Online Appendix
Medical Expenses and Saving in Retirement: The Case of U.S. and Sweden

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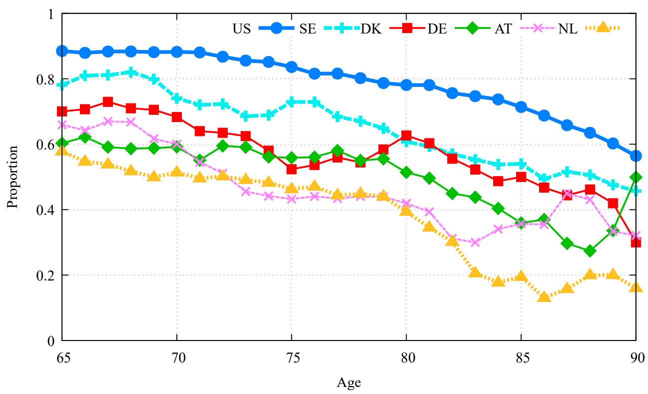
A Additional Facts for the U.S., Sweden, and Other European Countries

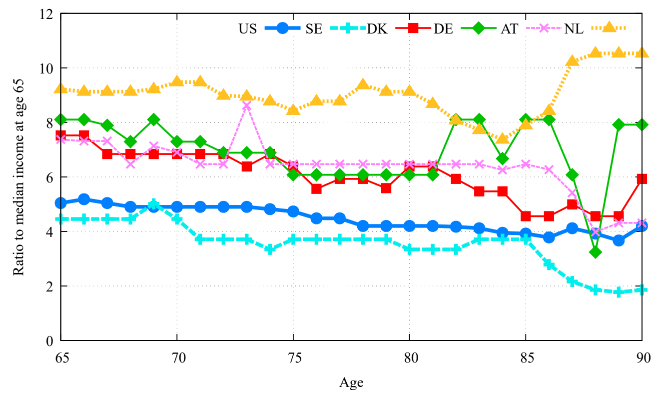
This appendix contains figures of the U.S., Swedish, and other Northern European data that are not in the main text. Figure A.1 contains (a) homeownership rate, (b) median conditional housing assets normalized by age-65 median income, and (c) median financial assets normalized by age-65 median income, for the U.S., Sweden, and four Northern European countries. This figure corresponds to Figure 1 in the main text, which shows total asset profiles for these countries. For all countries, conditional housing profile seems flat, while the homeownership profile is downward sloping but not as steep as financial asset profiles, suggesting that housing is a contributing factor for generally slow decumulation of wealth, which we argue in Nakajima and Telyukova (2020). Figure A.1(c) shows that the U.S. households decumulate financial assets more slowly than European countries, which suggests that the observed slower decumulation of wealth in the U.S. is mainly due to slower decumulation of financial assets among U.S¿ households.

Focusing on just the U.S. and Sweden, in Figure A.2 shows homeownership rate (top row), median conditional housing assets (middle row), and median financial assets (bottom row) for five income quintiles for the U.S¿ (left panels) and Sweden (right panels). The panels show what we argue using the median, namely, decumulation of housing assets is slow in both the U.S. and Sweden, and the decumulation of housing assets is mostly done by extensive margin (selling the house) instead of by intensive margin (downsizing the house). On the other hand, the observed faster decumulation of wealth among the U.S. households is mainly due to faster decumulation of financial assets among the U.S. households compared with the Swedish ones. These are true for all income groups.

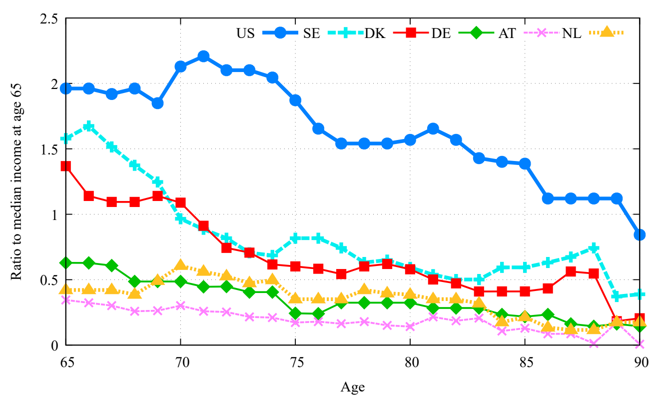
Finally, Figure A.3 shows that there is no significant differences between the U.S. and Sweden in terms of life-cycle profiles regarding debt. Panel (a) compares the overall proportion of households with a net negative financial asset position (net financial debt) for the U.S. and Sweden. They are remarkably similar, steadily declining from 20-25% at age 65 to less than 10% at around age 90. Panel (b) compares median net financial debt among debtors for the two countries. The U.S. median debt is decreasing in age, while the Swedish profile seems slightly flatter than the U.S. profile, but the difference is not large. Panels (c) and (d) compare the median debt profiles for five income quintiles, for the U.S. and Sweden. For the U.S. (Panel (c)), the median debt is generally decreasing in age for each income quintile. For Sweden (Panel (d)), it is hard to see a general tendency partly because of the small sample number of households if each income quintile is separately observed, but it seems like there is no obvious downward sloping profiles like for the U.S. profiles. Panels (e) and (f) show the proportion of households in negative financial asset position for each income quintile, for the U.S. and Sweden. For both countries, the profiles are steadily decreasing in age, as we have seen in Panel (a) which shows the overall proportion in debt. Panels (g) and (h) show that the declining profile of debt is not due to the definition of debt we use, by showing the proportion of households with gross secured debt (panel (g)) and with gross unsecured debt (panel (h)) in the U.S. and Sweden. In both countries, the proportion with gross secured debt and that with unsecured debt are decreasing in age.



(a) Homeownership Rate

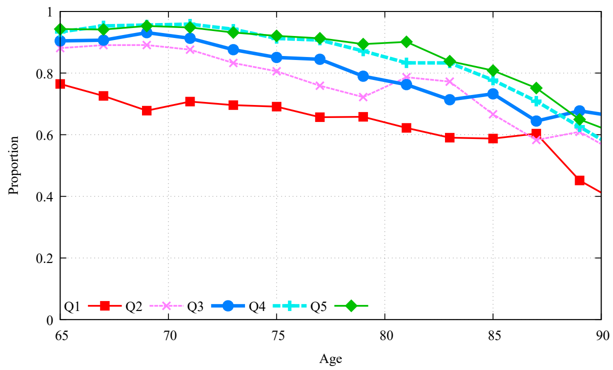


(b) Median Housing Assets / Median Inccome at 65

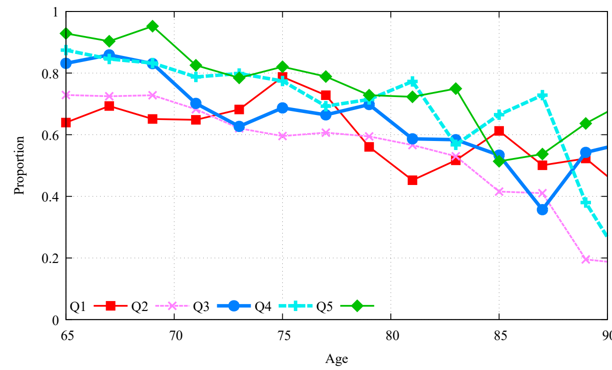


(c) Median Financial Assets / Median Income at 65

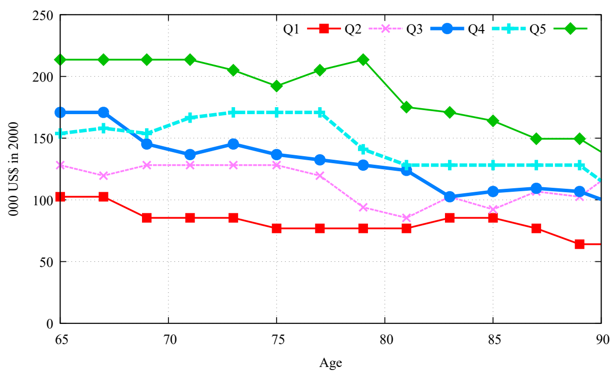
Figure A.1: Housing and Financial Asset Profiles, U.S. and Northern Europe



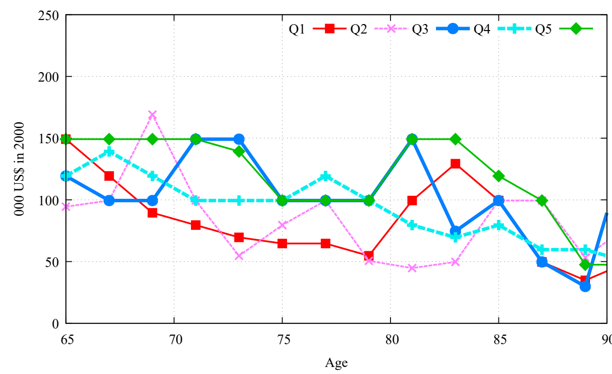
(a) U.S., Homeownership Rate



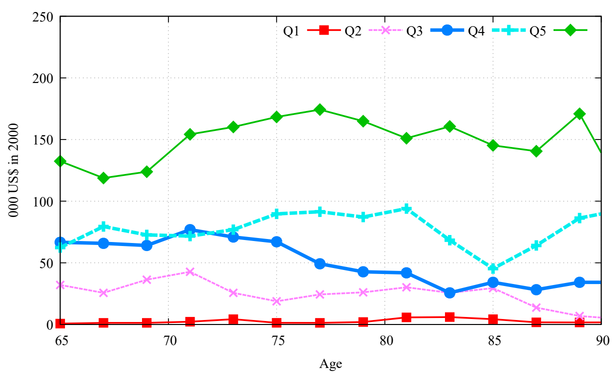
(b) Sweden, Homeownership Rate



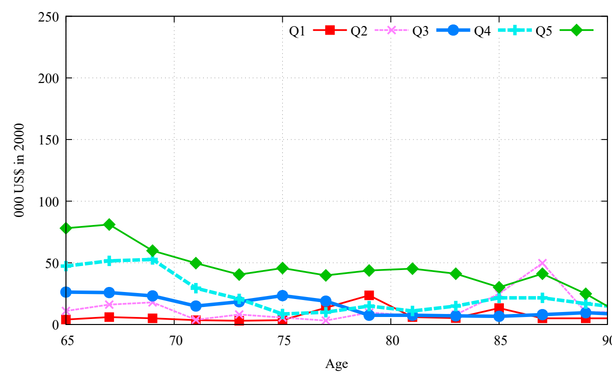
(c) U.S., Median Housing Assets



(d) Sweden, Median Housing Assets

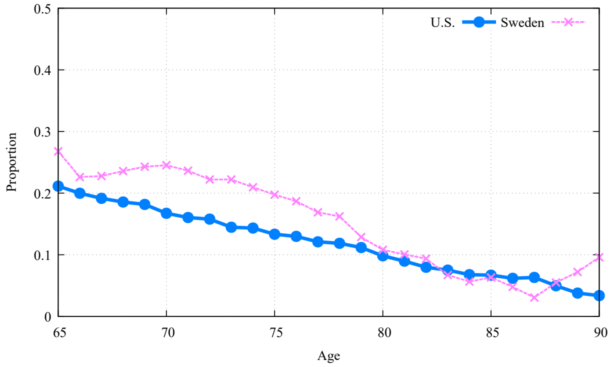


(e) U.S., Median Financial Assets

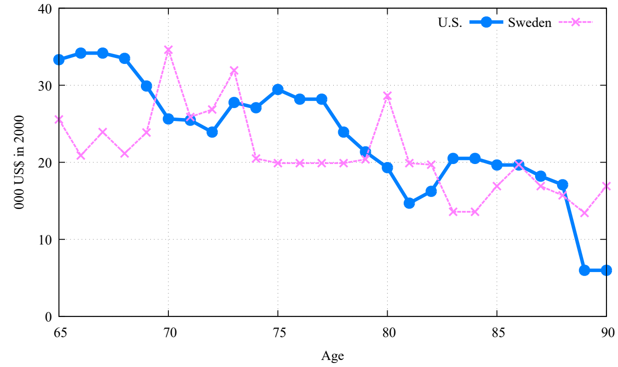


(f) Sweden, Median Financial Assets

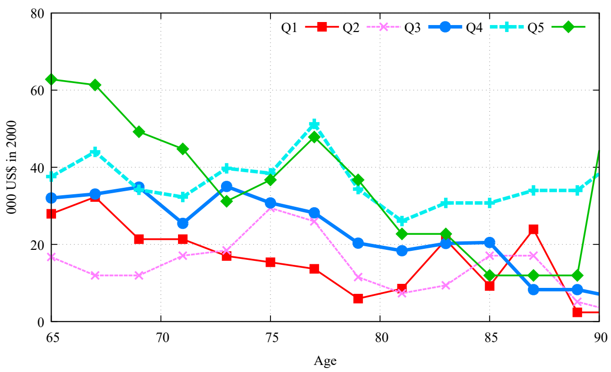
Figure A.2: Asset Profiles by Income Quintile



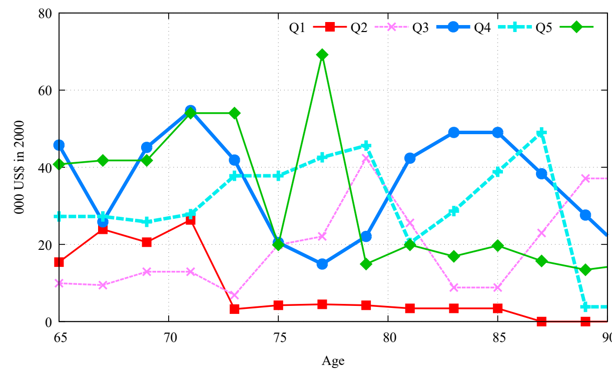
(a) Proportion in Net Debt: U.S. and Sweden



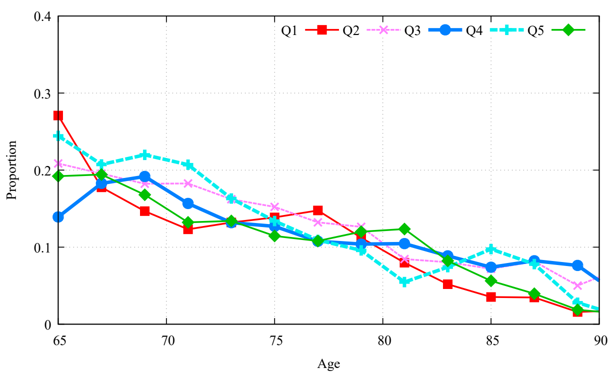
(b) Median Net Debt: U.S. vs. Sweden



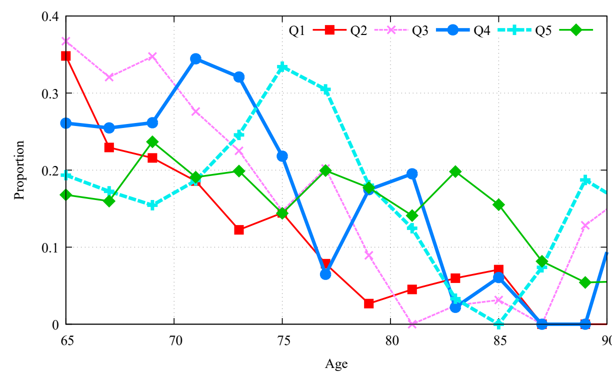
(c) Median Net Debt by Income Quintile: U.S.



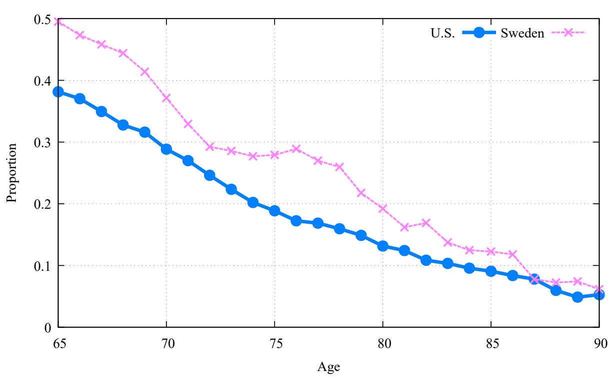
(d) Median Net Debt by Income Quintile: Sweden



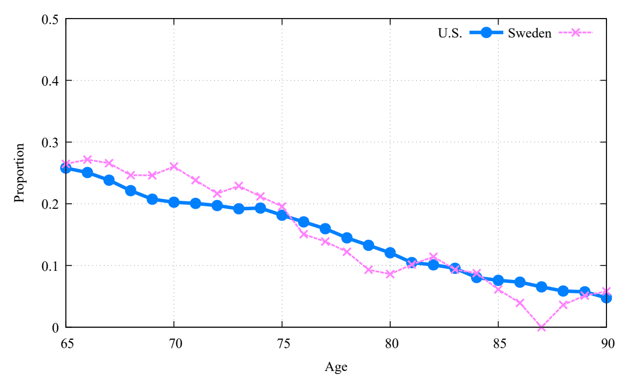
(e) Prop in Net Debt by Income Quintile: U.S.



(f) Prop in Net Debt by Income Quintile: Sweden



(g) Prop with Secured Debt: U.S. and Sweden



(h) Prop with Unsecured Debt: U.S. and Sweden

Figure A.3: Debt Profiles: U.S. and Sweden

B Health Transition Probabilities: Pre-65

Since we have a full life-cycle model, we need to construct health transition probabilities for all ages, $\pi^m_{i,b,m,m'}$, in the model. We divide the process of constructing health transition probabilities into pre-age-65 and post-65 stages. Prior to age 65, it is important for us to construct health transition probabilities that are consistent with the joint distribution of income and health at age 65. As emphasized by De Nardi et al. (2010) and Nakajima and Telyukova (2020), there is a strong correlation in the joint distribution between income and health status, among other household characteristics, at age 65. When a model starts at age 65, it is straightforward to incorporate the correlation since the initial type distribution can be directly taken from data, as in those two papers and many others taking the same approach. However, when we model the entire life cycle, joint distribution of income and health at age 65 becomes an endogenous object.

Unlike the post-65 health transition process, we cannot directly estimate the one prior to age 65 using longitudinal data, since HRS for the U.S. and SHARE for Europe only contain individuals of age 50 and above. For the U.S., MEPS (Medical Expenditure Panel Survey) covers individuals of all ages, and has longitudinal data. Therefore, we attempted to use MEPS to directly estimate pre-65 health transition probabilities. However, this method turned out to be unfruitful, for two reasons. First, since the distribution of health is different between HRS and MEPS, if we construct pre-65 health transition probabilities using MEPS, the resulting age-65 joint distribution of income and health is different from what we have in the HRS. Second, there is no clear way to translate income levels observed in MEPS into income shocks in the model, making the joining of the two periods of life difficult in the model.

Instead, we assumed a parsimonious parameterized form for the health transition probabilities and estimated pre-65 health transition probabilities so that the resulting age-65 joint distribution of income and health replicates the empirical age-65 distribution in the HRS as closely as possible. In estimating health transition probabilities, we make the following four assumptions. First, we assume that there is no mortality risk before age 65, i.e., $\pi^m_{i,b,m,0} = 0$. This is a reasonable assumption considering low mortality rates for younger individuals. Second, we assume that health transition probabilities are the same for all ages before age 65. This is to limit the number of parameters that we need to estimate with a limited target. Third, we take the initial (age-21) health distribution for the U.S. and Sweden from MEPS. MEPS asks its participants to self-report their health status in the same way as in HRS. However, the self-reported health status distribution at age 65 is different between HRS and MEPS, which suggests either that the questions are asked differently, or the sample is different. For tractability, we assume that the self-reported health status distribution at age 21 in MEPS captures the U.S. health distribution at age 21 well. We use the same initial health distribution for Sweden, since there is no such information for Sweden. In additional experimentation, we found that the initial health distribution is not important for age-65 health distribution since the age-65 distribution is mostly determined as the ergodic distribution of the transition matrix, independent of the initial distribution. Finally, we pose the following parameterized form for the health transition probabilities, given b, and for all i:

$$\pi^m_{i,b,m,m'} = \begin{bmatrix} 0 & \rho_{b,1} & 1-\rho_{b,1} & 0 \\ 0 & 0 & \rho_{b,2} & 1-\rho_{b,2} \\ 0 & 0 & 1-\rho_{b,1} & \rho_{b,1} \end{bmatrix} \tag{B.1}$$

Zeros in the left column indicates that mortality risk is zero before age 65. The matrix is characterized by two parameters, $\rho_{b,1}$ and $\rho_{b,2}$, with the former representing persistence of excellent and poor health states, and the latter representing persistence of good health status. Since this is age-independent, and there are five income levels, this parameterization implies that we have 10 parameters to be estimated. Given the initial (age-21) health status distribution, and guesses for the 10 parameters ($\rho_{b,1}$ and $\rho_{b,2}$ for all b), we can simulate the health status distribution up to age 65 and compare the health distribution at age 65 generated by the model with the actual health status distribution according to HRS for the case of the U.S. (SHARE for Sweden). The parameters are pinned down to minimize the sum of absolute distance between the distribution of health status generated by the model and the data. Notice there are five income bins, and two health states (the proportion of the third health status is automatically obtained as the residual), which means we have 10 parameters for 10 targets. Since the 2 parameters for each income level can be estimated to match the two distribution targets at age 65 independently from other parameters, the age-65 health distribution can be perfectly matched.

Table B.1 shows the initial (age-21) distribution of health (first column), and joint distribution of income and health at age 65, in the data (second column) and in the model (third column). The resulting estimated parameter values for the U.S. and Sweden are summarized in Table B.2. The estimated health transition probabilities generate the following features of the data successfully: (1) higher-income individuals are already healthier at age 21, (2) health deteriorates between age 21 and 65 for all income groups and (3) there are more individuals with excellent (poor) health in the higher (lower) income bins at age 65. We proceed similarly for Sweden. The last two columns compare the joint distribution between income and health in the data (fourth column) and generated by the model (last column). Our calibration procedure successfully replicates the fact that dispersion of health states is smaller, both overall and for each income group, in Sweden.

Table B.1: Joint Distribution of Income And Health at Age 65

	U.S., 21 Data	U.S., 65 Data	U.S., 65 Model	Sweden, 21 Data	Sweden, 65 Data	Sweden, 65 Model
Overall						
1 (excellent)	0.710	0.442	0.442	0.710	0.375	0.375
2 (good)	0.237	0.326	0.326	0.237	0.331	0.331
3 (poor)	0.053	0.232	0.232	0.053	0.294	0.294
Income Bin 1 (Bottom)						
1 (excellent)	0.696	0.262	0.262	0.696	0.313	0.313
2 (good)	0.262	0.332	0.332	0.262	0.302	0.302
3 (poor)	0.042	0.406	0.406	0.042	0.385	0.385
Income Bin 2						
1 (excellent)	0.701	0.409	0.409	0.701	0.327	0.327
2 (good)	0.261	0.357	0.357	0.261	0.390	0.390
3 (poor)	0.038	0.234	0.234	0.038	0.284	0.284
Income Bin 3 (Middle)						
1 (excellent)	0.639	0.463	0.463	0.639	0.349	0.349
2 (good)	0.301	0.351	0.351	0.301	0.363	0.363
3 (poor)	0.059	0.186	0.186	0.059	0.288	0.288
Income Bin 4						
1 (excellent)	0.725	0.545	0.545	0.725	0.384	0.384
2 (good)	0.222	0.270	0.270	0.222	0.399	0.399
3 (poor)	0.053	0.185	0.185	0.053	0.217	0.217
Income Bin 5 (Top)						
1 (excellent)	0.787	0.532	0.532	0.787	0.503	0.503
2 (good)	0.141	0.319	0.319	0.141	0.199	0.199
3 (poor)	0.071	0.150	0.150	0.071	0.298	0.298

Sources: MEPS 2006 (age 21), HRS 2006 (U.S., age 65) and SHARE 2006 (Sweden, age 65).

Table B.2: Estimated Parameter Values for Health Transition Probabilities

	U.S.		Sweden	
	$\rho_{b,1}$	$\rho_{b,2}$	$\rho_{b,1}$	$\rho_{b,2}$
Income Bin 1 (Bottom)	0.9565	0.9138	0.9644	0.9186
Income Bin 2	0.9758	0.9619	0.9659	0.9513
Income Bin 3 (Middle)	0.9854	0.9771	0.9728	0.9554
Income Bin 4	0.9871	0.9697	0.9715	0.9659
Income Bin 5 (Top)	0.9823	0.9775	0.9799	0.9223

Sources: Authors' estimates.

C Health Transition Probabilities: Post-65

Since we want to keep consistency between the full life-cycle model developed in this paper and the model only in retirement which is commonly used in the literature, including our previous work, we follow the same procedure as in past work in constructing health transition probabilities, for both the U.S. and Sweden. Specifically, we use HRS (for the U.S.) and SHARE (for Sweden) and estimate directly transition probabilities between health states, conditional on age and income level. Notice that health transition probabilities include mortality risk, as a transition from $m > 0$ (excellent, good, or poor) to $m' = 0$ (dead). For the U.S., we use our estimated health transition probabilities from our previous work (Nakajima and Telyukova (2020)). We use HRS, which is a longitudinal dataset, to estimate the probabilities that an individual with income bin b and the current health status m becomes a certain health status m' in the next period (two years later). Since HRS has a large sample, it is relatively a straightforward exercise.

Estimating the health transition probabilities for Sweden is more involved, because we only have one two-year panel (2004-2006) with SHARE at the time of writing the paper and the sample size is smaller than HRS. For a robustness exercise, we construct the health transition probabilities for four other Northern European countries (Austria, Germany, Denmark, and the Netherlands), take the average of the health transition probabilities of the five (including Sweden) countries, and refer to this as the Nordic health transition process. At the end of this section we investigate the robustness of the estimated Swedish health transition probabilities by comparing the Swedish ones with the Nordic ones. Below we explain in detail the steps we take to estimate health transition probabilities using SHARE.

C.1 Computing Income Adjustment Factor

We want to control for changes in income due to changes in the number of adult household members, since a spouse might be receiving pension as well. Therefore, in later analysis, we want to divide household income in SHARE by a factor if the household is a couple with two adult members. We denote the income adjustment factor ψ_s, with $s = 1$ meaning single household and $s = 2$ meaning a couple household. $\psi_1 = 1$ by definition. We compute ψ_2 for five countries. For comparison, in our previous work using HRS, we obtained $\psi_2 = 1.48$ for the U.S.

We use SHARE longitudinal data 2004-2006. We only use the observations that satisfy the following criteria:

1. Age in 2004 is between 63 and 101. Since elsewhere we use 5-year age bins, and we use ages 65 to 99, we include ages between 63=65-2 and 101=99+2.
2. Household income is above zero in both 2004 and 2006. This automatically eliminates any missing values for income.
3. Number of adults in the household is either 1 (single) or 2 (couple) in both 2004 and 2006.
4. Respondent weight in 2004 is positive.
5. Households are marked as retired in both 2004 and 2006.

Once we apply these selection criteria, we take households whose household size changes from 2 in 2004 to 1 in 2006. Then we compute the following:

$$\psi_2 = \frac{\sum w_{2004} y_{2004}}{\sum w_{2004} y_{2006}} \tag{C.2}$$

where w_{2004} is respondent weight, y_{2004} and y_{2006} are household income in 2004 and 2006, respectively. We compute the ratio of the averages, instead of the averages of the ratio, in order to avoid extreme values affecting the result disproportionally. But we found that the two methods provide very similar values of ψ_2. We also compute the median of the ratio, to check robustness. Table C.1 shows the results:

Table C.1: Income Adjustment Factor

	Mean	Median
Sweden	2.420	2.678
Austria	1.688	1.539
Germany	1.859	1.545
Denmark	2.687	2.671
Netherlands	1.703	1.677

C.2 Constructing Income Bins

Next step is to classify individuals' income into 5 income bins, since we want to estimate health transition probabilities for five income groups separately. We again use the 2004-2006 longitudinal dimension of SHARE. We first apply the following selection criteria.

1. Age in 2004 is between 63 and 67, which is five year age band around age 65.
2. Household income is above zero in 2004.
3. Number of adults in the household is either 1 (single) or 2 (couple) in 2004.
4. Respondent weight in 2004 is positive.
5. Household is retired in 2004.

For these individuals, we construct adjusted household income. Adjusted household income is the (raw) household income divided by ψ_s where s is the household size in 2004. Then we sort households by the adjusted household income, and create five equal-sized income groups. Each income group includes 20% of the sample households. We label them $b = 1, 2, 3, 4, 5$, with $b = 1$ the lowest 20% and $b = 5$ the highest 20%. We compute median adjusted household income in each income group, to represent income of each group in the model simulations. We also record the threshold values of adjusted household income. Table C.2 summarizes the results.

Table C.2: Income Bins

	Sweden	Austria	Germany	Denmark	Netherlands
Income bin 1	8,553	11,258	8,925	7,706	7,523
Income bin 2	14,031	15,028	12,632	10,556	12,037
Income bin 3	17,093	18,866	15,249	13,484	16,927
Income bin 4	21,940	23,750	19,928	16,207	23,774
Income bin 5	32,295	37,321	33,388	25,326	44,929
Income threshold: 1 and 2	11,932	13,481	10,985	9,231	9,285
Income threshold: 2 and 3	15,855	17,417	13,731	11,944	14,090
Income threshold: 3 and 4	19,150	21,014	17,671	14,569	18,808
Income threshold: 4 and 5	25,083	29,720	23,630	19,265	31,344
Wage growth rate: 1996-2006 (%)	2.33	1.01	0.38	1.55	0.53

There is one more complication. Since we use cross-sectional data of SHARE to compute health transition probabilities, we might not want to apply the same income bin criteria to different age groups in one cross-section, since they are from different cohorts. We are concerned about this issue because if we apply the same income bin thresholds shown above to Swedish cross-sectional data, the distribution across income groups shifts towards lower income bins as individuals age. This is opposite of what we think should happen, since higher-income households tend to be healthier, and live longer, so if anything, the distribution across income bins should shift towards higher income bins as individual ages. We concluded that this is happening since we apply the same income bin thresholds for different cohorts in one cross-sectional data. In order to deal with this issue, we decided to adjust the income bin thresholds for different age groups (cohorts). In particular, the income bin thresholds are adjusted using the average wage growth rate, shown in the bottom row of Table C.2. The idea is that older individuals worked in earlier years, and thus their wages are lower than younger retirees, which should show up as on average lower retirement income of older individuals. So we adjust the income bin thresholds by the average wage growth rate. For age 65, there is no adjustment. For age 67, for example, age thresholds are adjusted by dividing the thresholds for age 65 by $(1.0233)^2$. In general, for age-i individuals, income bin thresholds are computed as follows:

$$y_i = \frac{y_{65}}{(1+g_w)^{i-65}} \tag{C.3}$$

where y_{65} is an income threshold for age-65 individuals (shown in Table above), y_i is the income bin threshold for age-i individuals. g_w is the annual wage growth rate. For example, $g_w = 0.0233$ for Sweden. With this adjustment, distribution across income bins in Sweden shifts towards higher income bin as individuals age, which is what we expect to see.

C.3 Constructing Health Transition Probabilities

Now we are ready to construct health transition probabilities, using the longitudinal data 2004-2006 in SHARE. For age-i, we apply the following sample section criteria:

1. Age in 2004 is between i-2 and i+2, which is five year age bin around age i.
2. Household income is above zero in 2004.
3. Number of adults in the household is either 1 (single) or 2 (couple) in 2004.
4. Respondent weight in 2004 is positive.
5. Household is retired in 2004.
6. Self-reported health status in both 2004 and 2006 are valid (0 (dead), 1 (excellent), 2 (good), or 3 (poor)).

For those individuals that satisfy the criteria, we compute the adjusted household income in 2004 (dividing raw household income by ψ_s where s is the household size in 2004). Then we apply the age-dependent income bin thresholds constructed in the previous subsection to determine which income bin ($b = 1, 2, 3, 4, 5$) each individual falls into. Then the health transition probabilities $\pi^m(i, b, m, m')$ can be computed as follows:

$$\pi^m(i, b, m, m') = \frac{\text{Total respondent weights of individuals with } (i, b, m, m')}{\text{Total respondent weights of individuals with } (i, b, m)} \tag{C.4}$$

where i is age in 2004, b is income bin, m and m' are health status in 2004 and 2006, respectively.

The problem here is that there is not large enough number of individuals for a given (i, b, m). In order to overcome this problem, we apply two procedures. First, we introduce wider definition of income bins. In particular, we assume $\tilde{b} = 1$ includes $b = 1, 2$, $\tilde{b} = 2$ includes $b = 1, 2, 3$, $\tilde{b} = 3$ includes $b = 2, 3, 4$, $\tilde{b} = 4$ includes $b = 3, 4, 5$, and $\tilde{b} = 5$ includes $b = 4, 5$. This makes the difference across income groups potentially less stark since we allow mixing across true income bins, but we need this adjustment to keep a reasonable number of individuals for any given (i, b, m) cell. We replace b with $\tilde{b}$. Second, we apply the following linear regression to health transition probabilities, in order to account for smaller sample sizes for older age groups (above age 80).

$$\pi^m(i, b, m, m') = \beta_{0,b,m,m'} + \beta_{1,b,m,m'} i \tag{C.5}$$

We apply this regression for each of (b, m, m'), except for one $\tilde{m}'$, since health transition probabilities must sum up to one. We pick $\tilde{m}'$ with the fewest observations and $\pi^m(i, b, m, \tilde{m}')$ as a residual after obtaining $\pi^m(i, b, m, m')$ for all m' other than $\tilde{m}'$.

As we mentioned at the beginning of this section, we implement the procedure above separately for five European countries. Then we create $\pi^m(i, b, m, m')$ for what we call NE-A5, which is the simple unweighted average of $\pi^m(i, b, m, m')$ across five Northern European countries (Austria, Germany, Denmark, the Netherlands, and Sweden). Tables C.3, C.4, and C.5 summarize the obtained health transition probabilities for the U.S., Sweden, and Northern European countries, respectively.

Table C.3: Health Status Transition: U.S. (%)

	Low income				**Median income**				**High income**			
Age 65	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor
Exce	0.4	71.6	22.6	5.4	1.1	71.4	22.3	5.2	1.5	77.2	18.7	2.6
Good	3.7	24.8	52.0	19.6	1.7	25.5	54.2	18.6	1.4	30.0	53.4	15.3
Poor	9.9	5.0	17.0	68.1	9.7	5.3	19.0	65.9	5.9	10.3	32.1	51.7
Age 75	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor
Exce	3.7	58.2	27.1	11.0	3.0	60.3	25.7	11.1	4.4	64.7	26.7	4.2
Good	6.8	21.3	46.9	25.0	7.7	23.4	41.3	27.6	6.3	16.6	52.3	24.8
Poor	12.5	4.4	16.7	66.4	19.7	4.4	18.3	57.6	15.0	4.3	19.2	61.5
Age 85	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor
Exce	10.9	39.3	31.5	18.3	11.0	47.8	25.9	15.3	8.3	56.3	27.9	7.6
Good	19.3	21.1	34.8	24.9	11.6	17.3	39.1	32.0	15.5	15.9	44.0	24.7
Poor	26.6	5.6	14.2	53.7	29.5	3.9	15.3	51.4	26.1	9.2	17.2	47.4
Age 95	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor
Exce	47.5	34.2	12.0	6.3	24.5	27.7	14.7	33.1	16.7	60.2	23.1	0.0
Good	53.8	5.9	26.7	13.7	26.5	9.5	30.1	33.9	60.3	0.0	20.9	18.8
Poor	34.5	9.6	15.5	40.4	54.0	5.7	13.5	26.9	43.7	0.0	13.7	42.6

Note: Individuals are grouped into five equal income bins with low income = bin 1, median income = bin 3, and high income = bin 5. Sources: HRS 1996-2006 for the U.S., SHARE 2004-2006 for European countries. Five Northern European countries are Austria, Germany, Denmark, the Netherlands, and Sweden.

Table C.4: Health Status Transition: Sweden (%)

	Low income				**Median income**				**High income**			
Age 65	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor
Exce	3.7	61.9	33.2	1.1	0.0	72.9	27.1	0.0	0.0	62.1	21.8	16.2
Good	0.0	21.6	47.4	31.0	0.0	13.8	41.3	44.9	0.0	14.6	53.4	32.0
Poor	4.0	10.1	6.0	79.9	7.0	4.8	12.2	76.0	0.0	0.0	7.6	92.4
Age 75	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor
Exce	3.6	42.0	27.9	26.4	4.0	52.7	20.9	22.5	3.5	57.4	26.1	13.1
Good	7.0	17.1	32.7	43.3	5.7	14.0	37.7	42.6	3.4	11.7	49.8	35.1
Poor	16.8	8.1	12.3	62.8	12.9	4.2	10.5	72.4	11.2	2.5	5.2	81.1
Age 85	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor
Exce	3.5	22.1	22.7	51.7	7.4	30.7	13.9	48.0	17.5	46.1	28.1	8.3
Good	21.6	10.9	14.3	53.2	23.1	12.6	29.3	35.0	17.6	7.2	40.5	34.8
Poor	29.6	6.2	18.6	45.7	18.8	3.6	8.7	68.8	29.3	1.3	2.6	66.8
Age 95	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor
Exce	3.3	2.2	17.4	77.0	10.8	8.6	7.0	73.6	31.5	34.8	30.2	3.4
Good	32.2	4.7	0.0	63.1	40.5	11.1	20.9	27.5	31.7	2.6	31.2	34.5
Poor	42.4	4.2	24.9	28.5	24.8	3.0	7.0	65.2	47.4	0.1	0.0	52.5

Note: Individuals are grouped into five equal income bins with low income = bin 1, median income = bin 3, and high income = bin 5. Sources: HRS 1996-2006 for the U.S., SHARE 2004-2006 for European countries. Five Northern European countries are Austria, Germany, Denmark, the Netherlands, and Sweden.

Table C.5: Health Status Transition: Average of Five Northern European Countries (%)

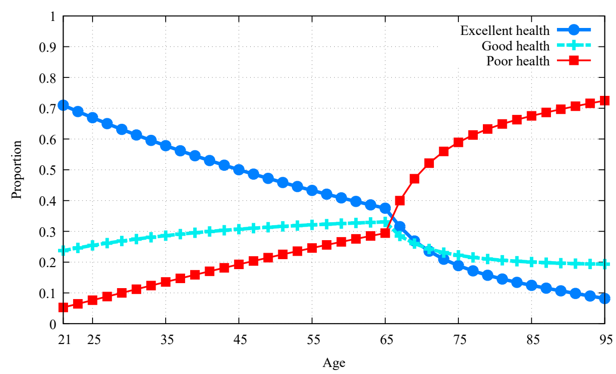
	Low income				**Median income**				**High income**			
Age 65	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor
Exce	0.9	48.5	43.7	6.9	1.1	59.2	30.6	10.1	1.1	53.9	29.6	15.4
Good	2.4	17.6	49.0	31.0	2.1	20.1	40.4	37.4	1.2	21.9	45.0	31.8
Poor	0.8	3.6	21.3	74.4	1.4	3.8	21.6	73.2	1.0	7.5	17.8	73.7
Age 75	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor
Exce	1.0	51.3	33.8	13.9	5.8	48.0	31.2	14.9	6.5	45.3	32.9	15.3
Good	5.2	17.9	43.5	33.4	5.0	18.1	41.6	35.2	3.6	19.1	45.2	32.0
Poor	13.9	4.4	17.3	64.4	12.0	4.9	17.6	65.6	9.5	7.4	16.5	66.6
Age 85	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor
Exce	0.7	44.9	29.1	25.3	16.6	33.4	29.4	20.6	21.8	31.9	32.5	13.8
Good	15.5	16.8	34.3	33.4	15.1	14.8	39.8	30.3	12.1	15.6	41.8	30.4
Poor	35.2	2.3	12.0	50.5	27.1	2.9	13.1	56.9	27.8	3.1	14.0	55.0
Age 95	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor	Dead	Exce	Good	Poor
Exce	0.7	35.4	27.7	36.2	22.2	18.8	29.9	29.0	35.0	18.4	32.1	14.4
Good	24.0	14.5	28.5	33.0	25.2	11.6	37.9	25.3	20.4	12.6	38.2	28.7
Poor	55.2	0.9	8.4	35.5	42.1	1.1	8.6	48.2	45.6	0.2	11.5	42.8

Note: Individuals are grouped into five equal income bins with low income = bin 1, median income = bin 3, and high income = bin 5. Sources: HRS 1996-2006 for the U.S., SHARE 2004-2006 for European countries. Five Northern European countries are Austria, Germany, Denmark, the Netherlands, and Sweden.

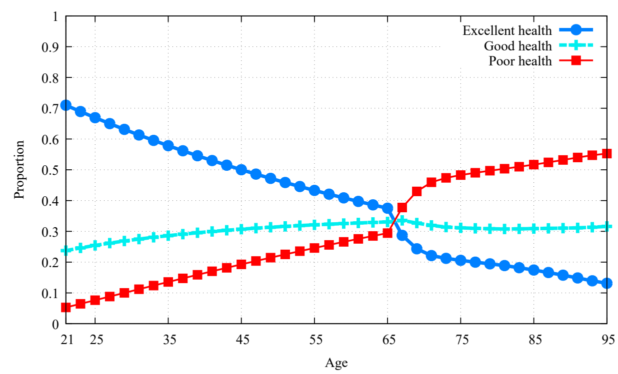
D Comparison of Swedish and Nordic Health Transition Probabilities

The number of observed individuals, especially at older ages, in Swedish data is not large, particularly if we want to slice the data into different ages, income bins, and health statuses, to estimate the health transition matrix which depends on these characteristics. While we implement various pooling measures to overcome this issue, we want to know if the resulting Swedish health transition matrix is robust. In order to answer this question, we build what we call a "Nordic" health transition matrix, which is the simple average of health transition matrices of four Northern European countries (Austria, Germany, Norway, and the Netherlands) that are similar to Sweden in terms of dissaving profiles (see Nakajima and Telyukova (2016)) and Sweden. Tables C.4 and C.5 show the obtained health transition probabilities of Sweden and the Northern European countries, respectively.

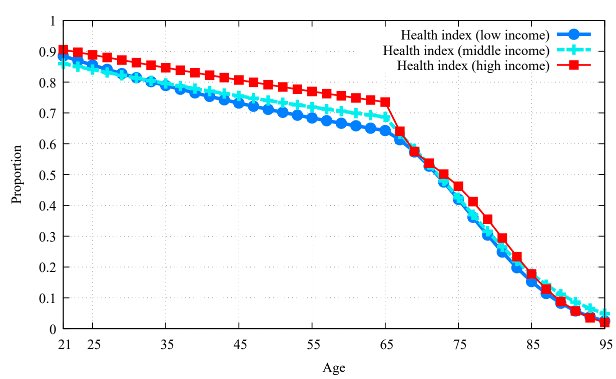
Figure D.1 compares characteristics of the Swedish health transition matrix (on the left) and the Nordic one (on the right). Panels (a) and (b) compare how the health status distribution changes over the life cycle, for Sweden and the Nordic countries. In both Swedish and Nordic models, the distribution shifts towards poor health with age, but the degree of health deterioration is less pronounced and closer to the U.S. counterparts (shown in Figure 5(a) in the main text) in the Northern European model, which implies that Swedish households are more



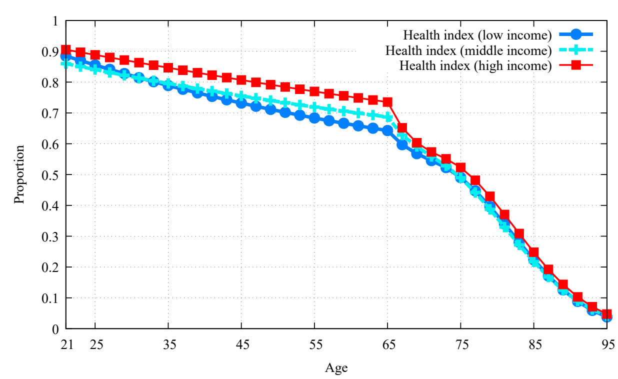
(a) Health Distribution: Sweden



(b) Health Distribution: Nordic

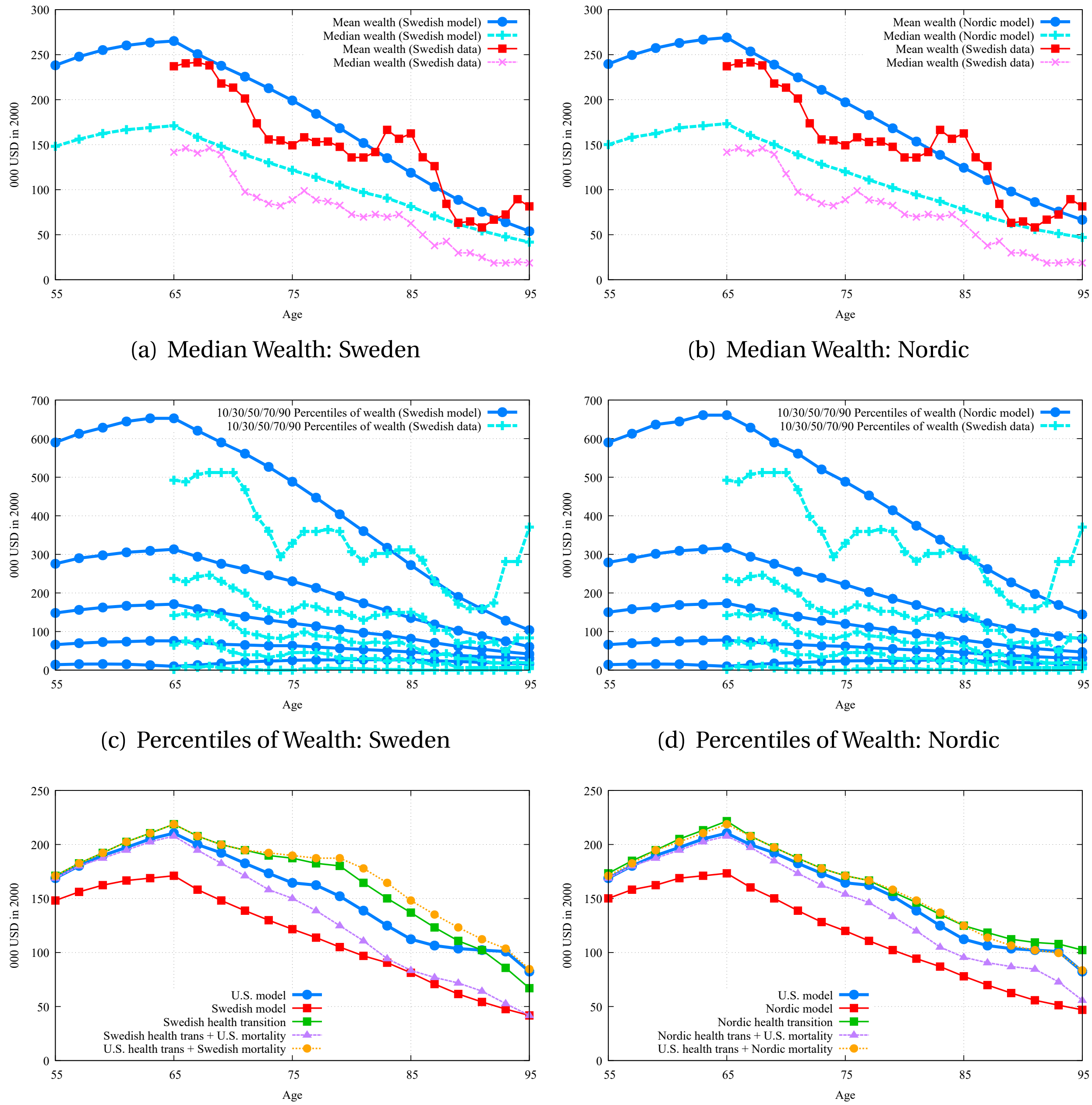


(c) Health Index by Income: Sweden



(d) Health Index by Income: Nodric

Figure D.1: Comparison of Health Transition Matrices: Sweden and Northern Europe



(a) Median Wealth: Sweden (b) Median Wealth: Nordic

(c) Percentiles of Wealth: Sweden (d) Percentiles of Wealth: Nordic

(e) Health Transition and Median Wealth: Sweden (f) Health Transition and Median Wealth: Nordic

Figure D.2: Comparison of Swedish and Northern European Model

pessimistic with their own health status compared with Northern European and U.S. counterparts. Panels (c) and (d) show how health status changes for different income groups over the life cycle. The health index shown in Panels (c) and (d) takes the value between 0 (all individuals are dead) and 1 (all individuals have excellent health) and represents the average health status of each income group. We assign the value 1, 2/3, 1/3, 0, to excellent, good, poor, and dead health status, and compute the average value across all individuals in the group. We can see that (i) the health index deteriorates with age for all income groups in both Sweden and

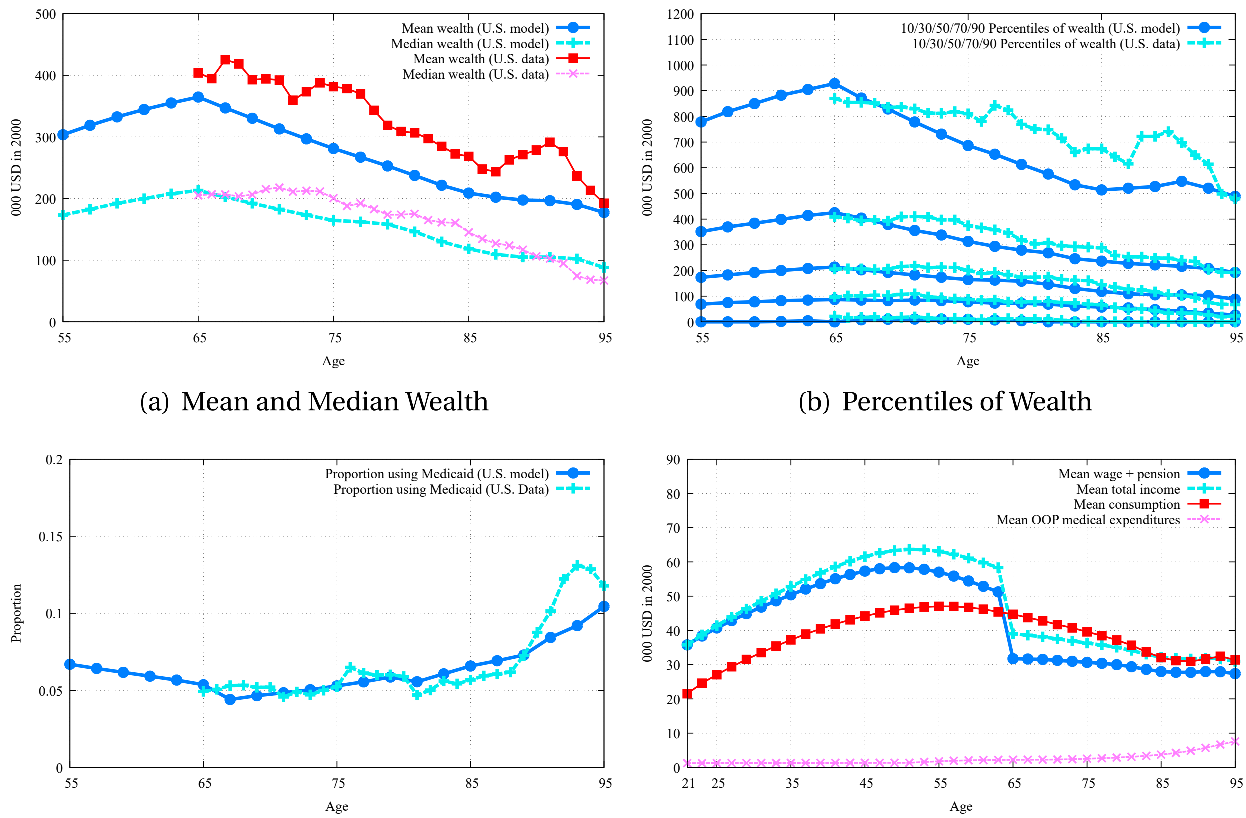
Northern Europe, (ii) higher-income individuals tend to have a higher health index especially before retirement age, but (iii) the dispersion is smaller in both countries compared with the U.S.

Regardless of this slight difference in terms of dynamics of health, the effects on the wealth decumulation profile turns out to be modest. Figure D.2 compares wealth profiles of the Sweden model (on the left) and the Nordic model (on the right), which is the same as the Swedish model except for the health transition matrix, in various experiments implemented in the paper. Comparison of mean and median wealth profiles (panels (a) and (b)) and the wealth percentiles (panels (c) and (d)) confirms that, regardless of the differences in health deterioration pace with age between the Swedish and Nordic models, wealth decumulation profiles are very similar. This is due to the fact that out-of-pocket medical expenses in Sweden and Nordic countries (the Swedish medical expense shock is used) are low regardless of health status.

Panels (e) and (f) of Figure D.2 dig deeper into the implications of the different health transition matrices. These panels correspond to Figure 9(a) in the main text. Panel (e) shows the U.S. model (blue), the Swedish model (red), the U.S. model with the Swedish health transition matrix (green), the U.S. model with the Swedish health transition matrix modified to exhibit U.S. mortality rates (purple), and the U.S. model with U.S. health transition matrix modified to exhibit Swedish mortality rates (orange). Panel (f) shows the same set of experiments for the Nordic model. If the health transition matrix is swapped to the Swedish one in the U.S. model, wealth decumulation further slows down, since households have to keep more wealth to pay for medical and non-medical expenses for longer periods late in life. This intuition is confirmed when the U.S. health transition matrix is modified with Swedish mortality rates. If U.S. mortality rates are retained, but household health decreases as with the Swedish health matrix, wealth decumulation becomes significantly faster; households do not expect to live as long as Swedish households, but they expect to and end up paying more as their health deteriorates faster than in the U.S. benchmark. Panel (f) shows that the Nordic health transition implies qualitatively the same results as the Swedish health transition.

E Model without Discount Factor Heterogeneity

We assume discount factor heterogeneity in our baseline model, which is supported by other studies, so that the model can match mean, median, and percentiles of wealth. Meanwhile, related papers, including our own previous work, use a (post-retirement) model without discount factor heterogeneity. In this Appendix, we estimate an alternative life-cycle model without discount factor heterogeneity and present some results. Estimated parameter values are $\beta = 0.9693$, $\sigma = 3.8684$, $\gamma = 5.2029$, $\zeta = 8,654$, and $\underline{c} = 5,874$. Since parameters are identified in the same way as our baseline model with discount factor heterogeneity, the estimated parameter values are similar. β is higher in order to match both mean and median wealth to a certain degree. Figure E.1 compares the estimated U.S. model to data. Figure E.2 compares the Swedish model, which uses the same parameter values as the U.S. model but introduces all the Swedish institutional features, to Swedish data. Figure E.3 contains the results of some of the same experiments that we conducted for the baseline model. Table E.1 is equivalent to Table 6 for the baseline model contained in the main text, but compares the decomposition of the contribution of Swedish elements between the baseline model with discount factor heterogeneity (top half of the table) and the alternative model without (bottom half). The takeaway is that results without discount factor heterogeneity are close to those obtained using our baseline model with discount factor heterogeneity, and thus the main results of the paper are robust to shutting down discount factor heterogeneity.



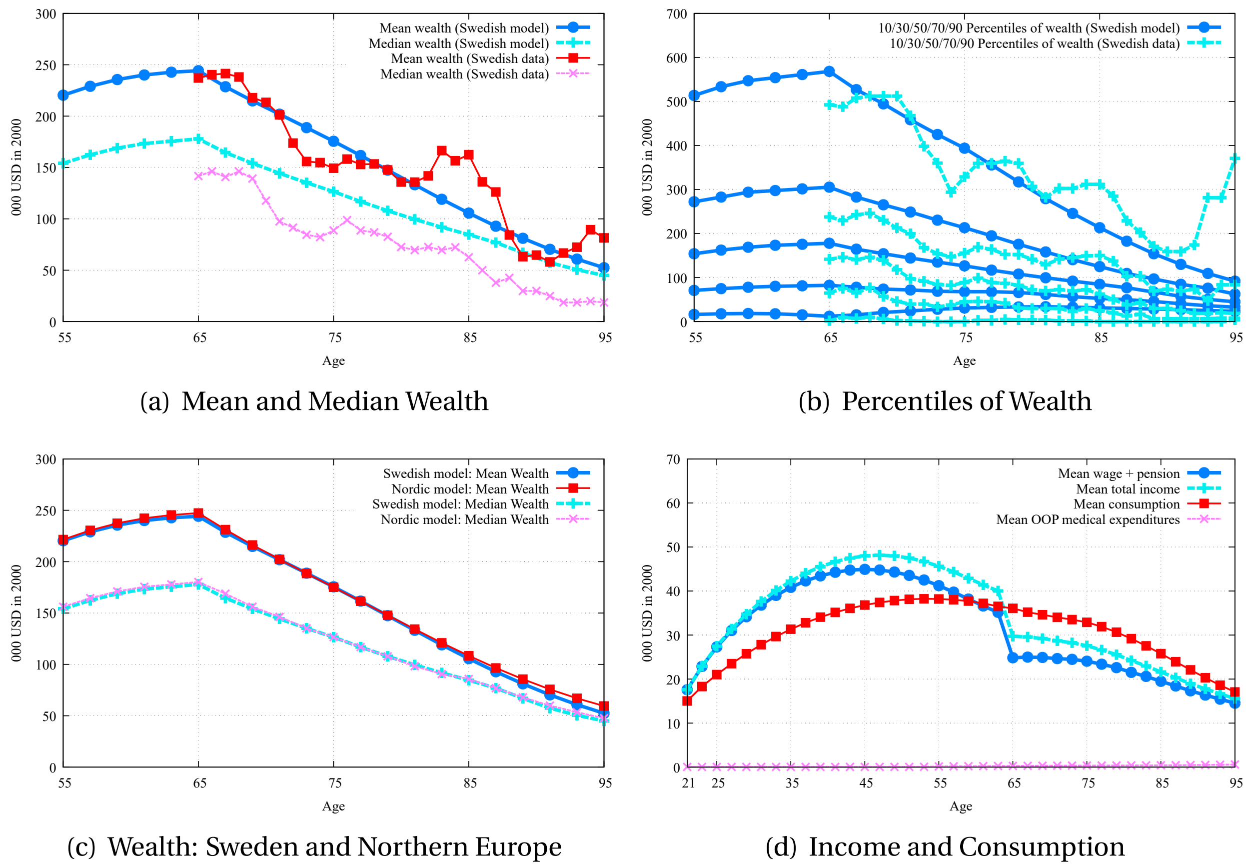
(a) Mean and Median Wealth

(b) Percentiles of Wealth

(c) Proportion with Medicaid

(d) Income and Consumption

Figure E.1: Model without Discount Factor Heterogeneity: U.S. Model and Data



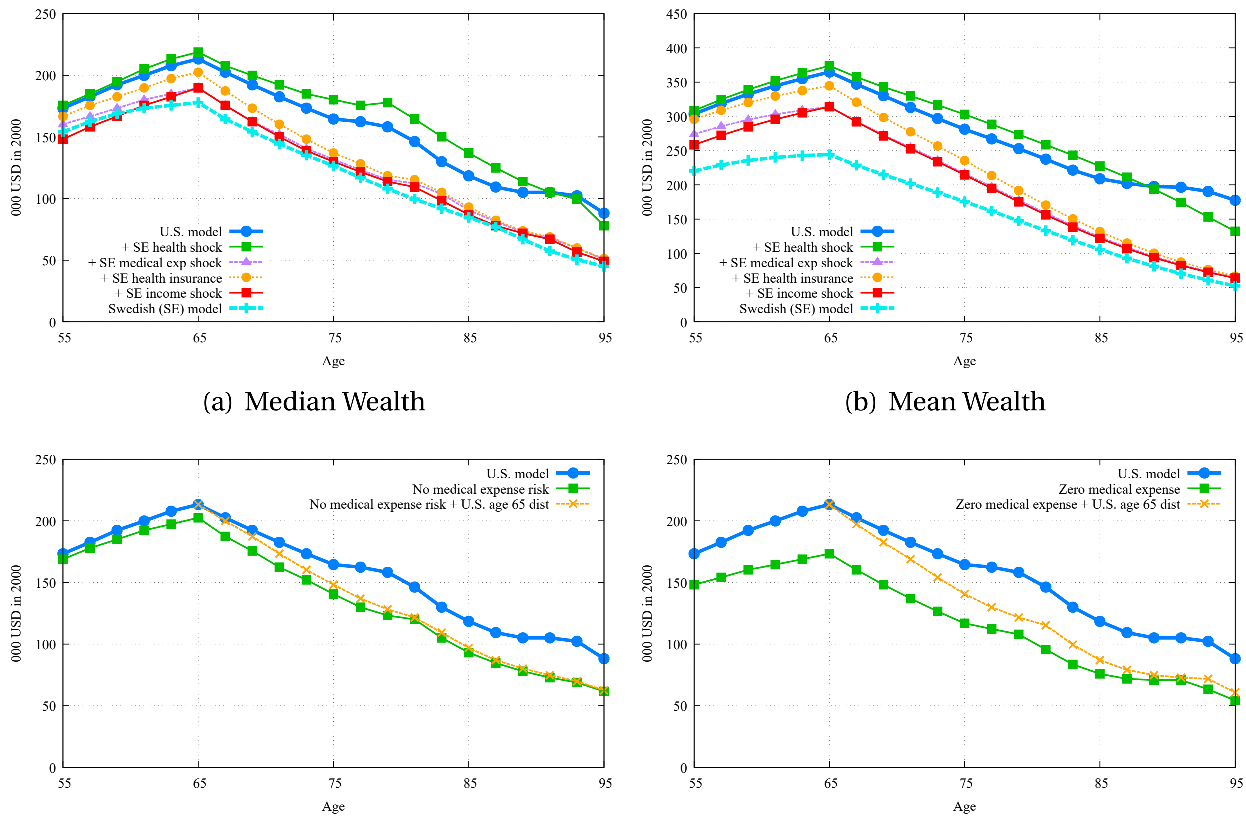
(a) Mean and Median Wealth

(b) Percentiles of Wealth

(c) Wealth: Sweden and Northern Europe

(d) Income and Consumption

Figure E.2: Model without Discount Factor Heterogeneity: Swedish Model and Data



(a) Median Wealth

(b) Mean Wealth

(c) No Medical Expense Risk: Median Wealth

(d) Zero Medical Expense: Median Wealth

Figure E.3: Model without Discount Factor Heterogeneity: Experiments

Table E.1: Quantifying the Contribution of Swedish Elements: Models with and without Discount Factor Heterogeneity[1]

		Contribution to Faster Decumulation		
Percent	W_{65}/W_{65}^{US}	Age 75	Age 85	Age 95
Baseline Model with β-Heterogeneity: Median wealth				
Swedish data	68.4	100.0	100.0	100.0
Swedish model	81.6	24.5	16.8	81.9
Swedish health transition	104.4	–25.9	–26.5	47.3
Swedish gross medical expense risk	88.2	36.9	32.1	59.1
Swedish OOP medical expense risk	83.7	37.1	32.4	57.7
Swedish health insurance coverage	90.5	36.7	30.2	47.0
Swedish health insurance financing	107.1	6.8	7.6	13.6
Baseline Model with β-Heterogeneity: Mean wealth				
Swedish data	55.9	100.0	100.0	100.0
Swedish model	62.6	54.8	94.0	163.8
Swedish health transition	99.5	–39.2	–18.7	88.3
Swedish gross medical expense risk	81.7	104.8	117.7	141.3
Swedish OOP medical expense risk	79.9	108.2	119.2	140.0
Swedish health insurance coverage	86.6	86.7	94.8	96.9
Swedish health insurance financing	102.8	6.1	9.4	14.5
Alternative Model without β-Heterogeneity: Median wealth				
Swedish data	68.4	100.0	100.0	100.0
Swedish model	84.8	20.9	22.8	89.4
Swedish health transition	104.4	–18.0	–20.2	31.7
Swedish gross medical expense risk	90.5	30.2	33.1	61.7
Swedish OOP medical expense risk	87.1	36.5	36.8	64.7
Swedish health insurance coverage	92.9	33.1	31.2	51.6
Swedish health insurance financing	107.1	3.3	6.0	17.4
Alternative Model without β-Heterogeneity: Mean wealth				
Swedish data	55.9	100.0	100.0	100.0
Swedish model	57.6	47.2	77.1	127.2
Swedish health transition	88.2	–35.2	–19.4	62.3
Swedish gross medical expense risk	73.7	92.5	102.3	113.0
Swedish OOP medical expense risk	71.9	97.8	104.5	111.3
Swedish health insurance coverage	77.4	81.6	87.3	79.7
Swedish health insurance financing	90.7	5.4	9.4	13.4

[1] The top half of this table is for the baseline model with discount factor heterogeneity and is the same as Table 6 in the main text. The bottom half of the table is for the alternative model without discount factor heterogeneity. See the notes for Table 6 and detailed explanation of the table in Section 6.4 in the main text.

F Interpretation of Bequest Parameters

In this appendix, we follow De Nardi et al. (2010) and present a way to interpret bequest-related parameters.[1] In particular, we compute (i) the minimum level of wealth where households start leaving bequests and (ii) the marginal propensity to bequeath, once the level of wealth goes above the minimum level.

Assume a single (one-adult) household of age-I (last year of life). In the last year of life, by assumption, future value consists only of the utility of bequest. The problem of such a household can be represented as follows:

$$\max_{c,e} \frac{c^{1-\sigma}}{1-\sigma} + \beta\gamma \frac{(e+\zeta)^{1-\sigma}}{1-\sigma} \tag{F.6}$$

subject to

$$e = (x-c)(1+r), \tag{F.7}$$

where c is last period consumption, x is the wealth holding at the beginning of the last period (after paying medical expenses), e is the amount of bequests, and r is the saving interest rate. By taking the first order condition with respect to consumption, we can derive the following decision rule for the optimal amount of bequests:

$$e^* = \frac{1+r}{1+r+\Lambda}(\Lambda x - \zeta), \tag{F.8}$$

where $\Lambda = (\beta\gamma(1+r))^{\frac{1}{\sigma}}$. From Equation (F.8), we can easily see that the optimal amount of bequests is positive if $x \geq \frac{\zeta}{\Lambda}$. Moreover, the marginal propensity of bequests can be calculated as

$$\frac{\partial \frac{e^*}{1+r}}{\partial x} = \frac{\Lambda}{1+r+\Lambda}. \tag{F.9}$$

In our U.S. model, we have $r = 0.02$, $\beta = 0.9673$, $\sigma = 3.8505$, $\gamma = 5.1554$, and $\zeta = 8,844$. From these parameter values, we can obtain the threshold value of x of $\$5,797$ and the marginal propensity to bequeath of 0.60. For the estimated model of De Nardi et al. (2010), $r = 0.02$, $\beta = 0.970$, $\sigma = 3.84$, $\gamma = 2,360$, and $\zeta = 273,000$. These parameters imply that the threshold value of wealth is $\$36,225$ and the marginal propensity of bequeath is 0.881. In both our benchmark model and the estimated model of De Nardi et al. (2010), once the wealth exceeds the threshold, the marginal propensity to bequeath is high (0.60 for us, 0.88 for them), but our elasticity is lower, and our estimated bequest threshold ($\$5797$) is lower compared with that of De Nardi et al. (2010) ($\$36,225$). This is likely because we include both single and couple households in building estimation targets, and thus households on average hold higher wealth compared with De Nardi et al. (2010), who only include single households in their estimation targets. We also include statistics of bequest distribution as targets, as can be seen in the main text.

[1] Appendix D of the working paper version of their paper.

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