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Abstract: Research on income and fertility has largely focused either on the cross-sectional relationship between income and current number of children or income the year before childbearing. In the current study, a novel and superior measure of income and earnings is introduced to assess whether poorer or richer individuals have more children. Accumulated income histories are calculated and presented for men and women in contemporary Sweden for cohorts born between 1940 and 1970 using administrative register data. The study shows how income is related to completed fertility and parity for two different operationalization of income: disposable income and earnings. There is a strong positive gradient between accumulated income and fertility for men for all cohorts, and a gradual transformation from a negative to a positive gradient for women. In particular, childless men and women have substantially lower accumulated incomes than do men and women with children. For men, fertility increases monotonically with increasing income, while for women much of the positive gradient is the result of low fertility among women with very low accumulated income in later cohorts.

Keywords: Fertility, Income, Accumulated income, Differential fertility, Sweden

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Introduction

The relationship between income and fertility is a classical topic in demography. The pioneers of social science in the 19th century, such as Galton and Pearson, were interested in the income gradient between income and fertility, and throughout the 20th century the topic was of continuing interest for social scientists. The relationship is also central to the theorizing on the relationship between the economy and population growth done by classical economists and demographers such as Thomas Malthus and David Ricardo, and has, since the 1960s, once again become a major topic in labor economics. Throughout the 20th century until today, sociologists and demographers have continued to empirically examine how fertility is related to various dimensions of social status. To understand why we observe an income gradient, two aspects are central, and have guided previous research on the topic.

– How does income affect childbearing?

– How does having children affect income?

In the present study, I examine the net outcome of these two relationships by examining the relationship between accumulated fertility and income. I also assess the overall bivariate association between fertility and accumulated income at different ages. Such an approach avoids many endogeneity issues associated with other attempts to study the income-fertility relationship. The goal of the study is to answer the following research question:

– How is total income associated with fertility over the life course for men and women? How has this changed over time?

The study provides an aswer to wheter richer or poorer individuals have more children over the life course in Sweden. To my knowledge, the relationship between accumulated income and fertility has never been empirically assessed in previous studies. The study question directly addresses one of the major questions in the social sciences, often referred to as the extent of differential fertility, or the income gradient for childbearing.

I use longitudinal Swedish register data containing over 44 years of yearly income histories to relate accumulated income over the life course to fertility outcomes at ages 20 to 60. Accumulated income over the life course is an ideal measure for assessing whether richer or poorer individuals have more or fewer children, as it accurately captures different wage trajectories, reduced formal labor participation following childbearing and income penalties related to childbearing. I focus on differences by gender, and how gender differences have

changed over time, which is important given changes in female labor force participation over the period. The longitudinal scope and life course measurements provide several advantages over earlier research on the topic, and the study offers evidence of a positive association between fertility and income that grows stronger over time.

To give a background to the interest in the overall income gradient in a society, I first summarize previous theorizing and researchers' reasoning concerning how the two-way relationship between childbearing and fertility works. Much of this research has been motivated by the puzzle of an empirical negative income and fertility gradient, and various explanations have been suggested as to why higher income may lead to lower fertility (Jones, Schoonbroodt, & Tertilt, 2010).

Does higher income increase childbearing?

A different way to put the question of whether fertility increases by income is: Does an increase in income increase the "consumption" of children? In general, more income and wealth lead to greater possibilities to meet the demands and desires related to most aspects of life. The question can then be posed as to whether children are a "normal good" (when income increases consumption, applying the terminology of economics)? Because children are both very desirable for most people and very costly, in material resources as well as time, this is an intuitive assumption. It these two requirements are met (as they arguably are for children), we would then expect the demand for quality (e.g. education) and quantity to increase with income, and richer individuals would be expected to have more children. Classical demographic theory, such as that presented in Thomas Malthus's writing on population (1798), assumes that childbearing will increase with increasing income and resources. In historical societies and in less developed societies, the evidence for such a relationship is robust (Galloway, 1988; Lee, 1987; Skirbekk, 2008). In all societies the financial costs of children for families are very substantial, and in high-income societies chidren provide few resources for their parents. For a dual earner couple this is particularly large in countries with non-subsidized pre-school childcare, while if one partner is a primary breadwinner there is a instead a major "shadow cost" of children (the lost income of the caregiver).

While the theoretical arguments suggesting that children behave like a normal good are strong (and that richer parents should be able to afford more and "higher quality" children), industrial societies in the 20th century have instead shown the reverse pattern. In most 20th century populations, it has repeatedly been shown that higher income, and to an even greater extent

education, is negatively related to completed parity for both men and women (e.g. Jones & Tertilt, 2008; Skirbekk, 2008). Based on such evidence, economists (most famously Gary Becker) have instead theorized that because children are very time intensive and time is fixed for all parents (and is assumed to be non-substitutable, unlike most other goods), the relative cost of children increases with income (Becker, 1991; Becker & Lewis, 1974). In essence, the argument is based on the idea that much of the investment in children consist of parental time, which is fixed for all parents. Higher-income parents will therefore have a higher relative demand for leisure and other goods than will poorer individuals, who, on the other hand, will have a relative abundance of time. Therefore the relative cost of children will be lower for lower-income parents and, consequently, these parents will have more children. There are many variations on this argument (see Jones et al., 2010, for an excellent summary). In general, a large number of assumptions have to be met for this argument to be true (Jones et al., 2010); most importantly that children require time investments that are not easily substitutable (employed non-parent caregivers cannot replace parental caregivers), and that there is a strong elasticity of substitution between leisure and childrearing (you have to choose between them).

Does childbearing affect income?

It is also possible that having children will influence income over the life course. This would be the second part of the two-way relationship that contributes to the overall relationship between accumulated income and fertility. It is obvious that having children is labor intensive and as such competes with wage labor. Even with public or private childcare during workdays, having children should compete with time in paid labor (because taking care of children takes time), and if cultural norms dictate that parents (or wives) should stay home to take care of children, such effects will have a dramatic effect on combined income. In all societies, parents must stay outside the labor market at least briefly, and even if the government subsidizes parental leave, this period will reduce income and disrupt careers. Sociologists and economists have focused a great deal on "fatherhood premiums" and "motherhood penalties" in the labor market, as employees may change their behavior, and employers may treat employees differently (Budig & England, 2001; Sigle-Rushton & Waldfogel, 2007). It seems clear, based on empirical evidence, that there is a negative effect of having a child on both the labor supply and wages of women after the birth of a child (e.g. Cools, Markussen, & Strøm, 2017). Many of the structural factors related to combining work and childbearing (both in how the labor market is organized, and in cultural norms in some societies discouraging female labor force participation of mothers) can be viewed as a negative of effect of having children on income.

Overall, such factors have primarily caused a negative relationship between yearly earnings and childbearing for women. In Sweden such factors have gradually diminished in importance over the 20th century though certainly not disappeared (Stanfors & Goldscheider, 2017).

Fertility, income, preferences, and selection

Theories above are of course based on the assumption that childbearing preferences (or "tastes" in economics terminology) are the same for everyone in a given society, as well as the assumption that childbearing decisions are planned by parents and primarily driven by rational calculations (cf. Blake, 1968). Throughout the study, the perspective taken is that childbearing is largely planned and linked to parental preferences and desires. This is a reasonable perspective on Swedish reproductive behavior during the period under study, but might be less valid in other time periods and contexts.

Finally, and very importantly, groups may simply differ in their desire for children for other (cultural, family background, religious, etc.) reasons, and these groups may also differ in income. In such cases, we might observe a relationship between income and fertility when such individual- or group-level traits are not taken into account, but once such factors were adjusted for, there would be either a positive or a negative relationship between fertility and income (based on a researcher's view of the underlying relationship). One example might be that recent immigrants to a country have both high fertility norms and lower income, and that this creates a spurious relationship between income and fertility. Such arguments have been used to explain observed negative empirical relationship between income and fertility for both men and women in the 20th century (Borg, 1989; Easterlin, 1969; Jones et al., 2010). According to such theories, the underlying relationship between fertility and income is positive, and negative empirical observations are due to a missing variable problem, which could in theory be adjusted for[1].

It is important to stress that the association between life-course income and fertility may vary across time, space, and context. This may be because rational calculations are context dependent across different societies or because of cultural preferences and group composition change over time and context. The goal of the current study is to empirically determine the overall income and fertility gradient in Sweden.

[1] For example, Becker (1960) initially theorized that it was differences in knowledge and access to contraception that explained a negative gradient in the US, while the underyling demand for children were as for a normal good.

Previous empirical investigations

Overall, there is evidence of a positive association between income and fertility in low-income and historical societies, in particular for number of surviving children (Lee, 1987; Skirbekk, 2008). With the fertility transition, a negative relationship started to emerge, with high-status groups being the first to reduce their fertility (Dribe, Oris, & Pozzi, 2014; Livi-Bacci, 1986). Over the 20th century, most richer societies have consistently shown a negative gradient between income and fertility (Jones & Tertilt, 2008; Skirbekk, 2008), with possible exceptions during times of rising fertility, such as the during the "baby boom". Most research have examined male or household income, and much less research have focused on the gradient between female income and fertility (though research on female labor force participation and fertility is common).

Some study designs have looked for exogenous variations in fertility to examine the relationship. Variations in child benefits seem to support the notion that an exogenous increase in child benefits is associated with higher fertility in Quebec (Cohen, Dehejia, & Romanov, 2013; Milligan, 2005). Studies from the US over the past 50 years provide mixed evidence for male and female income using a variety of identification strategies and theoretical models (e.g. Becker & Lewis, 1974; Borg, 1989; Freedman & Thornton, 1982; Schaller, 2016), though overall broad associations appear to be consistently and robustly negative (Jones & Tertilt, 2008).

Compared to many other rich countries, Sweden has shown a less clear pattern of a uniform negative association between income and fertility over the 20th century. For the period around 1920, Swedish researchers (Edin & Hutchinson, 1935) contrasted a positive household income and fertility association in urban Stockholm (though poorer rural areas still had higher fertility) with a negative pattern found elsewhere in other rich countries. In the first half of the 20th century, Sweden has a clear negative gradient between female labor force participation and fertility, but this weakens starting in the middle of the century onwards (Sandström & Marklund, 2017). Bernhardt (1972) examined the relationship between fertility and income among Swedish married couples, where fertility and income were measured in the 1960s. She found no strong gradient for entry into parenthood, a slight positive gradient for having a 2nd child, and a negative gradient for higher-order births. Overall, this translated into a slight

negative gradient. However, couples in the highest income groups also had a large number of children.

There is recent evidence of positive income-fertility associations in Scandinavia when current income is compared with propensity to have a child the following year, in particular for men, but also for women (Gunnar Andersson, 2000; G. Andersson & Scott, 2008; A. Z. Duvander & Andersson, 2003; Jalovaara & Miettinen, 2013). Recently there is also some evidence of a macro-level, positive cross-sectional association between GDP/HDI and fertility at high levels of development (Myrskylä, Kohler, & Billari, 2009). For education, researchers still typically find a negative gradient between longer education and fertility (e.g. Preston & Hartnett, 2010; Skirbekk, 2008), but this too is changing in Scandinavia in recent cohorts were gradients are positive for men, and neutral for women (Jalovaara et al., 2018).

There is strong support for a positive association between positive economic cycles and fertility historically, typically based on how mean salaries and grain prices have affected fertility prices (e.g. Bengtsson, Campbell, & Lee, 2003; Galloway, 1988; Lee & Anderson, 2002). Such a relationship is central in a Malthusian model of population development. There is also increasing evidence of macro-level pro-cyclical fertility in richer countries (e.g., Sobotka, Skirbekk and Philipov 2011). A negative relationship is clear when societies are examined cross-sectionally, based on the level of development (cf. Thornton, 2005). In a long-term historical perspective, it is also clear that people in vastly poorer societies have had more children. Therefore, it is important to keep in mind the fact that the theories and empirical findings on the gradient between income and fertility presented in the current study are related to the relative income distribution within a society, and are likely not as relevant to absolute income and fertility over longer time spans.

Measuring income and fertility

The classical method of assessing the relationship between income and fertility has been to simply examine the bivariate association between income at a given age and current fertility. In contemporary research, an increasing number of studies have instead used survival analysis models, in which longitudinal data are used to assess the relationship between conception risks and current income at the time of risk of conception. Through these two approaches, we have learned a great deal about the association between fertility and income. However, both the cross-sectional approach to correlating income with fertility and the approach correlating

current income with fertility are inconsistent with how researchers know men and women arrive at fertility decisions. Fertility choices are endogenously related to expectations of future income trajectories. There are also strong negative short-term effects of childbearing on income and labor supply, particularly for women. Therefore, it is potentially highly misleading asses the relationship between fertility and income both by relating income after childbearing is complete (e.g., at age 55), as well as examining how current income is related to the decision to have an (additional) child. Many such considerations were listed by Ewer and Crimmins-Gardner (1978).

Contemporary research on European and US populations has often used survival analysis models, with time-varying covariates, to assess how labor force participation and income affect the chance of conception at varies parities. This is clearly appropriate for studying how economic shocks affect fertility and gives a good indication of how current income is related to when parents choose to time their births. However, this approach will by necessity focus on income in early adulthood, before income is a good predictor of life course income. It also risks mixing up the question of when is a good time to have children with the different research question of whether richer men and women have more or fewer children. Finally, there are strong endogeneity problems related to such an approach, as fertility is carefully planned in contemporary societies and income before birth is likely endogenous with fertility plans. Couples living in societies with income-based parental leave benefits often have strong incentives to maximize income before a birth. It has also been suggested that timing of births in Sweden is influenced by reforms affecting how parental leave benefits are linked to income before childbirth (Hoem, 1993). Finally, by virtue of their design, such studies do not take into account the post-birth effects of childbearing on income. A particularly problematic aspect of using income before childbearing is that individuals with high-status occupations will have much more dramatic income acceleration in the middle of their working careers than will individuals in low-status occupations (Bhuller, Mogstad, & Salvanes, 2011). Because the costs of childbearing are spread out decades after the birth of a child, individuals with steeper income growth will have much better opportunities to afford a large number of children. By mid-adulthood most indivudals have at least a rough idea of their future career and income trajectories, and it seems likely that expected life-course income will play a part in their calculation how many children they can afford.

In economics, the concept of accumulated life course income is closely related to that of permanent income (Friedman, 1957). It plays a major role in theoretical economics, and is

typically operationalized as future expected income, which is postulated from present traits (such as sex, educational level, parental background or occupation in early adulthood). It is only very rarely assessed or validated using retrospective empirical data. Richard Easterlin (1969) made a strong case for the value of permanent income in studying the income-fertility relationship, but this call has not been answered in the empirical research. Becker also suggested that a fuller treatment of income and fertility required paying attention to the permanent income concept (Becker, 1960). One study (Ewer & Crimmins-Gardner, 1978) made a serious attempt to sort out how income measured at various life stages relates to life course income and how this affects the income and fertility relationship. They examined current income, expected income, and income trajectories, and found that relying on the current income measure was deeply problematic for assessing the relationship between life course income and fertility. Freedman and Thornton (1982) also compared to some extent current and expected income in their assessment of the relationship between income and fertility.

Some authors have argued that expected income is a better measure than actual income. This is motivated by the notion that expectations are what matter at the time of deciding to have a child. As such, expected income might be relevant to understanding childbearing decisions, if not overall associations between fertility and accumulated income. One inescapable problem is that expected income will always have to be inferred, and this is done typically based on cross-sectional or historical data. Expected income is calculated with an imputation technique with a large number of assumptions based on, for example, current educational achievement (e.g. Bollen, Glanville, & Stecklov, 2007). Expected income will by necessity capture typical and average trajectories and not the messy income trajectories observed in empirical populations. Such techniques will ignore the role of volatility, which accumulated measurements elegantly capture. To understand stratification using actual income and fertility associations is also clearly superior to measures of potential income. Some researchers are more interested in hypothetical income given a hypothetical lifecourse, for example when assessing the opportunity cost of childbearing for women. This is not, however, the research aim of the current study.

A limited number of previous studies have correlated life course income with current income at various ages (Björklund, 1993; Böhlmark & Lindquist, 2006). They found that, at all ages, it is an imperfect measure of life course measurement, but that it is highest around and after age 45. At ages 25 to 35 the correspondence is rather poor, which casts doubt on how useful current income before childbearing is in relation to future income trajectories. Such research has focused on men, but the problems when applying it women are likely much greater, as labor

force participation among women generally varies dramatically across the life course. This is particularly problematic when studying the fertility-income relationship, as fertility is directly and strongly related to labor force participation. It should also be noted that the association between current income and life cycle income looks very different for different occupational trajectories. For assessing social mobility, it is more robust to examine life course income rather than mid-life income (Grätz & Kolk, 2019).

The current study measures invidual lifecourse trajectories. Unlike most previous research, the aim is not to measure household income. With increasing female labor force particpation, increasing union instability, and increasing part of the life course spent outside unions, an invidual rather than household perspective on life course income become increasingly relevant to understand an inviduals socioeconomic position, in particular in Sweden, but also other western societies. The concept of life course earnings must also be neccessity be an indivudal measure, that cannot be applied to a couple (in particular in a context of increasing ages of union formation, and prevalence of union disolutions). An indivudal level perspective addittionally asures that we have a sample of the complete population, and our results generalize better for understanding societal level processes.

A large number of empirical drawbacks are avoided by relying on empirical data with accumulated income histories. The fact that this approach has been used so rarely is likely due more to lack of empirical data than to any theoretical objections. Unlike some other research designs in previous literature, the goal of this study is not to examine whether – everything else being equal – income increases or decreases childbearing. The goal is to give a detailed and unambiguous answer to the question of whether individuals with higher or lower income have more children over their life course, as observed in population data.

Data and methods

In the study, I examine how lifetime accumulated income correlates with fertility at various ages using Swedish register data on the complete population for cohorts born from 1940 to 1970. Administrative income registers are available from 1968 until the end of the dataset at 2012 for ages 20 to 60, together with complete fertility histories. For most cohorts, income and fertility trajectories are available from age 20, though for the earliest cohort (1940) the income measurements begin at age 28 and are therefore not directly comparable with those for younger cohorts. The income and fertility histories of the younger cohorts are right-truncated in 2012

before age 60. The information on fertility is derived from the Swedish multigenerational register, which is based on yearly birth records and documents the recognized biological parents. All children can be linked to both parents, as long as the government knows the father (over 99% of cases) and the parents survived until 1960. Administrative registers on taxation contain all income known by the authorities, including transfers made by Swedish state or municipal governments. Sweden had individual taxation throughout the period (though joint taxation for spouses was optional 1968-1971), and all income refers to individual (and not couple) income (and benefits).

The population of the study is the Swedish never-migrated population, which survived to age 60 (or 2012). The population that experienced death or emigration is not right censored, but is instead not part of the study population. Income measurements refer to the total taxed income of that year. Measures of hours worked and wages are not available in Swedish registers, as they are derived from yearly tax declarations of yearly income. Fertility measurements are based on the current fertility and accumulated income at that age (though I also provide some results using final rather than current parity). I will examine how this relationship has evolved over time, as well as estimating trends separately for both women and men, and differences by parity. I will also assess mean fertility in relation to various accumulated income brackets at age 50. In supplemental Figure S1, a lexis diagram shows data availability for the cohorts under study. The population include all residents of Sweden, but even including the complete population, some of the groups include very few individuals (in particular men with high parity at a very early age, and women with very high earnings). The estimates for these groups are not stable, and interpretation should be made with care (for the income-group statistics, data-points with less than 5 members have been removed). All input data for the graphs are available in supplemental material S1_data.

I use two time series for income for men and women. The first is disposable income, which is net of (progressive) taxes and includes all social benefits and transfers paid by the government, including social welfare schemes. Importantly it includes both child allowances and parental leave benefits. The second is earnings, which are a measure of all wage income, and is gross of taxes. Importantly it does not include parental leave but includes brief episodes of sick leave. These are the two reliable time series available in Swedish registers since 1968. Income series are inflation adjusted (2000 is the reference point) and presented in Swedish crowns, during the 2000s the exchange rate to the Euro and USD was around 0.1 to 0.15.

The two time-series capture different aspects of economic resources for the parents. Disposable income includes incomes after transfers. This means that it is income after progressive taxation as well as targeted support to disadvantaged groups that are included, and as such, the distribution is much more equal than for gross earnings. Additionally, and very important to the present study, is the fact that various government transfers targeting parents, such as the universal Swedish child allowance[2], are included in the disposable income measure. Equally important, the measure includes parental leave benefits[3] as well as benefits for support of sick children.

The measure of earnings, in contrast, is a conservative measure. It is based on pre-tax incomes and does not include parental leave (which is paid by the government and not the employer). As it does not include parental leave benefits, any episode away from work has a strong negative effect on accumulated earnings (even though the parent receives social insurance payments for the first year, close to income replacement). The measure is representative of the employer's perspective on an individual's labor supply. As it is based on income before progressive taxation and includes social transfers, it is less concentrated than the disposable income measure, which is after taxation.

Child allowances are by default paid to the mother, and even though this can be changed this is uncommon. Paid parental leave was introduced in 1976, and at that time men took out 0.5% of all days. Men took less than 10% of paid parental leave until the mid-1990s and less than 20% until 2006 (A.-Z. Duvander & Johansson, 2012). Therefore, female earnings are affected much more by childbirth, while in measures of disposable income parental leave benefits are included so the gender differences are less marked. Men's higher incomes also mean that men are affected by progressive taxation to a higher extent than women.

[2] The child allowance has grown from around 50€ child/month in current prices in the 1960s, to about 100€ child/month today, and it increases nonlinearly with each additional child. Starting from the 3rd child, parents get over 200€ per child, tax-free without any means testing.

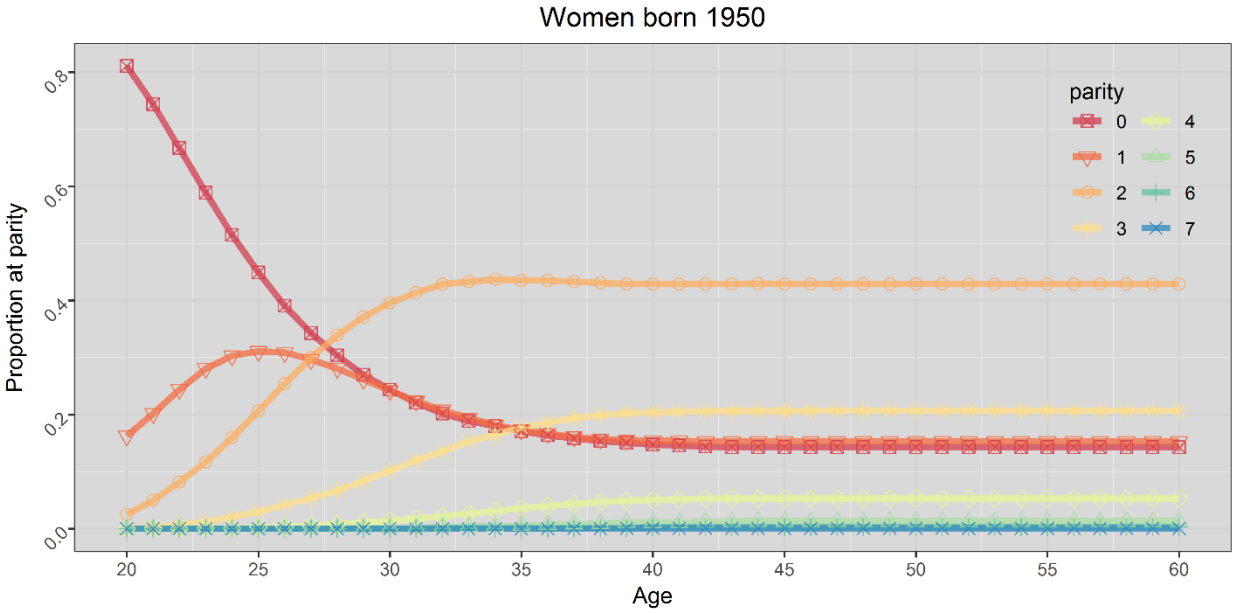
[3] When introduced in 1974, parental leave benefits were 60% of pre-birth salaries, for 6 months and shared by parents. They have increased over time to 80% (and often 90% through employer collective agreements) for 14 months. The ceiling levels are high enough to not affect most parents, particularly if they are covered by collective agreements.

Results

Descriptive results

I begin by giving a descriptive picture of fertility trends for the cohorts over time. In supplemental Figure S2, the relationship between mean fertility by age and cohort is shown. While levels varied substantially over time (Gunnar Andersson & Kolk, 2016), this was not reflected in cohort fertility rates, which were very stable over time for the study cohorts. However, age of childbearing increased across cohorts. The parity distribution for women in the 1950 cohort is included in Figure 1, as many of the results will be shown by parity. The distribution from a male perspective is very similar shifted a few years to the right. The completed parity distribution remained constant over time, with the exception of some fertility postponement. In other supplemental files (Figure S3), I show the distribution by parity by age by cohort.

Figure 1. Parity by age for Swedish women born in 1950.

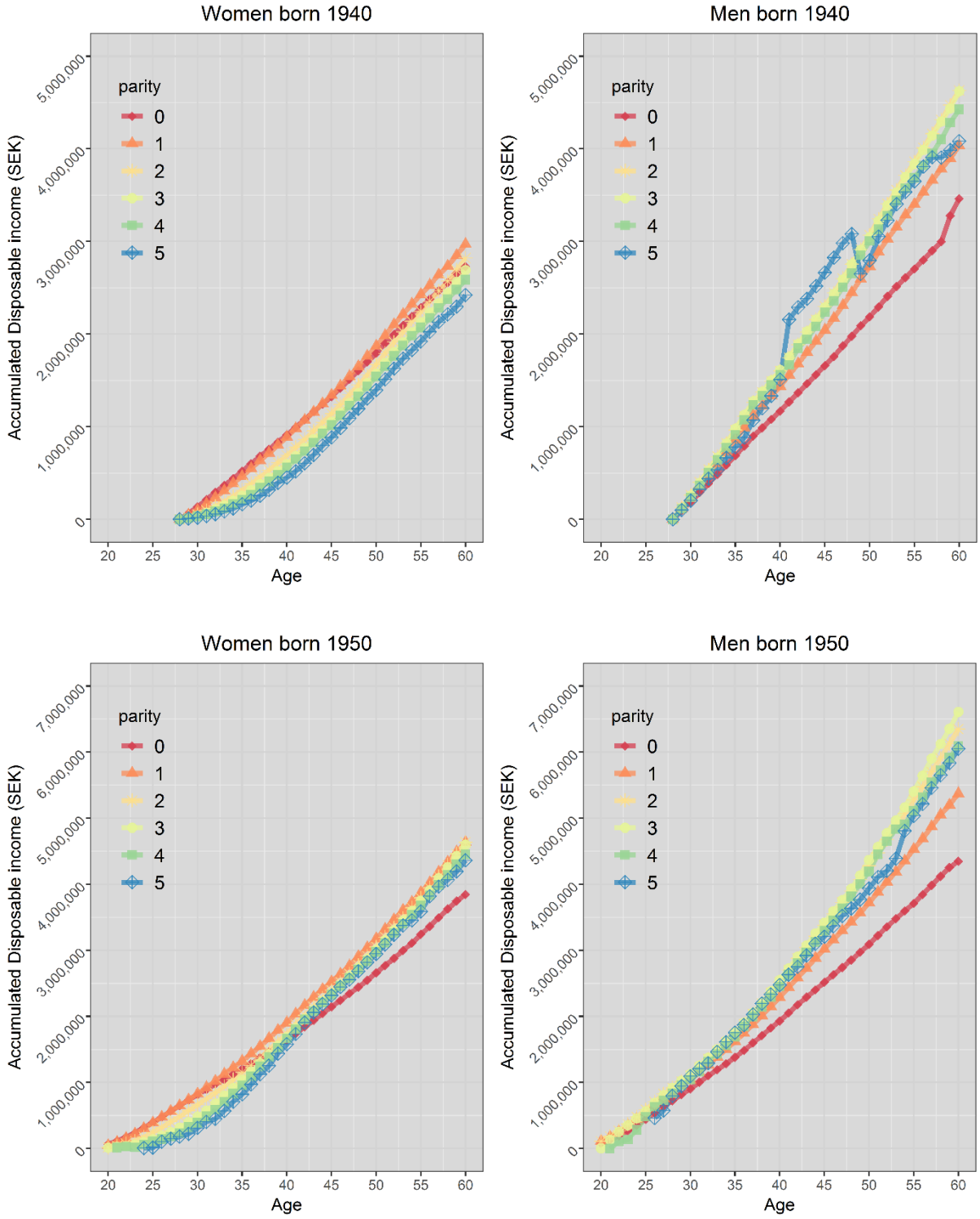


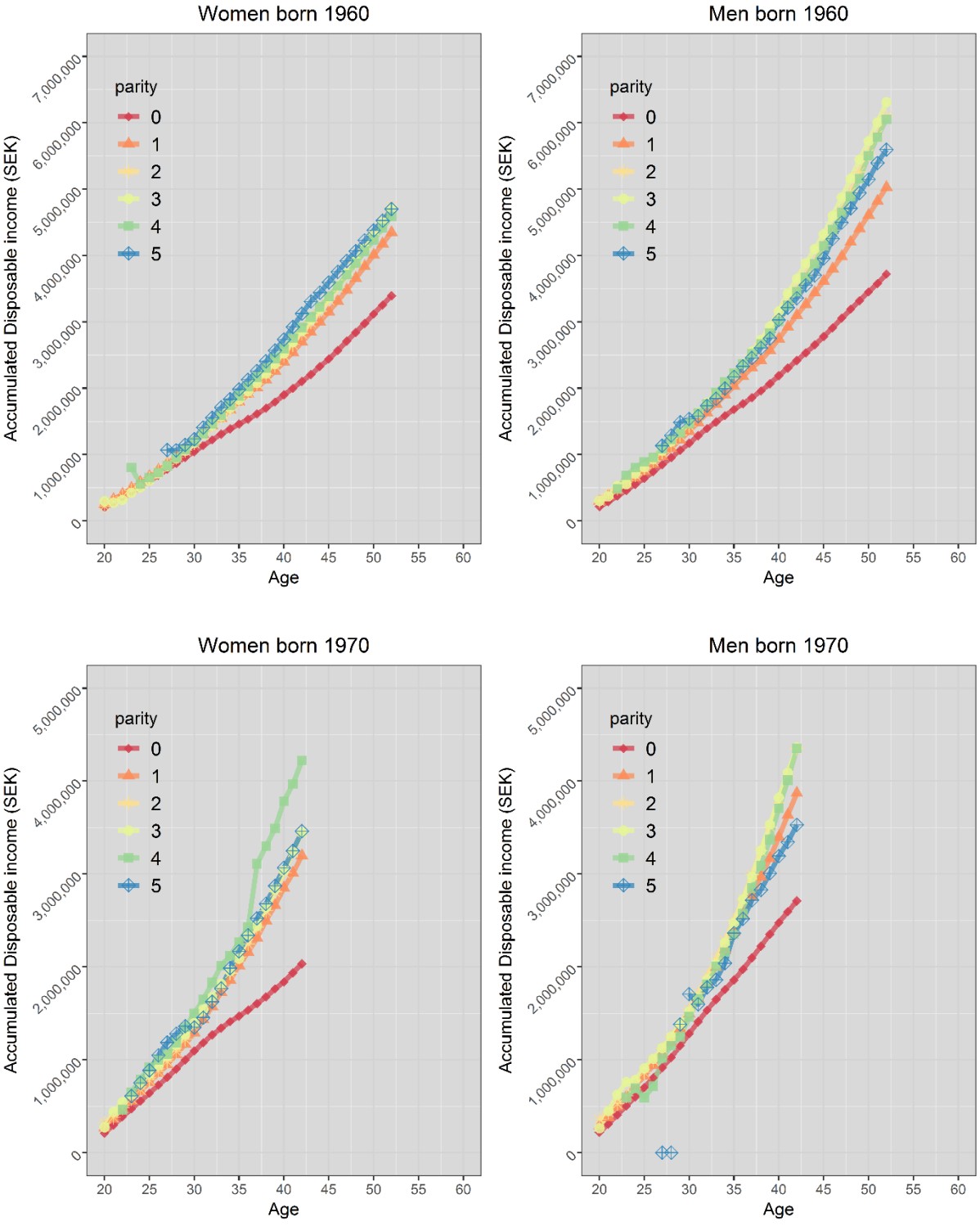
In supplemental Figure S4, I show yearly earnings and disposable income for men and women across time. Both earnings and disposable income increase greatly with increasing age and increasing period, consistent with strong GDP per capita growth over the period (except during a recession in the early 1990s). The income growth is much stronger for women than for men. The measure of accumulated earnings is the life course movement of a member of a cohort across the diagonal of Figure S4.

Mean accumulated income by parity

I present the relationship between current parity and current accumulated income in contemporary Sweden by sex for the 1940, 1950, 1960, and 1970 cohorts. The graphs show the accumulated income up to that age, and the different lines are the mean accumulated income (all income before that age) of men and women of that parity, at that age. The results refer to men and women born in a given year, which at that age has a specific parity (e.g. life course income at age 30 of parity 2, is the income to age 30 for individuals that had 2 children at age 30). I also calculate trends based on final parity of men and women in those cohorts (where parity 2 refers to the income up to age 30, of individuals that eventually had 2 children). The trends are overall very similar, and are virtually identical after age 50, only differing somewhat for parties 0 and 1 at low ages (as most men and women will transition from those states). These results are available in supplemental figure S5. To understand the overall gradient in income and fertility, the ratio of accumulated income among the parity 0s and 1s compared to the parity 2s and 3s is most important for the overall gradient. The parity distribution is heavily weighted toward parity 2 and to a lesser extent 3, with a substantial share also of parity 0 and parity 1 individuals (see Figure 1, and Figure S3). Parities 4 and 5 are however very rare (less than 7% of the population have 4 or more children, and less than 1.5% have 5 or more children), as shown in Figure 1. At early ages, men and women with parity 5 are uncommon, so the time series are occasionally unstable.

Figure 2: Accumulated disposable income and parity from age 20 to 60, for cohorts 1940 to 1970 of women and men born in Sweden. Data points are mean accumulated income up to that age, for indivudals of that parity.

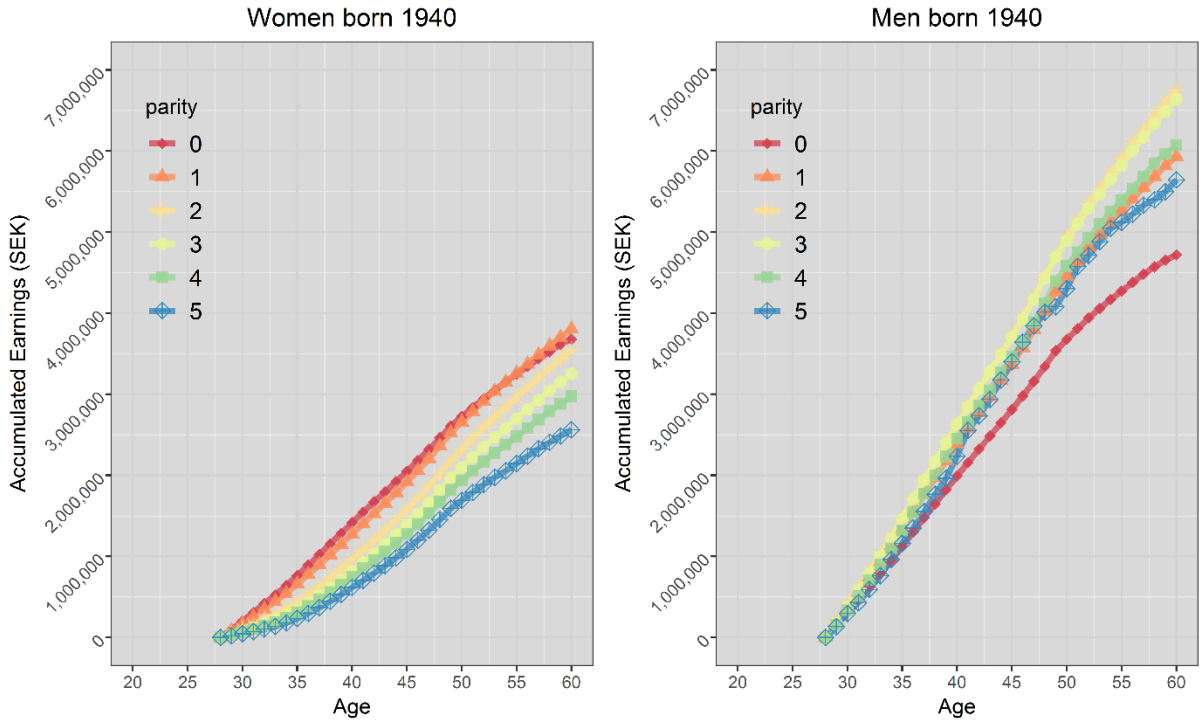


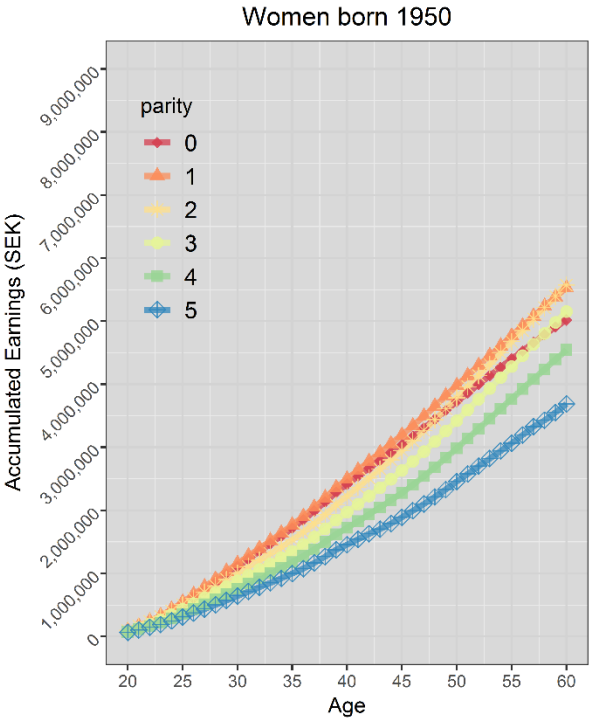


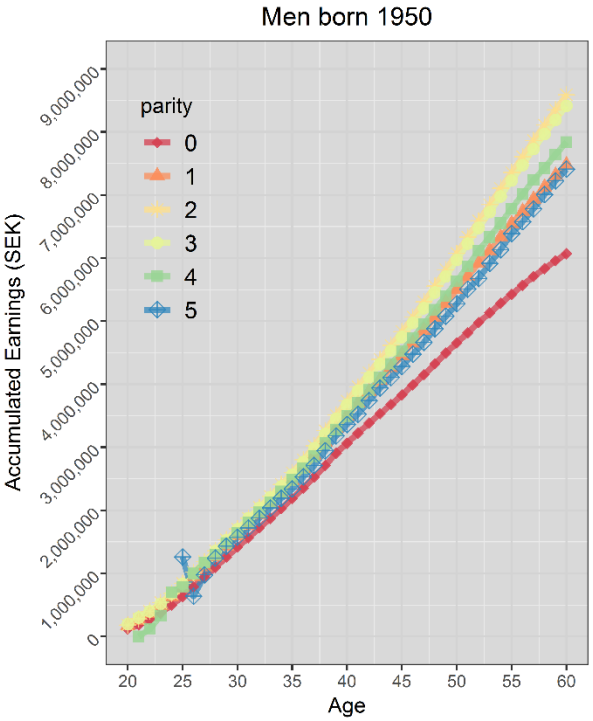
I begin by showing the relationship between accumulated disposable income and parity from age 20 to 60, for cohorts 1940 to 1970 (Figure 2). The main change in the relationship between accumulated disposable income and fertility is a change over time to an increasingly positive gradient between income and fertility. Men show a positive gradient for all cohorts, where the parity 0s and to a lesser extent parity 1s have clearly less accumulated income over time. This relationship starts out substantive, but increases in magnitude over time. Overall, men of parity

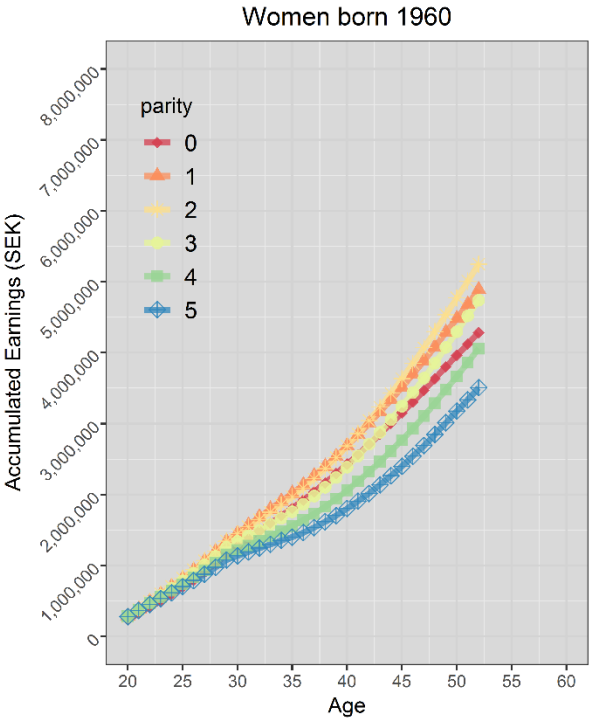
2 and 3 have the highest accumulated disposable income, while parity 5 men do slightly worse but have substantially higher disposable income than parity 0s and 1s. For women, the first 1940 cohort shows a slightly negative relationship, where parities 1, 2 and 0 (in that order) have the highest disposable income, but already for the 1950 cohort there is a positive gradient. For later cohorts, the pattern increasingly resembles that of men, with a strong positive gradient. However, for women the major divide is between childless women and all other parities. For the final 1970 cohorts, the positive gradient at the highest age (42) is very strong. In summary, there is strong evidence of an increasingly positive relationship between fertility and accumulated income, where childless men and women are particularly disadvantaged. It should be noted that the measure of disposable income includes (tax-free) child allowances, other government subsidies such as housing allowances, and parental leave. As such, it is an accurate measurement of how much money men and women actually receive in a year, but is less reflective of income from earnings of men and women.

Figure 3: Accumulated earnings parity from age 20 to 60, for cohorts 1940 to 1970 of women and men born in Sweden. Data points are mean accumulated income up to that age, for indivudals of that parity.




Women born 1950
Accumulated Earnings (SEK)
Age
parity
0
1
2
3
4
5


Men born 1950
Accumulated Earnings (SEK)
Age
parity
0
1
2
3
4
5


Women born 1960
Accumulated Earnings (SEK)
Age
parity
0
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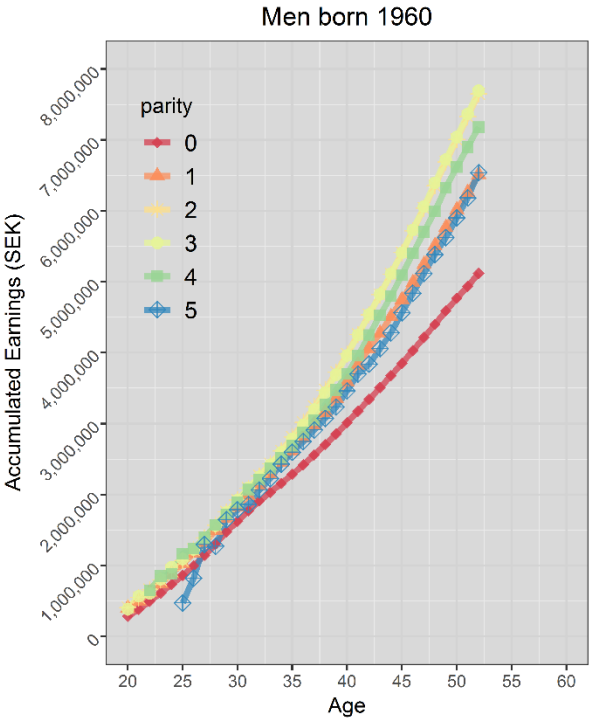
Men born 1960
Accumulated Earnings (SEK)
Age
parity
0
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The results for accumulated earnings are shown in Figure 3. Similar to the measure of accumulated disposable income, there is a gradually pattern of an increasingly positive relationship between earnings and fertility. The male pattern is very similar as the positive gradient observed for disposable income. For women, there is a clear negative relationship for the 1940 cohort, and to a lesser extent the 1950 cohort. Only in the latest cohort is there a more ambiguous pattern, where childless women have low incomes but women a parity 1 have a high income. It should be noted, however, that the measure of accumulated earnings is a very strict definition of earnings from labor. Most importantly, the generous Swedish parental leave benefits are not included in the measure, even though they could be viewed as an insurance payment. The parental leave benefits provide 80 to 90% of lost income up to a high threshold including almost all women, and a clear majority of men. The low accumulated earnings of women of high parities is typically related to subsequent episodes outside the labor market with no earnings (but parental leave payments), and in this context the high accumulated earnings of women at parity 2 and 3 are notable. It is striking that women who have had 2 children by age 42 have earned more money on the labor market than have childless women, despite (on average) having been outside the labor market for more than 2 years.

Mean fertility by categories of accumulated income

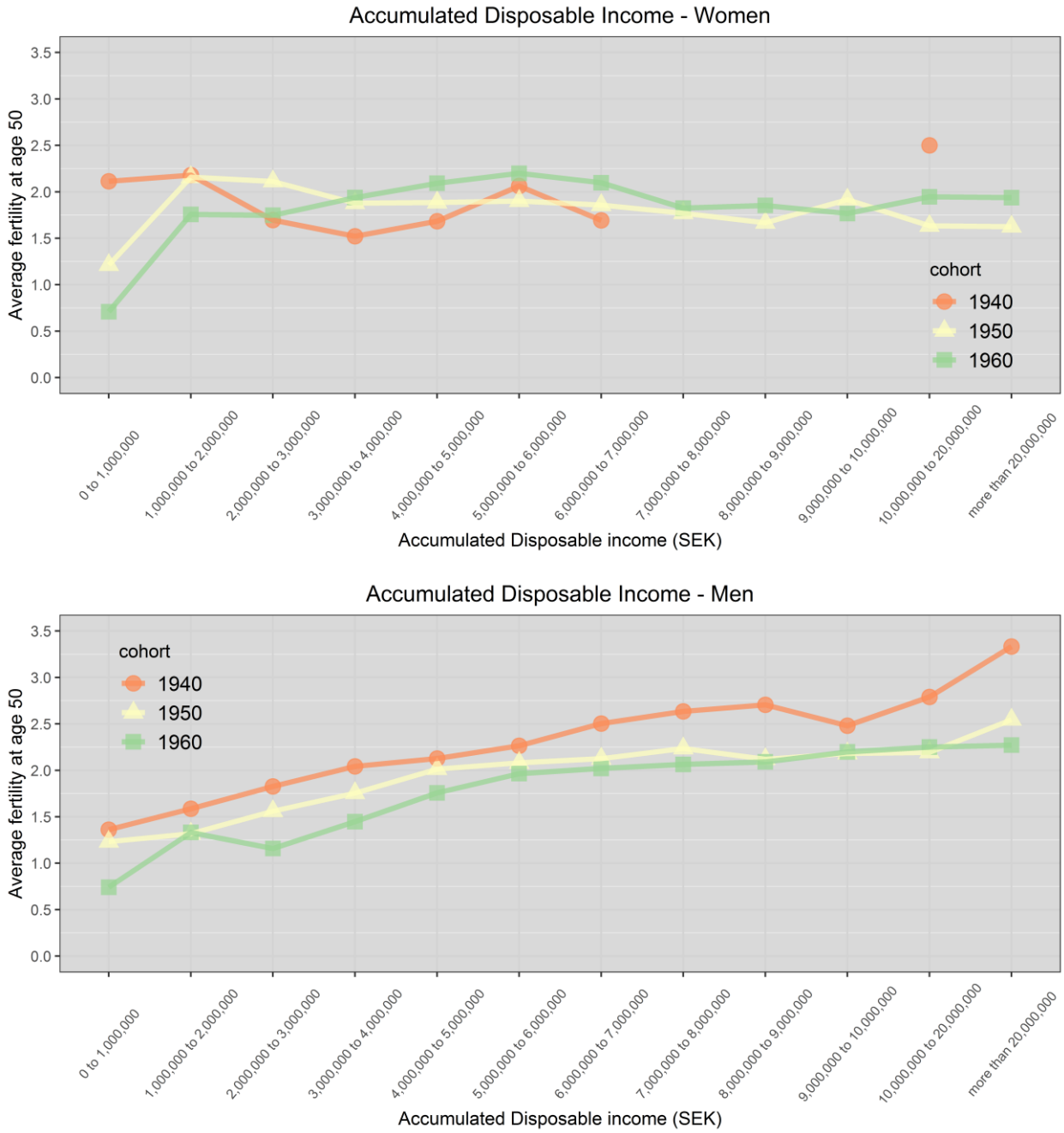
In the previous section, I described how mean accumulated income varied by eventual parity. In the following section, I instead focus on differences in the income distribution, and on how mean fertility varies across different accumulated income brackets. I show results on mean fertility for accumulated disposable income and earnings at age 50 for the 1940, 1950, and 1960 birth cohorts of men and women. The disposable income results for women and men are shown in Figure 4a and 4b, and the earnings results in Figure 5a and 5b. The distributions of number of men and women by income bracket for the different cohorts are shown in Supplemental Figure S6. As seen in earlier descriptive graphs on income change over time, later cohorts of both men and women have a substantively higher income. Therefore, the distribution of men and women shifts substantively toward higher accumulated incomes for the later cohorts.

Figure 4a shows mean fertility by category of accumulated disposable income at age 50 for women, and clearly illustrates a change from a negative to a positive gradient over time. For the 1940 female cohort, fertility is highest at very low disposable income levels, and shows a clear decrease at the highest percentiles of accumulated disposable income. For all cohorts, the group (around 3%) with no or very low declared income has the lowest fertility. For the female 1950 cohort, the fertility peak has shifted rightwards, and is highest around an accumulated income of about 2,000,000 SEK, still lower than the median of the accumulated income distribution for women. Unlike the 1940 cohort, women in the 1950 cohort in higher income brackets show only slightly lower mean fertility. The lowest fertility is found among women with very low accumulated disposable income. For the 1960 female cohort, there is instead a clear positive gradient, with the highest fertility at around 5,000,000 to 6,000,000 SEK, somewhat to the right of the median, and the lowest fertility in low-income categories. At very high disposable income, fertility is still clearly above the population mean. Overall, there is evidence of the gradual emergence of a positive gradient across cohorts, but one that tapers off into a modest inverse U-shape at very high disposable income levels. The peak of the largely uniform distribution of accumulated disposable income is at 1,800,000 SEK, 3,900,000 SEK, and 4,600,000 SEK for women born in 1940, 1950, and 1960 (Figure S5).

In Figure 4b, the same pattern is shown for disposable accumulated income at age 50 for men. Unlike for women, there are relatively small differences across cohorts. In all cohorts, there is an unambiguous positive association between disposable income and fertility. The pattern is strong, with mean fertility below 1.5 in low-income categories and well above 2 in high-income

categories. The trend is largely monotonic, with the highest fertility at very high levels of income (near 3.5 children for the 1940 cohort, and near 2.5 children for later cohorts).

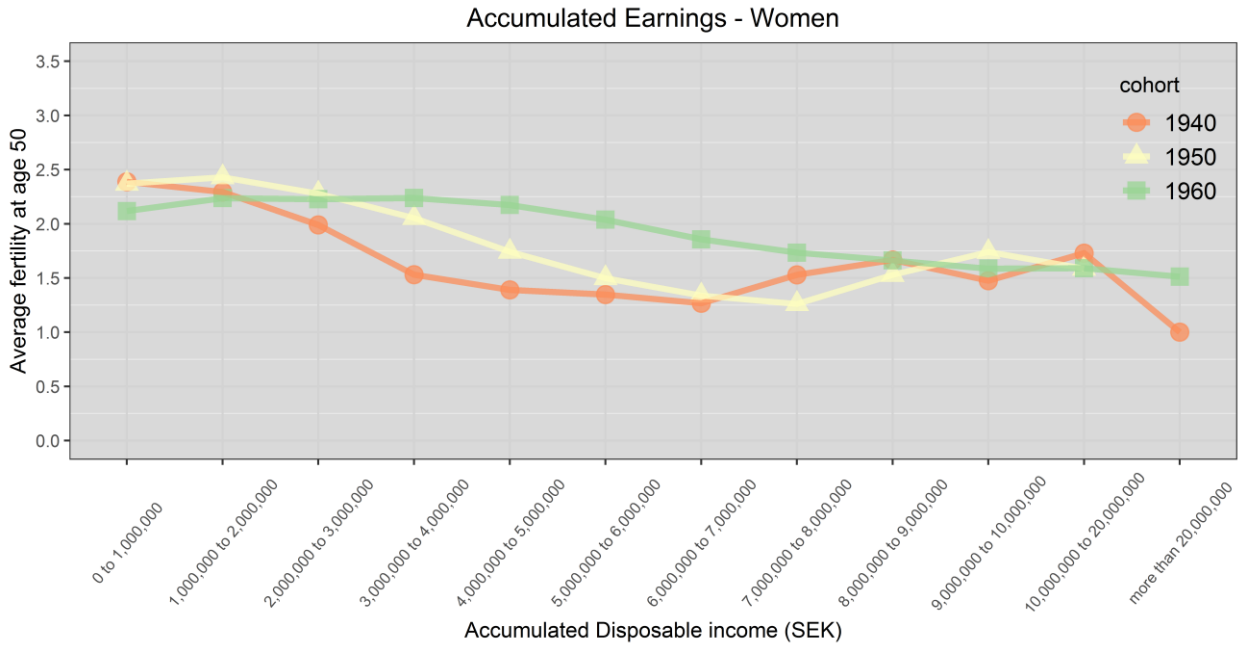
Figure 4: Mean fertility by accumulated disposable income categories at age 50, by cohort of women (4a) and men (4b) born in Sweden.

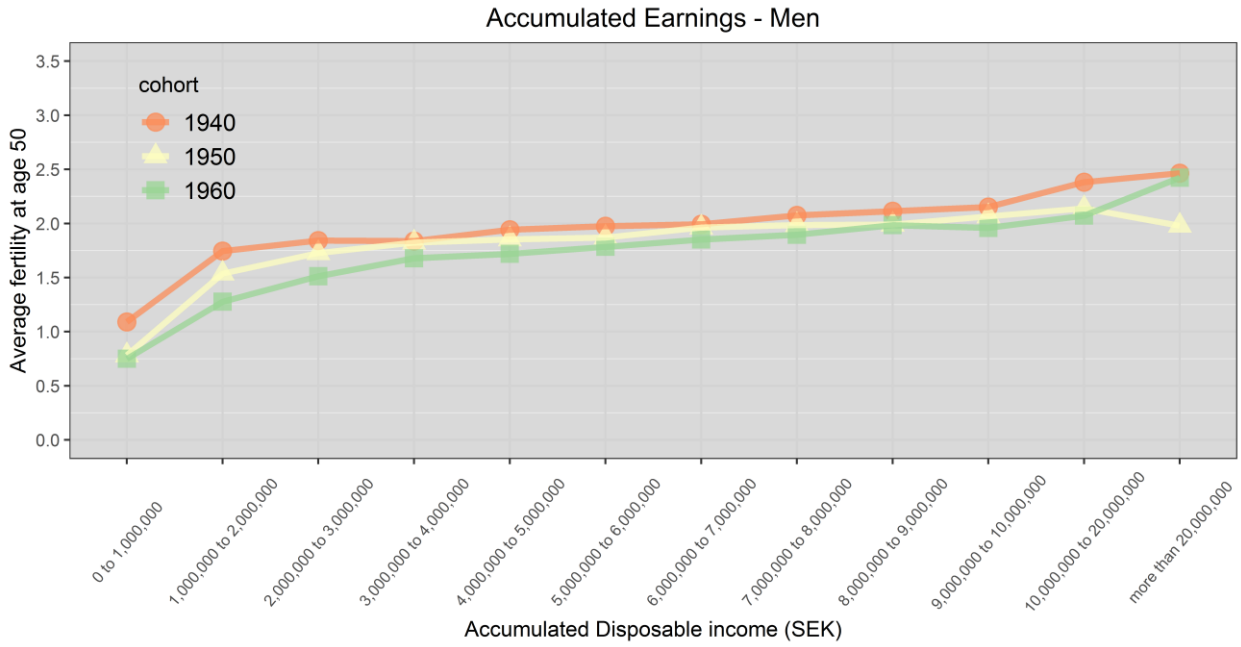


In Figure 5a and 5b, the results are shown for accumulated earnings. The overall patterns are similar to those shown for accumulated disposable income, though women have a more negative gradient. For women, there is a stronger negative gradient between earnings and

fertility at high levels of earnings, as compared to the disposable income measurement, and the (very few) women with very high income have substantially fewer children in the 1940s and 1950s cohort, though less so in the 1960s cohort. For men, there is a robust positive relationship in all cohorts for accumulated earnings, similar to accumulated disposable income.

Figure 5: Mean fertility by accumulated earning categories at age 50, by cohort of women (9a) and men (5b) born in Sweden.





Conclusion

In the present manuscript, I provide robust evidence of a positive relationship between accumulated income and fertility. The relationship grows stronger over time and is stronger for men than for women. For women, the relationship is negative for the 1940 and 1950 cohorts but reverses in later cohorts. I apply the novel measure of accumulated income, where lifecourse socioeconomic status is operationalized in a straightforward manner. The study is an empirical examination of the overall income gradient between fertility and income. The results also have implications for the reasons for such a gradient. The results are consistent with the notion that childbearing increases by income, and that children therefore may be viewed as a "normal good" (though only in the latest cohorts is this true for both men and women). I find higher income by increasing parity up to parity 4, while the very rare parities 5 and above still appear to be uncommon among the well and very well off. As such, there is an indication that having a 3rd and 4th child beyond the two-child norm is more common among those with high incomes, while 5 children are seen as too many. For men, mean fertility increases by income monotonically also at very high accumulated income levels. The group with the lowest income among both men and women are the childless. Income effects appear to be strongest for the decision to have at least 1 or 2 children. This is consistent with earlier US and Swedish research (G. Andersson & Scott, 2008; Simon, 1975).

While the results clearly show that men and women with high income have more children, the research design cannot be used to assess the causality of a pure income effect on childbearing. If young individuals have accurate forecasts of future income trajectories, and a realistic picture of the costs and career penalties or benefits of childbearing, the finding gives some indication of the overall elasticity of the relationship between income and fertility. An alternative explanation for the observed positive income gradient, is that instead of a positive income effect, we observe fertility preferences and behaviors that are much higher among men and women with very high income. That is, richer men and women value a large family size higher than men and women with lower income. Based on theorizing on fertility and income, it is unlikely that the ideal family size is much lower among lower-income individuals. The observed negative gradient is more likely due to the relative affordability of a large number of children. Previous research shows that childlessness and postponement are more commonly involuntary among low-income individuals as compared to high-income individuals (e.g. Testa & Toulemon, 2006).

The study provides unambiguous evidence on the empirical question of whether richer men/women have more/fewer children, and how this has changed over time. From a child's perspective, this is critical to understanding which children have access to more parental resources (McLanahan, 2004). It is also the relevant perspective if one wishes to understand intergenerational stratification processes (de la Croix & Doepke, 2003; Lam, 1986; Mare, 2011). It is also useful in the context of to what extent fundamental Malthusian or non-Malthusian relationships exist between income and fertility in contemporary societies. The study is limited to the Swedish born-population, as the lifecourse perspective makes it impossible to study migrants. Overall, life-course fertility is similar across natives and foreign-born in Sweden (Statistics Sweden, 2014), though there are some smaller immigrant-groups that display both a large share of high parities and most likely also lower lifecourse income.

Most men and women have some understanding of their probable future labor market outcomes when they make childbearing decisions. As such, it is important to both consider the temporary income loss associated with childbearing (in particular for women) and take into account the fact that men and women plan childbearing decisions with future income expectations. Examining how current income affects the probability of a birth (among people in their 20s and 30s) fails to take into account both career trajectories after the birth of a child and the negative labor supply effects associated with childbearing. In countries such as Sweden, men and women may also carefully plan their taxed income the year before the birth of a child to maximize parental leave benefits. Examining income and wages at age 45 to 50 fails to take into account the immediate negative labor supply effects of childbearing, and even if income at such ages has a reasonable (though not very strong) correlation with mean lifecourse income, this likely varies greatly with childbearing histories and gender. Issues such as the above are fully taken care of by empirically measuring lifecourse income histories.

The finding of a positive income and fertility gradient in contemporary Sweden is consistent with evidence from pre-industrial periods. One theoretical explanation for this finding is that previous values associated with lower fertility, which appeared early among higher social status groups, has now dispersed more evenly in the population. According to such an explanation, lifestyle choices associated with low fertility were likely adopted earlier primarily by higher socioeconomic groups, but might now be found in all groups in society. There is clear evidence that upper social status groups were in the vanguard of the fertility transition across Europe in the late 19th and early 20th century (Dribe et al., 2014; Livi-Bacci, 1986). Other demographic behaviors, such as modern contraceptives and divorce during the 20th century, were also first

adopted by high-status groups (Kasarda, Billy, & West, 1986; Lin & Hingson, 1974; Sandström, 2011).

In contemporary Sweden, where such values may no longer be more common in higher-status groups, the study shows a theoretically plausible pattern in which income increases how many (costly) children parents can have in contemporary Sweden. At least in a generous and relatively homogenous welfare state such as Sweden, it may be that such preferences are now no longer correlated with income or other dimensions of economic status, and the pure positive income effect may be responsible for the positive income fertility gradient. The results are consistent with the positive education-fertility gradient recently observed in Sweden (Jalovaara et al., 2018), as well as previous literature on the positive association between current income and probability of conception (Gunnar Andersson, 2000; G. Andersson & Scott, 2008; A. Z. Duvander & Andersson, 2003). Similarly, IQ is positively related to fertility for men, within and across educational groups (Kolk & Barclay, 2019). Earlier researchers have speculated that contraceptive knowledge (Becker, 1960; Notestein, 1936) may be one such variable that can explain a negative gradient. In contemporary societies, however, it is more likely related to other lifestyle preferences related to lower fertility that have explained lower fertility among high-status groups. One reason to expect that cultural differences in preferences for children across social groups are important for the observed 20th-century fertility differentials is that the business cycle level association appears to be largely positive in developed countries (Sobotka, Skirbekk, & Philipov, 2011). If changes in the business cycle covary positively with income, this may originate from a purer income (and labor market) effect, as positive business cycles an be seen as an exogenous increase in the income of most members of society.

An explanation based on changing preferences across societal groups is likely primarily relevant to interpret the increasingly positive gradient between overall household income and fertility. The reversal of the income gradient for female income can likely also be understood in diminishing structural barriers to combine work and family (e.g. the growth of subsidized daycare over the period), and increasing female entry to the formal labor market and an increasing contribution to household income over the cohorts under study (Stanfors & Goldscheider, 2017). In the first cohorts of the study, Sweden was only partially a dual-earner society and women only contributed a minor share of household income. The negative gradient between income and fertility of women therefore likely primarily reflected a negative association between female labor force participation and fertility for the 1940 and 1950 cohort, rather than a negative association between household income and fertility. The increasing

similarity between male and female patterns is consistent with an increasingly less gender differentiated dual-earner society. As a conclusion, it appears that male and female life-coruse income has a similar relationship with fertility.

Important steps for future research are to examine the extent of lifecourse income correlations with fertility, in other contexts and societies. It is plausible that fertility and the accumulated income gradient may look different outside Scandinavia, particularly for women. Future research should take a couple-level perspective on the issues examined in the current study, and examine both how total couple income varies with fertility and whether the share of cumulative income by sex affects fertility. Such research designs will have to be different from the one used in the present study. Because men and women change union formation status over the lifecourse (and enter their first union at different ages), different study populations and operationalizations of the lifecourse are necessary. The emergence of an increasingly positive income and fertility gradient is likeley a phenomena that will be increasiangly apparent in an increasing number of high-income societies. As it has major implications for many demographic and family sociological processes it deserves more attention by social scientists.

Acknowledgements

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Supplemental material:

Figure S1: Lexis diagram on cohorts in study. Pink line represents first year of yearly taxation data, and the first age considered for income measurements.

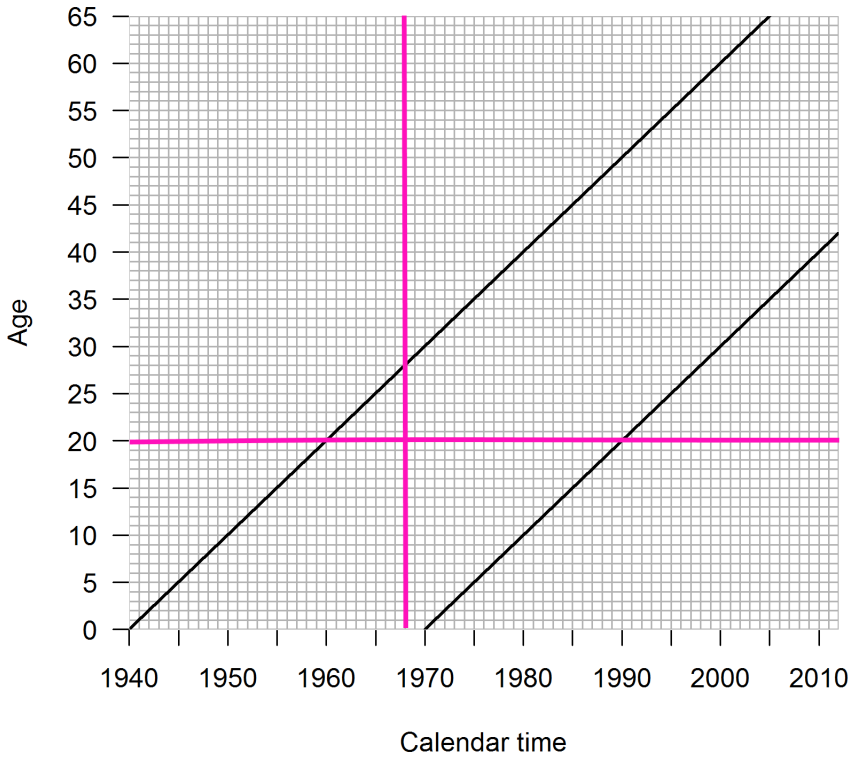


Figure S2: Mean fertility by age and cohort (women left – men right).

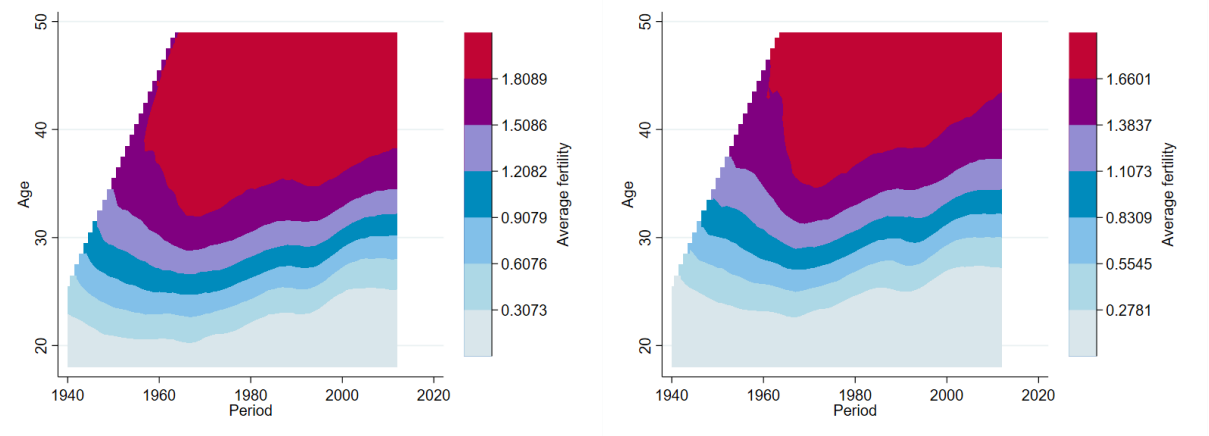


Figure S3: Parity distribution (ever in parity) by age and cohort, Swedish born women.

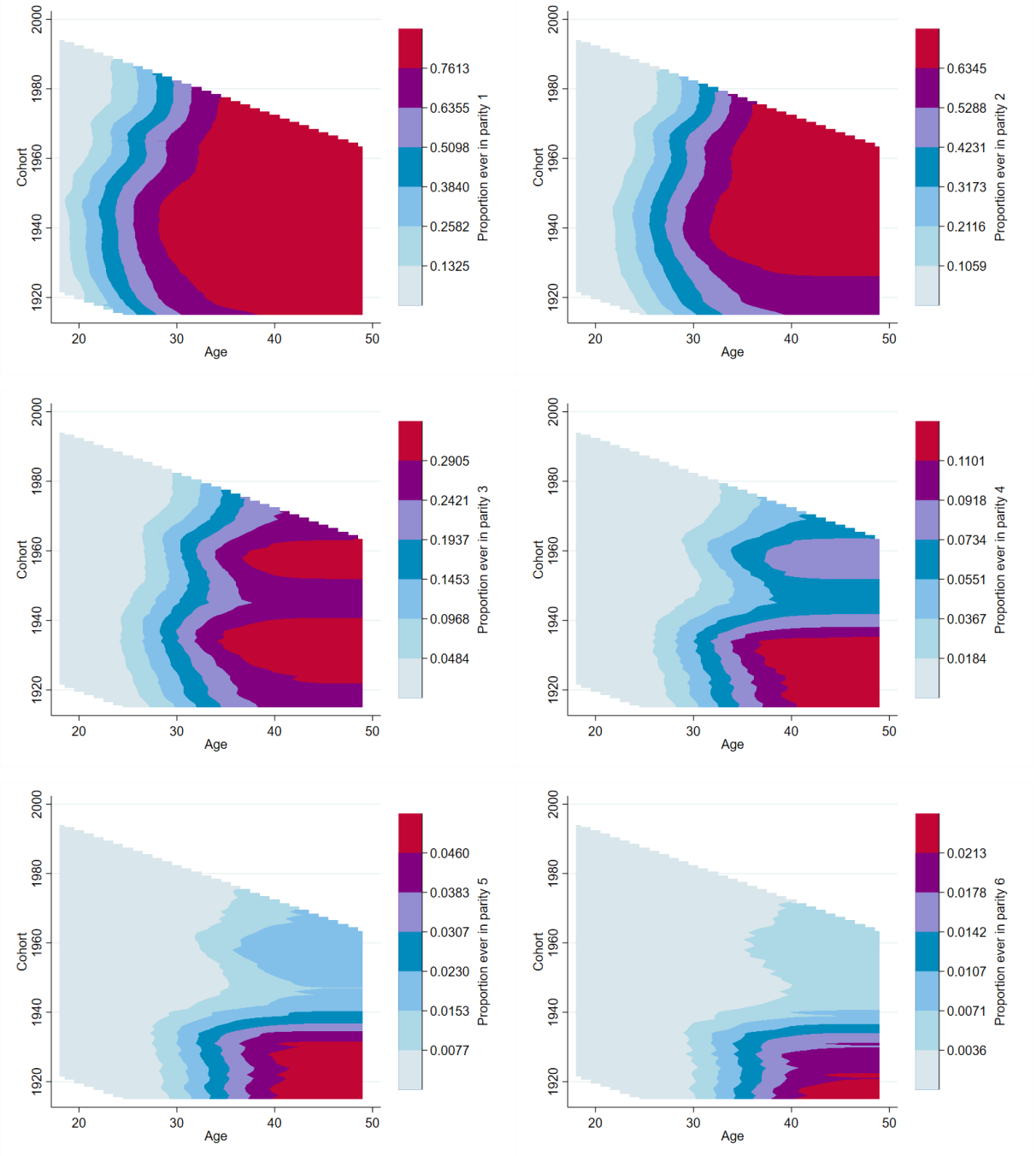


Figure S4-1: Disposable income by age and year in Sweden for Swedish born women (left) and men (right)

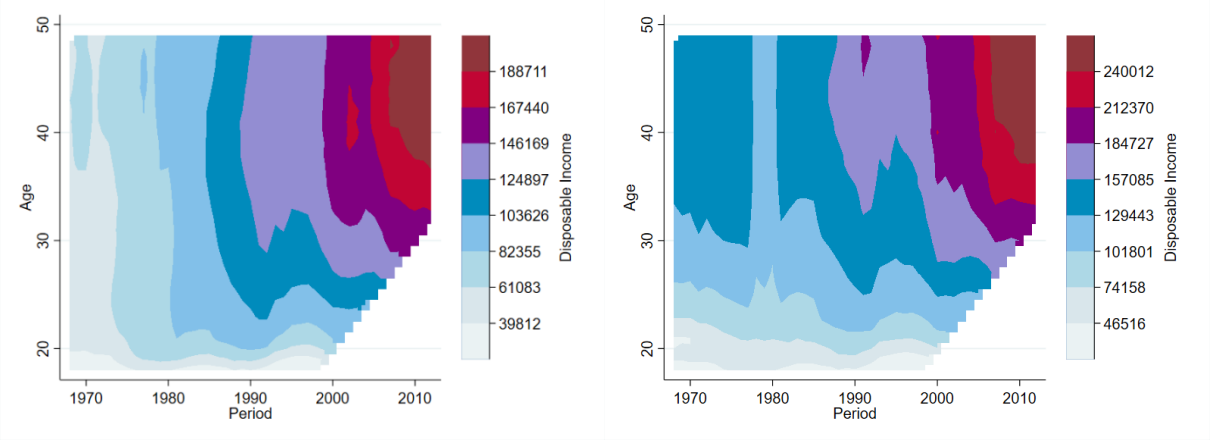


Figure S4-2: Earnings by age and year in Sweden for Swedish born women (left) and men (right)

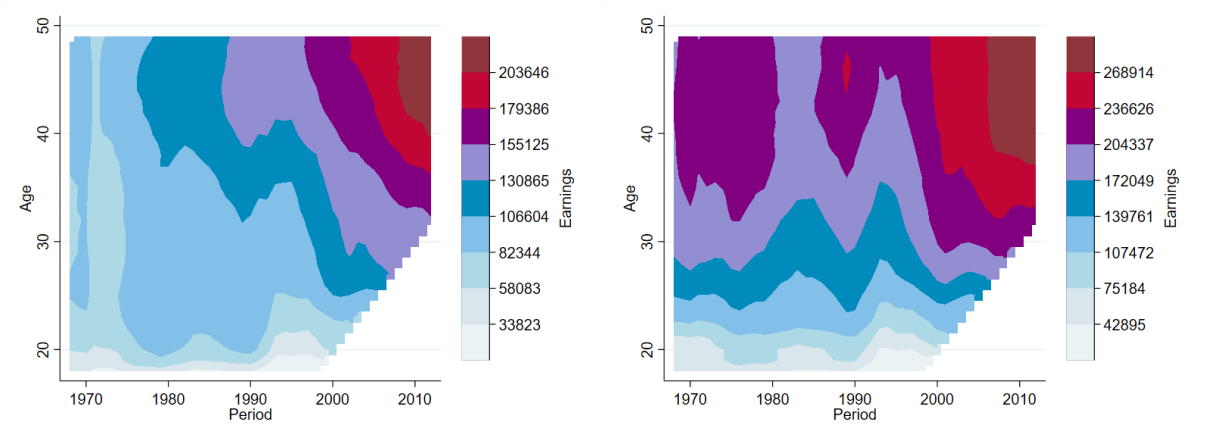
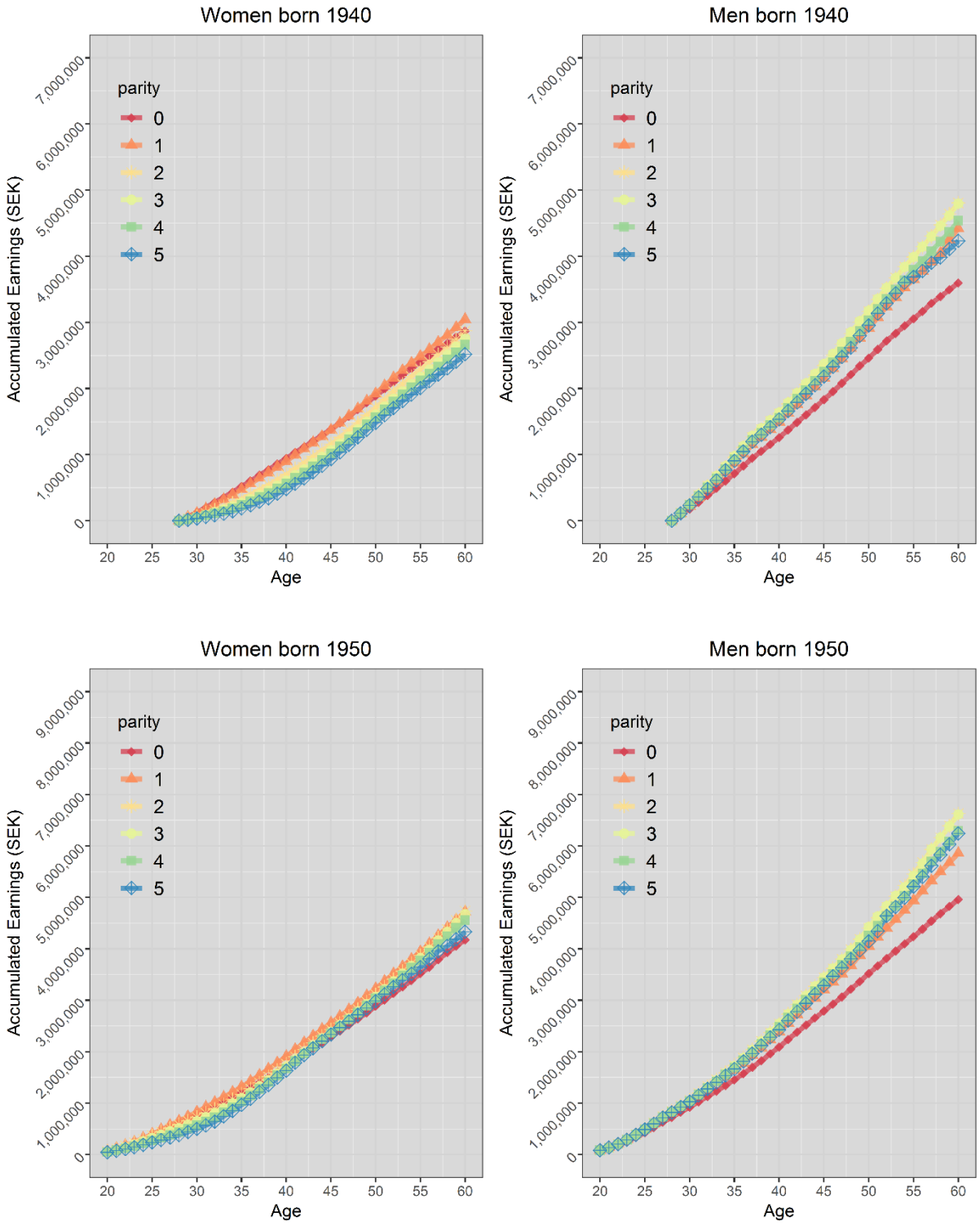
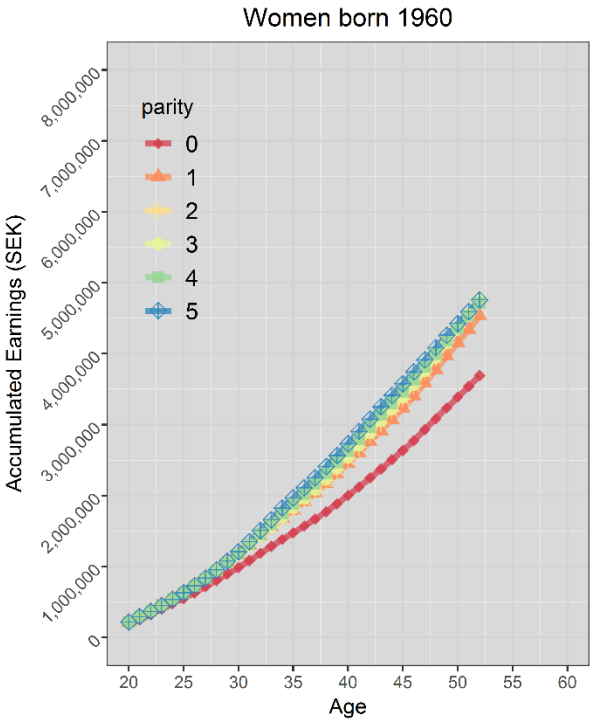


Figure S5: Accumulated disposable income and final parity from age 20 to 60, for cohorts 1940 to 1970 of women and men born in Sweden




Women born 1960
Accumulated Earnings (SEK)
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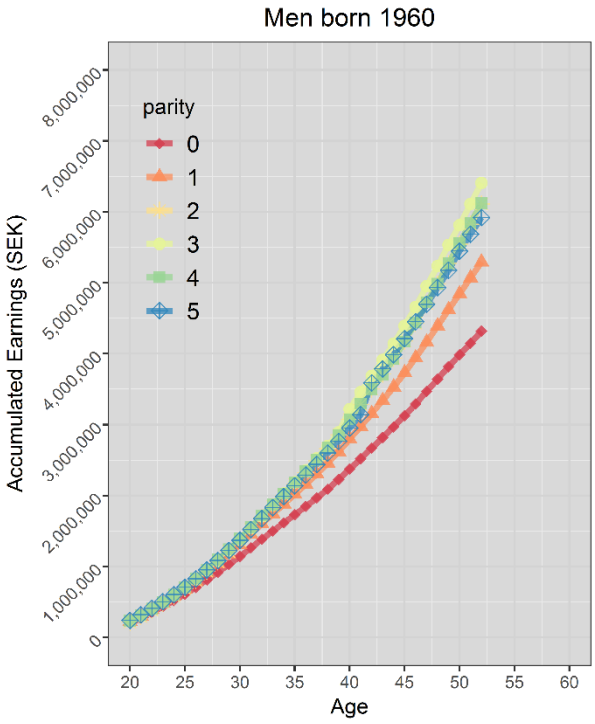
Age


Men born 1960
Accumulated Earnings (SEK)
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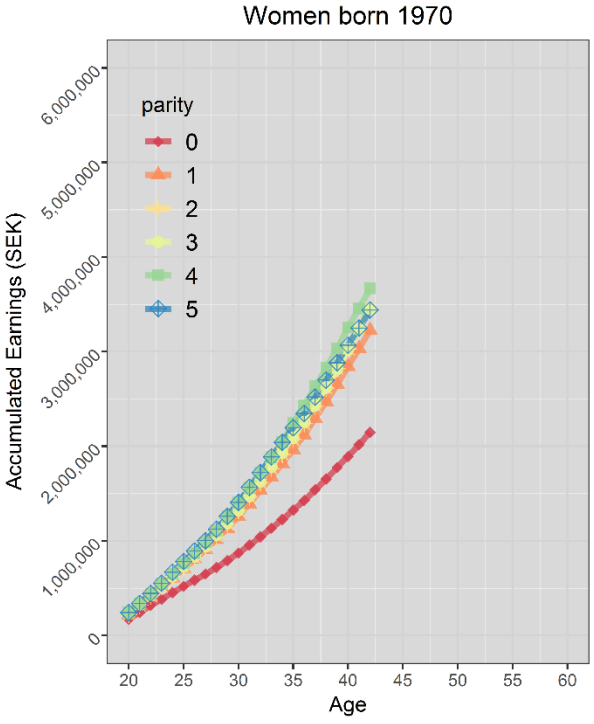
60
Age


Women born 1970
Accumulated Earnings (SEK)
0
1,000,000
2,000,000
3,000,000
4,000,000
5,000,000
6,000,000
parity
0
1
2
3
4
5
20
25
30
35
40
45
50
55
60
Age

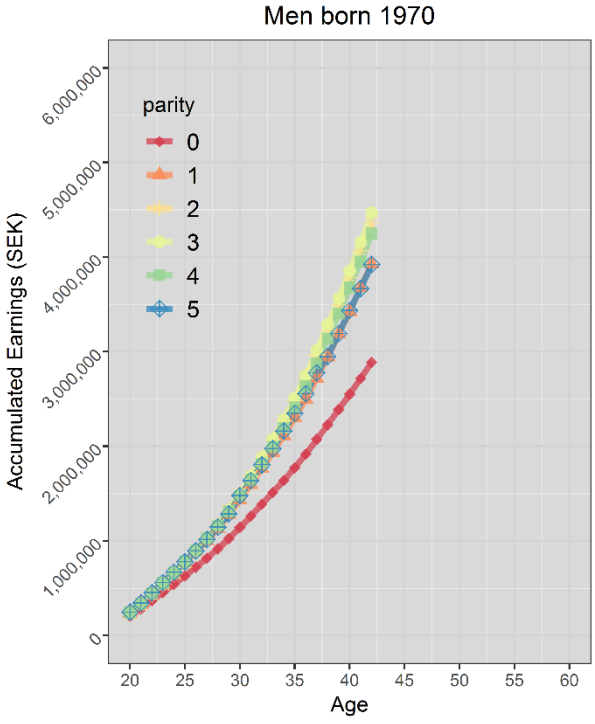
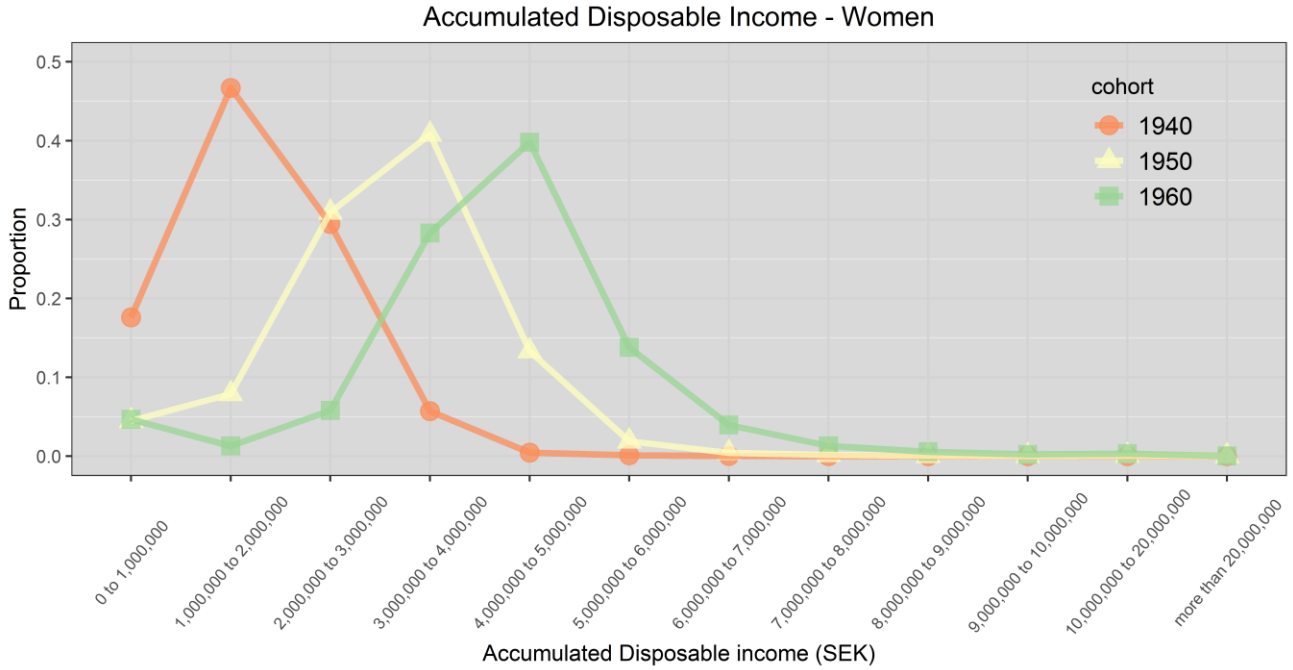

Men born 1970
Accumulated Earnings (SEK)
0
1,000,000
2,000,000
3,000,000
4,000,000
5,000,000
6,000,000
parity
0
1
2
3
4
5
20
25
30
35
40
45
50
55
60
Age

Figure S6-1: Distribution of accumulated disposable income at age 50 by cohort, Swedish born men and women.



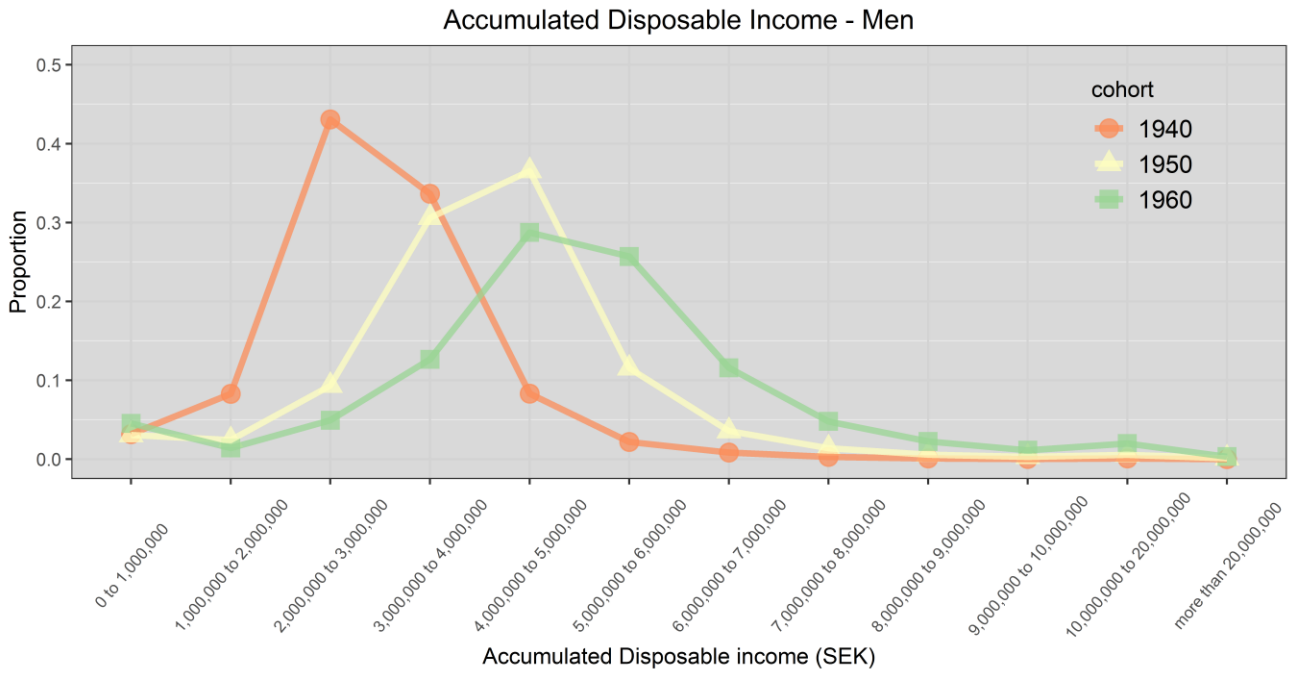


Figure S6-2: Distribution of accumulated earnings at age 50 by cohort, Swedish born men and women.