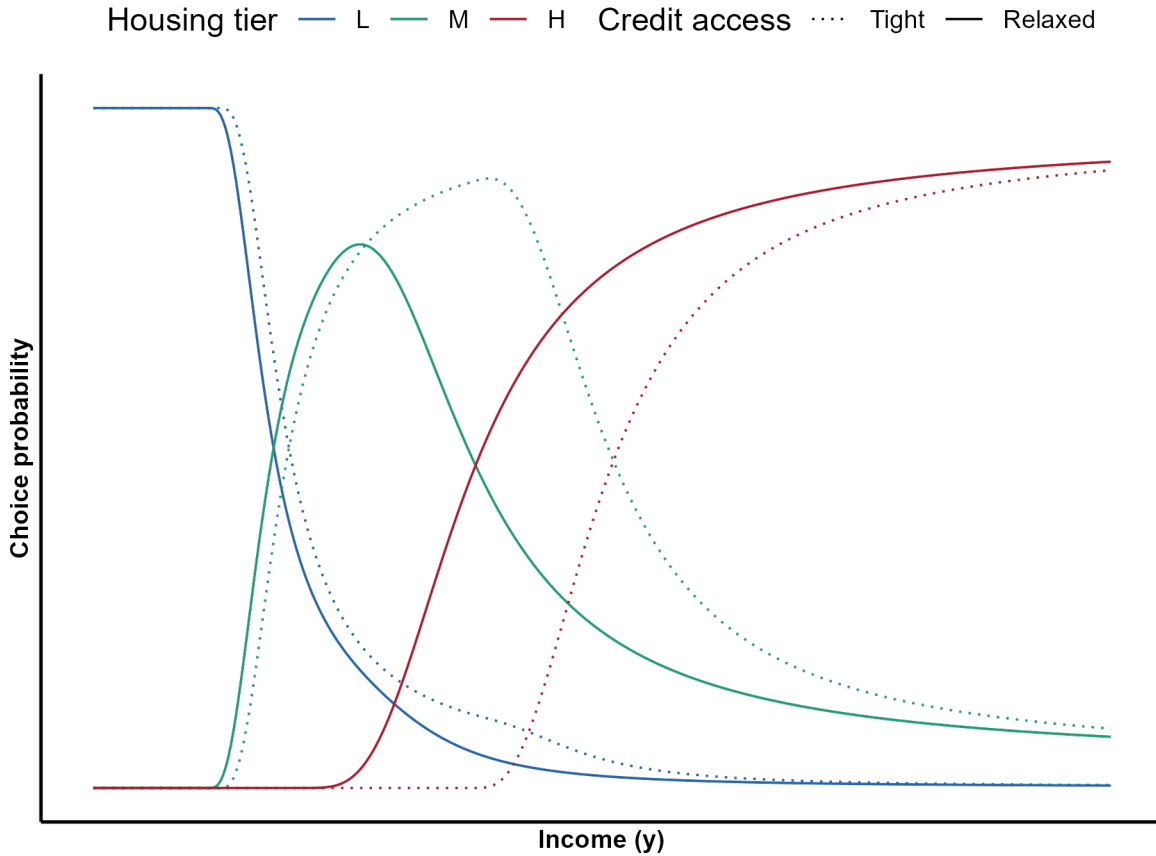
$$V^M(y, \Theta) = \begin{cases} \log(y + p^L - p^M + \theta^{DTI} \beta y) + \beta \log((1 - \theta^{DTI})y) + \psi \log(h^M) & \theta^{DTI} \leq \bar{\theta}^{DTI} \\ (1 + \beta) \log\left(y - \frac{p^M - p^L}{1 + \beta}\right) + \psi \log(h^M) & \text{otherwise,} \end{cases} \quad (16)$$

$$V^H(y, \Theta) = \begin{cases} \log(y + p^L - p^H + \theta^{LTV} p^H) + \beta \log\left(y - \frac{\theta^{LTV} p^H}{\beta}\right) + \psi \log(h^H) & \theta^{LTV} \leq \bar{\theta}^{LTV} \\ (1 + \beta) \log\left(y - \frac{p^H - p^L}{1 + \beta}\right) + \psi \log(h^H) & \text{otherwise,} \end{cases} \quad (17)$$

where $\bar{\theta}^{DTI} = (p^M - p^L)/((1 + \beta)y)$ and $\bar{\theta}^{LTV} = \beta(p^H - p^L)/((1 + \beta)p^H)$, as before.

Because M and H now answer to different constraints, the three-way choice no longer reduces to a clean case-by-case partition of (y, Θ) -space the way the two-tier model does. The L -versus- M margin depends only on θ^{DTI} and the L -versus- H margin only on θ^{LTV} , but the M -versus- H margin depends on both jointly and is not, in general, a single-crossing curve in income. Rather than force a closed-form five-regime characterization as in an earlier version of this model, we characterize the three-tier stage numerically: we solve the household's problem at calibrated parameter values and compute $P^L(y, \Theta)$, $P^M(y, \Theta)$, and $P^H(y, \Theta)$ directly.

Figure 14. Selection Probabilities by Income under Tight and Relaxed Credit Access



Notes: Selection probabilities P^L , P^M , and P^H from the three-tier model, plotted against income y , under two credit-access scenarios: tight credit (Θ close to zero, dotted lines) and relaxed credit (Θ higher, solid lines). Parameters set to illustrative values.

Figure 14 confirms the pattern the closed-form two-tier results anticipate. The low-quality tier dominates and falls monotonically with income; the mid-quality tier is the interior, marginal option, rising then receding as the high-quality tier takes over; the high-quality tier rises monotonically and dominates at high income. Relaxing Θ shifts the mid- and high-quality curves to the left, pulling the tier transitions to lower income levels. This is again the model's account of Section 2.3's empirical pattern: relaxing credit

access raises housing quality most for low- and mid-income households, with the effect fading out toward the top of the income distribution as households there choose the high-quality tier regardless of Θ .

Separately parameterizing income y and credit access Θ is what lets this model isolate the credit channel from income-process differences between formal and informal households. Chapter 3 operationalizes this identification argument quantitatively: formal and informal workers differ in both their income process and their credit access, and only by parameterizing the two separately can the model attribute part of the observed housing-quality gap to credit exclusion net of income-process differences.

3 Quantitative Model

We expand on our simple model presenting a quantitative exercise that introduces several sources of heterogeneity, stochastic shocks and distributional characteristics in order to provide answers to counterfactual exercises for the Mexican economy. In this model, consumers can choose three types of housing: low, mid and high quality, i.e. $h \in \{h^L, h^M, h^H\}$ every period. The model will feature home sales and purchases as well as home remodeling. Agents get an exogenous income $y(s)$ which follows an $AR(1)$ process with persistence ρ and standard deviation σ . Additionally, a fraction of people will be able to borrow a fraction of their income or home value whereas the rest will not have credit access.

We will then use the model to ask a simple question: what would happen if everyone gains credit access? In this counterfactual economy, the share of mid-quality houses would increase by more than 10% through remodeling. Moreover, there is a distributional effect where lower-wealth households will hold higher-quality houses than in the baseline economy. This comes at the expense of wealthier households, who will hold lower-quality houses in the counterfactual economy.

3.1 Model Overview

Agents choose consumption c , savings a' and housing h' to solve the following problem:

$$\begin{aligned} V(s, a, f, h) &= \max_{c, a', h'} u(c) + v(h') + \beta \mathbb{E}[V(s', a', f', h') | s, f] \\ \text{s.t. } a' + c + \chi p(h') + I(h, h') &= (1 + r)a + y(s) + T \\ a' &\geq -\mu(h', s, f) \end{aligned}$$

Where $v(h')$ is a flow consumption function from housing services. χ is a maintenance cost for housing and T represents government transfers. $p(h')$ represent price of house type h' and is an increasing function. f represents formality status, which governs credit access for a given individual, while $\mu(h', s, f)$ is the borrowing constraint. This function will be defined in the next section (3.1) and can either be a loan-to-value or debt-to-income constraint. On the other hand, $I(h, h')$ represents the total cost of adjusting housing, to be explained in subsection 3.1. This will account for the possibility of purchasing a home or remodeling.

This is a discrete-continuous choice model, which can be challenging to solve computationally. If we were to use the endogenous grid method as in [Carroll \(2006\)](#), there could potentially be kinks in the value function, resulting in discontinuities in the policy functions.

Following [Iskhakov et al. \(2017\)](#), we solve this class of models by including taste shocks. These are additive choice-specific independent and identically distributed extreme value taste shocks that can be thought of as *unobserved state variables* or *random noise*. This is sufficient to smooth the value functions and eliminate

any potential kinks, removing any discontinuities in the value functions.

Each housing option has its own taste shock $\sigma_\epsilon \epsilon_i$, and the problem becomes:

$$\begin{aligned} V(s, a, f, h, \epsilon) &= \max_{c, a', h'} u(c) + v(h') + \left(\sigma_\epsilon \sum_i 1(h' = h_i) \epsilon_i \right) + \beta \mathbb{E}[V(s', a', f', h', \epsilon') | s, f] \\ \text{s.t. } a' + c + \chi p(h') + I(h, h') &= (1 + r)a + y(s) \\ a' &\geq -\mu(h', s, f) \end{aligned}$$

We are not able to derive a deterministic policy function for the discrete choice of housing but only the non-degenerate probability of choosing each of the potential options.

Credit Access and Income Process

Credit access is governed by formality status $f \in \{0, 1\}$: $f = 1$ for formal workers, $f = 0$ for informal workers. Formal workers can borrow through either a loan-to-value (LTV) or debt-to-income (DTI) constraint, at fixed rates θ and ϕ respectively; informal workers cannot borrow against either. Guided by empirical evidence, we assume that people with low-quality houses can only borrow through a DTI constraint, whereas agents with mid- or high-quality houses can borrow using an LTV constraint. Intuitively, lenders will not take low-quality houses as collateral as they usually have low market value and are informally built, making it hard to verify their value. Instead, they rely on DTI constraints, where the verification process is simpler and less risky.

The type of borrowing will be reflected by the function $\mu(h', s, f)$ given by:

$$\mu(h', s, f) \equiv \begin{cases} \theta p(h') & \text{if } h' \in \{h^M, h^H\}, f = 1 \\ \frac{\phi \hat{y}(s)}{1 + r} & \text{if } h' = h^L, f = 1 \\ 0 & \text{if } f = 0 \end{cases}$$

Where $\hat{y}(s)$ represents *annual* income. It is important to make this distinction as the model will be calibrated using quarterly data. θ represents the share of housing equity a formal household can borrow against, and ϕ is a separate constant governing the debt-to-income limit on the DTI branch. These are the same two constants used in the comparative-statics model of Section 2.5, where a single continuous parameter stands in for both the extent and the rate of credit access; here we discipline that stand-in with the actual discrete process observed in the data: access is on or off by formality state, while the rate, once granted, is fixed.

Formality is not a household fixed effect: f changes over time. However, employment formality is correlated with the income process: higher-income households are more likely to be formal workers, and

formal workers are more likely to earn higher income. The same holds for lower-income households and informal workers. To reflect this, we assume that formality f and the income process $y(s)$ are correlated with each other. Moreover, these variables follow a bivariate Markov process, where the current state (s, f) is updated through a joint transition matrix π :

$$\pi = \begin{pmatrix} \pi_{(0,0)} & \pi_{(0,1)} \\ \pi_{(1,0)} & \pi_{(1,1)} \end{pmatrix}$$

Where $\pi_{(i,j)}$ is the transition matrix of income process conditional on $f = i$ and $f' = j$, with $i, j \in \{0, 1\}$. That is, assuming that $y(s)$ has n states (i.e. $y \in \{y^1, \dots, y^n\}$), then $\pi_{(i,j)}$ is given by:

$$\pi_{(i,j)} = \begin{pmatrix} p_{i,j}^{1,1} & \dots & p_{i,j}^{1,n} \\ \vdots & \ddots & \vdots \\ p_{i,j}^{n,1} & \dots & p_{i,j}^{n,n} \end{pmatrix}$$

Where $p_{i,j}^{k,l}$ is the probability of going from state $(y = y^k, f = i)$ to state $(y' = y^l, f' = j)$. The joint bivariate process has stationary distribution Π such that $\pi\Pi = \Pi$.

Home Purchases and Remodeling

The model allows for the possibility of remodeling a house. The data shows that remodeling is predominant among low-quality houses. We assume that people can move from low to mid-quality houses through remodeling and not by purchasing an existing home. This is embedded inside the adjustment cost function $I(h, h')$, given by:

$$I(h, h') \equiv \begin{cases} p(h') - (1 - \ell)p(h) & \text{if } h' \neq h, h \neq h^L, h' \neq h^M \\ \kappa & \text{if } h = h^L, h' = h^M \\ 0 & \text{if } h' = h \end{cases}$$

This means that households will need to pay a liquidity cost ℓ if they want to move to another house, thus paying $p(h')$ and receiving $(1 - \ell)p(h)$. However, note that if an agent starts with $h = h^L$ and decides to switch to $h = h^M$ then she will need to pay a remodeling cost $\kappa > 0$.

Up to a first-order, introducing remodeling will not have any effect as those agents will still need to pay a cost. Without remodeling they would still need to pay $p(h^M) - (1 - \ell)p(h^L) > 0$. Apart from its qualitative importance, we introduce remodeling for a simple quantitative reason: general equilibrium. Remodeling will play a key role in the model as we will be able to fully isolate the effect of credit on the demand side by fixing the supply of houses. If we fix the supply of houses, people can still convert their low-quality homes

to mid-quality through remodeling as it is the same physical house. This will be further discussed in section 4.1.

3.2 Calibration

We do the model calibration in two steps. First, we calibrate certain standard parameters consistent with the literature, such as the discount factor β . Second, we calibrate the remaining parameters in order to replicate some moments in the Mexican data.

We assume that $u(c) = \log(c)$ and $v(h) = \psi \log(h)$ where $\psi > 0$. Standard parameters, such as the discount factor β and interest rate r , are set to values consistent with the literature.

In particular, we calibrate the income process y to have a mean of 1 with three potential states $n_s = 3$ using the Rouwenhorst method of approximating a stationary AR(1), following Kopecky and Suen (2010).

We set $\theta = 0.8$ and $\phi = 0.1$ to replicate median values seen from the CNBV loan-level data. Additionally, we calibrate the bivariate Markov process for (s, f) using data from ENOE. We estimate the joint transition matrix π and stationary distribution Π by computing quarterly transition frequencies across income deciles and formality status from the ENOE panel. The ENOE is a rotating quarterly household survey; we use waves spanning 2005–2019. For each pair of consecutive interview rounds, we record each respondent’s income tercile (low, medium, high) and formality status (formal, informal), yielding six labor-market states. The joint transition matrix π is estimated from observed quarter-to-quarter state changes by computing row-normalized transition frequencies. The stationary distribution Π is then obtained as the normalized left eigenvector of π associated with the unit eigenvalue.

The estimated matrix reveals important asymmetries between the formal and informal sectors. Informal employment is substantially more persistent: low-income informal workers remain in the same state with probability 0.671 per quarter, compared with 0.449 for low-income formal workers. Transitions across the formality margin are infrequent—only 10.3% of low-income informal workers move to any formal state within a single quarter. The implied stationary distribution places 15.7%, 10.5%, and 18.0% of workers in low-, medium-, and high-income formal employment, respectively, and 32.1%, 14.3%, and 9.4% in the corresponding informal states, broadly consistent with observed formality rates in Mexico over this period.

Moreover, we calibrate the price of high-quality houses to target a fixed supply of high-quality houses equal to 25%. We let the combined supply of low- and mid-quality houses equal 75%, without imposing a particular mix between the two.

The rest of the parameters are related to housing and are used so that the steady state distribution replicates the following empirical findings:

- Housing quality is positively related to income

- Housing quality is positively related to credit access
- Credit becomes less relevant for housing quality as income becomes larger

Our calibration is done in the following way:

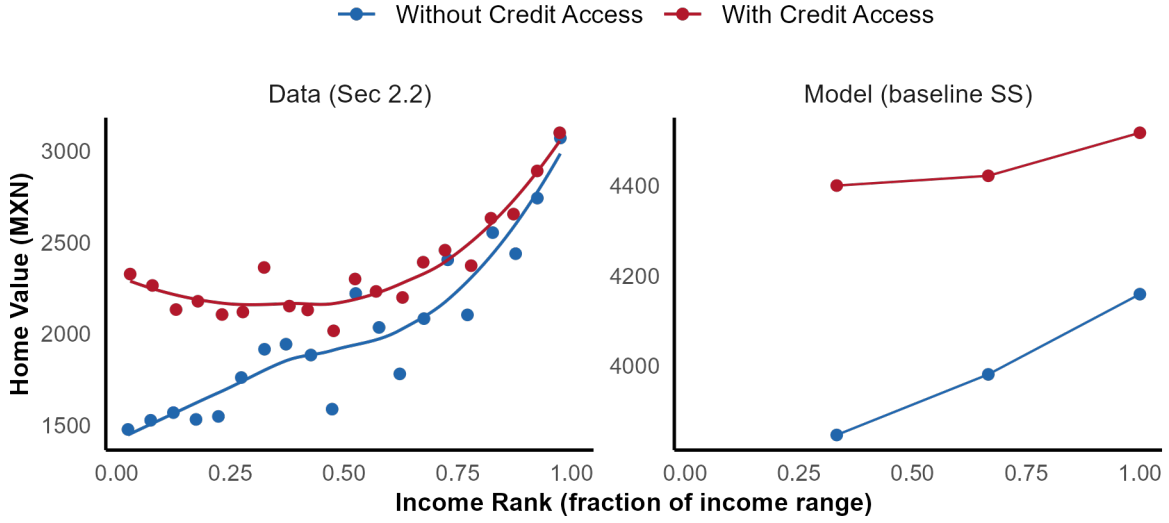
Parameter	Name	Value
β	Discount factor	0.98
r	Interest rate	0.01
$\mathbb{E}(y)$	Expected income	1
ρ	Income process persistence	0.975
σ	Income process variance	0.7
ψ	Housing utility parameter	0.1
h^H	Utility of high quality housing	14
h^M	Utility of mid quality housing	13
h^L	Utility of low quality housing	3
$p(h^H)$	Price of high-quality housing	2.6
$p(h^M)$	Price of mid-quality housing	2.5
$p(h^L)$	Price of low-quality housing	1
θ	Loan-to-value rate (formal households)	0.8
ϕ	Debt-to-income scaling constant	0.1
χ	Maintenance cost	0.3
ℓ	Liquidity cost of selling a house	0.1
T	Government transfers	2.5

Table 9. Calibration of the quantitative model

3.3 Model Fit

We compare the calibrated baseline with the qualitative patterns in Section 2.3. Figure 15 places the data and model in housing-value terms. Households with credit access have higher housing value in both panels, and the gap is smaller toward the top of the income distribution. The model captures this broad pattern, although its value levels and income gradient differ from those in the data. This comparison illustrates the qualitative calibration targets rather than providing an independent test of the model.

Figure 15. Housing Value by Credit Access over the Income Distribution: Data and Baseline Model (MXN)



Notes: Left: survey-weighted ENVI imputed rental values by income percentile and credit access, with smoothed curves. Right: baseline model imputed rental values by income state and credit access, converted to MXN using mean ENVI monthly income. Formal households have credit access in the baseline; informal households do not. The panels have separate vertical scales and compare income ranks, not matched income levels. The conversion provides a common monetary scale; the rental-value levels are not calibration targets.

Table 10 reports the model values in normalized income units. Imputed rental value rises with income for both groups, is higher for formal households at every income state, and displays a formal–informal gap that declines with income. Thus the baseline reproduces the three qualitative patterns used to guide the calibration.

Table 10. Baseline Model Fit: Imputed Rental Value by Income State and Credit Access

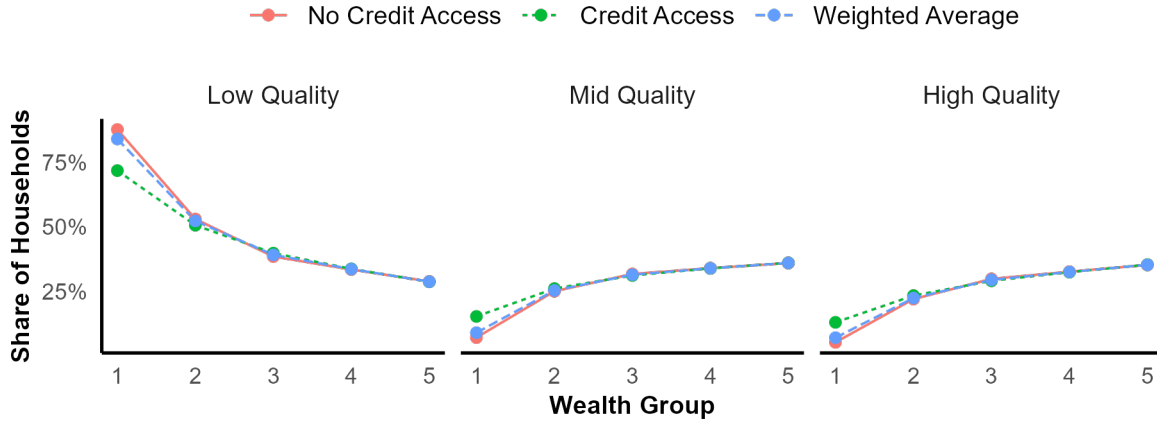
Income State	Informal (No Access)	Formal (Access)	Gap (Formal – Informal)
Low	0.516	0.590	0.074
Medium	0.534	0.593	0.059
High	0.558	0.606	0.048

Notes: Baseline steady-state mean imputed rental value, $p(h)(r + \chi)$, conditional on income state and formality. This user-cost measure assumes zero expected appreciation within the steady state. Values are in quarterly-income units, with mean model income normalized to one. Formal households have credit access; informal households do not. The last column reports the formal minus informal difference.

Figure 16 shows the share of households that own high-quality housing for different wealth groups (5 in total) in steady state. Each group contains the same mass of households over the asset space. It shows that the three facts mentioned above are satisfied under our calibration. Both the mid- and high-quality home curves have a positive slope, which implies that the share of households with higher-quality housing increases as

wealth increases, regardless of credit access status. The opposite happens with low-quality houses. Secondly, households with credit access have a higher share of mid- and high-quality housing than households without credit access, across wealth levels. Finally, the gap between the two curves decreases as wealth increases.

Figure 16. Steady State Share of Households by Housing Quality Tier



Notes: Model simulation at the calibrated baseline steady state. Each wealth group contains an equal mass of households sorted by liquid asset holdings a . Solid line: households with credit access ($f = 1$, formal workers). Dashed line: households without credit access ($f = 0$, informal workers). Parameters as in Table 9.

4 Counterfactuals

4.1 Main Results

We want to understand the role of credit in this economy. A simple way to do that is to ask the following question: what would happen if everyone had credit access? That is, what would happen if there is a *credit shock* and now $f = 1$ for both formal and informal workers? In this counterfactual economy, informal workers will have the same credit access as formal workers. However, they will still have a different income process than formal workers, so we are only shutting down heterogeneity in terms of credit access.

We want to isolate the effects of credit on the demand side of housing, while shutting down the supply side. To do so, we still assume a fixed supply of high-quality housing. The reason behind this is that people can always choose to remodel their low-quality houses into mid-quality houses. This will not change the supply of houses since this remodeling is done in the same physical house. For this reason, we calibrate the high-quality house price in the counterfactual economy so that it still constitutes 25% of the total housing stock.

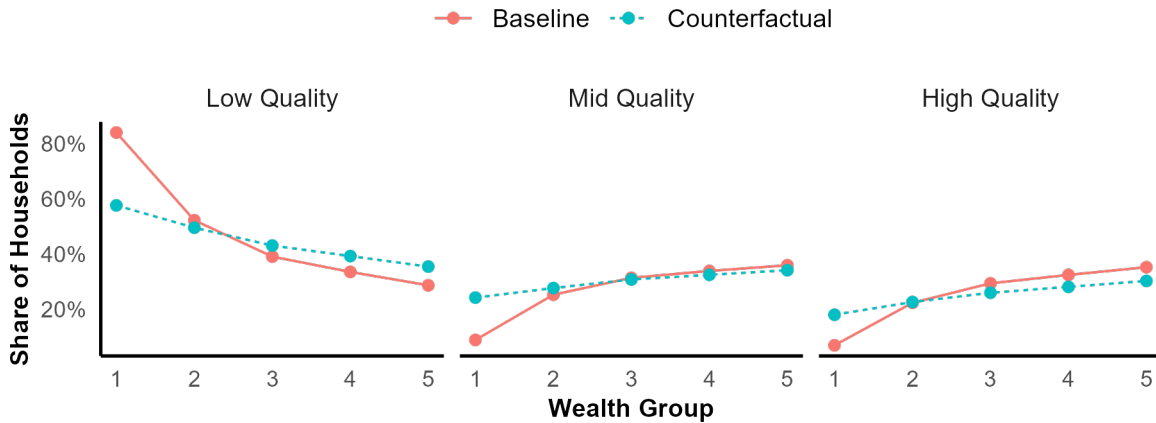
In the counterfactual economy, the share of people that hold mid-quality houses increases from 26.8% to 29.9%, reducing the share of low-quality houses by the same amount; by assumption, the share of high-quality houses remains fixed. This general-equilibrium counterfactual is the paper's actual evidence for weak aggregate demand. Section 2.3's partial-equilibrium aggregate gap sums individual-level gaps at fixed prices and supply and is illustrative bookkeeping, not independent evidence of demand suppression on its own; here, household choices and the high-quality house price are allowed to respond, so the 26.8%-to-29.9% gap is the paper's direct measurement of aggregate demand suppressed by credit exclusion. As in Section 2.2, this magnitude should be read as an upper bound on the response attributable to relaxing the financing constraint: it shares the same common-preference assumption across formality-income types, so any independent housing-quality-preference selection not already captured by the income-stability channel would work in the opposite direction.

Moreover, there is a redistribution effect as shown in Figure 17. This graph shows some interesting features by comparing the overall share of housing for each type by wealth level in the baseline and counterfactual economy. As a first point, housing quality becomes more homogeneous across wealth levels. Introducing credit for everyone results in a redistributive effect of housing. Wealthier households hold a lower share of higher-quality houses, whereas lower-wealth households now hold more of these houses. We are by no means talking about welfare, as part of the explanation behind this effect is that the price of high-quality houses increases in order to still clear that market. So high-wealth individuals may still be better off by moving to lower-quality houses, as they would get more money from selling those houses. We are only interested in the positive effect of homeownership.

Overall, the absolute value of the slope of each curve is reduced, which implies that wealth plays a less important role in this counterfactual economy. This is extremely intuitive, as the possibility of losing credit access made wealth the main explanatory variable for homeownership type in the baseline economy. People with lower wealth were less likely to buy a house even if they had credit access, since they could always move to an informal job, lose credit access, and be unable to repay their debt. Moreover, the importance of credit was directly related to wealth in the baseline economy: the largest gap between people with and without credit access comes from people with low wealth. For these people, having credit access may be the reason for having a higher-quality house. People with low wealth and no credit access chose to buy lower-quality houses, as they could not afford higher-quality houses and would not be able to take on any debt. In the counterfactual economy, the flattening of the curves across all house types implies that a *credit shock* results in a redistribution effect between wealth levels.

This redistribution result is secondary to the demand-suppression finding above, not a first-order claim of the paper. Its magnitude is conditional on the elasticity of high-quality housing supply, which we calibrate to a single 25% supply-share target rather than fit to an estimated supply-elasticity moment; a more or less elastic supply response would shrink or amplify the size of the wealth-composition shift accordingly.

Figure 17. Share of Households by Housing Quality Tier, Baseline vs. Counterfactual Economies



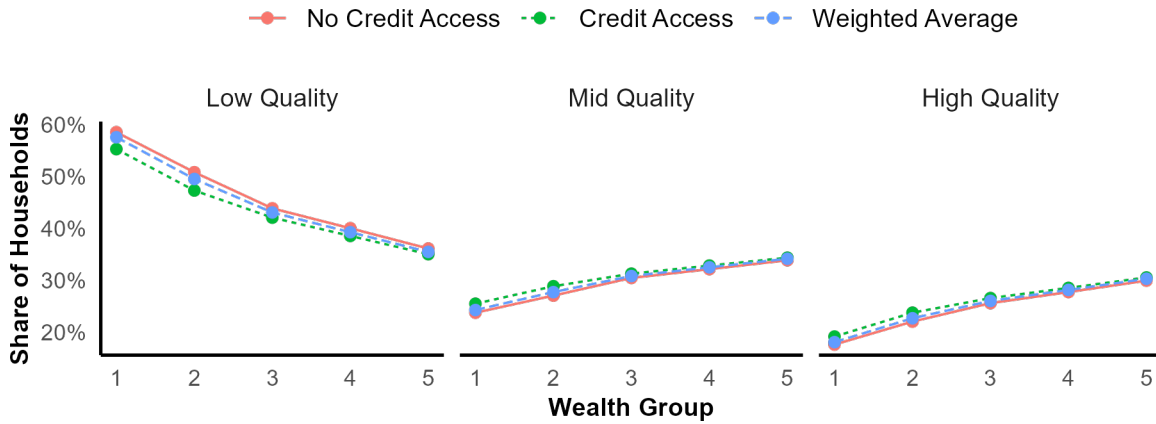
Notes: Model simulation. Baseline (blue): calibrated steady state with heterogeneous credit access by formality status. Counterfactual (orange): all households given equal credit access ($f = 1$ for all). The supply of high-quality housing is fixed in both economies; its price adjusts to clear the market.

4.2 Decomposing the Remaining Gap

Does equal credit access eliminate the housing-quality gap between formal and informal households? Figure 18 separates the universal-credit counterfactual by formality status. Both groups face the same borrowing limits, while their distinct income processes remain. Formal households continue to hold slightly

more mid- and high-quality housing within wealth groups, with the differences narrowing at higher wealth. Within the model, this remaining gap reflects income-process differences and the asset and housing choices they induce. Equal credit access therefore removes the financing distinction while leaving a source of housing inequality associated with labor-market income risk.

Figure 18. Housing Shares by Wealth Group and Formality under Universal Credit Access



Notes: Universal-credit steady state. Panels report low-, mid-, and high-quality housing shares by liquid-wealth group, separately for formal and informal households and for all households. Credit-access labels in the legend denote baseline formality groups; both groups receive the same borrowing limits in this counterfactual. Their income processes remain distinct, so the remaining group differences arise from the income process rather than unequal credit access. High-quality housing supply is fixed and its price adjusts to clear the market. Wealth-group shares describe the distribution; the aggregate result in Section 4.1 uses population weights from the full steady-state distribution.

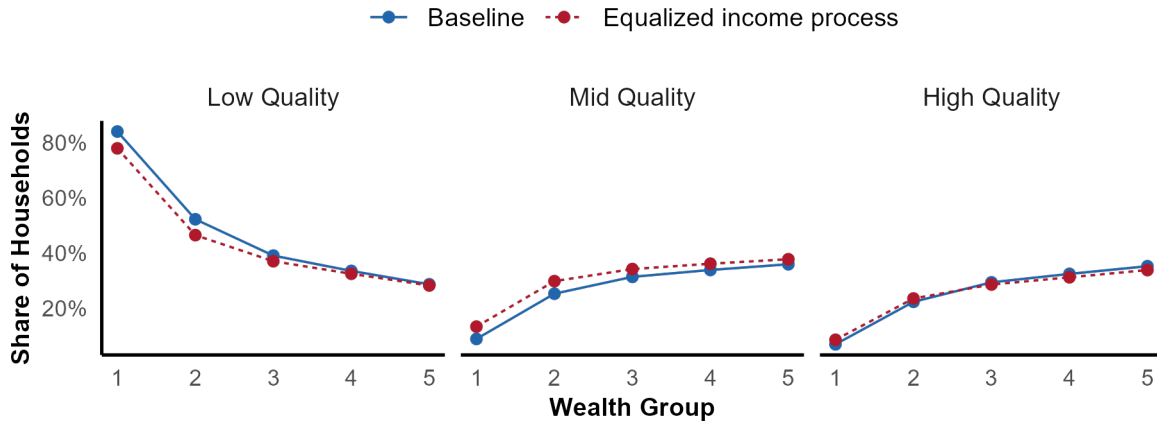
We next ask how housing choices respond when informal workers receive the same income process as formal workers while retaining the same borrowing constraint. Figure 19 presents this income-process decomposition exhibit. At each current income level, we give informal households the formal-state marginal distribution of next-period income, while preserving their baseline probability of moving to each formality state. Credit access continues to depend on current-period formality: households in the informal state remain unable to borrow. The modified transition rule combines the income and formality probabilities independently; formal-state transition rows remain unchanged.

Caveat: The stationary formal share rises from 44.2% to 47.2% as the population mix evolves under the modified kernel—a modeling artifact of this construction, not a change in credit-eligibility policy.

The aggregate mid-quality housing share rises from 26.79% to 30.08%, an increase of 3.29 percentage points. In the figure, mid-quality housing shares rise across wealth groups, with larger increases in the lower groups. Thus, income-process differences also shape housing demand within the model, even when the borrowing rule remains unchanged. Together with the universal-credit counterfactual, this income-process

decomposition exhibit separates the roles of the model's credit-access and income-process primitives through complementary general-equilibrium experiments; their effects need not add up to the baseline housing-quality gap.

Figure 19. Income-Process Decomposition Exhibit: Housing Shares by Wealth Group



Notes: Model steady states. Blue solid lines show the baseline; red dashed lines show the income-process decomposition exhibit. Panels report low-, mid-, and high-quality housing shares for all households within each economy's liquid-wealth groups. Informal households receive the formal-state marginal income-transition law conditional on current income, combined independently with their own unchanged formality-transition probabilities. Borrowing limits remain tied to current formality status. High-quality housing supply is fixed and its price adjusts to clear the market. Aggregate shares in the text use the full population distribution; averaging the plotted wealth-group shares does not recover these aggregates.

5 Conclusion

This paper documents two problems created by mortgage credit exclusion in Mexico, where access to INFONAVIT and FOVISSSTE financing is gated by employment formality. The first is unequal access: informal workers live in lower-quality housing than formal workers at the same income, and the gap is largest at low income and narrows toward zero by roughly the seventh decile. The second is weak aggregate demand: because roughly half the workforce is excluded from credit access, economy-wide demand for housing upgrades is structurally suppressed. A simple model with a borrowing constraint shows why the empirical gap concentrates at low income, and a quantitative heterogeneous-agent model with discrete housing choice extends this logic to a full general-equilibrium counterfactual. Giving every household equal credit access raises the mid-quality housing share from 26.8% to 29.9%, concentrated among low- and mid-income households – the paper’s direct measurement of the demand this exclusion suppresses.

The same counterfactual is also redistributive, though this is a secondary finding rather than a first-order result. Removing the formality gate flattens the relationship between wealth and housing quality: in the baseline economy wealth determines housing choice partly because a low-wealth household risks losing credit access through a future formality transition, and removing the gate removes that precautionary channel. This wealth-homogenization effect is real in the model, but its size depends on the elasticity of high-quality housing supply, which we calibrate to a single supply-share target rather than estimate directly; we report it as conditional on that assumption, not as an independently established result.

The paper’s own universal-credit-access counterfactual is itself the relevant policy exercise. Its natural real-world analogue is loosening or redesigning the formality gate on INFONAVIT and FOVISSSTE eligibility – for instance, verifying eligibility through income or contribution history rather than current formal-employment registration alone. A second-best alternative, since eliminating informality outright is a separate and much larger labor-market policy question outside this paper’s scope, is expanding credit channels that do not require formalization at all, such as alternative credit-scoring or microfinance products aimed at informal workers. Both proposals should be read modestly: the model is silent on the fiscal cost of expanding credit access and, consistent with the redistribution caveat above, on the true price response of high-quality housing supply, since supply elasticity is not estimated.

Two simplifications bound how these results should be read. The supply side is deliberately simple – a fixed high-quality stock and an elastic mid-quality stock generated by remodeling – and the counterfactual magnitude depends on that setup, disclosed in Chapter 3’s calibration. And as discussed in Section 2.2, the paper’s effects assume a common housing-quality preference across formality-income types; without an instrument for preference heterogeneity uncorrelated with income stability, both the empirical gaps and the counterfactual response are upper bounds on the effect of relaxing the financing constraint.

The mechanism studied here may have broader implications for wealth inequality tied to employment

formality. Many developing countries have a sizable informal workforce with limited access to housing credit; if the same financing constraint applies there, formality status may compound over time into a persistent gap in housing wealth between formal and informal workers, on top of the income gap between them. We leave a direct empirical or quantitative treatment of this wealth-accumulation channel for future research.

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A Solving the Simple Model

We will solve the model from section 2.5. Recall that the problem is

$$\begin{aligned} V^i(\bar{\theta}) &= \max_{c_1, c_2, a} \log(c_1) + \beta \log(c_2) + \psi \log(h^i) \\ \text{s.t } c_1 + a + P(h^i) &= y + P(h^L) \\ c_2 &= y + (1+r)a \\ a &\geq -\bar{\theta}\mu(h^i) \end{aligned}$$

Taking FOC we get:

$$\begin{aligned} c_1^{-1} &= \lambda_1 \\ \beta c_2^{-1} &= \lambda_2 \\ \lambda_1 &= (1+r)\lambda_2 + \eta \end{aligned}$$

Where λ_i represents the lagrange multiplier of the budget constraint in period $i \in \{1, 2\}$ and η is the multiplier for the liquidity constraint such that $\eta \geq 0$. Since we assume that $\beta(1+r) = 1$, using the three equations above we get the Euler Equation specified below:

$$c_1^{-1} = c_2^{-1} + \eta$$

Let's first assume that the constraint is not binding and thus $\eta = 0$. In that case we have that $c_1 = c_2 = c$. Then

$$\begin{aligned} c &= y - a - (P(h^i) - P(h^L)) \\ c &= y + (1+r)a = y + \frac{a}{\beta} \end{aligned}$$

We can then solve for the value of a and c :

$$\begin{aligned} a &= -\frac{1+\beta}{\beta}(P(h^i) - P(h^L)) \leq 0 \\ c &= y - \frac{(P(h^i) - P(h^L))}{1+\beta} \end{aligned}$$

This way, the unconstrained value function will be equal to:

$$V^i(\bar{\theta}) = (1 + \beta) \log \left(y - \frac{(P(h^i) - P(h^L))}{1 + \beta} \right) + \psi \log(h^i)$$

Now, assume that the constraint is binding. Note that whenever $h = h^L$ then $a = 0$ and thus households will not borrow and thus the constraint will not be binding. Moreover, for people that move to $h = h^M$ or $h = h^H$ then $\mu(h^i) = P(h^i)$. Then we will have:

$$\begin{aligned} a &= -\bar{\theta}\mu(h^i) \\ c_1 &= y - (P(h^i) - P(h^L)) + \bar{\theta}P(h^i) \\ c_2 &= y - (1 + r)\bar{\theta}P(h^i) \end{aligned}$$

In this case the value function would look like:

$$V^i(\bar{\theta}) = \log(y - (P(h^i) - P(h^L)) + \bar{\theta}P(h^i)) + \beta \log(y - (1 + r)\bar{\theta}P(h^i)) + \psi \log(h^i)$$

We just need to see when will the constraints be binding. Recall that the constraint is binding if $a < -\bar{\theta}\mu(h^i)$. Then we have

$$\begin{aligned} a < -\bar{\theta}\mu(h^i) &\Leftrightarrow \\ -\frac{1 + \beta}{\beta}(P(h^i) - P(h^L)) < -\bar{\theta}\mu(h^i) &\Leftrightarrow \\ \bar{\theta}\mu(h^i) < \frac{1 + \beta}{\beta}(P(h^i) - P(h^L)) \end{aligned}$$

Then we can see each value function easily:

$$V^L(\bar{\theta}) = (1 + \beta) \log(y) + \psi \log(h^L)$$

$$V^M(\bar{\theta}) = \begin{cases} \log(y - \kappa + \bar{\theta}P(h^M)) + \beta \log(y - (1 + r)\bar{\theta}P(h^M)) + \psi \log(h^M) & \text{if } \bar{\theta}P(h^M) \leq \frac{\beta}{1 + \beta}\kappa \\ (1 + \beta) \log(y - \kappa/(1 + \beta)) + \psi \log(h^M) & \text{if } \bar{\theta}P(h^M) > \frac{\beta}{1 + \beta}\kappa \end{cases}$$

$$V^H(\bar{\theta}) = \begin{cases} \log(y - \Delta(P) + \bar{\theta}P(h^H)) + \beta \log(y - (1+r)\bar{\theta}P(h^H)) + \psi \log(h^H) & \text{if } \bar{\theta}P(h^H) \leq \frac{\beta}{1+\beta}\Delta(P) \\ (1+\beta) \log(y - \Delta(P)/(1+\beta)) + \psi \log(h^H) & \text{if } \bar{\theta}P(h^H) > \frac{\beta}{1+\beta}\Delta(P) \end{cases}$$

Where we defined $\Delta(P) \equiv P(h^H) - P(h^L)$ as before.

A.1 Value Function and $\bar{\theta}$

Now we want to show that $\frac{dV^i(\bar{\theta})}{d\bar{\theta}} > 0$ if $\bar{\theta}\mu(h^i) < \frac{1+\beta}{\beta}(P(h^i) - P(h^L))$ for $i \in \{M, H\}$ as described in section 2.5. Recall that if $\bar{\theta}\mu(h^i) > \frac{1+\beta}{\beta}(P(h^i) - P(h^L))$ for $i \in \{M, H\}$ then

$$V^i(\bar{\theta}) = \log(y - (P(h^i) - P(h^L)) + \bar{\theta}P(h^i)) + \beta \log(y - (1+r)\bar{\theta}P(h^i)) + \psi \log(h^i)$$

Then, taking derivative with respect to $\bar{\theta}$ we get:

$$\frac{dV^i(\bar{\theta})}{d\bar{\theta}} = \frac{P(h^i)}{y - (P(h^i) - P(h^L)) + \bar{\theta}P(h^i)} + \frac{P(h^i)}{y - (1+r)\bar{\theta}P(h^i)} = \frac{P(h^i)}{c_1} + \frac{P(h^i)}{c_2} > 0$$

Where the inequality follows from the fact that

$$\begin{aligned} c_1 = y - (P(h^i) - P(h^L)) + \bar{\theta}P(h^i) &< y - (1+r)\bar{\theta}P(h^i) = c_2 \Leftrightarrow \\ \frac{1+\beta}{\beta}\bar{\theta}P(h^i) &< (P(h^i) - P(h^L)) \end{aligned}$$

Which is true by assumption.

B Quantitative Model Derivations

B.1 Solving the Model

We will solve the model backwards in three recursive steps. These steps follow the methodology described in [Iskhakov *et al.* \(2017\)](#).

- Step 3: Solve the consumer model after choosing h' . That is, solve the model for each $h' \in \{h^L, h^M, h^H\}$, assuming it is a state variable.
- Step 2: Choose h' optimally. Given the type of taste shocks, we will only get the probability of choosing each h' .
- Step 1: Get the continuation value.

Step 3: Solving the model after choosing h' . If we assume h' has already been chosen, we get the following problem:

$$\begin{aligned} \mathcal{V}(s, a, f, h, h') &= \max_{c, a'} u(c) + v(h') + W(s, a', f, h') \\ \text{s.t. } a' + c + \chi p(h') + I(h, h') &= (1 + r)a + y(s) \\ a' &\geq -\mu(h', s, f) \end{aligned} \tag{18}$$

Where $W(s, a', f, h') \equiv \beta \mathbb{E}[V(s', a', f', h', \epsilon') | s, f]$ is the continuation value, which is computed in step 1. We can easily solve this model as it is a simple continuous choice model. We can use the endogenous grid method as in [Carroll \(2006\)](#) to solve the model. By solving the model we get value function $\mathcal{V}$, marginal value function $\mathcal{V}_a$ and policy functions $\hat{c}$ and $\hat{a}$ in the state space (s, a, f, h, h') .

Step 2: Choosing h' optimally. We follow the methodology described in [Iskhakov *et al.* \(2017\)](#). The problem of choosing h' is then simply to choose $h_i \in \{h^L, h^M, h^H\}$ from among the discrete set of choices to maximize:

$$V(s, a, f, h) = \mathbb{E}_\epsilon \left[\max_{h' \in \{h_i\}} \mathcal{V}(s, a, f, h, h') + v(h') + \left(\sigma_\epsilon \sum_i 1(h' = h_i) \epsilon_i \right) \right]$$

That is, to maximize our post-choice value function plus the value of housing itself and the taste shocks. This gives us logit choice probabilities $p(s, b, f, h, h')$ of each h' . Furthermore V can be obtained using the

logsum formula, so that we have

$$V(s, a, f, h) = \sigma_\epsilon \log \left(\sum_i \exp \left(\frac{\mathcal{V}(s, a, f, h, h_i) + v(h_i)}{\sigma_\epsilon} \right) \right) \quad (19)$$

$$p(s, a, f, h, h_i) = \frac{\exp \left(\frac{\mathcal{V}(s, a, f, h, h_i) + v(h_i)}{\sigma_\epsilon} \right)}{\sum_j \exp \left(\frac{\mathcal{V}(s, a, f, h, h_j) + v(h_j)}{\sigma_\epsilon} \right)} \quad (20)$$

Additionally, for the endogenous grid point method, we'll also need to keep track of the marginal value function with respect to assets, V_a . This is given by simply taking the expectation of the marginal value function with respect to the probabilities. We can do exactly the same to get the policy functions in the original state space (s, a, f, h) .

$$\begin{aligned} V_a(s, a, f, h) &= \sum_i p(s, a, f, h, h_i) \cdot \mathcal{V}_a(s, a, f, h, h_i) \\ c(s, a, f, h) &= \sum_i p(s, a, f, h, h_i) \cdot \hat{c}(s, a, f, h, h_i) \\ a(s, a, f, h) &= \sum_i p(s, a, f, h, h_i) \cdot \hat{a}(s, a, f, h, h_i) \end{aligned}$$

Step 1: Get the continuation value. Now, we define the continuation value, the discounted expected utility $W(s, a', f, h')$ that enters into (18). We also need the discounted expected marginal utility $W_a(s, a', f, h')$ which is necessary to solve the problem via the endogenous grid method. This is simply given by taking the discounted expectation of utility V and marginal utility V_a . It is worth noting that this expectation is taken over two state variables: s and f .

$$W(s, a', f, h') = \beta \mathbb{E}_{s,f} [V(s', a', f', h') | s, f]$$

$$W_a(s, a', f, h') = \beta \mathbb{E}_{s,f} [V_a(s', a', f', h') | s, f]$$

Putting it all together. Now we can solve the problem recursively following these three steps. By making an educated guess of the value and marginal value functions, we implement steps 1 to 3 repeatedly until the policy and value functions converge.

B.2 Euler Equation

We derive the Euler equation now. Recall the original problem:

$$\begin{aligned}
 V(s, a, f, h, \epsilon) &= \max_{c, a', h'} u(c) + v(h') + \left(\sigma_\epsilon \sum_i 1(h' = h_i) \epsilon_i \right) + \beta \mathbb{E}[V(s', a', f', h', \epsilon') | s, f] \\
 \text{s.t. } a' + c + \chi p(h') + I(h, h') &= (1 + r)a + y(s) \\
 a' &\geq -\mu(h', s, f)
 \end{aligned} \tag{21}$$

Recall that in step 2 of solving the model we found V in terms of $\mathcal{V}$. Then we can replace 19 in 18 and get the following expression.

$$\begin{aligned}
 \mathcal{V}(s, a, f, h, h' | h') &= \max_{c, b'} u(c) + \beta \mathbb{E} \left[\sigma_\epsilon \log \left(\sum_i \exp \left(\frac{\mathcal{V}(s', a', f', h', h_i) + v(h_i)}{\sigma_\epsilon} \right) \right) | s, f, h' \right] \\
 \text{s.t. } a' + c + \chi p(h') + I(h, h') &= (1 + r)a + y(s) \\
 a' &\geq -\mu(h', s, f)
 \end{aligned} \tag{22}$$

Now let's take FOC for (21).

$$\begin{aligned}
 u'(c) &= \lambda \\
 \beta \mathbb{E}[V_a(s', a', f', h') | s, f, h'] &= \lambda
 \end{aligned}$$

Then we get

$$u'(c) = \beta \mathbb{E}[V_a(s', a', f', h') | s, f, h']$$

Now taking envelope condition for (21):

$$V_a(s, a, f, h, h' | h') = (1 + r)\lambda$$

Together with the FOC for consumption we get:

$$V_a(s, a, f, h, h' | h') = (1 + r)u'(c)$$

Now, if we take FOC with respect to (22) we get

$$u'(c) = \lambda$$

$$\beta \mathbb{E} \left[\left(\sum_i \exp \left(\frac{\mathcal{V}(s', a', f', h', h_i | h_i) + v(h_i)}{\sigma_\epsilon} \right) \right)^{-1} \right. \\ \left. \cdot \left(\sum_i \exp \left(\frac{\mathcal{V}(s', a', f', h', h_i | h_i) + v(h_i)}{\sigma_\epsilon} \right) \mathcal{V}_a(s', a', f', h', h_i | h_i) \right) \middle| s, f, h' \right] = \lambda$$

We can simplify and get

$$\beta(1+r) \mathbb{E} \left[\left(\sum_i p(s', a', f', h', h_i) u'(c') \right) \middle| s, f, h' \right] = u'(c)$$

Assuming $c \equiv c(s, b, f, h, h')$ then the Euler equation becomes:

$$\beta(1+r) \mathbb{E} \left[\left(\sum_i p(s', a', f', h', h_i) u'(c(s', a', f', h', h_i)) \right) \middle| s, f \right] = u'(c(s, a, f, h, h'))$$

C Additional Information about the Data

C.1 Summary Statistics

Table 11 reports summary statistics for the analysis sample used throughout the empirical section (Section 2.1), covering the housing quality index, income, formal credit access, and housing-cost measures drawn from the 2020 ENVI.

Table 11. Summary Statistics

	Mean	Std. Dev.	Median	Min	Max
Housing Quality Index	0.00	0.32	0.04	-2.10	2.69
Housing Quality Index (US-Weighted)	0.00	0.36	0.09	-3.57	1.08
Monthly Income (MXN)	7,453	7,585	5,633	10	424,667
Age	32.95	21.16	30.00	0.00	97.00
College Educated (%)	16	37	0	0	100
Married or in Union (%)	43	50	0	0	100
Formal Credit Access (%)	33.6	47.2	0.0	0.0	100.0
Credit Access, Any Institution (%)	34.3	47.5	0.0	0.0	100.0
Dwelling Value (MXN)	874,198	1,600,067	500,000	600	45,000,000
Actual Rent (Renters, MXN)	2,856	3,204	2,000	0	50,000
Self-Assessed Rental Value (Owners, MXN)	2,930	4,054	2,000	98	98,000
Imputed Rent (Owner-Occupied, MXN)	2,051	1,303	1,862	172	23,885
Construction Size (sq. m)	102	85	80	9	997
Bedrooms	2.13	0.92	2.00	1.00	13.00

Notes: Source: 2020 ENVI, weighted by the household sampling factor (FACTOR). Housing Quality Index is the standardized AHS-equivalent index from the Data section; the US-Weighted version uses American Housing Survey component weights. Shares are in percentage points. Actual Rent is reported only by renters; Self-Assessed Rental Value is reported only by owners; Imputed Rent is the hedonic-model prediction for owner-occupied units. Formal Credit Access is defined over income earners only (the survey question is not asked of non-earners), unlike the other share rows, which are defined over the full sample.

C.2 Survey Questions

Table 12 lists the ENVI survey questions used to construct the housing quality index introduced in Section 2.1, together with the mnemonic and possible answers for each question. Each question is converted into a binary quality indicator – a housing unit is coded as high-quality on a given dimension if it reports the best available answer, and low-quality otherwise – before being standardized and aggregated into the index.

Table 12. ENVI survey questions used to construct our housing quality index

Mnemonic Variable		Question	Answers
P4_4	Good Wall	4.4 What material are most of the walls of this dwelling made of?	Waste material; Cardboard sheeting; Asbestos or metal sheeting; Reeds, bamboo or palms; Mud or bajareque; Wood; Adobe; Drywall, brick, block, stone, stone quarry, cement or concrete
P4_5	Good Roof	4.5 What material is most of the roof of this dwelling made of?	Waste material; Cardboard sheeting; Metal sheeting; Asbestos sheeting; Fiber cement sheeting; Palm or straw; Wood or shingles; Roof with joists; Tile; Concrete slab or joists with vaulting
P4_6	Good Floor	4.6 What material is most of the floor of this dwelling made of?	Soil; Cement or pavement; Wood, mosaic or other covering
P4_7_1	Roof Thermal Insulation	4.7 To avoid excess heat or cold, does this dwelling have any type of thermal insulation in ceilings?	Yes; No; Doesn't Know
P4_7_2	Wall Thermal Insulation	4.7 To avoid excess heat or cold, does this dwelling have any type of thermal insulation in walls?	Yes; No; Doesn't Know
P4_7_3	Window Thermal Insulation	4.7 To avoid excess heat or cold, does this dwelling have any type of thermal insulation in windows?	Yes; No; Doesn't Know
P4_8_1	Roof Noise Insulation	4.8 To reduce excess noise, does this dwelling have any type of insulation in ceilings?	Yes; No; Doesn't Know
P4_8_2	Wall Noise Insulation	4.8 To reduce excess noise, does this dwelling have any type of insulation in walls?	Yes; No; Doesn't Know
P4_8_3	Window Noise Insulation	4.8 To reduce excess noise, does this dwelling have any type of insulation in windows?	Yes; No; Doesn't Know

Continued on next page

Table 12 – continued from previous page

Mnemonic Variable	Question	Answers
P4_8_4 Door Noise Insulation	4.8 To reduce excess noise, does this dwelling have any type of insulation in doors?	Yes; No; Doesn't Know
P4_9 Kitchen	4.9 Does this dwelling have a room for cooking?	Yes; No
P4_11 Toilet	4.11 Does this dwelling have an outhouse, toilet or sanitary toilet (latrine or black hole)?	Yes; No
P4_12 Flushing Water	4.12 Does the sanitary service...	have a direct water discharge? need water poured into it with a bucket? can't have water poured on it?
P4_13 Inhouse Water Supply	4.13 Do they get water from faucets or hoses that are...	inside the house? only in the yard or land? No piped water
P4_14 Safe Water	4.14 Does the piped water coming into your home come from....	from a public utility? from a well? from a pipe? from another house? from somewhere else?
P4_15 Public Drainage	4.15 Does this dwelling have drainage or sewage connected to...	the public network? a septic tank (biodigester)? a pipe leading to a ravine or crevice? a pipe leading to a river, lake or sea? No drainage? Not specified
P4_16 Electric Light	4.16 Is there electricity in this dwelling?	Yes; No
P4_17 Gas or Electric Cooking	4.17 In this household, the fuel they use most often to cook or heat food is....	gas? wood or coal? electricity? other fuel? No cooking? Not specified
P4_22_1 Washbowl	4.22 Is this dwelling equipped with a laundry room?	Yes; No
P4_22_2 Sink	4.22 Is this dwelling equipped with a sink or sink unit?	Yes; No
P4_22_3 Water Tank	4.22 Is this dwelling equipped with a water tank?	Yes; No

Continued on next page

Table 12 – continued from previous page

Mnemonic Variable		Question	Answers
P4_22_4	Cistern	4.22 Is this dwelling equipped with a cistern?	Yes; No
P4_22_5	Boiler	4.22 Is this dwelling equipped with a water heater or boiler (gas, electric, wood)?	Yes; No
P4_22_6	Solar Heater	4.22 Is this dwelling equipped with a solar water heater?	Yes; No
P4_22_7	Stationary Tank	Gas 4.22 Is this dwelling equipped with a stationary gas tank?	Yes; No
P4_22_8	AC	4.22 Is this dwelling equipped with air conditioning?	Yes; No
P4_22_9	Heater	4.22 Is this dwelling equipped with heating?	Yes; No
P4_23_1	Dining Room	4.23 Does this dwelling have a living/dining room?	Yes; No
P4_23_2	Garden	4.23 Does this dwelling have a garden?	Yes; No
P4_23_3	Patio	4.23 Does this dwelling have a patio?	Yes; No
P4_23_4	Laundry	4.23 Does this dwelling have a laundry room?	Yes; No
P4_23_5	TV Room	4.23 Does this dwelling have a television room or study?	Yes; No
P4_23_6	Garage	4.23 Does this dwelling have a garage or parking space?	Yes; No
P4_25_1	Cracks	4.25 Does this dwelling have problems with cracks or crazing in ceilings or walls?	Yes; No; Doesn't Know
P4_25_2	Window Damage	4.25 Does this dwelling have problems with buckling or warping of door or window frames?	Yes; No; Doesn't Know
P4_25_3	Floor Problems	4.25 Does this dwelling have problems with floor heaving or sagging?	Yes; No; Doesn't Know

Continued on next page

Table 12 – continued from previous page

Mnemonic Variable	Question	Answers
P4_25_4 Leaking Problems	4.25 Does this dwelling have problems with dampness or water seepage in foundations, walls or roofs?	Yes; No; Doesn't Know
P4_25_5 Column Fractures	4.25 Does this dwelling have problems with cracking, buckling, or buckling of columns, beams, or girders?	Yes; No; Doesn't Know
P4_25_6 Electric Problems	4.25 Does this dwelling have problems with the electrical system (walls, ceilings, etc.)?	Yes; No; Doesn't Know
P4_25_7 Drainage Problems	4.25 Does this dwelling have problems with the water or sewage pipes inside the dwelling?	Yes; No; Doesn't Know
P4_26_1 Corridor Crackings	4.26 Does your building have problems such as cracks, fractures or dampness in hallways?	Yes; No; Doesn't Know
P4_26_2 Stair Crackings	4.26 Does your building have problems such as cracks, fractures, or dampness in stairways?	Yes; No; Doesn't Know
P4_26_3 Elevator Crackings	4.26 Does your building have problems such as cracks, fractures or dampness in elevators?	Yes; No; Doesn't Know

Notes: Source: 2020 ENVI, Section 4 of the questionnaire (housing characteristics). Mnemonic is the ENVI variable code; Variable is the short label we use throughout the paper. Each question is converted to a binary quality indicator as described in Section 2.1.

C.3 ENVI vs. ENIGH Question Correspondence

Table 13 summarizes, by category, how the 43 ENVI housing quality-index components listed above compare in coverage to the 22 components available in ENIGH.

Table 13. Housing Quality Index: ENVI vs. ENIGH Question Coverage

Category	ENVI Compo- nents	ENIGH Compo- nents	Note
Wall / Roof / Floor Materials	3	3	Identical codes in both surveys (P4_4 / P4_5 / P4_6 vs. mat_pared / mat_techos / mat_pisos)
Water, Sanitation, Electricity, Cooking Fuel	8	8	Comparable in both; some ENIGH codes (e.g. disp_agua, disp_elect) are more granular than their ENVI counterparts
Thermal / Noise Insulation	7	0	Not asked in ENIGH
Fixtures and Amenities (Sink, Tanks, Heater, AC, etc.)	9	11	ENIGH adds shower (regadera) and water-deposit (pileta) fixtures not asked in ENVI; ENVI's other 9 fixtures all have identical-structure ENIGH counterparts
Living-Space Amenities (Dining Room, Garden, Garage, etc.)	6	0	Not asked in ENIGH
Structural Problems (Cracks, Leaks, Fractures)	10	0	Not asked in ENIGH
Total Quality-Index Components	43	22	

Notes: Component counts by category, ENVI (2020) vs. ENIGH (2020). ENVI's housing quality index (Section 2.1) uses all 43 components listed in Table 12; ENIGH's parallel index uses 22, with no ENIGH counterpart to ENVI's insulation, living-space-amenity, or structural-problem batteries.

Table 14 lists the survey questions and constructed variables ENVI and ENIGH each use to measure credit access and labor-market formality, the paper's central explanatory variables.

Table 14. Credit Access and Formality: ENVI vs. ENIGH Question Correspondence

Dataset	Survey Code	Constructed Variable	What It Measures
ENVI	P3_5	credit_access_formality	Job-based INFONAVIT/FOVISSSTE eligibility (codes 1-2); asked of income earners only
ENVI	P3_5	credit_access	Any job-based institutional credit eligibility (codes 1-3)
ENIGH	tipo_finan	credit_access_formal	Dwelling financed via INFONAVIT/FOVISSSTE/FONHAPO (code 1) – financing actually used, not job eligibility
ENIGH	tipo_finan	credit_access_any	Dwelling financed via any institutional channel (codes 1-3)
ENIGH	contrato	formality_contrato	Written labor contract – standard proxy in the Mexican labor literature
ENIGH	medtrab_1	formality_medtrab	IMSS medical benefit via job – closest to the official ENOE/INEGI formality definition
ENIGH	pres_5	formality_pres5	Job-based housing-credit benefit – closest structural analogue to ENVI's P3_5
ENOE	emp_ppal	formality	IMSS/ISSSTE social-security registration through the main job (codes 1=informal/2=formal); the official ILO/INEGI formality definition. No credit-access question exists in ENOE (pure labour-market survey) – formality is its only row in this table

Notes: ENVI's P3_5 asks about job-based institutional credit eligibility, among income earners. ENIGH has no single equivalent question; instead it offers three separate job-level formality proxies (written contract, IMSS medical benefit, job-based housing-credit benefit) plus a household-level measure of financing actually used to acquire the dwelling (tipo_finan). The two datasets' definitions are related but not identical – eligibility versus usage, in particular – see Section 2.1 for how each is used.

C.4 Weights on each question

Table 15 documents how each ENVI question maps onto the American Housing Survey (AHS) 2013 Physical Problems Index, whose component structure and weights we adapt to construct our housing quality index (Section 2.1). The left two columns reproduce the AHS component or problem and its original weight;

the right two columns give the corresponding ENVI variable(s) and the weight we assign it. Components marked with an asterisk are not part of the original AHS index but capture additional quality dimensions relevant to the Mexican housing market; conversely, not every AHS component has an ENVI counterpart, since some U.S.-specific problems (e.g., blown fuses, kerosene heaters) have no direct analogue in the ENVI questionnaire.

Table 15. ENVI and AHS index component equivalence

AHS Component / Problem		AHS Score (Weight)	ENVI Variable	ENVI Score (Weight)
Housing materials*				
			P4_4	10
			P4_5	10
			P4_6	10
Electricity problems				
1	Unit does not have electricity	10	P4_16	10
2	Unit has exposed wiring	4	P4_25_6	1
3	Unit does not have electric plugs in every room	3		
4	Each occurrence of a blown fuse or thrown circuit breaker ^a	1		
Amenities*				
			P4_23_1	1
			P4_23_2	1
			P4_23_3	1
			P4_23_4	1
			P4_23_5	1
			P4_23_6	1
Heating problems				
5	Unit was uncomfortably cold for 24+ hours	4	P4_7_1	0.66
6	Each heating equipment breakdown ^b	2	P4_7_2	0.66
7	Unit cold due to utility interruption	2	P4_7_3	0.66
8	Unit cold due to inadequate heating capacity	2	P4_8_1	0.5
9	Unit cold due to inadequate insulation	2	P4_8_2	0.5
10	Unit cold due to other reason	2	P4_8_3	0.5

Continued on next page

Table 15 – continued from previous page

AHS Component / Problem		AHS Score (Weight)	ENVI Variable	ENVI Score (Weight)
11	Main heating equipment is unvented kerosene heater(s)	4	P4_8_4	0.5
			P4_22_6	2
			P4_22_7	2
			P4_22_8	2
			P4_22_9	6
Inside structural or other problems				
12	Water leak in roof	2	P4_25_2	5
13	Water leak in wall or closed door/window	2	P4_25_3	2
14	Water leak in basement	2	P4_25_4	5
15	Water leak from other source	2	P4_25_5	2
16	Inside leak from leaking pipes	2	P4_25_7	2
17	Inside leak from plumbing fixtures	2	P4_26_1	2
18	Inside leak from other or unknown source	2	P4_26_2	2
19	Holes in the floor	2		
20	Open cracks wider than a dime	2		
21	Peeling paint larger than 8 by 11 inches	2		
22	Evidence of rodents	2		
Bathroom problems				
23	Unit does not have hot and cold running water OR Unit does not have a bathtub or shower OR Unit does not have a flush toilet	10	P4_11	6
24	Each breakdown leaving unit without a toilet for 6+ hours ^c	2	P4_12	2
			P4_22_5	2
Kitchen problems				
25	Unit does not have a refrigerator OR Unit does not have a kitchen sink OR Unit does not have a cook stove or range	10	P4_9	10
			P4_17	2

Continued on next page

Table 15 – continued from previous page

AHS Component / Problem		AHS Score (Weight)	ENVI Variable	ENVI Score (Weight)
Outside structural problems				
26	Windows broken	5	P4_25_1	5
27	Holes/cracks or crumbling in foundation	5		
28	Roof has holes	5		
29	Roof missing shingles/other roofing materials	5		
30	Outside walls missing siding/bricks/and so on	5		
31	Roof's surface sags or is uneven	5		
32	Outside walls slope/lean/slant/buckle	5		
Water and sewer problems				
33	Each time unit is completely without water ^e	2	P4_13	2
34	Each sewage disposal breakdown ^f	2	P4_14	2
			P4_15	2
			P4_22_1	2
			P4_22_2	2
			P4_22_3	2
			P4_22_4	2
Elevator problems				
35	No working elevator in building of four or more stories	4	P4_26_3	4

Notes: Left two columns reproduce the American Housing Survey (AHS) 2013 Physical Problems Index (PQI) component and its score weight; right two columns give the corresponding ENVI variable(s) we map it to and the weight used in our index, as described in Section 2.1. Components marked with * are not part of the AHS index. Superscript letters (a, b, c, e, f) mark footnotes to the original AHS methodology documentation and are not reproduced here.

D Additional Regression Results

This appendix reports five ENVI robustness checks on the relationship between housing quality and credit access documented in Section 2.3. The checks vary the quality index's weights and component set, replace the index with its first principal component, and use Imputed Sale Value (ENVI). Each table retains the same specification and control set while changing the dependent variable.

D.1 US-Weighted Quality Index

Table 16 uses the quality index weighted to match the American Housing Survey (AHS) component weights listed in Table 15. The positive associations of credit access and income with housing quality are not specific to the weighting scheme.

Table 16. Quality Index and Credit Access (US Weighted)

	Quality Index (US Weighted)	
	baseline	with state controls
	(1)	(2)
log(Income)	0.154*** (0.003)	0.111*** (0.002)
Age	0.002*** (0.0001)	0.002*** (0.0001)
Credit Access	0.108*** (0.004)	0.062*** (0.004)
College Educ	0.100*** (0.005)	0.112*** (0.004)
Urban		0.103*** (0.004)
Observations	35,402	35,402
R ²	0.210	0.317

Note: *p<0.1; **p<0.05; ***p<0.01

Notes: Dependent variable is the housing quality index reweighted using AHS component weights (Table 15), constructed as described in Section 2.1. Source: 2020 ENVI.

D.2 Equal-Weighted Quality Index

Table 17 returns to the baseline housing quality index, which gives equal weight to each available dwelling characteristic. The positive associations of credit access and income with housing quality therefore do not depend on using externally chosen component weights.

Table 17. Quality Index and Credit Access (Equal Weighted)

	Quality Index	
	baseline	with state controls
	(1)	(2)
log(Income)	0.150*** (0.002)	0.113*** (0.002)
Age	0.002*** (0.0001)	0.002*** (0.0001)
Credit Access	0.102*** (0.003)	0.061*** (0.003)
College Educ	0.128*** (0.004)	0.137*** (0.004)
Urban		0.100*** (0.003)
Observations	35,402	35,402
R ²	0.282	0.376
<i>Note:</i> *p<0.1; **p<0.05; ***p<0.01		

Notes: Dependent variable is the equal-weighted housing quality index constructed from the dwelling characteristics available in ENVI, as described in Section 2.1. Source: 2020 ENVI.

D.3 Common-Questions Quality Index

Table 18 restricts the equal-weighted index to dwelling characteristics observed in both ENVI and ENIGH. Credit access and income retain positive associations with housing quality when the index is built only from this common set of questions.

Table 18. Quality Index and Credit Access (Common Questions)

	Quality Index (Common Questions with ENIGH)	
	baseline	with state controls
	(1)	(2)
log(Income)	0.195*** (0.003)	0.137*** (0.003)
Age	0.003*** (0.0002)	0.003*** (0.0001)
Credit Access	0.159*** (0.005)	0.097*** (0.004)
College Educ	0.173*** (0.005)	0.176*** (0.005)
Urban		0.188*** (0.004)
Observations	35,402	35,402
R ²	0.266	0.402
<i>Note:</i> *p<0.1; **p<0.05; ***p<0.01		

Notes: Dependent variable is the equal-weighted housing quality index constructed from dwelling characteristics common to ENVI and ENIGH. Source: 2020 ENVI.

D.4 Imputed Sale Value

Table 19 replaces the index outcomes with Imputed Sale Value (ENVI), which applies coefficients estimated from reported dwelling sale values to the characteristics of all ENVI dwellings. The positive associations of credit access and income remain when housing quality is valued in sale-price rather than index units.

Table 19. Imputed Sale Value (ENVI) and Credit Access

	log(Hedonic Dwelling Value), ENVI	
	baseline	with state controls
	(1)	(2)
log(Income)	0.344*** (0.005)	0.228*** (0.005)
Age	0.010*** (0.0003)	0.008*** (0.0002)
Credit Access	0.211*** (0.008)	0.116*** (0.007)
College Educ	0.286*** (0.010)	0.244*** (0.009)
Urban		0.540*** (0.007)
Observations	30,942	30,942
R ²	0.257	0.484
<i>Note:</i> *p<0.1; **p<0.05; ***p<0.01		

Notes: Dependent variable is the log of Imputed Sale Value (ENVI), constructed by applying the ENVI sale-price hedonic specification to dwelling characteristics. Source: 2020 ENVI.

D.5 PCA-Based Quality Index

Table 20 instead replaces the weighted-sum quality index with its first principal component across the same underlying binary quality indicators, which does not require choosing weights at all. Credit access and income remain significant with the same sign, and the coefficient magnitudes rescale sensibly given the different units of the dependent variable.

Table 20. Quality Index and Credit Access (First Principal Component)

	Quality Index (First Principal Component)	
	baseline	with state controls
	(1)	(2)
log(Income)	1.217*** (0.015)	0.856*** (0.014)
Age	0.017*** (0.001)	0.013*** (0.001)
Credit Access	0.974*** (0.024)	0.583*** (0.022)
College Educ	1.048*** (0.029)	1.086*** (0.026)
Urban		1.088*** (0.022)
Observations	35,402	35,402
R ²	0.336	0.477
<i>Note:</i> *p<0.1; **p<0.05; ***p<0.01		

Notes: Dependent variable is the first principal component of the binary quality indicators listed in Table 12. Source: 2020 ENVI.

E Sampling Method in ENVI

For all surveys originated by INEGI (including ENVI and ENOE), two updating mechanisms are used in order to continuously reflect geostatistical changes: a master sample list used and updated every five quarters in order to reflect changes in streets and their property density, and a framework for areas of new growth updated quarterly in order to reflect new streets not reflected in the master sample list.