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Life Cycle Income and Consumption Patterns in Poland

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Abstract

This paper investigates the life cycle profiles of income and consumption and relative income mobility in Poland - a transition economy facing rapid structural economic and social changes. According to my results, and in line with the empirical evidence for advanced economies, the age-profiles of average income and consumption in Poland exhibit a hump. The inequality of income over the life cycle is found to flatten relatively quickly in Poland, which contrasts with the approximately linear shape observed in the US. When individual income process is fitted to match the Polish inequality profile, it exhibits less persistence than in the US. Past earnings turn out to affect current income more strongly for the group of more educated individuals. Moreover, and in contrast to the permanent income hypothesis as well as findings for other economies, no evidence of an increase in consumption inequality for households older than 30 years is found. Finally, the obtained estimates of relative income mobility in Poland are higher than those for developed countries.

Keywords: income and consumption, life cycle profiles, income inequality, relative income mobility, transition economy

JEL Classification: D12, D31, D91

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1 Introduction

There is vast literature examining how households' income and consumption change over the life cycle. These studies, however, are usually restricted to developed economies, such as the United States (US), Japan or the United Kingdom (UK). It is ex ante not clear if the results obtained for this group of relatively stable economies can be generalized to other countries, including ex-communist Central and Eastern European ones. In particular, it is reasonable to expect that rapid structural economic and social changes experienced by households during economic transition might make their individual income and consumption processes deviate from those reported in the US and old EU member states, leading to differences observed also at a more aggregate level.

The general objective of this paper is to add to the literature on household behavior by investigating the life cycle profiles of income and consumption, as well as relative mobility of the former in a transition economy such as Poland. There are two more specific objectives of this article. The first one is to study the evolution of households' distribution of income and consumption over the life cycle in Poland, focusing on two first moments, that is the mean and variance, where the cohort and year effects are controlled for. Importantly, the life cycle profiles are analyzed separately for more and less educated households, which allows to determine how the consumption-savings choices are affected by the level of education. The importance of education in households' decisions in transition economies is stressed among others by Večernik (2013). The second objective is to analyze the mobility of Polish households between income quintiles using the transition matrices. The ultimate aim of these calculations is to compare the obtained results with similar studies for developed countries, and thus to identify the crucial specific factors driving income mobility in Poland, and in transition economies more generally. A useful byproduct of the results reported in this paper is a set of characteristics, mainly life cycle profiles, which can be used to estimate macroeconomic models, in particular general equilibrium models with households experiencing uninsurable income shocks (see Cagetti, 2003; Gourinchas and Parker, 2002). Moreover, the accurately estimated profiles are of special importance in studies on the macroeconomic consequences of population aging (see Mason and Lee, 2013).

Cross-sectional data from the majority of countries show that the relationship between average household income and age has an inverted-U (hump) shape. This finding is true for different time periods and if a group of individuals born in the same year is tracked over time, i.e. if the year and cohort effects are controlled for (see i.a. Alessie *et al.*, 1997). The hump shape of the age-profile is generally confirmed by related studies looking at changes in individuals' average productivity, though some more recent works based on firm-level data find the productivity drop in the late working years insignificant, see Aubert and Crepon (2006) or Goebel and Zwick (2009). There are, however, significant differences across various educational groups and average income profiles of more educated individuals are found to be much steeper (see i.a. Carroll and Summers 1991). Interestingly, as documented by Fernández-Villaverde

and Krueger (2007), the average consumption profile over the life cycle also exhibits a hump shape, which is consistent with the observation of Carroll and Summers (1991) that consumption growth is closely linked to income growth. This result might be seen as standing in opposition to the permanent income hypothesis if the planning horizon is assumed to extend over several decades. What is more likely, however, is that individuals smooth their consumption over much shorter periods of time, not exceeding several years.

The permanent income hypothesis also predicts that for individuals born at the same time, income and consumption inequality should increase with age. In their influential paper based on data from both developed and developing countries (namely: the US, UK and Taiwan), Deaton and Paxson (1994) show that empirical evidence is consistent with this prediction. Since the (labour) income age-variance profile is governed by the underlying individual earnings process, direct estimation of which required very precise panel data with a long time dimension, the exact shape of income inequality over the life cycle has received special attention, especially in the case of the US. As shown by Storesletten *et al.* (2004), the parameters of an earnings process assessed from the age-variance profile are close to the estimates obtained from direct estimation. They point to high persistence of individual income, which manifests itself in an approximately linear shape of the age-variance profile of income. However, this particular shape cannot be easily generalized to other countries. Indeed, a different pattern is observed in Japan, where, according to Abe and Yamada (2009), the convexity of the age-variance profile is explained by a strong age dependence of individual income risk. In Germany an overall increase in life cycle inequality in income is substantially smaller compared to the US case (Fuchs-Schuendeln *et al.*, 2010).

Another important observation is that inequality of income is estimated to be lower if one averages it over several years. It results from income mobility, i.e. changes of individual's income relative to others. The statistics estimated for the US (see Auten and Gee, 2007 or Díaz-Giménez *et al.*, 2011) point to a relatively low level of mobility, even though some methodological or data issues might affect the comparisons (see i.a. Fabig, 1998). Aaberge *et al.* (2002) claim that although there exist significant differences in terms of income inequality, the pattern of income mobility in the Scandinavian countries and the US is remarkably similar. Chen (2009) compares income mobility between Canada, the US, the UK and Germany in the 1990s and early 2000s. He applies several measurement methods, but those which assessed relative income mobility do not point to any significant differences across the analyzed nations. Bayaz-Ozturk *et al.* (2014) present the evidence of a significant decrease in mobility after German reunification. They argue that after 1990 there is no significant difference in income mobility in Germany compared to that in the US, while in the years prior to the reunification it was higher in the former. Khor and Pencavel (2006) estimate the mobility indices in urban China and show that they are significantly higher than in the US and OECD countries. Lukiyanova and Oshchepkov (2011)

reach the same conclusion for Russia. To sum up, in general immobility measures are roughly similar between developed economies and significantly higher than those reported for developing and transition countries, where higher mobility of income is observed.

The focus of this article in on the relative intra-generational mobility, which is one of the types of social mobility. In the literature one might also encounter intergenerational mobility, which measures the chances that children move from their parents place in the social hierarchy. Interesting recent works in this field include Solon (2002), Corak (2013) and Nybom and Stuhler (2016).

The main findings of the paper are the following. The age profiles of income and consumption in Poland are in general similar to those observed in developed countries. Interestingly, there exists heterogeneity between households with and without an academic degree. The inequality profile of income is much steeper for the educated individuals and the estimates of their income process point to higher persistence compared to the rest of households. Relative income mobility is higher compared to developed economies and more similar to estimates obtained for transition countries, particularly from Central and Eastern Europe.

To my knowledge, evidence on households' income and consumption patterns in Central and Eastern European formerly communist countries is still very scarce. Hence, most of the results presented in this paper are novel and contribute to the literature devoted to this group of countries. In particular, there are very few studies that examine the life cycle profiles of income and consumption in this region and control for the cohort and year effects. One of the exceptions is Smyk *et al.* (2014), who investigate the age-productivity patterns in Poland in the context of gender differences. I am not aware of any work on the life-cycle inequality in European transition economies. As regards relative income mobility in this group, Lukiyanova and Oshchepkov (2011) estimate it for Russia and compare to developed countries, Galasi (1998) calculates the mobility between income quantiles for Hungary and Horváth and Siebertová (2015) show similar estimates for Slovakia.

The rest of this paper is organized as follows. Section 2 discusses the data sources and definitions. In Section 3 I present the estimates of average income and consumption over the life cycle as well as the age-profiles of income and consumption inequality. Section 4 is devoted to relative income mobility. Section 5 summarizes the main findings and offers some policy implications. Technical description and comparison of the datasets used in this study are presented in the Data appendix.

2 Data and definitions

In this paper I rely on two different sources of data. The life cycle profiles are calculated using the Household Budget Survey (HBS) while the estimates of income mobility are based on the Social Diagnosis (SD). These two datasets are both at a household level, with some questions answered separately by individual household

members. They are, however, designed for different purposes and therefore focus on different issues (see the Data Appendix for a more detailed description).

The HBS is the largest and most accurate Polish survey on income and consumption. It is conducted every year by the Polish Central Statistical Office on a sample of around 37 thousand of Polish households. It collects households' monthly income and spending data, as well as a number of other socio-economic characteristics. The data are then used, among others, to update the weights in the consumer price index or to calculate the poverty thresholds. Their biggest limitation is that they do not constitute a panel.

On the other hand, the SD enables to track the same individuals over time. Since it is designed to investigate the social aspects of households' life, mainly subjective quality of life, income and consumption data are often rounded. Therefore, they are not precise enough to model life cycle profiles. While assessing income mobility, both the panel structure and relative rather than absolute aspect of income is of the essence, hence the SD seems to be sufficiently accurate for this kind of analysis.

The most common definition of income used in analyses of households is *disposable income*. It comprises total monthly net income from hired work, private farm or agriculture, other self-employment and free profession, property income, rents from a property or land, social insurance benefits, other social benefits and other sources of income such as alimonies. One can easily get this statistics from the HBS, but in the SD the only income measure reported is *available income*. To ensure consistency I use available income as a definition of income throughout this study. The distinction between these two measures is subtle and, in short, it comes from a different treatment of gifts given by households, which are not included in disposable income. More precisely, disposable income equals available income minus expenditures on non-consumption goods and services. These expenditures constitute on average only a small part of households income: according to the 2009 HBS they accounted for around four percent of total disposable income. Therefore, using available income instead of disposable income should not lead to different conclusions and the results presented in this paper can be compared to those from similar studies.

To construct the consumption profiles, I use total monthly expenditures on consumer goods and services. These expenditures include not only non-durables, but also durables (cars, housing equipment, electronic equipment) as well as majority of services (e.g. spendings on education and health). Consequently, saving, which is defined as the difference between available income and consumption, consists of changes in household's both financial and capital wealth, where the latter also includes housing.

To control for family size, the OECD square root equivalence scale is applied, that is income and consumption are divided by the square root of the number of household members. For instance, for a four member family (such as a couple with two children) I divide their income by two (the square root of four). I treat a household as educated

if a household head has an academic degree, which means that he or she declares higher or post-secondary education.

3 Life cycle income and consumption profiles in Poland in 2000-2010

The aim of this section is to present the life cycle patterns of income and consumption in Poland. I start with the estimation technique, then move on to a discussion of the results, while the last part is devoted to a sensitivity analysis.

3.1 Estimation method

In this part of the paper, I rely on the HBS covering the period 2000-2010. As confirmed by Florczak and Jabłonowski (2016) the general shapes of the average life cycle profiles of income and consumption presented in this article are robust to more recent data vintages. To construct the life cycle profiles of the first two moments of the logarithm of households' income or consumption distribution, I follow the approach first adopted for this type of analysis by Fernández-Villaverde and Krueger (2007) and also used i.a. by Yang (2009). In the first step, a pseudo-panel (or a synthetic cohort panel, see Deaton, 1985) is created such that households are grouped in cohorts by the age of household heads observed in a particular year (or equivalently the household head's date of birth). Then, for each cohort and each period of time, the mean and the variance of the logarithm of income and consumption are calculated. In order to maintain a reasonable number of observations for each year-cohort unit, the sample is restricted to household heads aged between 18-85. For the same reason, while evaluating the profiles for educated households only, I restrict the sample to household heads between 24 and 75. For the whole sample this gives $(85-17)*(2010-1999) = 748$ records, each containing on average 500 individuals. However, there is a high dispersion in the size of the year-cohort units, ranging from around 10 to more than 1000 individual records. These calculated moments are weighted by the population shares provided in the HBS.
To estimate the life cycle profiles, I specify the following partially linear model:

$$w_{it} = \pi_j cohort_j + \phi_t d_t + m(age_{it}) + \epsilon_{it}, \tag{1}$$

where w_{it} is the mean or variance of the logarithm of consumption or income evaluated for year t ($t = 2000, 2001, \ldots, 2010$) and cohort group i with age of household head age_{it}, while ϵ_{it} is an independent, zero mean, random error. In this specification, I control for cohort, time and age effects using dummy variables $cohort_j$, d_t and a smooth function $m()$ which satisfies $m(age_{it}) = E(w_{it}|age_{it})$. While constructing cohort dummies, I cluster households using a five-year span. More precisely, having assigned to every cohort the date of birth of household head (in short DateOfBirth) from the set $I = \{1915, 1916, \ldots, 1992\}$, the cohort dummies are defined as follows

$$cohort_1 = 1 \text{ if DateOfBirth} \in I_1 = \{1988, 1989, 1990, 1991, 1992\} \text{ else } cohort_1 = 0$$

$$cohort_2 = 1 \text{ if DateOfBirth} \in I_2 = \{1983, 1984, 1985, 1986, 1987\} \text{ else } cohort_2 = 0$$

...

$$cohort_j = 1 \text{ if DateOfBirth} \in I_j = \{1988 - 5(j-1), 1989 - 5(j-1), 1990 - 5(j-1), 1991 - 5(j-1), 1992 - 5(j-1)\} \text{ else } cohort_j = 0.$$

Further, assuming that index i also indicates the date of birth of household head, it holds that $i \in I_j$. As a result of clustering, the number of estimated dummy-cohort parameters is reduced and no additional restrictions are needed.

In the classical Deaton decomposition, the cohort dummies are created for every year, which makes the explanatory variables in equation (1) linearly dependent. Deaton (1997) proposed two additional assumptions to eliminate the identification problem: the time effects sum up to zero and are orthogonal to the trend in the data. To see what these restrictions imply, let us consider a growing economy in which income and consumption of all individuals increase at the same rate. With no restrictions, this growth can be either attributed to time effects or distributed among the age and cohort effects with the opposite signs. The assumption of orthogonality between trend and time effects selects the latter option and implies that the slope of the age profile (the graph of age effects) increases with the aggregate growth rate observed in macroeconomic data.

For developed economies, where the pace of economic growth is moderate and fairly stable, the standard Deaton decomposition makes the age profile somewhat steeper, but other factors affecting its shape prevail. However, in the case of developing or transition economies, including aggregate trend into age effects might dominate the whole picture. In fast growing countries, this can result in strongly increasing age profiles of income and consumption even for very old individuals, see Deaton and Paxson (1992), Zhou (2012) or Smyk *et al.* (2014). Naturally, such a decomposition might still be useful as it actually shows the differences in real income and consumption that a typical individual can expect at different ages, but only on the assumption that the observed aggregate growth rate will be continued over his or her whole life. In the case of Poland, the post-communist transition that started in the 1990s has resulted in a significant acceleration of economic growth, which, given standard real convergence mechanisms, is likely to slow down once the distance of the Polish economy to the world technology frontier narrows down. Since I am interested in the universal income and consumption patterns in Poland, regardless of the underlying aggregate trends (that are, by the way, usually irregular for transition economies), I chose the approach where the trend growth is attributed to the time dummies and linear independence is achieved by clustering the cohort groups. It also increases the number of degrees of freedom compared to classical Deaton decomposition.

According to the equation (1), the dependent variable is explained by two components.

The first one is parametric (linear) and consists of the cohort and year dummies. The other part is a nonparametric relationship linking the dependent variable to household heads' age. The model is estimated using a two-step Speckman (1988) procedure, which is a combination of the ordinary least squares and a standard kernel smoothing estimator. The nonparametric component is estimated using a Nadaraya–Watson estimator with an Epanechnikov kernel. A detailed description of this procedure and its application to a life cycle framework is provided i.a. in the technical appendix to Fernández-Villaverde and Krueger (2007).The bandwidth parameter h is set to 2 and was chosen using a cross-validation method carried out on the average logarithm of consumption (the detailed results are available upon request).
Finally, to quantify the significance of the age-profiles' estimates, the 95 percent bootstrap confidence intervals (based on 500 replications) are calculated. As discussed in the literature (see Hall, 1992; Neumann, 1995), in nonparametric regressions the bootstrap method has an estimation bias. One way of dealing with this problem is to impose undersmoothing. Hence, while bootstrapping I set the bandwidth parameter (h) to 1.8.

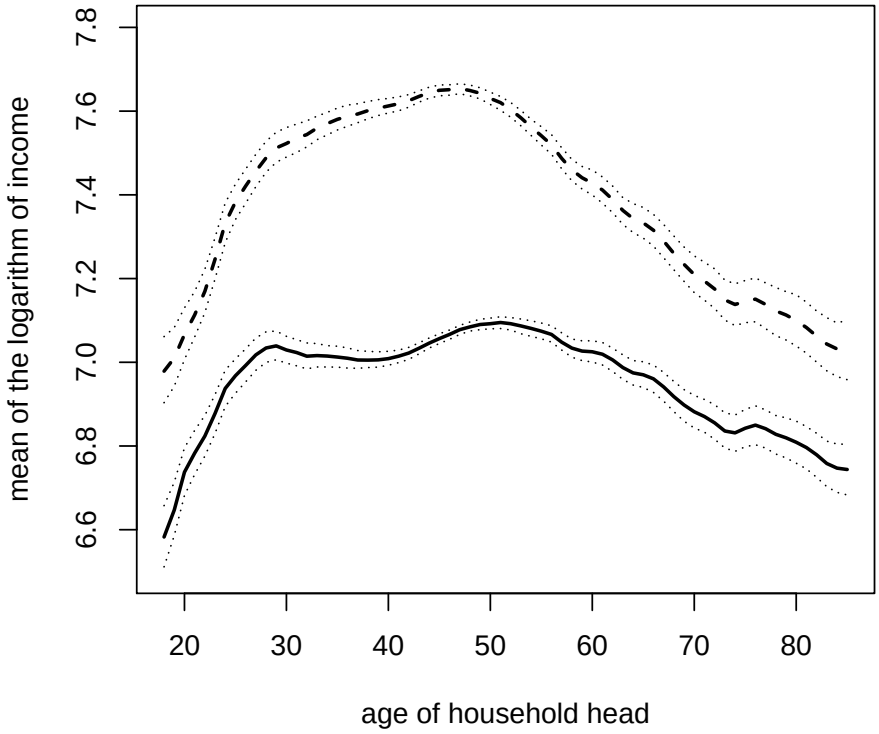
3.2 Average life cycle profile of income and consumption

Figure 1 presents the average logarithm of households' available income with and without adjustment for the number of households members, while Table 1 summarizes the changes in average available income. More precisely, Figure 1 depicts the income estimates in 2007 for households born between 1958 and 1962, that is $\hat{\pi}_7 + \hat{\phi}_{2007} + +\hat{m}(age)$. The same year and cohort group is chosen to illustrate all life cycle profiles in the article. The average income profile exhibits a hump-shaped pattern known from the literature. Most notably, and consistently with Alessie *et al.* (1997), while a sharp increase is observed below the age of 30, average income growth becomes moderate when household head is between 30 and 50. This pattern is even more evident when one controls for the household size.

One possible explanation for the rapid increase in the average income observed for households between 18 and 25 is a significant number of individuals who postpone their professional career in order to increase qualifications (or education). According to the 2009 HBS, 25 percent of young household heads (aged from 18 to 25) declared that they were not looking for a job because they were still learning. However, excluding these households from the sample does not change the observed pattern significantly. To further analyze this issue, the life cycle income profile was estimated separately for households with and without an academic degree (see Figure 2). It turns out that a significantly higher growth rate in the 25-30 phase of life occurs only for the more educated individuals.

The life cycle consumption profile roughly mimics that of income (see Figure 3). The evident similarities in the shapes of both profiles indicate that Polish households smooth their consumption over life only to a very limited extent. In another study for Poland Leszkiewicz-Kędzior and Welfe (2012) argue that only less than ten

Figure 1: Average income over the life cycle



Notes: solid line - square root equivalence scale; dashed line - household level; dotted lines - 95 percent bootstrap confidence intervals; estimates based on the Polish HBS 2000-2010.

percent of all individuals consider their permanent income during the consumption decision-making process. Limited ability to smooth consumption is also found for other transition countries, see for instance Skoufias (2003). The life cycle profiles of consumption follow very closely those of income even when high and low educated households are analyzed separately (not shown but available upon request). Average consumption tends to increase sharply for households aged between 18 and 30. This non-linear increase in consumption over the life cycle in Poland is different from the findings for developed economies. For example, Fernández-Villaverde and Krueger (2007) use the US data and estimate that the average consumption over the life cycle grows at a stable rate.

The consumption profile is significantly lower than the income profile, which at the early phase of the life cycle reflects accumulation of financial and/or capital (especially housing) wealth. This statement is also true when the aggregate trend is included in age effects as in the classical Deaton decomposition. However, positive saving observed for the oldest households are striking. This is because when income starts

Table 1: Changes in household's average available income over the life cycle (in percent)

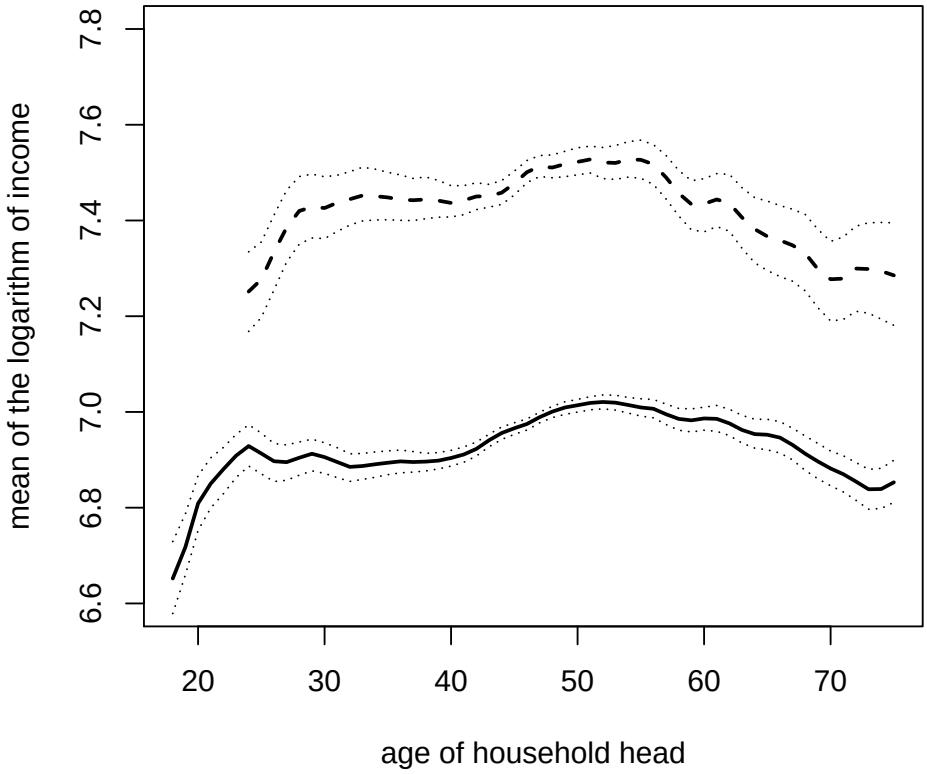
Household head aged between	Household level	Adult equivalent
25-20	31.6	23.0
30-25	14.0	6.2
35-30	5.8	-1.7
40-35	3.2	-0.4
45-40	3.7	4.8
50-45	-1.9	3.6
55-50	-8.9	-1.8
60-55	-11.3	-4.9
65-60	-9.5	-5.5
70-65	-12.4	-8.8
75-70	-6.4	-3.9
80-75	-4.6	-3.3
85-80	-7.1	-6.5

to decline around the age of 55, so does consumption.

A drop in consumption around the retirement age is also observed in other countries and there are a couple of possible explanations of this phenomenon both within and beyond the classical life-cycle framework. Banks *et al.* (1998) examine the case of Britain and argue that a part of the observed decrease in household consumption at the time of retirement can be explained by labour market participation, i.e. the fact that being active on labour market requires higher spending on work-related categories, such as food or transport. They associate the remaining part of consumption drop with arrival of unexpected and unfavorable information at the retirement. Blau (2008) argues that the observed drop in consumption of US households around retirement can partly result from the fact that the exact moment when a person retires is not certain. Some other possible explanations which could account for the drop of consumption are: age-varying marginal utility of consumption, nonseparability of preferences or bounded rationality.

The evidence from detailed categories of consumption could shed some light on the reasons for the observed decline in consumption of the elderly in Poland. According the HBS, spending on food starts decreasing around the age of 65 (the retirement age for men in Poland in the analyzed period). Even earlier, a drop in transport expenditures can be observed. This could speak in favor of the labour market participation costs hypothesis. However, the data also reveal some other interesting patterns. The decreasing trends in expenditures on cloths, furnishing the house, restaurants and hotels or cultural activities begin at middle age, much before retirement. One possible explanation could be that the marginal utility of consumption for these goods and services decreases with aging. The only consumption

Figure 2: Average income over the life cycle by educational groups



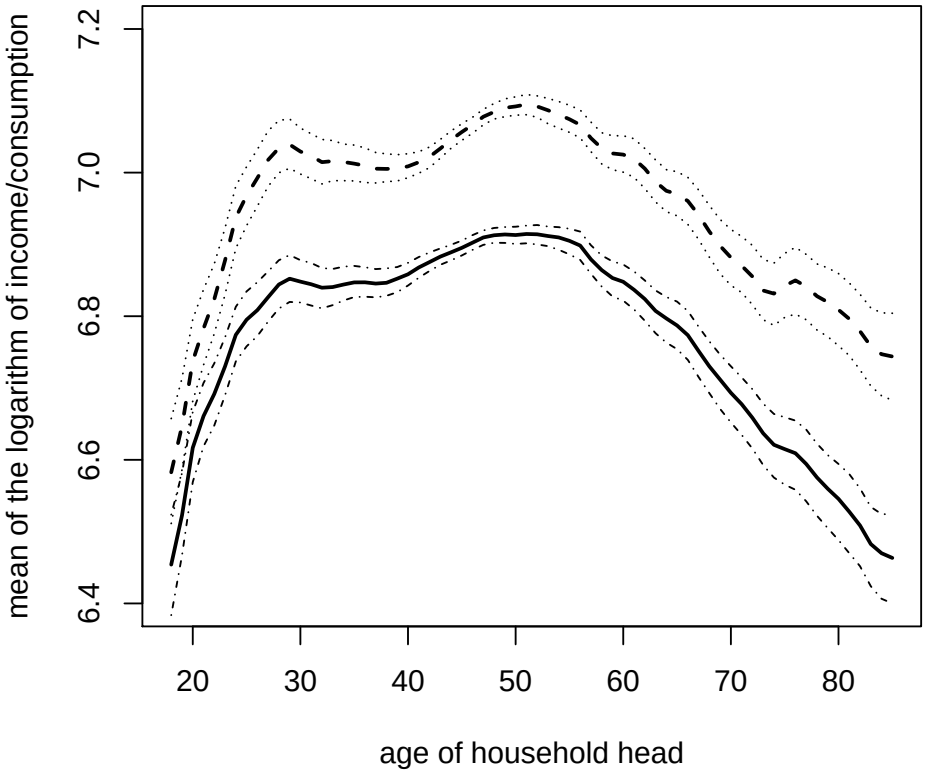
Notes: solid line - a household head without an academic degree; dashed line - a household head with an academic degree; dotted lines - 95 percent bootstrap confidence intervals; estimates based on the Polish HBS 2000-2010, adult equivalent (square root equivalence scale)

category that increases with age is health-related spendings. Since this type of expenditures are often lumpy, positive savings among the oldest households might also reflect the insurance motive and increased risk aversion.

3.3 Inequality in income and consumption over the life cycle

The age-variance profile of income at the household level is depicted in Figure 4. In line with the previous literature, there is a significant rise in inequality over the life cycle up to household head's age of 55. This profile is highly nonlinear. While a significant increase in income inequality is observed up to the age of 30, the age-variance profile flattens between 30 and 40 and then starts growing again. This last increase, however, can be attributed to changes in family composition and disappears if one controls for the household size (solid line in Figure 4). Hence, the adult

Figure 3: Average income and consumption over the life cycle



Notes: solid line - consumption; dashed line - income; dotted/dot-dash lines - 95 percent bootstrap confidence intervals for income/consumption curves; estimates based on the Polish HBS 2000-2010, adult equivalent (square root equivalence scale).

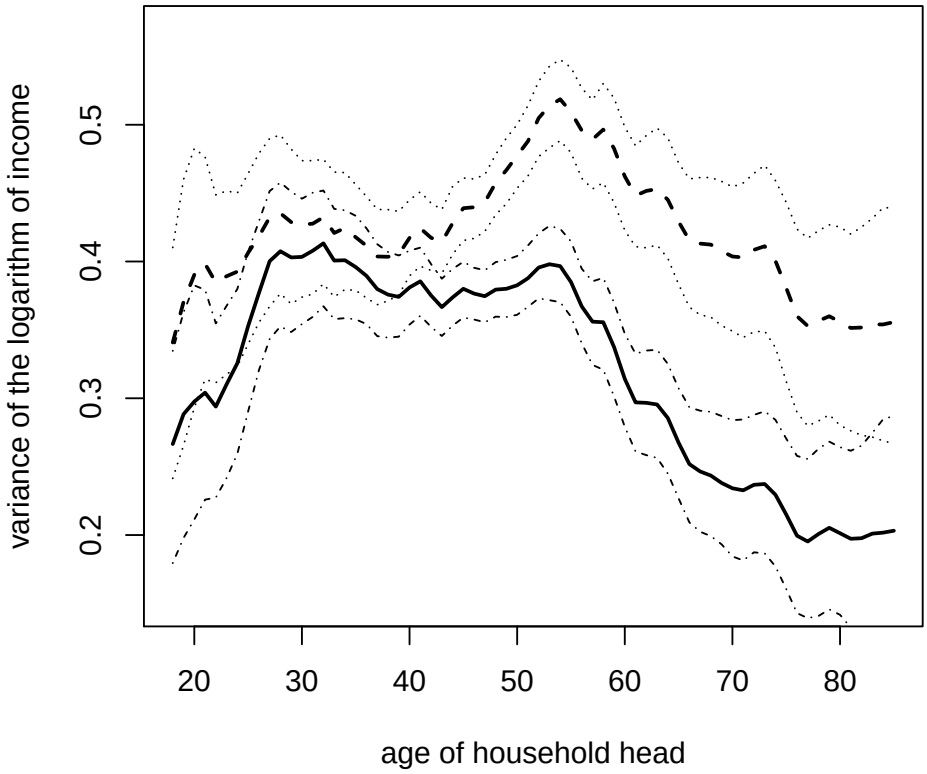
equivalent income inequality rises sharply in the early stage of life and remains at a fairly stable level afterwards.

Moreover, there exist heterogeneity in income inequality over the life cycle between households with and without an academic degree (see Figure 5). While the inequality pattern for all individuals is dominated by the shape of the less educated households, income inequality between households with a university degree exhibits a growing, roughly linear trend over the life cycle.

The confidence intervals associated with these inequality profiles are substantially wider than those for age-means. However, the shapes of the individual bootstrap profiles are very similar. The only exception is the variance-profile for educated households, which is estimated with a relatively low precision.

As regards consumption inequality (see Figure 6), after a rise in the early phase of life, even a slight decrease is observed as from the age of 30.The latter is clearly in contrast

Figure 4: Inequality in income over the life cycle



Notes: solid line - square root equivalence scale; dashed line - household level; dotted/dot-dash lines - 95 percent bootstrap confidence intervals for hsh level/square root eq. scale; estimates based on the Polish HBS 2000-2010.

to the earlier literature. However, taking into account wide confidence intervals, this result is not statistically significant.

Can these age-variance profiles of income tell us something about the individual income process? Following Storesletten *et al.* (2004), let us assume that for household i with household head aged h the idiosyncratic component of the logarithm of income can be expressed as

$$u_{ih} = \alpha_i + \epsilon_{ih} + z_{ih}, \tag{2}$$

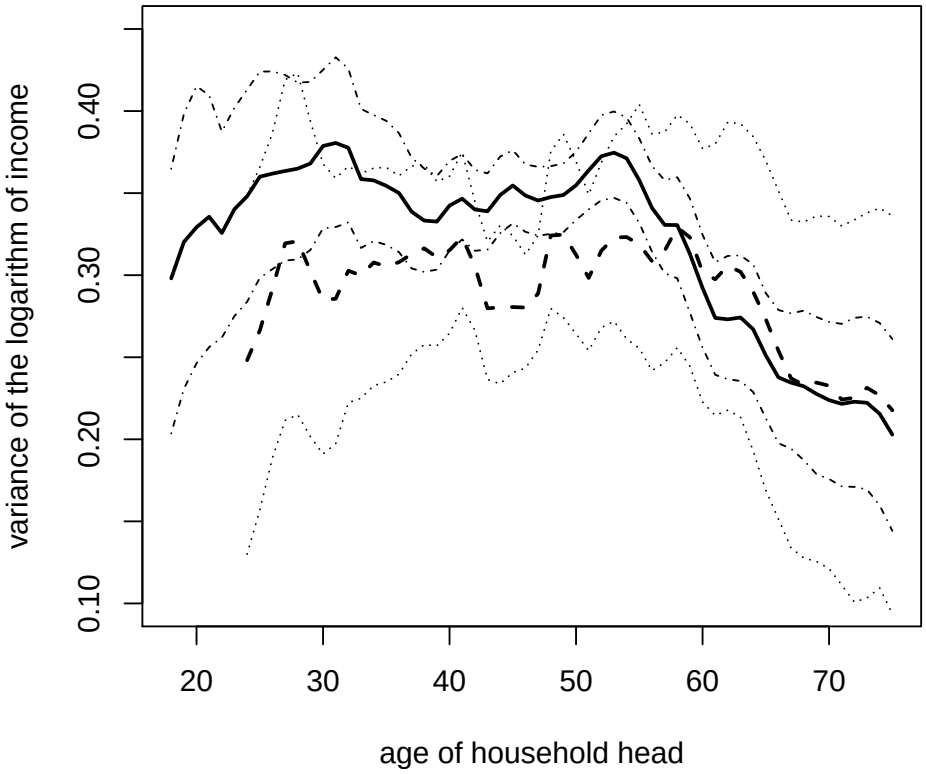
$$z_{ih} = \rho z_{i,h-1} + \mu_{ih},$$

$$\alpha_i \sim N(0, \sigma_\alpha^2), \quad \epsilon_{ih} \sim N(0, \sigma_\epsilon^2), \quad \mu_{ih} \sim N(0, \sigma_\mu^2), \quad \epsilon_{ih} \perp \alpha_i \perp \mu_{ih} \; i.i.d.$$

$$z_{i0} = 0, \quad E_i(u_{ih}) = 0,$$

where α_i is a fixed effect while z_{ih} and ϵ_{ih} are persistent and transitory life cycle shocks, respectively.

Figure 5: Inequality in income over the life cycle by educational groups



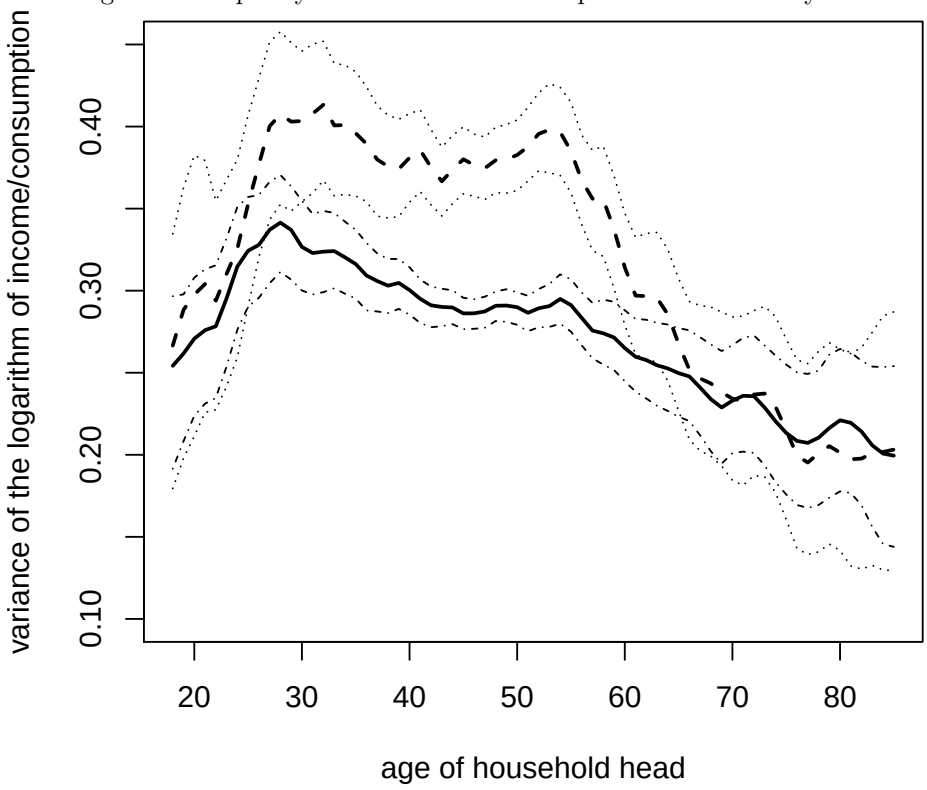
Notes: solid line - a household head without an academic degree; dashed line - a household head with an academic degree; dotted/dot-dash lines - 95 percent bootstrap confidence intervals for with/without academic degree; estimates based on the Polish HBS 2000-2010, adult equivalent (square root equivalence scale).

In the literature, two main specifications of income (earning) process dominate: the one presented here, often called the "restricted income profile" (RIP) model, and the "heterogeneous income profiles" (HIP) model. In the latter, households (or workers) face individual-specific income profiles. As stated in Guvenen (2007), the HIP model has several advantages over the RIP model in matching the US consumption data, mainly because it produces a non-concave shape of the age-inequality profile of consumption. Yet, this kind of feature is not present in Poland (see Figure 6). For this reason, and to facilitate comparisons with other empirical literature where the RIP model clearly dominates, the Polish income process in this study is modeled using the RIP specification.

Hence, the variance of the logarithm of income can be written as:

$$Var(u_{ih}) = \sigma_{\alpha}^2 + \sigma_{\epsilon}^2 + \sigma_{\mu}^2 \Sigma_{j=0}^{h-1} \rho^{2j}. \tag{3}$$

Figure 6: Inequality in income and consumption over the life cycle

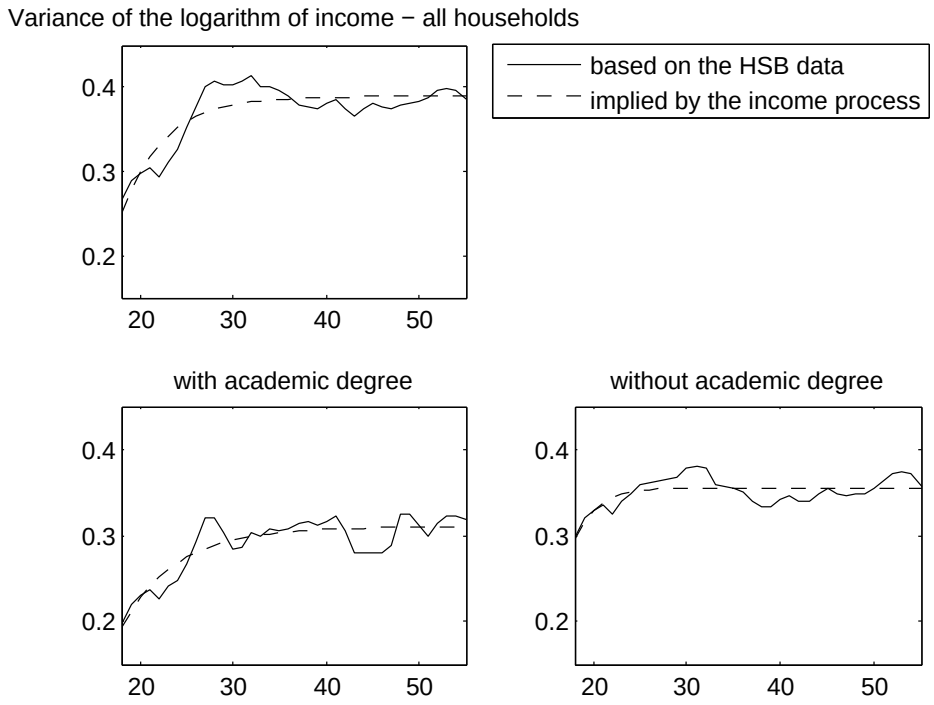


Notes: solid line - consumption; dashed line - income; dotted/dot-dash lines - 95 percent bootstrap confidence interval for income/consumption; estimates based on the Polish HBS 2000-2010, adult equivalent (square root equivalence scale).

One can use the age-variance profiles obtained before to estimate $\sigma_\alpha^2 + \sigma_\epsilon^2$, σ_μ and ρ from equation (3). It is not possible to separately identify σ_α and σ_ϵ. To this end, I search numerically for the parameter values that minimize the quadratic difference between the age-variance profile obtained from the HBS data and that implied by equation (3). To eliminate the effect of early retirement, data for households older than 55 years are excluded. Although the official retirement age in Poland in 2000-2010 was 60 for women and 65 for men, many early retirement options were available. According to Chłoń-Domińczak (2009), in 2006 more than 70 percent of women retired at the age of 55-59. I also assume that all age-profiles, also that for educated households, start at the age of 18 and that during the first six years the profile slope is the same for all households. This assumption is rationalized by the fact that it is not possible to isolate from the sample of individuals aged 18-23 those that will

eventually complete tertiary education.
The results are presented in Figure 7 and Table 2. The medians and 95% confidence intervals are obtained using a bootstrap method with 1000 replications. The estimates are broadly in line with studies for developed countries (see, among others, the wage process estimates for the US and Sweden in Flodén and Lindé (2001)). However, the obtained autocorrelation parameter (ρ) points to significantly lower income persistence compared with the US, where it is closer to or even equals unity according to studies relying on the RIP model, see e.g. Storesletten *et al.* (2004).

Figure 7: Empirical and fitted variances over the life cycle



Notes: solid line - empirical variances of the logarithm of income over the life cycle, based on the Polish HBS 2000-2010, adult equivalent (square root equivalence scale); dotted line - the fit of the variance profile based on the income process described by equation (2).

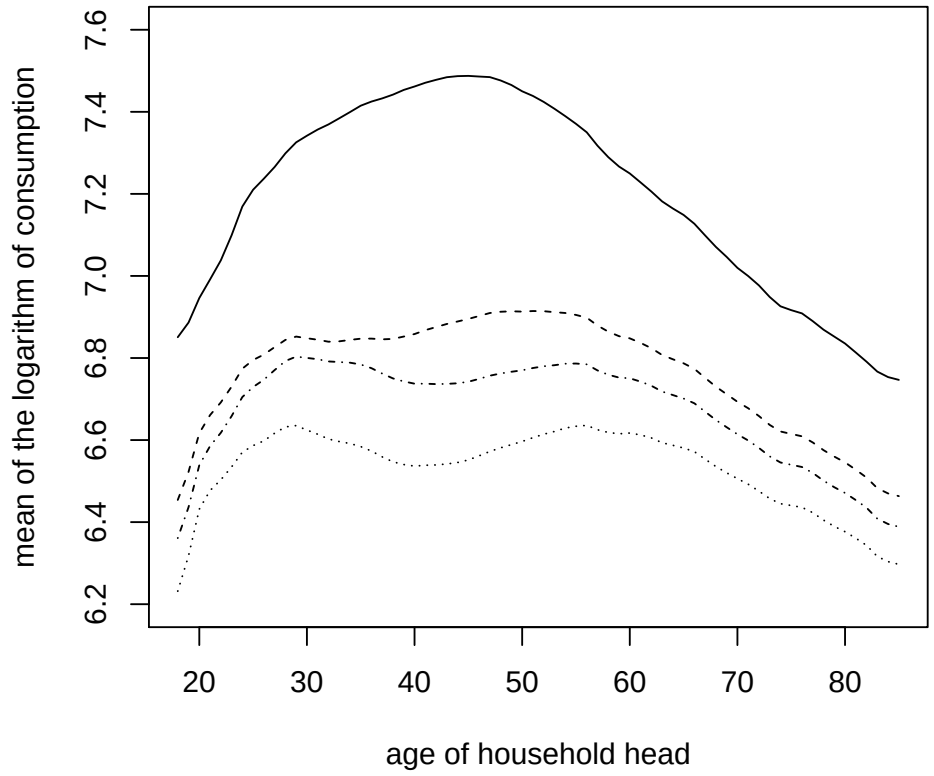
The income process is also estimated separately for households with and without an academic degree. While the conditional variance (σ^2_μ) is similar for both groups, the sum $\sigma^2_\alpha + \sigma^2_\epsilon$ is distinctly lower for educated individuals. Based on the inequality profile only, it is not possible to determine whether the difference lies in the fixed effects or temporary shocks. Interestingly, the income process of educated households is significantly more persistent than that for the less educated ones. It implies that

Table 2: Parameters of the income process (based on the empirical variance)

	all households with an academic degree		household head without an academic degree		household head without an academic degree	
	original sample	bootstrap * median (95% interval)	original sample	bootstrap * median (95% interval)	original sample	bootstrap * median (95% interval)
ρ	0.897	0.89 (0.83-0.92)	0.919	0.91 (0.87-0.93)	0.822	0.80 (0.73-0.84)
σ_μ^2	0.027	0.03 (0.02-0.09)	0.018	0.02 (0.01-0.04)	0.019	0.02 (0.02-0.07)
$\sigma_\alpha^2 + \sigma_\epsilon^2$	0.251	0.25 (0.10-0.27)	0.194	0.19 (0.13-0.20)	0.297	0.30 (0.20-0.30)

*Due to computational reasons the estimates from bootstrap method are rounded to two decimal places.

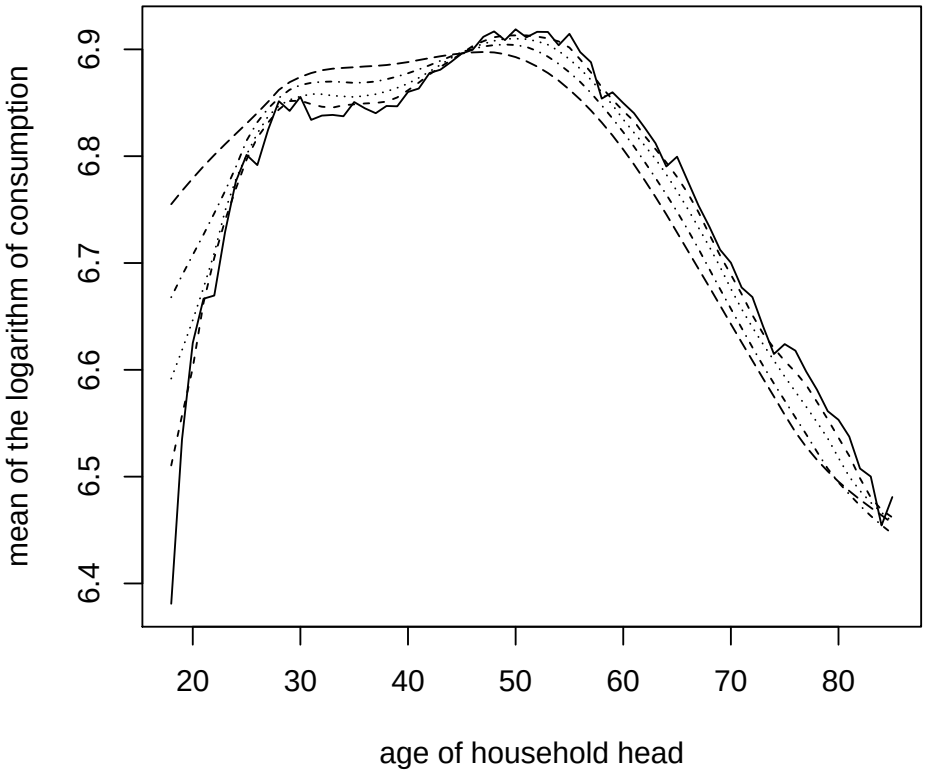
Figure 8: Average consumption over the life cycle and different equivalence scales



Notes: dashed line - square root scale ; solid line - household level; dotted line - OECD scale; dot-dash line - OECD modified scale; estimates based on the Polish HBS 2000-2010.

in Poland past experience has been more important for the evolution of income in the former group. This result is in line with Flodén and Lindé (2001), who show the same pattern based on Swedish data, but different from the empirical evidence for the US economy (see Storesletten *et al.* (2004)), where the inequality profiles are approximately linear for all educational groups. In their recent work Cooper and Zhu (2016) estimate the income process for different educational groups and find that the more educated households have smaller transitory shocks, but their persistence is very similar for all groups.

Figure 9: Average consumption over the life cycle and different bandwidth parameters



Notes: solid line – $h = 1$; dashed line – $h = 3$; dotted line – $h = 5$; dot-dash line – $h = 7$; longdash line – $h = 10$; estimates based on the Polish HBS 2000-2010, adult equivalent (square root equivalence scale).

3.4 Robustness checks

At this point I present some sensitivity analysis of the results presented above. First, the life cycle profile of the logarithm of consumption is calculated using two alternative

equivalence scales: the OECD scale (weights: 1 for the household head, 0.7 for each subsequent adult, 0.5 for each child) and the OECD modified scale (weights: 1 for the household head, 0.5 for each subsequent adult, 0.3 for each child). Although there are some differences between the results (see Figure 8), the main qualitative findings remain unchanged.

Another robustness check concerns the bandwidth parameter in the Speckman (1988) procedure. Reassuringly, the means of the logarithm of consumption over the life cycle estimated using alternative values of h ($h = 1, 3, 5, 7, 10$) are very similar (see Figure 9).

As regards households' income data, the mean and the variance of the logarithm of income over the life cycle were also calculated using the SD database. The results confirm the shapes of the life cycle patterns estimated with the HBS data (see Figures 10 and 11). Some quantitative differences are most probably driven by lower quality of the income data from the SD.

Figure 10: Comparison of average income over the life cycle in the HBS and the SD

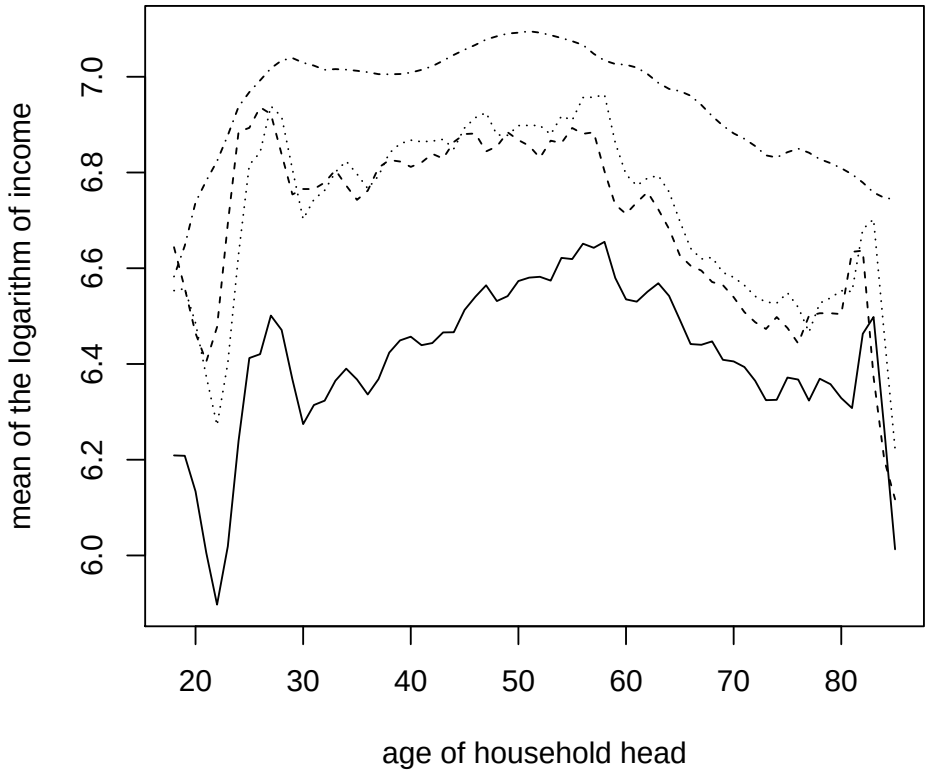
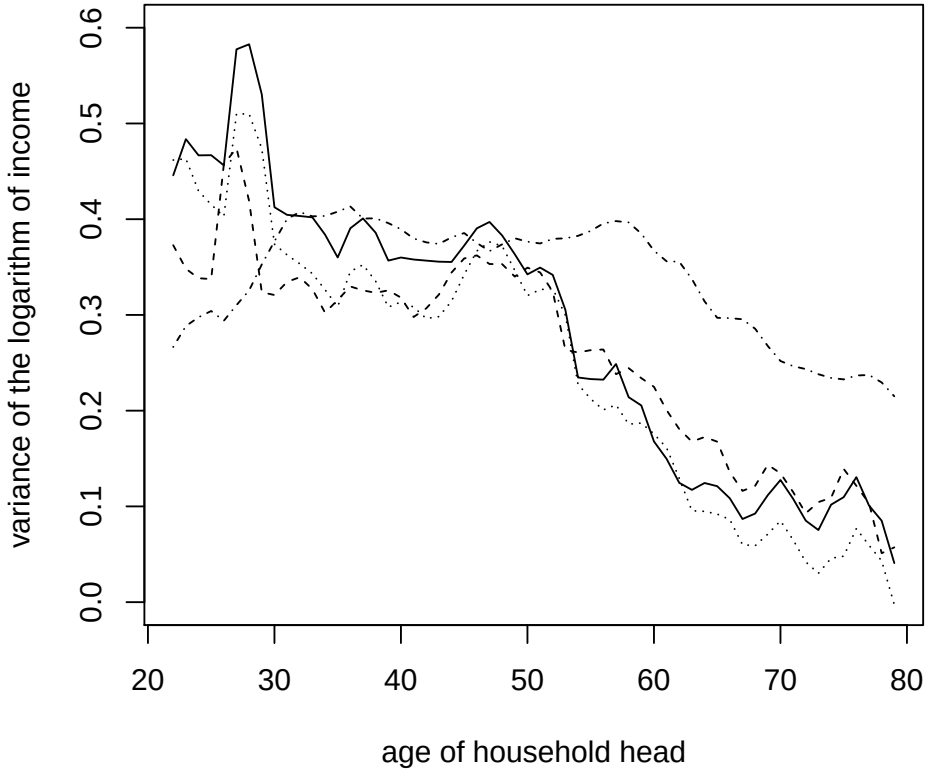


Figure 11: Comparison of inequality in income distribution over the life cycle in the HBS and the SD



Notes:
dashed line – based on the SD (2000-2009), variable – average monthly total income from the previous year, square root eq. scale;
dotted line – based on the SD (2000-2009), variable – total income from the previous month, square root eq. scale;
solid line – based on the SD (2000-2009), variable – income from the previous month, equivalence scale proposed by the SD;
dot-dash line – based on the HBS 2000-2010.

4 Relative income mobility in Poland in 1999-2008

This section is focused on income mobility observed for Polish households over the period 1999-2008. First, an estimation technique is described. Next, the estimates for transition matrices and corresponding summary statistics are discussed and compared with the results from similar studies devoted to other (both developed and developing) countries, with special attention given to the US. Finally, in order to eliminate

the influence of different shapes of the income distribution on the income mobility estimates in Poland and the US, some alternative mobility indices are calculated and discussed.

4.1 Estimation method

I construct the income transition matrices relying on five consecutive waves of the SD (2000, 2003, 2005, 2007 and 2009). Most calculations are based on a sample of households with household head aged between 18 and 85. The average declared monthly total net income from the previous year was used to divide households into income quintiles. The matrices with and without a correction for a household size were constructed. In the former case, the OECD square root equivalence scale was applied, that is each household's income was divided by the square root of its size. Additionally, in order to control for the life cycle income profile discussed in the previous section, quintiles are also calculated on the basis of income adjusted for the age effect. Income adjusted for the age effect equals individual income divided by the average life cycle income estimated in the previous section.

The transition matrices are presented in the common form, where the first quintile represents the poorest group while row i and column j shows the fraction of households in income quintile i in a given year that occupy income quintile j in a subsequent year. In order to ensure that each row or column of these matrices adds up to unity, if households at the quintile cutoffs have the same income, they are allocated randomly to the adjacent quintiles. In order to check the sensitivity of the results to this randomization, I recalculated the matrices, this time assigning the households with an identical income are in the same cluster. The results were broadly unchanged.

To obtain the final output, that is the average annual transition matrix for the period 1999-2008, I proceed as follows. First, I construct four mobility matrices $A_{y_1:y_2}$ for 2(3)-year periods, the multiplication of which gives me the nine-year transition matrix ($A_{2000:2009} = A_{2000:2003} * A_{2003:2005} * A_{2005:2007} * A_{2007:2009}$). These matrices are calculated based on the following pairs of the SD waves: 2000 and 2003, 2003 and 2005, 2005 and 2007, 2007 and 2009. For each of these pairs there is roughly 2000-3300 individual records. Obtaining the nine-year transition matrix $A_{2000:2009}$ directly is inefficient as it would rely on less than 1000 records. The final one-year period matrix (B) satisfies the following equation: $B = A_{2000:2009}^{1/9} = VD^{1/9}V^{-1}$, where VDV^{-1} (D - diagonal) is a spectral decomposition of matrix $A_{2000:2009}$. Distinct eigenvalues are a sufficient condition for the existence of such a decomposition of a quadratic matrix. However, this method of calculating the m-period average annual transition matrix has its limitations. First, with "m" being an even number, there might be more than one solution. Second, the average transition matrix might not exist, that is B can have negative entries if transition probabilities substantially vary over time.

Calculating the average transition matrix is appealing for at least two reasons. First, it allows to use all available information and maintain the statistical correctness of the results. Second, such a transformation is very convenient for comparative purposes. On the basis of the obtained matrices, the following summary indicators of income mobility are calculated: (1) the average quintile move (see Khor and Pencavel, 2006 for the formula), (2) the immobility ratio, defined as the fraction of households that remain in the same quintile (3) the adjusted immobility ratio, defined as the fraction of those who remain in the same quintile or move to an adjacent quintile, (4) the distance between the calculated matrix and the perfect mobility benchmark proposed by Shorrocks (1978), that is one minus the second greatest eigenvalue of a matrix, and (5) the Sommers and Conlisk (1979) measure of mobility, calculated as one minus the product of all eigenvalues.

4.2 Results

Evidence from transition matrices

The transition matrices and corresponding income mobility indices are presented in Tables 3 and 4. The chi-square test for symmetry of the matrices (see Khor and Pencavel, 2010 for an exact formula) cannot be rejected at any conventional level of confidence. At least fifteen percent of households with household head aged between 18 and 85 who occupy the lowest quintile in one period leave that quintile next year (see the left matrix from the top panel of Table 3). On the other hand, less than eighty percent of Polish households remain in the top rank in two subsequent years. Hence, staying in the same quintile appears to be more persistent for the poorest households. This property, also observed in Russia (see Lukiyanova and Oshchepkov, 2011), is not characteristic for the US (see Table 5). Moreover, in the center of the income distribution there is even more mobility with probabilities of remaining in the same rank for the second, third and fourth quintiles lying between 60-70 percent.
Since the main focus of this study is on idiosyncratic aspects of income mobility, those individuals' movements in income distribution that are caused by choosing between education and work or resulting from retirement are not of a particular interest. However, restricting the sample to working-age households (a household head aged between 25 and 65) turns out to add to income mobility, decreasing the immobility ratio from 0.72 to 0.68. This result is a consequence of excluding from the sample retired households whose income shows less variability. Nevertheless, the difference in income mobility between working-age households and the total sample is rather small. Further, adjusting for the household's size increases slightly individuals' movements in income distribution, while imposing correction for the life cycle income profile leaves the estimates of income mobility broadly unchanged. Examining urban and rural households separately (Khor and Pencavel, 2010 show that urban and rural households might not be homogenous in terms of relative income mobility) does not

Table 3: Average annual income transition matrices, Polish households 1999-2008

Sample: household head aged between 18 and 85
Eq. scale: NO, adjusted for age effect: NO

	Income Quintiles				
	Lowest	Second	Middle	Fourth	Highest
Lowest	0.84	0.11	0.03	0.02	0.01
Second	0.11	0.70	0.12	0.05	0.02
Middle	0.03	0.15	0.64	0.15	0.03
Fourth	0.01	0.03	0.16	0.63	0.16
Highest	0.01	0.01	0.05	0.16	0.78

Sample: household head aged between 18 and 85
Eq. scale: YES, adjusted for age effect: NO

	Income Quintiles				
	Lowest	Second	Middle	Fourth	Highest
Lowest	0.79	0.13	0.05	0.02	0.01
Second	0.14	0.63	0.15	0.06	0.03
Middle	0.05	0.17	0.58	0.16	0.03
Fourth	0.01	0.05	0.18	0.62	0.14
Highest	0.01	0.02	0.04	0.14	0.79

Sample: household head aged between 25 and 65
Eq. scale: NO, adjusted for age effect: NO

	Income Quintiles				
	Lowest	Second	Middle	Fourth	Highest
Lowest	0.82	0.11	0.04	0.02	0.01
Second	0.12	0.67	0.14	0.06	0.01
Middle	0.04	0.15	0.59	0.18	0.04
Fourth	0.01	0.06	0.19	0.56	0.19
Highest	0.01	0.01	0.03	0.19	0.76

Sample: household head aged between 18 and 85
Eq. scale: YES, adjusted for age effect: YES

	Income Quintiles				
	Lowest	Second	Middle	Fourth	Highest
Lowest	0.80	0.13	0.04	0.02	0.01
Second	0.12	0.63	0.17	0.05	0.02
Middle	0.05	0.18	0.58	0.16	0.04
Fourth	0.02	0.04	0.18	0.62	0.14
Highest	0.01	0.02	0.04	0.14	0.79

Table 4: Summary of income mobility, one-year horizon, indices for Poland and the US

	eq. scale	age adj.	sample	urban/rural	immobility ratio	adjusted immobility ratio	average quintile move	$1-\lambda_2$ (Shorrocks, 1978)	$1-\lambda_1*\cdots*\lambda_n$	(Sommers and Conlisk, 1979)
POLAND	**NO**	**NO**	**age 18-85**	**both**	**0.72**	**0.94**	**0.36**	**0.14**	**0.85**	
	NO	NO	age 25-65	both	0.68	0.93	0.41	0.16	0.90	
	YES	NO	age 18-85	both	0.68	0.92	0.42	0.17	0.89	
	YES	YES	age 18-85	both	0.68	0.93	0.41	0.16	0.89	
	NO	NO	age 18-85	urban	0.72	0.94	0.36	0.13	0.85	
	NO	NO	age 18-85	rural	0.70	0.93	0.40	0.15	0.85	
the US	NO	NO		both	0.87	0.98	0.15	0.05	0.53	
perfect mobility					0.20	0.52	1.60	1.00	1.00	
complete immobility (identity matrix)					1.00	1.00	0.00	0.00	0.00	

show significant differences between these two groups, either. Generally, the results obtained for Poland are fairly robust to alternative specifications.

How income-mobile are Polish households in comparison to other countries? First, I focus on the difference vis-a-vis the developed economies. Since the existing cross-country analyses (Aaberge *et al.*, 2002; Burkhauser *et al.*, 1998) clearly show that the differences in income mobility between the US and old EU countries are usually very small, and also income mobility in the US was a topic of a number of comprehensive empirical studies, I use this country as a benchmark. The estimates of income mobility in the US are taken from Díaz-Giménez *et al.* (2011) and annualized using the eigenvalue decomposition described in the previous subsection. As shown by Auten and Gee (2007), the results are very similar if one uses individual income tax returns as the data source (see Table 5). Table 4 shows the summary results while the average annual transition matrix for the US is presented in Table 5.

According to all mobility indices Polish households appear to be more mobile in terms of income than the American ones. To ensure comparability with the US, I use the results for Poland obtained for the whole sample without adjusting for family size and age effect (bolded row in Table 4). The smallest difference is observed for the adjusted immobility ratio, which suggests that the main difference between Polish

Table 5: Annual income transition matrices for the US, based on the results from two different studies

Calculated on the basis of Díaz-Giménez *et al.* (2011) Data from waves 2001 and 2007, based on PSID					
	Income Quintiles				
	Lowest	Second	Middle	Fourth	Highest
Lowest	0.92	0.06	0.01	0.01	0.00
Second	0.06	0.85	0.08	0.01	0.00
Middle	0.01	0.08	0.82	0.08	0.01
Fourth	0.01	0.01	0.10	0.83	0.06
Highest	0.00	0.00	0.00	0.07	0.92

Calculated on the basis of Auten and Gee (2007) Data from 1996 and 2005, based on individual income tax returns					
	Income Quintiles				
	Lowest	Second	Middle	Fourth	Highest
Lowest	0.92	0.06	0.01	0.01	0.00
Second	0.06	0.86	0.07	0.01	0.01
Middle	0.01	0.08	0.84	0.07	0.01
Fourth	0.01	0.01	0.08	0.86	0.05
Highest	0.00	0.00	0.01	0.05	0.94

and US households' mobility concerns movements between adjacent quintiles.
As regards the mobility indices for other countries, direct comparisons are difficult due to methodological differences (such as equivalence scales, income measures) and hence one needs to be cautious while interpreting the results. A summary of immobility measures for selected countries with a short description of the main assumptions imposed are presented in Table 6 and 7. The reported results might suggest that the degree of mobility in Poland is more similar to that observed in China and Russia, that is developing or transition economies, than to that obtained for developed countries. Finally, Polish and Slovak households are very similar in terms of relative income mobility while Hungarian households turned out to be slightly more mobile between the income quintiles. However, one should keep in mind that the estimates for Hungary were calculated in the middle of 1990-ties, so the income mobility could have evolved since that time.

Dispersion of income distribution and income mobility

One of the factors that can be responsible for the dissimilarities in income mobility between different countries is inequality in income distribution. Generally, the

Table 6: Summary of income mobility, one-year horizon, indices for Poland, Hungary and Slovakia

	data	year	source	immobility ratio	adjusted immobility ratio	average quintile move
POLAND	**Polish Household Budget Survey**	**1999-2008**	own calculations	**0.72**	**0.94**	**0.36**
Hungary	Hungarian Household Panel Survey	1995-1995	Galasi (1998)	0.56	0.90	0.57
Slovakia	Sociálna poistovňa, KRRZ	2012-2013	Horváth and Siebertová (2015)	0.73	0.95	0.33

narrower the income distribution, the more probable the jump for an individual from one quintile to another.

The quintiles of income in Poland and the US are reported in Table 8. According to these statistics, the income distribution in the US seems to be more disperse than in Poland. In particular, in the US (based on data from 2007, taken from Díaz-Giménez *et al.*, 2011), the third quintile of income distribution was roughly 2.9 times greater than the first one, while an analogous statistics for Poland (according to the Polish HBS from 2010) was only 2.14. Based on the Polish HBS from 2000-2010, the relation between income quintiles in Poland was quite stable over time. The same pattern is observed while comparing the means and medians between the quintiles.

I next try to assess, to what extent the dissimilarities in income mobility between Polish and American households are driven by the differences in the shapes of their income distributions. To this end, an artificial distribution of income for Polish households is generated, such that it mimics that observed in the US. More specifically, the first quintile is kept unchanged and the relation between the first and the rest of quintiles is taken from the US data, see Table 8. Then, the average probability of remaining in the same "simulated quintile" for two consecutive years is quantified and shown in Table 9, together with the estimates calculated on the basis of the observed quintiles for Poland and the US. Except for the lowest and highest quintiles, these artificially generated probabilities are higher than those reported for the original data. In addition, there is a slight improvement in income immobility ratio, but still its value is significantly lower than that in the United States. Hence, adjusting for

Table 7: Income mobility indices for selected countries

country	eq. scale	sample	urban/rural	income	period	database	IR	AIR	AQM
POLAND*	NO	age 18-85	both	average monthly net income	1999-2008 average 5-year	Social Diagnosis 2000-2009	0.35	0.73	1.04
POLAND*	YES	age 18-85	both	average monthly net income	1999-2008 average 5-year	Social Diagnosis 2000-2009	0.32	0.69	1.14
USA**	NO		both		2000-2006	Panel Study of Income	0.56	0.89	0.58
USA***					1986-1991	Dynamics	0.47	0.84	0.76
Germany***	NO	all wage and salary workers	both	gross monthly earnings	1986-1991	German Socio-economic Panel	0.52	0.88	0.65
Denmark***	NO	all wage and salary workers	both	gross monthly earnings	1986-1991	Danish Longitudial Database	0.46	0.81	0.81
Finland***	NO	all wage and salary workers	both	gross monthly earnings	1985-1990	Census Longitudial Database	0.44	0.79	0.89
France***	NO	all wage and salary workers	both	gross monthly earnings	1986-1991	Declarations Annuelles des Donnees Sociales	0.53	0.85	0.68
Italy***	NO	all wage and salary workers	both	gross monthly earnings	1986-1991	Instituto Nazionale de Previdenza Sociale	0.50	0.86	0.69
Sweden***	NO	all wage and salary workers	both	gross monthly earnings	1986-1991	HUS - Household market and nonmarket activities	0.51	0.87	0.68
U. Kingdom***	NO	all wage and salary workers	both	gross monthly earnings	1986-1991	New Earnings Survey Panel Dataset	0.51	0.87	0.66
Russia****	YES			income measured on monthly basis	2000-2005	Russian Longitudinal Monitoring Survey	0.34	0.72	1.06
China*****	NO	age 22-69 individuals	urban	recalled future and past income	1990-1995	Chinese Household Income Project 1995	0.33	0.71	1.06
perfect mobility							0.20	0.52	1.60
perfect immobility							1.00	1.00	0.00

* Own estimates, ** Díaz-Giménez *et al.* (2011), *** OECD (1996), **** Lukiyanova and Oshchepkov (2011), ***** Khor and Pencavel (2006)
IR – immobility ratio; AIR – adjusted immobility ratio; AQM – average quantile move

Table 8: Quintiles of income distribution in Poland and the US

	Quintiles (Q20=100)			
	20	40	60	80
Poland*	100	155	214	303
USA**	100	181	293	491

* From the Polish HBS, 2010.
** From Díaz-Giménez *et al.* (2011), data from 2007.

Table 9: Probability of remaining in the same quintile (2-year period) for Poland and the US, based on the observed and simulated quintiles

	Based on the observed quintiles					
	Q1	Q2	Q3	Q4	Q5	immobility ratio
Poland	0.72	0.52	0.45	0.45	0.63	0.55
USA	0.85	0.73	0.68	0.70	0.86	0.76

	Based on the simulated quintiles					
	Q1	Q2	Q3	Q4	Q5	weighted immobility ratio*
Poland	0.70	0.59	0.54	0.47	0.48	0.58
share of population	0.23	0.32	0.27	0.14	0.04	

*weighted with the share of population

the inequality in income distribution reduces only slightly the observed differences in income mobility between Poland and the US.

5 Concluding remarks

In this paper I investigated the life cycle income and consumption patterns in Poland in the 2000s, relying on the estimates of the income and consumption distributions as well as transition matrices of relative income mobility.

I find that the age-profiles of average income and consumption exhibit a hump over the life cycle, which is in line with the empirical evidence for advanced economies. However, in contrast to the US, where average consumption over the life cycle grows at a relatively stable rate up to the age of 50, in Poland a sharp increase is observed below the age of 30, after which consumption growth becomes moderate. Interestingly, a significantly higher growth rate during the 25-30 phase of life occurs only for the relatively educated individuals. Around the age of 55, together with declining income, households start to decrease their consumption and continue reducing their spending till the end of their lives. At the same time, they maintain their saving rate at a positive level. Possible explanations of this phenomenon, based on more detailed

spending categories, are a reduction of work related expenditures and a decrease in marginal utility of consumption with age.

The inequality of income over the life cycle is found to flatten relatively quickly in Poland. After a rise in the early phase of life, it remains quite stable for household head aged between 30 and 55. When individual income process is fitted to match this shape, it exhibits less persistence compared to that found for the US. Interestingly, if more and less educated households are examined separately, it turns out that past earnings affect current income more strongly in the former group. However, this conclusion is somewhat weakened by wide confidence intervals associated with the age-variance profile for educated households. Also, and in contrast to the permanent income hypothesis as well as findings for other economies, I do not find any evidence of an increase in consumption inequality for households older than 30 years.

Finally, I show that Polish households are more mobile between income quintiles than the American ones and only a small part of this difference can be explained by different shapes of their income distributions. In general, relative income mobility in Poland is more similar to that observed in other developing or transition economies, such as China, Russia, Slovakia or Hungary than to estimates obtained for developed countries.

Poland has recently seen a rapid increase in the share of young people starting tertiary education. Hence, as shown in the paper, one can expect that in the coming years the importance of past experience for the evolution of workers' income will be growing. This observation raises a number of challenges for economic policy. First, it is very important that the observed increase in education attainment is compatible with what the economy really needs. Second, since the first few years in the labour market might be of great importance for individuals' future earnings, some assistance for graduates that would help them choose an appropriate career path could be desirable.

The fact that Poland is characterized by higher relative income mobility than developed economies might be seen as a positive feature as it implies less permanent inequality, and in particular that people do not get easily trapped in poverty. However, in the case of Poland, high income mobility might also reflect a significant share of short-term contracts that give very little job and social security to employees. Indeed, Poland is one of the countries with the biggest share of such employment contracts in Europe. This problem needs to be addressed by appropriate policy measures. These have to be implemented carefully as less contractual flexibility in the labour market might bring undesired consequences such as higher unemployment.

Another striking finding of this paper is significantly positive savings among very old households. Since this group struggles with fast changing environment and worsening of their health conditions, its members might grow highly risk averse. Therefore, it would be interesting and policy relevant to indicate the exact factors behind such a substantial shrinkage in consumption of the elderly. I leave it for further research.

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Data appendix

Here I compare the data from two major sources used in this paper. The first one is the HBS. Every year the Polish Central Statistical Office (CSO) publishes a report "Household Budget Surveys", which contains the main descriptive statistics and indicators calculated on the basis of the HBS, with methodological notes explaining

how the survey is conducted. This report is publicly available on the CSO official website. Therefore, in this appendix I discuss only those HBS statistics which are crucial to the life cycle analysis. The second database is the Social Diagnostics, which is publicly available and can be downloaded from the website (see www.diagnoza.com). Since the data from this source were used in this study only to a limited extent, I also limit their discussion to the most important characteristics.

Table 10: Number of observations, left panel: in each cohort, based on the HBS 2009, right panel: for each 2(3)-year panels constructed using two adjacent waves, based on the SD 2000-2009.

age of household head	number of observations	age of household head	number of observations	age of household head	number of observations	age of household head	number of observations
18	10	38	678	58	865	78	348
19	65	39	690	59	862	79	308
20	118	40	656	60	846	80	239
21	126	41	662	61	824	81	215
22	187	42	679	62	740	82	195
23	227	43	667	63	639	83	184
24	248	44	773	64	441	84	143
25	338	45	748	65	524	85	106
26	333	46	739	66	459		
27	368	47	737	67	486		
28	433	48	815	68	467		
29	484	49	887	69	485		
30	508	50	950	70	495		
31	510	51	974	71	511		
32	577	52	966	72	437		
33	613	53	998	73	451		
34	634	54	981	74	409		
35	642	55	1014	75	386		
36	629	56	977	76	363		
37	608	57	953	77	341		

Panel	Number of observations
2000-2003	2095
2003-2005	2725
2005-2007	2391
2007-2009	3225

Roughly 37 thousand of observations from the HBS spread unevenly over the households with different age of household head, in line with the structure of the population. Therefore, cohorts used to calculate the mean and the variance of income/consumption distribution vary considerably in size. The left panel of Table 10 presents the number of observations in such cohorts for year 2009. For each age of household head, there are between 10 and more than 1000 observations, with the average number of 544. The second part of this study relies on all adjacent waves from the SD 2000-2009 and the size of the panels used to construct the transition

Table 11: Selected demographic facts from the HBS and the SD

	2000	**HBS**	**HBS**	**HBS**	2010	**HBS**	**HBS**	**HBS**
	Share of all HHS			Average no.	Share of all HHS			Average no.
Age	Without academic degree	With academic degree	total	of HHS members	Without academic degree	With academic degree	total	of HHS members
18-25	0.92	0.08	0.038	3.2	0.77	0.23	0.042	2.4
26-30	0.81	0.19	0.066	3.4	0.56	0.44	0.070	3.1
31-35	0.85	0.15	0.077	3.9	0.62	0.38	0.087	3.5
36-40	0.88	0.12	0.102	4.2	0.72	0.28	0.096	3.8
41-45	0.86	0.14	0.140	4.0	0.79	0.21	0.093	3.8
46-50	0.86	0.14	0.138	3.6	0.79	0.21	0.102	3.5
51-55	0.85	0.15	0.106	3.0	0.83	0.17	0.119	3.0
56-60	0.87	0.13	0.069	2.5	0.83	0.17	0.111	2.5
61-65	0.88	0.12	0.080	2.2	0.83	0.17	0.086	2.2
66-70	0.91	0.09	0.078	2.1	0.83	0.17	0.062	1.9
71-75	0.90	0.10	0.058	1.9	0.86	0.14	0.061	1.8
76-80	0.91	0.09	0.036	1.8	0.84	0.16	0.047	1.8
81-85	0.96	0.04	0.011	1.7	0.88	0.12	0.024	1.7

	2000-2003 (in 2000)	**SD**	2003-2005 (in 2003)	**SD**	2005-2007 (in 2005)	**SD**	2007-2009 (in 2007)	**SD**
	Share of all HHS	Av. no. of HHS members	Share of all HHS	Av. no. of HHS members	Share of all HHS	Av. no. of HHS members	Share of all HHS	Av. no. of HHS members
18-25	0.017	2.5	0.010	2.6	0.008	2.1	0.010	2.3
26-30	0.042	3.5	0.045	3.0	0.028	2.8	0.040	2.9
31-35	0.073	3.8	0.051	3.9	0.057	3.3	0.071	3.3
36-40	0.089	3.9	0.074	3.9	0.075	3.8	0.079	3.9
41-45	0.125	4.1	0.104	3.9	0.104	3.7	0.096	3.8
46-50	0.122	3.7	0.123	3.8	0.124	3.7	0.129	3.5
51-55	0.126	3.0	0.125	3.2	0.128	3.2	0.129	3.0
56-60	0.074	2.5	0.102	2.8	0.133	2.6	0.127	2.7
61-65	0.112	2.1	0.096	2.3	0.082	2.4	0.067	2.6
66-70	0.095	2.0	0.091	2.0	0.095	2.0	0.076	1.9
71-75	0.073	1.7	0.093	1.9	0.081	1.9	0.082	1.8
76-80	0.041	1.7	0.060	1.8	0.054	1.9	0.054	1.7
81-85	0.011	1.7	0.027	1.7	0.030	1.6	0.039	1.7

matrices varies between 2000 and 3300 observations (for exact numbers, see right panel of Table 10).

The life cycle characteristics of the data such as the distribution of population according the age of household head and the average number of households slightly differ between the two datasets (see Table 11). For instance, young households are underrepresented in the SD, while the share of elderly individuals is greater than in the HBS.

Finally, these two databases are compared in terms of income concentration. Based on the HBS from 2000-2010, the shares of total households' income in each quintile of population (where households in a sample are ranked according to their available

income) remained quite stable over time. The 20 percent of the richest generate more than 40 percent of total households' income, while the poorest 20 percent have at their disposal only less than 7 percent of income (see Table 12). This result remains unchanged when disposable rather than available income is used. Less precise estimates are obtained from different panels from the SD, probably due to the smaller number of observations and relatively lower quality of data. Nevertheless, no clear discrepancy in terms of income concentration is observed between the HBS and the SD.

Table 12: Income concentration

Household Budget Survey, 2010		Quintiles				
		Lowest	Second	Middle	Fourth	Highest
available income		0.066	0.116	0.167	0.230	0.421
disposable income		0.066	0.116	0.166	0.230	0.422
Social Diagnostics (from all 2(3)-year panels)						
available income	min	0.053	0.112	0.165	0.228	0.387
from previous year	max	0.078	0.125	0.174	0.238	0.429
	mean	0.070	0.120	0.170	0.232	0.408
Social Diagnostics (year 2009 from 2007-2009 panel)						
avalilable income from previous year		0.061	0.112	0.167	0.231	0.429
avalilable income from previous month		0.063	0.111	0.163	0.230	0.433