Housing in Retirement Across Countries[*]

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PRELIMINARY AND INCOMPLETE

Abstract

The "retirement saving puzzle" in the literature is the phenomenon that many households in the U.S. have significant wealth late in life, contrary to the predictions of a simple life-cycle model. The literature has weighted off precautionary motives versus bequest motives, pointing to longevity risk, out-of-pocket medical expense risk, and illiquidity of housing late in life as some of the factors important to account for the puzzle. In this project, we examine cross-country differences in saving behavior of retirees in order to weigh in on the discussion. First, we document the extent of the retirement saving puzzle in twelve developed countries, as well as the patterns of (dis)saving among retirees in housing versus non-housing assets, homeownership rates, and indebtedness rates. We find that countries in our sample vary noticeably in the extent of the puzzle: one group of countries looks like the U.S., while in another group, retirees spend down their wealth much more rapidly. The difference in the saving patterns between the two groups comes mainly from the speed at which retirees sell their homes. It also appears that the rate of dissaving in retirement is correlated with the extent of public coverage of healthcare and long-term care. For the quantitative experiments, we focus on the cases of U.S. and Sweden, and use a rich life-cycle model of homeownership and saving in retirement to evaluate to what extent the risk of large out-of-pocket medical expenses and variation in long-term care provision, as well as homeownership late in life, impact saving decisions of retirees. Consistent with previous work, we are finding in first experiments that housing plays a large role in explaining retiree saving behavior, while the risk of out-of-pocket spending plays a moderate role quantitatively.

1   Introduction

In the United States, retirees have significant positive wealth late in life. In the Health and Retirement Study (HRS) for instance, the median net worth of a household at age 90 is about $75,000. The literature has termed this phenomenon the retirement saving puzzle (RSP), and has proposed a number of explanations. For example, Hurd (1989) studies the role of bequest motives and finds them to be small, Hubbard et al. (1995) find that government-provided social insurance should create a motive to dissave in retirement, Ameriks et al. (2011) study the relative importance of bequest motives and public care aversion for the related annuity puzzle, and De Nardi et al. (2010) emphasize the role of out-of-pocket medical expense risk in motivating the elderly to save, while finding bequest motives unimportant. Lockwood (forthcoming) considers the low demand for long-term care insurance as evidence of the relative importance of bequest motives versus precautionary motives. All of these papers study net worth of retirees. Instead, Nakajima and Telyukova (2012) study the puzzle by decomposing retiree wealth into housing and financial assets, and find that housing plays a major role in saving patterns of retirees, partly due to the fact that it becomes illiquid late in life, yet many retirees choose to stay homeowners as they continue to age.

In this paper, we delve deeper into the question by studying cross-country variation in saving in retirement. Using household-level data from the U.S., U.K., and ten developed economies in continental Europe, we document cross-sectional age profiles for retirees age 65 and above of net worth, housing and financial assets, as well as homeownership rates and debt. Next, we document salient differences in institutions in these countries, focusing in particular on the prevalence of out-of-pocket medical expenses and long-term care expenses, housing and mortgage markets, estate and inheritance taxation, and social safety nets. Finally, our goal is to use this cross-country variation to understand how saving in retirement is affected by each of these factors, and thus to quantify the relative roles of housing, expense and longevity risk, social insurance, and ultimately bequest and precautionary motives. We do so by using a rich life-cycle model of saving in retirement, which we estimate to the United States, and then vary the parameters that capture relevant institutions across countries.

For the empirical analysis, we use the U.S. Health and Retirement Study (HRS), the English Longitudinal Study of Ageing (ELSA), and the Survey of Health, Ageing and Retirement in Europe (SHARE). ELSA and SHARE were modeled after, and are harmonized with, the HRS, to characterize the saving behavior of retirees in the U.S., the U.K. and a number of continental European countries. The results of our analysis indicate a clear separation of the countries in our sample into a group where the retirement saving puzzle is pronounced ("high-RSP" countries), i.e. where retirees spend down their wealth slowly as in the U.S., and where it is much less prevalent ("low-RSP" countries), where retirees

spend down wealth more quickly. In the high-RSP countries, retirees of age 86-90 still hold on average 67% of the wealth they held at age 65-69; in the low-RSP countries, this ratio is on average only 23%. By looking at housing versus financial assets separately, it appears that the most systematic difference between the two groups of countries is in the rate at which retirees sell their homes. In the analysis of the institutions, we show that out-of-pocket medical expense risk is very low in all the countries in our sample except for the U.S. However, our high-RSP countries are ones where the risk of out-of-pocket *long-term care* expenses (e.g. on nursing homes) is high, like in the U.S., while this risk is largely hedged by the government in the low-RSP countries. There are many other differences between the countries' housing markets, mortgage markets, etc., however for the retiree group, these differences appear small and may play a relatively minor role. This part of investigation is still in progress.

We also find important similarities between all the countries in our sample, which have to do with housing assets. First, homeownership rates, while they vary across countries, remain positive and significant late in life, i.e. at and past age 90. Second, the median conditional housing asset age profile is flat in age. Third, in all the countries in our sample, housing constitutes the majority of household net worth in retirement. In fact, compared to the U.S., European retirees tend to have significantly less financial wealth, and they spend it down much more quickly. That is, from the data it appears that to the extent that median net worth remains positive in all the countries in our sample, housing assets are responsible for this fact. At the same time, the low holdings of financial assets relative to the U.S. are consistent with retirees facing overall less risk than in the U.S.

To proceed with our quantitative analysis, we pose a modified version of the model of life-cycle saving in retirement from Nakajima and Telyukova (2011), where retirees can choose whether to own or rent a house, how much to save in a financial asset, and how much to borrow against their house if they are a homeowner. Model households face health and mortality risk, as well as out-of-pocket medical and long-term-care expense risk. They have a warm-glow bequest motive. The government provides a consumption floor, which in the U.S. captures Medicaid (seeDe Nardi et al. (2012)).

The goal of our first quantitative exercise is to evaluate the role of out-of-pocket expense risk versus housing on saving in retirement. Specifically, we want to measure how well the differences in risk of out-of-pocket expenses can account for the differences in retirement saving in the countries in our sample, and how housing contributes to the differences or similarities between them. For our quantitative analysis, we choose one country from each pool: the United States, where retirees hold significant wealth late in life, and Sweden, where retirees spend down their wealth more quickly and are much more comprehensively covered by government-run social programs.

We calibrate the benchmark model to match cross-sectional age profiles of net worth, housing and

financial assets, homeownership rates, as well as indebtedness rates in the United States HRS data. Some observable features of out-of-pocket expense risk and housing markets are calibrated exogenously from our household data. The quantitative experiments consist of changing the observable features of the environment from the U.S. to Sweden, to compare the optimal age profiles that result, both to each other and to the data.

In the experiment, under the assumption of identical preferences in the U.S. and Sweden, and identical housing and mortgage markets, we re-compute the implied age profiles of saving and homeownership in the model where we change only the initial distribution, health risks and out-of-pocket medical (and long-term care) expense risks. In this experiment, we find that the risk of out-of-pocket medical expenses plays a small role quantitatively in accounting for the differences between the two countries. Overall, and consistent with our previous work, we find that the role of medical expense risk is moderate, while the role of housing is large, in accounting for the retirement saving profiles that we observe in the data. In ongoing work, we are investigating (a) more aspects of the institutional differences between countries, by relaxing the assumptions of identical housing and mortgage markets, (b) the nature and role of bequest motives in the two groups of countries, and (c) the differences in the distributional aspects of the puzzle across the countries in our sample.

Our work is related to several strands of literature. In addition to contributing to the discussion cited above of the retirement saving puzzle, especially as it relates to housing, we contribute to the emerging body of work that considers cross-country evidence on household portfolios, particularly among older households. Examples are Angelini et al. (2011), who characterize homeownership throughout the life cycle using the retrospective SHARELife survey, and Christelis et al. (forthcoming), who characterize the differences in the composition of entire household portfolios in a previous wave of the data that we use, and decompose the reasons for these differences into influences of institutions versus household characteristics.

Below, in section 2, we discuss the data and document empirical facts about saving in retirement across countries. Section 3 presents major details of the housing markets, healthcare and long-term care provision, and social security systems across countries. We summarize our findings in section 4. In section 5 we present the model, and calibrate it in section 6. Quantitative results are in section 7. We discuss our future agenda for this project in section 8, while section 9 concludes.

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2 Facts on Saving in Retirement Across Countries

2.1 Data Sources

We use three household surveys in our analysis. The first is the Health and Retirement Study (HRS), which incorporates a lerge sample of the oldest old known as AHEAD, and which covers the U.S. The second survey is the English Longitudinal Study of Ageing (ELSA), which covers the U.K. Finally, the Survey of Health, Aging and Retirement in Europe (SHARE) covers thirteen other countries, of which we will use Sweden, Denmark, Netherlands, Belgium, Germany, Austria, France, Spain, Italy and Greece. All three surveys are biennial and longitudinal: the HRS covers the period 1992-2010, ELSA covers 2000-2010, while SHARE is the newest, and currently has two waves in 2004 and 2006.[1] Because the panel dimension of SHARE is very short, at this point we cannot usefully construct life-cycle analyses of individuals or cohorts in it. Therefore, for easy comparison across countries, and unlike our previous work with the HRS in Nakajima and Telyukova (2012), we will study the 2006 *cross-sectional* age profiles of the desired variables, keeping in mind that inference in such analysis can be affected by important composition and cohort effects.

We use the RAND versions of the surveys as the base for our analysis. RAND's versions of ELSA and SHARE are far less extensive than for the HRS, so that we had to convert a newer wave of ELSA into RAND format, as well as utilize a significant amount of raw information from these surveys, incorporating them into a comparable data set. For the most part, a direct comparison of the data is possible, upon conversion of currencies into 2000 dollars using real exchange rates. Compared to the HRS, a central weakness, from our perspective, of both ELSA and SHARE is the insufficient documentation of respondents who are in nursing homes. Relative to outside data that we have, SHARE understates significantly the percentage of people in nursing homes, while ELSA did not interview respondents in institutions. We will address these issues further below, where relevant.

In constructing the age profiles, we stop at age 90. The reason is that the SHARE data set has fairly small country sample sizes, and unlike HRS, it does not oversample the oldest old. As a result, the sample sizes of the oldest retirees get too small to construct reliable moments. In addition, to smooth noise in the data, in both the HRS and SHARE, we put households into 5-year centered age bins, so that age 65 is actually a bin of ages 63-67. Thus, each household is categorized into five different age groups, of its actual age, as well as minus/plus two years.
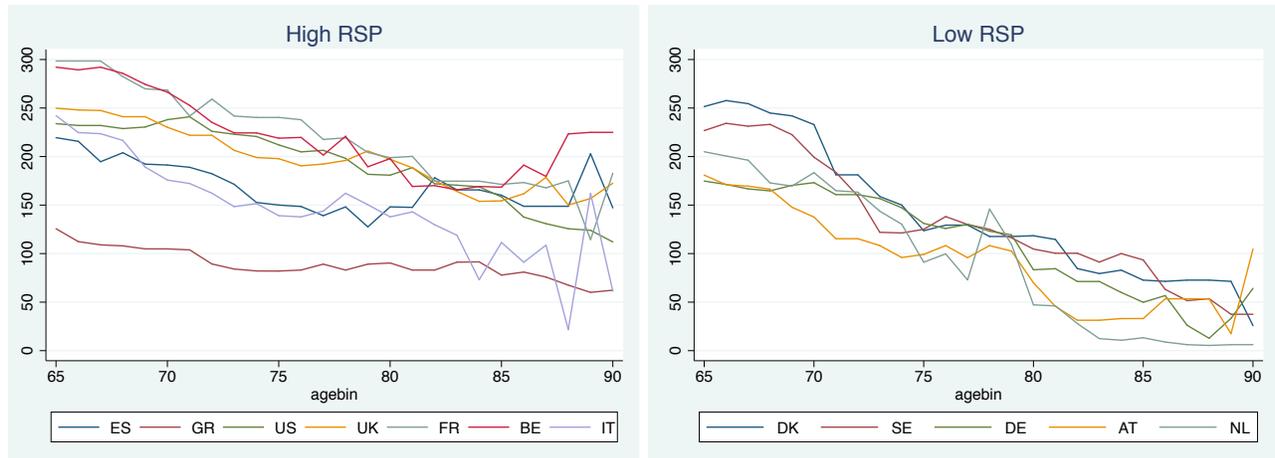
Figure 1: Age Profiles of Median Net Worth. Thousands 2000 US $.

2.2 Data Facts

Figure 1 shows how we divide the countries in our sample into two categories. In the left panel are countries where the age profiles of median net worth remain relatively flat until and past age 90, that is, where retirees are slow to spend down wealth. For example, in the United States, median net worth at age 90 is about $112,000. The full group of countries includes the United States and the U.K., as well as Spain, Greece, France, Belgium and Italy. As shorthand, we term these countries "high-RSP" countries, for the high prevalence of the retirement saving puzzle. In these countries, median net worth of retirees at age 86-90 is on average 67% of median net worth at age 65-69.

The right panel of figure 1 shows countries where in the median, net worth is spent down much more quickly with age. For example, in Sweden, median net worth at age 90 is about $37,000, while at age 65 it is comparable with the U.S. In the Netherlands, net wealth appears to decline to zero. The countries in the "low-RSP" group are Denmark, Sweden, Germany, Austria and the Netherlands. The average ratio of median net worth at age 86-90 to median net worth at age 65-69 is just 23% in these countries, and around 28% if Netherlands is excluded as a low outlier.

Figure 2 presents homeownership rates among retirees for the countries in the two groups. In high-RSP countries, homeownership rates are on average higher at age 65, and remain high until age 90. In low-RSP countries, retirees start with a lower ownership rate, and then sell houses at a faster rate. For example, in the U.S. the homeownership rate is about 90% at age 65 and is still above 50% at age 90. In Sweden, the rate declines from just under 80% to about 45%; in the Netherlands, that decline is from

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[1]The third wave of SHARE, known as SHARELife, came out in 2008 and constructs life-cycle data from restrospective surveys; we do not use this wave, as it is quite different from the other two.
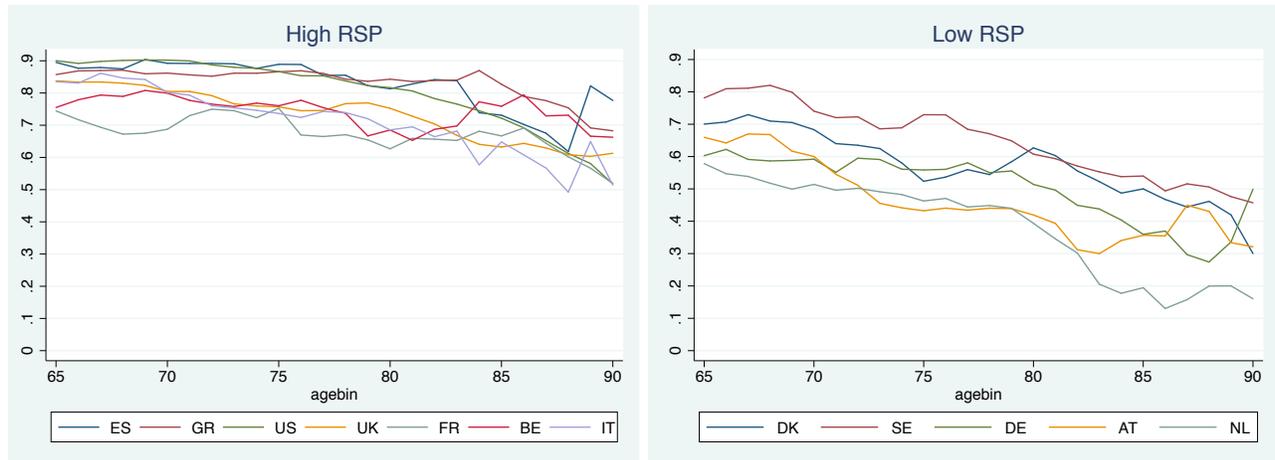
Figure 2: Homeownership Rates
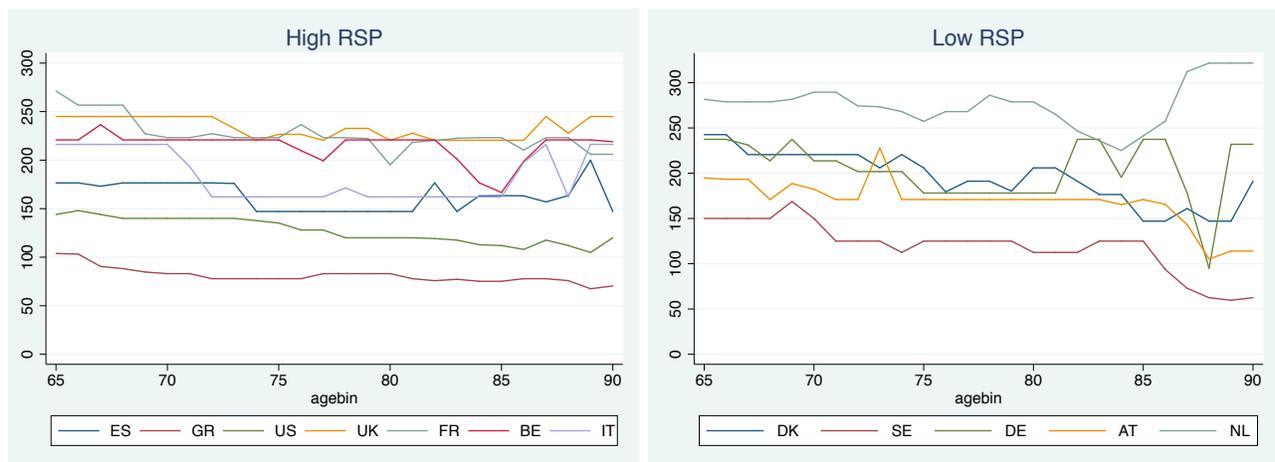
Figure 3: Age Profiles of Median Housing Assets. Thousands 2000 US $.

near 60% to about 20%.

Notice, however, that in all the countries, homeownership rates remain high and positive late in life; even in low-RSP countries, at age 90, homeownership rates are at 20-50%. This is an important aspect of saving late in life, and will be one of the facts that we will aim to account for using our model.

Breaking down the assets of retirees now, we look separately at housing and financial assets, presented, respectively, in figures 3 and 4. The median housing asset age profiles look similar in all the countries, not changing significantly with age, and on average at about the same level for high-RSP and low-RSP countries.

There is at first sight not much correlation between the levels of *financial* wealth and the prevalence of the retirement saving puzzle. At age 65, retirees in the U.S., but also Sweden and Denmark, hold
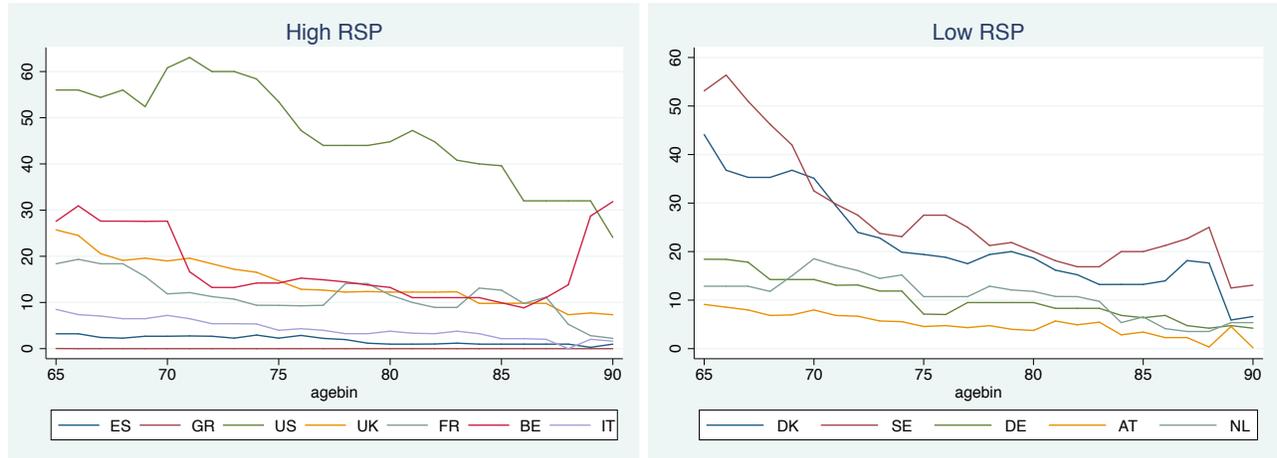
Figure 4: Age Profiles of Median Financial Assets. Thousands 2000 US $.

similar levels of financial wealth. Notice the following facts, however. First, in the low-RSP group, even countries where the level of financial wealth starts out high, this wealth is spent down much more quickly than in the U.S. Thus, retirees in the U.S. have the most financial wealth and it is most persistent there. For example, in Sweden retirees at age 90 hold about one-third the level of wealth that U.S. retirees hold. In many other countries, median financial assets at age 90 are drawn down close to zero. Second, in most European countries, retirees hold significantly less financial wealth than in the U.S.

Thus, insofar as there are differences between the countries in the two groups, in terms of decumulation of net worth, they are expressed in faster spend-down of financial assets and faster liquidation of housing. However, the important similarities between these countries is that a significant propotion of retirees remain homeowners late in life (until age 90 and beyond), and that conditional on ownership, median housing assets stay fairly flat with age.

To complete the picture, we look at the rates of indebtedness among the retirees in our sample. This is to give an idea of how well retirees can smooth consumption using both secured and unsecured debt. Figure 5 shows the proportion of retirees with negative net assets.[2] In most countries, the initial indebtedness rate by this measure ranges from about 8% to 35%, with no clear correlation across puzzle groups. In the low-RSP group, Denmark, Sweden and the Netherlands have the highest debt rates at age 65 (between 25 to 35%). In the U.S., the rate is around 21%. In most other countries, the rates are around 10-15% at age 65. In all countries, net debt rates decline monotonically, reaching similar low rates by age 90.

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[2]The measure is nonhousing wealth net of *all* debt, secured and unsecured. The reason for this definition is that it maps most directly to our model below.
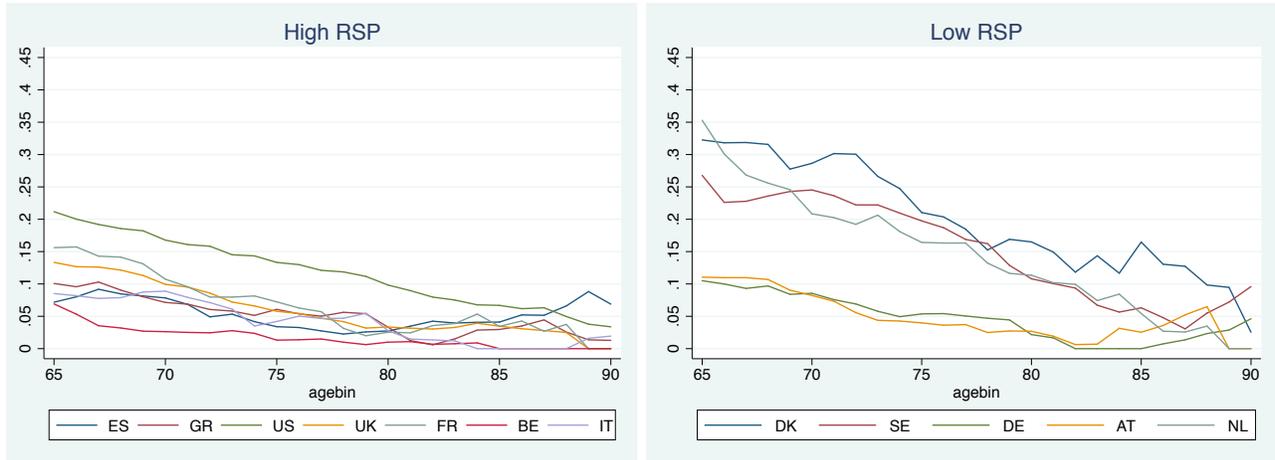
Figure 5: Proportion of Retirees with Negative Net Financial Assets
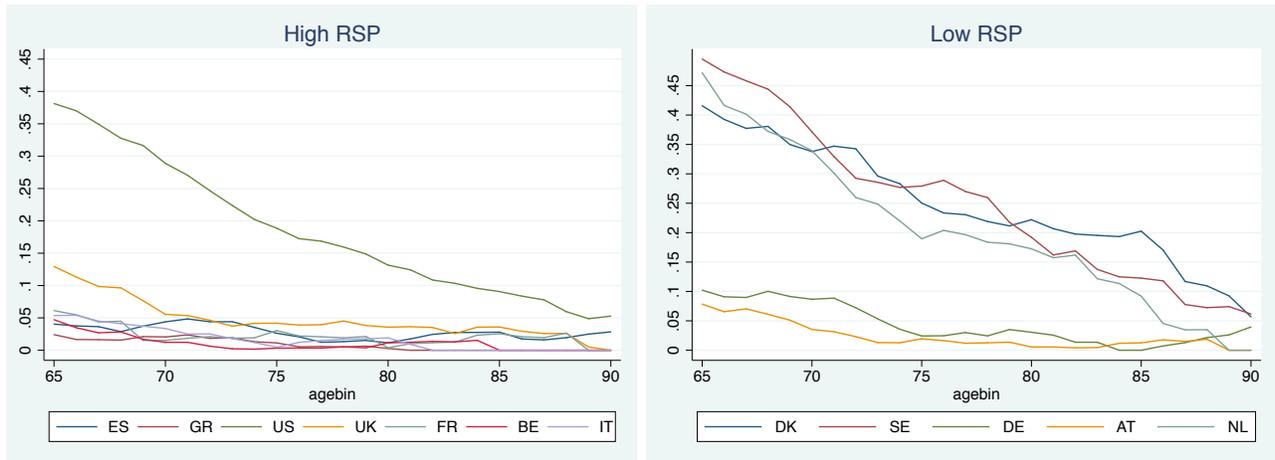
Figure 6: Proportion of Retirees with Secured Debt

Figure 6 shows the proportion of retirees in our sample with secured debt. Again, while there is no clear correlation between the prevalence of the puzzle and secured debt rates, there is a group of countries where secured debt among retirees of age 65 is particularly high: these are the U.S. (38%), Sweden (50%), Denmark (40%) and Netherlands (47%). The rest of the countries have much lower indebtedness rates: most at around 5% at age 65, and some at or just above 10%. Again, however, secured debt rates decline monotonically in all countries, reaching between 0 and 5% at age 90. The median conditional amounts of secured debt at age 65 (not shown) vary between $10,000 and $20,000 for most countries, with outliers at around $30,000-60,000 in Sweden, Netherlands, Denmark and the U.S., and these amounts decline with age.

As figure 7 demonstrates, the story is very similar for unsecured debt rates, although the highest
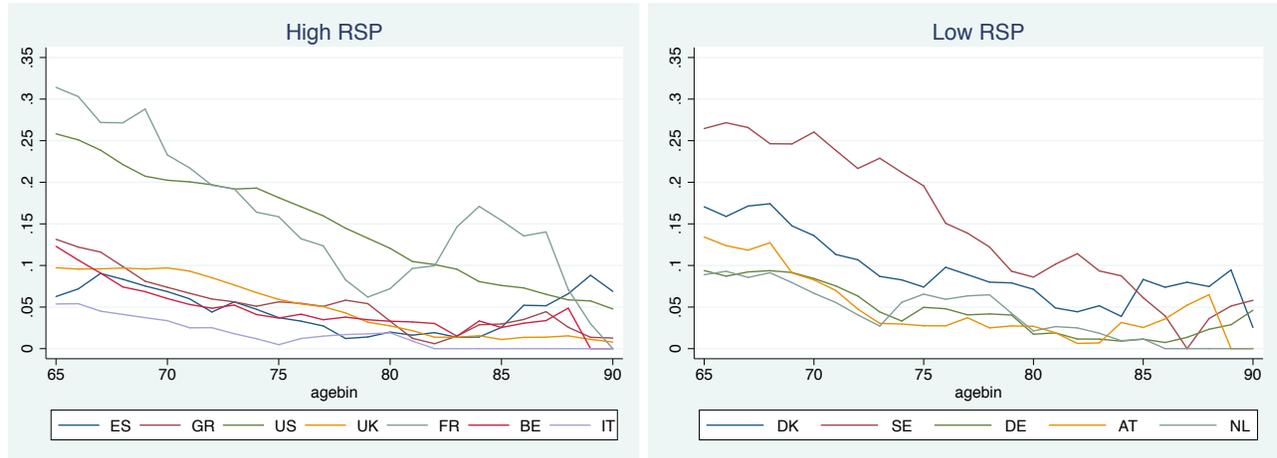
Figure 7: Proportion of Retirees with Unsecured Debt

rates of indebtedness are at about 25% at age 65, in Sweden, the U.S. and France. In all other countries, the rate of indebtedness is at about 10-15% at age 65. All decline monotonically to near zero by age 90. Median conditional unsecured debt, however, is relatively small, although there is significant variation by country. (This information is not in the graphs.) In the U.K., it is about $1,000 at age 65, in the U.S. it is $2,000; in many remaining countries the median conditional amount of debt is about $5,000 at age 65, but declines monotonically to zero as households age.

3 Institutions

3.1 Out-of-Pocket Medical and Long-Term Care Expenses

Previous work on saving in retirement has identified out-of-pocket (OOP) medical and long-term care expense risk a significant potential source of risk in retirement, which, in addition to longevity risk, may be capable of accounting for the patterns of saving in retirement in the U.S. (e.g. De Nardi et al. (2010)). Unlike in the United States, medical care across Europe tends to be insured by some combination of government-provided and mandatory private insurance (WHO, Allin et al. (2005)). There is wide variation in co-pay structures and the extent to which the population participates in private health insurance schemes, but it appears that out-of-pocket expenses are limited in all of the countries in our sample except for the U.S. We are able to measure OOP medical expenses in our sample and discuss this below. Details of healthcare coverage in our sample countries are in Appendix A.1.

As has been pointed out in the literature before (Brown and Finkelstein (2011)), there is a lot more variation in *long-term care* coverage, and many countries do not have universal coverage for long-term care in the same way that they do for healthcare. Based on our reading of the literature to date

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(e.g. OECD (2005)), we can classify European countries into three groups. Group (A) provides public coverage of long-term care, both in nursing homes and in-home care, and requires no means-testing and no OOP expenses. This group includes Sweden, Netherlands, Denmark, and Norway (the last is not in our sample). Group (B) provides significant public coverage of long-term care, but does require some OOP expenses, although these expenses are capped at a relatively low level. This group includes Austria and Germany. Finally, group (C) are countries where there is no or low public coverage of long-term care, with means testing and high OOP expenses. This group includes Spain, U.K., U.S. as well as Switzerland (not presented). Notice that in groups (A) and (B), there is no dependence on assets in qualifying for long-term care benefits, while in group (C), such dependence exists. The details of coverage in these countries are in Appendix A.2.

In all of our data except ELSA, we can observe OOP medical and long-term care expenses directly (that is, OOP expenses on prescription drugs, doctor visits, hospital stays and nursing homes). The HRS does the best job of measuring them, while SHARE may present measurement issues because the coverage of institutionalized population is not comprehensive (more on this below, in the Calibration section). ELSA does not measure OOP medical expenses because the National Health System at present makes them zero for all participants, and ELSA does not interview respondents in nursing homes. Based on the HRS and SHARE, we estimate expected mean medical expenses for all countries in our sample except the U.K., based on household size (single or couple), income, health status and age. Figure 8 shows expected mean medical expenses for a single person of median income by health status, for three countries – one from each group in terms of long-term care coverage. As we would expect, in all three, people in worst health pay the most. However, the orders of magnitude of the expenses are markedly different at all ages. For exampe, at age 90, a person might expect to spend about $12,500 in the U.S. in OOP medical expenses. That number is $2,000 in Sweden and about $2,500 in Germany.[3] Notice that the magnitude rises as we progress from group (A) to (B) to (C).

Figure 9 presents, for the same countries, mean expected medical expenses for singles of good health by income quintile. The figure demonstrates that correlation between income and medical expenses becomes stronger as the extent of privatization of coverage rises. In Sweden, with universal public coverage of both health care and long-term care, everyone pays roughly similar amounts out of pocket, regardless of income. Even at age 90, the distribution ranges between $900 and $1,400, and is not

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[3]We cannot reliably measure expenses for persons above age 90 in Europe because of small sample sizes, and this may raise concerns that we are underestimating expenses for the oldest old. While this is true, universal, or nearly, coverage of both health care and long-term care in these countries is a strong form of insurance and we rely on that information to assume that there is no hidden spike past age 90. In our data, in fact, past age 90 we find a *reduction* in OOP medical expenses.
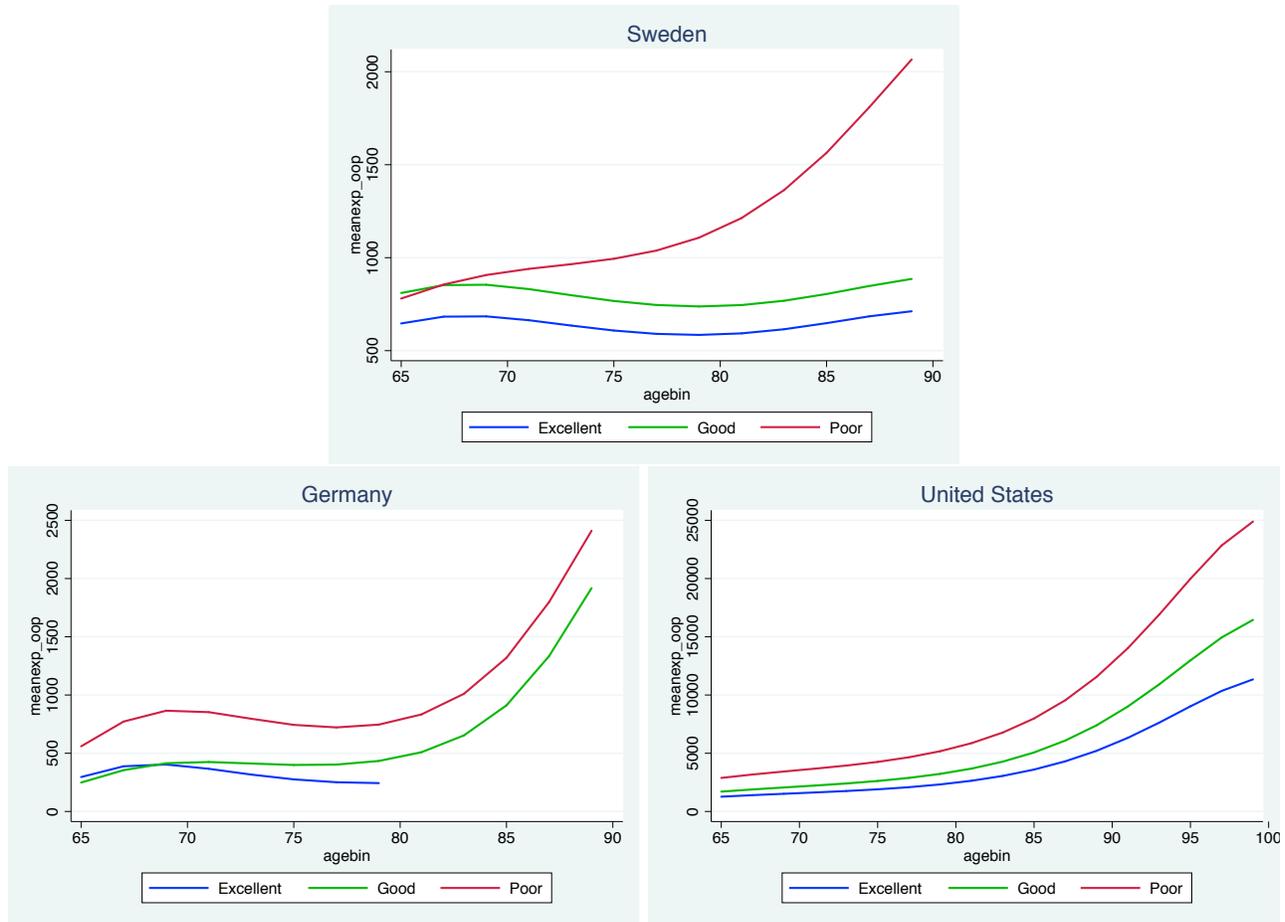
Figure 8: Expected Mean Medical Expenses by Health, Singles, Income Quintile 3

monotone in income. In Germany, where there is more OOP spending on medical care and long-term care due to a degree of privatization in the system, the upper two quintiles spend most out of pocket. At age 90, the top two quintiles spend on average about $5,000 on medical care, compared to about $2,000-$3,000 for the lower three quintiles. Finally, in the U.S. medical expenses are strongly monotonic in income, with the highest quintile at age 90 spending about $5,000 more than the next quintile down, at about $15,000, and that difference is exacerbated further later in life.

3.2 Housing Markets

There is wide variation in housing and mortgage markets across the countries in our sample, owing to differing regulations in the markets directly, and indirectly via tax policies, for example (ECB (2003)). There is variation in the extent of mortgage interest exemption, and in rental market policies, including public ownership of rental property (very high in the Netherlands, for example) and rent controls. There is significant variation in downpayment requirements at mortgage origination, ranging from minimum
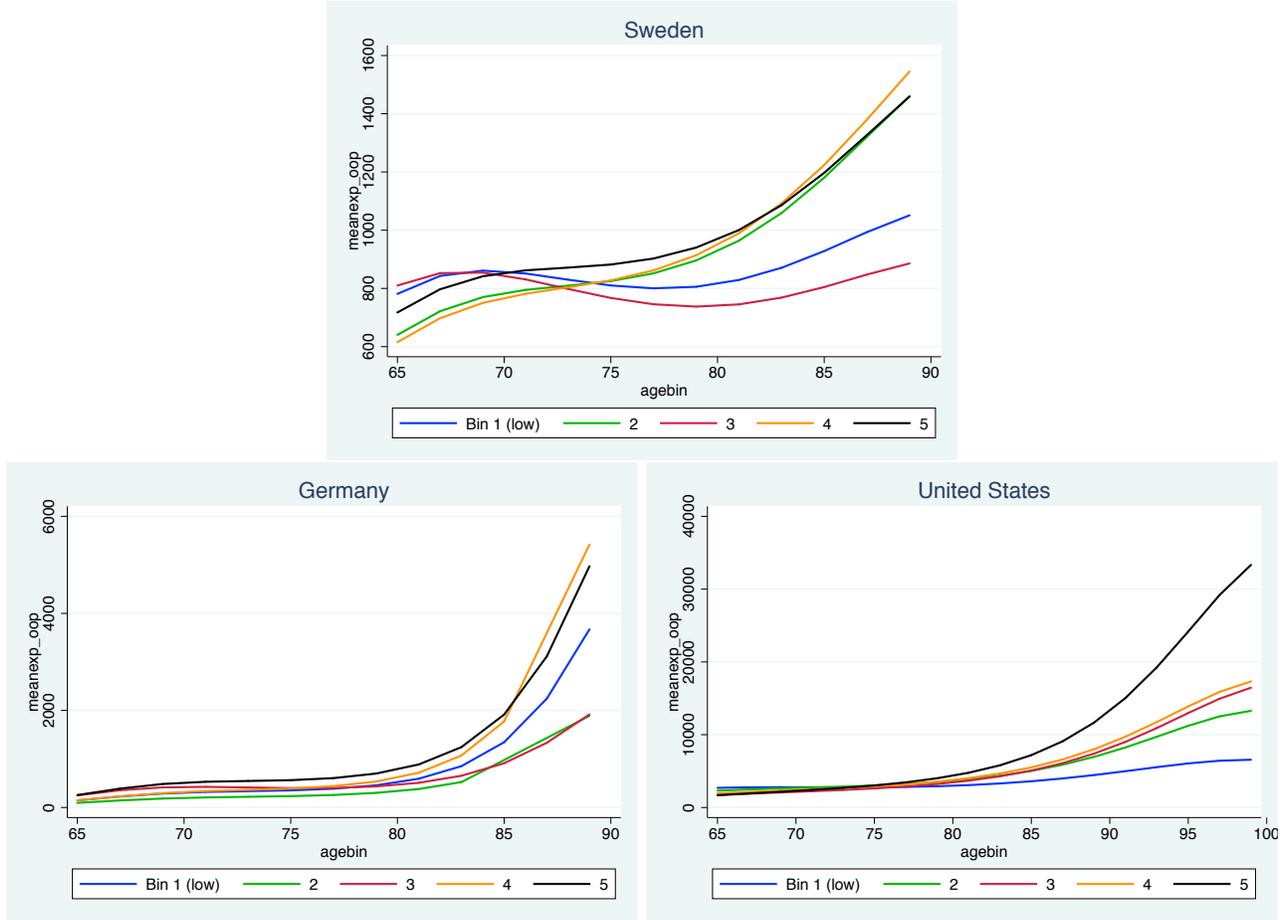
Figure 9: Expected Mean Medical Expenses by Income, Singles, Good Health

40% in Germany to no regulated minimum in the Netherlands. These factors are likely to contribute to the variation in the rate of homeownership at age 65, but as our interest is in what happens to home owners after age 65, we need to focus on differences in housing and mortgage markets targeting specifically the older population. Here, variation in availability of home equity release products for the elderly (such as reverse mortgages in the United States) may matter, and capital gains and estate taxation may play a role. We are still investigating these aspects of the countries in our sample, but for our first-pass exercise, we will not vary housing and mortgage markets across countries, in order to focus on the role of out-of-pocket expense risk. We will later relax these assumptions. Some details about housing markets for the countries in our sample are in Appendix A.3.

4 Summary of Empirical Facts

To summarize a few of our findings on the data and the institutions, first, there are two distinct groups of countries in our sample: in one group, retirees spend down their wealth much more slowly than in the

other group. Second, by looking at the respective breakdowns of housing and non-housing assets, as well as the homeownership rates, it appears that much of the difference between the two groups comes from the rate at which retirees sell their homes. To a lesser extent, some of the differences may be driven also by the rate at which retirees spend down financial wealth. Third, we observe that the classification into the two groups of countries is linked to the extent of public insurance of healthcare and long-term care. In countries where the risk of out-of-pocket expenses late in life is small due to extensive public coverage, retirees spend down their wealth faster. This will be the focus of our first quantitative investigation. It also points to differences in costs of selling a home, becoming a nursing home resident, or renting in retirement as a possible channel that accounts for how quickly retirees choose to sell their homes. Investigation of this channel, among others, is work in progress. We build the model below motivated by the key observations in the household data and the institutional structures of the countries in question.

5 Model

The model is a modified version of the baseline model in Nakajima and Telyukova (2011). In the model as in the data, we focus on retired households, so that we can avoid dealing with the labor supply decision of the elderly. (For a study on this issue using SHARE, see Erosa et al. (2012)). Thus, a household in the model starts out at age 65. Model households live until maximum age 99, but face age- and health-dependent probability of death each period.

A retiree household starts out as a homeowner or a renter. In each period, the household chooses consumption and financial saving, and makes a decision regarding housing. For a homeowner, the housing decision is whether to move out of the house or to stay in it. Homeownership provides utility benefits, in addition to consumption services from the house; these capture factors such as attachment to one's house and neighborhood, the ability to modify one's house to individual taste, but also some financial benefits of ownership that are not explicitly in the model, such as tax exemption of imputed rents of owner-occupied housing, mortgage interest payment deduction, or insurance against rental rate fluctuation. In addition, homeowners are able to borrow against their home equity; the collateral constraint can change with age. See Nakajima and Telyukova (2012) for the motivation of this assumption.

For a renter, the housing choice is only the size of the rental property. We abstract from the decision of a homeowner to move to a different, most likely smaller, house, or the decision of a renter to buy a house. These abstractions are motivated by the observation in the data that the proportion of homeowners making downsizing moves is small, as is the proportion of renters who purchase a home late in life. Finally, renters are not able to borrow; this is motivated by the observation in our data that the median amount of unsecured debt among retirees is small, regardless of the country.

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In addition to the mortality shocks, all households are subject to two other types of idiosyncratic shocks: a health status shock, which is conditioned on age and current health, and out-of-pocket medical expenditures, conditioned on age, health status and income.

Households get pension income, as well as interest income from their financial assets if any. Households also have access to a government-provided consumption floor, which captures social insurance programs for the impoverished elderly such as Medicaid in the United States. Finally, households have a warm-glow bequest motive.

From the perspective of country comparison, the features of the model that can be changed to examine cross-country variation are health status shocks, medical expense shocks, details of the mortgage and housing markets, expressed via transaction costs and collateral constraints, and the consumption floor. We will also vary the initial type distribution of households to match each country's data distribution. We discuss this further in the Calibration section.

Formally, the state variables of a household are (i, b, m, x, h, a): its age, income, health status, medical expenses, amount of housing, and its financial assets. In order to save notation, we use $h = 0$ to represent a renter. $h > 0$ means that a household is a homeowner with a house size of h.

The simplest problem is the problem of the renter. We describe it in recursive form, using primes to denote the next period:

$$V(i, b, m, x, h = 0, a) = \max_{\tilde{h}, a' \geq 0} \left\{ u(c, \tilde{h}, i, 0) \right.$$
$$\left. + \beta \sum_{m' > 0, x'} \pi^m_{i+1, m, m'} \pi^x_{i+1, b, m', x'} V(i + 1, b, m', x', 0, a') + \beta \pi^m_{i+1, m, 0} v(a') \right\} \quad (1)$$

subject to:

$$\tilde{c} + a' + r_h \tilde{h} + \nu_i x = (1 + r)a + \psi_i b \quad (2)$$

$$c = \begin{cases} \max\{\nu_i \underline{c} - r_h \tilde{h}, \tilde{c}\} & \text{if } a' = 0 \\ \tilde{c} & \text{otherwise} \end{cases} \quad (3)$$

The renter chooses the level of financial assets to carry over to the next period (a') and the property that he rents in the current period $(\tilde{h})$ to maximize the sum of three components. The first component is the period utility, which is a function of nonhousing and housing consumption, the tenure status of the renter, $o = 0$, and average household size for age i. The second component is the discounted expected future value conditional on surviving to the next period $(m' > 0)$. Notice that b does not change, and the renter remains a renter $(h' = h = 0)$. The expectation is formed based on the transition matrix π^m of the health status shock, which depends on age $i + 1$ and current health m,

and π^x of the medical expense shock, which depends on next period's age, income and health status. The third component of the maximand in the Bellman equation (1) is the utility from bequests, where $m' = 0$ indicates death. Notice that, for a renter, the only assets left as estate are financial assets (a'). Equation (2) is the budget constraint of the renter. The parameter ψ_i multiplying income is a scaling parameter that allows us to account for data couple versus single households, and is age-specific to capture how the probability of being a couple changes with age. The term $\nu_i x$ captures the medical expense shock, adjusted for household size in an age-specific way. Equation (3) represents the lower bound of consumption guaranteed to the household through the social insurance program, which is also dependent on the household size. The consumption floor is available only when the renter chooses not to save anything $(a' = 0)$ and the cost of the rent is figured in as part of the benefit.

The recursive problem of a homeowner is a choice between staying in his current house (V_1), or selling the house and becoming a renter (V_0).

$$V(i, b, m, x, h, a) = \max\{V_0(i, b, m, x, h, a), V_1(i, b, m, x, h, a)\} \tag{4}$$

The problem of the owner who decides to sell and become a renter is:

$$V_0(i, b, m, x, h, a) = \max_{a' \geq 0} \{u(c, h, i, 1)$$

$$+ \beta \sum_{m'>0, x'} \pi^m_{i+1,m,m'} \pi^x_{i+1,b,m',x'} V(i+1, b, m', x', 0, a') + \beta \pi^m_{i+1,m,0} v(a')\} \tag{5}$$

subject to:

$$\tilde{c} + a' + \nu_i x + h(\kappa + \delta) = h + (1 + \tilde{r})a + \psi_i b \tag{6}$$

$$\tilde{r} = \begin{cases} r & \text{if } a \geq 0 \\ r + \iota_m & \text{if } a < 0 \end{cases} \tag{7}$$

$$c = \begin{cases} \max\{\nu_i \underline{c}, \tilde{c}\} & \text{if } a' = 0 \\ \tilde{c} & \text{otherwise} \end{cases} \tag{8}$$

Relative to the renter problem above, first, the current tenure status is a homeowner $(o = 1)$ with the house size of h, in the period utility function. Second, the budget constraint (6) does not include rent, but includes income from selling the house h, net of the current maintenance cost (δ) and the selling cost (κ). Third, the interest rate is different depending on whether the homeowner is a net saver (in this case the interest rate is r), or a net borrower (the interest rate is $r + \iota_m$). Fourth, the household is eligible for the consumption floor if $a' = 0$. Also notice that the household begins the next period as a renter $(h' = 0)$.

The problem of the homeowner who decides to stay in his house is characterized by:

$$V_1(i, b, m, x, h, a) = \max_{a'} \{ u(c, h, 1)$$

$$+ \beta \sum_{m' > 0, x} \pi^m_{i+1, m, m'} \pi^x_{i+1, b, m', x'} V(i+1, b, m', x', h, a') + \beta \pi^m_{i+1, m, 0} v(h + a') \} \quad (9)$$

subject to (7) and:

$$\tilde{c} + a' + \nu_i x + h\delta = (1 + \tilde{r})a + \psi_i b \tag{10}$$

$$a' \geq -h(1 - \lambda_i) \tag{11}$$

$$c = \begin{cases} \max\{\nu_i \underline{c}, \tilde{c}\} & \text{if } a' \leq \min(0, a) \text{ and } h \leq \overline{h} \\ \tilde{c} & \text{otherwise} \end{cases} \tag{12}$$

First, a stayer homeowner can borrow against the house up to $1 - \lambda_i$ percent of equity. Second, in the case of death, the estate is the consolidated asset position, which now includes the value of housing (h). Third, the budget constraint includes the maintenance cost (δh). Fourth, the homeowner is eligible for the consumption benefit only if the value of his house is below some threshold value $\overline{h}$, and if the homeowner is a debtor, he keeps his debt.

6   Calibration

The goal of the computational experiment is to evaluate the extent to which differences in OOP medical and long-term care expense risk, housing and mortgage markets, and bequest motives can account for similarities and differences in saving in retirement across countries. The differences in OOP expense risk are directly observable in our data, and we begin with the experiments to address this question. Quantifying the differences in housing and mortgage markets, and mapping them to our model, is less direct and is work in progress. Bequest motives are hardest to measure in the data and map to the model; this will be the next step in our investigation.

We focus on the distinction between the high-RSP and low-RSP countries, and as representatives choose the U.S. and Sweden, respectively. As we discussed above, Sweden is one of the polar opposites of the U.S. in that it has universal public insurance both for medical care and for long-term care.

First, we calibrate our model to the United States data. Our calibration proceeds in two steps: in the first step, we calibrate the parameters that are directly observable in the data, while in the second, we estimate the remaining parameters to match the cross-sectional age profiles that we documented in the data for the U.S. Then, in a series of experiments, we keep the preference (second-stage) parameters fixed, and recalibrate desired observable parameters that describe institutions in Swedish data. The experiments change the institutions sequentially, so that we can isolate the influence of each; this is

work in progress. For each alternative calibration, we compute the optimal saving decisions of retirees, to see how closely the model can account for the differences between U.S. and Swedish data.

6.1 First-Stage Calibration

6.1.1 Health Status and Mortality Risk

In both the HRS and SHARE, households are asked to self-report their health status, and we group it into three categories: excellent (1), good/average (2) and poor (3). We also add death (0), so the transition matrix is defined accordingly. We estimate the transition probabilities by age and current health status. In the HRS, we take any pair of consecutive survey waves (1996-1998, 1998-2000, 2000-2002, etc.) and assuming stationarity, pool them all together to create two "pooled" consecutive waves. In SHARE, we only have two consecutive waves, and hence compute the probabilities based on 2004-2006 waves. Table 1 presents the resulting probabilities for the U.S. and Sweden, for four selected age groups; to be clear, as model input, we estimate separate probabilities for each model age (i.e. age 65, 67, 69, etc.)

The measured transition probabilities in Sweden are slightly noisier than in the U.S. because unlike in the HRS, we are unable to pool multiple waves together, and thus the higher the age, the smaller our sample size. In the early 90's, the sample is so small that we are forced to combine ages further (instead of age 95, we present ages 89-93). Some resulting irregularities and nonmonotonicity aside (e.g. occasional zero probabilities for Sweden), the numbers in Sweden and the U.S. are comparable in magnitude, and have the logical tendency: probability of death increases in age and is higher the worse is the respondent's health. In addition, health deteriorates with age (not shown in the table), and is less persistent with age, owing to a higher probability of death. We plan to confirm and make more robust the mortality numbers with another source from Swedish data, because in many sample attrition cases in SHARE, we cannot identify whether the former respondent is still alive or died; in such cases, we do not assume death.

6.1.2 Medical Expenses

We estimate the distribution of log-OOP medical expenditures by age, health, income quintile and household size (single or couple).The mean, standard deviation and probability of zero expenses are estimated as quartics in age, and include interaction terms between age and the other three variables. Under the assumption of log-normality of medical expenses, we then compute the expected mean and standard deviation of level medical expenses. Figure 10 reproduces, once again, mean medical expenses for the U.S. and Sweden, for single households in the middle income bin by health. As we would expect, people in worse health pay higher expenses, but in Sweden, the differences in expenses by health are

Table 1: Health Status Transition, Selected Age Groups (Percent)

		UNITED STATES							

Age 65 / **Age 75**

Age 65	Dead	Excellent	Good	Poor	Age 75	Dead	Excellent	Good	Poor
Excellent	1.3	72.8	21.5	4.4	Excellent	3.9	60.1	26.9	9.2
Good	2.2	25.8	53.3	18.7	Good	6.6	21.1	46.9	25.4
Poor	9.6	6.1	20.7	63.7	Poor	16.3	3.8	17.6	62.3

Age 85	Dead	Excellent	Good	Poor	Age 95	Dead	Excellent	Good	Poor
Excellent	10.5	46.8	27.1	15.6	Excellent	28.5	29.5	19.8	22.3
Good	14.7	17.0	37.8	30.5	Good	32.9	12.9	26.8	27.5
Poor	28.8	5.1	13.2	52.9	Poor	56.9	4.2	13.6	25.3

SWEDEN

Age 65	Dead	Excellent	Good	Poor	Age 75	Dead	Excellent	Good	Poor
Excellent	0.4	65.7	23.7	8.3	Excellent	3.8	54.3	20.8	21.0
Good	2.7	17.6	44.8	34.8	Good	0.8	16.4	40.0	42.8
Poor	0.0	3.7	23.4	72.9	Poor	18.4	12.1	10.7	58.9

Age 85	Dead	Excellent	Good	Poor	Age 89-93	Dead	Excellent	Good	Poor
Excellent	8.2	45.2	22.3	24.3	Excellent	25.5	32.7	24.5	17.4
Good	6.1	5.2	42.6	46.2	Good	16.8	11.8	33.5	38.0
Poor	20.2	0.0	17.0	62.8	Poor	13.9	0.0	7.4	78.8

[1] Sources: HRS 1996-2006, SHARE 2004-2006.

small compared to the U.S., and, as we mentioned before, the level of expenses is also an order of magnitude lower.

6.1.3 Initial Distribution at Age 65

As another input into the model, we construct the initial distribution of households across all the state variables at age 65. The dimensions of the distribution are thus income quintile, health status, homeownership status and amount of housing for homeowners, and the financial asset position. We
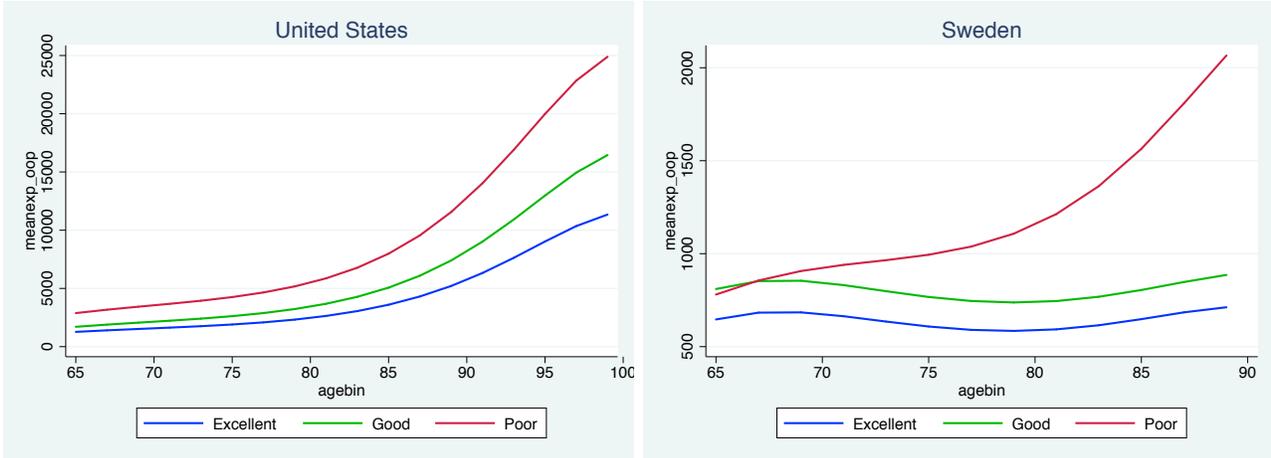
Figure 10: Expected Mean of OOP medical expenditures, mid-income singles, by health

treat income as fixed with age, as it incorporates pension and social security income and does not vary with the life cycle in our data. Tables 2 and 3 summarize the dimensions of the initial distribution not already discussed. The distribution of health states is similar in the U.S. and Sweden, although 8 percentage points more respondents classify themselves in excellent health in the U.S. than in Sweden. As already discussed, the home ownership rate is higher in the U.S. than in Sweden at age 65, and somewhat more retirees are net borrowers in Sweden at age 65. The income distribution displays more dispersion in the U.S. compared to Sweden. In order to measure income comparably in the U.S. and Sweden, we had to convert U.S. income into after-tax terms, since the HRS measures income before tax. We did so using the 2006 tax tables.

6.1.4 Remaining First-Stage Parameters: Housing Costs

Table 4 shows the calibration for housing cost parameters that we use. We take these numbers directly from the data or the literature for the United States. The saving interest rate is 4% per year, since the financial asset in the model captures all of the financial assets that retirees hold. The mortgage interest premium is 1.6% above that rate, that is, the mortgage interest rate is 5.6%. The maintenance cost of a house is 1.7% per year of the house's value. The selling cost of a house is 6.6% of the house's value, and captures all the financial and time costs associated with the process of selling a house. See Nakajima and Telyukova (2012) for justification of these parameter choices.

As we mentioned, for the first experiment we will assume these parameters to be the same in Sweden. Later on we will relax that assumption and calibrate these numbers to Swedish markets, where appropriate.

Table 2: Initial Distribution at Age 65

	U.S.	Sweden
Health status		
1 (excellent)	0.46	0.38
2 (good)	0.32	0.33
3 (poor)	0.22	0.29
Tenure		
Homeowner	0.88	0.82
Renter	0.12	0.18
Net financial asset position		
Saver	0.79	0.73
Borrower	0.21	0.27

Table 3: Initial Distribution at 65 – Income Bins

	1	2	3	4	5
U.S.	8,028	14,517	21,330	30,273	48,920
Sweden	10,500	14,203	16,796	21,579	33,974

After-tax income. 2000 US dollars.

6.2 Second-Stage Calibration: United States

We estimate the remaining parameters for the baseline model to the United States data. The parameters include preference parameters and some others; the estimation matches U.S. cross-sectional age profiles that we described in the Data section to the ones derived from the model.

With respect to preferences, households discount the next period using the factor β. We use the following period utility function with constant relative risk aversion:

$$u(c, h, i, o) = \frac{\chi_i \left(c^\eta (\omega_o h)^{1-\eta} \right)^{1-\sigma}}{1-\sigma} \tag{13}$$

η is the Cobb-Douglas aggregation parameter between non-housing consumption goods (c) and housing services (h). σ is the risk aversion parameter. ω_o represents the extra utility of housing. For renters ($o = 0$), ω_0 is normalized to unity. For homeowners ($o = 1$), $\omega_1 > 1$ represents benefits of homeownership, both financial that we do not explicitly model, and nonfinancial. χ_i is the adjustment for household

Table 4: First-Stage Housing Cost Parameters, U.S.

Parameter	Description	Value
δ	Maintenance cost of housing[1]	0.017
κ	House selling cost	0.066
r	Saving interest rate[1]	0.040
ξ	Mortgage interest premium[1]	0.016

[1] Annualized value.

size, which takes into account the household equivalence scale in consumption and aggregation of utility according to the age-specific probability that the household is a couple.[4]

A household gains utility from leaving bequests. When a household dies with the consolidated wealth of a, the household's utility function takes the form:

$$v(a) = \gamma \frac{(a + \zeta)^{1-\sigma}}{1 - \sigma}.$$ (14)

Here, γ captures the strength of the bequest motive, and ζ affects the marginal utility of bequests.

In the second stage of the estimation, we estimate the parameters to maximize the fit of the model according to the cross-sectional age profiles of median net worth, housing and financial wealth, home-ownership rate and the net debt rate. We discuss the fit of the model below. Table 5 presents the estimated parameters in the second stage of the estimation. The age-specific borrowing constraint λ_i is estimated by piecewise-linear approximation, with the intervals being 10 years long. Thus, the borrowing constraint of a 67-year-old is not the same as that of a 65-year-old. The parameters imply that although retirees at age 65 begin with a fairly loose collateral constraint (they are able to borrow up to 91% of their home equity), they quickly become constrained, so that by age 75 they can only access 12% of their home equity. This is a parsimonious way to capture the fact that in the data, borrowing becomes very costly for the elderly. Some, possibly a lot, of this cost comes from the supply side: elderly borrowers do not have easy access to traditional equity borrowing instruments because they fail the inherent income requirement (Caplin (2002)). The market that exists for reverse mortgages – instruments targeted at elderly borrowers – appears thin, which is both demand- and supply-side driven (Nakajima and Telyukova (2011)). Here, we capture all these factors in reduced form via λ_i.

The coefficient of risk aversion σ is on the lower end of the standard range in the macro literature, at around 2.5. The estimates imply that living in an owned home gives retirees 3.7 times the utility

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[4]Specifically, $\chi_i = \mathbb{P}_i(s = 1) \times 1 + \mathbb{P}_i(s = 2) \times 2(1/1.34)^{1-\sigma}$, where $\mathbb{P}_i(s = n)$ is age-specific probability of household size being n, 1.34 is the household eqivalence scale for couples, and utility is multiplied by 2 if the household is a couple.

Table 5: Second-Stage Estimated Parameters, U.S. Benchmark

Parameter	Description	Value
β	Discount factor[1]	0.97
η	Consumption aggregator	0.85
σ	Coefficient of RRA	2.53
ω_1	Extra-utility from ownership	3.70
γ	Strength of bequest motive	1.31
ζ	Curvature of utility from bequests	23555
$\underline{c}$	Consumption floor per adult[1]	12476
λ_{65}	Collateral constraint for age-65	0.09
λ_{75}	Collateral constraint for age-75	0.88
λ_{85}	Collateral constraint for age-85	0.99
λ_{95}	Collateral constraint for age-99	1.00

[1] Biennial value.

benefit of being a renter. As we mentioned before, this parameter captures both utility benefits, such as attachment to the house, the neighborhood, the custom features of the house, as well as financial benefits, such as insurance against rental rate risk or tax exemption of mortgage interest, which we do not model explicitly. Finally, the consumption floor per adult is estimated at \$12,476 per adult per two years. This is in line with the non-Social-Security social insurance benefit computed by Hubbard et al. (1994), adjusted for inflation. Finally, we estimate the strength of the bequest motive at 1.3, and the curvature parameter at \$23,555 – this parameter affects the threshold of wealth at which retirees find it valuable to accumulate a bequest.

To assess the fit of the model with these parameters, figure 11 shows the age profiles in the U.S. data and in the model of median net worth, homeownership rate, median housing assets conditional on ownership, median financial assets, and proportion of retirees in debt (with negative financial assets). The model replicates median total assets and the homeownership rate nearly perfectly. Consequently the matches on the age profiles of housing and financial wealth are very close as well, although the model produces a slightly flatter median housing profile than the data. The model predicts a slightly slower rate of debt payoff at earlier ages, but overall gets the indebtedness rate very well.

It is worth noting that the parameters appear well-identified, in the sense that the estimation converges to this set of parameters regardless of initial conditions. We will later demonstrate this robustness through sensitivity analysis, which is work in progress.
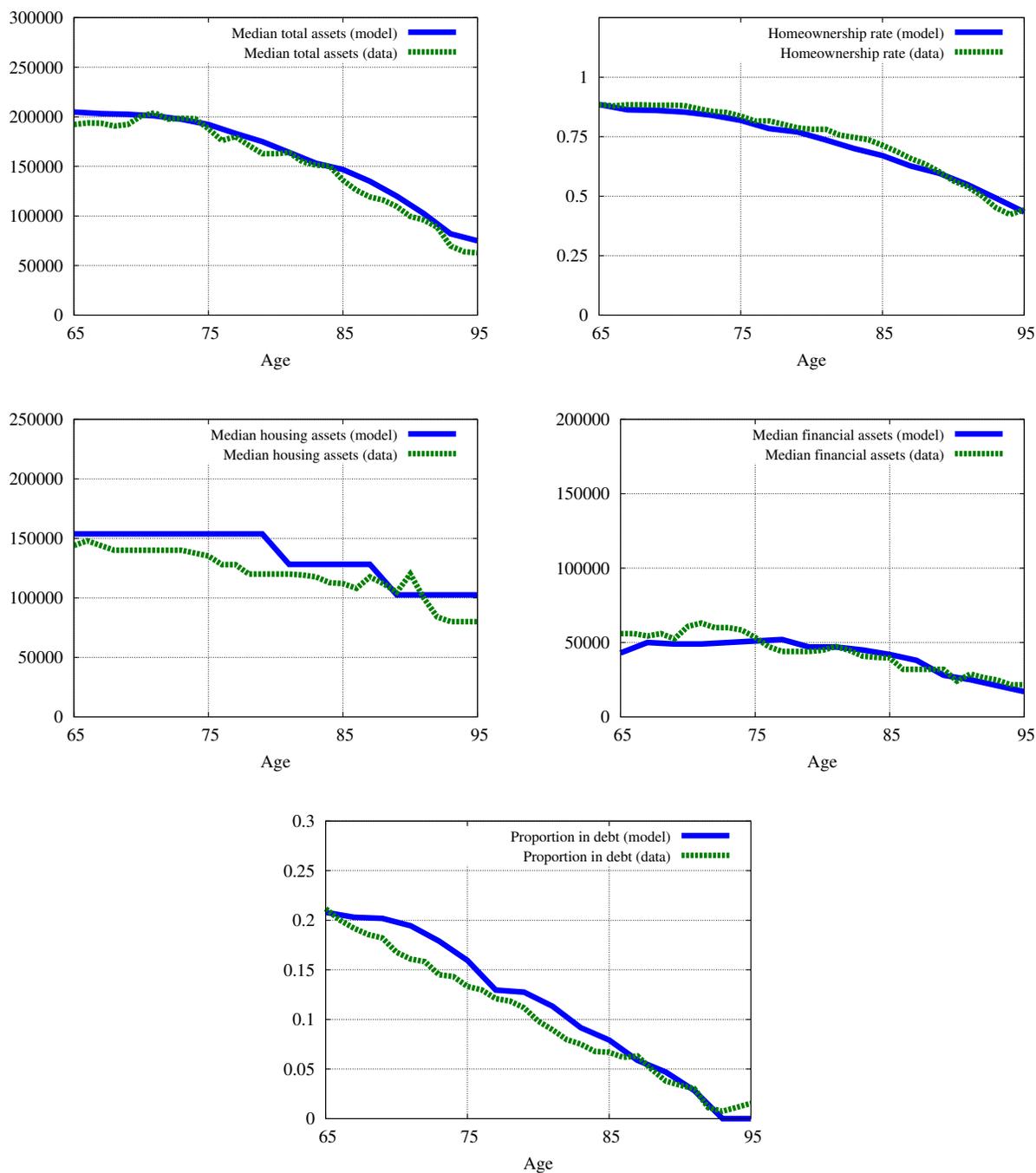
Figure 11: Benchmark Model Fit – Age Profiles in Model vs. U.S. Data

7 Experiments

7.1 Effect of OOP Expense Risk on Saving in Retirement

In this experiment, we use the preference parameters that we estimated in the model for the U.S., and under the assumption of preferences being identical in Sweden, as well as housing and mortgage markets being identical, change only the observable inputs for health status shocks, medical expense shocks, and the initial distribution, as described in section 6.1.

Figure 12 presents the predictions of the experiment. In each graph, we show U.S. (thick blue dash) vs Swedish data (thin pink dash), and the predictions of the benchmark model (thick blue solid) versus the experiment model (thin pink solid). First, notice that the differences between the data profiles are moderate when it comes to homeownership (similar slopes, slightly different levels) and the median housing profile. They are more pronounced with respect to the indebtedness rates of retirees (higher in Sweden than the U.S. until later in life), and noticeable with respect to median net worth and median financial assets. We see faster decumulation of net worth among younger retirees in Sweden, which is mirrored by the faster decumulation of financial assets as well.

Next, notice that while the U.S. model matches the U.S. data well, the experiment model – with just the health and medical-expense inputs changed, as well as the initial distribution – matches the homeownership and median housing asset profiles well, but underpredicts the rate of decumulation of net worth relative to Swedish data. This is driven by two factors: first, retirees in the Swedish model repay debt too quickly relative to the data; second, they do not spend down financial wealth quickly enough.

Another way to see this is to recognize that unlike in the data, in the model with only the initial distribution, health and OOP shocks changed, the rate of dissaving in retirement is very similar. Instead, a lot of the similarities in the profiles are created by similar homeownership behavior in the two countries. The different *levels* in some of the profiles are likely accounted for by different initial conditions. We confirm this in the experiment where, in the benchmark model, we still use Swedish inputs for health and OOP expense shocks, but keep the initial distribution as in the U.S. This model behaves similarly to the benchmark, as shown in figure 13. That is, the differences in the levels of wealth in the first experiment are created primarily by differences in the initial conditions at retirement between the two countries. Of course, it is also important to point out that the differences in initial conditions may be accounted for by different anticipated levels of uncertainty late in life in the two countries; establishing this vigorously would require a full life-cycle model, and is outside the scope of this paper.

From these experiments, we conclude that OOP medical expenses alone cannot account for the
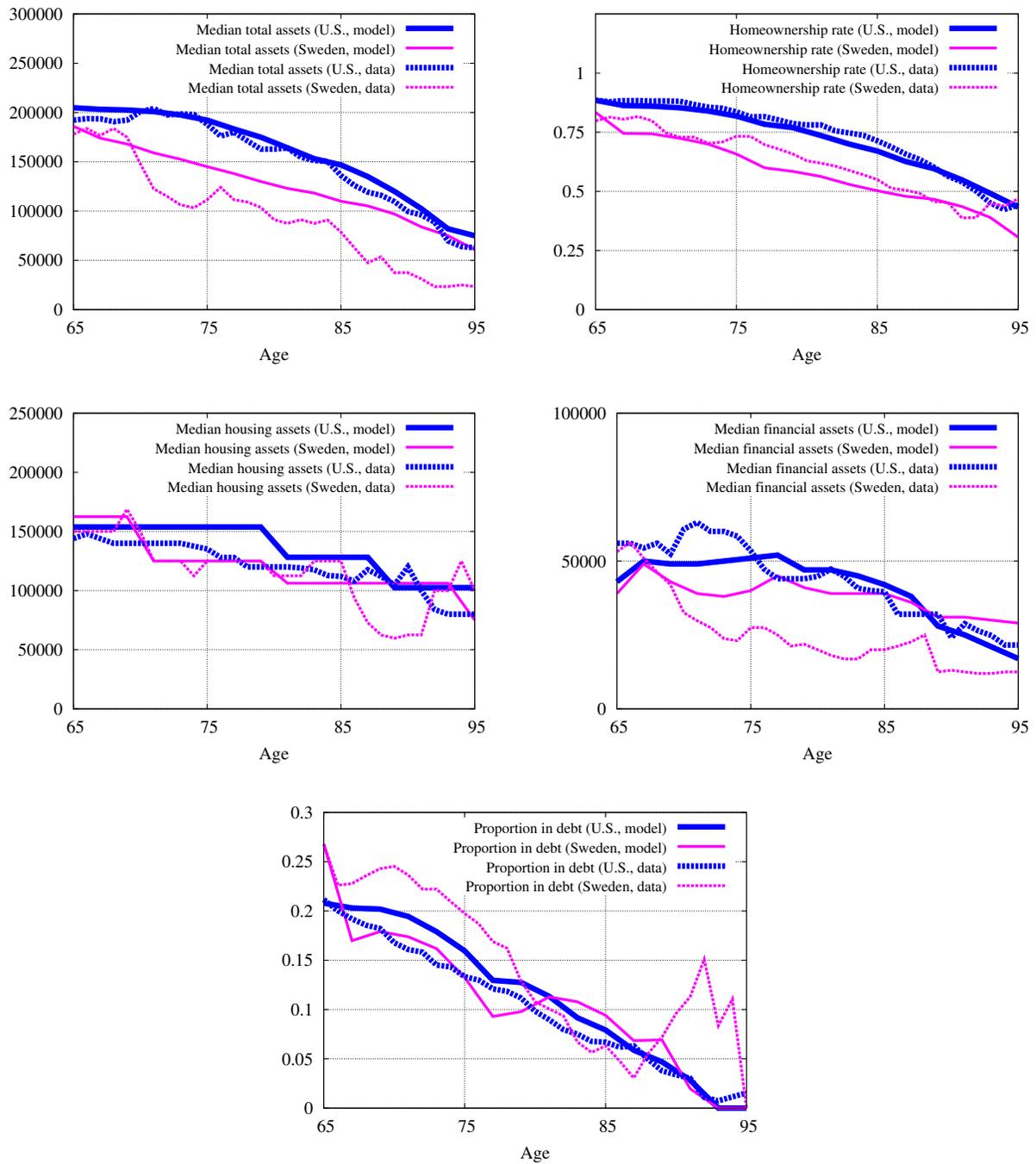
**Figure 12: Role of OOP Expenses and Initial Distribution – U.S. vs Sweden, Model and Data**
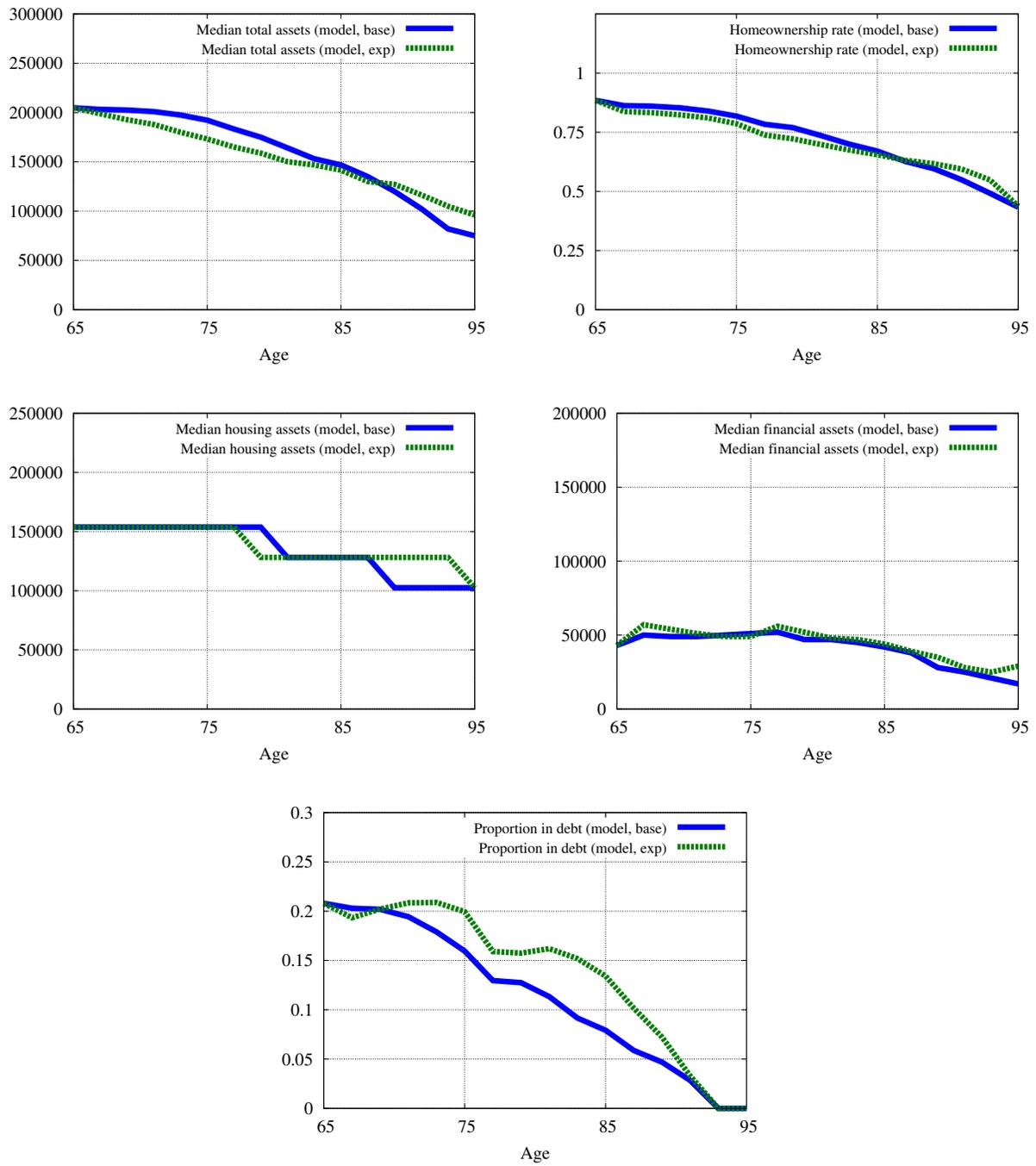
Figure 13: Role of Initial Distribution – Benchmark vs Sweden Model with U.S. initial distribution

salient differences in saving profiles between the U.S. and Sweden. Other factors must also be at play. In particular, given that the Sweden model underpredicts the indebtedness rate, it appears that the parameters that we use in this experiment to capture the mortgage market, which are consistent with the U.S., may be misrepresenting the environment in Sweden. In the next experiment, we will evaluate how a possible difference in mortgage markets change the predictions of the model.

7.2 Effect of Mortgage Markets on Saving in Retirement

In this experiment, in addition to changing health and medical expense shocks and the initial distribution, we also re-estimate the collateral constraint parameters λ_i for the Swedish model, in order to match the percent of the population that is in debt. The goal is to evaluate whether differential ability to borrow against one's house can be responsible for some of the differences in the rates of dissaving in high-RSP versus low-RSP countries. (To be continued.)

8 Discussion and Agenda

One way to view the data comparison of countries where retirees dissave slowly (high-RSP countries) versus quickly (low-RSP countries), i.e. of the U.S. versus Sweden in our example, is that the age profiles of assets, debt and homeownership are moderately different but contain important similarities. While there is a difference in the rate of dissaving, in both the U.S. and Sweden, homeownership is prevalent and many retirees are still homeowners late in life.

Looking at the institutions that we examined so far, an obvious difference is in out-of-pocket medical and long-term care expense risk; Sweden is a far more low-risk environment. This is the obvious factor to investigate, which is the first thing we do here. We find that the moderate differences in the dissaving rates of the two countries are partly accounted for by the differences in medical expense risk, and partly by the difference in the initial conditions – which may well be connected to these risk differences. However, the flip side is that the dramatically different degrees of medical expense risk do not produce dramatic differences in the rate of dissaving in retirement.

Instead, the similarities between the two countries are well accounted for by the behavior of retirees with respect to housing. Thus, we conclude that housing is an important explanatory factor for the retirement saving puzzle. As the next step, we are evaluating the role of collateral constraints in old age. We are also in the process of measuring and testing the impact of other cross-country differences in institutions and environments that we mentioned earlier, such as housing transaction costs, the extent of development of reverse mortgage markets, differences in estate and capital gains tax laws and the like.

These preliminary findings on the importance of housing and mortgage markets in impacting the

way that retirees (dis)save in retirement are consistent with our conclusions in Nakajima and Telyukova (2012). In that paper, we also investigate what accounts for the desire of retirees to stay in their homes late into their lives. There we found that this behavior is accounted for by bequest motives dominating precautionary motives late in life.

Thus, as the next step, we plan to delve deeper into the comparison of bequest motives across the two countries. In particular, we will gather more information in our data about the retirees' family composition, and the extent of formal versus informal long-term care. Insofar as these data may give us additional information about bequest motives for the model, we may do further work on the model to ask whether our assumption of uniform preferences across countries is justified.

Second, we also want to investigate distributional differences in asset accumulation and decumulation among retirees. Even looking at the wealth or income distribution, shown above, it is clear for example that in Sweden, inequality is much narrower than it is in the U.S. This observation can be extended, for example, to look at which tiers of the population participate in homeownership versus financial asset accumulation. We will describe these facts in the data and then use our model to address these distributional facts.

9 Conclusion

We use harmonized cross-country data on twelve developed economies to document the patterns of (dis)saving among retirees in housing versus non-housing assets, and the extent of the retirement saving puzzle in these countries. We find that countries in our sample vary noticeably in the extent of the puzzle: one group of countries looks like the U.S., while in another group, retirees spend down their wealth much more rapidly.

Once we document the data facts, we focus on the cases of the U.S. and Sweden. We pose a rich life-cycle model of homeownership and saving in retirement. To date, we used this model to evaluate quantitatively how much risk of large out-of-pocket medical expenses and variation in long-term care provision impact the lifecycle patterns of home ownership, housing and financial asset accumulation, as well as borrowing, in retirement. Consistent with our previous work, we find so far that housing plays a large role in retiree saving, while the risk of out-of-pocket spending plays a moderate role.

In future experiments, we will investigate the distributional differences in saving in retirement across our countries of choice, and investigate further what the data tell us about possible differences in bequest motives.

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APPENDIX

A   Institutional Details

A.1   Health Care

This information is based on Allin et al. (2005).

Austria: statutory health insurance (SHI) - covers 95% of population mandatorily, 2% voluntarily. 19% of total expenditure was financed from user charges or direct payments (2000). Contributions represent from equal shares from employees and employers, accounting for 7.4% of salary in 2004. There are ceilings for max income and contributions.

Belgium: 99% of population are covered by compulsory health insurance; reimbursements are differentiated by social-risk status, and thus, patients finance about 19% of health expenditure mostly through OOP payments (as well as some voluntary health insurance premiums). OOP payments are capped based on family income and "other socioeconomic factors".

Denmark: tax-based universal system. Private payments cover about 17% of costs, via OOP co-pays for PT, dental, glasses and drugs, as well as contributions to voluntary health insurance schemes. (About 30% of population purchases VHI coverage for the co-pays.)

France: covers via national social insurance system by tax-based financing and complementary VHI. OOP payments cover 9.8% of total expenditure, VHI premia – 13.2%.

Germany: universal healthcare coverage; OOP expenses only for drugs (copays). Starting in 2004, co-pays introduced for outpatient visit and have been raised for other benefits.

Greece – one of the most "privatized" in the EU; voluntary payments by individuals or employers represent 42% of total health expenditure (2002). There are both compulsory HI and VHI schemes, the latter purchased by 8% of population.

Italy – universal healthcare; OOP payments capped at EUR36 since 2002 for outpatient care; co-pays for drugs and specialist services are low and make a low contribution to overall cost (2.9% in 2002). There are also *private* healthcare services and OTC drugs that require OOP payment; 15% has complementary private health insurance either individually or through employer.

Netherlands –(a) national insurance scheme for exceptional/ high-cost medical expenses; (b) compulsory sickness funds for those with income below EUR 30000, with PHI for those above the ceiling (28% of population). (c) Supplementary private insurance covers dentists and the like. PHI and OOP payments cover , respectively, 16% and 5% of total medical costs.

Spain - universal public care, plus 15% of population purchase also private insurance (to avoid lines).

Sweden – compulsory tax-based system for the entire population; voluntary additional insurance is

very limited. Private expenses are OOP and premia (14% of total); 90% of employers pay for voluntary insurance to avoid paying for sick leave.

UK – NHI renders OOP medical expenses at zero; uptake of private medical insurance is low (11.5% of population). Service is usually free at point of service.

A.2 Long-Term Care

Based on the information in OECD (2005), we categorize the countries as follows:

(A) All public long-term care, no means-testing, no OOP expenses: Sweden, Netherlands, Denmark, Norway (not in our sample). *Eligibility does not depend on assets.*

(B) A mix, some OOP expenses: Austria, Germany. *Low or no dependence on assets.*

(C) A lot of OOP expenses/means-testing: Spain, Switzerland (not in sample), Italy, UK, US. *Eligibility depends on assets.*

Group A: Netherlands provides both home-care (consumer-directed budged) and institutional (in-kind) care benefits, which are universal (not means-tested). On the consumer's part, income-related co-payments are required. Usage: 2.4% of those aged 65+ received long-term institutional care; 12.3% received home care benefits (2000).

Sweden similarly provides universal public long-term care in-kind benefits for both home and institutional care; users pay moderate amount of fees set by the local government. Usage: 7.9% institutional / 9.1% home care (2000).

Norway (not in our sample): also universal benefits for both home and institutional care; residents in institutions are charged about 80% of their income. Usage: 6% institutional / 18% home care (2000).

Group B: Austria provides a long-term care cash allowance universally (not means-tested), financed by general taxation, but the user will pay the difference between the benefit and actual cost, both for institutional care and home care. Usage: 3.6% of 65+ received institutional long-term care; 14.8% received home care benefits. (2000)

Germany has social long-term care insurance for both home and institutional care, which is universal (not means-tested). Benefits are in-kind for nursing home care, and cash and in-kind for home care. For home care, the average OOP to cover additional/more expensive services were about EUR 130 per month on average (2003) - I do not know if this is a conditional number. For nursing home care, board/lodging are not covered (EUR 560 per month on average). Service charges in excess of statutory

limit are EUR 313 per month on avg, though these can be covered by means-tested social assistance. Usage: 3.9% institutional / 7.1% home care (2003).

Group C: Spain: in 1998, 73% of total long-term care cost was met privately. There are social-care programs for both home and nursing home care, but they are all means-tested. In Spain, high prevalence of informal/family arrangements is noted. This is also true for Italy, where informal arrangements involving hiring of live-in help for care of the elderly are common.

Switzerland: private cost-sharing is "high" – no numbers provided. Benefits are in-kind and cash. Institutional care benefits are means-tested. Usage: 7% institutional / 5.4% home care (2000).

The U.K. has a tiered system. The NHS provides universal in-kind home-care and nursing home benefits, which is completely free. Social services provide additional such benefits, but they are means-tested, and users are charged according to ability to pay. Social Security provides cash home-care benefit in addition, which is means-tested. . Usage: 5.1% institutional / 20.3% home care (2000/2002).

In the U.S., Medicare and Medicaid both provide in-kind homecare and institutional benefits. Medicare is universal, but has limits. (E.g. home nursing care is free of charge, but skilled nursing care is only covered up to 20 days for $0 OOP, 20-100 days – $105 per day, 101+ days – user pays 100% of the cost). Medicaid is means-tested, and will require co-pay based on financial status of recipient. . Usage: 4.3% institutional / 2.8% home care (1999/2000).

A.3 Housing and Mortgage Markets

These notes are a brief summary of ECB (2003) and is the starting point of our institutional analysis. This will be filled in further. This information is not specific to retirees.

Spain, Netherlands and the UK have experienced two-digit growth rates in house prices in the 1990's; since 2002 (our data) Spain in the UK have as well. 2001-2002 saw rapid rise of house prices in Greece and Italy.

In many EU countries, tax policies are favorable to owner-occupied housing, while rental markets feature strict rent controls, which makes it favorable to be a long-term renter in particular. Denmark, France, Sweden all have provisions to index rent to house pries or costs, which at least captures a trend above CPI. In other countries, rent controls make rents particularly of sitting renters be below market conditions. Denmark, France, Netherlands have high public ownership of rental property – around half of the rental market.

House buying: mortgage interest relief in Belgium, Denmark, Greece, Spain, Italy, Netherlands, Portugal, Sweden. The U.K. phased out mortgage interest relief in the 1990's.

Ownership: property taxes in most places, though not Germany (there is land tax instead). Rates

vary from 0.025% (Greece) to 1.5% (Austria) to much higher in France.

House selling: capital gains taxes everywhere, though generally excepted for long-term owner-occupiers (exemptions for those living over 5-10 years or reinvesting within 2).

Bequests: in addition to capital gains taxes (how does it affect heirs?), there are inheritance taxes – same as for financial assets – in Belgium, Denmark and the UK; lower than financial assets in Germany; progressive between 0 and 65% in Greece, between 8 and 34% in Spain, 5-40% in France, 5-27% in NL above threshold. Sweden taxes too. In Italy, the tax was abolished in 2001. If taxing at the same rate as financial assets, then makes little difference whether to inherit a house or financial assets.

Mortgage markets: home equity withdrawal has been significant in Denmark, Netherlands and UK. In Netherlands, the average LTV for a new mortgage loan is 112% (no legal limits on LTV). Denmark requires 20% downpayment on a new mortgage loan. UK average LTV is 30%. All three have equity release products available. Among these, Netherlands and Denmark are among countries with high secured debt rates in our sample (around 40% at age 65, to 5% at 90). In Austria, average LTV is 60%; in Germany, it is 60% by law. We observe, consistent with this, noticeably lower homeownership rates in these countries.

Countries with no equity release products/not permissible: Belgium, France (or not used), Italy. They are available but unusual in Spain, of very limited use in Greece, and restricted purpose-wise in Germany.