Essays on Residential Investment and Social Insurance*

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Thesis Summary

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1 Introduction

My dissertation consists of two chapters on quantitative macroeconomics. The first chapter analyzes the dynamics of residential investment in the United States. In U.S. business cycles, residential investment differs from consumption and business investment in two respects. First, residential investment leads GDP while business investment lags and consumption coincides with GDP. Second, residential investment is more volatile than consumption and business investment. The literature attempts to account for these two features, but does so with limited success. This chapter is an attempt to tackle this problem.

To do this, I develop a dynamic stochastic general equilibrium model. In the model, I make two distinctive assumptions. First, agents face collateral constraints. Second, agents receive a signal about Total Factor Productivity (TFP) one period in advance. In a partial equilibrium analysis where interest rates are fixed, when agents receive positive signals, they want to increase current consumption, including housing consumption, to inter-temporally smooth consumption. Because the income of agents does not increase, they must dissave in order to make most of their purchases. If they extend their houses or move into bigger houses, they can borrow against their house through mortgages based on the value of the houses. As a result, agents purchase housing more than other consumption goods in response to good signals because they are bound by collateral constraints. This is the income effect of a positive signal. Through this mechanism, the model can generate a result in which residential investment leads consumption and GDP.

In a general equilibrium analysis where interest rates are endogenous, in the event of good news, the income effect dominates and residential investment still leads consumption and GDP, despite the expectation of a higher rate of return on business capital. Furthermore, residential investment increases more than business investment in response to a

positive signal. This occurs because poorer agents borrow more and purchase more housing. Savings from wealthy agents are used to finance this increased borrowing. This process leads to a reallocation from business investment to residential investment. Through these mechanisms, the model can generate the lead-lag relationship and the relatively high volatility of residential investment observed in the data.

The second chapter analyzes the social insurance programs of developing countries. Developing countries generally have much smaller social insurance programs relative to their outputs than developed countries do. It is generally regarded that this is due to inefficient governments or low incomes. However, the literature ignores the difference in institutional features between developing and developed countries. Limited enforcement of financial contracts is a prevailing feature of financial markets in developing countries. This chapter investigates the adverse impact of limited contract enforcement on the welfare effects of social insurance programs. This chapter argues that smaller social insurance programs may be better than large social insurance programs for countries where financial institutions cannot fully enforce contracts with entrepreneurs.

The reason for this result is as follows. Better social insurance reduces the idiosyncratic risks that agents face. Using a general equilibrium model, I show that lower risks will decrease savings and hence generate higher interest rates. In the case of limited enforcement, entrepreneurs are more likely to breach financial contracts due to higher interest rates. When the default problem worsens, borrowing becomes more difficult for entrepreneurs, which reduces the productivity of the economy. This adverse effect on productivity offsets the welfare improvements from improved social insurance. Thus, with better social insurance, social welfare decreases rather than increases. This finding suggests that financial market reforms should take priority over social insurance reform.

2 Explaining Residential Investment over the Business Cycle: the Importance of Information and Collateral Constraints

In U.S. business cycles, residential investment differs from consumption and business investment in two respects. First, residential investment leads GDP, while business investment lags and consumption coincides with GDP. This lead-lag relationship is widely studied in the literature, e.g. in Green (1997) and Leamer (2007). Second, residential investment is more volatile than consumption and business investment. This chapter attempts to explain these two features.

Understanding the dynamics of residential investment and its role in the business cycle is important. Aggregate housing values constitute about half of the aggregate private wealth for the United States as documented by Greenwood and Hercowitz (1991). In addition, residential investment is a good predictor of economic recessions. In the past fifty years, seven of nine recessions were preceded by a severe reduction in residential investment, as stated in Leamer (2007). Indeed, Leamer (2007) suggested that housing is the most important sector to our economic recessions and any attempt to control the business cycle needs to focus especially on household investment.[1]

In this chapter, two key assumptions help explain the dynamics of residential investment. First, collateralized consumer loans, such as mortgages, are less restricted in size and carry lower interest rates than unsecured consumer loans, such as credit card debt. This assumption is consistent with the reality of the U.S. financial market. In 2002, the

[1] In Leamer (2007), household investment includes residential investment and consumer durables. However, the data from National Income and Product Accounts(NIPA) shows that residential investment not only leads GDP more but also has higher volatility than consumer durables.

30-year mortgage rate in the U.S. was 6.40 percent, while the average interest rate on credit card loans was 16.6 percent.[2] This suggests that, even if unsecured consumer loans are available to everyone, the high borrowing cost will keep most consumers from using them as a major financing resource. This finding is consistent with the fact that most of consumer debt in the United States is collateralized.[3]

Second, agents receive a signal of TFP one period in advance, which provides more information than current TFP. There is some empirical literature that displays evidence supporting this assumption about information. For example, Beaudry and Portier (2006) show that changes in interest rates and equity prices are almost perfectly correlated with innovations in future TFP. Some of the recent literature incorporates this assumption in their business cycle models and matches the U.S. data better, which further validates the assumption.[4]

A simple example can illustrate the main mechanism at work in this chapter. An agent receives good news about future productivity shocks and wants to increase current purchases, including housing purchases, in order to inter-temporally smooth his consumption. Because his current income does not increase, he has to dissave to finance his increased expenditures. He is able to borrow at a lower rate of interest for most of his housing purchases, which is not possible for purchases of other types of consumption. As a result, the agent will buy more housing relative to other goods. In other words, the accessibility of credit through mortgages makes residential investment respond more quickly to signals of future TFP shocks. This can account for why residential investment leads consumption

[2] The data on the mortgage rate is taken from International Monetary Fund (2002). The data on the credit card rate is taken from Gross and Souleles (2002).

[3] In 2001, 81.5 percent of consumer loans are collateralized by residential properties, while unsecured consumer loans take only 10 percent.The education loans constitute about 50 percent of the unsecured loans. These statistics are taken from Aizcorbe, Kennickell and Moore (2003) computing these numbers with the data of Survey of Consumer Finance (2001).

[4] See, for instance, Backus, Routledge and Zin (2007) and Jaimovich and Rebelo (2006) for the examples of such applications.

and GDP. If the signal turns out to be accurate, the agent will achieve a higher income and become less financially constrained. At this time, he is able to increase his consumption of other goods, which explains why consumption tends to coincide with GDP. This is the income effect of a positive signal.

However, there is also a substitution effect in the general equilibrium model where interest rates are endogenously determined by the marginal return of business capital. Because future productivity is expected to increase, the agent can also obtain an expected higher capital income if he chooses to invest more in business capital now and consume later. The above example will therefore reverse if the substitution effect dominates the income effect. This is addressed in my model by considering income and wealth heterogeneity. The agent's current consumption increases with his expected lifetime income. For a wealthy individual, financial wealth contributes to the majority of his expected lifetime income, which decreases in the event of good news because of a higher expected discount rate. Thus, wealthy agents tend to reduce housing and invest more in business capital in response to positive news. In contrast, for a poor individual, labor income constitutes the majority of his expected lifetime income, which increases because of a higher expected wage. Poor individuals borrow more and buy more housing in response to positive signals. The savings from the wealthy will be used to finance increased mortgages taken by the poor. In the aggregate, this process leads to the reallocation of wealth from business investment to residential investment in the event of positive signals. Therefore, the model can generate the lead-lag relationship and the high volatility of residential investment.

This mechanism is consistent with the differences in the compositions of family finances over various wealth levels in the United States. As shown in 2001 data, households between the 10th and 90th percentiles of the wealth distribution borrowed 72.7 percent of collateralized consumer loans. The households with the wealth above the 90th percentile

held 72.8 percent of financial assets.[5] This mechanism is also consistent with the literature on consumption and saving. For example, Storesletten, Telmer and Yaron (2004) document that consumption choices of less wealthy agents, such as the young, are more sensitive to expected labor income changes.

The existing literature attempts to account for these two dynamic features of residential investment, but only with limited success. In standard DSGE models of homogeneous agents, when there is a positive technology shock, the representative agent tends to reduce residential investment and increase business investment because of the substitution effect, which I explain above. As a result, generating the positive correlation between residential investment and business investment observed in the data is difficult, let alone the lead-lag relationship. For the same reasons, the literature also fails to account for the higher volatility of residential investment compared to business investment.[6] Modified versions of these standard models can generate the numerical result that residential investment leads business investment but they need very special assumptions. Davis and Heathcote (2005), for instance, attribute increases in residential investment to positive productivity shocks in construction sectors. Consumers buy more houses because of lower prices. However, this story of supply-driven cycles is inconsistent with the positive correlation between house prices and residential investment, which instead favors a demand-driven explanation. Gomme, Kydland and Rupert (2001) introduce a time-to-build technology and make the assumption that business investment projects require one extra period to start compared to home investment. This assumption moves the traditional home production models closer to the data. But, in their model, the volatility of residential investment is lower than volatility of business investment, which does not match the high volatility

[5] These statistics are taken from Campbell and Hercowitz (2005), which calculates these numbers with the data of Survey of Consumer Finance (2001).

[6] This literature includes the papers by e.g. Greenwood and Hercowitz (1991), Benhabib, Rogerson and Wright (1991) and Gomme and Rupert (2007).

of residential investment. Fisher (2007) assumes a complementary relationship between business capital and household capital in business productivity. His model makes further improvements in accounting for the data. However, the leadership of residential investment is still absent from his model. In contrast to these papers, this chapter stresses the demand effect. This chapter emphasizes that, as a form of consumption, housing mostly relies on individuals with low and median wealth in the aggregate effect. These individuals are more adversely affected by borrowing constraints. Hence, mortgages are important in that they enable poor agents to responde rapidly in the form of increased housing purchases to expectation shocks.

2.1 Modeling Strategy

In the first step, I conduct a partial equilibrium analysis where interest rates are exogenously given and fixed over time. The agents face two kinds of income shocks: aggregate productivity shocks and heterogeneous income shocks.[7] Following Jaimovich and Rebelo (2006), I introduce information as noisy signals about future productivity. The signal has a probability $p \in (0, 1)$ of being correct. The agents form expectations about future productivity based on the current TFP and the signal. As for the collateral constraint, agents can borrow no more than 90% of the value of their house through low-interest mortgages, and loans exceeding this amount are charged credit card rates, which are much higher than mortgage rates.[8] In addition to collateral constraints, agents also face a borrowing constraint. Agents can not borrow more than the amount that their lowest possible wage income can support given the interest payments based on the interest rate associated with

[7] Aggregate productivity shocks follows AR(1) process of which parameters are calibrated to trended US GDP. Heterogeneous income shock is discretized from the earning process of Guvenen (2007)

[8] Fisher and Gervais (2007) compile the down payment ratio of first-time house buyers as 11% from the data of 2005.

the consumer loans.[9] I compute and compare three models that have different assumptions about collateral constraints and information shocks. The benchmark model has both collateral constraints and the assumption that agents are informed of information about TFP one period in advance. In the no-signal model, agents can borrow through mortgages but do not receive more information about future TFP then what the current TFP provides. The no-mortgage model contains the assumption of advance information, and also assumes that agents have no access to mortgages. The numerical results show that only the benchmark model can generate the result in which residential investment leads consumption and GDP.

In order to highlight the mechanism through which this benchmark model works, I also describe the agent's policy functions over various wealth levels. To do this, I look at the percentage difference in the policy functions of housing and consumption between bad information shocks and good information shocks. Inspection of the policy functions reveals the following three feature. First, the percentage adjustments on housing and consumption decreases with wealth. This implies that the income effect of the positive signal matters more for the poor agent because his expected lifetime income increases by a higher percentage from the positive signal than does the lifetime income of wealthy individuals. Second, for wealthy individuals who are not financially constrained, the percentage adjustment of consumption is roughly equal to the percentage adjustment of housing capital. This is consistent with the functional form of log utility, where consumption and housing are proportional to the expected lifetime income. Finally, poor agents make much larger adjustments of housing compared to consumption in the event of good news. This is consistent with the intuition that mortgages allow housing purchasers to respond more rapidly to information shocks. In sum, agents who make the largest adjustments in response to information shocks are financially constrained and therefore adjust

[9] Aiyagari (1994) is one person who makes this assumption.

their residential investment more than their consumption.

In the second step, I discuss the general equilibrium model where interest rates are determined endogenously by the marginal return of business capital and the condition of the financial market clearing. There are two kinds of capital in this economy. Housing capital provides agents with a service flow from housing. The business capital combines with labor to produce the general good. In contrast to Section 2, there is only one form of consumer finance in this economy. The agent can take mortgages on his house, but he cannot borrow through credit cards. I take the parameters for income from Chatterjee, Corbae, Nakajima and Ríos-Rull (2007). The model in Chatterjee et al. (2007) features agents with very high incomes. This provides opportunity and incentives for a high concentration of earnings and wealth. Castaneda, Diaz-Giménez and Rios-Rull (2003) stress that the existence of a high-income group is crucial in generating the current level of inequality in U.S. wealth. The computational method mainly follows Krusell and Smith (1998) and Ríos-Rull (2004). With simulated data, I compute moments of residential investment, consumption, business investment, and GDP. They are consistent with the patterns of the lead-lag relationship and the high volatility of residential investment. I also consider the agent's policy functions over various wealth levels and compare it with the policy functions of the partial equilibrium model. In the partial equilibrium model, wealthy individuals increase consumption and housing modestly; but in the general equilibrium model, wealthy individuals decrease consumption and invest more in business capital. This verifies the other mechanism working in the model. In the event of good news, wealthy individuals tend to consume less and save more while poor individuals tend to borrow more. The savings of wealthy individuals will be used to support the borrowing of the poor, which leads to a reallocation from business investment to residential investment. This helps generate the lead-lag relationship.

2.2 Conclusion

This chapter sets up a dynamic stochastic general equilibrium model to explain residential investment dynamics in the United States. Specifically, it focuses on the two cyclical features of residential investment: lead-lag relationship and high volatility. Being different from the existing literature, this chapter applies two distinctive assumptions of collateral constraint and information shocks into the model of heterogeneous agents with aggregate uncertainty. The partial equilibrium analysis where interest rates are exogenously fixed shows that these two assumptions are crucial to generate that residential investment leads consumption and GDP, which is what we observe in the data. The key mechanism for these results is that in response to good news, agents purchase housing more than other consumption goods because they are bound by collateral constraints. The general equilibrium analysis where interest rates are determined by capital market clearing reveals that the wealthy and the less wealthy agents have different responses to the information shocks. In the event of a good signal, rich agents tend to reduce housing capital and invest more in business capital. However, poor agents tend to borrow more and increase residential investment, which makes rich agents shift from business investment to mortgages. This leads to the reallocation from business investment to residential investment in the event of good signals. Numerical results suggest that this model can better match the cyclical features of U.S. residential investment.

3 What Is the Impact of Limited Contract Enforcement on the Welfare Effects of Social Insurance Programs?

The lack of social insurance systems is widely regarded as an important reason for poverty and inequality in developing countries. Theoretically, social insurance systems can improve risk-sharing within an economy, which may increase social welfare. However, poor countries, that is to say countries with low GDP per capita, tend to have poorly functioning legal systems and expend fewer resources on social insurance. The prevailing view of the literature seems to be that this negligence of poverty reduction and inequality is due to resource shortages and inefficient administration.[10]

However, the literature generally fails to consider the specialty of institutions in developing countries. Especially in the financial markets, these countries are characterized by limited enforcement of financial contracts between lenders and borrowers. Due to incomplete legal systems and inefficient administration, enforcing a financial contract in these economies takes substantial time and effort. Many data, such as World Development Indicators (WDI), has compiled substantial evidence of the serious problems of limited contract enforcement in developing countries. WDI displays an index measuring the extent of contract enforcement across all countries.[11] According to the data of 2007, the protection index for the legal rights of borrowers and lenders in the countries of low and middle income is four while the same index in the countries of high income is six. This

[10] See, for instance, Blanchard and Giavazzi (2006), Feenstra, Hai, Woo and Yao (1998) and references therein.

[11] This index is called "Legal Rights of Borrowers and Lenders Index". It measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. The index ranges from 0 to 10, with higher scores indicating that these laws are better designed to expand access to credit.

means that contract enforcement problem in poor countries is one and a half times more serious than that in rich countries.

If the contract enforcement problem can affect welfare improvements from risk-sharing, improved social insurance is not necessarily welfare-improving. This chapter shows that with entrepreneurship and limited contract enforcement, improved social insurance decreases social welfare. Improved risk-sharing reduces precautionary savings. This will increase the interest rate in a general equilibrium model. Higher interest rates increase the financing costs faced by entrepreneurs. This encourages entrepreneurs to breach financial contracts and this makes a relatively limited contract problem more serious. This reduces TFP because productive entrepreneurs encounter more difficulties in borrowing operating capital. My numerical results reveal that production capital is allocated less efficiently when we impose larger social insurance programs and thus have smaller idiosyncratic risks. This adverse impact on TFP offsets positive welfare improvements from improved social insurance. When the limited contract enforcement problem is sufficiently serious, ex ante welfare decreases rather than increases. In addition, there is an increase in wealth inequality with the reduction of idiosyncratic risks because entrepreneurs have to save in response to tightened constraints on borrowing.

This chapter is closely related to the literature studying limited commitment. A well documented fact is that even in developed countries, entrepreneurs face binding liquidity constraints and, as a result, use a suboptimal amount of capital to start up businesses.[12] Motivated by empirical studies, Cagetti and Nardi (2006) model entrepreneurship and limited contract enforcement to explain U.S. wealth inequality in the sense that entrepreneurs tend to accumulate large amounts of wealth to avoid borrowing constraints. Cooley, Marimon and Quadrini (2004) apply this assumption to show that countries with low con-

[12]Please refer to Evans and Jovanovic (1989) for an example of such empirical evidence.

tract enforcement are characterized by greater macroeconomic volatility because of the dynamism of borrowing constraints. Amaral and Quintin (2006) show that the informal sector employs more low-skilled workers because they are financially constrained and have to substitute low-skilled labor for physical capital. This chapter is also related to the literature of precautionary savings in which ex ante identical agents invest in precautionary savings in order to buffer against uninsured idiosyncratic risks.[13] In this literature, only Krueger and Perri (1999) claim that improved social insurance might reduce welfare because it crowds out private insurance by increasing the reserve value from defaulting on private insurance contracts. However, they do not consider the adverse impacts of improved insurance on TFP, which is explored in this chapter.

This chapter shows that when developing countries design reform processes, it is necessary to take into account the interaction between limited financial contract enforcement and social insurance. This finding suggests that financial market reform should take priority over social insurance reform. Also, the literature worries about the excessively high savings rates in some developing countries, such like as China, and claims that the reason for this trend is the lack of social insurance.[14] This chapter shows that when the contract enforcement problem is sufficiently serious in the economy like China's, choosing a smaller social insurance program might be a better choice than a larger program: a large amount of savings, generated by the precautionary savings, are necessary to compensate for the inefficient financial markets and hence help to raise the aggregate productivity.

[13]This literature includes Huggett (1997), Aiyagari and McGrattan (1998), Krueger and Perri (1999), and Chamberlain and Wilson (2000).

[14]This literature includes Blanchard and Giavazzi (2006) and Feenstra et al. (1998).

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