Transmission of Household and Business Credit Shocks in Emerging Markets: The Role of Real Estate*

Berrak Bahadir†  Inci Gumus‡
Ozyegin University  Sabanci University
March 21, 2017

Abstract

We study the role of real estate in the transmission of household and business credit shocks to the economy. To this end, we construct a small open economy real business cycle model with households and entrepreneurs, who hold real estate and face credit constraints on their borrowing. The impulse response analysis shows that both household and business credit shocks lead to an expansion in the economy, with business credit having a larger effect. Real estate plays an important role in understanding the response of the economy to credit shocks. A credit expansion in one sector increases house prices, which raises the value of real estate holdings of the other sector and generates spillover effects between sectors. As a result, household and business credit shocks lead to similar responses. Without housing, the two types of shocks affect the key macroeconomic variables differently with only business credit shocks leading to an expansion. Our findings suggest that housing as a common asset provides a transmission channel between the sectors that mitigates the differences in the responses to the credit shocks.

JEL Classification: E32, E44, F41
Keywords: Credit shocks, household credit, business credit, real estate

*We would like to thank participants at the SNDE Meeting (2012), the Central Bank of Turkey Conference on Financial and Macroeconomic Stability: Challenges Ahead (2012), the fourth International Symposium in Computational Economics and Finance (2016) and seminar participants at the University of Georgia, the Federal Reserve Bank of Atlanta, the Central Bank of Turkey, Bahcesehir University, and Kadir Has University for valuable comments and suggestions. We also thank William D. Lastrapes for helpful suggestions. All remaining errors are our own.

† Corresponding author. Department of Economics, Faculty of Business, Ozyegin University, Istanbul, Turkey. Email: berrak.bahadir@ozyegin.edu.tr, tel: +90-216-564-9270

‡ Sabanci University, Faculty of Arts and Social Sciences, Orhanli, Tuzla, Istanbul, 34956, Turkey. Email: incigumus@sabanciuniv.edu, tel: +90-216-483-9318
1 Introduction

In recent years, the level of credit to the private sector has increased substantially in many emerging economies. An important part of this rise is due to the rapid expansion of household credit including consumer credit and housing loans. Table 1 reports the household and business credit-to-GDP ratios, as well as the share of household credit in total credit, for a group of emerging market economies for 1998 and 2015. We observe that household credit has grown substantially over the period in all of these countries except for Argentina, whereas the growth in business credit has been slower in most cases. As a result, household credit has become an important component of overall private credit and both types of credit have a sizeable share in the economy. These developments in credit markets underline the importance of understanding the dynamics of the two types of credit and their interaction.

Table 1. Household and business credit in emerging markets

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>6.1</td>
<td>6.5</td>
<td>34.3</td>
<td>12.7</td>
<td>15.1</td>
<td>33.9</td>
</tr>
<tr>
<td>Brazil</td>
<td>9.0</td>
<td>25.5</td>
<td>27.5</td>
<td>50.1</td>
<td>24.7</td>
<td>33.7</td>
</tr>
<tr>
<td>Chile</td>
<td>22.8</td>
<td>40.2</td>
<td>98.4</td>
<td>111.1</td>
<td>18.8</td>
<td>26.6</td>
</tr>
<tr>
<td>Korea</td>
<td>47.2</td>
<td>88.4</td>
<td>111.5</td>
<td>106</td>
<td>29.7</td>
<td>45.5</td>
</tr>
<tr>
<td>Mexico</td>
<td>9.7</td>
<td>15.5</td>
<td>23.9</td>
<td>24.8</td>
<td>28.9</td>
<td>38.5</td>
</tr>
<tr>
<td>Thailand</td>
<td>51.1</td>
<td>71.6</td>
<td>103.7</td>
<td>51.9</td>
<td>33.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Turkey</td>
<td>2.1</td>
<td>21.4</td>
<td>22.5</td>
<td>57</td>
<td>8.54</td>
<td>27.3</td>
</tr>
</tbody>
</table>

Average

<table>
<thead>
<tr>
<th>HC/GDP</th>
<th>BC/GDP</th>
<th>HC/TC</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.1</td>
<td>38.4</td>
<td>60.3</td>
</tr>
<tr>
<td>59.1</td>
<td></td>
<td>22.7</td>
</tr>
</tbody>
</table>

Note: HC, BC and TC denote household, business and total credit.

For Chile, the values reported under 1998 correspond to 2002 figures, since series start in 2002. The data are obtained from the Bank for International Settlements.
One channel through which household and business credit affect the economy is the housing market. Real estate is an important asset held by both households and firms, and both agents use bank loans to finance real estate purchases. The literature that studies credit cycles has shown that credit movements are closely correlated with asset price movements, including housing prices (Mendoza and Terrones, 2008; Mendoza and Terrones, 2012). Since bank loans are an important source of financing for real estate, credit movements affect the housing market and real estate values. With the increasing trend in household credit in emerging markets, the share of housing loans used by households has reached sizeable amounts as well. Housing loans represent around 40 percent of total household loans in Turkey and Brazil, and reach close to 70 percent in Chile and Czech Republic as of 2014. Therefore, the real estate market is expected to play an important role in the interaction between household and business credit fluctuations, and credit conditions that separately affect households and firms are expected to have widespread effects on the economy through this channel. In this paper, we construct a real business cycle (RBC) model that allows us to study the transmission of household and business credit shocks to the wider economy in the existence of real estate.

Real estate is an important asset for both households and firms. The homeownership rate of households is 67.3 percent in Turkey as of 2011, 73.5 percent in Brazil and 76.4 percent in Mexico as of 2010. These numbers show that housing plays a major role as a storage of wealth for households in emerging markets. Real estate also represents a significant share of corporate assets. In the US, the share of tangible assets (the sum of real estate, equipment, and software) is close to two-thirds of total corporate assets, and real estate averages about 58% of total tangible assets for the period from 1952 to 2010. Among emerging market economies, the only country for which we were able to obtain data on commercial real estate is South Korea, where the ratio of commercial real estate to GDP is around 60% in 2012. Since real estate is a major asset for both households and firms, changes in house prices have large wealth effects for both agents. Therefore, it is

---

1 We use housing and real estate interchangeably throughout the paper.
2 Source: Respective Central Banks.
3 Source: Turkish Statistical Institute for Turkey, the Instituto Nacional de Estadística y Geografía (INEGI) for Mexico, the Instituto Brasileiro de Geografia e Estatística (IBGE) for Brazil.
4 Source: Flow-of-Funds tables provided by the Federal Reserve Board.
important to analyze how credit shocks affect the economy through changes in real estate values.

To understand the role of real estate in the transmission of credit shocks, we construct an RBC model with two types of agents: households and entrepreneurs. Both agents hold real estate, borrow from international markets, and face constraints on their borrowing. Furthermore, we assume that total business debt includes both standard intertemporal debt and intratemporal working capital loans. The model dynamics are generated by credit shocks to households and entrepreneurs, and productivity shocks. The credit shocks are modeled as stochastic processes that affect the borrowing limits of the two agents. The shocks to credit are similar to the financial sector shocks studied in Jermann and Quadrini (2012) and Kiyotaki and Moore (2008) who show that these shocks play an important role as a source of macroeconomic fluctuations using closed economy models. The model is calibrated to the Turkish economy for the period 1995Q1-2009Q4. We choose Turkey because it is a standard emerging market economy in terms of its business cycle properties featuring high consumption volatility and countercyclical net exports.

The impulse response analysis shows that both household and business credit shocks lead to an increase in output, consumption, investment, labor and house prices, with business credit generating a larger expansion in the economy. Real estate plays an important role in understanding the responses of these key variables to credit shocks. A credit expansion in one sector affects the other sector through changes in the price of real estate and generates spillover effects between sectors. In the case of a positive household credit shock, higher credit availability to households raises their demand for housing and house prices increase. Due to higher prices, entrepreneurs’ demand for real estate decreases and they generate a flow of funds by reducing the real estate they own. Using these excess funds, they increase their demand for labor and capital. This income-generation effect of a positive household credit shock leads firms to hire more labor, increase investment and output. Hence, a credit shock that originates in the household sector is transmitted to firms through changes in the price of real estate.

To better understand the importance of the spillover effects generated by real estate, we also analyze the model dynamics without housing. The impulse response functions to credit shocks show that the predictions of the model change substantially when we abstract from
housing. After a household credit expansion, labor and output do not change on impact and decline in the second period. Investment also decreases after the shock. Hence, a positive household credit shock does not generate an expansion in the economy in terms of these key variables when the transmission that works through housing is missing.

The decline in labor and output observed in the model without housing is due to the effect of a household credit shock on labor supply. Since the credit constraint of the household is tied to the expected labor income in the next period, changes in the borrowing capacity of the household affect the labor supply decision. A positive household credit shock relaxes the credit constraint and reduces the benefit of working, leading to a decline in labor supply in the second period. While the labor supply response is effective in both the benchmark model and the model without housing, the higher labor demand generated through the spillover effects of housing suppresses this effect in the benchmark model. Hence, labor and output initially expand, followed by a much smaller decline in the benchmark model. Likewise, the decline in investment in the model without housing is due to the absence of income that firms generate through real estate sales. Therefore, output, labor and investment contract when the transmission channel of housing is not effective.

The existence of real estate affects the response of the economy to a business credit shock as well. An expansion in business credit relaxes the credit constraint of entrepreneurs, leading to an increase in demand for labor and capital in both models. In the benchmark model, there is an additional channel that works through the housing market. As borrowing increases, entrepreneurs’ demand for real estate goes up and house prices increase. As a result, households lower their real estate holdings and generate income. This additional income lowers the benefit of working and households work less. Higher borrowing by firms increase their demand for labor and investment, leading to an expansion in output, labor and investment on impact in both models. In the model with housing, the economy experiences a contraction in the second period as households lower their labor supply. Hence, in the existence of spillover effects, a business credit shock generates responses that are similar to those generated by a household credit shock. Without housing, the two shocks generate different dynamics, showing that housing serves as a common asset that mitigates the differences in the responses to the credit shocks.
In the benchmark model with housing, we assume that the aggregate real estate stock is fixed and spillover effects are generated by an increase in real estate prices as a result of a shock to credit limits. One may, however, be interested in knowing how the model’s implications would change if we relax the assumption of a fixed real estate stock and allow for investment in real estate. To this end, we extend the model to incorporate a production technology for both residential and commercial real estate using land and structures. While the aggregate amount of land is still fixed, investment in structures allows the stocks of residential and commercial structures, and hence the real estate stocks, to change. Both the impulse response analysis and the moments from the extended version of the model show that allowing for investment in real estate does not affect the dynamics of the model. In the version with real estate investment, the transmission of credit shocks works through changes in the land price and land sales between the agents. The two versions of the model overall show that the credit shocks generate spillover effects in the economy as long as there is a common asset that links the agents.

A recent strand of literature, including Iacoviello (2005), Iacoviello and Neri (2010), and Liu, Wang, and Zha (2013), focuses on the role of housing and land in understanding the linkages between credit constraints, real estate prices and economic fluctuations. Our model closely follows Iacoviello (2005), where both households and entrepreneurs hold real estate and face constraints on their borrowing. Since we analyze our question in the context of an emerging market, we use a small open economy model, where agents borrow from international markets. We also abstract from nominal rigidities whereas Iacoviello (2005) uses a monetary model to study inflation dynamics. Our paper is also closely related to Liu, Wang, and Zha (2013), who show that the effects of a change in housing demand are transmitted to firms through fluctuations in land prices in a credit constrained economy. In their model, an increase in land prices due to a positive housing demand shock increases the value of firms’ collateral and relaxes their credit constraint. The resulting increase in borrowing allows firms to increase investment, labor, and output. Our paper studies household and business credit shocks, instead of a housing demand shock, and proposes a different mechanism for the transmission of shocks. The transmission in our paper works through income that agents generate when real estate prices increase instead of the collateral effect.
The differences between household and business credit have been the subject of a recent empirical literature (Büyükkarabacak and Krause, 2009; Büyükkarabacak and Valev, 2010; Beck et al., 2012; Sassi and Gasmi, 2014; and Mian, Sufi and Verner, 2015). The main conclusion of these studies is that the two types of credit have differential effects on the trade balance, banking crises and economic growth. Although the decomposition of credit has been investigated empirically, theoretical papers that distinguish between household and business credit are scarce. One recent study by Bahadir and Gumus (2016) uses a two-sector small open economy RBC model to separately analyze the effects of household and business credit shocks on business cycles in emerging market economies. Our contribution to this literature is to investigate the role of real estate in the transmission process of the two types of credit shocks using a small open economy RBC framework.

The findings of our paper are relevant for understanding the effects of macroprudential policies that aim to control credit growth and housing booms. Limits on loan-to-value (LTV) and loan-to-income (LTI) ratios on household loans are suggested as an effective tool to deal with housing booms and to strengthen the financial system. Our analysis shows that limiting credit growth in one sector may have unintended consequences for the other sector. In particular, limiting household credit growth by LTV or LTI caps is likely to affect firms’ balance sheets through reducing the value of real estate they hold. In a related paper, Yesiltas (2015) empirically analyzes the effects of tightening LTV ratio of mortgages in Europe using firm-level data. She shows that these policies significantly reduce firms’ borrowing capacity by affecting the collateral values. Our paper provides a theoretical framework and a different transmission mechanism for understanding how policies that limit credit growth in one sector can have widespread effects on the economy.

2 The Benchmark Model

We use a small open economy model inhabited by two types of agents: households and entrepreneurs. There is a single tradable good, which is produced by entrepreneurs using capital, labor and real estate. Labor services are provided by households while capital is held by entrepreneurs. There is a fixed stock of housing, which is used by both agents as households get utility from housing services and entrepreneurs use real estate in production.
Both types of agents have access to international financial markets, but face constraints on their borrowing. For entrepreneurs there is also a working capital constraint that requires them to hold liquid assets in an amount proportional to their wage bill.

### 2.1 Households

Households choose consumption, labor and housing services to maximize their expected lifetime utility given by

$$E_0 \sum_{t=0}^{\infty} (\beta^h)^t \ln \left( c_t^h - \psi n_t^h \right) + \gamma \ln h_t^h.$$  

(1)

where $\beta^h \in (0, 1)$ is the discount factor of the household, $c_t^h$ is household’s consumption, $n_t$ represents labor, $h_t^h$ is household’s holdings of housing, $\eta$ is the parameter that governs the intertemporal elasticity of substitution in labor supply, $\psi$ is the measure of disutility from working, and $\gamma$ is the weight of housing in the utility function.

The budget constraint of households is given by

$$c_t^h + R_{t-1} b_{t-1}^h + q_{h,t}(h_t^h - h_{t-1}^h) = w_t n_t + b_t^h,$$  

(2)

where $b_t^h$ denotes the amount borrowed by the household at time $t$, $R_{t-1}$ is the gross interest rate, $q_{h,t}$ is the housing price, and $w_t$ is the wage rate. In the solution of the model, we take the interest rate as constant so that $R_t = R$, for all $t$.

Households face a credit constraint in every period. The total value of their debt including both interest and principal cannot exceed a fraction of their expected income in the next period plus a fraction of the expected value of their housing stock. The credit constraint of households is of the form

$$R_t b_t^h \leq m_t^h E_t \left( w_{t+1} n_{t+1} + \chi q_{h,t+1} h_{t+1}^h \right).$$  

(3)

The loan-to-income (LTI) ratio\(^5\) denoted by $m_t^h$, determines the credit availability to households and is modeled as a stochastic process. The share of collateral in the credit

---

\(^5\)Since household’s debt is partially secured by holdings of housing, $m_t^h$ is not exactly equal to the ratio of loans to income and we use the "loan-to-income ratio" term in a broader sense.
constraint is given by $\chi$. We assume that $\beta^h < 1/R$, which guarantees that the credit constraint is binding in the steady state. In the calibration of the model, we set the value of $\beta^h$ low enough to give a binding constraint in the model solution.

### 2.2 Entrepreneurs

Entrepreneurs produce output by a Cobb-Douglas technology using capital, real estate and households’ labor services:

$$y_t = e^{A_t k_{t-1}^\alpha (h_{t-1}^e)^\mu n_t^{1-\alpha-\mu}},$$

where $k_{t-1}$ and $h_{t-1}^e$ denote entrepreneur’s capital and real estate holdings, respectively, at the start of period $t$ and $A_t$ is an exogenous stochastic productivity shock.

The capital accumulation decision is made by entrepreneurs and the equation for capital accumulation is given by

$$i_t = k_t - (1 - \delta)k_{t-1}.$$

As standard in small open economy business cycle models, we use capital adjustment costs in order to avoid excessive volatility of investment. The adjustment cost function is of the form $\Phi_k(k_{t-1}, i_t) = \frac{\delta}{2} k_{t-1} \left( \frac{i_t}{k_{t-1}} - \delta \right)^2$.

Firms have to pay a fraction $\theta$ of the wages before output becomes available and they need working capital loans from foreign lenders. They borrow $\theta w_t n_t$ at the beginning of period $t$ and repay $R_t \theta w_t n_t$ at the end of the period as in Neumeyer and Perri (2005). Working capital requirement is widely used in small open economy RBC models (see Neumeyer and Perri, 2005; Uribe and Yue, 2006; Mendoza, 2010; Mendoza and Yue, 2012 among others). These studies show that working capital is important for interest rate fluctuations to play a significant role in driving business cycles in these models and for matching the countercyclicality of interest rates observed in emerging market economies.

As households, entrepreneurs are also restricted in their borrowing due to enforceability problems. Following Mendoza (2010), we assume that the entrepreneur’s total borrowing, which includes one-period bonds, $b_t^e$, and within-period working capital loans, cannot exceed a fraction of the expected value of their collateral assets, i.e. capital and real estate holdings, next period:

$$R_t b_t^e + R_t \theta w_t n_t \leq m_t^e E_t(q_{k,t+1} k_t + q_{h,t+1} h_t^e).$$
The loan-to-capital (LTC) ratio, denoted by $m^e_t$, is modeled as a stochastic process. Due to capital adjustment costs, the price of capital in terms of consumption goods differs from one. It is denoted by $q_{k,t}$ and is given by

$$q_{k,t} = 1 + \frac{\partial \Phi_k(k_t-1, i_t)}{\partial i_t}.$$  

(7)

Formally, the entrepreneur’s problem is to maximize her expected utility

$$E_0 \sum_{t=0}^{\infty} (\beta^e)^t \ln(c_t^e)$$

subject to technology, capital accumulation and borrowing constraints, as well as the following flow of funds constraint:

$$c_t^e + w_t n_t + i_t + \Phi_k(k_{t-1}, i_t) + q_{h,t}(h_t^e - h_{t-1}^e) + R_{t-1} b_{t-1}^e + (R_t - 1) \theta w_t n_t = y_t + b_t^e.$$  

(9)

where $c_t^e$ is entrepreneur’s consumption and $(R_t - 1) \theta w_t n_t$ represents the net cost of the working capital requirement.

As in the case of households, we assume that $\beta^e < 1/R$ so that the credit constraint is binding in the steady state. The value of $\beta^e$ is set low enough to make sure that the credit constraint remains binding in the model solution.

2.3 Equilibrium

Given initial conditions $b_0^h, b_0^e$ and $k_0$, a constant real interest rate $R$, and the sequence of shocks to productivity, the LTI ratio and the LTC ratio, the competitive equilibrium is defined as a set of allocations and prices $\{y_t, c_t^h, c_t^e, n_t, k_t, i_t, h_t^h, h_t^e, b_t^h, b_t^e, w_t, q_{k,t}, q_{h,t}\}$ such that (i) the allocations solve the problems of households and entrepreneurs at the equilibrium prices, (ii) factor markets clear, and (iii) the resource constraint holds:

$$c_t^h + c_t^e + i_t + \Phi_k(k_{t-1}, i_t) + n x_t = y_t$$

(10)
where net exports are defined as

\[ nx_t = R_{t-1} \left( b^h_{t-1} + b^e_{t-1} \right) + \left( R_t - 1 \right) \theta w_t n_t - \left( b^h_t + b^e_t \right). \]  

(11)

We assume that the total stock of real estate is fixed. The market clearing condition for the housing sector is

\[ h^h_t + h^e_t = H, \]  

(12)

where \( H \) denotes the fixed stock of real estate.

### 3 The Extended Model

As an extension, we consider a version of the model where the stock of housing is not fixed and agents can change their holdings of real estate through investment. Specifically, the amount of real estate for each agent is a function of land and structures. There is a fixed stock of land available in the economy but the amount of structures can be changed through investment.

The stock of real estate for each agent is given by the following production function:

\[ h^j_t = \left( s^j_t \right)^v \left( l^j_t \right)^{1-v}, \quad \text{for } j = h, e, \]  

(13)

where \( s^j_t \) is the stock of structures and \( l^j_t \) is the stock of land for agent \( j \). This way of modeling housing as a composite of structures and land is similar to the setup used by Davis and Heathcote (2005).

The stock of structures for each agent evolves according to

\[ s^j_t = x^j_t + \left( 1 - \delta_s \right) s^j_{t-1}, \quad \text{for } j = h, e, \]  

(14)

where \( x^j_t \) denotes investment in structures by agent \( j \) and \( \delta_s \) is the depreciation rate of structures.

Every period, the agents can purchase land from each other and they invest in structures. The budget constraints reflecting these changes are as follows:
for the household, and
\[
c_h^t + R_{t-1} b^h_{t-1} + x^h_t + \Phi(s^h_{t-1}, x^h_t) + q_{t,t} (l^h_t - l^h_{t-1}) = w_t n_t + b^h_t, \quad (15)
\]

for the entrepreneur, where \( q_{t,t} \) denotes the price of land. We use adjustment costs for investment in structures to reduce the volatility of this type of investment as in the case of investment in capital. The adjustment cost function is of the same form as the one for capital investment. Specifically, \( \Phi(s(j_{t-1}, x(j^j_t)) = \frac{q(j_{t})}{2} s(j_{t-1}) \left( \frac{x(j^j_t)}{s(j_{t-1})} - \delta_s \right)^2 \).

As in the case of capital, adjustment cost of investment in structures drives a wedge between the price of structures and the price of consumption goods. Depending on the agent’s stock of structures and amount of investment, there is a separate price of structures for each agent, denoted by \( q^j_{s,t} \). Specifically, the price of structures for agent \( j \) is given by
\[
q^j_{s,t} = 1 + \frac{\partial \Phi(s^j_{t-1}, x^j_t)}{\partial x^j_t}, \quad \text{for } j = h, e. \quad (17)
\]

With the production function given in equation (13), the price of real estate for each agent as a composite of structures and land is as follows
\[
q^j_{h,t} = \left( \frac{q^j_{s,t}}{v} \right)^{\frac{1}{1-v}} (q_{i,t})^{1-v}, \quad (18)
\]

Since the structure price is different for each agent depending on the adjustment cost, there is a separate real estate price reflecting the value of real estate owned by each agent as well.

The resource constraint in this version of the model is given by
\[
c^h_t + c^e_t + i_t + x^h_t + x^e_t + \Phi_k(k_{t-1}, i_t) + \Phi(s^h_{t-1}, x^h_t) + \Phi(s^e_{t-1}, x^e_t) + n x_t = y_t, \quad (19)
\]

where \( n x_t \) is given in equation (11).
The market clearing condition for land holdings is

\[ I_t^h + I_t^e = L, \]  

(20)

where \( L \) denotes the fixed stock of land.

The borrowing constraints of the agents and the rest of the equations remain the same as the benchmark model.

4 Calibration

The model is solved using quarterly Turkish data for the period 1995Q1-2009Q4. The construction of the series used in the model solution is explained in detail in the Appendix. The parameter values for the benchmark and the extended models are given in Table 2.

We set the discount factors of households and entrepreneurs such that the credit constraints bind in and around the steady state. The values for \( \beta^h \) and \( \beta^e \) are set to 0.95 and 0.96, respectively, which are the highest possible values that guarantee binding credit constraints in the solution of the model.

The value of \( \eta \), which determines the intertemporal elasticity of substitution in labor supply, is set to 1.7 following Correia et al. (1995). The value of \( \psi \) is set such that the steady state labor supply equals 0.18, which is the average value of time spent working as a percentage of total discretionary time in Turkey.

The parameter \( \alpha \) is calibrated using the average value for the labor share of income in Turkey. Following Gollin (2002), we adjust the labor income figures to account for the income of the self-employed, which gives an average value of 0.60 for the labor share. The real interest rate is taken as constant and set equal to the average real interest rate in Turkey. The annual depreciation rate of capital is set to 0.08 following Meza and Quintin (2007). The values used in the literature for the depreciation rate of structures are much lower than the depreciation rate of capital. Following this, we use 3% for the depreciation rate of structures.

The two key parameters that determine the stocks of residential and commercial real estate are \( \gamma \) and \( \mu \). We set \( \gamma \) equal to 0.82 in the benchmark model and 1.08 in the extended
model, which give a residential housing stock-to-annual GDP ratio of 100 percent. We set μ, the elasticity of output to entrepreneurial real estate, such that the steady-state value of commercial real estate over annual output is 50 percent in both versions of the model. For the share of structures in real estate production, ν, in the extended model, we follow Davis and Heathcote (2007). We set ν equal to 0.64, which corresponds to a 36% land share in the total housing stock.

The steady-state value of the LTC ratio, \( \bar{m}^e \), is set to match the average value of the ratio of business credit to GDP in Turkey for the sample period, which is 11.5%. Likewise, the steady-state value of the LTI ratio, \( \bar{m}^h \), is set to match the average value of the ratio of household credit to GDP in the data, which is 4.5%. We set \( \chi \) to 0.063 to match the share of housing credit in total household credit, which is 30 percent.

For the calibration of the parameter \( \theta \), we use data on short-term bank loans from the Company Accounts database of the Central Bank of Turkey, which is available for the 1997-2009 period. Total liabilities of firms in our model is \( lb_t + \theta w_i n_t \), and the loans for working capital have a shorter duration compared to other loans. Therefore, we choose to approximate the working capital loans with short-term bank loans. We calibrate \( \theta \) by taking the average of the ratio of short-term loans to the compensation of employees, which equals 0.25.

In the benchmark model, we set the capital adjustment cost parameter, \( \phi_k \), to 5.827 to match the volatility of investment relative to output. In extended model, we have an additional adjustment cost parameter, \( \phi_s \), which is for investment in real estate. We set \( \phi_s \) and \( \phi_k \) equal to each other and set this value to 12.65 to again match the volatility of investment relative to output in the data.

---

6Statistical databases for Turkey do not report any values on the stock of real estate. We set the values of \( \gamma \) and \( \mu \) such that the residential housing to annual GDP ratio is equal to 1, and the commercial real estate to annual GDP ratio is 0.5. In Iacoviello (2005), housing stock to annual GDP ratio is equal to 1.4 and commercial real estate over annual output is 0.5.

7In the extended model, total investment is the sum of investment in capital and investment in structures. Since we do not have separate data for real estate investment, we assume that the adjustment cost parameters are equal for the two types of investment and set them to match to volatility of total investment in the data.
Table 2. Parameter values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Benchmark model</th>
<th>Extended model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta^h$</td>
<td>0.95</td>
<td>0.95</td>
<td>Discount factor of households</td>
</tr>
<tr>
<td>$\beta^e$</td>
<td>0.96</td>
<td>0.96</td>
<td>Discount factor of entrepreneurs</td>
</tr>
<tr>
<td>$\eta$</td>
<td>1.7</td>
<td>1.7</td>
<td>Labor curvature</td>
</tr>
<tr>
<td>$\psi$</td>
<td>2.792</td>
<td>2.546</td>
<td>Labor weight in utility</td>
</tr>
<tr>
<td>$\delta$</td>
<td>0.08</td>
<td>0.08</td>
<td>Annual depreciation rate of capital</td>
</tr>
<tr>
<td>$\delta_s$</td>
<td>-</td>
<td>0.3</td>
<td>Annual depreciation rate of structures</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>0.314</td>
<td>0.291</td>
<td>Exponent of capital in production</td>
</tr>
<tr>
<td>$\mu$</td>
<td>0.08</td>
<td>0.103</td>
<td>Exponent of real estate in production</td>
</tr>
<tr>
<td>$\nu$</td>
<td>-</td>
<td>0.64</td>
<td>Exponent of structures in housing production</td>
</tr>
<tr>
<td>$R$</td>
<td>1.015</td>
<td>1.015</td>
<td>Real interest rate</td>
</tr>
<tr>
<td>$\theta$</td>
<td>0.25</td>
<td>0.25</td>
<td>Working capital coefficient</td>
</tr>
<tr>
<td>$\bar{m}_h$</td>
<td>0.214</td>
<td>0.214</td>
<td>Loan-to-income ratio</td>
</tr>
<tr>
<td>$\bar{m}_e$</td>
<td>0.064</td>
<td>0.068</td>
<td>Loan-to-capital ratio</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>0.82</td>
<td>1.08</td>
<td>Weight of housing in the utility function</td>
</tr>
<tr>
<td>$\chi$</td>
<td>0.063</td>
<td>0.063</td>
<td>Share of collateral in household’s credit constraint</td>
</tr>
<tr>
<td>$\phi_k$</td>
<td>5.827</td>
<td>12.65</td>
<td>Capital adjustment cost</td>
</tr>
<tr>
<td>$\phi_s$</td>
<td>-</td>
<td>12.65</td>
<td>Structure adjustment cost</td>
</tr>
</tbody>
</table>

The stochastic processes used in the model are for total factor productivity and the LTI and LTC ratios. The process for the productivity shock is estimated using the Solow residual for Turkey as

$$A_t = \rho^A A_{t-1} + \varepsilon_t^A,$$

(21)

where $\varepsilon_t^A$ is a normally distributed and serially uncorrelated innovation.
The LTI and LTC ratios are characterized by the following law of motion

\[ m_i^t = \bar{m}^i \exp(\tilde{m}_i^t), \]

for \( i = h, e \), and

\[ \tilde{m}_i^t = \rho^i \tilde{m}_{i-1}^t + \rho_a A_t + \varepsilon_t^i \]

where innovations \( \varepsilon_t^i \) are normally distributed and serially uncorrelated. We model the shocks to credit availability as being affected by productivity shocks. It is a well-documented fact that emerging market economies borrow more when their output level is high and have limited access to international financial markets in low-output episodes. Based on this observation, we choose to incorporate the interaction between the productivity shocks, which are the main determinant of output fluctuations, and credit access. This formulation is similar to the way the country risk component of interest rates is modeled in Neumeyer and Perri (2005), as a decreasing function of expected productivity.

5 Results

5.1 Impulse Response Analysis

Figure 1 shows the response of the economy to a positive one percent shock to household and business credit, i.e. an increase in \( m^h_t \) and \( m^e_t \), respectively. In the figure, \( \lambda_t^h \) and \( \lambda_t^e \) refer to the Lagrange multipliers on the credit constraints of the household and the entrepreneur, respectively.

Both shocks lead to an expansion in the economy with output, consumption, investment, labor and housing price increasing in the initial period. While the economy expands, net exports contract due to higher borrowing. The responses are similar for the two shocks, while the changes are bigger for all variables in the case of a business credit shock. The impulse responses of the real estate holdings show how real estate changes hands with a credit expansion for each agent. Higher credit availability to households raises their demand for housing and their holdings of housing increase while firms’ real estate holdings
decrease. The opposite movement is observed when firms’ credit access increases. In both cases, rising demand for real estate leads to an increase in its price.

Figure 1. Positive shocks to credit: Percent deviation of variables from their steady-state values

To better understand the role of housing in credit dynamics, we plot the impulse responses of the benchmark model together with the impulse responses of the model where there is no housing. In the model without housing, households do not get utility from housing services, i.e. \( \gamma = 0 \), and real estate is not used in the production function, i.e. \( \mu = 0 \). We keep the labor’s share of income the same in the two models and increase the exponent of capital in the model without housing. We also adjust the steady state values \( \tilde{m}^h \) and \( \tilde{m}^e \) so that the credit-to-GDP ratios remain the same in the two models. The rest of the parameter values are the same across the models. Figures 2 and 3 show the impulse responses to a positive one percent shock to household credit and business credit, respectively, for the two models.
Figure 2. Positive household credit shock: Benchmark model vs. the model without housing

Figure 3. Positive business credit shock: Benchmark model vs. the model without housing
In the model with housing, both shocks lead to an expansion in the economy on impact whereas without housing, a business credit expansion leads to an increase in output and a household credit expansion leads to a decline. Housing as a common asset held by both agents generates spillover effects between the agents. Any disturbance that affects house prices and the demand for real estate in one sector is transmitted to the other one through changes in the value of the real estate they own. Therefore, housing serves as a factor that mitigates the differences in the responses to the credit shocks and the economy responds in a similar way to both shocks in the benchmark model whereas without housing the responses are different.

Consider the effect of a positive shock to the LTI ratio. In the model without housing, a household credit expansion leaves output unchanged on impact and leads to a decline in the following period. The output dynamics closely follow the labor supply dynamics as seen in the figure. Since household’s credit constraint is tied to labor income, labor supply has the additional benefit of enabling a higher level of borrowing. Therefore, labor supply response is not only determined by the wage rate, but also by changes in credit availability. Specifically, since the credit constraint is tied to the expected labor income next period, an increase in the LTI ratio in period $t$ affects the labor supply response in period $t+1$. An increase in $m_{t}^{h}$ raises the direct return to labor but also has a negative effect through a decline in the Lagrange multiplier of the credit constraint, $\lambda_{t}^{h}$.[8] The decline in $\lambda_{t}^{h}$ is bigger than the positive effect of an increase in $m_{t}^{h}$ and labor supply decreases in period $t+1$ as a result of an increase in the LTI ratio in period $t$.

In the model with housing, labor and output also decrease in period one but the responses are much smaller and there is an expansion on impact. The decline in labor supply due to higher borrowing is still effective but changes in the value of housing have an additional effect on labor. With an increase in credit availability, households demand more housing and housing price increases. The increase in house prices lowers the entrepreneurs’ demand for real estate, which allows them to generate a flow of funds by reducing the real estate they own. Using these excess funds, they increase their labor demand, which leads to

\[ \frac{\psi m_{t+1}^{h} - 1}{c_{t}^{l} - c_{t}^{u}} = w_{t} \left( C_{t+1}^{l} - \psi m_{t+1}^{h} + \lambda_{t+1}^{h} m_{t+1}^{h} \right). \]

A change in $m_{t}^{h}$ affects the return to labor in the next period directly and through $\lambda_{t}^{h}$.  

---

[8] With the borrowing limit of the household tied to next period’s labor income, the first order condition for labor supply from the household’s problem takes the form $\frac{\psi m_{t+1}^{h} - 1}{c_{t}^{l} - c_{t}^{u}} = w_{t} \left[ \frac{1}{C_{t+1}^{l} - \psi m_{t+1}^{h}} + \lambda_{t+1}^{h} m_{t+1}^{h} \right]$. A change in $m_{t}^{h}$ affects the return to labor in the next period directly and through $\lambda_{t}^{h}$.  

19
The spillover effects of housing are also important for the behavior of investment. The excess funds that entrepreneurs generate lead to an increase in investment. Without housing, investment does not change in the initial period, which is followed by a decline.

The predictions of our model regarding investment are similar to the findings of Liu, Wang and Zha (2013). They show that when firms are credit constrained, a housing demand shock originating in the household sector raises the land price and thereby expands firms’ borrowing capacity, enabling firms to finance expansions of investment and production. In our model, instead of a housing demand shock, an increase in household borrowing leads to an increase in the real estate price and investment by firms. In both cases, a shock originating in the household sector is transmitted to the business sector through a change in the value of housing, however the transmission mechanisms are different. In Liu, Wang and Zha (2013), increasing house prices raise the value of collateral held by firms and increase investment through higher borrowing by firms. In our model, firms sell some of the real estate they own when housing price increases and use these revenues to increase investment. Therefore, we identify another mechanism through which a shock in the household sector is transmitted to the business sector.

Additionally, we find that along with investment, equilibrium employment is affected by the mechanism generated by housing due to the higher labor demand by firms. Hence, the effects of a shock that influences house prices are also propagated through changes in employment.

In the case of a positive shock to business credit, labor demand increases on impact through higher credit availability of firms in both models. Therefore, labor and output expanding on impact.\footnote{To be exact, the first order condition for labor demand from the entrepreneur’s problem takes the form \( \left( \frac{1}{c^*} \right) (1 - \alpha - \mu) \left( \frac{w}{c^*} \right) = \left( \frac{1}{c^*} \right) w_t \left[ 1 + (R_t - 1) \theta \right] + \lambda^*_t R_t \theta w_t. \) The excess flow of funds generated through the sale of real estate reduces the firm’s demand for borrowing and \( \lambda^*_t \) decreases. The decline in \( \lambda^*_t \) reduces the cost of labor, as seen in the above equation, and raises the firm’s demand for labor.\footnote{As seen in Figure 1, firm borrowing does not increase with a household credit shock in our model since the increase in housing price lasts one period. Borrowing by firms is tied to the value of their collateral in the next period. Therefore, for the borrowing level to increase, the value of real estate has to stay high for at least one more period as in Liu, Wang and Zha (2013). Even though the credit shocks are persistent, the price of housing decreases in the second period. The amount of new borrowing decreases every period after a positive credit shock until it reaches its steady state value. Since new borrowing is decreasing over time, the repayment on previous period’s debt including the interest payment exceeds the amount of new borrowing. Therefore, demand for housing decreases in the second period, which leads to a decline in the housing price.}
increase on impact and decline in period one but the decline is bigger in the model with housing. This difference is again due to the spillover effects generated by housing. As entrepreneurs demand more real estate with an increase in their borrowing capacity, house prices increase and households generate a flow of funds by reducing their housing stock. In both models, increasing income in the initial period makes the household’s credit constraint less binding and $\lambda_t^h$ decreases but the decrease is bigger in the model with housing due to the excess funds households generate through real estate sales. Since $\lambda_t^h$ affects the labor supply response in period $t + 1$, labor supply decreases more in the benchmark model in the period following the shock.

To summarize, with housing as a common asset that links households and firms, there are spillover effects between the agents that work through the value of housing. As a result, a credit shock in one sector is transmitted to the other sector and the two types of credit shocks affect the key macroeconomic variables in the same direction. In the absence of housing, this transmission mechanism is missing and the model generates different dynamics for the two shocks.

5.2 Impulse Responses in the Extended Model

In this section, we analyze the response of the economy to credit shocks in the model extended to include land and investment in structures. Figure 4 shows the impulse response functions for positive one percent shocks to household and business credit. In addition to the variables considered in the benchmark model, here we also plot the responses of land, investment in structures, and the two real estate prices.$^{11}$

All of the common variables respond similarly to credit shocks in the benchmark and extended models. The mechanism working through real estate sales between the agents in the benchmark model works through land in the extended model. When households receive a positive shock to their credit access, their demand for housing increases, which induces them to purchase land from entrepreneurs and increase their investment in structures. As a result, their housing stock increases as well as the prices of both residential and commercial real estate, reflecting the increase in the price of land. Entrepreneurs receive a flow of funds

$^{11}$We do not plot the impulse responses for $\lambda_t^h$ and $\lambda_t^e$ for brevity purposes. Their responses also closely follow those in Figure 1.
through selling some of the land they hold to households, which generates an effect similar to the one through real estate sales in the benchmark model. They use this additional revenue to hire more labor and to increase their investment in capital and structures. Even though entrepreneurs’ investment in structures increases, there is still a decline in their real estate holdings reflecting the decline in the stock of land they hold.

Figure 4. Positive shocks to credit: Percent deviation of variables from their steady-state values in the extended model

In the case of a business credit shock, the mechanism is again similar to the benchmark model but works through land sales. As entrepreneurs demand more housing, they purchase land from households. Therefore, households receive a flow of funds through land sales. They use some of these funds to increase their investment in structures but their housing stock decreases due to the decline in the land they hold.
In sum, the impulse response analysis shows that incorporating land and investment in structures does not affect the mechanism generated by the baseline model and spillover effects between agents exist as long as there is a common asset that links households and firms.

5.3 Business Cycle Statistics

In this section, we examine the ability of the model to match the main characteristics of business cycles observed in Turkey in the period 1995Q1-2009Q4. Table 3 compares the key business cycle moments obtained from the data with those from the benchmark and the extended models. The models are log-linearized around the steady state and the moments are calculated using HP-filtered series. The model dynamics are generated by productivity and two credit shocks.

Business cycle properties of Turkey conform with the properties observed in other emerging market economies as documented by Neumeyer and Perri (2005) and Aguiar and Gopinath (2007), among others. In particular, the volatility of consumption is higher than output, investment is about three times more volatile than output, and the ratio of net exports to output is strongly countercyclical.

In Turkey, the changes in household credit and business credit relative to output are both procyclical, which shows that credit expansions for both types of credit occur in periods of high output. The correlation of household credit with output is higher, suggesting that household credit responds more strongly to cyclical fluctuations. The correlations of changes in household credit and business credit with net exports are negative and household credit has a higher correlation than business credit. These patterns are consistent with the cyclical features of household and business credit observed in emerging market economies as documented by Bahadir and Gumus (2016).

The model replicates most of the features of the data successfully and the moments generated by the two versions of the model are quite close to each other. The relative volatility of consumption and the volatilities of output, net exports-to-output ratio and the change in household credit-to-output ratio are very close to the data. The model also generates strongly countercyclical net exports, which is hard to generate in standard small open economy RBC models. The correlations of changes in credit with output are positive.
and the correlations with net exports are negative for both types of credit in the model as in the data. The model generates a higher correlation between output and household credit compared to business credit, which is consistent with the data, while it overestimates the negative correlation between business credit and net exports.

Table 3. Business cycle properties

<table>
<thead>
<tr>
<th></th>
<th>Standard Deviations</th>
<th>Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Data model</td>
<td>Benchmark model</td>
</tr>
<tr>
<td>$\sigma(Y)$</td>
<td>3.78</td>
<td>3.58</td>
</tr>
<tr>
<td>$\sigma(C)/\sigma(Y)$</td>
<td>1.13</td>
<td>1.12</td>
</tr>
<tr>
<td>$\sigma(I)/\sigma(Y)$</td>
<td>3.13</td>
<td>3.13</td>
</tr>
<tr>
<td>$\sigma(L)/\sigma(Y)$</td>
<td>0.53</td>
<td>0.64</td>
</tr>
<tr>
<td>$\sigma(\frac{NX}{Y})$</td>
<td>1.78</td>
<td>1.72</td>
</tr>
<tr>
<td>$\sigma(\frac{\Delta HC}{Y})$</td>
<td>1.03</td>
<td>1.01</td>
</tr>
<tr>
<td>$\sigma(\frac{\Delta BC}{Y})$</td>
<td>2.53</td>
<td>1.56</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Net exports (NX) are exports minus imports. Change in household credit ($\Delta HC$) is $HC_t - HC_{t-1}$, change in business credit ($\Delta BC$) is $BC_t - BC_{t-1}$. GDP (Y), consumption (C), investment (I), and labor (L) are in logs. Data series have been seasonally adjusted and all series have been HP filtered. The standard deviations are reported in percentage terms. See the appendix for data sources.

6 Concluding Remarks

This paper studies the role of real estate in the transmission of household and business credit shocks to the economy using a small open economy RBC model. We show that both types of credit shocks generate an increase in output, consumption, investment and house prices with business credit generating a larger expansion. In the existence of housing, which serves as a common asset in the model, a credit shock in one sector is transmitted to the other one through changes in the price of real estate. As borrowing increases in one sector, house prices increase, affecting the flow of funds of the other agent. Because of these spillover effects, the two shocks generate similar responses in the economy. When housing
is abstracted from the model, this channel is missing and the two types of credit generate different dynamics. Household credit expansions lead to a contraction in the economy due to the response of labor supply, whereas an increase in business credit results in an expansion. The predictions of the model do not change when we relax the assumption of a fixed stock of real estate and allow for the real estate amount to adjust through investment in structures.

Our findings suggest that the transmission mechanism of credit shocks should be considered when evaluating the effects of macroprudential policies that target credit growth to promote financial stability. Limiting credit growth in one sector may have widespread effects on the economy through changes in house prices. Therefore, possible spillover effects of such policies should be taken into account in policy formulation.
References


Appendix

The construction of the series used in the model solution is explained below. The data sources are given at the end of the Appendix.

Real GDP, investment and consumption: Nominal series are converted into real units by dividing with the GDP deflator for constant 2005 prices.

Capital Stock: The capital stock is generated using a perpetual inventory method. The investment series in constant 2005 prices is obtained by dividing the nominal series with the GDP deflator. For the perpetual inventory method, we use a yearly depreciation rate of 0.08 as Meza and Quintin (2007). To set the initial capital stock, we follow Young (1995) and Meza and Quintin (2007) and assume that the growth rate of investment in the first five years of the series is representative of the growth rate of investment in previous years.

Labor Input: We calculate total hours worked by multiplying the average hours per worker with total employment. Since there is no data for average hours per worker for the whole economy, we use average hours per worker in the manufacturing sector (Bergoeing et al. (2002) and Meza and Quintin (2007) also use manufacturing sector data). In order to find average hours per worker in the manufacturing sector, we multiply an index of total hours worked in manufacturing by the actual hours worked in 2005, which is the base year. We then divide this by the number of workers in manufacturing, which is also calculated as the index of workers times the actual number of workers in 2005. We scale the resulting series by 1274, an approximation of total discretionary time available in a quarter (corresponds to 98 weekly hours used by Correia et al., 1995). We use this series as representative of average hours per worker in the economy as a whole. We multiply it by total employment to get total hours worked and seasonally adjust the series to calculate total factor productivity.

To calibrate the parameter that measures the disutility from working, $\psi$, we need a measure of total hours per capita. We divide the total hours worked series by the total working age population, which corresponds to the population of age 15 and higher. We then set $\psi$ so that the steady state labor supply equals the average value of total hours per capita as a fraction of total discretionary time, which equals 0.18.
The total employment and total working age population figures are reported twice a year by the Turkish Statistical Institute in the period 1995-1999, and quarterly figures are available starting in 2000. The quarterly values are obtained from the biannual figures through linear interpolation in the period where quarterly data are missing.

**Labor income:** Calculating the labor’s share of income as the ratio of the compensation of employees to income gives an average value of 0.31, which is much lower than the standard values used in the literature (in the range of 0.60 to 0.70). Gollin (2002) points out that the labor income of the self-employed is often treated incorrectly as capital income, which leads to the labor income share being underestimated. Following one of the methods he uses, we correct our labor income figures to account for the income of the self-employed. For this purpose, we divide the compensation of employees by the number of employees and multiply this by total employment minus the number of employers. Taking the ratio of these new labor income figures to GDP gives an average value of 0.60, which is much closer to values used in the literature. Note that the data on compensation of employees are only available until the end of 2006. Therefore, the data we use for this part of the calibration covers the period 1995-2006.

We also use the compensation of employees data in the calibration of the working capital coefficient $\theta$. We calibrate this parameter as the average of the ratio of short-term loans to the compensation of employees. Since the working capital requirement represents borrowing by firms to pay for the wage income of their workers, we use the unadjusted data on compensation of employees, directly from the GDP figures. We do not use the adjusted data since the adjustment is to correct for the income of the self-employed, which is not relevant for the working capital requirement.

**Total Factor Productivity:** The data on TFP have been constructed using the production function specified in equation (4). Since there is no data on housing stock in Turkey, we use the series for capital stock and total hours worked to compute the TFP. We keep the labor’s exponent in the production function equal to the value implied by the labor’s share of income in the data and increase the exponent of capital to include the share of housing,
i.e. the exponent of capital equals $\alpha + \mu$. The resulting TFP series is then linearly detrended and the residuals are used to estimate the AR(1) process for the productivity shock.

**Net exports:** Exports minus imports of goods and services.

**Real interest rate:** The series for the real interest rate is computed using the procedure followed by Neumeyer and Perri (2005). The real interest rate for Turkey is computed as the U.S. real interest rate plus the sovereign spread for Turkey. The sovereign spread is measured by J.P. Morgan’s Emerging Markets Bond Index Global (EMBIG), which is available starting in 1998. The EMBIG spread measures the premium above U.S. Treasury securities in basis points for dollar denominated sovereign debt. The U.S. real interest rate is computed by subtracting expected inflation rate from the interest rate on 90-day U.S. Treasury bills. Expected inflation in period $t$ is computed as the average of U.S. GDP deflator inflation in the current period and in the three preceding periods.

**Business Credit:** Credit to nonfinancial firms. We construct the real value of business credit in 2005 prices by dividing the business credit series with the GDP deflator. Since there is no data on housing stock in Turkey, we calculate the series for $m_t^c$ as the ratio of the real value of business credit divided by the value capital stock next period, where both series are in units of 2005 prices.

**Household Credit:** The sum of housing credit, consumer credit, individual credit cards, and loans to personnel. Because of the lack of data on housing stock, we calculate $m_t^h$ as the value of household credit divided by the labor’s share of income in the next period.

Data sources:
- Indexes of total hours worked and total employment in manufacturing: OECD
- Total employment and total working age population: Turkish Statistical Institute
- Household credit, business credit, short-term bank loans of firms: Central Bank of Turkey

30