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Consumption, Durable Goods, and Transaction Costs

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Abstract: We study consumption of durable and nondurable goods when the durable good is subject to transaction costs. In the model, agents derive utility from a service flow of a durable good and a consumption flow of a nondurable good. The key feature of the model is the existence of a fixed transaction cost in the durable good market. The fixed cost induces an inaction region in the purchase of the durable good. More importantly, the inability to adjust the durable stock induces variation in consumption of the nondurable good over the inaction region. The variation is a function of the degree of complementarity between durable and nondurable goods in the period utility function, the rate of intertemporal substitution, and a precautionary motive induced by incomplete markets. We test the model using the PSID. Housing serves as the durable good. The data indicate an increase in consumption before moving to a smaller house and a decrease in consumption before moving to a larger house. This result is consistent with the model when there exists complementarity between the durable and nondurable good or when there is a strong precautionary effect.

Keywords: housing, consumption, durable goods, transaction costs, PSID

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1 Introduction

We study consumption of durable and nondurable goods when the durable good is subject to transaction costs. In the model, the agent derives utility from a service flow of a durable good and a consumption flow of a nondurable good. Transactions in the nondurable good are frictionless; however, in order to change the level of durable good consumption, the agent must pay a fixed transaction cost. Once the transaction cost has been incurred the agent may freely adjust his stock of the durable good. Agents face uninsured idiosyncratic risk. The durable good in the model is quite general; however, we find it most natural to interpret it as housing. Grossman and Laroque (1990) study a continuous time version of this model in the absence of the nondurable good.

The implications of the fixed transaction cost on the policy function for durable consumption are immediate. The introduction of a fixed transaction cost forces agents to reduce the frequency of transactions in the durable goods market. In the presence of transaction costs, agents employ an optimal stopping rule for purchase of the durable good. The stopping rule is defined by two boundaries, (y_l, y_h), and an optimal return point, y^*. The interval (y_l, y_h) defines the inaction region. In our model, y will be the ratio of financial wealth to durable wealth plus a constant.

Agents make no change to the stock of the durable good until the wealth to durable good ratio, y, hits a boundary of the continuation region. If the agent hits y_l, he will increase his stock of the durable good. If instead he hits y_h, he will decrease his stock. Independent of the boundary hit, upon hitting a boundary, the agent will return the wealth to durable good ratio to y^*.

Our main result focuses on the implications transaction costs in the durable goods market have for non-durable consumption. In the model, the pattern of nondurable consumption changes significantly as the agent approaches the boundary of the inaction region. Changes in consumption result from the degree of complementarity between the two goods, the intertemporal rate of substitution, and a precautionary motive. The precautionary motive is induced by the large changes in wealth at the boundaries of the inaction region. In order to disentangle precaution, we also solve the model for the risk-free case.

In the neighborhood of y^*, agents engage in consumption policies which will tend to keep them near the optimal return point. If the current y is greater than y^*,the agent increases consumption, if y is less than y^* the agent decreases consumption.

Consumption in the neighborhood of the boundaries follows a different pattern than consumption in the neighborhood of y^*. The pattern is parameter dependent. When the two goods are complements, an agent sufficiently close to the boundary alters his consumption such that the probability of hitting a boundary is increased. In this case, the agent prefers to spend time in the vicinity of y^*. When he is sufficiently close to the boundary the fastest way back to $y^*$is to hit the boundary and jump. The resulting effect is for consumption to decrease in the periods before increasing the durable stock and for it to increase before reducing the durable stock. The precautionary motive reinforces this effect.

When the two goods are substitutes, consumption increases toward the upper boundary and decreases toward the lower boundary. The resulting effect on consumption is not as strong in this case because the precautionary motive works as a counter force.

We compare the results of the model to data from the Panel Survey of Income Dynamics (PSID). We compare consumption growth rates of agents with differing proximity to the boundaries of the continuation region. The state variable will be the ratio of nonhousing wealth to housing wealth. We find households with a sufficiently high probability of moving to a larger house (higher dollar value) decrease consumption. Likewise, households sufficiently likely to move to a smaller house (lower dollar value) increase their consumption.

1.1 Literature Review

The response of non-durable consumption changes in house value has been studied by several authors. Skinner (1993) uses aggregate data between 1950 and 1989 to estimate the marginal propensity to consume out of housing wealth. He found a point estimate of .03 percent that was not statistically significant. Skinner (1989) focusing exclusively on non-movers regressed change in house price on change in consumption and found essentially no effect. Bhatia (1987) and Hendershot and Peek (1989) found consumption increased 4 to 5 cents for every dollar increase in equity. Hoynes and McFadden (1994) find that an increase in the growth rate of housing prices of ten percentage points leads on average to an increase in total savings of 2.28 percentage points. However, the change in non-housing saving is statistically insignificant. Engelhardt (1996b) finds home owners which receive an unanticipated real capital loss increase their marginal propensity to save by .03 percent. In the same study, he finds homeowners which receive unanticipated capital gains have no change in marginal propensity to save. None of these studies attempt to measure or condition the probability of moving.

The paper closest to ours and to which we owe an intellectual debt, is that of Grossman and Laroque (1990). Grossman and Laroque solve our model in continuous time in the absence of the nondurable consumption good. Dunn (1998), Eberly (1994), and Beaulieu (1993) also solve models similar to Grossman and Laroque.

2 The Model

Our model is one in which an agent derives utility from a service flow (proportional to the stock) of a durable good and a consumption flow of a nondurable good. Transactions in the nondurable good are frictionless; however, in order to change the level of durable good consumption, the agent must pay a fixed transaction cost[1].

[1] The transaction cost paid will be proportional to the stock. This assumption maintains the homogeneity of the problem while allowing us to study the effects of a fixed cost. While there is no question that moving entails large fixed costs, it is arguable whether making these fixed costs proportional to the stock is realistic. We will justify this assumption by showing that move frequency does not depend on house value.

The agent solves the following problem:

$$
\begin{aligned}
U(Z_0, K_0) &= \max_{\{C_t, Z_t, K_t\}_{t=0}^{\infty}} E\left[\sum_{t=0}^{\infty} \beta^t \frac{(C_t^{\alpha} + QK_t^{\alpha})^{\frac{\rho}{\alpha}}}{\rho}\right] \\
& \quad s.t. \\
C_t + Z_t &\leq (R + \theta_t) Z_{t-1} \text{ if durable good stock not changed} \\
C_t + Z_t + K_t &\leq (R + \theta_t) Z_{t-1} + K_{t-1} - \Gamma \text{ if durable good stock is changed} \qquad (1) \\
K_{t+1} &= \delta K_t \\
Q &= \varphi \gamma^{\alpha} \\
\beta &\in (0, 1)\,,\ \alpha \in (-\infty, 1)\,,\ \rho < 1,\ \varphi,\ \gamma \in (0, \infty),\ \theta\ i.i.d \\
C_t &\geq 0,\ Z_t \geq 0,\ K_t \geq 0\ \forall t
\end{aligned}
$$

This problem is more conveniently solved in a recursive formulation. We choose $\Gamma = \lambda K$ the value function is homogenous Properties of the value function are established in Martin (2002). Since λK is independent of the transaction size[2], this cost structure is a fixed transaction cost formulation. We exploit the homogeneity of the value function and reduce our problem to a single state variable. After this transformation, our new state will be the ratio of financial wealth to the durable good plus a constant. We define the following

[2]Notice λK is a number which is a function of the state not the choice variable, H. The size of the transaction is $\mid H - K \mid$. The relative size of H and K is unconstrained. Hence, the size of the transaction is independent of K and hence independent of λK.

transformed variables:

$$y = \frac{Z+K}{K} - \lambda;\ a = \frac{A}{K};\ h = \frac{H}{K};\ c = \frac{C}{K}; \tag{2}$$

We have the following transformed problem:

$$\begin{aligned}
V(y) &= \max \left\{ \begin{array}{c} \max_{\{c,\ a\}} \left(U(c,1) + \beta\delta^{\rho} \int V(y')\phi(\theta') \right), \\ \max_{\{c,\ a,\ h\}} \left(U(c,h) + \beta(\delta h)^{\rho} \int V(y')\phi(\theta') \right) \end{array} \right\} \\
\textit{top s.t. } c + a &\leq y - 1 + \lambda \qquad (3) \\
\textit{bottom s.t. } c + a + h &\leq y \\
y' &= \frac{\theta}{\delta h} a + 1 - \lambda
\end{aligned}$$

We are now in a position to characterize the agent's problem.

3 Characterization

In order to better understand the solution to the agent's problem, we will first characterize the solution to the problem when $\theta = 0$. This case will help us to understand which aspects of the model are driven by a precautionary motive and which are driven by the complementarity between durable and nondurable goods. We will then turn to numerical solutions of the general problem.

3.1 Characterization: θ constant

In this section, we replace the risky asset with a risk-free asset with constant return, R. The solution to the model consists of a deterministic set of stopping times at which the agent will update their capital stock. Consumption will evolve deterministically over each interval. We wish to characterize the path of nondurable consumption between stopping times and the behavior of consumption and durable goods at each stopping time. This example will demonstrate the importance of the interaction between ρ, δ, and the degree of complementarity between durable and nondurable goods.

For any time interval in which the durable good is not adjusted, we have the following Euler equation:

$$U_c\left(C_t, \delta^t K_0\right) = \beta R U_c\left(C_{t+1}, \delta^{t+1} K_0\right) \tag{4}$$

Where we have substituted for the evolution equation for K. For simplicity of exposition, we will work with the case of $\beta R = 1$. With the durable good, the first condition still holds but the depreciating durable stock implies that for nonseparable utility C_t must also evolve.

First, we study the general case with CES preferences

$$U\left(C, K\right) = \frac{\left(aC^{\alpha} + (1-a)K^{\alpha}\right)^{\frac{\rho}{\alpha}}}{a\rho} \quad a \in (0,1),\ \rho \in (-\infty, 1), \alpha \in (-\infty, 1) \tag{5}$$

In this case, the Euler equation does not offer a closed form solution of C_{t+1} in terms of C_t. However, we can solve numerically for the sequence of C implied by the Euler equation from any starting point, $(C_0,\ K_0)$. Assuming $\beta R = 1$, average consumption of durable and nondurable goods must not be increasing or decreasing over time. This fact implies that $K_0 = K_\tau$ and $C_0 = C_\tau$ for every stopping time τ. C is increasing or decreasing over the interval depending on the sign of α-ρ. If $\alpha > \rho$, consumption is increasing over the interval. If $\alpha < \rho$, consumption is decreasing over the interval. In this case, the curvature of the time path of consumption is determined by the distance between α and ρ. For the case $\alpha < \rho$, the time path of consumption is more convex the more negative α becomes. In other words, increasing the complementarity between durable and nondurable goods increases the curvature of the time path of consumption.

In the Cobb-Douglass case, $U(C,K) = \frac{\left(C^a K^{(1-a)}\right)^\rho}{a\rho}$. The Euler equation implies

$$\begin{aligned} C_t^{a\rho-1}\left(\delta^t K_0\right)^{(1-a)\rho} &= C_{t+1}^{a\rho-1}\left(\delta^{t+1} K_0\right)^{(1-a)\rho} \\ & \quad or \\ C_{t+1} &= \delta^{(a-1)\rho/(a\rho-1)} C_t \end{aligned} \tag{6}$$

Consumption is increasing or decreasing over the interval depending on the sign of ρ. If ρ is positive, consumption is decreasing over the interval. If ρ is negative, consumption is increasing over the interval. We can know write C_t as an explicit function of C_o, $C_t = \delta^{\frac{(a-1)\rho}{a\rho-1}t} C_0$. Substituting this value of C into the Euler equation we verify that marginal utility is constant. Since the Euler equation for nondurable consumption must also hold across the boundary, we can also determine the behavior of C at any stopping time.

Therefore, with a depreciating durable stock, $K > K_T$. The durable stock is always increased at the boundary. If ρ is positive, then $C_0 > C_T$. The opposite is true if ρ is negative.

The separable case is the easiest to solve. We consider $U(C,K) = \frac{C^\rho}{\rho} + v(k)$. Here, the Euler equation evolves as it does in the absence of the durable good. C is constant across the inaction region. Hence, C is constant for all t. The durable good is increased at each stopping time.

3.2 Numerical Characterization

3.3 Durable Good

The policy function for the durable good is characterized by three numbers (y_l, y^*, y_h). y_l is the smallest ratio to which the agent allows the financial wealth to durable good ratio to fall, while y_h is the highest. Hence, the interesting question is how the interval changes for changes in parameter values and how large of an interval do we expect to observe.

The primary variable which controls the width of the inaction region is the size of the transaction costs. Our choices of λ are governed by empirical findings from the CEX. The average costs an agent pays to change housing is just over 7% of their house value. We vary transaction costs around this number.

Table 1 gives values of (y_l, y^*, y_h) for several different parameter specifications. As expected, the width of the continuation region is strictly increasing in the size of the adjustment cost. The interval is increasing in the return to the risky asset, in the sense $\frac{\partial y_l}{\partial R} \geq 0$, and $\frac{\partial y_h}{\partial R} \geq 0$. The interval is also decreasing in the depreciation rate of the durable good in the same sense as before.

Even for relatively small transaction costs, the range of inaction is quite large. Agents allow the ratio of financial wealth to durable wealth move from as low as .4 to a high of 1.9. In other words, the agents allow the value of their financial asset to fall to half the value of their house before downsizing their house. Similarly, the agents allow their financial wealth to be almost double their house value before increasing home size ($\alpha = -8$).

In the data, agents maintain a relatively high proportion of their wealth in housing. In fact, the mode of the empirical distribution of wealth to house value is close to zero. To match this fact, we vary the spread in mean return to equities and mean return to housing around 8%. This spread is also substantively in line with the figures found by Flavin and Yamashita 1998.

3.4 Nondurable Good

Recall that given our model specification consumption is the ratio of nondurable to durable consumption. Figures 1 and 2 show the nondurable consumption policy function for different parameter values. We see, in general, increases in y lead to increases in consumption and decrease in y lead to decreases in consumption Only as the agent approaches the boundary does this effect change. We can see that sharp changes in consumption occur only over a relatively small region. The region over which agents change their consumption behavior is very important for empirical testing of the model. We only expect to see changes in consumption for a relatively short period of time before the household updates their durable stock. The shape of the optimal policy function changes with changes to the complementarity between durable and nondurable goods and with changes in variance. In general, increases in the complementarity between the two goods increases the change in consumption as we approach the boundary. This change occurs for the same reasons as in the complete market case above. For a fixed level of the durable good, increases in nondurable consumption provide smaller and smaller increments to the agents utility. Table 1a gives the percent change in consumption at the upper boundary for differing values of α. When the two goods are on the boundary between being substitutes and compliments ($\alpha = \rho$), consumption of the nondurable good flattens but does not become negative. For the choice of return structure and $\rho - 1$, the slope of the consumption function is zero. When we increase the complementarity to -2, the percent change in consumption between the highest nondurable consumption and the boundary is .9. For values of -8, the change is 4.5%. Finally, for the relatively high level of complementarity $\alpha = -20$, the change is a large 12%.

The second factor affecting the shape of the consumption function is the degree of market incompleteness. While the case of complete markets has been studied at length above, we also show that as the variance of the model is reduced the percent change in consumption reduces as well. For the borderline case of ($\alpha = \rho$), the consumption function is eventually smooth at the boundary. In other words, for small enough variance the shape of the consumption function does not change as we approach the boundary. With $\alpha = -20$, the change in consumption is reduced form 12% to only about 4% when the variance is reduced by 50%. With the variance reduced by 90%, the change in consumption is less the 1%.

Therefore, the changes in consumption produced by this model are strongest when the durable and nondurable goods are strongly complimentary and when markets are not complete. When we test these consumption changes in the data, we will be looking for changes in consumption near the boundary.

3.5 Distribution

We examine the model for the case in which each agent receives independent shocks to wealth and housing. In our model, we do not allow an interaction between the price of housing and the aggregate statistics of the economy. In effect, we have fixed the relative price of nondurable and durable goods. Under this assumption, computation of the invariant distribution is quite simple. Starting from any initial distribution of agents, we apply the policy function for nondurable and durable consumption to the distribution. This gives us a mapping between the distribution in period n and the distribution in period $n + 1$. We continue to apply this mapping until the distribution has approximately converged. In practice, we do this for each type of agent and then aggregate to get the final distribution whenever we want to model heterogenous agents. We now give the results of this exercise.

The aggregate distribution in this case consists of 5 types of agents. 60% of agents face transaction costs of 10%, 20% face 5% costs, and 20% face 1% costs. The mean return for all agents is 4%. The agents face an equal probability of realizing the following returns [-.01, .02, .04, .06, .09]. The durable good appreciates 5% per year. Agents are homogenous in all other aspects.

We plot the resulting distribution in Figure 3. The hump of the distribution occurs at a wealth to durable ratio of .6. The average return of the asset is such that over time most agents increase their stock of the durable good. The distribution reduces mass away from the optimal return point relatively slowly at first then drops away fairly quickly. Close to the boundary the mass of agents drops away very fast. We can see from this distribution that the agents close to the boundary will have very little affect on aggregate statistics because their relative mass is quite low.

The general shape of the simulated distribution closely replicates the empirical distribution. In all cases, the distributions are right skewed with the hump occurring for very low levels of the ratio of wealth to house value. As seen in Table 2, agents employ optimal return points biased toward the lower boundary whenever consumption is increasing on average over time. For most agents in our model, increasing consumption profiles are the case. In the data, most agents increase consumption and wealth over the life-cycle.

An important feature of the empirical distribution is the existence of agents with negative values of y. In our model, the absence of labor income implies y must be bounded below by zero. If we reinterpret our wealth as incorporating the present value of income, then the appropriate comparison to the data is to add to current wealth a measure of the present value of labor income. This addition will shift the empirical distribution away from zero.

We are not able to replicate the tails of the distribution. Even with transaction costs of forty percent we only get maximal state values of around 4. Only by increasing the mean return on non-housing wealth (or equivalently decreasing the return to housing) can we shift agents far enough to begin to match the tails. However, these agents tend to increase their optimal return point as well, significantly reducing the hump of the distribution. Also as seen in Table 2, to get an upper boundary above 6, the returns on non-housing financial wealth must be very high.

4 Data

We use the from the University of Michigan's Panel Study of Income Dynamics (PSID) for the years 1983-1985. The PSID began in 1968 with 4,802 households and over 18,000 individuals and by 1994 it had nearly 8,500 families and over 50,000 individuals. Of the initial 4,802 households, 2,930 were selected from the Survey Research Center's random sample of the U.S. population, while the remaining 1,872 families were drawn from the Survey of Economics Opportunity's (SEO) sample of the low-income population. Starting in

1968, the PSID has re-interviewed individuals from those households every year - adults have been followed as they have grown older, and children have been observed as they advance through childhood and into adulthood. The main focus of the PSID's data collection effort is on economic and demographic characteristic, especially with respect to earned an unearned income, employment, family composition and geographic location.

While the study does not, in general, attempt to collect data on the consumption patterns of households, it does gather two components of consumption which are critical for this study. The first component is food consumption. Each year each respondent is asked to estimate their total expenditures on both food consumed at home and food consumed out of the home. While food consumption is certainly not a perfect substitute for total consumption it has been shown to be highly correlated with total consumption by Skinner (1989). The second component of consumption which is collected by the PSID is housing. The survey collects detailed information on rents, mortgages, and owner estimated house value. This information will allow us to compare the growth rate in consumption for agents in the proximity of the boundary and agents far from the boundary. It also allows us to differentiate between agents which move to a larger house and agents which move to a smaller house.

For the purpose of this study, a key feature of the PSID is the wealth supplements collected in 1984, 1989, 1994, and 1999. Funded by grants through the National Institute on Aging (NIA), the wealth supplements contain comprehensive data on net worth, defined as liquid assets (checking accounts, savings account, CSs, IRAs, bond and stock values), the value of business equity, real estate and vehicle equity, less any outstanding debts. The PSID wealth data compares favorable with other, more targeted, wealth survey such as the Survey on Consumer Finances (Curtin et. al. 1989; Juster et. al., 1999).

Most of the analysis presented in this study will surround the 1984 wealth supplement. We choose to focus on this year since the 1987 and 1988 PSID did not collect food consumption. For the 1994 wealth supplement, release 2 data is not yet available. For 1999, the survey data is not yet available. We will use the wealth supplements in 1989, 1994, and 1999 only to give descriptive characteristics of the empirical distribution of wealth to housing ratios.

In the data, our measure of wealth includes all financial assets of the household. These include traditional savings and stocks as well as small business capital, car value, and other owned real estate. The measure also includes liabilities outstanding to the household. Outstanding liabilities are subtracted from the total assets to give the agents net wealth position. Approximately five percent of agents in the data set hold negative net wealth positions.

Our measure of house value is given by the home owners estimate of home value. Home value is problematic in that on average there is a large amount of measurement error in the figure quoted. Goodman and Ittner (1992) estimate this error to average 6% in the PSID. We maintain the assumption that while most home owners only have a general idea of the value of their home, owners which are near the boundary or who have recently updated have very precise knowledge of the value of their home.

4.1 Housing as the Durable Good

The relative size and special characteristic of housing make it a natural choice as the durable good for the purposes of testing the model. Treated as a consumption good, the home is the single largest expenditure made by consumers over their lifetime. The price of a home is generally measured in multiples of a family's annual income. The median household has a house value which is almost two times their annual income; while, the flow cost of housing is greater than seventeen percent of annual income for the median household. In comparison, median car value is less than twenty percent of annual income for the average household. Treated as an asset, the home dominates the portfolios of most households. Seventy-Five percent of the median households portfolio is allocated to housing. We arrive at this figure by treating the mortgage as a short position in the bond market and the house as a long position in real estate. Since the correlation between the two assets is far less than one, these two assets do not imply a zero net position. This figure drops to thirty five percent if we only consider equity. Fewer than five percent of households have a portfolio with less than a twenty percent share allocated to their home; almost ten percent of households hold no assets which are unrelated to housing. For details of these statistics see Table 1. For simplicity of exposition, the statistics in this paper apply primary to home owners. Clearly, non-homeowners do not hold a significant portion of their assets in housing. However, saving toward home ownership is one the most common reason given for asset accumulation in young households (Engelhardt 1996b, Tachibanaki 1994). In some sense, these assets can also be attributed to housing.

The housing market is also characterized by features which prevent it from being easily aggregated into a composite consumption good. First, agency problems (both on the renter and landlord side), search costs, and tax advantages to home ownership, make rental housing an imperfect substitute for owned housing. In other words, for the same service flow, the flow cost of owned housing is lower than that of rental housing. The second feature distinguishing housing from other goods is its durability. While virtually all consumption goods have some component of durability, housing is the most durable good which is regularly consumed by households. Finally and most importantly, the housing market is characterized by large transaction costs. Monetary costs of buying a new home range on average between 7 and 11 percent of the purchase price of a home (CEX 1993). The bulk of these costs are for agent fees but transfer taxes, appraisal and inspection fees etc. are also significant costs. In addition, before the new housing flow can be consumed, the household must physically move. While the true costs of moving are difficult to measure, they are certainly not negligible and involve significant expenditures of time, effort, and money.

5 Empirical Model and Results

The theoretical model presented above will proved us with a specific framework in which to perform empirical analysis of the behavior of the consumption of durable and nondurable goods. We wish to compare the behavior of the consumption of nondurable consumption of agents which are located at different point in the state space. Specifically, we wish to look for changes in the behavior of consumption as agents approach the lower and upper boundaries of the inaction region. The simplest test of the model is then to observe the changes in consumption as the agent approaches the boundary. Ideally, we would simply follow agents across time and observe the changes in the consumption growth rate as a function of their wealth and house value over the entire inaction region. Unfortunately, this approach is not feasible in the PSID since wealth is only observed at five year intervals and food consumption is not observed in every year in which we have wealth data. Therefore, in order to conduct this analysis, we must first identify the boundaries of the inaction region.

The empirical study will take two stages. First, we will attempt to identify the location of agents within the inaction region. Since we do not have direct information on the agents location, we will have to infer their location. Second, with the agents location in hand, we will use the information from the first step to compare consumption growth rates of agents which are in the vicinity of the boundary and agents which are far from the boundary.

5.1 Identification of the Inaction Region

The difficulty in identifying the inaction region is that for household not engaging in a transaction neither the optimal return point nor the band are observable. Our model informs us that the band width is a function of the degree of complementarity between durable and non durable goods (i.e. the opportunity cost of deviating from the optimal level of durable consumption is a function of the degree of complementarity), the transaction costs, and the structure of returns to wealth and the durable good. Since we do not have a nice first order condition determining the boundaries of the inaction region that can be exploited for empirical analysis, and since the main parameter, the size of the transaction cost is unobservable in the PSID, we will rely on a more fundamental property of the model.

Recall in the model, an agent only updates his stock of the durable good when his ration of financial wealth to durable good stock moves sufficiently far form the optimal ratio. When the ratio is sufficiently low, the agent will decrease his stock of the durable good. When the ratio is sufficiently high, the agent increases his stock. Independent of the parameterization, the model predicts that agents with high values of the sate variable are more likely to be near the upper boundary; agents with low state values are more likely to be near the lower boundary. We will identify the hazard function of agents moving as a function of the ratio of wealth to durable good.

To reiterate, we want to identify the probability of an agent hitting a boundary in the next period conditional on their current value other ratio of wealth to house value. We want to know the probability of moving tomorrow for an agent who has already made an allocation decision today. In other words, we wish to find the probability that $y' > y_h$ or $y' < y_l$. Essentially, this is a statement on the size of the inaction region and the return structure of the model. In order to find the appropriate statistical model, we will first derive these probabilities from the theoretically model.

First, start with the evolution of the state variable when the durable good is not updated. Takin logs, we have

$$
\begin{aligned}
\ln y' &= \ln\left(\frac{Z}{K} + \frac{\delta}{\theta}(1-\lambda)\right) + \ln\frac{\theta}{\delta} \\
&\simeq \ln\left(\frac{Z}{K} + 1 - \lambda\right) + \ln\frac{\theta}{\delta} + \frac{1}{\frac{Z}{K} + 1 - \lambda}\left(\frac{\delta}{\theta} - 1\right) \\
&\simeq \ln\left(\frac{Z}{K} + 1 - \lambda\right) + \ln\frac{\theta}{\delta} = \ln y + \ln\frac{\theta}{\delta}
\end{aligned} \tag{7}
$$

The first approximation comes from taking a first order Taylor series approximation around $\frac{\delta}{\theta} = 1$ and the second approximation comes from treating the last term as negligible. Define the variable M. $M \in \{0,\ 1,\ 2\}$ 0 indicates the agent decreases his durable stock; 1 indicates the agent does not move; 2 indicates the agent increases his durable stock. We get the following relationship between the above model and M

$$
\begin{aligned}
M &= 0\ if\ \ln\left(\frac{Z}{K} + 1 - \lambda\right) + \ln\frac{\theta}{\delta} \leq y_l \\
M &= 1\ if\ y_l \leq \ln\left(\frac{Z}{K} + 1 - \lambda\right) + \ln\frac{\theta}{\delta} \leq y_h \\
M &= 2\ if\ y_h \leq \ln\left(\frac{Z}{K} + 1 - \lambda\right) + \ln\frac{\theta}{\delta}
\end{aligned} \tag{8}
$$

Hence, effectively we have a latent variable model with $\ln\frac{\theta}{\delta}$ serving as the stochastic term.

The hazard function for M is given by the following probability structure.

$$\begin{aligned}\Pr(M=0) &= \Pr\left(y_l - \ln\left(\frac{Z}{K}+1-\lambda\right) \geq \ln\frac{\theta}{\delta}\right) \\ \Pr(M=2) &= \Pr\left(y_h - \ln\left(\frac{Z}{K}+1-\lambda\right) \leq \ln\frac{\theta}{\delta}\right)\end{aligned} \tag{9}$$

If we estimate the model using a log normal distribution for $\frac{\theta}{\delta}$, the above probabilities are given by the normal distribution. An agent will move to the boundary for a sufficiently large realization of $\frac{\theta}{\delta}$. The size of the shock needed to move an agent to the boundary is directly dependent on $|\frac{Z}{K} - y_i|$ for $i = l, h$. Hence, the nearer the agent is to the boundary the higher the probability of hitting.

5.2 Ordered Probit

Using a log normal distribution for $\frac{\theta}{\delta}$and assuming the returns are i.i.d. across individuals and over time leads immediately to the use of an ordered probit for estimating the probabilities in the above model. One great difficulty we face in moving from the theoretical model to an empirical model is the presence of additional states in the data. For the purposes of this paper the primary missing component is human capital. A more difficult problem is how to control form shifts in preferences brought about by changes in family size.

In order to use the ordered probit, all explanatory variables must have affect the probability of moving to a larger house and moving to a smaller house in opposite directions.

Increases in the number of children increase the probability of moving in both directions. We have a similar problem with time reaming in the work force in our definition of human capital. Increases in age decreases unconditionally the probability of moving. We will attempt to control for these ideas when we perform a sensitivity check with a multinomial logit. In order to maintain the use of the ordered probit, we assume that all wealth enters linearly into a summary variable for total wealth. We think of human capital in the context of this model as the present value of the agent's lifetime labor income. The absence of the ability to borrow against human capital will lead to the main difference between the theoretical model and the empirical results. In the data, many agents hold negative values of financial wealth. These agents are borrowing against a positive present value of lifetime nonfinancial wealth. If we had a good measure of the expected value of total lifetime wealth, we would not expect to see negative wealth values. In the model, the agent's current wealth summarizes accurately the agent's lifetime expected wealth.

The empirical model is built around a latent regression: $y^* = \beta' x + \varepsilon$. x is a vector containing log wealth, log house value, human capital. We will assume human capital is a linear function of years reaming in work force, education, race, and current income. These variables will all enter in levels to correspond with the theoretical model. ε represents unobservable heterogeneity in the population, error in the measurement of x, and the current shock to total wealth for the household this period. We follow the financial literature to assume innovations to financial wealth are log normally distributed and we follow Vissing-

Jorgensen (2002) to make the same assumptions on nonfinancial wealth. ε is unobserved by the econometrician.

The timing is as follows: We observe the vector x at the beginning of the period. We use the panel aspect of the PSID to check if the agent moved during the following year. We view uncertainty as being resolved at the beginning of the period but after the vector x is recorded. What we do observe is z.

$$\begin{aligned} z &= 0\, if\ y^* \leq \mu_1 \\ z &= 1\, if\ \mu_1 \leq y^* \leq \mu_2 \\ z &= 2\, if\ \mu_3 \leq y^* \end{aligned} \tag{10}$$

An agent moves to a smaller house if $z = 0$, does not move if $z = 1$, moves to a larger house if $z = 2$. To obtain identification, we will normalize μ_1 is the estimation. Notice that this reduced form equation fixes the boundary for all agents. For our work, this restriction is less important as we only wish to derive the imputed probability of moving. However, if the primary interest is in the boundary itself a more sophisticated estimation approach is called for (see Attanasio (2000)). Our assumptions on ε imply the probabilities will be given by the normal distribution.

$$\begin{aligned}
\Pr(z &= 0) = \Phi(\mu_1 - \beta' X) = 1 - \Phi(\beta' X - \mu_1) \\
\Pr(z &= 1) = \Phi(\mu_2 - \beta' X) - \Phi(\mu_1 - \beta' X) \qquad (11) \\
\Pr(z &= 2) = 1 - \Phi(\mu_2 - \beta' X)
\end{aligned}$$

The model implies that two agents with the same house and wealth value will move or not move depending on the size of the shock to wealth. Referring to the theoretical model, an agent will change stock of the durable good depending on whether the current innovation to wealth is sufficient to move him to a boundary of the inaction region. The size of the shock needed to move an agent to the boundary is then a function of the ratio of financial wealth to housing wealth.

The theoretical model predicts the sign on wealth to be positive, the sign on house value to be negative and for them to be of roughly the same order of magnitude. In other words, increases in wealth or decreases in house value require smaller shocks to wealth to move the agent towards a boundary. Therefore, the higher the value of $\beta' X$ the more likely an agent is to be in the neighborhood of the boundary. The theoretical model refers to total wealth; hence, we also expect increases in human capital to have the same signs as increases in financial wealth. Years remaining in work force and education have the predicted sign. Total income and race are not statistically significant. We also include the results of the probit using only the log ratio of wealth to house value. This model is the most directly comparable to the results in the simulated economy. Obviously, in the simulated economy we are not able to separate house value and wealth.

Table 3 gives the results of the ordered probit. Ordered Probit 1 gives the results of the ordered probit when we include human capital. All the coefficients are significant at traditional levels with the exception of age and age squared. We can see the signs on the coefficients are as predicted by the model. Higher wealth conditional on house value increases the probability of moving to a larger house. Similarly, higher house value conditional on wealth decreases the probability. Larger increases in two year income also lead to higher probability of moving to a larger house. Households whose head has more than a high school education are more likely to move to a larger house. They are also more likely to move than households with high school education or less. Notice, wealth and house value enter with approximately the same order of magnitude. Ordered Probit 2 gives the results of an ordered probit using only wealth and house value to predict movers (i.e. no human capital proxy). As in the first probit, the coefficients are strongly statistically significant and the signs are consistent with theory. Ordered Probit 3 gives the results for the ordered probit using the log ratio of wealth to house value. The result is not equivalent to Ordered Probit 2 because it adds the restriction that the coefficient on wealth and house value be the same. However, the coefficient is significant and matches that prediction of theory. We run this probit as it is the most direct comparison with the Ordered Probit we will conduct on the simulated data.

We next want to examine changes in consumption growth rates as a function of the predicted probabilities. Table 4a gives summary statistics of the predicted probabilities from Ordered Probit 1. As is to be expected, the predicted probability of moving is quite small for most households. The predicted probability of moving to a smaller house for each quartile is much smaller that of moving to a larger house. This effect reflects the higher unconditional probability of moving to a larger house. A household is almost twice as likely to move to a larger house as it is to move to a smaller house. We find this result to be true independent of age and is true for 1982 to 1990 in the PSID. In other words, this effect is unlikely to be entirely due to life-cycle effects. Another possible explantation is asymmetric tax treatment of capital gains and losses in housing. In the United States before 1995, households under the age of 55 paid capital gains taxes on all housing capital gains not rolled over to the new property at the time of purchase. Households over the age of 55 could sell one home without incurring the capital gains tax. Hence, downgrading housing stock entailed relatively higher transaction costs for young households. The asymmetric transaction cost theory does not full explain the pattern, since conditioning on $age > 55$ does not affect the result. We do not have an explantation of this point. This fact must have implications for the rate of growth of the housing stock. It would be interesting to see if estimated growth rates of the housing stock match the implied figures from PSID data.

5.3 Multinomial Logit

The primary difference between the multinomial Logit and the ordered probit is in the assumption over the ordering of the dependent variable. The ordered probit forces the sign on all explanatory variables to have opposite signs for moving to a larger house and moving to a smaller house. This characteristic increases the probability of observing the correct signs on house value and wealth. It also prevents us from exploring the usefulness of other variables such as changes in family size and age which affect the overall probability of moving. The multinomial logit makes no such ordering assumptions. For instance, the coefficient on age in the ordered probit regressions is invariably insignificant. The reason for the insignificance is that increases in age decrease the probability of moving. Hence, the sign of the coefficient should be negative for both moving to a larger house and to a smaller house. Most importantly for our purposes, the logit regression allows the sign on wealth and house value to be arbitrary. Therefore, as an additional test of the characteristics of the inaction region we repeat the above exercise using a multinomial logit. We could follow Attanasio (2000) and run separate probit regressions for the probability of increasing and the probability of decreasing. However, we feel the advantage of joint estimation outweigh the change in the distributional assumptions made in the shift from probit to logit.

Table 7 gives the results of the multinomial logit regression as well as the results from an ordered probit with exactly the same variables for comparison purposes. First and foremost, we see the signs on the variables for wealth and house value match the predictions of the model and of the ordered probit. Increases in wealth increase the probability of moving to a larger house; while decreases in wealth, increase the probability of moving to a smaller house. The opposite holds true for house value. However, the effect is not entirely symmetric. Increases in income and decreases in house value have a stronger effect on moving to a larger house than do the opposite movement in income and house value have for decreasing house size. This effect is anticipated in the fact that unconditionally household are more likely to increase than decrease house size.

5.4 Consumption

We now wish to turn to the study of the nondurable consumption of agents as they approach the boundary of the inaction region. We wish to compare the consumption growth rates across agents as a function of the agents proximity to the boundary We will use this approach using the agents imputed probabilities form the first stage ordered probit described above. In this approach, agents with high imputed probabilities of moving will be viewed as being in the neighborhood of the boundary We will use the following regression model:

$$y = x_2\beta + \Pr(z = i)\delta_1 + \Pr(z = i)^2\delta_2 + u \text{ for } i = 1,\ 3 \tag{12}$$

x_2 will be a vector of household characteristics which explain chance sin consumption (e.g. changes in income, family size, age etc.). The probabilities will be the imputed probabilities from the first stage probit regression. We assume u to be normally distributed, i.i.d., and $u \perp \varepsilon$. The least squares estimates of β and δ are consistent. However, the standard errors must be corrected for the fact that the imputed probabilities are measured with sampling error (Pagan 1984, Hansen 1982). The correction term in the two step procedure is a positive definite matrix under the assumption of independence between u and ε. Hence, the naive standard errors given by least squares are always smaller than the true standard errors. The standard errors given in the table have been corrected.

The results of the regressions are given in Tables 5 and 6. Table 5 gives the results of consumption growth regressed on the predicted probability of increasing house size. We conduct these regression for the full sample, the high wealth sample, the high equity sample, and the high wealth and equity sample. The first column we control for other factors potentially affecting consumption growth rates. The last column contains the results from the simulated economy - we discuss this regression below. Table 6 has the same lay out and is for consumption growth regressed on the predicted probability of decreasing house size..

We can see that the full sample regression is consistent with the presence of complentarity between durable and nondurable goods and the presence of a precautionary motive. The coefficients for the probability of increasing (decreasing) and the probability squared are of the correct signs and are significant. Consumption growth is increasing in the probability of moving to a larger house over a certain range; however, once the probability of moving is high enough the consumption growth rate starts to fall. Consumption growth is decreasing in the probability of moving to a smaller house over some range and then increasing as the probability gets high enough. Keep in mind the high correlation between the probability of moving and wealth in interpreting these results. What is most remarkable in these results is the magnitude of the quadratic term. Consumption growth changes a lot as household approach the boundaries of the continuation region. The changes in consumption before purchasing a smaller house are particular dramatic. The changes in consumption in the data are larger (for reasonable values of α) than the changes predicted by our model. These results hold true even when controlling for changes in income, house value and family size.

While these results are in support of our model, they do not distinguish well between our model and models of traditional liquidity constraints. Therefore, in an effort to make this distinction we repeat the test on a several subsets of the population. In picking these subsets we want to choose groups which are least likely to be liquidity constrained. Following Zeldes (1989) and Hurst and Stafford (2001), We assume agents with high levels of financial assets and agents with high amount of equity in their current house are the least likely to be liquidity constrained Therefore, we rerun the same regressions on the following subsets: 1) agents holding financial assets above the median level 2) agents with equity above median equity 3) agents with both equity and financial wealth above the median.

For the high wealth subset, the results are very much the same as in the full sample. We see a slight reduction in significance but all coefficients are still significant at traditional levels. The only exception to this is the quadratic term for household reducing their house size when house value and wealth levels are not controlled for. This result is slightly in favor of liquidity constraints not explaining the movement in consumption. However, recall from our model, that we are predicting the economy to be fairly homogenous in wealth. Therefore, a household with very high wealth and a large house value can still be liquidity constrained in our model.

The need to be specific becomes clear as we examine the result from the high equity sample. The regressions for households which are likely to decrease house size stay approximately the same. However, the quadratic term for increasing house size becomes very statistically insignificant. We interpret this to be in support of liquidity constraints.

The final set of regressions subsets the data for households with both high equity and high wealth. In this sample, we lose the significance of both quadratic terms.

Finally, we wish to run the same exercise using the predicted boundaries from the multinomial logit regression. The results are presented in Table 8. The results form the logit are not as strong as the results from the probit. In the multivariate regression, the signs of the coefficients on the probability are correct and significant. However, the signs on the regressions including only the probability the coefficients are of the right sign but are not significant.

5.5 Simulated Data

We repeat the same exercises on the simulated economy represented by the simulated distribution computed above. The final column of Table 3 gives the results of the ordered probit on the log ratio of wealth to house value. The important result here is that the sign of the coefficient matches between the simulated data and the data from the PSID. However, the coefficient on the simulated data is approximately ten times the size of the coefficient in the empirical data. The main reason for this large difference is in the support of the distribution between the simulated and empirical data. As we described above in the construction of the simulated data, reasonable levels of transaction costs can not replicate the size of the observed inaction region. The support of the simulated data is about $1/6^{th}$ the size of the support of the empirical data. One thought for the under estimate for the size of the inaction region is that the transaction costs which we use greatly underestimate the true transaction costs involved with moving. We use data on financial cost of relocation from the CEX arriving at an empirical figure of 7-11% of the value of the agent's house. The true total cost of moving must also include the cost of the time and disruption caused by move. However, in our simulations, only by including transaction costs on the order of 50-60% could we come close to matching the empirical support. When we run an ordered probit on data generated by a 60% transaction cost, we achieve a coefficient of .285 which we consider to be reasonably close to that found in the empirical data. Clearly, this level of transaction cost is unlikely to be supported by including these other costs.

An alternative specification is that some agents are prohibited from moving for reasons outside of our model. We naively simulate such a model by recoding a portion of the simulated data. A subset of agents who have chosen to move are prohibited from doing so. Applying this recoding to 20% of the population reduces the magnitude of the probit coefficient by a factor of 2.

The approximate magnitude of the imputed probabilities of increase, no move, and decrease are the same between the simulated distribution and the data. However, in the simulated economy, the overall probability of moving is lower than in the data. In other words, agents in the model have policy functions which are much better at keeping the agents in the center of the inaction region. We could increase the percent of agents moving by increasing the volatility of returns. In particular, adding a jump process to the evolution of assets would increase this probability considerably. We view the jump process as modeling unexpected large changes in the preset value of human capital (i.e. the jumps would measure aspects of labor income such as layoffs and promotions). Dunn (1998) tests whether shift in the probability of unemployment affect the timing of purchases of housing. She finds increases in the probability of unemployment decrease the probability of buying a house. She does not condition on whether the household is likely to increase or decrease their stock of housing.

The last column of Tables 5 and 6 give the result of regressing changes in consumption growth on the predicted probabilities of moving in the simulated economy. Our primary test of the model is passed. The signs on the imputed probability coefficients match between the simulated data and the empirical data and they do so for very reasonable levels of transaction costs. While the magnitude of the two sets of coefficients are quite different, the shape of the implied curves is quite similar between the data and the simulated economy. In other words, while the magnitude of the curve is not matched, both curves reach their maxima at approximately the same probability of moving and both curves decrease but approximately the percent as the agent nears the boundary.

6 Conclusion

We have presented a model which explicitly considers durable and nondurable consumption when the durable market is not frictionless. We have shown that nondurable and durable consumption are, in general, not separable. Nondurable consumption is not a constant proportion of financial wealth in this model except when the assets span the risk in the economy and nondurable and durables are separable in the utility function. Further, we have shown that the behavior of the model is substantively supported by consumption data from the PSID. The model matches both the shape of the average individual consumption policy and the shape of the distribution of wealth to house value ratios.

We also shed light on the recent empirical debate over the effects of unexpected capital gains on savings-consumption decisions We show that much of the empirical work is consistent, once we understand the expected relationships between nondurable consumption, durable consumption, and wealth. The relationship in this model is more complex than that given by the standard asset accumulation model.

As with most models of this class, we have not been able to allow the price of housing to interact with the distribution over agents. In our setup with only idiosyncratic risk, the assumption of no price effects is justified. However, to fully understand a market as complex as housing, one must allow aggregate shocks. We can see from the work of Martin (2000) that the dynamics in the presence of aggregate risk can be very revealing. Once aggregate risk is incorporated, the distribution over agents and the price of housing must be allowed to interact. In other words, positive aggregate shocks which tend to make the households increase their stocks of the durable good should have the effect of increasing either the price or the total stock of housing. In this manner, we can have a set of agents increasing their stock at the same time as other agents are decreasing their stocks.

A study of the effects of transaction costs on life-cycle expenditures on nondurable and durable goods would be a significant extension of this work. The existence of the transaction cost has many implications for the life-cycle model. We would expect young households facing increasing wage profiles to purchase relatively large houses. As the households age and their income profile stabilizes, we expect the household to be fairly stable in their housing stock. We also predict that older households should be less likely to move than younger households. They will consume the new durable for a relatively short period of time making the transaction costs relatively high. Modeling the effect of transaction costs in a finite life-cycle is also computationally less burdensome. As a result, adding life-cycle income to the model is feasible.

One final note, the shape of the consumption function has implications for the correlation in consumption between agents. In this model, we no longer predict that the correlation between the consumption of any two agents to be one, even in a world where agents have identical preferences and face no idiosyncratic shocks. Here, two agents may have a negative correlation in consumption growth when they differ only in initial endowment. The low correlation in consumption between agents is well documented and robust (Deaton 1992). Our result does not resolve the aggregate consumption correlation puzzle. It fails to do so because the mass of agents near the boundary of the inaction region is relatively small. For most agents, the correlation in consumption in response to the same shock is quite high. Second, part of the force driving the changes in consumption is the incomplete market structure. Incomplete market structures inherently reduce the correlation in consumption across agents.

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Figure 1: Consumption Function
[alpha=-8, pho=-1, Q=1, r=.0515, Beta=.95, lambda=.1]

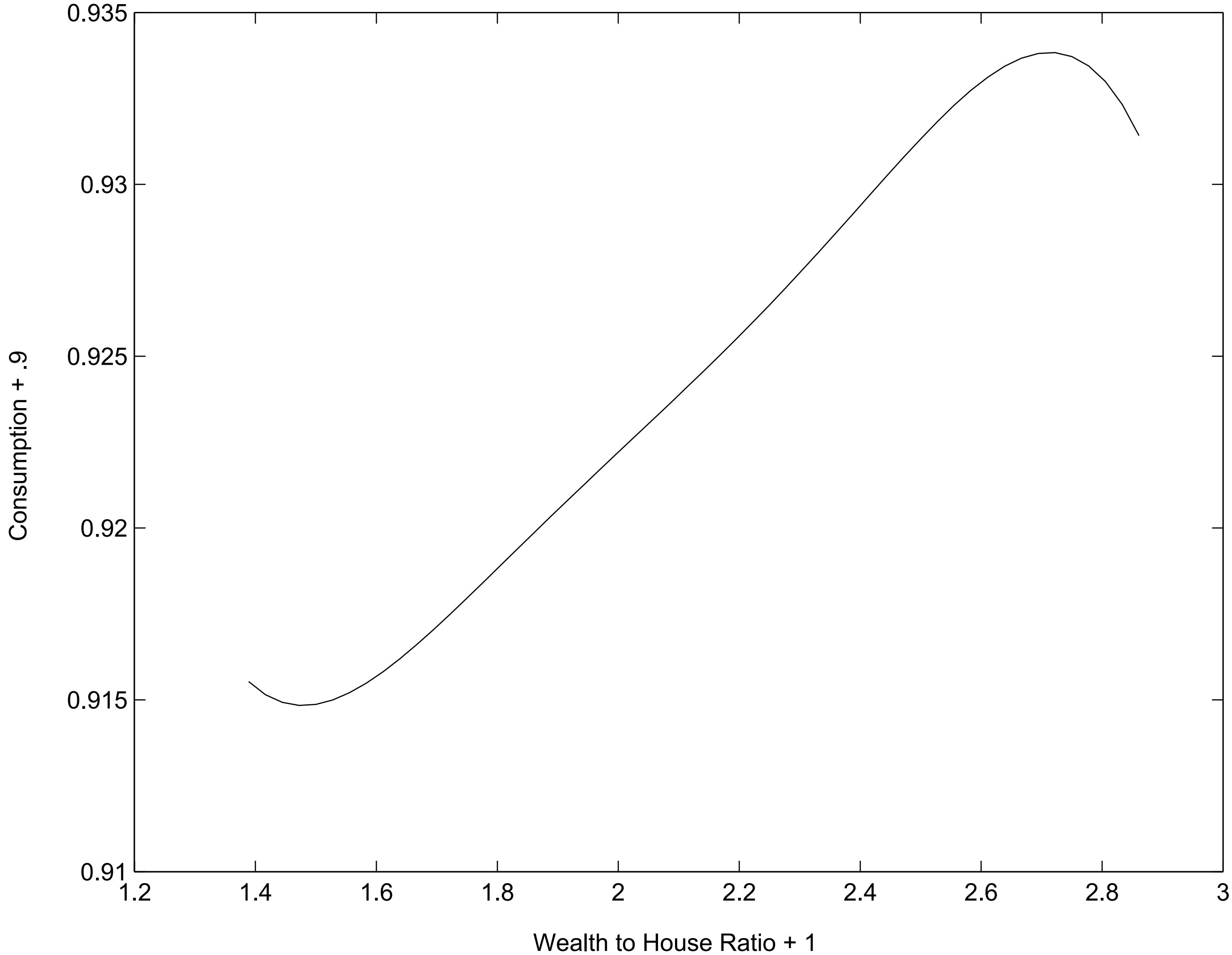

Figure 2: Consumption Function
[alpha=-2, pho=-1, r=.0515, Beta=.95, lambda=.1]

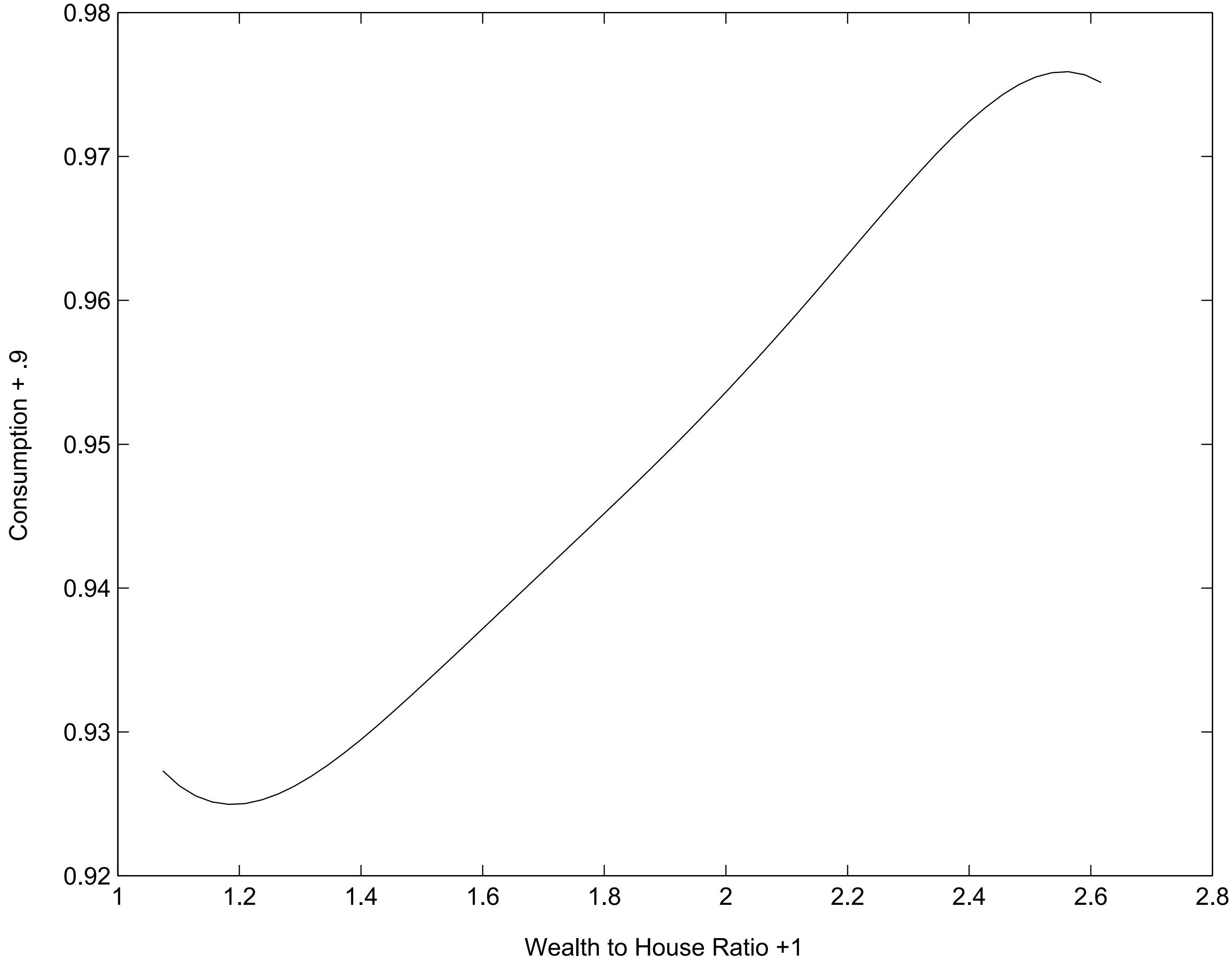

Figure 3: Simulated Distribution

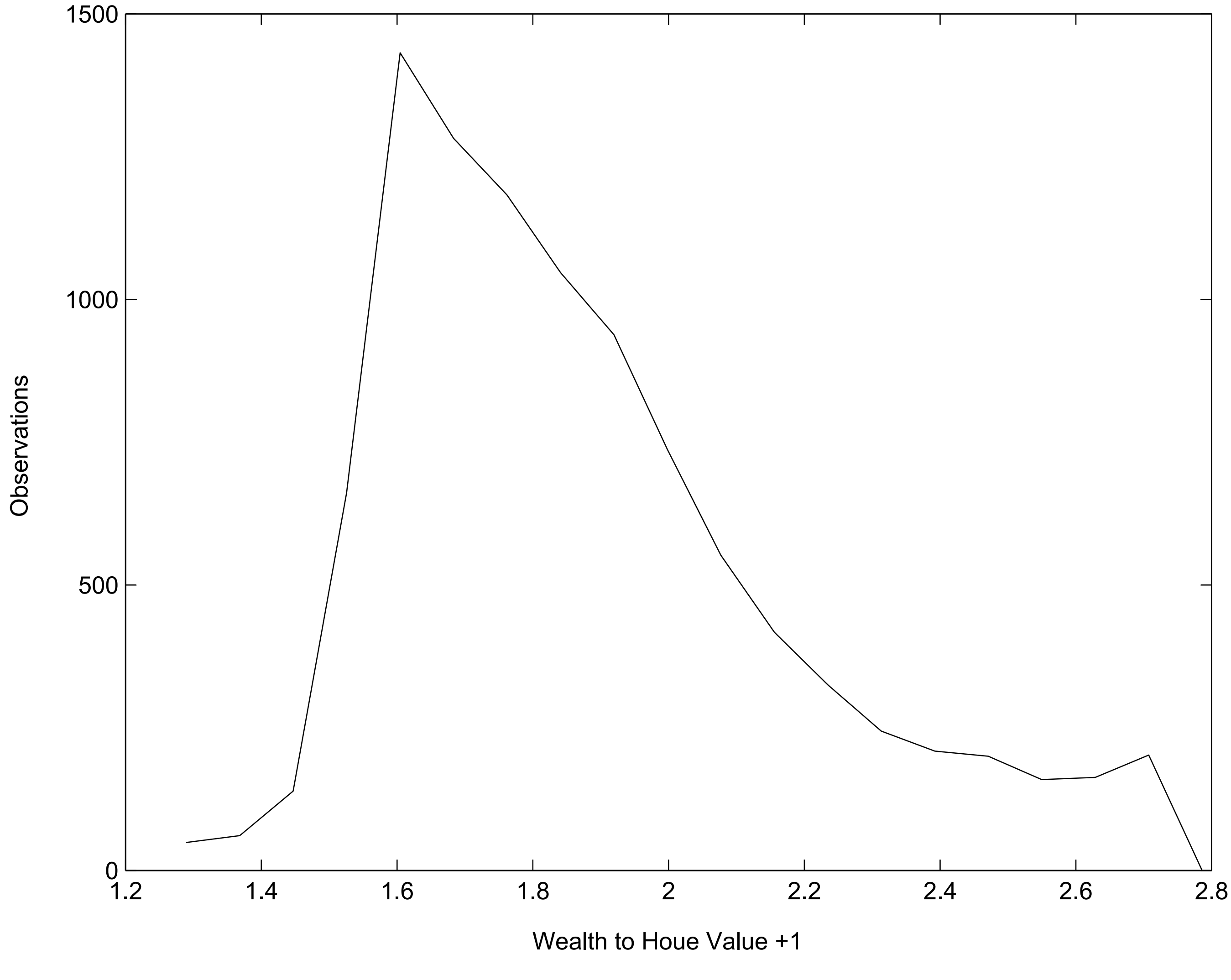

Table 1: Characterization of the Inaction Region

	R=.09	*R=.07*	*R=.05*
Delta=.99 Lambda=.01	(1.40,1.66,2.11)	(1.39,1.44,1.76)	(1.02,1.43,1.68)
Delta=.99 Lambda=.03	(1.30,1.67,2.33)	(1.29,1.52,1.95)	(1.02,1.35,1.81)
Delta=.99 Lambda=.05	(1.28,1.53,2.39)	(1.25,1.51,2.19)	(1.02,1.37,1.84)
Delta=.97 Lambda=.05	(1.22,1.44,2.27)	(1.18,1.38,2.21)	(1.10,1.37,1.78)
Delta=.97 Lambda=.01	(1.58,1.74,2.21)	(1.20,1.61,2.07)	(1.24,1.40,1.56)

Note: The first and last numbers correspond to the barriers. The middle number corresponds to the optimal return point.

Table 2: Description of Data

	Mean	*Std Dev*	*Median*
House Value[a]	64,442	45,595	55,000
Accumulated Equity[a]	42,315	37,845	33,500
Remaining Mortgage[a,b]	22,127	25,713	15,000
Wealth no Equity[a]	32,938	39,048	16,400
Wealth with Equity[a]	75,254	64,163	58,000
Percent Housing in Portfolio[a,c]	0.70	0.21	.75
House to Income Ratio[a,e]	2.18	1.71	1.78
Mort Pmnt to Income Ratio[a,b]	0.15	0.12	.12
Car Value to Income Ratio[a,d]	0.25	0.27	.19
Age of Head[a]	43	11	42

a. Excludes renters, households with head over 65, and the top and bottom 1% of wealth holders. b. Excludes households with no mortgage. c. Excludes households with negative net wealth positions. d. Excludes households with zero cars. e. Excludes bottom 5% of income.

Table 3: Ordered Probit

	Probit 1	*Probit 2*	*Probit 3*	*Sim. Data*
Log Ratio Wealth to	—	—	.135	1.20
House Value (HV)			(.048)	(.049)
Ln Wealth	.163	.111	—	—
	(.0614)	(.049)		
Ln House Value (HV)	-.302	-.209	—	—
	(.069)	(.057)		
Income	1.88e-06			
	(4.20e-06)			
Yrs Left to Retirement	.022	—	—	—
	(.004)			
> High School	.311	—	—	—
	(.099)			
Non-White	-.092			
	(.153)			
Age	-.024	—	—	—
	(.029)			
Age Squared	1.74e-05	—	—	—
	(3.20e-04)			

Note: The regression results in tables 4 and 5 use the predicted probabilities from Ordered Probit 1.

Table 4a: Predicted Probabilities from Ordered Probit 1

	Mean	*Std Dev*	*25%*	*50%*	*75%*	*90%*
Increase	.039	.038	.014	.029	.051	.079
No Move	.939	.037	.935	.949	.956	.958
Decrease	.022	.030	.007	.015	.029	.048

Table 4b: Predicted Probabilities from Simulated Data

	Mean	*Std Dev*	*25%*	*50%*	*75%*	*90%*
Increase	.006	.013	2e-04	.001	.005	.020
No Move	.965	.074	.972	.989	.994	.995
Decrease	.029	.076	9e-04	.004	.016	.072

Table 5: Consumption Growth Rate Versus Probability of Increasing Home Size

	Full Sample		*High Wealth*	*High Equity*	*Sim. Data*
Constant	-.030	-.051	-.060	-.054	-.004
	(.025)	(.026)	(.030)	(.041)	(.002)
Prob.	3.490	4.091	4.849	3.917	1.205
	(1.358)	(1.871)	(1.762)	(2.791)	(.232)
Prob. Squared	-29.972	-31.602	-40.208	-30.650	-13.260
	(13.289)	(13.562)	(16.019)	(32.615)	(3.711)
Δ Inc. 84-83	7.13e-07	—	—	—	—
	(7.10e-07)				
Δ HV 84-83	4.10e-07	—	—	—	—
	(4.25e-06)				
More Chil 84-83	.152	—	—	—	—
	(.033)				
Less Chil 84-83	-.130	—	—	—	—
	(.028)				

Table 6: Consumption Growth Rate Versus Probability of Decreasing Home Size

	Full Sample		*High Weatlh*	*High Equity*	*Sim. Data*
Constant	.116	.113	.107	.108	.006
	(.023)	(.017)	(.020)	(.031)	(.001)
Prob.	-.7890	-.6952	-.5317	-.7318	-.375
	(.410)	(.217)	(.235)	(.353)	(.046)
Prob. Squared	14.5378	10.7736	6.4813	12.6076	.735
	(5.352)	(4.411)	(4.736)	(5.921)	(.113)
Δ Inc. 84-83	5.69e-07	—	—	—	—
	(6.89e-07)				
Δ HV 84-83	4.44e-07	—	—	—	—
	(3.51e-07)				
More Chi 84-83	.137	—	—	—	—
	(.037)				
Less Chil 84-83	-.128	—	—	—	—
	(.026)				

Table 7: Logit

	Decrease	*Increase*	*Comp Probit*
Wealth	-2.29e-05	6.25e-06	3.42e-06
	(1.29e-05)	(3.87e-06)	(1.59e-06)
Wealth Old	3.56e-05	-1.94e-04	-7.77e-06
	(1.39e-05)	(9.04e-06)	(2.15e-06)
Income	-2.11e-05	1.37e-05	4.71e-06
	(1.57e-05)	(8.88e-06)	(3.14e-06)
HV	9.25e-06	-1.23e-05	-3.98e-06
	(5.04e-06)	(4.68e-06)	(1.24e-06)
Change HV 84-83	1.19e-05	2.45e-06	-1.74e-06
	(6.21e-06)	(4.45e-06)	(1.56e-06)
Δ Inc. 85-83	-3.67e-05	2.40e-05	1.16e-05
	(2.16e-05)	(9.15e-06)	(3.40e-06)
Δ Inc 84-83	-3.84e-05	8.15e-06	1.03e-05
	(1.51e-05)	(1.19e-05)	(4.08e-06)
Δ Inc 87-85	-2.31e-05	1.24e-05	6.12e-06
	(1.40e-05)	(5.25e-06)	(2.24e-06)
Second Mortgage	.174	-.014	-.034
	(.107)	(.057)	(.020)
Retired 84-83	1.567	.630	-.303
	(.665)	(.667)	(.208)
Employed 84	.469	-.511	-.065
	(.681)	(.493)	(.174)
Employed 83	-.322	.583	.126
	(.669)	(.498)	(.167)
Moved in 84	1.789	.649	.040
	(.496)	(.332)	(.134)
Age	.079	.027	-.003
	(.042)	(.024)	(.009)
> High School	-.740	.446	.242
	(.616)	(.278)	(.110)
Δ Married 84-83	-.505	-.162	-.006
	(.556)	(.326)	(.118)
More Children 86-83	1.27	.409	.042
	(.610)	(.310)	(.136)
Less Children 86-83	.026	.758	.213
	(.787)	(.405)	(.156)
Planned Move	2.912	2.706	.758
	(.463)	(.265)	(.134)
Age Youngest Child	.101	-.055	-.024
	(.039)	(.030)	(.009)
Youngest Child <5	.626	.332	.035
	(.631)	(.279)	(.115)
Constant	-8.978	-4.506	—
	(1.940)	(1.073)	

Table 8: Consumption Growth Rate Versus Probability of Changing Home Size

	Increase	*Decrease*	*Increase*	*Decrease*
Prob.	.297	-.962	.158	-.949
	(.110)	(.370)	(.114)	(.349)
Prob Sq.	-.354	2.036	-.188	1.901
	(.118)	(.817)	(.208)	(.895)
△ HV 84-83	1.29e-06	1.34e-06	—	—
	(2.66e-07)	(2.66e-07)		
△ Inc 84-83	2.57e-06	2.58e-06	—	—
	(4.93e-07)	(4.96e-07)		
Age	1.85e-04	-4.75e-05	—	—
	(9.81e-04)	(.001)		
Moved 84	-.063	-.039	—	—
	(.015)	(.014)		
Moved 83	.018		—	—
	(.015)			
> 45	-.028	-.032	—	—
	(.024)	(.024)		
> High School	-.009	-.011	—	—
	(.014)	(.014)		
Black	.040	.025	—	—
	(.018)	(.018)		
△ Married 84-83	.007	.005	—	—
	(.012)	(.012)		
More Child 86-83	.100	.110	—	—
	(.025)	(.024)		
Less Child 86-83	-.140	-.137	—	—
	(.020)	(.020)		
Constant	.033	.069	.036	.053
	(.037)	(.033)	(.008)	(.006)