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Prices and investment with collateral and default

Michael Magill [a], Martine Quinzii [b,*]

[a] University of Southern California, Los Angeles, CA 90089-0253, USA
[b] Department of Economics, University of California, Davis, CA 95616-8578, USA

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ABSTRACT

This paper uses the framework of an OLG economy with three-period lived agents in which a durable good serves as collateral for loans, to study the effect of an unanticipated income shock when the economy is in a steady state equilibrium. We focus on the consequence of default on loans when the value of the collateral falls below the value of the debt it secures. We analyze the impulse response functions of the price and production of the durable good and show that there is an asymmetry between the response of the price and investment of the durable good to a positive and a negative income shock arising from default on the collateralized loans. We show that this asymmetry can be seen in the data on housing prices and construction and is attributable to the default on mortgages in periods of decreasing prices which acts as a turbo mechanism magnifying the decline in investment.

1. Introduction

The recent financial crisis originated in the mortgage market where a decrease in house prices triggered extensive default on mortgages. Motivated by this episode we study the consequence of a shock which unexpectedly changes the price of a durable good used to collateralize loans. As in the collateral model of Kiyotaki–Moore (KM) (1997) we adopt the method widely used in macroeconomics of studying the effect of an unanticipated income shock when the economy is in a steady state equilibrium. Our model differs from KM since we focus on consumer durables rather than the durable capital (or land) which is the focus of their study. The main conceptual difference with KM however is that we assume that as soon as the value of the collateral falls below the value of the loan the borrower defaults. That is, we adopt the approach of the general equilibrium literature initiated by Dubey et al. (1995) and Geanakoplos and Zame (1997) where the seizure of the collateral is the only penalty for default.[1]

Thus in our model a negative unexpected shock leads to default, a feature not taken into account in KM. To study the consequence of default we contrast the behavior of the equilibrium variables, in particular the price and the production of a durable good, following a positive or negative income shock of the same magnitude. A positive shock to the agents' endowment—their labor income—leads to an increase in the price of the durable good so that the agents' wealth increases

* Corresponding author.
E-mail addresses: magill@usc.edu (M. Magill), mmquinzii@ucdavis.edu (M. Quinzii).

[1] This assumption is relatively realistic for the current US mortgage market where a mortgage loan is de facto a non-recourse loan.

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for two reasons: the first is the direct effect of the increase in the labor income, the second is the indirect wealth effect of the increased value of the durable purchased in the previous period. The indirect effect is akin the "multiplier effect" exhibited by KM following a positive shock to the endowments of entrepreneurs.

If agents had to pay their loans in all circumstances then the equilibrium response to a negative shock would be the negative counterpart of the response to a positive shock. However with collateralized loans which permit default, the agents who borrowed against the full value of their durable last period (in our model the young who become middle aged) are not exposed to the negative indirect wealth effect: the decrease in price of the durable good following a negative shock implies that the value of the collateral is less than the value of the loan and the agents default. Thus aggregate demand decreases less than it would if default were not permitted. This has two consequences, one for the prices, the other for investment. The decrease in the durable good price is less than it would otherwise have been, and the demand for the consumption good also decreases less than it otherwise would. Thus investment has to decrease more to reestablish equilibrium on the consumption good market. This fits with the financing behavior of the intermediaries who receive payments on the loans incurred in the previous period and use the proceeds to finance investment and new loans in the current period. With a negative shock the intermediaries make a loss on loans which default and are forced to reduce financing. If we compare the reaction functions of prices and investment to a negative shock and their reaction to a positive shock with a change in sign (the symmetric counterpart) then we find that the decrease in price is less steep while the decrease in investment is steeper.

We study these effects in the setting of an overlapping generations model (OLG) with three-period lived agents, identical cohorts and two goods, one perishable (also called the consumption good) and one durable which serves to collateralize loans. This provides a setting in which there are natural borrowers (the young agents) who purchase a durable good which serves at the same time for consumption and as collateral for their loans. Each agent has an initial endowment consisting solely of the perishable good, small in youth, larger in middle age and zero in retirement, the life-cycle profile originally studied by Samuelson (1958). The young borrow to finance their consumption of the durable good and we assume that the collateral constraint is binding: as we will see this implies that the young cannot anticipate on their future income in middle age. The need to post collateral thus endogenously justifies the very plausible assumption that "Junior Can't Borrow" against future labor income in the well-known analysis of Constantinides et al. (2002). The durable good is transferred across periods with depreciation. To maintain or increase the stock of durable there is a technology with constant returns which transforms the consumption good into the durable good with a lag of one period. At each date there are spot markets for the perishable and the durable goods, and loans subject to collateral are issued by competitive intermediaries who make zero profit.

The perishable good serves as the unit of account so that an equilibrium consists of a sequence of durable good prices and interest rates such that markets clear. Studying paths which revert to a steady state equilibrium after a shock requires an analysis of the steady state equilibria and their stability properties. The economy always has a steady state in which the interest rate is zero (there is no population growth): following standard terminology for the OLG model, we refer to this steady state as the Golden Rule with Collateral (GRC). Its stability properties are however different from the Golden Rule (GR) of standard OLG model with perishable goods: with only perishable goods, when the old agents have zero endowment, the Golden Rule is unstable.[2] In contrast in our model with a durable good which serves as a store of value, the GRC is stable (saddle-point stable when the local dynamics is of dimension greater than 1) as long as the durable good is desired for consumption and its depreciation rate is not excessive. Even though the old agents have no labor income, they become 'rich' by carrying over stocks of the durable good to retirement. We show that the economy thus behaves like a 'classical' rather than a 'Samuelson' economy in the terminology of Gale (1973), meaning that the GRC is stable and other steady states when they exist are unstable. This striking property of the model with a durable good implies that we can restrict the analysis of the impact of an unanticipated shock to a shock around the GRC.

Equilibrium models with collateral have been developed over the last fifteen years and are the subject of active research. Collateral constraints were introduced almost simultaneously in the macro literature by Kiyotaki and Moore (1997) and in the general equilibrium literature by Dubey et al. (1995) and Geanakoplos and Zame (1997, 2014). The ensuing GE literature on collateral has split into two branches: the one studies models in which durable goods serve as collateral for borrowing, the other branch initiated by Geanakoplos (2003) and Kubler and Schmedders (2003) studies models in which financial securities serve as collateral. From the modeling point of view the first is closer to our paper, but in terms of seeking a simplified structure to enable qualitative properties of equilibrium to be derived, the latter is closer to our concerns.

The models with durable goods progressively incorporated more realistic features of collateralized loans and their terms and focused on proving existence of equilibrium in these more general settings. Araujo et al. (2000, 2005) study two alternative approaches to endogenizing collateral, while Poblete-Cazenave and Torres-Martinez (2013) add bankruptcy with protected assets to the model. Araujo et al. (2002) and Pascoa-Seghir (2009) show how the collateral model can be extended to an open-ended future with infinite-lived agents; a model closer in spirit to ours since it draws on the overlapping generations structure is that of Seghir and Torres-Martinez (2008) which introduces realistic features such as random lifetimes and bequests. However since our goal is to derive properties of the equilibrium rather than establishing existence, we are led to study a much simpler OLG economy.

[2] This was the property that Samuelson (1958) considered a huge deception since the GR had all the nice properties except stability and hence would never be achieved in the long run (by markets): the steady state which is stable and hence is achieved in the long run, offers disadvantageous terms to the old generation in their retirement.