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# Collateral constraints and rental markets[☆]

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## HIGHLIGHTS

- We study a standard model with collateral constraints and heterogeneous discounting.
- We introduce rental markets.
- Impatient agents choose to rent rather than own the collateral.
- Borrowing constraints play no role in local dynamics.

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ABSTRACT

We study a benchmark model with collateral constraints and heterogeneous discounting. Contrarily to a rich literature on borrowing limits, we allow for rental markets. By incorporating this missing market, we show that impatient agents choose to rent rather than to own the collateral in the neighborhood of the deterministic steady state. Consequently, impatient agents are not indebted and borrowing constraints play no role in local dynamics.



## 1. Introduction

In recent years, a rich literature has developed to study the role of collateral constraints in driving fluctuations throughout the business cycle.

Collateral constraints are a common feature of housing finance in the developed world (IMF, 2008; Iacoviello, 2010, 2011; Calza et al., 2013). They are aimed at responding to enforcement limits of debt contracts: in case of default, the creditor can seize borrowers' real assets. Moreover, the structure of this type of debt limits implies a strong linkage between agent's access to credit and real estate markets, which is of empirical relevance.

Introducing borrowing limits into an otherwise frictionless framework entails significant deviations from the Modigliani–Miller theorem. Moreover, all shocks affecting the value of the collateral are amplified and spread throughout the economy via their impact on credit markets themselves. However, for this financial accelerator mechanism to work, two ingredients are necessary. First, the borrowing limit has to bind in equilibrium. Second, at each period the economy needs to be populated by a set of agents willing both to lend and borrow up to the limit. Becker (1980) and Becker and Foias (1987) show that one way to insure this is to introduce discount-factors heterogeneity. Indeed, impatient agents are always debt constrained while patient agents are willing to lend.

Kiyotaki and Moore (1997) introduce collateral constraints on land value together with heterogeneous discount rates to study the impact of the financial accelerator mechanism. They show how the propagation mechanism mentioned above can be decomposed into a static multiplier and a powerful dynamic multiplier entailing persistent cycles.

Following Kiyotaki and Moore (1997), a large literature has developed incorporating heterogeneous discounting to insure

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binding collateral constraints. Iacoviello (2005) introduces collateral constraints into the housing market. Because the structure of credit limits implies that agents can borrow more whenever their housing wealth rises, there is a strong correlation between movements in housing wealth and movements in aggregate consumption. Indeed, relatively poor people with lower propensity to save respond more to changes in housing wealth. These properties of the model allow him to explain the amplification of cycles and to match some empirical stylized facts (Iacoviello, 2010).

In light of the extensive use of the benchmark model in the literature, we analyze some fundamental features of the model and their implications for the equilibrium. To this purpose, we focus on a standard housing model where the collateral is real estate.[1] We believe that the standard framework is based on the implicit assumption that the only way to benefit from housing services is to own real properties. We relax this assumption by introducing a rental market. Thus the modified model accounts for agents who can own real assets and produce housing services for themselves, and renters who buy housing services from landlords. Agents face a portfolio decision; they confront the trade-off between investing in real estate or in financial assets/being indebted. Our analysis shows that in this context, in contrast to the above mentioned literature, the optimal behavior of the impatient agent generically consists of not investing in housing. Therefore, the equilibrium is characterized by no private debt. Indeed, the impatient agent aims at increasing current consumption as much as possible. When agents can borrow less than the entire value of their house (i.e., the loan-to-value ratio is less than one), any increase in real properties implies a less than proportional increase in private borrowing, and thus, current consumption. In this case, impatient agents choose not to invest in housing thereby consuming all of period-$t$ income. Consequently, the credit market collapses and impatient agents buy housing services on the rental market, leaving no role for collateral constraints.

## 2. The model

There are two types of agents who are characterized by different discount rates. Both agents derive utility from consuming nondurable goods and housing services. They can buy and/or rent housing units (i.e., square meters) and have access to the credit market. Henceforth, we will denote the agent having a relatively higher preference for the present as the impatient agent, and the one with the highest discount rate, as the patient one.

The objective function of the representative impatient agent at date $t = 0$ can be written as:

$$\max_{c_t, h_t} E_0 \sum_{t=0}^{\infty} \beta^t u(c_t, h_t), \tag{1}$$

where $c_t$ represents nondurable consumption, $h_t$ represents consumption of housing services, $\beta \in (0, 1)$ is the discount factor and function $u(.,.)$ is increasing, concave and satisfies the Inada conditions in both arguments. Finally, $E_0$ is the expectation operator conditional to the information set at date $t = 0$. The budget constraint at date $t \geq 0$ can be written as:

$$p_t s_t - d_t + c_t + p_t l_t (h_t - s_t) = p_t s_{t-1} - R_{t-1} d_{t-1} + y_t, \tag{2}$$

where $p_t$ is the relative price of one unit of housing $s_t$, and $d_t$ is outstanding private debt. Moreover, $l_t$ is the rent-to-price ratio, $R_t$ is the interest factor that prevails on the credit market and $y_t$ is the (exogenous) income endowment. Therefore, $p_t s_t - d_t$ represents the net wealth of the agent and $p_t l_t (h_t - s_t)$ represents the rent paid to or received from the landlord depending on whether the agent eventually buys (i.e., rents housing) or produces (i.e., owns and rents) housing services.

An impatient agent's debt, $d_t$, is constrained to be less than or equal to a share $m \in (0, 1)$ of the expected present value of their housing holdings. Following Kiyotaki and Moore (1997), the constraint can be written as:

$$d_t \leq m s_t \frac{E_t p_{t+1}}{R_t}. \tag{3}$$

The housing stock cannot be negative, thus:

$$s_t \geq 0. \tag{4}$$

Let us denote by $u_1'(c_t, h_t)\varphi_t$ the Kuhn–Tucker multiplier associated with the collateral constraint (3) and by $u_1'(c_t, h_t)\zeta_t$ the one associated with the non-negativity constraint (4). The first order conditions of the impatient agent with respect to housing assets and debt read as:

$$-p_t(1 - l_t) + \beta \frac{E_t p_{t+1} u_1'(c_{t+1}, h_{t+1})}{u_1'(c_t, h_t)} + m\varphi_t \frac{E_t p_{t+1}}{R_t} + \zeta_t = 0, \tag{5}$$

$$1 - R_t \beta \frac{E_t u_1'(c_{t+1}, h_{t+1})}{u_1'(c_t, h_t)} - \varphi_t = 0. \tag{6}$$

Condition (5) represents the arbitrage between the marginal cost of investing in housing, $p_t(1 - l_t)$, and the marginal gain deriving from future nondurable consumption and from increasing borrowing, provided that constraint (3) is binding. When (3) is not binding, $\varphi_t$ is equal to zero and condition (6) is the standard Euler equation with respect to private debt. When $\varphi_t \neq 0$, the marginal utility of present consumption is larger than the discounted utility of future consumption. Therefore, agents borrow up to the limit to increase current consumption and constraint (3) is binding. Moreover, complementary slackness conditions can be written as:

$$\left(m s_t \frac{E_t p_{t+1}}{R_t} - d_t\right)\varphi_t = 0, \tag{7}$$

$$s_t \zeta_t = 0. \tag{8}$$

The representative patient agent is similar to the impatient one. The main difference lies in the discount factor, $\mu \in (\beta, 1)$. The objective function of the patient agent at date $t = 0$ can be written as:

$$\max_{c_t^*, h_t^*} E_0 \sum_{t=0}^{\infty} \mu^t u(c_t^*, h_t^*), \tag{9}$$

where starred letters refer to patient-agent variables. The budget constraint is the same as the one described in (2) except that $b_t^*$ are bonds (i.e., the funds lent to impatient agents):

$$p_t s_t^* + b_t^* + c_t^* + p_t l_t (h_t^* - s_t^*) = p_t s_{t-1}^* + R_{t-1} b_{t-1}^* + y_t^*. \tag{10}$$

For simplicity, we do not introduce borrowing constraints as, in equilibrium, the patient agent holds a non-negative quantity of bonds, provided that the relative transversality condition is imposed. Moreover, the patient agent's housing stock cannot be negative:

$$s_t^* \geq 0. \tag{11}$$

Let us denote by $u_1'(c_t^*, h_t^*)\kappa_t$ the Kuhn–Tucker multiplier associated with the non negativity constraint (11). The intertemporal arbitrage conditions with respect to $s_t^*$ and $b_t^*$ can be written as:

$$-p_t(1 - l_t) + \mu \frac{E_t p_{t+1} u_1'(c_{t+1}^*, h_{t+1}^*)}{u_1'(c_t^*, h_t^*)} + \kappa_t = 0, \tag{12}$$

$$-1 + R_t \mu \frac{E_t u_1'(c_{t+1}^*, h_{t+1}^*)}{u_1'(c_t^*, h_t^*)} = 0. \tag{13}$$

[1] Alternatively, we could have chosen as collateral land or other durable collateralizable assets. This would not have changed the results of our analysis.