

# Lifetime versus Annual Tax Progressivity: Sweden, 1968–2009<sup>\*</sup>

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## **Abstract:**

This paper analyzes the evolution of tax progressivity in Sweden from both an annual and a lifetime framework. Using a rich micro panel with administrative records over incomes, taxes and benefits over the period 1968–2009, we compute measures of average tax rates across the income distribution and account for the relative importance of different tax bases as well as the role of transfers. The uniquely long time span allows us to estimate actual life cycle progressivity. Our main finding is that Swedish taxes are considerably less progressive over the lifetime than in any single year. In fact, life cycle taxes are close to proportional bearing a redistributive effect of only a few percent. This result seems mainly driven by intragenerational income mobility, but also to some extent by the major tax reform of the 1991. The role of labor income taxes for progressivity has declined markedly whereas increased transfers to unemployed and old-age pensioners has pushed up progressivity.

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**Keywords:** Tax progressivity, Income distribution, Lifetime income, Redistributive effect, Transfers.

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## 1. Introduction

Tax reforms are often motivated by a political will to shift the burden of taxes according to the different abilities to pay taxes across the income distribution. But a fundamental problem with conventional assessments of tax burdens is that they typically rely on annual cross-sectional outcomes. Incomes vary over the life cycle, with young people often being low-income earners regardless of whether they are future high-paid surgeons or low-paid clerks. Old-age pensioners do not pay payroll taxes even though they may well earn more than younger individuals in the labor force. Capital incomes are typically observable and taxed when they are realized rather than when they accrue, and such one-shot realizations might not truthfully depict the lifetime income status or lifetime tax burden. Accounting for lifetime variations in both incomes and ability to pay taxes is important in order to make a balanced assessment of the trade-off between the equity and efficiency of the tax system.

In this paper we analyze the implications of studying tax progressivity in an annual versus a lifetime perspective. We do this by exploiting a rich data source with register information on taxes paid and benefits received by a large and nationally representative sample of individuals. Using a 42-year long panel we are able to compute measures of “lifetime tax progressivity” relating information about *actual* lifetime tax payments and *actual* lifetime incomes for various parts of the distribution of lifetime incomes. The use of such a long panel appears to be a unique contribution to the literature. Previous studies of the redistributive impact of taxes over the lifetime have typically been based on either simulation methods or much shorter panels. In particular, our work extends the previous work on tax progressivity using microdata that started with Pechman and Okner (1974). Previous studies using the life-cycle perspective using microdata include Davies, St-Hilarie and Whalley (1984), Slemrod (1992), Fullerton and Rogers (1993), Cameron and Creedy (1994), Creedy and van de Ven (2001), and, on Swedish data, Björklund, Palme and Svensson (1991).<sup>1</sup> These studies have either relied on quite strong data assumptions or been restricted to much shorter time periods. The richness and size of our data – a sample size of about 200,000 individuals per year – allow us to compare narrow income segments in the top of the income distribution, such as percentiles and

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<sup>1</sup> There is a related – and more extensive – literature analyzing income inequality over annual and lifetime horizons, paying little or no attention to taxation and tax progressivity (see Creedy, 1999, for an overview). Studies of Sweden include Blomquist (1981), Björklund (1993), Hussenius and Selén (1994) and Pettersson and Pettersson (2003).

tenth of percentiles. Such focus is of particular relevance when pinpointing the differing impacts of labor and capital taxation.

Another contribution of our paper is to provide a comprehensive assessment of how the redistributive properties of the Swedish tax system have evolved over the past decades. The Swedish tax system has undergone major changes over the past 40 years. The overall tax burden has increased and government tax revenues have gradually become more dependent on social security contributions and value added taxes. Some specific reforms are particularly noteworthy. In 1971, the traditional system with joint taxation of married couples was replaced by a system in which each spouse pays taxes on his or her own income. The tax reform of 1991 – called the “tax reform of century” for its groundbreaking impact – involved substantial cuts in marginal income taxes along with the introduction of a dual income tax system where earned income and capital income are taxed at different rates. More recent reforms include the abolishment of the inheritance tax, the gift tax and the wealth tax as well as the introduction of a system with earned income tax credits.

In line with conventional terminology, taxes are referred to as progressive if the average tax rate increases with income. We compute measures of average tax rates, typically net of transfers, for various segments of the income distribution and examine how these rates change over time, noting that the effective degree of tax progressivity depends on the composition of the tax base as well as the statutory tax rates. We also compare the contribution of different taxes such as the income tax, the payroll tax, the wealth tax and the value-added tax, to the overall level of tax progressivity. As in Piketty and Seaz (2007), we pay particular attention to tax progressivity at the top of the income distribution.

Several important results come out of the analysis. First, we find that lifetime tax progressivity is lower than tax progressivity in any single year. This has mainly to do with considerable within-life redistribution, where amounts received as student or old-age support almost make up for the taxes paid for most income earners.<sup>2</sup> Our empirical evidence at the individual longitudinal level using actual incomes received and taxes paid thus reinforces much of the previous simulation evidence on life cycle progressivity. Second, we show that the discrepancy between annual and lifetime tax progressivity reflects the transitory nature of low-income

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<sup>2</sup> This finding gives empirical backing to the notions of Bergh (2005) that the redistributive achievements of the welfare state cannot be assessed only from comparing pre- and post-fisc distributions.

status rather than the transitory nature of high incomes. Many of the individuals earning low or zero market income do thus not belong permanently to the bottom of the income distribution: they can be workers temporarily outside the labor market, being unemployed, in education or on sickness leave. These individuals appear to be greatly favored by the tax-cum-benefit system using annual data as opposed to lifetime estimates. By contrast, transitory high income shocks, such as large realized capital gains, fall mainly on those who have already high permanent incomes. At the top of the income distribution, annual progressivity estimates therefore correlate highly with lifetime tax burdens.

Third, we document that Swedish tax progressivity has followed an inverted U-shape over the past four decades, increasing sharply in the 1970s and dropping in the 1990s and 2000s. The exact characterization of the experience depends on whether transfers are included. When only considering actual taxes, the primary source of the variation in progressivity appears to be changes in the tax system, in particular the tax reforms of 1971 and 1991, rather than trends in the distribution of market incomes. The dramatic rise in unemployment – and thereby associated transfers – during the economic crisis of the 1990s increased the tax-and-transfer progressivity. Comparing Sweden’s progressivity experience with that of Great Britain and the U.S., taxes in Sweden appear less progressive, a fact primarily due to the high levels of income and payroll taxes paid by low-income earners. Fourth, our decomposition of tax bases, in which we not only include the standard income and wealth taxes but also payroll and consumption taxes, reveals drastic restructurings over the study period. In particular, payroll taxes have become increasingly important whereas the capital taxation (which includes taxes on capital income, real estate, and wealth) has diminished substantially.

The remainder of the paper is structured as follows. Section 2 offers a brief overview of some key features of the Swedish tax system. In section 3 we discuss the basis of comparing annual and lifetime outcomes and discuss various measurement issues. Section 4 is devoted to a study of the evolution of tax progressivity by means of cross-section and panel data with information on incomes and tax payments. Section 5 concludes.

## **2. The Swedish Tax System**

The total Swedish tax-to-GDP ratio stood at 40 percent in 1970 and has hovered around 50 percent during the 2000s. Sweden used to have the highest tax-to-GDP ratio in the world, but

this position has in recent years been overtaken by Denmark. In fact, the Swedish tax-to-GDP ratio has fallen by four percentage points since 1990. It should be noted that most transfers, such as pensions and social insurance benefits, are treated as taxable income in Sweden, a fact that tends to exaggerate differences relative to countries where benefits are tax exempt.

Taxes on labor are the most important source of tax revenues, accounting for more than half of the revenues. These taxes include personal income taxes to central and local governments as well as social security contributions paid by employers. The local government income tax rate is proportional and stood at 20 percent of taxable income on average in 1970 and had increased to 31 percent in 2008. Since 1991, the central government income tax only applies to incomes above a threshold; some 20 percent of income earners are subject to the state tax which involves two brackets, 20 and 25 percent.

Payroll taxes, or social security contributions, are paid by employers in Sweden. Their standard rate amounted to 11.6 percent of the wage bill in 1968. By 2009, the standard rate stood at 31.4 percent. These contributions are, however, not entirely equivalent to taxes since they are partially matched by increased benefit entitlements, such as higher retirement benefits. The social contributions are proportional to the wage bill since 1982 (although with some age variation from 2006 and onwards). Before 1982, however, contributions were markedly nonlinear with low rates for low earnings, higher rates for intermediate earnings (the standard rate), and again much lower rates for top earnings. The average payroll tax rate was therefore higher than the marginal rate for workers with high earnings.

Taxes on consumption and input goods include a value added tax (VAT). By 2008, these taxes contributed to more than a fifth of all tax revenues. The value added tax was introduced in 1969 and the standard rate was then set at 11 percent; numerous services were however exempted from VAT. Since 1991, the standard VAT rate has stood at 25 percent of the tax base. The effective VAT rate is much lower than the standard rate since some goods and services are taxed at lower rates (6 or 12 percent) and some are exempt from taxation. There are also a few excise taxes which in total account for almost 8 percent of tax revenues in 2008. These taxes include “sin” taxes on alcohol and tobacco as well as taxes on energy, carbon and motor vehicles.

From 1991 and onwards, Sweden has practiced a dual income tax system with separate rules for earned income and capital income. Individual capital income (interest, dividends and capital gains) is subject to a proportional income tax of 30 percent.<sup>3</sup> The corporate income tax is 28 percent of net taxable profit as of 2008. Inheritance and gift taxes were abolished in 2004 and the wealth tax has been abolished as from 2007. As from 2008, the property tax on real estate was abolished and replaced by a municipal property charge, a reform that substantially reduced property taxes for the more expensive dwellings. By 2008, capital taxes accounted for 11 percent of the total tax revenues.

A recent innovation of the Swedish tax system is the introduction of an earned income tax credit from 2007 and onwards. This reform reduces marginal taxes on low incomes by raising the threshold for income tax liability. A noteworthy feature of the reform is that the lower taxes apply only to earned income, not to transfers such as unemployment or sickness benefits. The reform thus increases the after-tax difference between income from work and income during non-work.

### **3. Measuring Annual and Lifetime Incomes, Taxes and Progressivity**

The rationale behind making lifetime estimates of income inequality and tax progressivity is that the same individuals tend to appear in different tails of the income distribution in different years. Annual snapshots of tax progressivity therefore capture both redistribution between individuals within years and redistribution across years for the same individuals. This means that the difference between annual and lifetime progressivity boils down to two dimensions: how transitory annual market income is and the extent of insurance elements in the tax system.<sup>4</sup>

Regarding the transitory nature of incomes, it is a well-known fact that annual incomes are more volatile than longer-run incomes and that lifetime incomes are more equally distributed than annual incomes (for an early treatment on Swedish data, see Blomquist 1981). Part of this is because annual incomes reflect a cross-sectional snapshot of the current population, capturing differences between younger individuals, who have recently entered the labor mar-

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<sup>3</sup> The effective capital gains tax rates have varied somewhat, e.g., with cuts in the early 1990s and a generally lower effective rate on real estate sales (only two thirds of such gains taxable).

<sup>4</sup> See also Fullerton and Rogers (1993) for a comprehensive discussion.

ket, experienced workers, and seniors who have left the labor market. In welfare states, a tax on labor income effectively distributes income from those who are in the labor force to those who have not yet entered it and those who have left it. A related issue is the role of capital income gains. On tax records, capital gains appear in a quite lumpy fashion, placing some individuals in the top of the income distribution although they do not regularly show up there. From a permanent income perspective, capital income gains should be measured when they accrue rather than when they are realized. If capital income realizations place individuals in the top of the income distribution temporarily and if capital income gains are taxed less heavily than labor earnings, the annual estimate of tax progressivity would appear regressive at the top compared to the lifetime perspective.<sup>5</sup>

The second dimension of lifetime progressivity pertains to the role of social security. In any given year, the bottom of the income distribution includes individuals who are temporarily out of work (being, e.g., sick, unemployed or on parental leave). Transfers targeted at these individuals will reinforce the effect of a strong degree of annual tax progressivity. The annual average tax rate at the bottom of the annual income distribution would be zero, whereas the “effective” tax rate, which defines transfers as negative taxes, would be negative (see further below for a discussion of these concepts). However, to the extent that social security transfers are paid *and* received by the same individuals, the tax and transfer system will appear less progressive in a lifetime perspective. In Sweden, replacement ratios have occasionally been about 90 percent, which means that every unit of currency SEK collected in social security implies close to a one-to-one increase in expected benefit. Some analysts therefore regard the payroll tax as an actuarially fair insurance premium rather than a tax, with no effect on vertical redistribution at all. In reality, however, the social security system contains caps, exceptions and eligibility constraints, making it much less “fair” in an actuarial sense and more tax-like. Annual estimates of tax progressivity therefore need to make an *ex ante* stand on how much of the payroll tax is really a “tax”, which is a very delicate task (see, e.g., Sørensen, 2010, p. 211). In contrast, lifetime estimates of tax progressivity “nets out” taxes that are transferred to the same individual automatically.<sup>6</sup>

Notably, it is not certain that a tax system that exhibits tax progressivity from an annual per-

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<sup>5</sup> For this reason, Piketty and Saez (2007) rank tax units based on income net of capital gains (and then add back capital income gains when calculating the tax rates).

<sup>6</sup> See also the distinction between insurance and redistribution in Hoynes and Luttmer (forthcoming).

spective will exhibit progressivity from a lifetime perspective. Imagine two individuals, A and B, in two periods. A has a first-period income of 40 and second-period income of 60, whereas B receives 50 in both periods. Suppose A pays 10 percent in taxes the first year and 60 percent in taxes the second year, whereas B always pays 50 percent. This system is clearly progressive in any single year. However, by summing individual income and taxes over time, B faces a higher lifetime tax rate (50 percent) than A (40 percent), despite the fact that they are equally rich (both have an lifetime income of 100).

The above example makes it clear that annual and lifetime estimates of tax progressivity can differ substantially. The distinction between horizontal redistribution (across time) and vertical redistribution (across individuals) is necessary to understand this difference, in particular in understanding the rise (and presumed demise) of the modern welfare state. From a political economy perspective, insurance elements in the tax-and-transfer system can justify public sector spending; social insurance, if properly designed, can be less distortionary than redistributive taxes with high marginal tax rates. Drawing partly on this idea, Lindert (2004) notes that countries with a high share of public spending relative GDP (like Sweden) have traditionally had a more proportional tax system, at least compared to the Anglo-Saxon countries. Our view is that such a story needs to consider data on the lifetime distribution of the tax burden in order to be considered complete.

### 3.1 Average Tax Rates

We wish to describe how average tax rates vary by income. To serve this aim, we consider two measures of average tax rates. The first measure, arguably the most conventional, relates total tax payments to the tax base, pre-tax total income. In Sweden, the tax base includes market income as well as taxable transfers such as unemployment benefits and sickness benefits. We thus have

$$(1) \quad t_i = \frac{T_i}{Y_i + B_i},$$

where  $T_i$  is total tax payments,  $Y_i$  is *pre-tax market income* (also referred to as gross income) and  $B_i$  taxable transfers; subscript  $i$  refers to individual  $i$ . We shall refer to the sum of  $Y_i$  and  $B_i$  as *pre-tax total income* or taxable income.

This measure, referred to as the *average tax rate* (or ATR for short) is conventionally referred in international comparisons, but it suffers from a number of conceptual shortcomings concerning progressivity measurement. First, the ATR does not directly account for the redistributive effects of transfers, which can be disproportionately targeted to poor individuals. As such, it is conceptually difficult to regard transfers  $B_i$  as part of the tax base, since it is in turn a function of  $Y_i$ . Taxable transfers and market income are perfect substitutes in the short run, so in the annual perspective this need not be a severe issue. But from a lifetime perspective, calculating average tax rate in this fashion is not optimal. By adding taxable transfers  $B_i$  to market income  $Y_i$ , pre-tax total income effectively double-counts transfers within the social security system.

A second, more comprehensive measure, is the *effective tax rate* (ETR for short), which not only includes taxes paid but also transfers received, noting that they are in principle *negative taxes*.<sup>7</sup> The ETR is in this way a function of disposable income relative to gross income and defined as

$$(2) \quad t_i^e = \frac{Y_i - D_i}{Y_i}$$

where disposable income ( $D_i$ ) includes after-tax income from labor and capital as well as transfers after tax (including transfers that are not taxed). ETR takes into account that the tax-cum-benefit system becomes more progressive if transfers are disproportionately targeted at individuals with low incomes. Effective tax rates will typically be negative for individuals with very low pre-tax incomes. Since no upper age limit is imposed, old age individuals who receive pensions (which are transfers, not included in market income) will thus usually have negative ETRs when using annual figures. ETR goes to infinity as market income approaches zero and is not defined for individuals without any market incomes.

Gross (market) income is obtained as

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<sup>7</sup> Analyses of progressivity of taxes net of transfers is not new, but has previously been made in a more general framework in which all of government's redistributive expenditures are considered (see Lambert, 2001, ch. 11).

$$(3) \quad Y_i = Y_i^w (1 + t_i^p) + Y_i^k$$

where  $t_i^p$  is the payroll tax rate and  $Y^k$  is income from capital. Disposable income is written as:

$$(4) \quad D_i = (1 - t_i^w) Y_i^w + (1 - t_i^k) Y_i^k - t^c D_i + (1 - t_i^w) B_i + Z_i$$

where  $t^w$  is the income tax rate applied to earned income,  $t^k$  the tax rate on capital,  $t^c D_i$  VAT-payments,  $B_i$  taxable transfers, and  $Z_i$  transfers that are not taxed. From (4) we derive:

$$(5) \quad D_i = \frac{1}{1 + t^c} \left[ (1 - t_i^w) (Y_i^w + B_i) + (1 - t_i^k) Y_i^k + Z_i \right]$$

Using (2), (3) and (5) yields ETR as:

$$(6) \quad t_i^e = 1 - \left( \frac{1}{1 + t^c} \right) \left[ \frac{(1 - t_i^w) (Y_i^w + B_i) + (1 - t_i^k) Y_i^k + Z_i}{Y_i^w (1 + t_i^p) + Y_i^k} \right]$$

whereas ATR is obtained as:

$$(7) \quad t_i = \frac{t^p Y_i^w + t_i^w (Y_i^w + B_i) + t_i^k Y_i^k + t^c D_i}{Y_i^w (1 + t_i^p) + Y_i^k + B_i}$$

where disposable income is defined by (5). All else equal, an increase in transfers implies a fall in ETR since transfers increase disposable incomes. An increase in untaxed transfers increases ATR by increasing disposable income and thereby VAT-payments. An increase in taxable transfers has in general ambiguous effects on ATR as  $B_i$  appears both in the numerator and the denominator of (7).<sup>8</sup>

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<sup>8</sup> These exercises take the various tax rates as fixed. We have

$$\text{sign} \frac{\partial t_i}{\partial B_i} = \text{sign} \left[ - (1 - t_i^w) t_i^p + (t_i^w - t_i^k) (Y_i^k / Y_i^w) - t^c (Z_i / Y_i^w) \right]$$

Lifetime equivalents to (6) and (7) are obtained by taking the discounted lifetime sum of incomes and taxes before calculating the tax rates (that is, the denominator and nominator in (6) and (7) are summed separately before taking the ratio).

### 3.2 Measuring Tax Progressivity

There are alternative ways of characterizing a progressive tax system. A central notion is that progressivity reflects the relationship between the pre-tax income distribution, the tax schedule and, finally, the post-tax income distribution outcome. In his overview of the tax progressivity literature, Lambert (2001) states that a common distinction is made between the *redistributive capacity of a tax* and the *departure from proportionality*. The former aspect refers to the redistributive effect coming from the difference between pre- and post-tax incomes and is captured by the well-known Reynolds-Smolensky measure (Reynolds and Smolensky, 1977). The latter part relates to the distribution of tax burdens and is typically associated with Kakwani (1977).<sup>9</sup> Both of these measures are founded on Lorenz curve representations and thus a solid linkage to welfare theory. Both are also commonly used in empirical assessments (Urban, 2009), but as Lambert (1985) notes the Kakwani measure is less useful when faced with the negative taxes arising from incorporating transfers into the tax scheme. For that reason, and bearing in mind that our main interest lies in *de facto* redistribution of incomes as a result of both taxes and transfers, we will in this analysis put main emphasis on the Reynolds-Smolensky measure. This measure,  $L^{RS}$ , is defined as the difference between the pre-tax income Gini coefficient  $G_Y$  and the post-tax Gini coefficient with income earners ranked according to pre-tax incomes,  $G_{Y-t}$ :

$$(8) \quad L^{RS} = G_Y - G_{Y-t}.$$

The Reynolds-Smolensky measure tells us how much, in percentage points, income inequality is reduced. Note that it captures the redistributive capacity of taxes over the population as one entity. If one wishes to treat the redistributive outcomes separately across different parts of the income distribution, this can be done by using a unidimensional version of the measure called

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A negative impact is most likely except for individuals with a very large fraction of income as income from capital.

<sup>9</sup> As was originally shown by Kakwani (1984) and later extended by Aronson, Johnson and Lambert (1994) and Lambert and Urban (2008), the Reynolds-Smolensky redistribute effect can be decomposed into a vertical and a reranking effect.

*relative share adjustment (RSA)*. The *RSA* is defined as the after-tax income share for a particular income group (or individual) divided by the pre-tax income share of the same group (see Baum, 1987; 1998). It is straightforward to show that *RSA* is equivalent to

$$(9) \quad RSA_i = \frac{1-t_i}{1-t}$$

where  $t_i$  is the average tax rate for group  $i$  and  $t$  is the overall average tax rate. Here, the average tax rate can be defined either as the effective tax rate (ETR) or the average tax rate (ATR). A strictly proportional tax system would thus imply  $RSA_i = 1$  for all  $i$ . The rate at which *RSA* declines with income provides information about the progressivity of the tax system. The unidimensional version of this measure focuses on pre- and post-tax income shares of two groups, viz. the top quintile (P80–100) and the lower four quintiles (P0–80). This distinction between the top and the rest of the income distribution, based on imposing a dividing line at the 80th income percentile, follows previous conventions used by the European Union and many others to analyze income inequality in terms of income quintiles. In fact, in their investigation of how to define the “middle class”, Atkinson and Brandolini (2011) land at the 80th income percentile being a sensible boundary for separating the top income earners from the rest of the distribution. The ratio between incomes at the top and at the bottom – *the top quintile ratio* – is computed before tax as well as after tax. The measure of progressivity ( $Q$ ) captures the ratio between pre- and post-tax income shares for the top and the bottom and boils down to comparing the tax rates met by the top and bottom groups, i.e.,

$$(10) \quad Q = \frac{1-t_{top}}{1-t_b} = \frac{RSA_{top}}{RSA_b}$$

where subscripts refer to top and bottom, respectively. A strictly proportional tax system would imply  $Q=1$ . Progressive tax systems generate measures below one whereas measures above one reflect a regressive tax system.

### 3.3 Data

Our main data source is a longitudinal data base, LINDA, which is a 3.35 percent random sample of the Swedish population. LINDA is based on a combination of different public reg-

isters, such as income tax registers and population censuses.<sup>10</sup> These data are available from 1968 and onwards and we focus on the period 1968–2009. In addition to rich information on incomes, the data include information on tax payments and for most tax bases and deductions.<sup>11</sup> There is also information on some human capital attributes and demographic characteristics such as age, gender, education and marital status.

We focus on individuals aged 20 and over. Using individuals as the unit of analysis is deliberate as the Swedish tax system has been individual-based since 1971. Furthermore, our focus on lifetime incomes and taxes complicates the use of household units since they tend to change over the life cycle. The sample is representative for the total population each year except for the period 1968–1970 due to missing information on residence (see below). The data consist of about 180,000 to 240,000 observations per year. We dropped the three richest individuals from the sample each year.<sup>12</sup> A small number of duplicate errors in the early period (1968–1974) were dropped.

Our analysis provides a lifetime approach on tax progressivity by focusing on individuals aged 20–40 in 1968. We follow this cohort for 42 years and rank the individuals on the basis of their lifetime real incomes, i.e., incomes over the period 1968–2009. This means that in 2009 the individuals are between 62 and 82 years old.<sup>13</sup> Lifetime tax payments are applied to lifetime incomes so as to obtain lifetime average tax rates by lifetime income category. When calculating lifetime taxes and incomes, we discount the figures by a rate of three percent annually.<sup>14</sup>

A few additional remarks concerning the analytical approach are needed. First, taxes influence peoples' behavior and this is reflected in the distribution of market incomes as well as tax burdens. Unlike studies using simulation data, which need to model explicitly (or assume away) such responses, our use of actual income and tax outcomes implies that we – for good and for bad – incorporate behavioral adjustments spurred by the tax system. Second, we as-

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<sup>10</sup> For a description of LINDA, see Edin and Fredriksson (2000).

<sup>11</sup> We use supplementary historical tax rate information for the calculation of payroll taxes and VAT (see further below).

<sup>12</sup> For the early 1980s, the inclusion of two extremely rich individuals has had dramatic impact on the results when using annual data.

<sup>13</sup> We do not require survival of all individuals in the panel up to 2009; a deceased person contributes zero to lifetime income.

<sup>14</sup> The discount rate of three percent is chosen so as to reflect the average real interest rate during the period of analysis, and is also a standard rate in previous studies for Sweden (see, e.g., Blomquist, 1981).

sume that tax incidence is the same for annual and lifetime outcomes by considering annual incomes as being snapshots of long-term outcomes. Third, the unit of analysis is the individual. Although the households forms an economically more relevant unit at the annual level, in a life cycle perspective it is hard to think in terms of a household unit given the large variation of household structure over the life path. From a more practical viewpoint, most taxes in Sweden are levied on the individual.<sup>15</sup> Fourth, capital income, i.e., interest earnings, dividends and capital gains, is included in both annual and lifetime incomes.

Our main concept of income is *pre-tax market income* defined as the sum of earnings from employment and self-employment and income from capital, including capital gains. We do not include social insurance transfers and pensions in our definition of earnings (although employer-paid benefits, such as sick pay for short spells of absence, are included in our definition of earnings).<sup>16</sup> However, earnings from employment are defined as inclusive of an imputed payroll tax, reflecting the assumption that the burden of payroll taxes levied on employers is ultimately borne by workers. Thus, transfers in the social insurance system are thus counted as market income when they are collected and not when they are paid out. Capital income is defined as the sum of interest payments, income from owner-occupied housing, dividends and capital gains.<sup>17</sup> Capital income is never negative (thus, we do not subtract losses from total income).<sup>18</sup> Finally, pre-tax market income also includes the imputed value of owner-occupied housing for those who pay real estate taxes (i.e. those who own their houses).

We also elaborate with two other income concepts. *Pre-tax total income* is pre-tax market income plus taxable social transfers. Pre-tax total income reflects the conventional tax base definition, and is used when calculating average, rather than effective, tax rates (see above). *Disposable incomes* include all transfers (including non-taxable transfers) net of VAT-payments. Disposable incomes are reported in the income registers only from 1978 onwards.

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<sup>15</sup> Since 1971, all income taxes (and deductions) and most transfers are individual. Wealth and consumption taxes and a few transfers (child allowances) are household-based. In the register databases, however, these taxes and transfers are split between the adults in a household.

<sup>16</sup> The employer has to provide sick pay for the first weeks of sickness absence. Such sick pay is regarded as wage payments and is subject to payroll taxation. Longer periods of sickness absence are covered by sickness benefits provided by the national social insurance system.

<sup>17</sup> Income from owner-occupied housing is imputed by tax authorities before 1991 (“schablonmässig inkomst av annan fastighet”) and by us thereafter, using the real estate tax payments as basis.

<sup>18</sup> This is mainly for comparative reasons, as capital incomes before 1991 is never negative whereas they can be so after 1991 due to a separate reporting of earnings/gains and losses.

We therefore compute them for earlier years back to 1968 by adding child allowances using statutory allowance levels.

Personal income taxes for each tax base are observed as they appear on tax records between 1971 and 2009. For the period 1968–1970, only the total sum of all personal tax payments is shown. In order to separate municipal and state income tax payments for these three years, we use the municipal statutory tax rates to impute the municipal income tax and then calculate the state income tax as a residual from the total income tax payment. Place of residence was not observed until 1971, and the statutory municipal tax rates for 1969 was used for 1970 due to lack of original data. Thus, for the years 1968–1970, the sample is only representative for those living in Sweden in 1970.

Payroll taxes are levied on employers and imputed (see equation 3) using information on individual labor income and statutory tax rates in Söderberg (1996). The payroll tax rate is typically the same for all individuals, but as already noted it has varied by earnings before 1982 and it varies by age from 2006 and onwards.

Before the tax reform in 1991, earnings, capital income and the imputed value of owner-occupied housing were taxed at the same rate. A special real estate tax was introduced in 1985 and the taxation of labor income and capital income was separated in 1991. Net marketable wealth, i.e., the sum of most real and financial assets less debts, was taxed at the household level until its abolishment in 2007.<sup>19</sup> We thus observe the value of owner occupied housing up until 1990. From 1991 and onwards, we impute the value of owner-occupied housing for those who pay real estate tax.

Value added taxes (VAT) are imputed using information on effective VAT rates from Statistics Sweden. Effective VAT rates are lower than the standard rates because of tax differentiations and tax exemptions. To obtain effective VAT rates, we use data on overall VAT revenues along with data on private consumption. For now, we treat the VAT rate as equal across individuals, thus ignoring the fact that differentiated VAT rates may result in variations in effective VAT rates as consumption patterns vary across individuals with different incomes.

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<sup>19</sup> Corporate income is mainly not taxed at the personal level in Sweden and is therefore excluded from the analysis. Small businesses and some partnerships, however, are registered at the individual level and thus taxed along with other incomes. Inheritance and gift taxes existed in Sweden up until 2004, but were taxed separately from incomes and were therefore never included in the database by Statistics Sweden. Parts of inheritances should, however, be reflected in the realized capital gains (when heirs sell their inherited assets).

Moreover, we impute individual VAT payments by applying the VAT rate to disposable income, a procedure that underestimates progressivity since it ignores that top income individuals typically consume much less than their disposable incomes.

## 4. The Evolution of Taxation in Sweden, 1968–2009

### 4.1 Average Tax Rates

We begin our analysis by providing a series of *annual snapshots* of the Swedish tax progressivity. In Figure 1 the evolution of average tax rates (ATR) is shown across income categories. Several features stand out. There is marked increase in tax rates for all categories up to 1990, but the tax rates at the top increase faster than at the bottom. The early 1990s involves a sharp fall in progressivity, a development that is bound to be mainly driven by the 1990–1991 tax reform. Finally, we note a regressive element in the tax system prevailing since the early 1990s: average tax rates are often lower at the very top than at income levels just below the top. This feature reflects in part the fact that the income from capital – a major income source at the top – is relatively low compared to earnings taxes.<sup>20</sup>

[Figure 1 about here]

### 4.2 The Composition of Tax Bases

What type of taxes contributes to progressivity? Figure 2 shows how the composition of taxes (disregarding transfers) has evolved over the time. Throughout the 42-year period of analysis, the income tax represents the most progressive element in the Swedish tax system. The wealth tax and the real estate tax have but a trivial impact on the overall picture, despite being referred to as important redistributive elements in the Swedish transfer system. The payroll tax and the municipal income tax are proportional except in the bottom (where social insurance becomes a much more common source of taxable income) and in the top (where capital income becomes relatively important).

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<sup>20</sup> Another reason for the lower tax rates in the very top is the relatively large deductions for interest expenses among the income rich. Note also that we rank individuals based on the expression in the denominator in (6) and (7). Past work has subtracted capital income gains from total income before ranking (Piketty and Saez 2007), precisely because they wish to avoid to have “transitory rich” individuals in the top. To ease comparison with lifetime measures of income, where such manipulations are unwarranted, we include capital income gains in the annual ranking.

[Figure 2 about here]

### 4.3 International Comparison of Average Tax Rates in 1970 and 2004

To get a more complete picture of the Swedish experience we also wish to examine how Sweden's income and wealth tax progressivity compares to the same tax progressivity in other Western countries. The comparison is based on the recent study of the progressivity of the U.S. federal tax system by Piketty and Saez (2007), in which the tax progressivity in France, Great Britain and the U.S. in 1970 and around 2004 are compared.

Figure 3 displays an interesting pattern. In 1970 (panel a) Sweden had the by far highest average tax rate over the entire distribution, with exception for the top 0.1 percentile. As we have shown above, this was due to the high income and payroll taxes paid by low-income earners. The graphical evidence suggests that progressivity (heuristically defined as the curvature of the graph) is lowest in Sweden and in France. Swedish top marginal tax rates increased rapidly after the 1971 tax reform up until unprecedented levels in the latter half of that decade.

[Figure 3 about here]

In 2004 (panel b), the picture has changed dramatically. Average tax rates are significantly lower across the board in all countries, including Sweden. Moreover, the degree of progressivity has also decreased in all countries. The decrease is most pronounced in the Anglo-Saxon countries, but also quite notable in Sweden. Still there are differences in the composition of taxes paid, e.g., as regards the relative importance of payroll taxes in France and Sweden but not in the other countries.

The main message is that income and wealth taxation in Sweden seems to have converged with that of other Western countries over the last decades. In the 1970s, Swedish citizens both paid markedly higher taxes than elsewhere and experienced a highly progressive tax schedule. One generation later this is no longer true, and Swedish taxes are aligned with those in France, Great Britain and the U.S. Although Sweden famously reformed its tax system in 1991, the "convergence" in tax schedules is driven as much by reforms in the UK, US and France as in Sweden.

#### 4.4 Effective Tax Rates

As pointed out in Section 3, a substantial fraction of tax payments are returned to tax payers as transfers. Some of these transfers are intertemporal redistributions, e.g., social security taxes returned as pensions later in life. Transfers can offset non-progressive elements in the tax system if they are targeted at the relatively worse off. For instance, earlier evidence indicates that the increase in the child allowance in the early 1990s largely offset the regressive impact of the tax reform (Björklund, Palme and Svensson, 1995). These considerations call for a more comprehensive measure of tax progressivity, which regards transfers as “negative taxes” and correctly adjust the denominator to include only market income. The effective tax rate (ETR) is equal to one minus the ratio between disposable income (including transfers) and market income (not including taxable transfers).

In Figure 4, the evolution of effective tax rates, ETR, are shown for selected percentiles. The dispersion of ETR between the top and the middle of the distribution reaches a maximum in the early 1980s. As expected, the use of ETR does not differ from ATR measures (Figure 1) at the top, where transfers constitute a negligible part of total income. However, the more comprehensive ETR measure produces lower tax rates even among the upper middle class. Notably, the effective tax rates in the middle and the bottom fell dramatically in the early 1990s; a development triggered by a macroeconomic crisis that brought about a rise in unemployment from 2 to 10 percent between 1990 and 1993 and a fall in the employment-to-population rate by more than 10 percentage points. These events reduced effective tax rates via sharp falls in market incomes in conjunction with substantial increases in transfers to the non-employed.

[Figure 4 about here]

#### 5. Annual vs. Lifetime Tax Progressivity

Figure 5 encapsulates the central empirical findings of our study. It shows the evolution of annual tax progressivity over the whole cross-section of Swedish taxpayers and also the lifetime progressivity of the cohort of income earners living their adult lives during the entire study period. The left panel is based on ETR progressivity, considering both taxes and transfers, and the right panel with ATR progressivity considers tax payments only. We note that the level of progressivity differs across the two panels, with the redistributive effect being

markedly larger in the ETR case. This reflects the role of transfers.<sup>21</sup> Lifetime taxes are conceptually more coherent in the ETR case since the ATR case includes both payroll and pension incomes in the income concept, which generates a double count.

Swedish annual tax progressivity has followed an inverse-U shaped pattern over the past forty years. The 1970s saw a sharp increase, with tax progressivity almost tripling. In the case of ETR progressivity, the reduction of the Gini coefficient increased from being 10–15 percent in the beginning of the 1970s to almost 30 percent around 1980. For ATR progressivity, the same increase was from 3 to about 10 percent. Thereafter the two concepts exhibit some differences although the overall curvature is roughly the same. When only considering tax payments in the ATR-based measures (right panel), progressivity fell in a stepwise fashion first in the mid-1980s and then, more drastically, in the early 1990s. As noted in Section 2, these episodes when the political system explicitly aimed at lowering the highest marginal tax rates. When instead considering the combined effect of taxes and transfers in the ETR progressivity (left panel), progressivity remains relatively high throughout the 1980s, and declined only slowly from the mid-1990s although not all the way back to the low level around 1970. Here we clearly observe the muting effect of the transfer system, which channels funds to the bottom of the distribution and thereby increase effective progressivity. The most striking example of this should be the spike in unemployment – and unemployment insurance – of the early 1990s.

[Figure 5 about here]

Lifetime tax progressivity is depicted as straight lines in the two panels of Figure 5. The most immediate result coming out of comparing the annual and lifetime progressivity lines is that lifetime progressivity appears to be markedly lower than annual progressivity. In fact, it is lower than annual progressivity in just about any single year of the analysis.<sup>22</sup> In Table 1 a

<sup>21</sup> The levels of ETR progressivity are in line with a cross-country analysis of tax-and-transfer redistribution in other Western countries (Immervoll et al. 2006).

<sup>22</sup> A potential concern with this comparison between annual and lifetime tax progressivity is that there are different sample populations in the two cases. The annual outcomes are based on the incidence among the entire population whereas the lifetime estimations derive from a specific cohort aged 20–40 in 1968. A reasonable question to ask would therefore be whether the different annual and lifetime outcomes remain when one studies the annual progressivity of the specific cohort. Such a comparison holds the sample constant, but of course suffers from the problem that the annual series will now be constantly changing with respect to the age profile. We have studied the annual and lifetime tax progressivity of both the full population and the cohort. The main message is that also for the cohort, lifetime progressivity is markedly lower than annual progressivity. There are six out of 42 years, predominantly during the beginning of the period, where the cohort's annual levels are somewhat lower

subset of the estimates of Swedish income inequality and tax progressivity over the period 1968–2009 is presented. A second result coming out of both Figure 5 and Table 1, almost equally striking, is the low level – 0.105, or about 10 percent Gini reduction – of the lifetime ETR progressivity. To put this number into perspective, it is half of the 20 percent redistributive effect that Björklund (1993) found for Sweden during the period 1978–1990. Possibly this reflects the effect of increasing the time window for measuring people’s incomes. It is larger than the almost proportional 4–6 percent redistributive effect found for the U.S. by Slemrod (1992).<sup>23</sup> But when comparing with the lifetime ATR progressivity, a measure that is arguably more comparable to the Björklund and Slemrod estimates (that do not address the role of transfers), the lifetime redistributive effect is only 4.5 percent, i.e., exactly the U.S. level found by Slemrod.

[Table 1 about here]

What explains the finding that Swedish tax progressivity is so much lower over the life cycle than at the annual level? We can think of at least two plausible channels. The first concerns a difference in income inequality between the annual and lifetime horizons. Consider figure 6, which shows Gini coefficients for market incomes before and after effective taxes over the annual and lifetime. Regardless of income concept, lifetime inequality is lower than annual inequality but the difference is most pronounced for pre-tax incomes. This is bound to reflect substantial income mobility so that low income in one year is partly offset by higher income in another year, thus implying a more even income distribution in the long run than in the short run. The life cycle contains periods during which people may be low income earners almost regardless of their lifetime income status, e.g., when being students or retirees. This result is largely in line with previous studies comparing annual and longer-run income inequality, such as Blomquist (1981) and Björklund (1993) for Sweden and Slemrod (1992) for the United States.

[Figure 6 about here]

The second channel puts more emphasis on the role of the tax system. Specifically, we wish

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than over its entire life cycle. But that is the exception, and when noting the stark increases in progressivity in later years, especially when using effective tax rates, the overall finding remains intact.

<sup>23</sup>

to know whether annual tax burdens are the same as lifetime tax burdens across the income distribution. A part of the answer is provided by Figure 7, which presents both annual and lifetime effective tax rates of the top income quintile and bottom four income quintiles. Its main message is that while top taxes are roughly at the same level in annual and lifetime horizons, taxes paid by the low and middle income earners differ quite markedly depending on time horizon. In particular, the lifetime tax rate for the bottom quintiles is almost twice as high as the annual tax rate. This pattern suggests, just as for income inequality, that the roots of the differential experience of annual and lifetime tax progressivity emanates from the volatile incomes and resulting volatile tax burdens in the bottom of the income distribution.

[Figure 7 about here]

Figure 7 strengthens the evidence that it is “transitory poverty” rather than “transitory richness” that causes the discrepancy between annual and lifetime estimates of tax progressivity. The interpretation is consistent with the historical labor market development in Sweden, along with its large emphasis on social security. The huge increase in unemployment in the early 1990s implied that large segments of the population earned zero market income. As the social security system kicked in, individuals remaining employed were effectively taxed to smooth the disposable incomes at the bottom of the distribution. In contrast, the lifetime tax burden at the top is remarkably close to annual tax burden at the same income segment. This pattern is consistent with previous research on the role of capital income gains in Swedish income inequality (Roine and Waldenström 2012); capital income gains seem to fall on the same persons from year-to-year.

Further evidence of the importance of the tax-and-transfer system for the finding of a lower lifetime tax progressivity is presented in Figure 8. It shows how market and disposable income shares evolve across annual and lifetime horizons. In the left panel, market income shares over the lifetime are lower for all income fractiles except for the bottom four deciles where the opposite holds true. By contrast, the disposable income shares are strikingly similar for annual and lifetime outcomes across the entire distribution. These patterns reinforce the result that the social insurance element in the Swedish tax system creates an annual distribution of disposable incomes that are largely similar to the lifetime distribution of disposable incomes.

[Figure 8 about here]

As a final piece of evidence, we inquire the role of the different tax bases for annual and lifetime progressivity. Table 2 presents average annual tax rates for each tax base using both ETR and ATR concepts.<sup>24</sup> The differences between lifetime and annual outcomes are strikingly consistent across the two tax concepts. First, income taxes have relatively similar progressivity profiles for annual and lifetime progressivity, a finding that is largely in line with previous results for the U.S. (Davies, St-Hilarie and Whalley, 1984; Fullerton and Rogers, 1991). Although municipal taxes deviate somewhat in the bottom income fractiles, annual and lifetime tax rates are almost identical for both state income tax rates (paid predominantly by higher income earners) and payroll tax rates.

Capital (i.e., wealth, property and capital income) taxes and consumption taxes become more progressive – or less regressive – over the life cycle than at the annual level. In the case of capital taxes, this finding reflects the fact that among the transitory low-income earners there are people with positive net wealth (e.g., old-age pensioners owning their house). The large annual regressivity of consumption taxes is particularly interesting since even at the annual level sales taxes can be argued to reflect lifetime income tax incidence, due consumption smoothing. Studies of lifetime vs. annual tax incidence in the U.S., using annual sales and excise taxes as measure of the former, have found lifetime taxes to be less progressive, or more regressive, than annual taxes (see, e.g., Poterba, 1989, Metcalf, 1994; Caspersen and Metcalf, 1994). Our findings of a quite regressive annual consumption tax, caused primarily by the low annual incomes in the bottom of the distribution, are thus not entirely in line with their results. Moving to lifetime consumption tax burden over lifetime incomes, i.e., an analysis more similar to that of Fullerton and Rogers (1991), however, we arrive at lifetime consumption taxes indeed being more progressive, or less regressive, than annual taxes as was also found in the previous literature..

Finally, payroll taxes and transfers are more progressive in the annual context over the life cycle, which fits nicely with the paper's main finding. Payroll taxes are not paid by jobless people and since few people are jobless their entire life, this will primarily affect annual pay-

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<sup>24</sup> Recall that the bottom four deciles in the annual framework consist of retired, students and unemployed with virtually zero market incomes, making effective tax and transfer rates very high. Since their transfer incomes are taxable (as in equation 1), they still record a fair amount of income taxes. This is why recorded payments of income tax need to be netted out against the transfers.

roll taxes. Transfers reflect the same pattern and are by their mere size a central driver of the ETR progressivity results. Specifically, the high degree of annual progressivity comes through the institutional feature of the Swedish welfare state that about four deciles in the adult population are net transfer beneficiaries or, if one prefers, net negative taxpayers.

[Table 2 about here]

## **6. Concluding Remarks**

All tax systems need to strike a balance between the fairness of tax burdens across the distribution and the efficiency considerations inherent in all market-oriented economic activities. Most countries have more or less progressive tax systems, but the exact structure and composition of tax bases differ across countries and over time. If one wishes to comprehend to what extent a certain tax structure is equitable and efficient, and whether this was sensibly designed by policymakers or the result of historical accident, a closer look at the long-run evolution of taxes and their progressivity is needed.

In this paper we have presented evidence on tax progressivity in Sweden, its evolution since the 1960s and, most importantly, novel estimates of tax progressivity over the entire working life cycle. The analysis also decomposes the determinants of progressivity across tax bases, especially labor earnings, capital income, wealth and consumption, and with respect to changes in the underlying distribution of market income.

Our main contribution concerns the estimation of life cycle progressivity. While previous studies relied on either simulated observations or much shorter episodes, our 42-year panel allows us to relate lifetime tax payments to lifetime incomes for various parts of the distribution of lifetime incomes. We follow individuals from their labor market entry at age 20–30 to their exit at age 60–70. The estimations show that life cycle taxes are substantially less progressive than taxes in any single year or shorter episode. This confirms much of the theoretical predictions about life cycle taxation, but is still noteworthy because of the remarkably low level of the redistributive effect of Swedish lifetime taxes; they are only marginally higher than in the U.S. tax system that previous studies (e.g., Slemrod, 1992; Fullerton and Rogers, 1993) have found to be close to proportional in the long run. We link the result of a lower lifetime than annual progressivity to the higher income volatility, and thus volatility of tax

burdens, among low-income earners. In particular, a large share of the annually income poor are not lifetime poor, which means that their relatively low payroll taxes and large transfer benefits do not translate into similarly low taxes and high benefits over the life cycle. We propose that the insurance elements in the tax-and-transfer system, driven by the expansion of social security from 1960 and onwards, is central to understand this result. Future research focusing more explicitly on the role of social security and horizontal redistribution would therefore be valuable.

We are also able to provide the first detailed picture of the evolution of tax progressivity in Sweden since the late 1960s. This is a highly significant period, both politically and economically, beginning in the period just before the large tax hikes of the 1970s, continuing over the comprehensive tax reform of the 1990s and ending after the tax cuts in both labor and capital taxation of recent years. Our series portray an inverted U-shape of progressivity over this period, which fit well into the past fiscal policy events.

Finally, our analysis also shows that payroll taxes have become markedly more important in the taxation of Swedish incomes over the study period. This is a pattern also seen for other Western countries such as France and the U.K., and it potentially indicates an increased role in broad-based semi-visible taxes for the financing of modern welfare states. Furthermore, the role of capital taxation has decreased in Sweden, and this happened around the time of the capital market deregulations and liberalizations in the late 1980s and 1990s. As was both argued at the time and has been shown subsequently, increased mobility of (capital) tax bases suggest downward pressure on their tax rates.

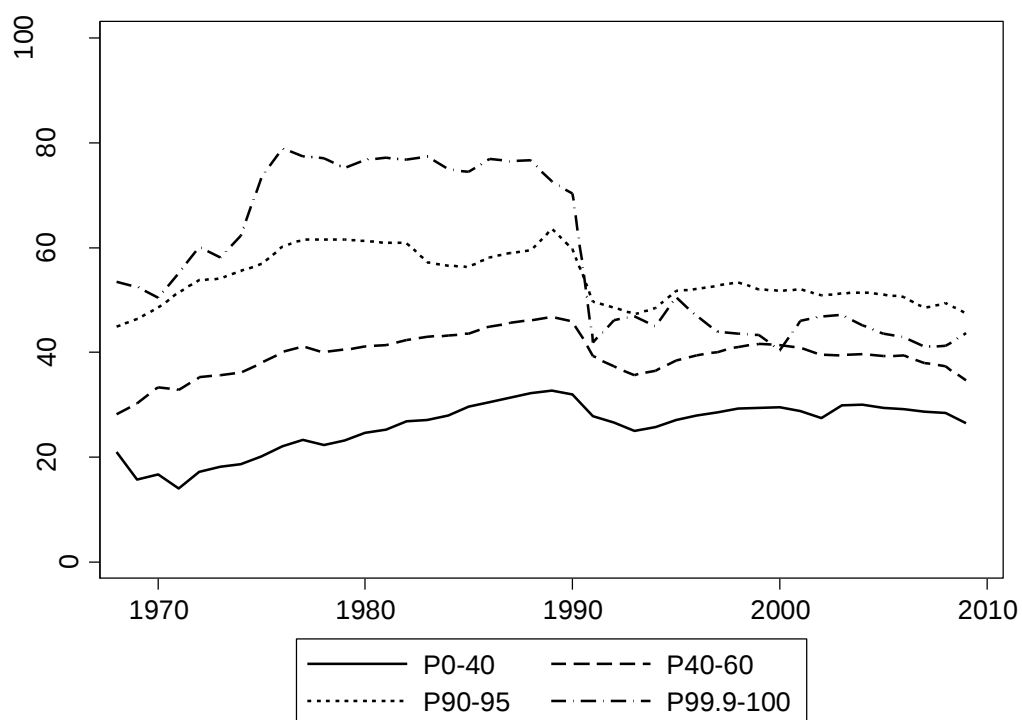
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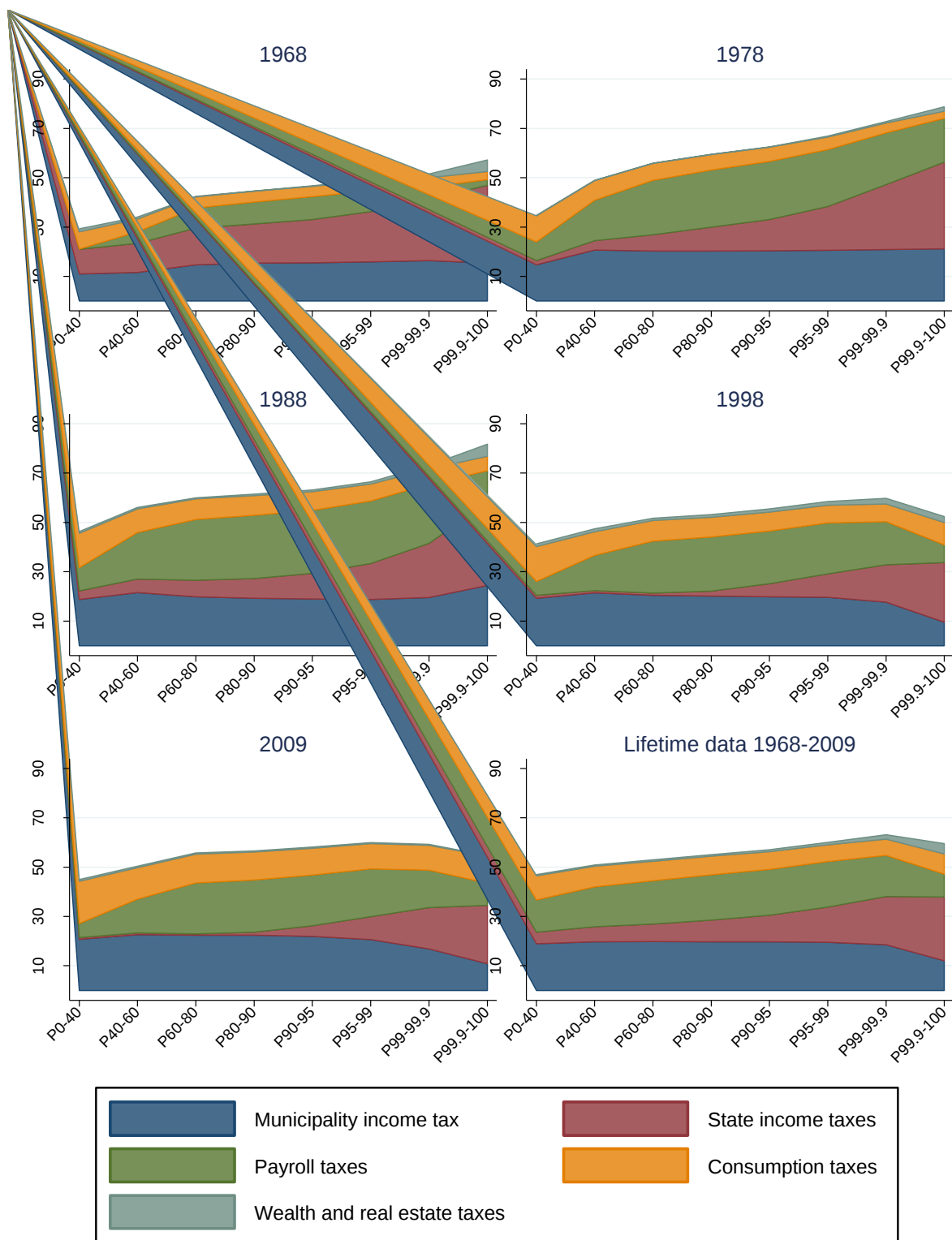
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Figure 1. Average tax rates (ATR) across the distribution, Sweden 1968–2009



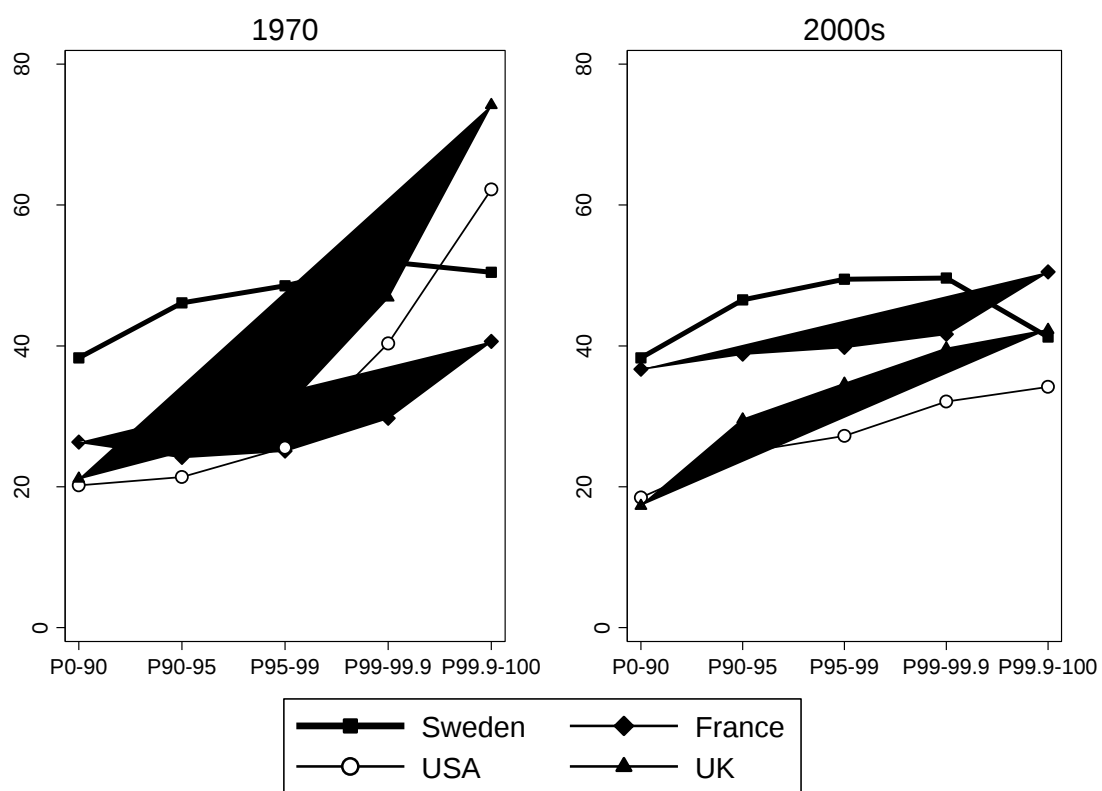
*Notes:* Figure displays the average tax rate (ATR) across different income groups in Sweden between 1968 and 2009. Average tax rates are defined as total tax payments (net of exemptions and tax credits) divided by taxable income. Taxable income includes market income and taxable social security transfers. Individuals are ranked according to taxable income.

Figure 2. The composition of taxes in Sweden: Average tax rates (ATR).



Notes: Lifetime figures uses discounted market income in the denominator, otherwise these figures represents average tax rates (see definition in Section 3), excluding tax credits and negative taxes (transfers).

Figure 3. Tax progressivity in Sweden, France, USA and UK, 1970 and 2000s.



Notes: Right panel displays data from 2004 (France), 2005 (UK, USA) and 2008 (Sweden). Non-Swedish numbers from Piketty and Saez (2007).

Figure 4. Effective tax rates (ETR) across the distribution, Sweden 1968–2009.

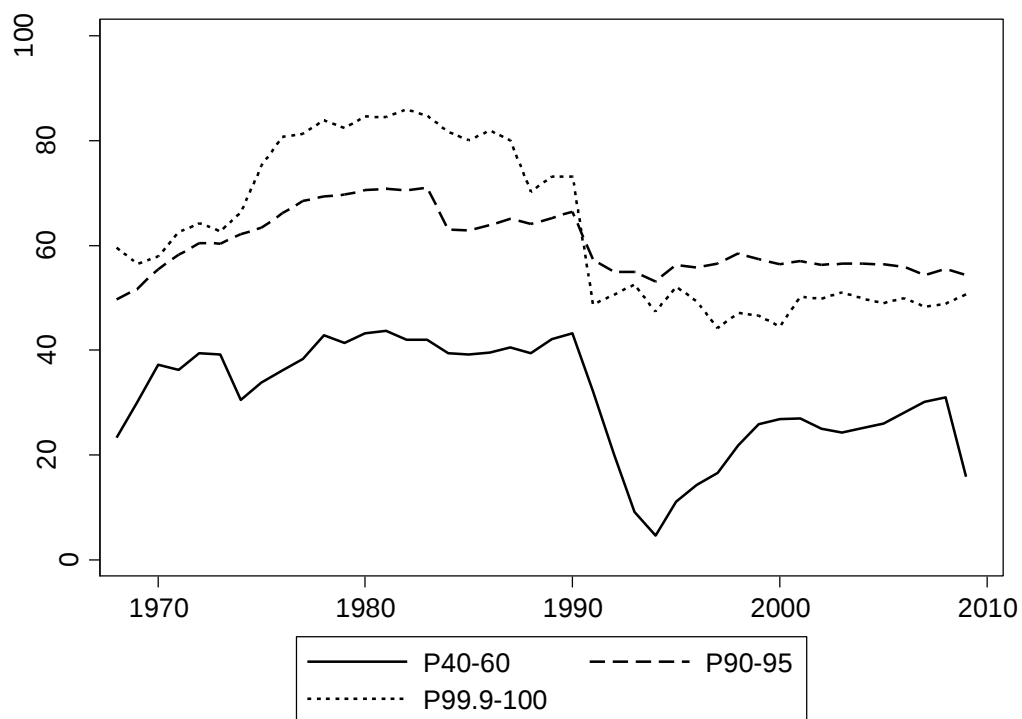


Figure 5. Tax progressivity in Sweden: Lifetime vs. annual.

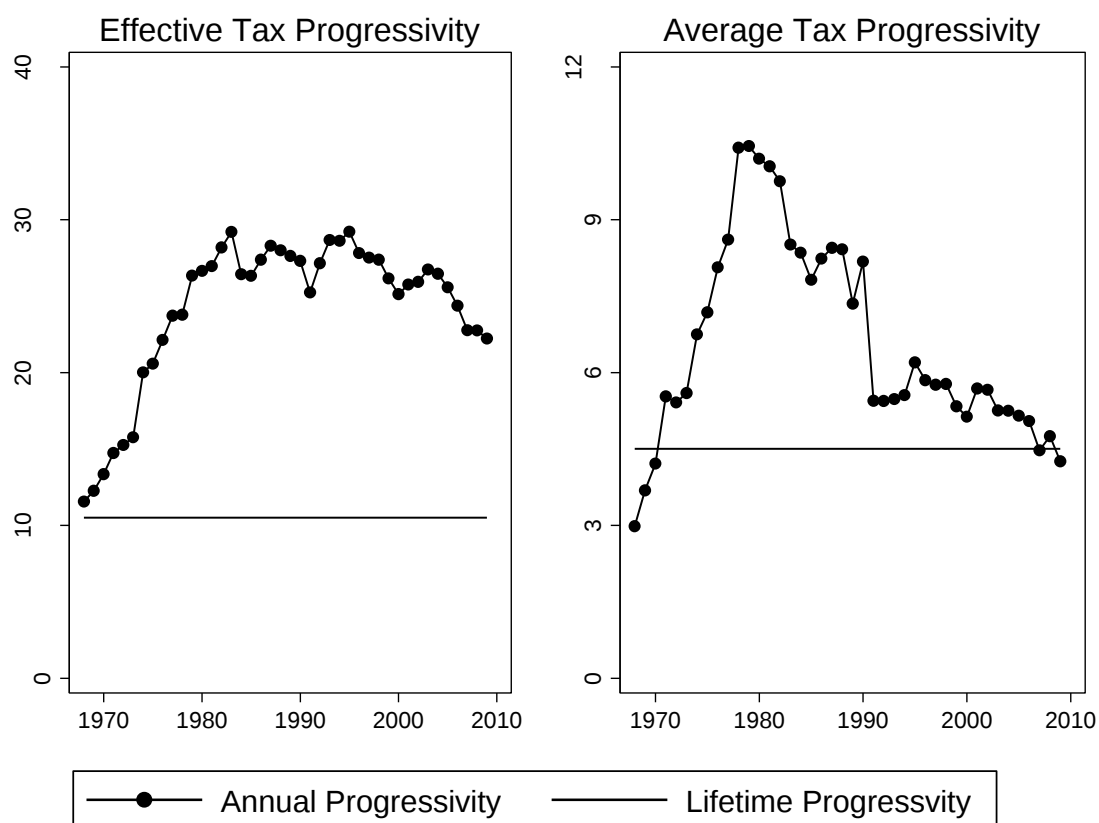


Figure 6. Income inequality before and after redistribution: Lifetime vs. annual.

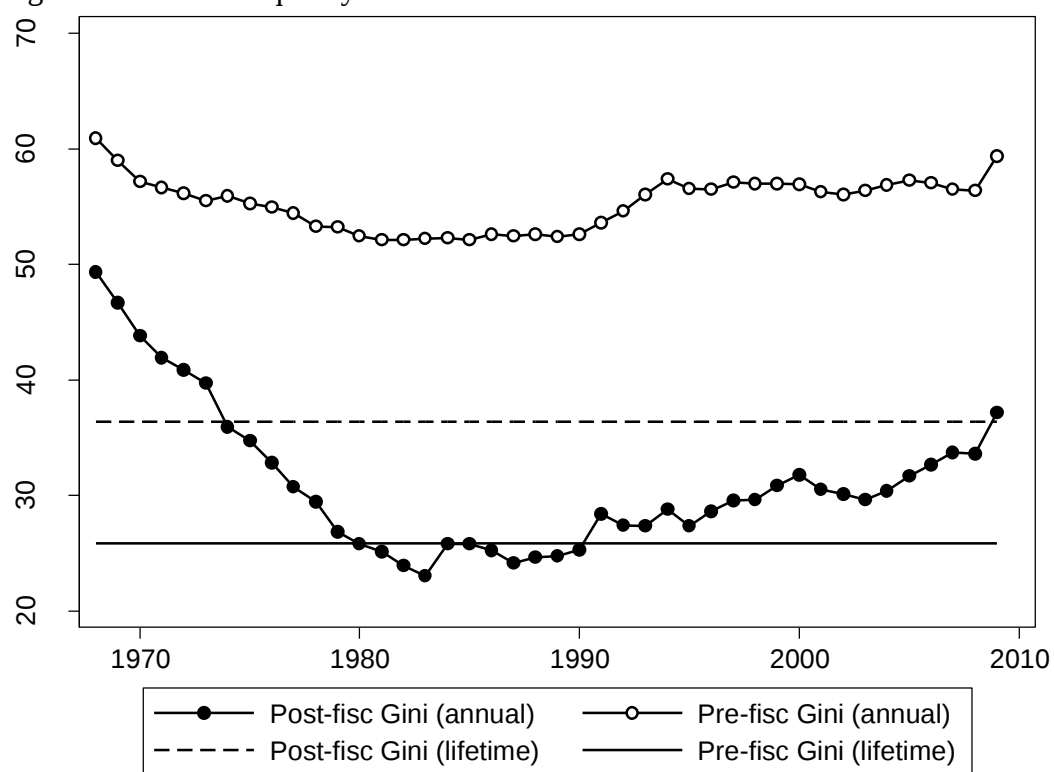


Figure 7. Effective tax rates in top and bottom income quintiles: Lifetime vs. annual.

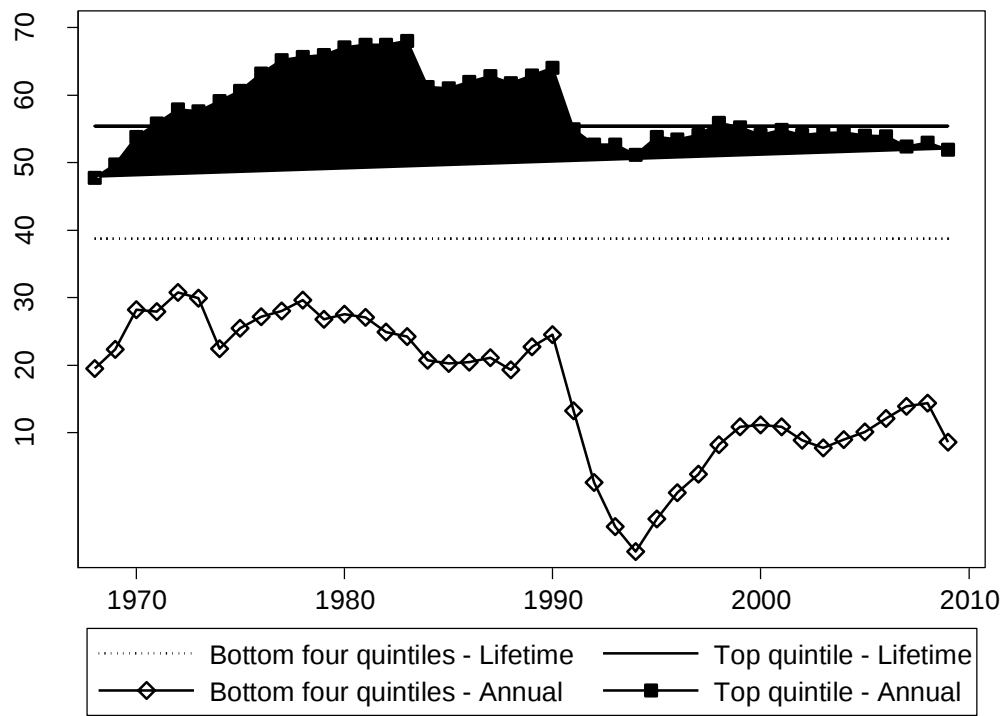
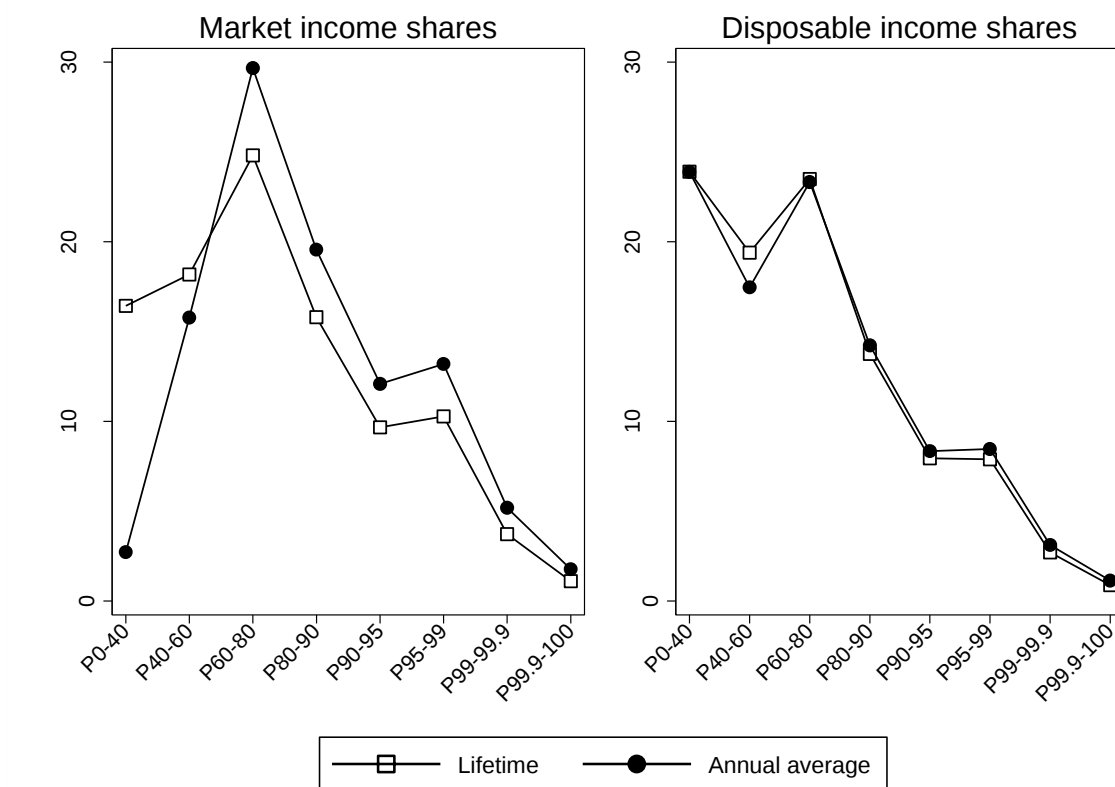


Figure 8. Taxes as insurance? Lifetime and annual market and disposable income shares.



Notes: Figure displays the income shares at each income group.

Table 1: Income inequality and tax progressivity, lifetime and annual, Sweden, 1968–2009.

|                                       | Income inequality (Gini, %) |                   |                     |                      | Tax progressivity ( $L^{RS}$ ) |                  |
|---------------------------------------|-----------------------------|-------------------|---------------------|----------------------|--------------------------------|------------------|
|                                       | Market income               | Disposable income | Pretax total income | Posttax total income | Tax-and-transfer (ETR)         | Taxes only (ATR) |
| <i>Annual estimates:</i>              |                             |                   |                     |                      |                                |                  |
| 1968                                  | 60.9                        | 49.4              | 55.3                | 52.3                 | 11.6                           | 3.0              |
| 1978                                  | 53.3                        | 29.5              | 39.6                | 29.2                 | 23.8                           | 10.4             |
| 1988                                  | 52.6                        | 24.6              | 35.4                | 27.0                 | 28.0                           | 8.4              |
| 1998                                  | 57.0                        | 29.6              | 39.6                | 33.8                 | 27.4                           | 5.8              |
| 2009                                  | 59.4                        | 37.2              | 44.3                | 40.0                 | 22.2                           | 4.3              |
| <i>Long-run estimates (1968–2009)</i> |                             |                   |                     |                      |                                |                  |
| Annual average                        | 55.3                        | 31.1              | 40.7                | 34.1                 | 24.2                           | 6.6              |
| Lifetime                              | 36.4                        | 25.9              | 31.5                | 27.0                 | 10.5                           | 4.5              |

*Notes:* Calculations are made from the micropanel LINDA, a three-percent representative sample of the Swedish population. Observational units are individuals. Tax progressivity is measured by the Reynolds-Smolensky redistributive effect. ETR denotes effective tax rate and ATR average tax rate. Lifetime measures are calculated using a cohort of taxpayers aged 20–40 years in 1968 and followed for the subsequent four decades.

Table 2: Tax rates across tax bases: Lifetime vs. annual (average)

|                              | P0–40  | P40–60 | P60–80 | P80–90 | P90–95 | P95–99 | P99–99.9 | P99.9–100 |
|------------------------------|--------|--------|--------|--------|--------|--------|----------|-----------|
| Effective tax rates (ETR, %) |        |        |        |        |        |        |          |           |
| <i>Municipal income tax</i>  |        |        |        |        |        |        |          |           |
| Annual                       | 0.0    | 0.5    | 14.9   | 17.1   | 16.9   | 16.1   | 12.7     | 4.8       |
| Lifetime                     | 0.0    | 5.3    | 12.0   | 15.3   | 16.2   | 16.1   | 14.0     | 7.5       |
| <i>State income tax</i>      |        |        |        |        |        |        |          |           |
| Annual                       | 0.0    | 1.5    | 16.5   | 19.6   | 21.5   | 24.1   | 24.0     | 14.5      |
| Lifetime                     | 0.0    | 11.7   | 19.1   | 23.6   | 26.4   | 29.4   | 30.9     | 19.9      |
| <i>Payroll tax</i>           |        |        |        |        |        |        |          |           |
| Annual                       | 11.3   | 22.4   | 23.8   | 23.6   | 23.2   | 22.3   | 19.2     | 10.2      |
| Lifetime                     | 17.8   | 18.5   | 18.7   | 18.9   | 18.9   | 18.8   | 17.1     | 9.3       |
| <i>Capital tax</i>           |        |        |        |        |        |        |          |           |
| Annual                       | 11.8   | 2.4    | 1.0    | 1.2    | 1.7    | 2.8    | 6.6      | 17.3      |
| Lifetime                     | 1.3    | 1.2    | 1.1    | 1.3    | 1.6    | 2.3    | 5.1      | 17.9      |
| <i>Consumption tax</i>       |        |        |        |        |        |        |          |           |
| Annual                       | 115.2  | 13.7   | 9.4    | 8.8    | 8.4    | 7.9    | 7.8      | 9.3       |
| Lifetime                     | 13.2   | 9.6    | 8.5    | 7.8    | 7.4    | 7.0    | 6.7      | 8.2       |
| <i>Transfers</i>             |        |        |        |        |        |        |          |           |
| Annual                       | –841.5 | –39.4  | –5.9   | –3.3   | –3.2   | –3.6   | –5.1     | –6.9      |
| Lifetime                     | –44.1  | –17.2  | –9.1   | –5.1   | –3.9   | –3.9   | –4.9     | –4.5      |
| Average tax rates (ATR, %)   |        |        |        |        |        |        |          |           |
| <i>Municipal income tax</i>  |        |        |        |        |        |        |          |           |
| Annual                       | 22.0   | 17.1   | 16.5   | 16.5   | 16.3   | 16.0   | 14.7     | 10.2      |
| Lifetime                     | 16.7   | 17.0   | 16.9   | 16.7   | 16.6   | 16.5   | 15.8     | 11.0      |
| <i>State income tax</i>      |        |        |        |        |        |        |          |           |
| Annual                       | 1.5    | 1.2    | 1.3    | 2.0    | 3.7    | 6.5    | 9.4      | 8.7       |
| Lifetime                     | 3.7    | 4.8    | 5.6    | 6.9    | 8.4    | 11.0   | 14.1     | 11.3      |
| <i>Payroll tax</i>           |        |        |        |        |        |        |          |           |
| Annual                       | 1.3    | 14.7   | 18.8   | 19.1   | 18.8   | 18.2   | 15.9     | 9.0       |
| Lifetime                     | 11.6   | 13.9   | 14.9   | 15.5   | 15.6   | 15.5   | 14.3     | 8.5       |
| <i>Capital tax</i>           |        |        |        |        |        |        |          |           |
| Annual                       | 1.6    | 1.8    | 0.8    | 1.0    | 1.4    | 2.2    | 5.4      | 15.3      |
| Lifetime                     | 1.0    | 0.9    | 0.9    | 1.0    | 1.4    | 1.9    | 4.3      | 16.3      |
| <i>Consumption tax</i>       |        |        |        |        |        |        |          |           |
| Annual                       | 13.7   | 9.0    | 7.4    | 7.1    | 6.8    | 6.5    | 6.5      | 8.2       |
| Lifetime                     | 8.6    | 7.2    | 6.7    | 6.4    | 6.1    | 5.8    | 5.6      | 7.4       |