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Muhammad Zohaib

zohaibahmadani48@gmail.com

Ghazi University

Kashif Raza

Ghazi University

Muhammad Asif

Ghazi University

Abdul Ghaffar

Ghazi University

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Credit Constraints and Household Residential Investment: A Dynamic Macroeconomic Perspective

Muhammad Zohaib *

1*Email: zohaibahmadani48@gmail.com

1* Faculty of social sciences and management, Department of Economics, Ghazi University Dera Ghazi Khan, Punjab, Pakistan

Kashif Raza

Email: 2021gu1196@gmail.com

Faculty of social sciences and management, Department of Economics, Ghazi University Dera Ghazi Khan, Punjab, Pakistan

Muhammad Asif

Email: masifhotmail240@gmail.com

Faculty of social sciences and management, Department of Economics, Ghazi University Dera Ghazi Khan, Punjab, Pakistan

Abdul Ghaffar

Email: abdulghaffar7423@gmail.com

Faculty of social sciences and management, Department of Economics ,Ghazi University Dera Ghazi Khan, Punjab, Pakistan

Abstract

The American public tends to see manufacturing as a natural consequence of real estate investment. Our study's overarching goal is to identify the function of family borrowing restrictions in relation to this event. As a tool of increasing consumption, our study examines the impact of home-equity loans on their real estate investments. We discuss a scenario in which several agents encounter difficulties obtaining home equity loans or refinancing due to lending limitations. Individual patterns in US real estate investment can be illuminated by the extent to which a country's residents are unable to borrow. The research found that nations with less strict

borrowing restrictions would see patterns of house investment happening at the same time. Using data from France in the Model keeps the forecast valid.

Keywords; Household Borrowing Constraints, Residential Investment, Household finance, Mortgage borrowing, Down payment constraints, Housing investment

1. Introduction

It has long been acknowledged that home investment plays a significant role in explaining US economic volatility (Ngoc et al., 2024a). According to (Hagspiel et al., 2021), the decline in total investment in residential real estate accounts for nearly partial of the weakening in GDP during recessions in the US. "Among the components of GDP, residential investment functions as the most reliable early indicator of an impending recession" (Yadav et al., 2024), he said in the same year. This study primarily seeks to understand this phenomenon by highlighting the relevance of borrowing limits for families. At any given time, investment in individual dwellings in the US is the major driver of economic development. In this essay, we examine a hypothetical situation in which home-equity loans affect spending and property investment. Investment in housing and manufacturing takes a back seat to the severity of the borrowing limit in this case. The Model's predictions on the patterns of simultaneous home investment in countries with lenient borrowing rules are spot on. When the Model is run on French data, this prediction holds. Consequently, there is an inherent motivation to understand the basics of home investment, given constraints on family Financing.

Recent studies have shown that borrowing constraints significantly affect the economic cycle; therefore, it is reasonable to use them as a starting point for any analysis of housing investment trends. Collateral makes it easier for individuals and businesses to respond to changes in property values (Ren et al., 2022). While (He & Huang, 2021) show that changes in home values affect people's ability to borrow money, which might explain overall disparities, (Zhang et al., 2024) investigate the role of land in connection to the constraints placed on businesses by collateral and how this affects the business cycle. Restrictions on home equity resulting from changes in house prices helped drive up consumer debt from 2000 to 2007, according to (Ngoc et al., 2024b). Using microdata analysis, (Fan et al., 2022) showed that the borrowing restriction channel is crucial for understanding how changes in family wealth impact consumption.

Consumers' options for taking out home equity loans are examined. Here, we examine a homeownership Model with several agents to simulate the effects of limited home equity loans and refinancing options on individual homeowners. We hope that this will become clearer by using the paradigm (Tiep et al., 2021) put forth, which is based on (Agoraki et al., 2023). An unexpected Total factor Productivity (TFP) shock, often called a technological shock, is predicted to impact economic cycles in the baseline Model.

We show that home investment is 25% more than output when the proportion of families facing Financing limits is in line with US figures. This result is based on the following reasoning: when choosing a home investment, there are two factors to consider. In terms of home utility functions, housing services are quite important. Spending on housing rises due to the TFP shock's positive wealth effect. But this positive effect on wealth isn't enough to explain the current pattern. Certain families are restricted in the amount they may borrow. More property on the market means more individuals can take out loans, boosting demand for necessities with shorter shelf lives. To see why it's more important than manufacturing, let's look at the family borrowing limit and how it affects home investment.

Whether home investment boosts productivity depends on the extent to which the borrowing limit is enforced, as shown by the percentage of households affected. (Pan et al., 2022) found that the rates of residential investment and output are similar in many Eurozone countries. This proves that our Model is accurate. Housing investment is expected to follow the economic cycle in Eurozone countries, since a smaller share of homeowner’s face financing constraints than in the US. Overall, this claim is supported by the fact that the American household debt-to-GDP Ratio is higher than the Eurozone average. From 1999 to 2015, the average American household's debt was 84.05% of GDP, according to data compiled by the Bank for International Settlements. The corresponding Figure for the Eurozone was 56.35%. Fourth, we show that the Model simultaneously generates patterns in home investment after calibrating it using French data.

The format is described below, and the following sections follow it. In Section 2, we discuss how these results relate to prior studies. In Section 3, the Model is described. How to calibrate the parameters is shown in Section 4. The complete quantitative outcomes are presented in Sector 5. The results of the sensitivity analysis are presented in Section 6.

2. Relation to the literature

Prior research using approaches different from ours has attempted to capture the aforementioned stylized reality but failed. Using a Model that incorporates multi-period building schedules and long-term mortgage loans, (Agoraki et al., 2023) explain why the US ranks first among Eurozone nations for residential investment. A credit system based on "first mortgage" loans completely ignores the effects of consumption-based refinancing and collateralized borrowing. However, two significant limitations remain. More and more American households are taking advantage of home equity loans and refinancing their mortgages to access the value that has accrued in their properties over the years. As noted by (Chu & Zhou, 2022), the rules governing home loan collateral were relaxed during the early 1980s, with the financial reforms of the Monetary Control Act of 1980 and the Garn-St. The Germain Act of 1982 was a federal statute that, respectively, eliminated the regulatory framework that had been in place since the New Deal period. Thus, home fairness lends and loan refinancing has been crucial to the US housing market for the last 30 years.

Secondly, throughout the time frame examined by (Agoraki et al., 2023), there was a clear association between house starts and residential investment in a number of European nations, including Belgium and France. This fact adds another layer of complexity to the reasons why the construction timelines of the US and the Eurozone countries differ.

In their study, (He & Huang, 2021) sought to explain the significance of home investment using a partial equilibrium Model with news shocks to total factor productivity, agent heterogeneity, collateral limits, and the US economic cycle. Their Model indicates that agents will delay buying luxury goods after receiving a positive endowment shock, thereby saving for the future. Despite the decline in mortgage rates, credit cards remain a popular payment method in today's market. (Gao et al., 2024) partial equilibrium framework omits the labor supply decision, a crucial but neglected component of the Model. This assumption has the potential to alter the explanations offered by (Feng et al., 2022) for total factor productivity (TFP) shocks, which rely on wealth effects on labor supply to reduce correlations across economic cycles. This means there is some risk involved.

3. The model

Impatient households, patient households, and entrepreneurs make up the economic Model. The three agents are identified by the designations I, P, and E. Thus, the ϋI, ϋP, and ϋE represent the corresponding economic portions of these substances. In a perfect world, if agents could live indefinitely, they would maximize the reduced amount of their time-separable utility. We contend that irritated businesses and families copy from enduring families, which act as creditors. The two borrowing entities' reduction influences, ΘI and ΘE, are therefore less than the lenders' reduction influence, γ. These anxious families put their homes up as collateral when they take out loans. In addition to holding real estate, both lines of the family own businesses that make both transient items and permanent buildings. Products and services that do not endure, like consumer goods and household items, provide them joy.

In contrast to businesses making throwaway items, home developers face a much more cutthroat business climate. A collateral constraint prevents them from engaging in all areas of the residential and non-residential sectors. Working capital loans and inter-period labor expenditure debt should not cause their capital stock to surpass a specific percentage. The Model is fully described in the appendix.

3.1. Domestic Units

All anxious families encounter the same maximizing dilemma, which is as follows:

$$\max E_0 \sum_{t=0}^{\infty} \theta_I^t (\ln(c_{It} - \zeta c_{It-1}) + \psi \ln h_{It} + \eta_I \ln(1 - (n_{Ict}^{1+\epsilon} + n_{Iht}^{1+\epsilon})^{1/(1+\epsilon)})) \quad (1)$$

Conditional upon

$$c_{It} + (1+\tau_h) q_{ht} h_{It} - q_{ht}(1-\delta_h) h_{It-1} = b_{Ht} - R_{t-1} b_{Ht-1} + p_{lt} l_{It} + \sum_{i=c,h} w_{it} n_{Iit} - \tau_n \left(\sum_{i=c,h} w_{it} n_{Iit} - \tau_m r_{t-1} b_{Ht-1} \right) + \xi_{It}, \quad (2)$$

$$b_{Ht} \leq m_H E_t q_{ht+1} h_{It}. \quad (3)$$

Every family of irritation includes the variables cIt, hIt, nIct, nIht, bHt, lIt, and ξIt. Factors such as housing stock (hIt), labor hours (nIct), consumption of non-durable products (cIt), and housing stock (nIht) are included in their time-logarithmic utility function. Products with a short lifetime are more likely to be purchased by them if the statistic ζ is high. The regulations established by

(Cagli, 2023) control the parameter ϵ and permit a partial transfer of work across sectors, which we adhere to. If ϵ is large, impatient families are less likely to move their work hours between sectors in response to income inequalities.

Impatient families may use a combination of approaches, as shown in Eq. To overcome their budgetary limits. Earnings subject to a tax rate τn are used to calculate their total after-tax labor income. In addition, the astronomical interest rates imposed on their loans cause them to accumulate far more debt.

Grants and contracts provide financial support; they earn a profit of plt from the sale of land to developers. Actually, I had assumed that to be true. The tax advantages of holding mortgage debt stem from the fact that a portion of the interest paid can be subtracted from chargeable revenue. Here, we examine restructured one-period loans at every stage. The spending non-durable commodity consumption and housing stock building is given by the left side of the equation, which represents the household tax rate τh. Θh denotes the rate of depreciation of housing, while qht stands for the relative price of housing.

Equation (3) expresses the collateral constraint, the second constraint. There is a cap on the overall debt for each period, based on the home's assessed value. This limitation becomes quite important when impatient families reach a steady state and show a reduced discount factor. In addition to the steady state, small disturbances and a discount rate small enough to contain them are considered.

Due to a significant difference, the impatient families are hesitant to take on debt. This is because their discount factor is greater than the family's discount factor for the sample patient (β > ΘI). However, this is the form of the equation that represents the utility function of patient accommodations:

$$\max E_0 \sum_{t=0}^{\infty} \beta^t (\ln(c_{Pt} - \zeta c_{Pt-1}) + \psi \ln h_{Pt} + \eta_P \ln(1 - (n_{Pct}^{1+\epsilon} + n_{Pht}^{1+\epsilon})^{1/(1+\epsilon)})) \quad (4)$$

Dependent upon

$$c_{Pt} + (1+\tau_h)q_{ht}h_{Pt} - q_{ht}(1-\delta_h)h_{Pt-1} = \frac{1}{\omega_P}(\omega_I(R_{t-1}b_{Ht-1} - b_{Ht}) + \omega_E(R_{t-1}b_{Kt-1} - b_{Kt})) + (1-\tau_n)\sum_{i=c,h} w_{it}n_{Pit} + p_{lt}l_{Pt} + \xi_{Pt}. \quad (5)$$

Like the variables mentioned earlier for inpatient hospitals, the ones with the subscript P concern patient housing. Quantification is done on a household-patient basis for all variables. This group is vital to the economy's stability because of the short-term loans they provide to businesses and worried families.

3.2. Businesses

The business owners optimize the subsequent issue:

$$\max E_0 \sum_{t=0}^{\infty} \theta_E^t \ln(c_{Et} - \zeta c_{Et-1}) \quad (6)$$

Dependent upon

$$c_{Et} + x_{ct} + x_{bt} + \frac{w_{ct}}{\omega_E}\sum_{j=I,P} \omega_j n_{jct} + \tau_k r_{ct}k_{ct-1} = \frac{y_t}{\omega_E}b_{Kt} - R_{t-1}b_{Kt-1} + (1-\tau_k)p_{bt}k_{bt} + p_{lt}l_{Et} + \xi_{Et}, \quad (7)$$

$$y_t = z_t(\omega_E k_{ct-1})^{\alpha c}(\sum_{j=I,P} \omega_j n_{jct})^{1-\alpha c}, \quad (8)$$

$$x_{ct} = k_{ct} - (1-\delta_c)k_{ct-1}, \quad (9)$$

$$x_{bt} = k_{bt}, \quad (10)$$

$$b_{Kt} + \frac{w_{ct}}{\omega_E}\sum_{j=I,P} \omega_j n_{jct} \leq m_K k_{ct}. \quad (11)$$

Each business owner has their own collection of factors that include cEt, xct, xbt, bKt, kct, lEt, kbt, and ξEt. Businesses that are strapped for cash may find it difficult to invest in and manufacture non-durable goods. Equation (7) makes it quite evident that the production of these products involves two distinct kinds of families: the impatient and the patient. Wage wct is given to the impatient families and capital kct is given to the patient families. The Cobb-Douglas production function (YT) and an external neutral technical shock (zt) collaborate to influence variations. A mechanism involving AR (1) has been identified in this shock.

$$\ln z_t = \rho_z \ln z_{t-1} + \epsilon_{zt}, \epsilon_{zt} \sim N(0, \sigma_z^2) \quad (12)$$

In this case, the innovation's variation is represented by the persistence parameter ρz. Where xct is the investment in non-durable items, businesses use the mobility rule to acquire capital, as indicated in Equation (9). They set aside funds to purchase timber, nails, and other items for house renovation. The money that goes into making things that won't last very long can be recycled, but the materials needed to build new houses in the era t can't. The prospect of amassing substantial kbt capital is therefore eliminated. Our argument states that the rate of taxation on capital rental income (rctkct) is τk, where rct is the rental rate and τk equals the marginal product of capital. The habit of consuming items like houses that don't last long is symbolized by them. Assume for the sake of argument that they are currently unemployed and do not own their own home.

On the right side of Equation (7), we can see the owners' profit. The remainder will be used internally or invested, with a portion going to homes for the impaired and sickly. The second point is that beginning businesses pay their owners in PBT for KBT. The tax rate is τk for both material sales and rental income, as prescribed by capital. Last but not least, company owners get plt per month in exchange for using their lt acres of land. Finally, their net borrowing results from their reduced discount factor, which allows them to borrow bKt at the interest rate Rt. They get žEt, which are government transfers, as the fifth point.

Two common forms of loans held by entrepreneurs are working capital loans and inter-period debt. Enterprises use the former to cover payroll commitments. Since repayment is due at the end of the period following the sale of non-durable commodities, these loans are intra-period in nature. According to Equation (11), there is a maximum allowable Ratio of mK for inter-period debt and working capital loans.

3.3. Residential Builders

There is significant rivalry among home builders in the residential construction industry. The static aspect of real estate investing comprises two components. Think about this to see how the Cobb-Douglas production function uses labor and inputs to make investments in housing units:

$$\max p_{rt} x_{rt} - w_{ht} \sum_{j=I,P} \omega_j n_{jht} - \omega_E p_{bt} k_{bt} \tag{13}$$

subject to

$$x_{rt} = z_t (\omega_E k_{bt})^{\alpha_B} (\sum_{j=I,P} \omega_j n_{jht})^{1-\alpha_B} \tag{14}$$

The creators of the housing investment, prtxrt, give careful thought to each and every stage of creation. Because the three sets of agents have different population proportions, the labor inputs and supplies need to be adjusted. The construction of non-durable items is strongly related to the output of house investment, as shown in Equation (8), which is in turn affected by the external variable zt.

This is what comes next:

$$\max q_{ht} ih_t - p_{rt} x_{rt} - p_{lt} l_t \tag{15}$$

$$\text{subject to} \quad ih_t = x_{rt}^{\phi} l_t^{1-\phi}, \tag{16}$$

$$l_t = \sum_{j=I,P,E} \omega_j l_{jt}. \tag{17}$$

Residential developers pool financial and physical resources to construct new dwellings. At home, the idea of competitive marketplaces ensures that there is no profit.

3.4. Governance

For the time being, the government will stay out of the economy. It provides firms and individuals with disproportionate tax advantages while ensuring that overall transfers are equal to tax inputs through lump-sum payments.

$$\xi_{It} = \omega_I(\tau_n \sum_{i=c,h} w_{it} n_{Iit} + \tau_h q_{ht} h_{It} - \tau_m \tau_n r_{t-1} b_{Ht-1}), \tag{18}$$

$$\xi_{Pt} = \omega_P(\tau_n \sum_{i=c,h} w_{it} n_{Pit} + \tau_h q_{ht} h_{Pt}), \tag{19}$$

$$\xi_{Et} = \omega_E \tau_k [r_{ct} k_{ct-1} + p_{bt} k_{bt}]. \tag{20}$$

3.5. Requirements for Marketplace Equilibrium

Due to resource constraints, the economy must produce enough to cover consumption and asset in non-durable goods and resources:

$$y_t = \sum_{i=I,P,E} \omega_i c_{it} + \omega_E (x_{ct} + k_{bt}). \tag{21}$$

We use a value-added approach to assess the Model's output in terms of GDP, using the NIPAs GDP definition; thus:

$$GDP_t = y_t + q_{ht} ih_t - \omega_E k_{bt}. \quad (22)$$

Furthermore, the complaint's rule pertaining to dwellings is as follows:

$$ih_t = h_t - (1 - \delta_H) h_{t-1} \quad (23)$$

We assert that the amount of land available is fixed at one throughout history.

4. Calibration

Table 1 displays the results of the baseline Model's calibration. In our Model, the percentage of impatient families is represented by the household participation rate in mortgage markets, which is the most relevant element. That number was 47% in 2010, according to (Adebayo et al., 2021) these findings inform our strategy revision. To align with the findings from France and the Eurozone, as provided by the ECB (2016), we lessen the number of households experiencing borrowing limits in Section 5. Between 1999 and 2015, American household debt averaged 84.05% of annualized GDP, compared to 56.35% in the Eurozone, according to data from the Bank for International Settlements. Our calibration option is validated by the 'high' and 'low' patterns that are recognized for the US and France, respectively. The household debt-to-GDP Ratio reflects problems with contract enforcement. The number of borrowers that face collateral restrictions and whether or not there are borrowers who are not limited outside of our Model are both unknowns. Previous statistics show that France has a lower proportion of restricted borrowers than the United States. We performed a sensitivity analysis to find the precise value of this parameter; Figures 3 and 7 show the results.

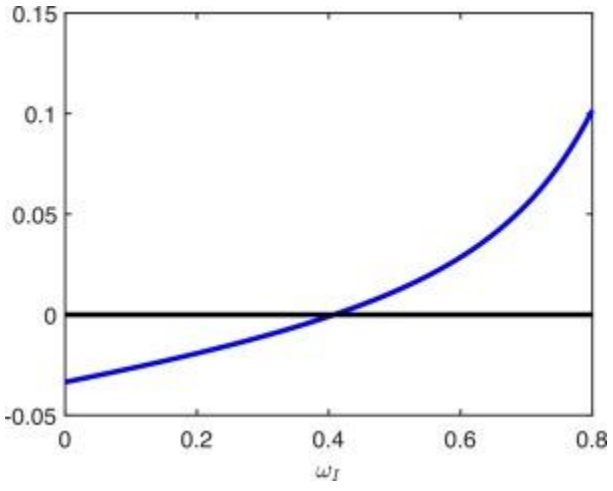

Figure 3. Relationships of GDP and gross investment in housing conditioned on TFP shocks.

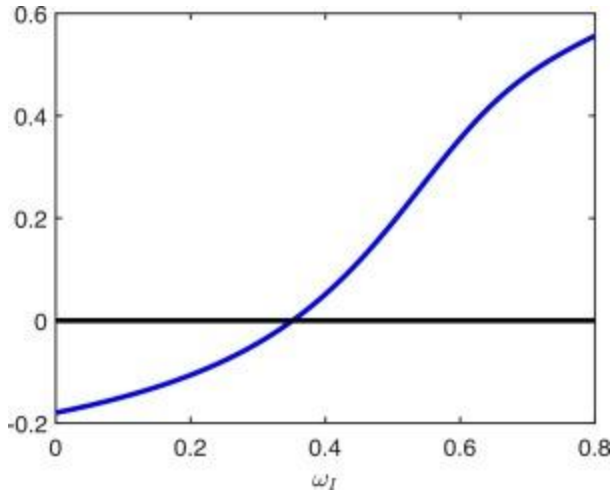

Figure 7. Relationships of GDP and gross investment in housing conditioned on patient shocks.

According to (Diaconașu et al., 2022), 9.1% of the population is a company owner, based on SCF data. With that proportion in mind, the remaining patient homes are on board.

When everything is running well, the quarterly discount factor will provide patients' families and savings a true interest rate of 3%. Companies and individuals with limited borrowing capacity who are impatient incur additional hidden costs beyond interest payments when they borrow. This outlay could be better understood as an interest premium. Bernanke, Gertler, and Gilchrist (1999) state that a 2% interest premium has to be included into the discount factor for impatient families. Assuming a negligible TFP shock, the discount factor maintains a stringent borrowing limit. Using the anticipated outcomes from earlier studies, (Saba & Ngepah, 2024) conducted a meta-analysis on consumption pattern parameterization. Research on the US economy has shown that macroeconomic estimates often have a median value of 0.72. The value of ν is therefore set to 0.7. In this section of the sensitivity analysis, we see how much the value of this parameter affects our findings.

The limitation ψ, which denotes the importance of housing in households' helpfulness purposes, is calibrated using the average real estate-to-GDP Ratio for the US, which was 4.68 from 1983 to

2016. This Figure is derived from data provided by the National Replacement Panel (Table B.101, line 3). The purpose of using the leisure weights ηI and ηP is to guarantee that families remain in the steady state for 30% of their allocated time. The parameter Ↄ, which affects the level of sectoral labor mobility, is the only steady-state variable influenced by external variables. The aim is to have home investment volatility equal to GDP volatility. The adjusted loan-to-value Ratio for residences, as defined by (Abakah et al., 2023), will be used for this research. The mean loan-to-value for acquisitions and refinances, calculated from the SCF data for 1992, 1995, and 1998, serves as the basis for this Ratio. The entrepreneurs have been assigned a loan-to-value Ratio (LTV) of 0.5, which aligns with the findings of (Essayem et al., 2024).

Taxes distort the decision-making process for households and enterprises. (Khan et al., 2025) used the method developed by (Fallah & Fitzpatrick, 2022) to determine the real average due taxes on employment and capital, denoted τn and τk, respectively. To calculate the US property tax rate—a quarterly statistic—we employ an examination of house taxes in OECD nations by (Prodromou & Demirer, 2022). The fact that mortgage interest is fully deductible in the US is why we get this outcome.

We adopt the methods proposed by (Zhao et al., 2023) to determine and define the home depreciation rate using BEA data. We selected how to split the home-building budget based on the same survey. (Chauhan et al., 2024) and (Bagh et al., 2024) describe the approach used to calculate the proportion of land designated for new housing development. In the home production function, we do not differentiate between intermediate goods and building capital. The cost of materials accounts for a significant portion of the overall cost of producing a house. According to US input-output statistics spanning 1997-2014, this Ratio is 15% higher than workers' compensation. We followed the two studies mentioned previously and allocated 10% to structures, ensuring that αH would equal this Ratio. Finally, we settle on a parameter for the technological shock's permanence. This is the means of forecasting the ability to withstand technological upheavals affecting the manufacturing of both housing and non-durable goods, as stated by (Cobbinah et al., 2024).

5. Quantitative results

Based on the US data moments (see Table 2), we present the key quantitative findings for the Model's baseline calibration here.

Table 2. Characteristics of the basic system

Co-movements			**Qualified instabilities**		
Statistic	**Statistics**	**Exemplary**	**Figure**	**Statistics**	**Exemplary**
$\rho(c_t, GDP_t)$	0.78	0.89	σ_c/σ_{GDP}	0.83	0.6
$\rho(p_{rt}x_{rt}, GDP_t)$	0.67	0.86	$\sigma_{prxr}/\sigma_{GDP}$	6.55	6.55
$\rho(x_{ct}, GDP_t)$	0.86	0.97	σ_{xc}/σ_{GDP}	4.22	3.78
$\rho(p_{rt}x_{rt}, x_{ct})$	0.39	0.87	$\sigma_{prxr}/\sigma_{xc}$	1.55	1.74
$\rho(q_{ht}, GDP_t)$	0.51	0.76	σ_{qh}/σ_{GDP}	2.94	0.49

Borrowing restrictions are essential for the US to regain its status as a leader in home investment, since the conventional real economic cycle Model does not account for the co-movement and relative volatility observed in the US.

5.1. Findings

Chart 2 compares consumption, investment (including residential and non-residential), housing starts, pricing, and volatility. After calibrating it using the qualified normal deviancy of housing asset, we have limited the Exemplary to the sectoral labor mobility parameter, F, to the specified interval; however, the other parameters are free to take whatever values they want. The model appropriately portrays the qualified instability of non-residential asset. The data and Model results show that the residential building business has much higher investment volatility. Perhaps volatility would be better understood if we compared the depreciation rates of residential buildings with those of capital used to produce non-durable goods. An investment in a home's construction offers a longer-term benefit and slower depreciation. When investors experience a TFP shock, their response is magnified. The second difference is that, unlike non-residential investment, residential investment is more likely to experience the TFP shock again and again. A combination of factors, including the impact of the TFP shock on the construction of non-durable products used in new house building and an increase in the marginal product of residential investment, causes demand to rise and supply to rise. There is significant variation in domestic output because technology shocks affect both industries simultaneously.

The Model faithfully reproduces all of the positive relationships seen between aggregate quantity components and property prices. The very random nature of the property prices in the data is one of the Model's many flaws. According to the study, rapid technological developments cannot explain large changes in real estate values.

The benchmark Model and empirical data were used to create the cross-correlation purposes of production and housing asset, as shown in Figure 1. There is a 25% gap between residential investment and output. Production and residential investment have the strongest leading relationship during period t, as shown by the correlation's maximum absolute amplitude. While the Model's estimates for the other clues and pauses are rather accurate, the cross-correlations between -2 and 2 lags are higher than those observed in the data.

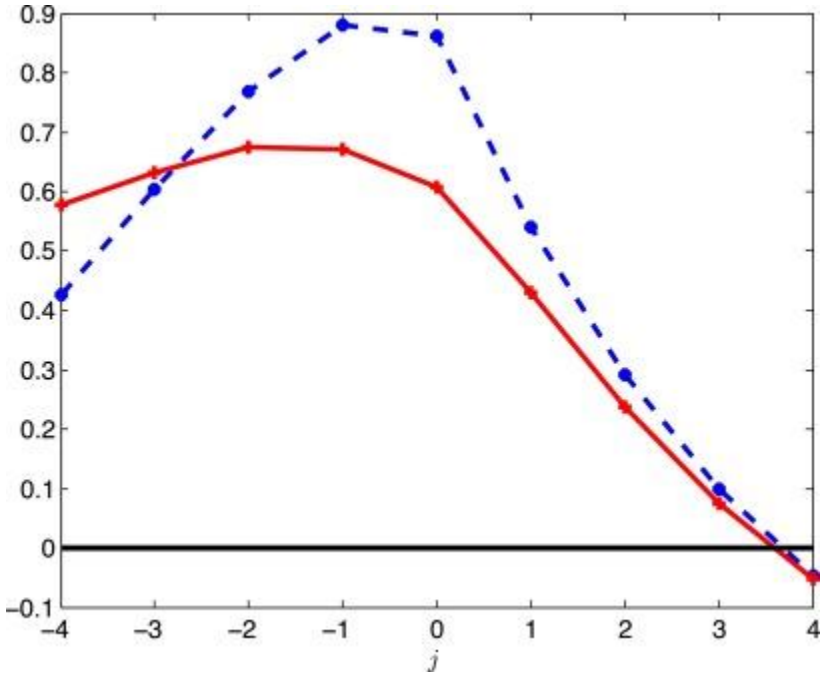

Figure 1. Relationship functional among GDP and household investments, conditioned on the TFP shock.

Table 1. Validation of the foundational framework

Population		
ω_I	0.58	section of irritated families
ω_P	0.66	Section of persistent families

ω_E	0.08	Section of businesspersons
Reduction aspects, favorites and loan-to-values		
β	0.8836	Concession feature (collectors and enduring families)
θ_W	0.864	Reduction feature (annoyed families)
θ_E	0.684	Reduction feature (businesspersons)
ζ	0.8	Conducts in ingesting
ψ	0.358	Heaviness on cover
η_I	2.06	Heaviness on vacation (irritated families)
η_P	1.88	Heaviness on freedom (enduring families)
ϵ	0.23	Sectoral employment flexibility
m_H	0.5	Irritated families' loan-to-value
m_K	0.6	Businesspersons' loan-to-value
Taxation		
τ_n	0.33	Employment revenue due
τ_k	0.37	Wealth due
τ_h	0.00737	Stuff due
τ_m	1	Section of deductible loan attention costs
Devaluation and technology		
δ_m	0.036	Reduction of wealth
δ_h	0.005	Reduction of housing
α_C	0.37	Bounciness with respect to wealth (non-durable properties)
α_B	0.78	Bounciness with respect to physical efforts (housing asset)
ϕ	0.3	Bounciness with respect to property (housing)
ρ_z	0.795	Resolution of the technology surprise

The impulse replies shown in Figure 2 demonstrate the efficacy of the operational borrowing-limits mechanism. Two types of people would want to amass more property. In terms of home utility functions, housing services are quite important. As a consequence of technological advancements, people are becoming richer and can afford to spend more on housing. Nonetheless, the present tendency cannot be explained by this beneficial effect on wealth. The fact that some families are subject to limits on the amount they may borrow is a big consideration. Buyers of non-durable products are more likely to take out loans to finance their purchases, both now and in the future, as a result of rising home prices.

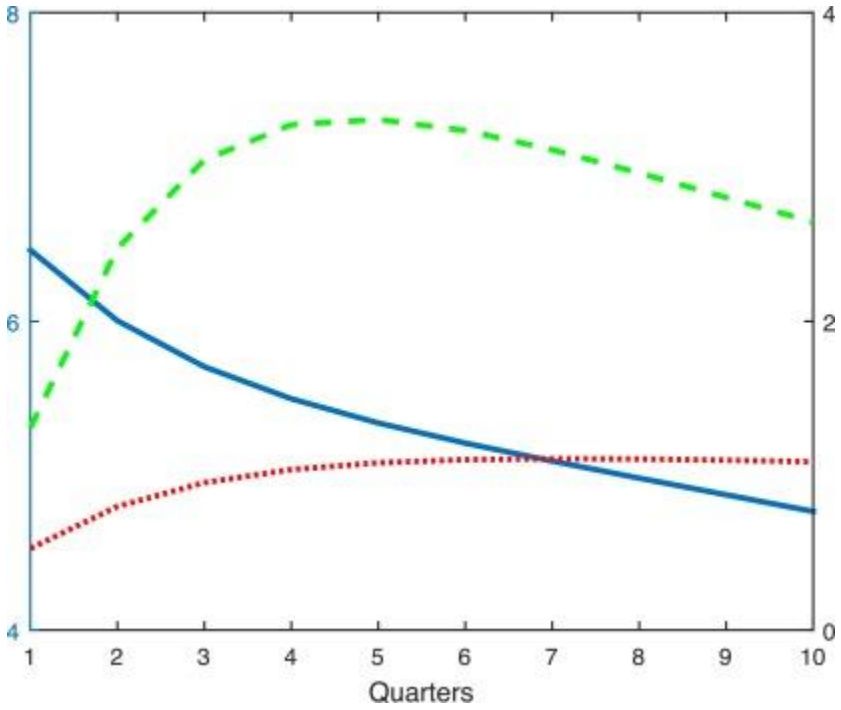

Figure 2. Reflex reactions to a one percentage technological shock.

In response to technological shocks, GDP has been slow and hump-shaped, reflecting changes in consumption patterns. Eleven tastes and behaviors indicate that, when money is tight, families choose durable goods over throwaways. But as we'll see in the next section, home investment is losing ground in the economy as a whole since fewer people are willing to wait for things to become habitual.

The relationships between home beginnings and output are shown in Figure 3. Building on housing begins before manufacturing does in both the US data and the baseline calibration Model, even though the connections produced from the standardization are larger than their experiential complements in the first two rows. Previous studies on the relative importance of housing investment and productivity have shown that our Model's efficacy is associated with the household borrowing limitation mechanism.

Table 3. Initiation of building homes and production

Associations among housing starts at period $t+j$ and output at period t									
	$j=-4$	-3	-2	-1	0	1	2	3	4

Associations among housing starts at period $t+j$ and output at period t									
	$j=-4$	-3	-2	-1	0	1	2	3	4
US data	0.46	0.56	0.62	0.64	0.58	0.4	0.22	0.08	-0.05
Baseline calib.	0.43	0.6	0.77	0.88	0.87	0.55	0.3	0.11	-0.04
French data	0.36	0.44	0.44	0.44	0.45	0.31	0.16	0.02	-0.15
French calib.	0.49	0.67	0.8	0.84	0.87	0.59	0.34	0.14	-0.02

The next section will demonstrate a crucial aspect of the concept. The proportion of irritated families in a budget impacts housing investment before manufacturing takes place. Figure 3 displays the paradoxical relationship between the correlations of home investment and production at time t and these two variables at time t across various impatient household fractions (óI) throughout the economy. When the former goes up, the proportion of families that are patient decreases, and vice versa when the impatient proportion goes down. Every other criterion is in accord, as shown in Table 1. A positive gap exists when the foremost connection is more robust than the period connection. The disparity among the two sets of connections grows as the proportion of households with restricted access to credit increases.

5.2. Different Measurement for Domestic Loan

In light of the recent emphasis on the role of borrowing restrictions in attracting US homebuyers, we adjust the financial friction parameters to align with the French data. All we have to do is recalibrate this parameter till it is in line with the standard.

Given the tiny number of families facing financial problems, the motivation to buy a house is significantly diminished. As a result, the relationship between the aggregate quantity variables is much stronger. House investment loses some of its luster, as shown in Fig. 4. This outcome is steady with the France cross-correlation design, signifying that the Model provides a superior match to the data. Moreover, as the number of impatient families in the economy diminishes, new building initiatives are linked to GDP. The last two rows of Table 3 display data from France, and this outcome aligns with that.

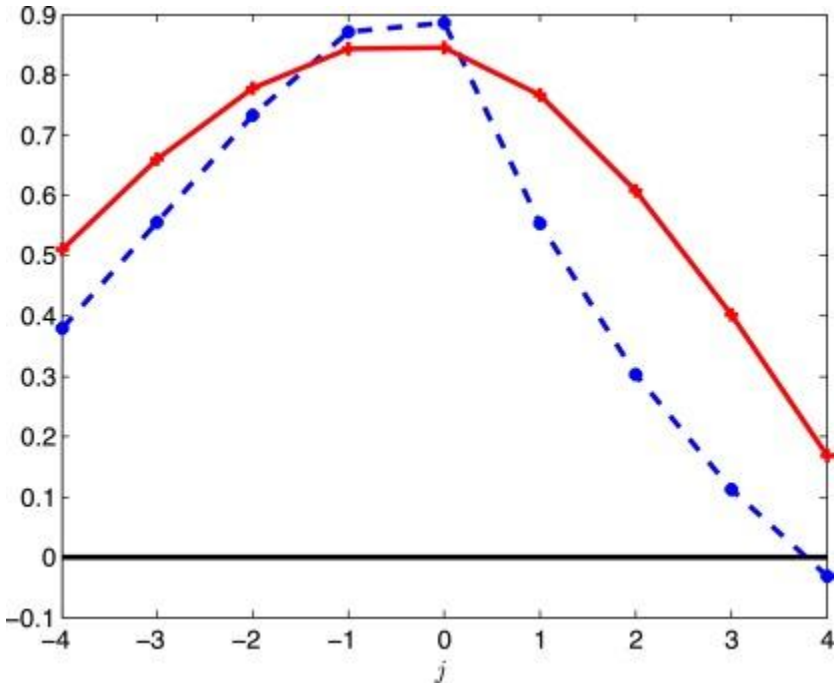

Figure 4. Relationship among investment in housing and GDP conditioned on TFP shocks: French calibration.

5.3. Relationships that are Depending on Patience Shocks

Here, we examine how a patience shock can affect how families and businesses make decisions over time. There is a constant impact on their discount factors. The letters \IAt, HAt, and \EAt stand for impatient families, patient houses, and entrepreneurs, respectively.

$$\ln A_t = \rho_A \ln A_{t-1} + \epsilon_{At} \epsilon_{At} \sim N(0, \sigma_A^2).$$

In their 2010 investigation, Iacoviello and Neri confirmed the same result. Figure 5 shows the cross-correlation function of home investment with the baseline calibration, and Figure 6 shows the same function for GDP with the French calibration. We only observe preference shocks among all external disturbances. A decrease in the percentage of impatient households in the economy has a substantial impact on the cross-correlation function, much as total factor productivity shocks. When impatience reaches 60% of households, residential investment increases GDP, and when it reaches 20%, the two aggregate variables converge.

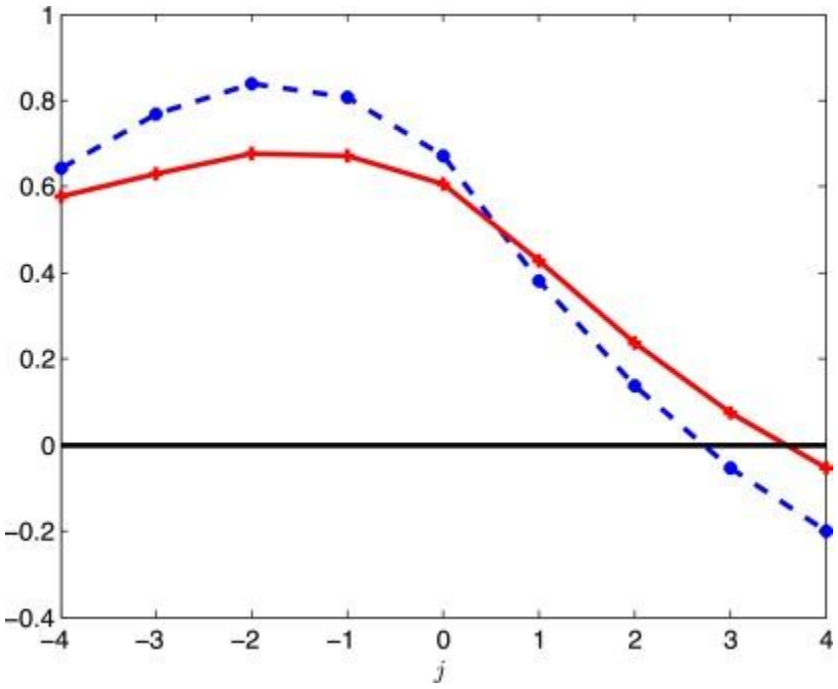

Figure 5. Relationship among investment in housing and GDP contingent upon tolerance shocks: Fundamental calibrating.

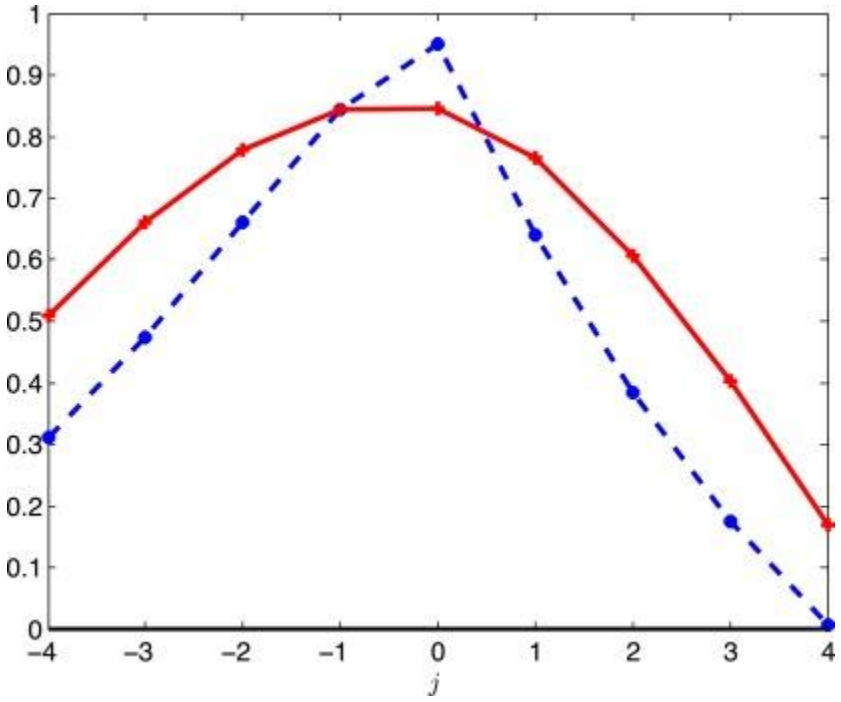

Figure 6. Relationship among investment in housing and GDP, conditioned on tolerance events: French calibrating.

Our emphasis is on negative patience shocks rather than positive technical shocks because of the stronger relationship between the two. Providing housing services and non-durable items becomes significantly more essential after severe disruptions, since everyone is more eager. Homebuyers who are impatient generally purchase quickly, thereby increasing their borrowing power, since they have something tangible to put up as collateral. Consequently, as the proportion of families in the economy who are borrowing-constrained rises, housing demand shifts more favorably than demand for non-durable goods during the shock phase. An increase in the proportion of impatient families delays the production of non-durable goods. Investment in homes so influences the business cycle.

Figuring out how preference shocks affect the magnitude of the home investment lead over a variety of impatient household proportions óI is shown in Figure 7, which is similar to Figure 3. Home investment is no longer a factor in boosting production since borrowing limits are less impactful at lower öI levels.

6. Sensitivity analysis

Using four separate approaches, we evaluate the sensitivity of the results here. First, for non-durable consumable products, we see how well cross-correlations hold up as the degree of habit persistence varies. The favorites projected by (Li et al., 2023) constitute the second utility function we analyze to mitigate the effect of wealth on labor supply. Research on economic cycles (GHH) often uses this function. We construct cross-correlation functions employing a variety of shocks, including housing preference and loan-to-value (LTV) shocks. Investment Adjustment Costs (IAC), which rank fourth, are included in both the housing and non-residential groups.

6.1. Continuity of routine feeding

A hump-shaped reaction in consumption and non-residential investment is required to identify residential investment as a leading indicator of the economic cycle, as shown in the preceding section. Because of the finite shelf life of perishable commodities, this is conditional on their continued use. As shown in Figure 8, to obtain this lead, ζ must be greater than 0.55.

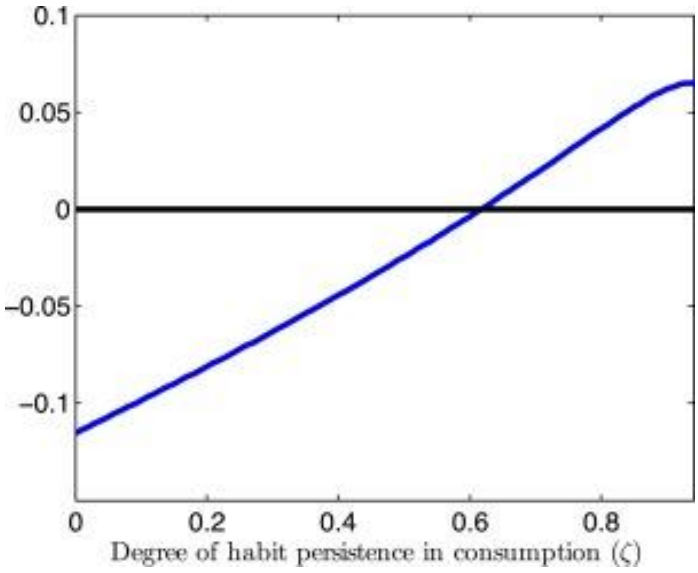

Figure 8. Relationships of GDP and gross investment in housing conditioned on TFP shocks.

6.2. Mitigating income consequences

Gross domestic product is more susceptible to total factor productivity shocks when GHH preferences, unlike log-log choices, lessen the effect of wealth on labor supply. The cross-correlations will be investigated after this wealth influence channel is eliminated. We achieve this goal by feeding impatient families and patients into the Model with modified periodic-utility functions, as shown below:

$$u(c_{it}, h_{it}, n_{ict}, n_{iht}) = \ln((c_{it} - \zeta c_{it-1})^{1-\psi} h_{it}^{\psi} - \eta_i \frac{(n_{ict}^{1+\epsilon} + n_{iht}^{1+\epsilon})^{\frac{1+\chi}{1+\epsilon}}}{1+\chi}) \text{for} i = \{I, P\}. \quad (24)$$

It is important to acknowledge that an additional parameter, χ, controls how the labor supply responds to changes in sectoral wages. About fifteen different The Frisch elasticity of the labor supply is 2, assuming there is no association between the persistence of habits and the hours worked across industries. As you can see in the "TFP" rows, the moments derived from this utility function formulation closely resemble those derived from a log-log design. We conclude that this supports the possibility that the mechanism under consideration may continue to operate even after accounting for GHH preferences, which mitigate the impact of wealth on worker availability.

6.3. Property Preferences and LTV Fluctuations

We examine the belongings of two shocks on the dynamics of housing asset: one on housing favorites and the other on the loan-to-value Ratio, which impacts household borrowing constraints. As is evident above, these two shocks have been the subject of prior studies.

About a quarter of the cyclical fluctuations in home investment and prices can be explained by shocks to housing preferences similar to those simulated, according to (Zheng et al., 2024), who used a multi-agent DSGE Model estimated using Bayesian techniques and US data from 1965Q1 to 2006Q4. (Jena et al., 2021) give these shocks greater weight when evaluating a DSGE Model. They account for 30–50% of investment increases and almost 90% of land value fluctuations between 1975 and 2010, according to US figures.

Researchers have focused heavily on household LTV shocks in the years before the early 2000s housing boom and crisis. But how much role these shocks played in explaining the swings in investment and property prices remains unclear. Homeowner diversity is crucial, according to Favilukis, (Ali et al., 2021), who use an overlapping generations Model. Total risk and inheritance heterogeneity are two essential elements that the study considers in order to arrive at this outcome. Contrarily, as stated by (J. K. Shah et al., 2025), alterations to collateral requirements do not provide insight into the dynamics of the credit cycle; hence, they do not significantly impact fluctuations in house investment and prices.

According to Eqs. (1) And (4), the housing preference shocks impact the parameter ψ, which in turn influences the importance of housing in the broken helpfulness purposes of irritated and persistent families. More specifically, they adhere to an AR (1) protocol:

$$\psi_t = (1-\rho)\psi + \rho\psi_{t-1} + \epsilon_{\psi t}, \epsilon_{\psi t} \sim N(0, \sigma_{\psi}^2). \quad (25)$$

The same holds for converting it to an AR (1) process; in Eq. (3), we introduce stochasticity into the loan-to-value parameter mH:

$$m_{Ht} = (1-\rho)m_H + \rho m_{Ht-1} + \epsilon_{m_H t}, \epsilon_{m_H t} \sim N(0, \sigma_{m_H}^2). \quad (26)$$

We determined the persistence characteristics of both disturbances. Because we focus on correlations, our results are independent of the standardized standards of the inventions' average deviations.

Our baseline Model predicts dynamic correlations in house investment across different types of shocks; Table 4 shows how these correlations align with the actual data. Using data sets from the United States and France, we first examine the relationship between home investment and GDP, as well as the link between the two investment types for families with a high impatience rate.

Table 4. Evaluation of Sensitive

Associations among housing inv. at time $t+j$ and GDP at time t										**$\rho(p_{rt}x_{rt}, x_{ct})$**
	$j=-4$	-3	-2	-1	0	1	2	3	4	
United States										
Data	0.58	0.63	0.68	0.67	0.61	0.43	0.24	0.07	−0.05	0.36
GHH pref.	0.43	0.57	0.72	0.83	0.82	0.45	0.19	0	−0.14	0.96
IAC	0.48	0.67	0.84	0.95	0.94	0.74	0.5	0.28	0.08	0.92
Shocks										
TFP	0.43	0.6	0.77	0.88	0.86	0.54	0.29	0.1	−0.05	0.87
Patience	0.64	0.77	0.84	0.81	0.67	0.38	0.14	−0.05	−0.2	0.76
Housing pref.	0.71	0.57	0.35	0.08	−0.38	−0.38	−0.36	−0.33	−0.3	−0.69
LTV	0.5	0.48	0.34	0.03	−0.4	−0.65	−0.63	−0.53	−0.42	−0.34
France										
Data	0.51	0.66	0.78	0.84	0.85	0.77	0.61	0.4	0.17	0.74
GHH pref.	0.41	0.56	0.71	0.83	0.84	0.47	0.21	0.02	−0.12	0.96
IAC	0.45	0.64	0.82	0.94	0.95	0.74	0.5	0.28	0.09	0.94
Shocks										
TFP	0.38	0.56	0.73	0.87	0.89	0.55	0.3	0.11	−0.03	0.92
Patience	0.31	0.48	0.66	0.84	0.95	0.64	0.38	0.17	0	0.9
Housing pref.	0.5	0.67	0.79	0.84	0.87	0.58	0.33	0.13	−0.02	−0.68
LTV	0.51	0.45	0.25	−0.11	−0.56	−0.67	−0.6	−0.49	−0.38	−0.52

Residential investment impacts GDP by four quarters due to shocks to household loan-to-value ratios and by three quarters due to shocks to home choice, both caused by the influx of impatient families. Residential investment has an overly positive correlation with GDP, whereas the correlations between non-residential and residential investment are too negative. All the many investment strategies put in place in response to the shocks have led to this result. Evidence suggests that residential investment tracks the economic cycle, driven by variations in home

demand and a handful of impatient families. The robust relationship between housing investment and GDP at time t demonstrates that this inverse lagging indicator is responsive to changes in the household loan-to-value Ratio. No matter how few families are having trouble securing loans, the unfavorable association between various investment types persists.

Our approach remains relevant to the two additional shocks we've covered, even though there are several limitations on the concurrent link between investment types. When it comes to explaining recent patterns in home investment, the housing choice shock goes above and beyond the other two supplementary shocks.

6.4. Expenses of Capital Adjustments

Here we look at the adjustment costs that come with investing in items and materials that don't last long. We state that the following expenses have a quadratic effect on the capital mobility equations:

$$k_{ct} = (1-\delta_c)k_{ct-1} + x_{ct}\left(1-\frac{\kappa}{2}\left(\frac{x_{ct}}{x_{ct-1}}-1\right)^2\right), \quad (27)$$

$$k_{bt} = x_{bt}\left(1-\frac{\kappa}{2}\left(\frac{x_{bt}}{x_{bt-1}}-1\right)^2\right). \quad (28)$$

Following (M. I. Shah et al., 2022), who determined a minimum amount for asset change charges at the US business level, we calibrate the parameter for these costs. With IAC in place, home investment has a smaller effect, and asset replies to the TFP shock are generally milder. To outperform the baseline scenario for housing asset in the US, the Model requires somewhat higher consumption patterns, as seen in Table 4. French manufacturing and home investment are in perfect harmony when it comes to the same IAC calibration.

7. Conclusion

To put it simply, the US economy is propelled by the housing market. Taking out home-equity loans for consumption could impact patterns of residential investment, as this research mainly demonstrates. This might help us better understand this stylized phenomenon. Because many people can borrow only a certain amount, home investment productivity has increased. When this percentage is low, as it is in most Eurozone countries, residential investment ceases to be a

leading economic indicator. Bans on family loans provide a clear rationale for a significant share of home investment activity.

Appendix A. Statistics

A.1. US

Using NIPA, Table 1.1.3, we may extract data on production, consumption, investment in houses and companies, and investment in other forms of physical structures. The new dwellings are chosen from the "Housing Starts: Total: New Privately Owned Housing Units Started" series by the United States Bureau of the Census. The S&P/Case-Shiller U.S. National House worth Guide is the housing market guide, distinct from the BLS's Consumer Price Index (CPI).

A.2. France

The Quarterly National Accounts published by INSEE provide the data used to calculate residential property investment and production. Housing shocks are derived from the OECD's Main Financial Pointers.

Appendix B. The exemplary equations

B.1. Irritated families

$$\max E_0 \sum_{t=0}^{\infty} \theta_I^t (\ln(c_{It} - \zeta c_{It-1}) + \psi \ln h_{It} + \eta_I \ln(1 - (n_{Ict}^{1+\epsilon} + n_{Iht}^{1+\epsilon})^{1/(1+\epsilon)})) \quad (30)$$

subject to

$$c_{It} + (1+\tau_h) q_{ht} h_{It} - q_{ht}(1-\delta_h) h_{It-1} = \begin{matrix} b_{Ht} - R_{t-1} b_{Ht-1} + p_{lt} l_{It} + \sum_{i=c,h} w_{it} n_{Iit} \\ -\tau_n (\sum_{i=c,h} w_{it} n_{Iit} - \tau_m r_{t-1} b_{Ht-1}) + \xi_{It}, \end{matrix} \quad (31)$$

$$b_{Ht} \leq m_H E_t q_{ht+1} h_{It}, \quad (32)$$

$$n_t = (n_{Ict}^{1+\epsilon} + n_{Iht}^{1+\epsilon})^{1/(1+\epsilon)}. \quad (33)$$

Primary factors

cIt:

$$\frac{1}{c_{It}-\zeta c_{It-1}} - E_t \frac{\theta_I \zeta}{c_{It+1}-\zeta c_{It}} = \lambda_{1It} \quad (34)$$

bHt:

$$\lambda_{1It} - \lambda_{2It} = \theta_I (1 + r_t(1-\tau_n\tau_m)) E_t \lambda_{1It+1} \quad (35)$$

hIt:

$$q_{ht}\lambda_{1It}(1+\tau_h) - m^H \lambda_{2It} E_t q_{ht+1} = \theta_I (1-\delta_h) E_t \lambda_{1It+1} q_{ht+1} + \frac{\Psi}{h_{It}} \quad (36)$$

$\mathbf{n_{Ijt}} j = c, h$

$$\lambda_{1It}(1-\tau_n) w_{jt} = \frac{\eta_I}{1-n_{It}} \left(\frac{n_{Ijt}}{n_{It}}\right)^{\epsilon} \quad (37)$$

B.2. Persistent families

$$\max E_0 \sum_{t=0}^{\infty} \beta^t (\ln(c_{Pt} - \zeta c_{Pt-1}) + \psi \ln h_{Pt} + \eta_P \ln(1 - (n_{Pct}^{1+\epsilon} + n_{Pht}^{1+\epsilon})^{1/(1+\epsilon)})) \quad (38)$$

subject to

$$c_{Pt} + (1+\tau_h) q_{ht} h_{Pt} - q_{ht}(1-\delta_h) h_{Pt-1} = \frac{1}{\omega_P} (\omega_I (R_{t-1} b_{Ht-1} - b_{Ht}) + \omega_E (R_{t-1} b_{Kt-1} - b_{Kt})) + (1-\tau_n) \sum_{i=c,h} w_{it} n_{Pit} + p_{lt} l_{Pt} + \xi_{Pt} \quad (39)$$

$$n_t = (n_{Pct}^{1+\epsilon} + n_{Pht}^{1+\epsilon})^{1/(1+\epsilon)}. \quad (40)$$

Initial-order variables

cPt:

$$\frac{1}{c_{Pt}-\zeta c_{Pt-1}} - E_t \frac{\theta_P \zeta}{c_{Pt+1}-\zeta c_{Pt}} = \lambda_{1Pt} \quad (41)$$

hPt:

$$q_{ht}\lambda_{1Pt}(1+\tau_h) = \beta(1-\delta_h) E_t \lambda_{1Pt+1} q_{ht+1} + \frac{\Psi}{h_{Pt}} \quad (42)$$

nPjt j=c,h:

$$\lambda_{1Pt}(1-\tau_n)w_{jt} = \frac{\eta_P}{1-n_{Pt}}\left(\frac{n_{Pjt}}{n_{Pt}}\right)^{\epsilon} \quad (43)$$

bHt and bKt:

$$\lambda_{1Pt} = \beta R_t E_t \lambda_{1Pt+1} \quad (44)$$

B.3. Businesspersons

$$\max E_0 \sum_{t=0}^{\infty} \theta_E^t \ln(c_{Et} - \zeta c_{Et-1}) \quad (45)$$

subject to

$$c_{Et} + x_{ct} + x_{bt} + \frac{w_{ct}}{\omega_E}\sum_{j=I,P} \omega_j n_{jct} + \tau_k r_{ct} k_{ct-1} = \frac{y_t}{\omega_E} + b_{Kt} - R_{t-1} b_{Kt-1} + (1-\tau_k) p_{bt} k_{bt} + p_{lt} l_{Et} + \xi_{Et}, \quad (46)$$

$$y_t = z_t(\omega_E k_{ct-1})^{\alpha_c}\left(\sum_{j=I,P} \omega_j n_{jct}\right)^{1-\alpha_c}, \quad (47)$$

$$x_{ct} = k_{ct} - (1-\delta_c)k_{ct-1}, \quad (48)$$

$$x_{bt} = k_{bt}, \quad (49)$$

$$b_{Kt} + \frac{w_{ct}}{\omega_E}\sum_{j=I,P} \omega_j n_{jct} \le m_K k_{ct}. \quad (50)$$

Initial-order variables

cEt:

$$\frac{1}{c_{Et} - \zeta c_{Et-1}} - E_t \frac{\theta_E \zeta}{c_{Et+1} - \zeta c_{Et}} = \mu_{1Et} \quad (51)$$

bKt:

$$\mu_{1t} - \mu_{2t} = \theta_E R_t E_t \mu_{1t+1} \quad (52)$$

kct:

$$\mu_{1t} - m_K \mu_{2t} = \theta_E E_t(\mu_{1t+1}(1 - \delta_c + (1-\tau_k) r_{ct+1})) \quad (53)$$

where $r_{ct} = \frac{\alpha_c y_t}{k_{ct-1}}$ (54)

kbt:

$$\mu_{1t} = \mu_{1t}(1 - \tau_k)p_{bt} \quad (55)$$

njct:

$$\frac{\mu_{1t}(1-\alpha_C)y_t}{\sum_{j=I,P}\ \omega_j n_{jct}} = (\mu_{1t} + \mu_{2t})w_{ct} \quad (56)$$

B.4. Household inventors

Initial phase:

$$\max p_{rt}x_{rt} - \omega_E p_{bt}k_{bt} - w_{ht}\sum_{j=I,P}\ \omega_j n_{jit} \quad (57)$$

subject to

$$ih_t = z_t(\omega_E k_{bt})^{\alpha_B}(\sum_{j=I,P}\ \omega_j n_{jht})^{1-\alpha_B}. \quad (58)$$

Phase two:

$$\max q_{ht}ih_t - p_{rt}x_{rt} - p_{lt}l_t \quad (59)$$

subject to

$$ih_t = x_{rt}^{\phi} l_t^{1-\phi}. \quad (60)$$

Availability of property:

$$l_t = \sum_{j=I,P,E}\ \omega_j l_{jt} = 1 \quad (61)$$

Principle of residential dynamics:

$$ih_t = h_t - (1 - \delta_h)h_{t-1} \quad (62)$$

$$h_t = \omega_I h_{It} + \omega_P h_{Pt}. \quad (63)$$

Primary criteria

njht:

$$w_{ht} = (1 - \alpha_B)\frac{p_{rt}x_{rt}}{\sum_{j=I,P}\ \omega_j n_{jht}} \quad (64)$$

kbt:

$$\omega_E p_{bt} = \alpha_B \frac{p_{rt}x_{rt}}{k_{bt}} \quad (65)$$

xrt:

$$p_{rt} = \phi \frac{q_{ht} i h_t}{x_{rt}} \quad (66)$$

lt:

$$p_{lt} = (1 - \phi) \frac{q_{ht} i h_t}{l_t} \quad (67)$$

Ethical Approval and Informed Consent. This article does not contain any studies with human participants performed by any of the authors

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