Land-price dynamics and macroeconomic fluctuations with nonseparable preferences

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A B S T R A C T

In this paper, we introduce a complementary relationship between consumption and labor hours by revising the household's period utility function in Liu et al. (2013). The revision concomitantly allows for a finite Frisch elasticity of labor supply and a stronger consumption smoothing motive. We find that, in general, the estimation of Liu et al. (2013) is quite robust. In addition, the propagation mechanism of the credit constraint triggered by a housing demand shock still persists. However, the amplification effect of the credit constraint triggered by the housing demand shock on key macroeconomic variables is greatly muted. We also find that, except for land price fluctuations, the housing demand shock cannot act as the primary force to drive the fluctuations in other macroeconomic variables.

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1. Introduction

The Great Recession has turned academic researchers' interest to financial frictions. Since the seminal work of Kiyotaki and Moore (1997), many academic researchers find that the borrowing constraints can powerfully propagate and amplify a small shock by changing the net worth of credit-constrained agents.[1] The experience of the U.S. housing market during the period of the Great Recession has led many academic researchers to believe that house prices could be one of the key driving forces of business cycles. Recently, Liu et al. (2013) introduce land as a collateral asset in firms' credit constraints and find that a housing demand shock can trigger a mechanism that propagates and amplifies the shock through the joint dynamics of land prices and business investment. Their estimation also shows that a housing demand shock alone can account for about 90% of land-price fluctuations, 30–40% of investment fluctuations, 20–30% of output fluctuations, and 35–45% of labor hours fluctuations.

However, Liu et al. (2013)'s striking conclusions are based on some assumptions about the representative household's period utility function. Following Hansen (1985) and Rogerson (1988), Liu et al. (2013) assume that the period utility function is linear in leisure, thus it implies that Frisch elasticity of labor supply is infinite. But the recent research on the topic

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[1] See, among many others, Iacoviello (2005), Iacoviello and Neri (2010), Jermann and Quadrini (2012), Favilukis et al. (2017), Liu et al. (2013, 2016).

has rejected the assumption.[2] Liu et al. (2013) also assume that the period utility function is separable in consumption and labor. By comparison, since Becker (1965), Kydland and Prescott (1982), and Greenwood et al. (1988), many economists emphasize that consumption and labor being complements has important implications for business cycles. Do Liu et al. (2013)'s striking conclusions hold if we generalize the household's period utility function to allow for a complementary relationship between consumption and labor hours and a finite Frisch elasticity of labor supply?

In this paper, following Kydland and Prescott (1982), Backus et al. (1992), Chari et al. (1994, 2000) and Schmitt-Grohe and Uribe (2007), we assume a complementary relationship between consumption and labor hours in household's period utility function of Liu et al. (2013). Our revision of the household's period utility function has two accompanying advantages. First, in our model, Frisch elasticity of labor supply is finite intrinsically. Second, the household prefers consumption smoothing while, in Liu et al. (2013), the period utility function is logarithmic in consumption, which implies that when the interest rate changes, the income effect equals the substitution effect and saving is not affected by the changes in the interest rate.

Following Liu et al. (2013), we fit the log-linearized equilibrium system to the same data and use the Bayesian method to estimate the revised model. In general, the estimated parameters of our model with a complementary relationship between consumption and labor hours suggest that the estimation of Liu et al. (2013) is quite robust. In addition, we find that the propagation mechanism through the collateral channel triggered by a housing demand shock still persists. However, the amplification effect on key macroeconomic variables is greatly reduced, due to the combined effects of a complementary relationship between consumption and labor hours, a finite Frisch elasticity of labor supply, and the household's consumption smoothing motive.

When the household prefers consumption smoothing, after a housing demand occurs, the household is less willing to decrease the consumption and lend to the credit-constrained entrepreneur. Thus, after a positive housing demand shock occurs, the land price increases following the household's higher demand for land, which expands the entrepreneur's net worth and thus loosens her borrowing constraint. However, the household's unwillingness to lend than before reduces the amount of credit that the entrepreneur can borrow. As a result, the entrepreneur's land demand curve does not move as high as that in Liu et al. (2013). Thus, the demand for land from the entrepreneur is depressed. It means that the competing demand for land cannot drive the land price up to the same level as in Liu et al. (2013). Accordingly, the static financial multiplier is not as large as that in Liu et al. (2013).

In spite of the fact that the entrepreneur's borrowing capacity is weaken by the household's unwillingness to lend, the rise in the land price still expands her net worth and causes her to borrow from the household, thus the household's consumption falls. In the presence of a complementary relationship between consumption and labor, the fall in household's consumption induces the household to supply less labor and enjoy more leisure. In addition, a smaller Frisch elasticity of labor supply than that in Liu et al. (2013) also contributes the relative reduction in household's labor supply.

The lower labor supply in our model has important implications for the entrepreneur's investment and land price. The previous analysis implies that the business investment at the time when the housing demand shock hits the economy is lower than that in Liu et al. (2013), thus the capital stock in the future is also lower in our model. In addition, since the capital and labor hours are complementary in the production function, the relative reduction in labor supply decreases the marginal product of the capital, which lowers the shadow price of capital in consumption units. Thus, the entrepreneur's willingness to invest is lower than that in Liu et al. (2013), which further reduces the future capital stock. The relative decline in the capital stock and the shadow price of capital in consumption units reduces the value of the entrepreneur's collateral capital, thus entrepreneur can borrow less from the household than that in Liu et al. (2013). In addition, there is a complementary relationship among three production factors, with the future capital stock and the labor hours being lower in our model, the future marginal product of land will also be lower, which reduces the current land price. Thus, the value of the entrepreneur's collateral land is lower than that in Liu et al. (2013). Our analysis implies that the degree to which the entrepreneur's credit constraint is relaxed is lower and a smaller dynamic financial multiplier emerges.

The above reasoning implies that, after a positive housing demand shock occurs, the major macroeconomic variables, including land price, investment, output, and labor hours, all respond upward, but weaker than before. Therefore, the amplification effect triggered by a housing demand shock through the credit constraint mechanism is far smaller than that claimed by Liu et al. (2013).

Furthermore, variance decompositions show that, except for the land price, a housing demand shock cannot act as the primary force to drive the fluctuations in other main macroeconomic variables. Specifically, the housing demand shock, as in Liu et al. (2013), can account for about 80% of land-price fluctuations. By comparison, a labor supply shock is the primary force to drive the fluctuations in output (about 40–60%) and labor hours (about 60–80%). As for investment, a patience shock accounts for most of fluctuations (about 40%).

Our paper is related to the literature on questioning the quantitative significance of the amplification through the borrowing constraint channel. Kocherlakota (2000) demonstrates, in a small open economy with credit constraints, that the effect of the amplification through the borrowing constraint channel is sensitive to the structural parameters of the economy, especially to the shares of capital and land in the production function. Unlike Kocherlakota (2000), Cordoba and Ripoll (2004) directly modify Kiyotaki and Moore (1997) to introduce standard specifications of preferences and technologies. Specifically, two types of agents both have concave preferences and concave production technologies. They find that the output ampli-

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[2] See Chetty et al. (2012).