The Scandinavian
Journal of Economics

Scand. J. of Economics 118(4), 619–645, 2016
DOI: 10.1111/sjoe.12160

Lifetime versus Annual Tax-and-Transfer Progressivity: Sweden, 1968–2009*

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Abstract

In this paper, we analyze the evolution of tax-and-transfer progressivity in Sweden over both annual and lifetime horizons. Using a rich micro panel covering the period 1968–2009, we calculate tax rates over a cohort's entire working life cycle. Our main finding is that taxes are considerably less progressive over the lifetime than in any single year. Social insurance transfers to transitory low-income earners account for most of this result. We offer a number of robustness checks of the measurement of lifetime incomes and progressivity, but none of them changes our overall findings.

Keywords: Income distribution; lifetime income; redistributive effect; tax progressivity; transfers

JEL classification: *D*31; *H*20

I. Introduction

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 will be high-paid surgeons or low-paid clerks in

*We have received valuable comments from Giacomo Corneo, Stephen Jenkins, Andreas Peichl, Thomas Piketty, Alain Trannoy, three anonymous referees, and participants at the National Conference in Economics in Sweden, Lund 2010, the 10th Journées Louis-André Gérard-Varet Conference in Public Economics, seminars at IZA, IFS, Helsinki Center of Economic Research, Copenhagen University, Research Institute of Industrial Economics and Gothenburg University. We acknowledge financial support from the Jan Wallander and Tom Hedelius Foundation, Riksbankens Jubileumsfond, and the Swedish Council for Working Life and Social Research.

the future. Capital gains are typically observable and taxed when they are realized rather than when they accrue, and such one-shot realizations might not accurately depict the lifetime income status or lifetime tax burden. Accounting for lifetime variations in both income and the ability to pay taxes should thus be important for conducting a balanced assessment of the progressivity of the tax system.

In this paper, we analyze the implications of studying the progressivity of taxes and transfers from an annual versus a lifetime perspective. We do so by exploiting a rich Swedish data source with register information on the taxes paid and benefits received by a large and nationally representative sample of individuals. Using a panel covering a 42-year period, we are able to compute measures of lifetime 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 one's lifetime have typically been based on either simulation methods or considerably shorter panels. There are indeed advantages to using micro-simulated life spans; in particular, they offer a more controlled approach to incorporate theoretically relevant aspects of lifetime tax incidence. Our work extends this previous work on tax progressivity, which began with Pechman and Okner (1974) and features subsequent contributions by Davies *et al.* (1984), Slemrod (1992), Fullerton and Rogers (1993), Cameron and Creedy (1994), Creedy and van de Ven (2001), and, using Swedish data, Björklund *et al.* (1995).[1] The richness and size of our data – a sample size of approximately 200,000 individuals per year – allow us to compare narrow income segments at the top of the income distribution, such as percentiles and tenths of percentiles. This focus is particularly relevant for specifying the differing impacts of labor and capital taxation.

Another contribution of our paper is that it provides a comprehensive assessment of how the redistributive properties of the Swedish tax system have evolved in recent 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 fees levied on employers (payroll taxes) and value-added taxes. Specific reforms and other legal changes 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 involved substantial cuts in marginal income taxes

[1] There is a related and more extensive body of literature analyzing income inequality over annual and lifetime horizons, which devotes little or no attention to taxation and tax progressivity; see Creedy (1999) for an overview. Studies of Sweden include Blomquist (1981), Lindbeck (1983), Björklund (1993), Hussenius and Selén (1994), Björklund and Palme (2002), and Pettersson and Pettersson (2003).

and the introduction of a dual income tax system in which earned income and capital income are taxed at different rates. More recent reforms include the abolition of the wealth tax and the introduction of a system with earned income tax credits.

Our main analysis focuses on the progressivity of the tax-transfer system, based on the premise that governments can choose either to tax and then distribute transfers, or to distribute transfers and then tax them, which necessitates a comprehensive approach to measuring redistribution and taxation. In doing so, we compute measures of effective tax rates (ETRs) for various segments of the income distribution, and we examine how these rates change over time. We also compare the contribution of different tax bases, capital, earnings, and transfers to the overall level of tax progressivity. Because of the comprehensive coverage of our data, we are able to pay particular attention to the progressivity of taxes and transfers at the very top of the income distribution, which is in line with the analysis of the progressivity of US federal taxes conducted by Piketty and Saez (2007).

We find that lifetime tax-and-transfer progressivity is lower than annual progressivity in almost any single year. This finding is primarily due to the considerable redistribution within an individual's lifetime, where, for example, the amounts received as a student or as old-age support nearly offset the taxes paid as an income earner. Our empirical longitudinal evidence thus reinforces much of the previous simulation evidence on life-cycle progressivity. We also show that the discrepancy between annual and lifetime tax progressivity reflects social transfers intended to smooth transitory drops in market income, rather than differential tax rates on high incomes. At the bottom of the income distribution, taxes are highly progressive from an annual perspective but not from a lifetime perspective. By contrast, at the top of the income distribution, annual progressivity correlates highly with lifetime progressivity.

Our data also show that long panels – covering most of the working age population aged between 18 and 65 – are necessary to fully capture lifetime tax-and-transfer redistribution, at least in the Swedish case. A substantial share of annual progressivity is attributable to business cycle shocks, and in particular crisis years, when large shares of the population become dependent on social benefits and taxes are concentrated on the relatively few individuals who actually work. Such episodes can be readily smoothed out by using three- or five-year panels. However, to completely capture lifetime redistribution, smoothed panels, even those including up to ten years, do not suffice; to achieve this objective, actual lifetime income histories are required. As our study shows, the primary reason for this is that many social insurance transfers are targeted at different episodes in the lifetime (e.g., transfers targeting child-related work absence and early retirement transfers).

The paper is structured as follows. In Section II, we discuss the measurement of incomes, taxes and tax-and-transfer progressivity, and we depict the long-run evolution of taxes and transfers in Sweden. Our main results, contrasting annual estimates with lifetime estimates of tax progressivity, are presented in Section III. In Section IV, we discuss different characterizations and interpretations of the results, and in Section V we provide robustness and sensitivity checks. Section VI concludes.

II. Measuring Annual and Lifetime Incomes, Taxes, and Progressivity

The rationale for computing lifetime estimates of income inequality and tax progressivity is that the same individuals tend to appear in different parts of the income distribution in different years. Therefore, annual snapshots of tax progressivity capture both redistribution between individuals within years and redistribution across years for the same individuals. The intra-personal redistribution in part reflects the insurance elements in the tax system.[2]

Regarding the transitory nature of incomes, it is well known that lifetime incomes are more equally distributed than annual incomes.[3] In part, this finding is because the cross-sectional distribution of income captures differences among younger individuals who have recently entered the labor market, experienced workers, and seniors who have left the labor market. In welfare states, a tax on labor income effectively redistributes income from those who are employed to those who are unemployed. A related issue is the role of capital gains. On tax records, capital gains appear in a very lumpy manner, placing certain individuals at the top of the income distribution where they do not typically appear. From a permanent income perspective, capital income gains should be measured when they accrue rather than when they are realized. The annual estimate of tax progressivity will appear regressive at the top compared with an estimate obtained following a lifetime perspective if capital income realizations temporarily place individuals at the top of the income distribution and if capital income gains are taxed less heavily than labor earnings.[4]

The second dimension of lifetime progressivity pertains to the role of the social insurance system. In any given year, the bottom of the income distribution includes individuals who are temporarily out of work (e.g., off

[2] See also Fullerton and Rogers (1993) for a comprehensive discussion.

[3] See Jäntti and Jenkins (2013) and, for an early treatment on Swedish data, Blomquist (1981).

[4] For this reason, in their study of US federal tax progressivity, Piketty and Saez (2007) rank tax units based on income net of capital gains (and then reincorporate capital income gains when calculating the tax rates).

sick, unemployed, or on parental leave). Transfers directed 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 might be zero, whereas the ETR, which defines transfers as negative taxes, might be negative (see 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 from a lifetime perspective. In Sweden, replacement rates have occasionally been approximately 90 percent, which means that every unit of currency collected in social security implies a nearly one-to-one increase in expected benefits. Some analysts thus regard the payroll tax as an actuarially fair insurance premium rather than a tax. In practice, 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 must thus adopt an *ex ante* position regarding the extent to which the payroll tax is really a tax, which is a very delicate task (e.g., Sørensen, 2010, p. 211). In contrast, lifetime payroll taxes net out taxes that are transferred to the same individual automatically.[5]

The distinction between redistribution across time and redistribution across individuals is also related to our understanding of the rise of the modern welfare state. From a political economy perspective, insurance elements of 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 understanding, Lindert (2004) notes that countries with a high share of public spending relative to GDP (such as Sweden) have traditionally had a more proportional tax system, at least compared to the Anglo-Saxon countries. The emphasis on social insurance as characterizing states with high public expenditures is also consistent with the canonical taxonomy of welfare capitalism, in which Scandinavian welfare states are characterized by a high level of universality and limited reliance on markets and families (Esping-Andersen, 1990).

Measuring Progressivity

In line with conventional terminology, taxes are referred to as progressive if the average tax rate increases with income. Therefore, to compute the degree of progressivity, we first compute a measure of the ETR. The ETR includes taxes paid and transfers received, as transfers are in principle

[5] See also the distinction between insurance and redistribution in Hoynes and Luttmer (2011).

negative taxes.[6] In this way, the ETR is a function of disposable income relative to gross income and it is defined as

$$t_i = \frac{Y_i - D_i}{Y_i}, \tag{1}$$

where Y_i is pre-tax market income, D_i is after-tax disposable income including taxable and non-taxable transfers, and subscript i refers to individual i. One feature of the ETR is that it recognizes that the tax–benefit system becomes more progressive if transfers disproportionately target individuals with low incomes. ETRs will typically be negative for individuals with very low pre-tax incomes. If no upper age limit (at retirement age) is imposed, then elderly individuals who receive pensions will often obtain negative ETRs when using annual figures. ETR goes to infinity as market income approaches zero, and it is not defined for individuals without any market income.

Annual pre-tax market income is obtained as

$$Y_i = Y_i^w\left(1 + t_i^p\right) + Y_i^k, \tag{2}$$

where Y_i^w is earned income, t_i^p is the payroll tax rate, and Y_i^k is income from capital. Disposable income is written as

$$D_i = \left(1 - t_i^w\right)Y_i^w + \left(1 - t_i^k\right)Y_i^k + \left(1 - t_i^w\right)B_i + Z_i, \tag{3}$$

where t^w is the income tax rate applied to earned income, t^k is the tax rate on capital, B_i represents taxable transfers, and Z_i represents transfers that are not taxed. Using equations (1) and (3) yields ETR as follows:

$$t_i = 1 - \left[\frac{\left(1 - t_i^w\right)Y_i^w + \left(1 - t_i^k\right)Y_i^k + \left(1 - t_i^w\right)B_i + Z_i}{Y_i^w\left(1 + t_i^p\right) + Y_i^k}\right]. \tag{4}$$

Note that equation (4) reflects the fact that the ETR comprises four main components: the effective labor income tax, the effective capital income tax and the sum of transfers (taxable (net of tax) and non-taxable), and the payroll tax.[7] All else being equal, an increase in transfers implies a decrease in ETR, as transfers increase disposable income.[8]

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[6] The analysis of the progressivity of taxes net of transfers is not a new concept but has previously been conducted in a more general framework in which all of the government's redistributive expenditures are considered (see Lambert, 2001, Chapter 11).

[7] In the Swedish tax data, it is not possible to distinguish between labor and capital incomes before 1991. Therefore, our decomposition analysis will focus on the differences across income taxed by municipal taxes (almost exclusively earnings) and state taxes on income (higher earnings and capital income) and wealth.

[8] We ignore consumption taxes, mainly for data reasons. The working paper version of this article includes a brief discussion of how consumption taxes might affect our progressivity measures (see Bengtsson *et al.*, 2012).

Next, we wish to measure progression in the tax-and-transfer system using the ETR. As stated above, progressivity is an ambiguous concept and the literature typically distinguishes between local measures of structural progression (e.g., the degree of tax progression along the income scale) and global measures of effective progression, which typically reduces progressivity into a scalar index (Lambert, 2001). Our interest in this study lies in assessing the latter aspect of the Swedish tax-and-transfer system. Several specific measures have been proposed, and we focus on two that capture the most central dimensions of progressivity: the redistributive effect in the income distribution proposed by Reynolds and Smolensky (1977); and the disproportionality of the distribution of tax burdens proposed by Kakwani (1977, 1984).[9]

Specifically, as the measure of the redistributive effect, we use the Reynolds–Smolensky index. This index, denoted Π^{RS}, is a scalar that indicates the degree to which the tax schedule reduces income inequality. It is the difference between the dispersion of pre-tax market incomes, measured as the Gini coefficient G_Y, and the dispersion of post-ETR disposable incomes, measured as the concentration coefficient C_D:[10]

$$\Pi^{RS} = G_Y - C_D. \tag{5}$$

The other progressivity measure is the Kakwani index of the departure from proportionality in the tax schedule, Π^K, which is a measure of the amount of the tax burden that is shifted from low-income earners to high-income earners due to progressivity (Kakwani, 1977, 1984). The Kakwani index is defined as the difference between the dispersion of net tax liabilities across the distribution of market income earners, C_{Y-D} (note that $Y - D$ equals taxes minus transfers), and the dispersion of pre-tax market incomes, G_Y:

$$\Pi^K = C_{Y-D} - G_Y. \tag{6}$$

While the concepts of the redistributive effect and disproportionality capture different aspects of progressivity, they are closely related. If a tax schedule becomes more disproportionate, individuals with higher incomes

[9] There are some other proposed measures of effective progression, such as the redistributive effect of Musgrave and Thin (1948) and the tax disproportionality index of Suits (1977). See Lambert (2001, Chapter 8) for an overview.

[10] Both the Gini coefficient and the concentration coefficient are measures of dispersion ranging between 0 (complete equality where everyone earns the same income) and 1 (complete inequality where one person earns all income). The difference is that the concentration coefficient measures the dispersion of the disposable incomes of income earners who are ranked according to market incomes (i.e., a different income concept than that used to assess dispersion), and this is the reason why it is not a Gini coefficient in which the same income concept is used in the outcome and ranking dimensions.

pay relatively higher taxes, which shift their post-tax incomes down. As originally shown by Kakwani (1984), the Reynolds–Smolensky redistributive effect can be decomposed into two components: the Kakwani index of disproportionality multiplied by the average tax rate and the reranking effect.[11] Reranking occurs when the tax system treats incomes – or income earners – differently (e.g., taxing capital income at a lower rate than labor income), regardless of their respective amounts. As first shown by Atkinson (1980) and Plotnick (1981) and later by Jenkins (1988), reranking can bias the estimation of the redistributive effect and progressivity. However, our robustness analysis below shows that reranking does not change our findings.

Note that the analysis only considers cash-based redistribution and thus disregards non-cash transfers associated with the public provision of welfare services (e.g., subsidized healthcare and childcare). Prior research has shown that the imputed value of non-cash transfers to households comprises an important part of redistributive policies in most Western countries, and some estimates even suggest that their redistributive effect is as large as that of cash-based transfers (Verbist and Matsaganis, 2014). How would lifetime progressivity be affected by also including public welfare services in the transfers? To the best of our knowledge, such an analysis has not been conducted, and because it is beyond the scope of the present analysis, we can only speculate about it. Verbist and Matsaganis (2014, see their Table 2) show that for Sweden, compulsory education represents approximately half of the total redistribution resulting from public welfare services, while childcare and healthcare (excluding elderly care) represent one-eighth each. Cash transfers in Sweden peak circa age 30, when individuals have children in childcare and primary school, and in the years immediately preceding retirement. In other words, cash- and non-cash transfers appear to redistribute to roughly the same groups in the population: families with small children and, increasingly, healthcare-consuming elderly people close to retirement. A tentative conclusion based on this scattered evidence is that lifetime redistribution works along similar lines for both cash and non-cash transfers, and this in turn suggests that our main findings should not evaporate altogether if we include both types of transfers.

Finally, lifetime incomes, lifetime tax burdens, and lifetime progressivity are computed using a standard approach in the literature. This is to calculate present values of the streams of incomes and taxes over the individual's entire life cycle, using the observed data points in the income tax registers. In equation (7), lifetime tax rates are obtained by calculating the ratio of

[11] Through their Lorenz curve foundations, it can be shown that the redistributive effect equals the disproportionality of taxes times the tax level (defined as $t/(1-t)$) less the reranking effect R (i.e., $\Pi^{RS} = [t/(t-1)]\Pi^{K} - R$.

discounted lifetime incomes and lifetime tax payments measured over S years as follows:

$$t_i^{\text{Lifetime}} = \frac{\sum_s^S Y_{i,s}(1+r)^{-(s-1)} - \sum_s^S D_{i,s}(1+r)^{-(s-1)}}{\sum_s^S Y_{i,s}(1+r)^{-(s-1)}}, \tag{7}$$

where s is the year, and r is a discount rate that reflects that incomes and taxes have more of an effect earlier in the life cycle. In our benchmark measures, we use a 3 percent annual discount rate. This discount rate is chosen to reflect the average real interest rate during the period of analysis.[12]

For reasons of comparability, the incidence of taxes is assumed to be the same in the annual and lifetime perspectives. In the case of payroll taxes levied on employers, this assumption is potentially problematic because payroll taxes are occasionally regarded as mainly falling on employers in the short run, and on employees over the long run. Capital income is another difficult concept in our analysis. We include interest earnings, dividends, and capital gains in both annual and lifetime incomes, but this is not an obvious choice, as capital income largely reflects how much of their income individuals save and consume. In a standard life-cycle model, in which individuals typically consume all of their wealth, lifetime capital incomes and taxes are thus problematic concepts. We address this issue in our sensitivity checks in Section IV, and we find that the key results are robust irrespective of whether capital incomes are included in the analysis.

Data

We use Swedish register data on tax and transfers between 1968 and 2009. The total Swedish tax-to-GDP ratio stood at 40 percent in 1970, and hovered around approximately 50 percent during the 2000s. Sweden formerly had the highest tax-to-GDP ratio in the world but, in recent years, this position has been occupied by Denmark. From 1991 onward, Sweden has practiced a dual income tax system featuring 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. Taxes on labor are the most important source of tax revenues, accounting for more than half of total revenues. These taxes include personal income taxes to central and local governments, and social insurance contributions. The central government tax is progressive. The local government income

[12] We have examined Swedish data on inflation and long-term interest rates (government bonds with a ten-year maturity). The average real interest rate over the period 1965–2005 is 3.1 percent.

tax rate is proportional and stood at approximately 31 percent in 2009.[13] Social fees are paid by employers;[14] the standard payroll tax rate amounted to 31.4 percent of the wage bill in 2009. Taxes on consumption and input goods include a value-added tax (VAT). Since 1991, the standard VAT rate has stood at 25 percent of the tax base.[15]

Our main data source is an individual longitudinal database, LINDA, which contains a 3.35 percent random sample of the Swedish population. LINDA is based on a combination of different public registers, such as income tax registers and population censuses.[16] These data are available from 1968 onward, and we focus on the period 1968–2009. In addition to providing rich information on income, the data include information on tax payments for most tax bases and deductions. There is also information on demographic characteristics, such as age, gender, education, and marital status.

We focus on individuals aged 20 and over. Using the individual as the unit of analysis is deliberate because the Swedish tax system has been individual-based since 1971.[17] More important, however, we study lifetime incomes and lifetime taxes. Defining a corresponding lifetime household would be difficult because the household structure for most people changes several times over the life cycle. The sample is representative of the total population each year except for the period 1968–1970, due to missing information on residence. The data consist of approximately 180,000 to 240,000 observations per year.[18] A small number of duplicate errors in the early period (1968–1974) were omitted. For a detailed discussion of the dataset, including the original data labels used to construct the variables, see the working paper version of the paper (Bengtsson *et al.*, 2012).

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.,

[13] Municipal income tax rates were approximately 10–15 percent in the 1970s, and then increased rapidly to over 30 percent in the 1980s where they have remained. Throughout the period, tax rate variation across municipalities has been quite limited.

[14] The payroll tax increased sharply during the 1970s from approximately 15 percent on most incomes to well above 30 percent in the 1980s (Söderberg, 1996).

[15] The working paper version of this article describes the Swedish tax system in greater detail (see Bengtsson *et al.*, 2012).

[16] For a description of LINDA, see Edin and Fredriksson (2000).

[17] Since 1971, all income taxes (and deductions) and most transfers have been individual. Wealth taxes and a few transfers (child allowances) are household-based. In the register databases, however, these taxes and transfers are divided between the adults in a household.

[18] In four instances during the late 1980s, we drop an extremely rich individual who realized abnormally high capital gains, and who had a dramatic impact on the annual cross-sectional results. To aid robustness, we conducted the analysis without the three richest individuals over the full period. The results are virtually identical and available upon request.

incomes over the period 1968–2009). Therefore, in 2009, these individuals are between 62 and 82 years old, depending on whether we restrict the sample to include only working ages (20–64) or to include the full population. We do not require the survival of all individuals in the panel up to 2009 (a deceased person contributes zero to lifetime income). Lifetime tax payments are applied to lifetime incomes to obtain lifetime average tax rates by lifetime income category. As mentioned, we discount the future incomes and taxes by a rate of 3 percent annually.

The main income concept (i.e., pre-tax market income) is defined as the sum of earnings from employment and self-employment and income from capital, including realized capital gains. This concept does not include social insurance transfers and pensions, but it does include employer-paid benefits, such as sick pay for short spells of absence.[19] Among earnings, we include an imputed payroll tax, reflecting the assumption that the burden of payroll taxes levied on employers is ultimately borne by workers. Therefore, transfers in the social insurance system are considered market income when they are collected and not when they are paid. Capital income is defined as the sum of interest payments, income from owner-occupied housing, dividends, and realized capital gains, less interest payments and capital losses. In the Swedish tax data until the tax reform of 1991, reported capital income was censored at zero, and to maintain comparability, we make the same adjustment for the post-reform years. Income from owner-occupied housing is imputed by tax authorities before 1991 and by us for the period thereafter, using information on tax-assessed real estate values and a fixed real return of 3 percent per year.

Disposable income is defined as the sum of pre-tax market income and taxable and non-taxed transfers net of taxes. Disposable income is constructed by Statistics Sweden in the income register data back to 1978. However, for the earlier period, we are able to compute disposable income using the available information on market income, all taxes and taxable transfers, and new imputed values of the major non-taxed transfers, child allowances, and basic pension (*folkpension*). Housing allowances cannot be imputed due to a lack of data on dwelling status.

Personal income taxes are observed between 1971 and 2009 for each tax base as they appear on tax records. Before the tax reform in 1991, when the taxation of labor income and capital income was separated, earnings, capital income, and the imputed value of owner-occupied housing were taxed at the same rate. For the period 1968–1970, we only observe the

[19] The employer must provide sick pay for the first few 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.

total sum of all personal tax payments. 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 we calculate the state income tax as a residual from the total income tax payment.[20]

Wealth and property taxes are included in the analysis. Net marketable wealth (i.e., the sum of most real and financial assets less debts) was taxed at the household level until the abolition of the wealth tax in 2007. Real estate was taxed as imputed income until 1991 but, as observed, since 1985 in the form of a property tax. The property tax was replaced by a municipal property fee in 2008.

Payroll taxes levied on employers are imputed using the information on individual labor income and statutory tax rates in Söderberg (1996). The payroll tax rate is typically the same for all individuals but varied by earnings before 1982 and has varied by age since 2006.

Some tax bases are excluded from the analysis. Corporate income is typically not taxed at the personal level in Sweden and is therefore excluded from the analysis. However, we do include income from sole proprietorships, which is registered at the individual level as business income and taxed jointly with other types of income. Inheritance and gift taxes existed in Sweden until 2004 but were taxed separately from income and wealth and are not available in our register data. Therefore, we do not account for inheritance taxes, but parts of inheritances, which appear as realized capital gains when heirs sell their inherited assets, are included in our data.[21]

III. Results

Evolution of Taxes and Transfers in Sweden

We begin our analysis by providing a series of annual cross-sections of Swedish tax-and-transfer progressivity. Figure 1 depicts the evolution of ETRs (i.e., rates of taxation net of transfers) across the income distribution from the late 1960s until the present day. Several features are noteworthy. There is a marked increase in the ETRs for all income classes during the 1970s but especially at the top; the early 1980s witnessed a spike in the dispersion between the top- and middle-income earners. This development most likely mainly reflects increases in the top-income tax rates. We also

[20] Place of residence data were not observed until 1971, and the statutory municipal tax rates for 1969 were used for 1970 due to the lack of original data. Therefore, for the years 1968–1970, the sample is only representative of those individuals living in Sweden in 1970.
[21] The effect of excluding inheritances and gifts on lifetime progressivity is not obvious. It depends on several factors, including the timing of gifts and inheritances during the life course, the location of heirs in the income distribution, and the structure and size of inheritance (or estate) taxes (see Davies *et al.*, 1982; Fullerton and Rogers, 1993).

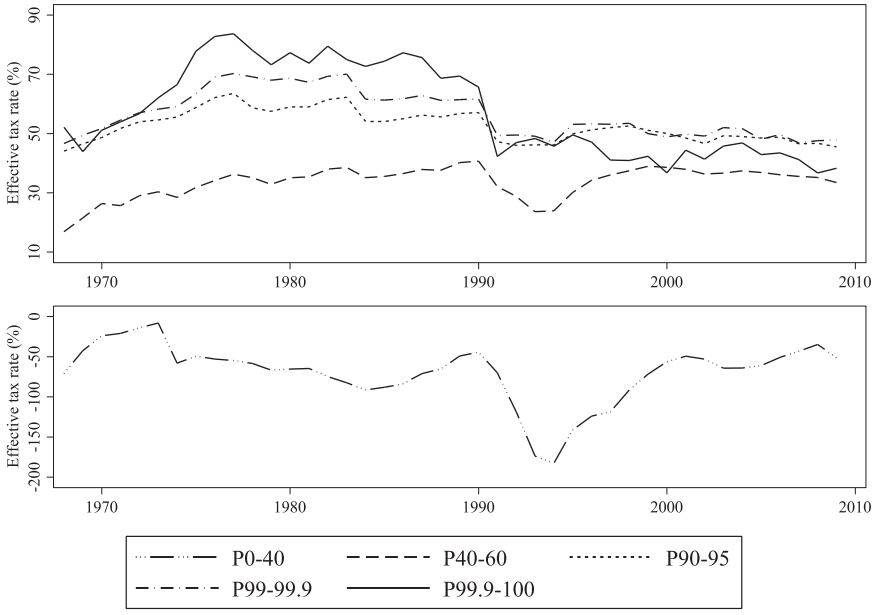

Fig. 1. Effective tax rates across the income distribution, Sweden 1968–2009
Notes: Percentile ranking is based on pre-tax market income. Sample: age 20–64.

note a regressive element in the tax system prevailing since the early 1990s – ETRs are often lower at the very top than at income levels just below the top. This feature reflects that income from capital is a major income source at the top of the income distribution and that taxes on capital are relatively low compared with taxes on earnings.

In the early 1990s, there is a sharp decline in the ETRs across all income levels in the early 1990s. This breakpoint is associated with two main events. First, the 1990–1991 tax reform implied substantial cuts for high incomes, both in the form of slashed tax rates on top earnings and the newly separate taxation of capital incomes (an income source of particular importance at the top) at a low flat rate. A second factor is the macroeconomic crisis that affected Sweden in the early 1990s, during which unemployment rose from 2 to 10 percent between 1990 and 1993, and the employment-to-population rate fell by more than 10 percentage points. These events primarily pushed down the ETR of middle- and low-income earners, and the effect came via falls in market incomes in conjunction with substantial increases in transfers to the unemployed. Figure 1 shows that middle-income ETRs declined to just above 20 percent whereas the average ETR fell dramatically to large negative numbers in the bottom four income deciles.

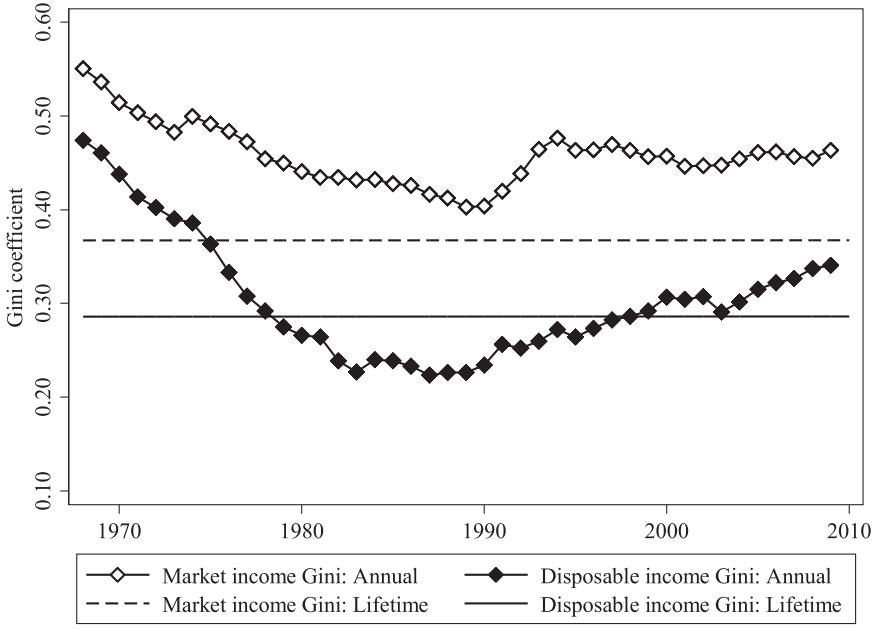

Fig. 2. Income inequality before and after redistribution: lifetime versus annual
Notes: The Gini coefficients are calculated using pre-tax market incomes and disposable incomes. Annual sample: age 20–64. Lifetime sample: age 20–40 in 1968, then kept until 64. A 3 percent discount rate is used for the lifetime estimates.

Annual versus Lifetime Progressivity

In this section, we compare annual and lifetime estimates of tax-and-transfer progressivity in Sweden. Our main results focus on contrasting a cohort aged 20–40 in 1968 with annual snapshots of progressivity using the full sample aged 20–64 (see Section IV for a discussion of how sensitive our results are to this restriction). Consider first Figure 2, which displays Gini coefficients for market incomes and disposable incomes over annual and lifetime horizons. For market incomes, lifetime inequality is lower than annual inequality in all years, whereas this is only true for some years in the case of disposable income. This pattern is bound to reflect substantial income mobility, particularly in pre-tax incomes – low income in one year, perhaps due unemployment or college studies, is partly offset by higher income in another year – implying a more even income distribution in the long-run incomes. 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 US.

Figure 3 encapsulates the central empirical findings of the study. It depicts the evolution of annual tax progressivity in Sweden since 1968 and

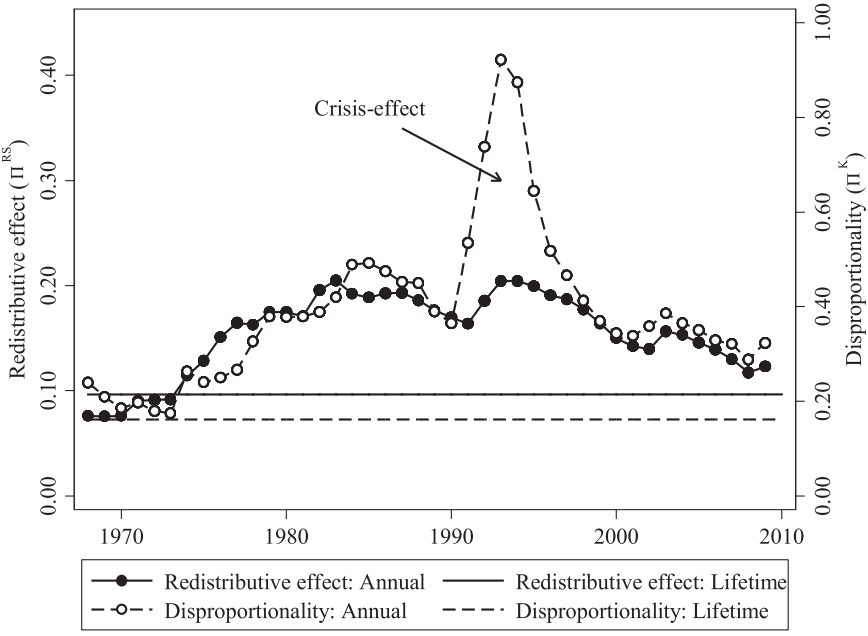

Fig. 3. Annual and lifetime tax-and-transfer progressivity in Sweden, 1968–2009
Notes: The measures of ETR progressivity are based on Reynolds–Smolensky and Kakwani indices, calculated from equations (5) and (6). Annual sample: age 20–64. Lifetime sample: age 20–40 in 1968, then kept until 64. A 3 percent discount rate is used for the lifetime estimates.

the level of lifetime tax progressivity over the same period. Progressivity is assessed through its two central dimensions, the redistributive effect (Π^{RS}) and the disproportionality of the ETRs (Π^{K}).[22]

Beginning with the assessment of Swedish annual tax progressivity in Figure 3, both the redistributive effect and ETR disproportionality exhibit an inverse U-shaped pattern over the past 40 years. In the 1970s, progressivity approximately doubled, but it flattened in the mid-1980s. During the 1990s and 2000s, progressivity exhibited a secular downward trend, reverting to the level of the mid-1970s. One specific finding is the spike in Π^{K} during the early 1990s, depicted in the figure as a crisis effect. This effect stems from the Swedish economic crisis during this period, when unemployment-related transfers were primarily responsible for sharply reduced ETRs, which in turn sharply increased the concentration of net tax liabilities, C_{Y-D}, from 57 to 90 percent, between 1990 and 1993. Over and above this crisis effect on the disproportionality of taxes and transfers,

[22] All computations of progressivity and related measures are made using the PROGRES module in STATA (Peichl and van Kerm, 2007).

however, both progressivity measures follow identical trends over the study period.

Lifetime tax progressivity is depicted as straight lines in Figure 3. The most immediate result yielded by 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 virtually every year of the analysis. A second result shown in Figure 3 is the low level of the lifetime progressivity. The redistributive effect is equivalent to a 10 percent reduction in the Gini coefficient. To put this number into perspective, note that this figure is greater than the nearly proportional 4–6 percent redistributive effect found for the US by Slemrod (1992) but half of the 20 percent redistributive effect that Björklund (1993) found for Sweden during the period 1978–1990. As we show in the final subsection of Section IV, the difference with Björklund (1993) likely reflects the effect of increasing the time window for measuring individual incomes.

IV. Why is Progressivity Lower over the Life Cycle?

In Section III, we showed that the annual tax progressivity in Sweden has been considerably higher than lifetime tax progressivity over the past four decades. In this section, we examine three possible channels that could account for this result: high taxes on transitory capital gains at the top of the income distribution, business cycle transitions in and out of employment, and transfers associated with specific periods in the lifetime.

The Role of Capital Income Taxation

Capital gains (i.e., income from value increases for housing or financial assets) are an unusual income source on tax returns: they do not appear when they accrue but when they are realized (i.e., when the asset is sold). For this reason, a large one-time capital gain could place lifetime middle-income earners at the very top of the annual income distribution. Previous research on Swedish income inequality has shown that capital income and capital gains are indeed particularly important for top-income earners in Sweden (Roine and Waldenström, 2008, 2012). Thus, we might have a situation in which a sort of transitory richness gives rise to a transitory progressivity that increases annual progressivity while leaving lifetime progressivity unchanged.

We examine this channel in two ways. First, Figure 4 depicts the discrepancy between annual and lifetime ETRs at the top (where capital incomes and capital gains are predominant), middle, and bottom of the income

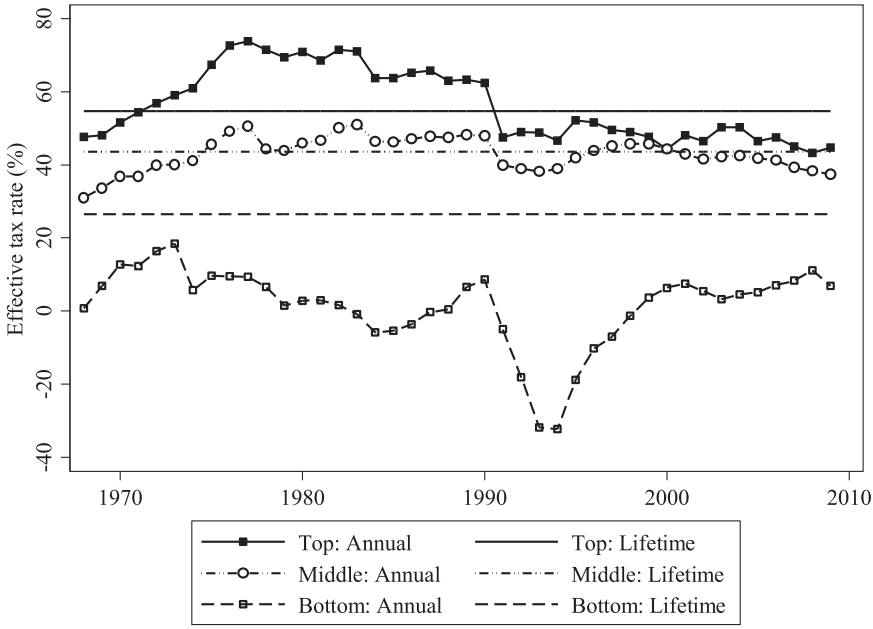

Fig. 4. Effective tax rates in top- and bottom-income quintiles: lifetime versus annual
Notes: Individuals are ranked as top- and bottom-income earners based on market income. Annual sample: age 20–64. Lifetime sample: aged 20–40 in 1968, then kept until 64. A 3 percent discount rate is used for the lifetime estimates.

distribution.[23] The results are clear: the lifetime tax burdens of top- and middle-income earners are approximately the same as their annual tax burdens, perhaps with exception of the late 1970s and 1980s when top tax rates were historically high. By contrast, low-income earners exhibit a large gap between lifetime and annual ETRs throughout the time period. This pattern suggests, if anything, that it is transitory poverty, arising from lifetime middle- or top-income earners having temporarily low incomes (e.g., while being students, sick, or unemployed), rather than transitory richness that drives the observed difference between lifetime and annual progressivity.

In a second check of the transitory capital income channel, we revisit our progressivity estimates by excluding all capital incomes and realized capital gains. As the results in Figure 5 show, omitting capital income (and capital income taxes after the 1991 reform) has a negligible impact on the main results. Using the Reynolds–Smolensky index of the redistributive effect, both annual and lifetime progressivity appear to increase slightly when excluding capital income, particularly in the latter period. This is

[23] The figure defines the top as all individuals in the top quintile, but the pattern is qualitatively similar if one were to define the top as all individuals in the top percentile.

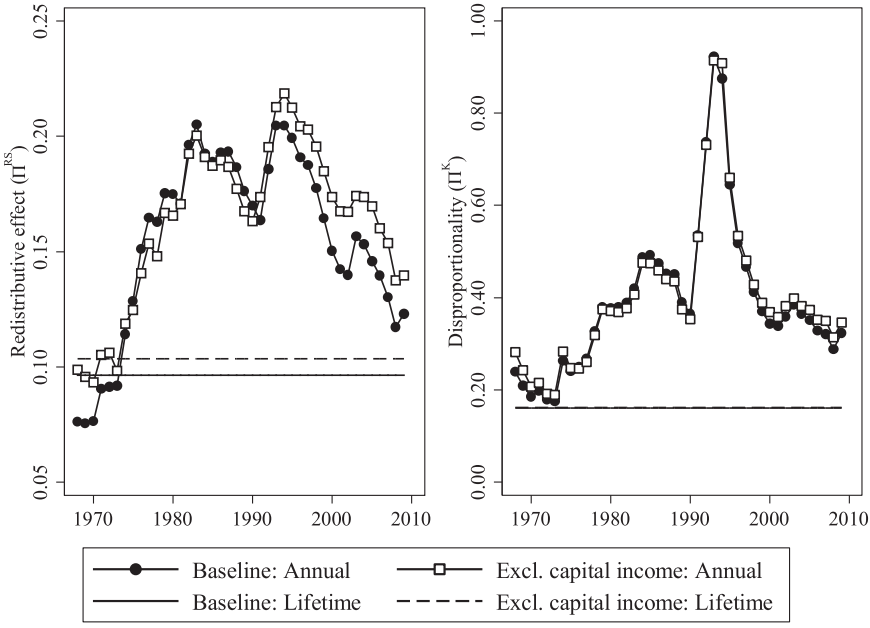

Fig. 5. Impact of excluding capital income (capital income gains, capital income, and income from owner-occupied housing) from our baseline income measures

consistent with the presumption that the lower tax on capital income since 1991 has made the tax-and-transfer system appear less progressive. The Kakwani index of departure from proportionality is virtually unaffected by excluding capital income from the analysis. In sum, the results shown in Figures 4 and 5 firmly reject the notion that lumpy one-time realizations of capital income gains are what is driving the difference between annual and lifetime tax progressivity in our data.

Can Business-Cycle Fluctuations Explain the Gap between Lifetime and Annual Progressivity?

Previous empirical analyses of life-cycle incomes and tax burdens study a handful up to a dozen or so years to capture lifetime outcomes. However, if such short time periods capture the essence of the gap between annual and lifetime progressivity, the gap might merely reflect the impact of business-cycle-related income and tax fluctuations across the income distribution rather than some other phenomenon related to differences in tax treatments or transfer patterns. To check the business cycle channel, Figure 6 depicts our baseline series of annual and lifetime progressivity contrasted with a set of smoothed series, computed as moving averages,

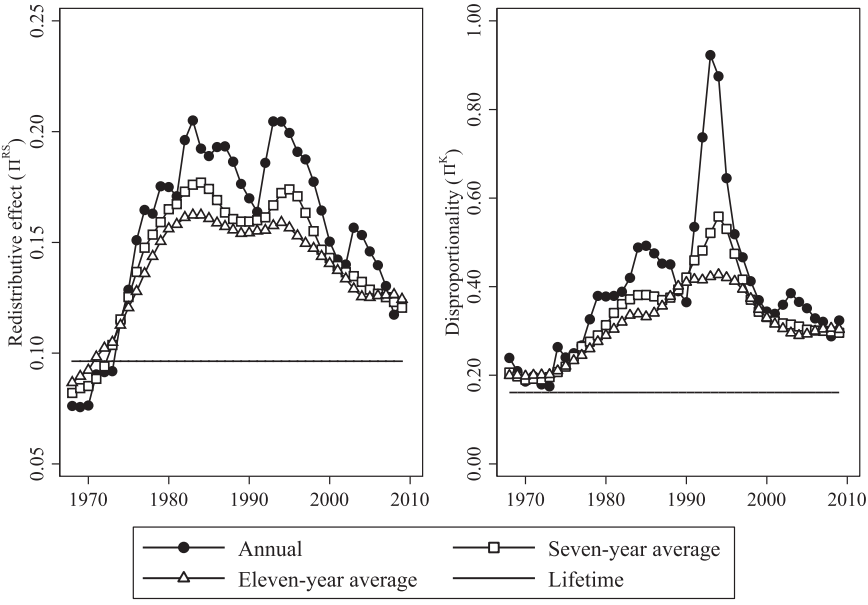

Fig. 6. Impact of using individual-specific moving averages instead of annual data
Notes: Seven- and eleven-year moving averages around the year (i.e., having three or five lags and leads).

over seven and eleven years. Notably, a seven-year moving average (three years of lags, three years of leads, and the current value) removes some of the cyclicality in redistribution measures and makes annual progressivity appear closer to lifetime progressivity. An eleven-year moving average (five lags, five leads, and the current value) reduces the impact of business-cycle busts even further. However, a marked difference between lifetime and annual progressivity persists, even when taking eleven-year individual moving averages.

Thus, short-run fluctuations in transfers targeted at the unemployed explain some, but not all, of the gap between annual and lifetime tax-and-transfer progressivity. The reason that social insurance is more sticky over the lifetime is because the time spent as an unemployed individual is associated with different phases in a lifetime. Social insurance benefits peak twice over the life cycle, with the first peak representing parental leave benefits and work-absence related to childcare, and the second peak representing retirement benefits and increases in sickness insurance payments. This implies that when taking social benefits into account, lifetime progressivity is overstated even when using ten-year individual averages. Thus, to capture lifetime progressivity without simulation, lifetime data appear necessary.

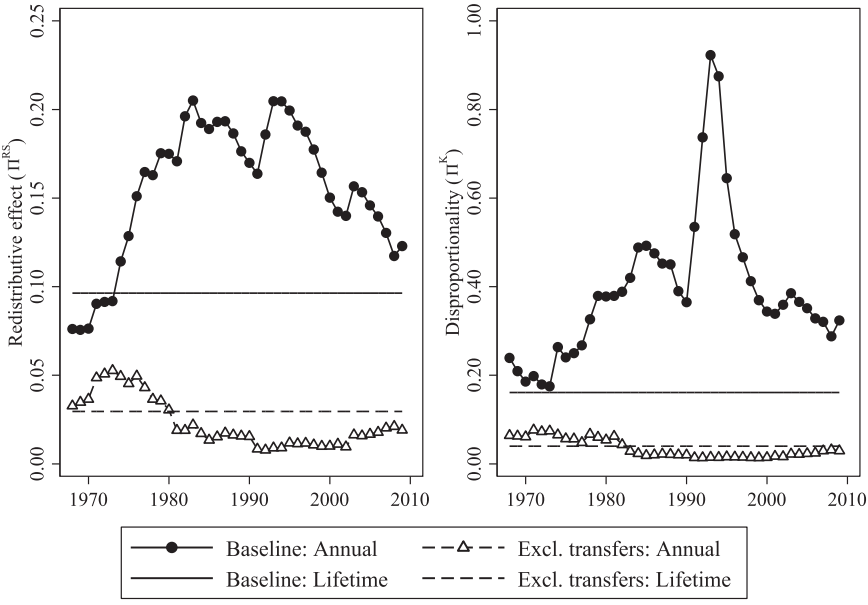

Fig. 7. Lifetime and annual tax progressivity with and without inclusion of social benefits

The Role of Earnings-Related Social Transfers

Having ruled out capital income taxation and taxes levied on the rich and business-cycle fluctuations as explanations for the large discrepancy between annual and lifetime progressivity, we now turn to the third proposed channel: transfers in the social security system associated with labor earnings. In Figure 7, we depict annual and lifetime tax-and-transfer progressivity when these social benefits have been removed entirely from the analysis (i.e., defining disposable income simply as market income minus taxes levied on market income).[24] The result is striking: social benefits appear to explain the entire difference between lifetime and annual progressivity, in terms of both the redistributive effect and departure from proportionality.

Why does the social insurance system have such a large impact on progressivity measures? One reason for the discrepancy between annual and lifetime measures of progressivity is related to the Nordic model of social insurance and its focus on individuals who are temporarily out of work. In Sweden, transitory declines in labor earnings – due to unemployment, parental leave, or sickness absence – are typically replaced by benefits

[24] Social benefits include sickness insurance, unemployment benefits, parental leave, disability grants, widow pensions, early retirement pensions, and a few other minor benefits.

that are linked to past (or sometimes future) earnings. Among low-wage income earners, the replacement ratio has occasionally been approximately 90 percent, which means that those temporarily out of work have similar disposable incomes as those who are working. However, beneficiaries of social insurance have (by definition) no market incomes in the short run, which places them at the bottom of the market income distribution when using annual data. As the denominator in our baseline ETR measure tends to zero, progressivity becomes infinitely negative at the bottom of the distribution.

Given the scope of the Swedish social insurance system, transfers have a remarkable effect on the measurement of tax progressivity. This is why the Kakwani index spikes in the early 1990s, when a large fraction of Swedish market incomes was replaced by social benefits. A secondary finding that follows from Figure 7 is that despite efforts to design the social insurance system in an actuarial way, there is still considerable lifetime redistribution in the system. Comparing the lifetime measure of progressivity in Figure 7, social benefits account for nearly two-thirds of the redistribution between individuals in Sweden.

V. Sensitivity Analysis

We have undertaken a series of additional sensitivity checks to test the robustness of the results from the main analysis. We have examined the result of including old-age pensioners, the consequences of gender-specific analyses, the impact of different discount rates, the imputation of consumption taxes, the effect of reranking on the progressivity measures, and the impact of computing cross-sectional progressivity measures using only the lifetime cohort population instead of the full population. These latter tests, available in the working paper version of the paper (Bengtsson *et al.*, 2012), indicate no important deviations from the main results.

Regarding the age restrictions, our baseline analysis includes people aged 20–64, and thus excludes most old-age pensioners. To determine whether this exclusion matters, we rerun the core analyses using a broader sample in which all individuals aged 20 and above are included. Figure 8 depicts the redistributive effect with and without retirees included in the population.[25] The main message is that our finding concerning the difference between annual and lifetime progressivity is reinforced. The annual redistributive

[25] We exclude the analysis of Kakwani's index of disproportionality because it breaks down (i.e., takes on two-digit levels although its theoretical range is $[-2, 1]$) when ETRs go to zero, which they do when a large share of the population (i.e., pensioners) has zero market income and high transfer income. This instability in both sign and level of the Kakwani measure as tax rates approach zero is a well-known problematic feature (see Lambert 2001, p. 235).

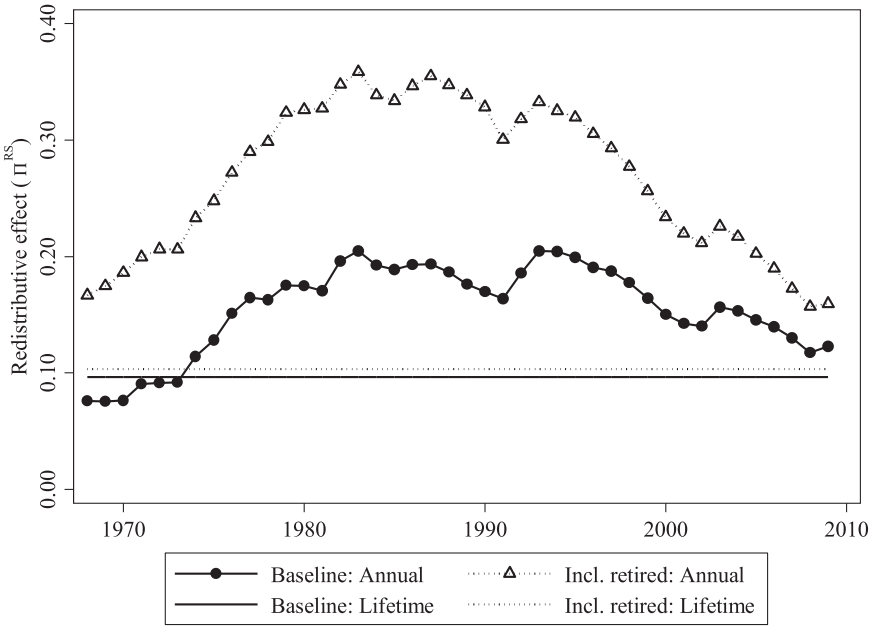

Fig. 8. Inclusion of the retired population when computing tax progressivity

Notes: The figure depicts lifetime and annual measures of effective tax progressivity based on the Reynolds–Smolensky index. The Incl. retired: Lifetime sample includes all individuals in the data aged 20 and above. The Baseline: Annual sample includes all individuals in the data aged 20–64 (the main sample). The Incl. retired: Lifetime sample is based on a cohort of individuals aged 20–40 in 1968. The Baseline: Lifetime data are based on individuals aged 20–40 in 1968 and retained until they are 64 years old.

effect nearly doubles in levels while maintaining its hump-shaped trend over the period under study. Moreover, lifetime progressivity increases only marginally, and the difference with the annual estimates is considerably larger than when only the working-age population is analyzed.

Labor force participation among Swedish women has increased substantially since the late 1960s. This development is likely driven in part by the introduction of individual taxation in 1971 and by family policies that have facilitated market work (e.g., childcare subsidies). How would our progressivity measures be affected if we controlled for changes in labor force composition by focusing only on males? Figure 9 depicts annual and lifetime progressivity when using the male and the full populations. It is clear that progressivity is lower at both the annual and lifetime levels when we only consider the male population. This implies a significant redistribution across but possibly also within sexes, with women being the net beneficiaries from the Swedish tax-and-transfer system over this time period. This result is also what we would expect given the gender income gaps that we have in society. Moreover, our main result from the lifetime

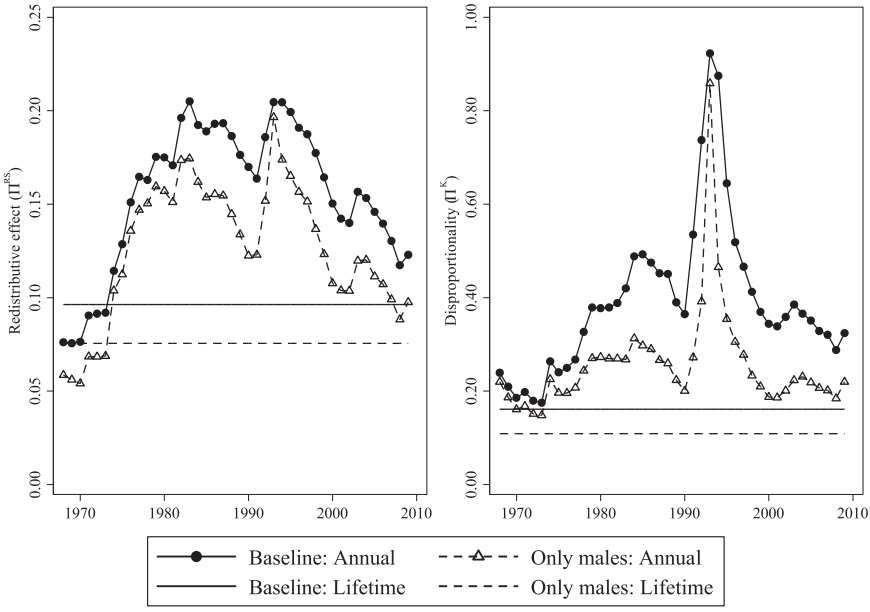

Fig. 9. Impact of gender on tax progressivity (ETR), 1968–2009

analysis, that lifetime progressivity is markedly lower than progressivity in any single year, holds when controlling for secular changes in labor supply. This is not to say that labor supply has no impact on measured progressivity across different time horizons, but we can at least conclude that the dramatic shifts observed in female labor supply over the 1970s and 1980s have little bearing on our findings.

As a final sensitivity check, we consider a measure of tax rates equal to the ratio of total tax payments to the legal tax base. Compared to the ETR, the Swedish tax base includes market income and some taxable transfers, such as unemployment benefits and sickness benefits, when presenting tax rates. The legal average tax rate paid by individual i is defined as $t_i^{\text{legal}} = T_i/(Y_i + B_i)$.

Table 1 presents the legal average tax rates across classes of taxable income $(Y + B)$ and different tax bases for the whole population aged 20–64 in 2009 and the lifetime for the cohort used earlier. The municipal income tax and the payroll tax produce an inverse U-shaped pattern of tax rates over the income distribution, with the highest rates as a share of taxable income to be found among the middle-income earners. The property taxes are very low and basically flat. By contrast, the state taxes on earned and capital income are both clearly progressive, both increasing in the level of income. Table 2 shows the final ETR and its components

Table 1. *Average tax rates (legal tax base) in Sweden in 2009 (in percent)*

	Municipal income tax	State earned income tax	State capital income tax	Property taxes	Payroll tax	Final average tax rate
0–40	19.74	0.00	0.44	0.48	14.83	32.31
40–60	21.47	0.00	0.23	0.37	21.57	39.24
60–80	21.91	0.01	0.29	0.42	22.37	40.56
80–90	21.85	0.82	0.60	0.44	22.23	42.15
90–95	21.43	3.25	1.21	0.41	21.86	45.03
95–99	20.68	6.46	2.39	0.36	21.00	48.58
99–99.9	18.10	9.40	6.00	0.30	17.91	50.38
99.9–100	10.83	7.62	12.99	0.15	9.84	41.14
All	19.50	3.44	3.02	0.37	18.95	42.42

Notes: Figures from 2009. Ranking based on taxable income. Sample: all individuals aged 20–64.

Table 2. *Effective tax rates in Sweden in 2009 (in percent)*

	Effective tax rate: annual	Effective tax rate: lifetime
0–40	−51.43	14.75
40–60	33.50	36.85
60–80	37.43	43.56
80–90	38.98	47.54
90–95	41.93	50.48
95–99	45.55	53.74
99–99.9	47.85	56.30
99.9–100	38.32	49.23
All	29.02	44.06

Notes: ETR defined as in equation (1). Figures from 2009. Ranking based on market income. Sample: all individuals aged 20–64 for annual estimates.

across classes of market income and for different components in 2009 and over the lifetime.

Overall, the main picture is quite similar to what we found in the previous analysis of tax-transfer progressivity. However, there are also some notable differences. In terms of levels, ATR progressivity is markedly lower than ETR progressivity, again reflecting the progressive nature of transfers.

VI. Concluding Remarks

All tax systems must 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 essentially progressive tax systems, but the exact structure and composition of tax bases differ across countries and over time. If one wishes to comprehend the extent to which a certain tax structure is equitable and efficient, and whether this was sensibly designed by policymakers or the result of

historical accident, a closer examination of the long-run evolution of taxes and their progressivity is required.

In this paper, we have presented evidence on tax progressivity in Sweden, its evolution since the 1960s, and, most important, novel estimates of tax progressivity over the entire working life cycle. This is a highly significant period, both politically and economically, beginning just before the large tax hikes of the 1970s, continuing over the comprehensive tax reform of the 1990s, and ending after the recent years' cuts in both labor and capital taxation. Our series portray an inverted U-shape of progressivity over this period, which fits with past fiscal policy events. The analysis also decomposes the determinants of progressivity across tax bases, especially capital income and social transfers, and with respect to changes in the underlying distribution of market income.

Our main contribution concerns the estimation of life-cycle progressivity. Whereas 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 to their exit at age 60–70. The estimations show that lifetime taxes are substantially less progressive than taxes in any single year or shorter episode. This finding confirms many of the theoretical predictions concerning life-cycle taxation but remains noteworthy because of the remarkably low level of the redistributive effect and disproportionality of Swedish lifetime taxes.

We also examine the mechanisms underlying the finding that there is less lifetime progressivity than annual progressivity. Two proposed channels, transitory capital income among top earners and business-cycle fluctuations, do not appear to be important drivers of the observed patterns. By contrast, the higher income volatility and volatility of tax burdens among low-income earners appears to be central. In particular, a large share of the annual low-income earners are not low-income earners over their entire lifetime, 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 onward, are central to understanding this result. Future research focusing more explicitly on the insurance versus redistributive functions of the social security system would therefore be valuable.

References

Atkinson, A. B. (1980), Horizontal Equity and the Distribution of the Tax Burden, in H. Aaron and M. Boskin (eds.), *The Economics of Taxation*, Brookings Institution, Washington DC.

Bengtsson, N., Holmlund, B., and Waldenström, D. (2012), Lifetime versus Annual Tax Progressivity: Sweden 1968–2009, UCLS Working Paper 2012:13, Uppsala University.
Björklund, A. (1993), A Comparison between Actual Distributions of Annual and Lifetime Income: Sweden 1951–89, *Review of Income and Wealth 39*, 377–386.
Björklund, A. and Palme, M. (2002), Income Redistribution within the Life Cycle versus between Individuals: Empirical Evidence Using Swedish Panel Data, in D. Cohen, T. Piketty, and G. Saint-Paul (eds.), *The Economics of Rising Inequality*, Oxford University Press, Oxford.
Björklund, A., Palme, M., and Svensson, I. (1995), Tax Reforms and Income Distribution: An Assessment Using Different Income Concepts, *Swedish Economic Policy Review 2*, 229–266.
Blomquist, S. (1981), A Comparison of Distributions of Annual and Lifetime Income: Sweden around 1970, *Review of Income and Wealth 27*, 243–264.
Cameron, L. and Creedy, J. (1994), Taxation and the distribution of lifetime income", in J. Creedy (ed.), *Taxation, Poverty and Income Distribution*, Edward Elgar, Aldershot, 140–162.
Creedy, J. (1999), Lifetime versus Annual Income Distribution, in J. Silber (ed.), *Handbook on Income Inequality Measurement*, Kluwer, Dordrecht.
Creedy, J. and van de Ven, J. (2001), Decomposing Redistributive Effects of Taxes and Transfers in Australia: Annual and Lifetime Measures, *Australian Economic Papers 40*, 185–198.
Davies, J. B., St-Hilaire, F., and Whalley, J. (1984), Some Calculations of Lifetime Tax Incidence, *American Economic Review 74*(4), 633–649.
Edin, P.-A. and Fredriksson, P. (2000), LINDA – Longitudinal INdividual DAta for Sweden, Working Paper 2000:19, Uppsala University.
Esping-Andersen, G. (1990), *The Three Worlds of Welfare Capitalism*, Princeton University Press, Princeton NJ.
Fullerton, D. and Lim Rogers, D. (1993). *Who Bears the Lifetime Tax Burden?*, Brookings Institution, Washington DC.
Hoynes, H. W. and Luttmer, E. F. P. (2011), The Insurance Value of Tax-and-Transfer Programs, *Journal of Public Economics 95*, 1466–1484.
Hussenius, J. and Selén, J. (1994), *Skatter och socialförsäkringar over livscykeln - En simuleringsmodell*, ESO rapport, Ds 1994:135, Finansdepartementet, Stockholm.
Jäntti, M. and Jenkins, S. P. (2013), Income Mobility, IZA Working Paper 7730.
Jenkins, S. P. (1988), Reranking and the Analysis of Income Redistribution, *Scottish Journal of Political Economy 35*, 65–76.
Kakwani, N. C. (1977), Measurement of Tax Progressivity: An International Comparison, *Economic Journal 87*, 71–80.
Kakwani, N. C. (1984), On the Measurement of Tax Progressivity and Redistributive Effect of Taxes with Applications to Horizontal and Vertical Equity, *Advances in Econometrics 3*, 149–168.
Lambert, P. J. (2001), *The Distribution and Redistribution of Income*, Manchester University Press, Manchester.
Lindbeck, A. (1983), Interpreting Income Distributions in a Welfare State: The Case of Sweden, *European Economic Review 21*, 227–256.
Lindert, P. (2004), *Growing Public: Social Spending and Economic Growth since the 18th Century*, Cambridge University Press, Cambridge.
Musgrave, R. A. and Thin, T. (1948), Income Tax Progression 1929–48, *Journal of Political Economy 56*, 498–514.
Pechman, J. and Okner, B. (1974), *Who Bears the Tax Burden?*, Brookings Institution, Washington DC.

Peichl, A. and van Kerm, P. (2007), PROGRES: STATA Module to Measure Distributive Effects of an Income Tax, Statistical Software Components S456867, Boston College Department of Economics.

Pettersson, T. and Pettersson, T. (2003), *Fördelning ur ett livscykelperspektiv,* SOU 2003:110, Allmänna Förlaget, Stockholm.

Piketty, T. and Saez, E. (2007), How Progressive is the U.S. Federal Tax System? A Historical and International Perspective, *Journal of Economic Perspectives 21*, 3–24.

Plotnick, R. (1981), A Measure of Horizontal Inequity, *Review of Economics and Statistics 63*, 283–288.

Reynolds, M. and Smolensky, E. (1977), *Public Expenditures, Taxes, and the Distribution of Income: The United States, 1951, 1960, 1970*, Academic Press, New York.

Roine, J. and Waldenström, D. (2008), The Evolution of Top Incomes in an Egalitarian Society: Sweden, 1903–2004, *Journal of Public Economics 92*, 366–387.

Roine, J. and Waldenström, D. (2012), On the Role of Capital Income Gains in Swedish Income Inequality, *Review of Income and Wealth 58*, 569–587.

Slemrod, J. (1992), Taxation and Inequality: A Time-Exposure Perspective, in J. Poterba (ed.), *Tax Policy and the Economy 6*, MIT Press, Cambridge, MA.

Söderberg, H. (1996), *Inkomstskattens utveckling under 1900-talet: en vägvisare för skatteberäkningar aren 1921–1996*, Skattebetalarna, Stockholm.

Sørensen, P. B. (2010), *Swedish Tax Policy: Recent Trends and Future Challenges*, Report to the Expert Group on Public Economics 2010:4, Fritzes, Stockholm.

Suits, D. (1977), Measurement of Tax Progressivity, *American Economic Review 67*(4), 747–752.

Verbist, G. and Matsaganis, M. (2014), The Redistributive Capacity of Services in the EU, in B. Cantillon and F. Vandenbroucke (eds.), *Reconciling Work and Poverty Reduction: How Successful Are European Welfare States?*, Oxford University Press, Oxford.

First version submitted May 2013;
final version received June 2015.