Debt Overhang and the Hedging Incentives of Housing Demand - Evidence from the US

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Motivation

One simple question - why people buy houses - is perhaps one of the most recurring and intriguing themes on research surface. In the US, nearly two-thirds of the population owns houses (Tracy and Schneider (2001)). On the other hand, however, in Switzerland only one-thirds of the population owns houses. The difference could be due to different institutional arrangements in different countries. For the US, it seems that one major incentive for ownership is tax benefits (Poterba (1992)).

Campbell (2006) terms household finance a complex, challenging, and difficult research field where much needs to done to understand the household financial decision-making. From a household finance perspective, the fact, that two-thirds of the households' liabilities in the US is in mortgages, is pretty striking (Campbell (2006)). In the realm of household finance, this study proposes a topic - housing loan - that affects probably every household.

Broadly speaking, most of the studies on housing decisions can be classified in one of the two frameworks - life cycle, and/or portfolio decisions. Life cycle hypothesis originally comes from Modigliani and Brumberg (1954, 1990). Under this hypothesis, the basic story is young households dissave and buy houses from the old households who live off the savings accumulated through assets such as housing from the past. During the (professionally) peak period, they save enough to compensate the dissavings of the past and accumulate assets for future. Regardless of ownership, the average household in the North America and Western Europe spends approximately 25% to 35% of its income on housing (Englund et al (2002)). However, while a household needs housing services in every period, the labor income is uncertain. So far, there are no insurance or hedging arrangements for labor income risk. While a lot of early research was motivated by life cycle hypothesis, a higher proportion of recent work follows portfolio approach.

Demand for housing has dual components - consumption demand arising from housing services, and investment demand. So the household faces two objectives simultaneously - smoothing the lifetime housing consumption and optimizing investment portfolio. Intuitively, it may also be conceived off as investment in housing as an asset and housing services coming from it as dividends in the spirit of Lucas (1978).

When housing enters as investment demand also, the risk-return trade-off becomes relevant. Price risk is probably the most modeled risk for housing. Several studies including document that a large part of the housing is idiosyncratic risk! Traditionally, a household is assumed to have concave utility function esp in an uncertainty environment. We know, risk aversion and concavity imply each other. So, optimal decision-making entails risk management or hedging for those risks that can not be diversified away. Undiversified portfolio risk can be hedged by options (systematic risk) or insurance (idiosyncratic risk). The risk that can not be hedged or insured has to be borne by the agent.

Henderson and Ioannides (1983) introduced so called investment constraint for housing. The idea is that a household will not consume housing services in a partially owned house. So, for a owner housing consumption can not be greater than its investment weight. Exploiting this constraint in a mean-variance framework, Brueckner (1997) shows that a household holds an inefficient portfolio. More specifically, he shows there is an overinvesting in housing and underconsumption of housing, simultaneously. Using repeat house sales data Goetzmann (1993) also shows that the household portfolio in presence of housing is imbalanced. The result can be summarized as that such a household is over-exposed to housing risk. Case, Shiller, and Weiss (1991) and Shiller, and Weiss (1999) propose cash-settled short term futures to hedge the real estate risk for efficient risk sharing. They also argue that (geography-based) indexed futures are better than individual insurance for houses due to potential issues related to agency and adverse selection. One conceptual issue to be handled very carefully for such hedging instruments is the presence of inefficient market for housing. Englund, Hwang, and Quigley (2002) show large gains from hedging especially to poorer households using options on housing price index in Stockholm. Syz (2007) documents two index based hedging instruments in Switzerland. Options/futures on a national price index in the US have already been introduced by Chicago Mercantile exchange in 2006. Also, the literature focusing on housing futures is growing as we speak. Nevertheless, the present impact of housing futures on consumption and investment decisions is very limited in popularity and also the coverage of these securities, so far, is confined to a few selected locations. One of the main reasons is that a large part of the housing risk is idiosyncratic which remains uncovered by the housing futures.

Price risk & Hedging for Housing Demand

Another strategy is self-hedging documented by Han(2010, 2011) that focuses on self-hedging. In the absence of optimal hedging arrangements, self-hedging may be a good strategy for households. Recently, Han (2010) investigates the role of hedging incentives and price risk on housing demand. Han (2010) distinguishes price rick and hedging risk on housing demand. First, in response to financial incentives, households reduce current housing demand to avoid future financial risk. Second, in response to hedging incentives, households take a bigger housing position to offset potentially large housing costs in the future. For illustration consider an example. There are two houses - A and B - with equal and perfectly correlated prices. Both individuals own houses (any type). There are no transactions or moving costs. In face of any volatility in housing prices, these individuals are hedged. An increase or decrease in perfectly correlated prices for A and B, does not affect their net worth if they decided to move into another type. So their position in one house hedges them for any future rebalancing. The crucial factor for such a hedging effect is the degree of correlation between the prices.

Focus of this study:

However, Han (2011) does not address the role of leverage. This is what this study is all about. Stein (1995) documents a theoretical setting to model down payment/ leverage effects on housing prices. Later, Lamont and Stein (1998) empirically investigate the effect of leverage on the housing prices in selected metropolitan statistical areas (MSAs). Their main result is that in cities with a higher LTV (loan to value ratio), house prices react more sensitively to city-specific shocks, such as changes in per capita income. Leverage could affect the above mentioned risks in different ways:

1. Leverage amplifies the price risk - Given correlation between housing prices, individuals with higher LTV will be exposed to higher price risk vis--vis individuals with lower LTV for the similar properties.

2. The net impact of leverage on hedging incentives depends on the correlation between the housing prices of the currently owned house and the desired house to move in. Let us consider an example. Assume there is only one asset, house - with two types, A and B - worth \$100,000 each with perfectly correlated prices. So, with no leverage and moving costs, there is no price risk. There are two individuals - X and Y. There are similar agents except their leverage positions (for their house). X has a LTV (loan to value ratio) at 75% whereas Y has a LTV at 60%. It requires 20% down payment to move in another house and there are 10% moving or transaction costs (fixed, irrespective of states) if there is a move. Also assume, there are two states - boom and doom. In the boom state, housing prices shoot up by 10% to \$110,000 and in the doom state prices drop by 10% to \$90,000. Let's consider the boom state first. Assume that both agents live in type A houses. If both individuals decide to move in type B houses, it requires approximately \$32,000 taking into account down payment (\$22,000) and moving costs (\$10,000). If Y sells his house, after paying his loan he still has \$44,000 which is more than sufficient to pay the overheads to move into another house. However, X has only \$27,500 after paying his existing loan if he also considers moving in type B house. The moving costs exceed his net worth so he cannot move in type B house. Now, we consider the doom when housing prices drop by 10% to \$90,000. Given a drop, if they contemplate on moving into another house, it requires \$28,000 taking into account down payment (\$18,000) and moving costs (\$10,000). After selling type B houses and paying off the loans, Y has \$36,000 (which is more than sufficient to pay the overheads for moving into another house) whereas X has only \$22,500 which is less than the required amount, \$28,000. So, we can see how leverage could affect X's potential move in both states.

Real Option Framework

Merton (1974) terms equity as a call option written on firm's value as price and debt as the exercise price:

$$Equity_t = (Value_t - Debt_t)^+$$

In the same spirit, one can intuitively argue that net wealth from owning a house is a call option written on value of the underlying asset, house, with loan or leverage as the exercise price. Let us assume there are n households, indexed by i, at any given time, t. So,

$$NW_{it} = (H_{it} - M_{it})^+$$

In the above equation, NW denotes net wealth of household i at time t, H denotes the value of underlying asset, house, for household i at time t, and

M denotes the mortgage of household i at time t on the underlying asset, H. At any time, debt or mortgage is assumed to be less than or equal to the value of the house [1], it can not be negative. So, debt can also be denoted in terms fraction of H, α, where α can take value from 0 to 1. Rewrite the above equation as,

$$NW_{it} = (H_{it} - \alpha_i H_{it})^+.$$

Now, for simplicity, we assume that there are only two types of houses, A & B, with equal and perfectly correlated prices[2] and let's further assume that the downpayment required to purchase the new house is fixed at some fraction, say β[3]. So, the net worth from the new house is:

$$NW_{it} = (H_t - \beta H_t)^+$$

By construction, there is no price risk and the hedging benefit is fully realized when the agent can costlessly move from one type to another type house. In other words, unwind the option on the existing house and create a new option by buying a new house and if the resulting difference between these two options is zero, hedging benefit is fully realized. For completeness, we include transaction costs also and assume they are fixed at some fraction, γ, of the value of the house at the time of the move. In most studies, transaction costs are assumed to be 10% of the value of the house. So, the hedging gains/deficiency:

$$HedgingDeficiency_{it} = (H_t - \beta H_t)^+ - (H_t - \alpha_i H_t)^+ - \gamma H_t$$

Since β and γ are fixed by assumption, we can rewrite the above equation as:

$$HedgingDeficiency_{it} = (\alpha_i - \delta)H_t,$$

where δ is the sum of β and γ. If the leverage and transactions costs are assumed to be zero, α and δ disappear then the hedging deficiency is zero or the hedging benefits are fully realized. However, when leverage and transaction costs are not zero, the hedging deficiency is not zero or hedging benefits are not fully realized. At any given point of time, different households may

[1] If the value of the house falls below the face value of mortgage, it is not rational to exercise the option particularly when the mortgage is embedded with recourse. If without recourse, household can just walk away and the call option has zero as the boundary value.

[2] H^A (value of A) = H^B (value of B) = H.

[3] I argue that it is not an unreasonable assumption; in most cases, it is 20%.

have different level of leverage on their existing houses. In presence of leverage, we can see it is the leverage on the existing house which is generating variation cross-sectionally and not the downpayment or transaction costs as they are fixed constants. In other words, the leverage on the existing house is constraining the hedging benefits of the household, i.

In the perfect Modigliani and Miller (1958) world, leverage does not matter. The argument was made for firms but it is evident in the above case that leverage could impact household decisions as well. Ignoring it might give us less precise results in filtering the impact of price risk and hedging demand of the housing demand. This study is an attempt to extend the underlying hedging demand analysis and investigate the role of leverage on the price risk and hedging incentives/demand of housing demand. Effect of downpayment or constraint qualification for mortgage has already been considered in several studies including (Brueckner (1986) & Zorn (1989)). However, most of those studies investigates the role of collateral requirements on the potential ownership. In this study, ownership is already there since we are considering the existing house owners. The question, how (existing) leverage affects the hedging propensity to move into a different house, is the focal point of this paper. So, two hypotheses are proposed:

Hypothesis 1 (for price risk): Given any degree of correlation between housing prices (hedging effect), individuals with higher LTV (loan to value ratio) will be exposed to higher price risk than individuals with lower LTV.

Hypothesis 2 (for hedging incentives): Given price risk and even with similar correlation in housing prices, individuals with higher LTV (loan to value ratio) will be less hedged than individuals with lower LTV (leverage undermines hedging incentives).

Finally, let's complete the analysis by considering the case of zero correlation also. There are two possibilities - move and no move. If an agent stays put and decides not to move from his current house, there is no risk. However, if he decides to move then he is exposed to 100% price risk and the net impact depends entirely on the relative change in prices.

Empirical Strategy: Data Resources, Analysis and Future Scope

This is an empirical study. The focus of the study is the US repeat sales market for the housing. The data to be employed are available from the public source, Panel Study of Income Dynamics (PSID) hosted by the University of Michigan (http://psidonline.isr.umich.edu/). It is the longest running longitudinal household survey in the world. We will also require the Conventional Mortgage Home Price Index (CMHPI)to construct housing return and risk variables. The CMHPI, provided by Freddie Mac, provides quarterly nominal weighted repeat-sales house price indices on single-family homes. These data are available for 148 metropolitan areas from 1980.

The longitudinal nature of the data will help identifying the effects of house price risk on housing demand. It also allows the possibility of incorporating the households' demographic and economic circumstances. Besides, it is easy to control for time-invariant household-specific unobservables affecting the decisions. It its empirical analysis strategy, this study will follow a very rigorous and potentially a very time-demanding Han(2010, 2011). The principal variables are leverage and several others as defined in Han (2010) for the period 1980 onwards. Though the data are publicly available but the process of careful cleaning and processing before it can be analyzed is a bit cumbersome. This study will take care of issues such as endogeniety using tightest empirical strategies and a very novel technique to estimate hedging propensity.

If the results are encouraging, the analysis could also be extended to measure the impact of leverage on the rent risk as documented by Sinai and Souleles (2005). They present a rent risk versus asset price risk model. To understand the difference between the two risks, consider an example. Let us assume there is an infinitely lived agent with a demand for housing services in each period. He can buy housing services in the spot market by paying rents in each period. However, he faces rent volatility risk. The agent can hedge this risk by owning a house which is also assumed to be infinitely lived and we also assume that the agent lives in the same house forever. Now we can see that we do not have asset price risk at all. Asset price risk enters when we have different life spells for houses and agents or when the agent needs to sell/change the house. The main result they document is that rent risk can dominate the asset price risk, especially for households with long horizons or when housing costs are spatially correlated. However, even if the agent lives intends to live in the same house, the price risk is relevant since a lowered value of the house could affect the net worth of the agent. For instance, Poterba (1992) documents the role of geography to the ownership choice but that risk could equally affect the rent risk as well. I want to extend the analysis to investigate the role of leverage on the rent risk.

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