CHAPTER 3

REVIEW OF RELATED LITERATURE

This chapter is divided into two sections. In the first section, related literature on portfolio choice is presented. The second section presents some empirical studies on housing in Thailand.

3.1 Models of portfolio choice with housing

Henderson and Ioannides (1983) focus on the determinants of tenure choice in the housing market by considering any differences in opportunity cost between renting and owning. They highlight the fact that there is a basic externality connected with the rental of a durable that, given equilibrium prices, makes it more attractive to own than to rent. To isolate this factor, they postulate that the services from a durable are a function of the capacity (or stock) and of the rate of utilization. Where h_c is capacity and u is the rate of utilization, total services are given by $h_c f(u); f' > 0, f'' < 0$. Thus at the same rate of utilization, services double when capacity is doubled, but less than double when the rate of utilization is doubled. The costs of greater rates of utilization include the resource costs of utilization itself such as time costs and the costs of increased maintenance and repairs. These costs are summarized by the strictly convex function $T(u)$ where the total utilization costs are $h_cT(u)$; $T' > 0$, $T'' > 0$.

The externality involved in renting arises from maintenance problems. An owner-occupier directly incurs $h_cT(u)$. But, a landlord can collect from the tenant only part of variations in $h_cT(u)$, over and above the basic contract rent. Since it is impossible to explicitly provide in rental contracts for all possible contingencies, the tenants are assumed to pay less than owners at all rates of utilization. Tenants pay $h_c\tau(u)$; $\tau' > 0$, $\tau'' > 0$, $\tau(u) < T(u)\ \forall u$, $\tau'(u) < T'(u)\ \forall u$. This is a classic externality problem in the rental market, where tenants do not face the social marginal costs of their utilization rates. This is not the case for owner-occupiers and is a critical factor in the determination of the opportunity cost of renting vs. owning and occupying.

Without any other considerations, renting is always inferior to owning. The variable u is chosen on the basis of $\tau(u)$ rather than true costs; however, the tenant must indirectly pay the balance in terms of higher contract rents. They introduce the economic basis for renting by treating housing investment as a risky asset, relative to a safe financial asset. They also impose the investment constraint that requires housing investment by homeowners to be at least as large as housing consumption.

Their conclusion is that renting becomes more attractive if housing is subject to random capital gains or losses and consumers may also invest in a capital market at a fixed rate of return. The advantage which the rental externality confers on owner-occupancy has to be weighted against the characteristics of consumers' risk avoidance behavior.

Flavin and Yamashita (2002) incorporate real estate as an asset in a mean-variance efficiency framework. The focus is on the portfolio problem faced by the typical household. They assume that households hold real estate in the form of a specific house (rather than investing in a diversified fund and renting to satisfy their demand for housing services) due to tax distortions and transactions or agency costs associated with renting, but do not explicitly model the renting versus owning decision. The household can invest in any of n risky financial assets. The household can also borrow up to the value of the house in the form of a mortgage; other than the mortgage, all financial assets must be held in nonnegative amounts. Once the household purchases a particular house, no adjustments to the size can be made without selling the existing house, incurring an adjustment cost proportional to the value of the house, and buying a new house. The transaction cost is zero for financial assets.

The households' problem is to maximize a function of the mean and variance of the return to its asset portfolio (inclusive of housing) by choosing the holding of each financial asset, taken as given the holding of housing asset as a proportion of net worth. The return of each financial asset and housing is the sum of expected return and a stochastic component, specified separately for each asset. At every moment, the household considers whether the disparity between the current-size house and the frictionless optimal-size house is sufficiently large to justify paying the transactions cost and re-optimizing over the house.

Since the ratio of housing to net worth declines over the file cycle, the housing constraint generally induces a life-cycle pattern in the portfolio shares of stocks and bonds. The consumption demand for housing is likely to create a highly levered position in real estate for younger households. This levered position in a risky asset should affect the tolerance for stock market risk relative to older households who have paid off their mortgage.

Brueckner (1997) investigates the portfolio choices of homeowners, taking into account the investment constraint similar to Henderson and Ioannides (1983). His model requires housing investment by homeowners to be at least as large as housing consumption. If housing investment is larger than housing consumption, the excess can earn rental income at some rental rate s. Homeowner's utility depends on current consumption of both housing h_c and a numeraire non-housing good (x), and on consumption in future periods, which depends on the random total return R from the investment portfolio and future income y. Investment portfolio consists of housing investment, riskless asset, and m risky assets. Except for the riskless asset whose return is nonstochastic, the return on housing (capital appreciation) and other risky assets are assumed to be normal random variables. Covariance of returns between each pair of assets is also specified. The future income y and the rental rate s are among the parameters that are tested for their effect on housing investment.

He concludes that when the constraint is binding, the optimal portfolio of the homeowner from his model is inefficient in a mean-variance sense, reflecting overinvestment in housing. The outcome is not an indication that homeowners are irrational or careless in their financial decisions. Instead, portfolio inefficiency can be seen as the result of a rational balancing of the consumption benefits and portfolio distortion associated with housing investment.

Platania and Schlagenhauf (2000) construct an overlapping generation heterogeneous agent model where individuals differ with respect to age, stock and bond holding position, and employment opportunity. In each period, agents make consumption decisions, asset decisions, and a shelter decision over to rent and buy or sell a home. Each individual is assumed to maximize their expected, discounted life-time utility which depends on the consumption of non-housing goods, the service flow that housing goods generate, and leisure. Individuals are assumed to have an endowment of one unit of time each period which is allocated between leisure and work.

The agent in their model will have the choice of purchasing a house or renting a house. They assume that an individual receives more utility from owner-occupied housing than from rental housing by a certain factor. The purchase of a house requires a mortgage in the amount of purchase price less a down payment, which is specified as a fixed percentage of the purchase price. The mortgage has to be taken for a fixed *N* period with a fixed repayment schedule and cannot be prepaid. The house cannot be sold until the mortgage is fully paid off. Selling a house (after all mortgage is fully paid off) incurs a transaction cost at a proportion of the price of the house. Both the supply of rental housing and owner-occupied housing is fixed.

For each age, the proportion of agents with high human capital and low human capital is specified. The productivity or efficiency in the labor market of an agent depends on the age *j* and the human capital *hc*, and is denoted ε_j^{hc}. In each period, individuals face a stochastic employment opportunity. When the agent is employed, he inelastically supplies a fixed amount *h* of labor hours to the aggregate production technology and earns $wh\varepsilon_j^{hc}$ before tax, where *w* represent the wage rate. When the agent is unemployed, he receives fixed amount of unemployment insurance benefits. The production technology is given by a constant return to scale Cobb-Douglas function.

Their model is able to replicate general patterns in wealth allocation; however, it is not very successful in explaining homeownership rates for different age groups.

Peterson (2003) explores whether friction in the housing market along with the interplay between aggregate uncertainty and individual uncertainty can generate large swings in housing demand that can contribute to the observation that residential investment leads output by one to two quarters in the post-World War II United States economy.

In his model, households of all ages face a constant positive probability of not surviving into the next period. They are heterogeneous in earnings with the preferences defined over two goods – consumption goods and housing service. In each period, a household chooses a portfolio of assets, consisting of a position with a bank and housing assets, for the next period. A positive position with the bank implies that the household has deposits at the bank and will receive a saving interest rate in the next period. On the other hand, negative position with the bank implies that the household has a loan from the bank and will have to pay a borrowing interest rate in the next period. The negative position with the bank is limited by the housing collateral.

His model allows households to choose whether to be a renter or a homeowner but restricts the choice of households who choose to be a homeowner to only one size of house. Owner-occupied houses are costly to maintain with a fixed maintenance cost at a fixed fraction of the size of the house in each period. Renters can choose to rent any size of house. The cost to rent a house is the saving interest costs plus some maintenance, which does not necessarily equal the maintenance of owner-occupied houses. Buying or selling a house incurs a transaction cost as a fixed fraction of the size of the house. The rental cost is set to match the ratio of renters to homeowners in the U.S.

There is aggregate uncertainty, $X \in \{X_g, X_b\}$, which determines the interest rate and the process for individual earnings. Labor earnings are given by $ew(X)$. The term $w(X)$ can be interpreted as the market wage that depends on the aggregate state of the economy. The first term e can be interpreted as the level of an individual household's productivity, which is assumed to evolve according to

$$\ln(e_t) = z_t$$
$$z_t = \rho z_{t\text{-}1} + \eta_t$$

where $\eta_t \sim N(0, \sigma^2(X))$. The variance of shocks can depend on the aggregate state of the economy.

There assumes to be an infinite set of banks competing for deposits (at an endogenous saving interest rate) from households and loan out funds to households as a mortgage (at an endogenous borrowing interest rate) or to a non-housing sector at the exogenous rate of $r(X)$. A bank incurs a real fixed cost for every dollar it intermediates between a borrower and a lender. In equilibrium, this cost creates a fixed spread between saving interest rate and borrowing interest rate. Treating the loan to household the same as the loan to non-housing sector results in borrowing interest rate equal to $r(X)$.

Three main scenarios are tested – constant interest rates, countercyclical interest rates, and procyclical interest rates. Results show that the combination of countercyclical earnings variance and a transaction cost can generate leading behavior of housing investment. Counter-cyclical interest rates can also generate similar leading behavior. The most striking result is that the combination of countercyclical earnings variance and a transaction cost can generate leading, procyclical behavior of housing investment even when interest rates are procyclical. He concludes that the presence of uninsurable idiosyncratic earnings shocks can have significant implications for the aggregate behavior of the economy.

Cocco (2004) shows that investment in housing plays a crucial role in explaining the patterns of cross-sectional variation in the composition of wealth and the level of stockholdings observed in portfolio composition data. In each period, an investor who lives for T periods chooses the size of house to own and other nondurable goods consumption. In the first K periods of his life ($K \leq T$), the investor supplies labor inelastically and receives a stochastic labor income stream $\tilde{Y}_t$, given by:

$$\ln(\tilde{Y}_t) = \tilde{y}_{it} = \begin{cases} f(t, Z_{it}) + \tilde{u}_{it}, & \text{for } t \leq K, \\ f(t, Z_{it}), & \text{for } t > K, \end{cases}$$

where $f(t, Z_{it})$ is a deterministic function of age, t, and other individual characteristics, Z_{it}, and $\tilde{u}_{it}$ can be decomposed into an aggregate η_t and idiosyncratic components ω_{it} such that: $\tilde{u}_{it} = \tilde{\eta}_{it} + \tilde{\omega}_{it}$.

Assume further that idiosyncratic labor income risk is transitory so that $\tilde{\omega}_{it}$ is an i.i.d. normally distributed random variable with mean zero and variance σ_{ω}^2. The aggregate shock, $\tilde{\eta}_t$, follows a first-order autoregressive process:

$$\tilde{\eta}_t = \phi\eta_{t-1} + \tilde{\varepsilon}_t,$$

where $\tilde{\varepsilon}_t$ is an i.i.d. normally distributed random variable with mean zero and variance σ_{ε}^2. Thus, prior to retirement, log income is the sum of a deterministic component that can be calibrated to capture the hump-shape of earnings over the life-cycle, and two random components, one transitory and one persistent. Log income in retirement is modeled as a deterministic function of age and other individual characteristics, reflecting the fact that at this stage of life most of the uncertainty related to future labor income has been resolved.

To capture the idea that price of housing in a given region might be affected by labor income shocks in the same region, the cyclical fluctuations in house prices are assumed to be perfectly positively correlated with aggregate labor income shocks and imperfectly correlated with temporary labor income shocks. That is:

$$\eta_t = \kappa_{\eta}\tilde{p}_t',$$
$$\omega_{it} = \kappa_{\omega}\tilde{p}_t' + \zeta_{it},$$

where κ_{η} and κ_{ω} are regression coefficients, and ζ_{it} is a normally distributed variable with zero mean and variance σ_{ζ}^2.

All households in the model are homeowners. A minimum house size to buy is imposed to reflect the indivisibility feature of housing. Besides moving decision endogenously generated by the utility maximization, Cocco (2004) imposes a fixed probability for an involuntary move. Selling a house is associated with a monetary cost equal to a proportion λ of the house value and annual maintenance costs are equal to a proportion δ of the house value.

A mortgage is available to allow the investor to borrow up to a specified proportion of the value of the house at a fixed real interest rate. The investor is allowed in every period to costlessly renegotiate the desired level of debt. Households are also allowed to hold stocks and bonds. The rate of returns on stocks is assumed to be: $\log(\tilde{R}_t) = \mu + \tilde{\iota}_t$, where μ>0 is the expected log return and $\tilde{\iota}_t$, the innovation to log returns, is assumed to be distributed as $N(0, \sigma_\iota^2)$. One-time monetary fixed cost of equity market participation is specified. The rate of return on bonds is fixed.

The model is able to explain the patterns of cross-sectional variation in the composition of wealth observed in the data, and the effects of the housing investment on portfolio composition, but it has several limitations that are acknowledged and discussed. It is not very successful at matching stock shares (conditional on participation) with predicted values much higher than those observed in the data. The costless debt adjustment is thought to play a role in the model's inability to match the stock shares (conditional on stock market participation). If increasing debt levels were costly, smoothing income shocks by increasing debt levels would be suboptimal within a certain region of the state space, and stock market participants may wish to hold bonds in their liquid assets portfolio in order to hedge against income shocks.

3.2 Housing studies in Thailand

Rakwit (1993) studied the housing demand in Bangkok Metropolitan Area (BMA) using multiple linear regression. The time series data used was between 1970 and 1990. The independent variables included household income, housing price index, borrowing interest rate (MLR), change in amount of housing loan, dummy variable reflecting speculative behavior (taking value of 1 for the year 1987 to 1990), and dummy variable reflecting government policy (taking value of 1 for the year with the presence of government policy stimulating housing demand). The results showed that the income elasticity of housing demand was around 1.9 and the price elasticity of demand was around 1.85. The speculative behavior in the period between 1987 and 1990 is concluded to positively affect the housing demand, whereas the interest rates and government policy was found to not significantly affect housing demand. The future housing demand in the period between 1993 to 2000 was also estimated under a different scenario.

Pithaktheeratham (1994) applied similar multiple linear regression to study the determinants of housing demand in BMA using the data between 1977 to 1991. The independent variables included in the study were housing price index, number of population in BMA, total income of population in BMA, average interest rate on housing loan, and amount of housing loan. The coefficients on income and interest rate were not significantly different from zero so the author removed those two independent variables. He also tried adding a dummy variable reflecting whether the government implements or does not implement some plan to stimulate demand for housing. The result suggested that the price elasticity of housing demand in BMA was around 2.7. The different result with respect to the effect of income compared with Rakwit (1993) might be due to the inclusion of the level of housing loan instead of the change in the level of housing loan.

Charoenkij (1994) estimated the elasticity of demand for housing to changes in price, income, interest rate, and the level of housing loan, using the data from 1982 to 1991. Houses under study were classified into three types – single house, townhouse, and twinhouse. Three sets of linear relationships were estimated for each type of house. The first equation related to the unit price of the particular type of house, the interest rate, and the construction loan that the private sector gets from banks to the demand for the particular type of house. The second equation related to the demand for the particular type of house, the average cost of land, the new housing construction permit for the particular type of house, and the construction price index to the price of the particular type of house. The third equation related to the change in average income of household in Bangkok, the interest rate (along with its one-period lag), the change in population in Bangkok, and the price of particular types of house (along with its one-period lag) to the new housing construction permit for the particular type of house. The first part was a short-run analysis. The results showed that price and interest rates do not significantly affect the demand for single houses. The price significantly affects the demand for twinhouses and the interest rate significantly affects the demand for townhouses. The second part was a long-run analysis using the reduced form equations. Since some coefficients have low explanatory power in the short-run analysis, the long-run results may have low explanatory power accordingly. The results showed that the income elasticity of demand for twinhouses and townhouses was around -3 and 41, respectively. The income elasticity of demand for single house was close to 0. The elasticity of demand for twinhouses to change in interest rate was negative as expected. However elasticity of demand for single houses and for townhouses to change in interest rate was positive.

Jantarakolica (1996) applied three econometric methods to estimate the regression models that predict the transaction prices of houses in Bangkok. First, he focused on the demand side of the housing market and defined a measure of "standard qualitative unit" of housing that takes into consideration many features of the house such as the type of the house, lot size, number of floors, number of bedrooms, etc. The income of the buyer as well as other demographic factor like location (urban, sub-urban or rural), price of the land, and traffic situation were also assumed to affect the hedonic housing demand. The housing data collected by the National Housing Authority of Thailand (NHAT) from October 1993 to December 1994 for transaction in Bangkok were used to estimate the parameters of the hedonic housing demand model. The data set included 1,144 observations. The regression results showed that individual's housing demand in Bangkok significantly depends on the type of the house, lot size, number of floors, number of rooms, number of bathrooms, price of the land, the demographic location (being in urban area), and the buyers' household income.

The second method involved estimating the frontier production function for housing supply. The idea was that the production theory considers the production function to be an upper bound of efficient points and not the average of points as often treated in traditional econometric setting. The relationship between the efficient production points and the individual producer's observed points reflected varying degrees of inefficiency. The inefficiency in the study was identified as technical inefficiency and allocative inefficiency. Technical inefficiency refers to the situation when a firm cannot produce the level of output that the best competitor can using the same combination of inputs. Allocative inefficiency refers to inefficiency arising from not using the combination of inputs that matches the marginal rate of technical substitution with the relative cost of each input. So, the perfectly efficient output is the level of output of the most efficient firm that uses the optimal mix of inputs to produce a certain level of output. The transcendental production function is chosen and the profit maximization assumption is applied. The regression results, using the same data set, confirmed that individual's housing supply in Bangkok significantly depends on the type of the house, lot size, number of floors, number of rooms, number of bathrooms, price of the land, and the demographic location (being in urban area).

The highlight of Jantarakolica (1996) lied in the third part, where two switching regression models were estimated – one with general distribution and the other with a truncated distribution. The focus was on the unobserved reservation prices of the buyer and the seller. Specifically, the buyer faced a distribution of a potential seller's price offers that may be truncated at an unobserved seller's reservation price. At the same time, the seller faced a distribution of a potential buyer's price offers that may be truncated at an unobserved buyer's reservation price.

Obviously, if the seller's (lower bound) reservation price was higher than the buyer's (upper bound) reservation price, no transaction would take place and the observed data would not include this information. However, if the seller's reservation price was equal to or less than the buyer's reservation price, the transaction could take place at a transaction price, lying somewhere between the two reservation prices. This transaction price is modeled to be a linear combination of the seller's and buyer's reservation prices, depending on their relative bargaining power. The seller's bargaining power was defined to range between 0 and 1, to equal 0 when the house is sold at the seller's reservation price and to equal 1 when the seller can sell the house at the buyer's reservation price. The reservation prices for both seller and buyer are assumed to depend on the characteristics of the house. The seller's bargaining power, which will be used as the probability associated with the supply curve in the switching model, is also considered to be a function of the characteristics of the house. Assuming normal distribution of potential prices, the seller's and buyer's conditional density functions for transaction price are derived. Then the likelihood function for the truncated distribution switching regression with flexible reservation prices is specified. In effect, this switching regression models combines together the models of hedonic housing demand and frontier production for housing supply.

The advantage of the switching regression model with truncated distribution is that it allows simultaneous estimation of (i) the potential transaction price of the house, (ii) the standard qualitative units of the house, (iii) the qualitative price per unit of the house, (iv) the bargaining power of the seller, (v) the seller's and buyer's reservation prices, and (vi) the technical, allocative, and overall inefficiency ratios of output in the housing market.

The estimated results, using the maximum likelihood method, showed that the actual transaction price was very close to the seller's reservation prices. The low ratios of seller's bargaining power (mostly in the range of 0.2 to 0.5) indicated that home buyer in Bangkok had more bargaining power than home sellers. The author notes, however, that since the non-negotiated transactions were not included in the data set, the estimated bargaining power may be subject to some bias.

The results also indicated that housing production in Bangkok performed only at 29% to 35% of its technically efficient point. In other words, at the technically efficient point, the housing market in Bangkok during 1993-1994 should provide about 65% to 71% more housing output. However, as noted by the author, this does not infer that housing production should be increased to the technically efficient point – it only means home buyers should have been able to find a house that satisfied their needs better. The allocative efficiency ratios were estimated to be less than 0.75, with about 90% of the observations obtaining the ratio in the range between 0.35 and 0.60. This implies that at the allocatively efficient point, the housing market in Bangkok during 1993-1994 should have provided about 40% to 65% more housing output. Again, this only means that the home buyers should have had more choices in their purchasing decisions. The overall efficiency ratios were estimated to be less than 0.26 with about 90% of the observations obtaining the ratio in the range between 0.11 and 0.20.

The revision of government subsidy plan for low-price condominiums and houses is recommended as a way to solve the problem of excess demand for low-price housing in Bangkok. The maximum selling price set by BOI in the subsidy plan for developers of low-price condominiums is too low compared to the estimated sellers' reservation prices in the study.

Siripanyawat (2006) studied debt for housing and housing tenure status of households in Thailand. She focused on life cycle, affordability, and household composition as major factors explaining housing tenure status. Classifying the housing tenure status into three categories – full ownership, partial ownership, and renters, she compiled the data for household in Thailand and found that:

- On a countrywide basis, debt for housing rose rapidly for the 30-34 year age group to peak at the 45-49 year age group. For Bangkok, household debt for housing rose rapidly for the 35-39 year age group. The probable reason for this is the higher relative price of housing in Bangkok and the fact that individuals in Bangkok get married relatively later in life.
- Households with higher income have better access to housing loan, higher repayment ability, and better skill in financial management. Occupation and education are crucial factors determining current and future income.
- Location affects tenure status. Housing in Bangkok is more expensive than the rest of the country and housing in municipal areas is more expensive than non-municipal areas. The ownership rates in Bangkok and municipal areas are low.
- Ownership rate increases with household size. The marital status of the household head also affects the housing choice.

A logit model was used to analyze the factors affecting the choice to own or rent a house. It turned out that the significant factors in favor of the choice to own were a high age of the household head, high household income, being farm operators, living in non-municipal areas outside Bangkok, high level of vehicle ownership, and length of stay in the current house.

Another logit model was used to analyze the factors affecting the probability that a household will incur debt for housing. The sample group for this model was the indebted household only. It turned out that the significant factors in favor of incurring debt for housing were high age of household head, high household income, high rental income (which is a proxy for household asset), education, being professional, technical & administrative workers, marital status, and length of stay in the current house.

In addition, the future trend of debt for housing and housing tenure status of household was analyzed. From the current demographics, the average household age in Thailand will be higher in the next 5-10 years. The group older than 65 years old will become a larger fraction of the population. Moreover, migration towards municipal areas will lead to higher housing prices in the municipal areas. The improvement in education level will shift households towards a higher and steadier income occupation, resulting in higher demand for housing debt.

The demographic trend will result in higher housing ownership rate (for both full and partial ownership) but will not have a significant effect on household debt and housing debt. The occupation shift towards being professional, technical & administrative workers and the migration into the cities will increase the partial ownership group and the renters group.

Government policy and financial environment also affect the housing tenure status. Tax exemptions on interest paid on housing mortgage benefits professional, technical & administrative workers group the most, whereas the development project of housing for low to middle income household benefits other groups more. The interest rate also affects both the new buyers and the indebted household.