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Micro and macro evidence of the relationship between income mobility and taxation

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Published: January 2024

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ISSN 1892-753X (electronic)

Abstract

How taxation influences income mobility is largely a neglected topic. In this study we discuss the relationship between taxation and income mobility by analyzing both macro and micro data. Administrative register data based on income tax returns are used to produce individual and aggregate measures of income mobility from 1994 to 2021. Income mobility is explained in terms of marginal tax rates on both wage income and capital income. Estimation results are obtained from an autoregressive distributed lag model and a fixed effects linear probability model for the macro and micro data approaches, respectively. The macro and micro evidence point in the same direction – we find that income mobility is negatively influenced by higher marginal tax rates on both earnings and capital income, with the largest effect found for tax on capital income.

Keywords: Income mobility; tax effects; administrative register data

JEL classification: D31; H24; H30

Acknowledgements: We thank Terje Skjerpen and Elina Tuominen for comments to earlier versions of the paper.

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Sammendrag

Sammenhengen mellom inntektsmobilitet og beskatning er lite diskutert i litteraturen om effekter av inntektsskatt. I dette arbeidet diskuterer vi hvordan endringer i det norske skattesystemet i perioden fra 1994 til 2021 påvirker inntektsmobiliteten. I denne sammenheng refererer inntektsmobilitet til individers bevegelser i inntektsfordelingen fra et år til et annet.

Det er vanlig å betrakte inntektsmobilitet som fordelaktig fordi det reduserer inntektsulikhet i et langsiktig perspektiv. Fra et teoretisk ståsted er det ikke klart hvordan inntektsmobiliteten påvirkes av endringer i beskatning av inntekt, men det kan argumenteres for at høye marginalskatter reduserer skattyterens villighet til å dra fordel av økonomiske muligheter og at en derfor vil finne at økte marginalskatter reduserer inntektsmobiliteten.

Analysen tar utgangspunkt i serier av årlige mål på inntektsmobilitet for perioden 1994–2021, beregnet ved en hel rekke mobilitetsindekser. Selv om det er variasjon, viser de fleste indeksene en liten nedgang i inntektsmobiliteten over tidsperioden.

Disse mobilitetsindeksene anvendes som avhengige variabler i regresjoner der inntektsmobiliteten forklares ved endringer i marginalskattene på lønnsinntekt og kapitalinntekt. Vi estimerer effektene både ved hjelp av makrodata-regresjoner og regresjoner på individnivå (paneldata). Resultatene av begge de to økonometriske tilnærmingene gir støtte til at økte marginalskatter reduserer inntektsmobiliteten og at effekten er størst for marginalskatten på kapitalinntekt. Men effektene må karakteriseres som relativt moderate. Dersom beslutningstakerne legger vekt på hensynet til inntektsmobilitet ved fastsettelse av skattesatser, gir disse resultatene støtte til reduserte marginale skattesatser.

1 Introduction

In addition to the conventional focus on economic efficiency and income inequality effects, policy-makers should give weight to income mobility when they construct the optimal tax system. One reason is that higher income mobility reduces long-term inequality. It is therefore a major problem that we do not really know how taxation affects intragenerational income mobility: does income mobility increase or decrease when the marginal tax rate is increased? The present study responds to the shortage of information on this relationship by providing estimates based on both macro and micro data regressions. We benefit from having access to administrative register data, derived from income tax returns for the whole population of Norway, for almost three decades. These data are used to produce estimates of the development of annual income mobility from 1994 to 2021.[1]

Two key points of our empirical approach are worth highlighting. First, the relationship between income mobility and taxation is discussed by considering the effects of marginal tax rates on both capital and labor income, and second, estimates are obtained by both macroeconometric regressions and fixed effects panel data regressions.

Theoretically, taxation may influence intragenerational income mobility through a number of channels. An empirical challenge is that income mobility is a multifaceted concept, associated with several factors, such as income growth, directional or non-directional income movements, long term income inequality and income risk (Fields, 2008; Jäntti and Jenkins, 2015). From a tax perspective, individual incomes are influenced directly and indirectly through behavior. The direct effect follows from a progressive tax scheme that compresses income distribution through the transformation from pre-tax to post-tax income distributions,[2] but may also cause reranking of taxpayers in the process. Reranking could result from tax schemes involving differentiation of taxation according to income source, which, as we will return to, is implied by the dual income tax scheme of Norway. It could also result from other tax-treatment concessions in the Norwegian tax law.[3] As highlighted by the labor supply literature (Blundell and MaCurdy, 1999; Keane, 2011), including the literature on the elasticity of taxable income (Feldstein, 1995; Saez, Slemrod, and Giertz, 2012), taxation of income is also influenced by increased labor efforts to reduce rates. This means that tax changes have both direct effects and behavioral effects that may influence income compression and the reshuffling of individuals. Notably, income mobility in the present study is measured by positional change – we employ measures of income mobility that focus on the ranking order of individuals (Bartholomew, 1973; King, 1983).

The tax system features considered here are mainly limited to marginal tax rates (on labor income and capital income). This is clearly seen in the macroeconometric approach, but also follows from the analysis of the panel data. It may be argued that as a general rule individuals are more mobile at lower marginal tax rates, as high marginal tax rates may discourage agents from taking advantage of economic opportunities. The detrimental effects of high taxes on labor supply may serve to illustrate this. Consistent with this view, Alloza (2021), which is one of few previous studies discussing the effect of taxation on income mobility, finds that higher marginal tax rates reduce income mobility.

In our empirical investigation we employ estimates of income mobility that reflect positional changes from one year to the next as the dependent variable, when positions are determined by

[1] Auten and Gee (2009), DeBacker, Heim, Panousi, Ramnath, and Vidangos (2013) and Splinter (2022) are other studies that discuss income mobility by means of panel data based on information from income tax returns.

[2] Benabou and Ok (2001) discuss income mobility as another form of progressivity, but with a focus on equality of opportunity. More generally, it is worth noting that equality of opportunity is often associated with mobility (Roemer and Trannoy, 2016; Trautmann, 2022). Moreover, in the equality of opportunity literature, the distinction between efforts and circumstances could be essential for tax policy implications, as for example argued by Fleurbaey and Maniquet (2011).

[3] Which may result in horizontal inequity effects (Bø, Lambert, and Thoresen, 2012).

disposable income. In the macro regressions we use annual measures of positional movements as described by the King index (King, 1983) and the Average Rank Jump measure (Bartholomew, 1973). In the micro data estimations we employ decile rank change as the dependent variable, which means that each individual's change in decile position (1 to 10) for each pair of years is measured and employed.

We argue that letting the tax system be represented by rates on both wage income and capital income is essential for understanding Norwegian mobility patterns, as the personal income tax scheme is a dual income tax system. This means that Norwegian taxpayers face separate rate schemes for labor and capital income.[4] In the macro-data regressions we employ different specifications of the autoregressive distributed lag model, in which top statutory marginal tax rates on labor income and capital income and the (calculated) average tax rate explain mobility. The marginal tax rate on capital income is represented by the statutory tax on capital gains and dividends, while micro data are used to calculate the average tax rate. We allow for the tax variables having lagged effects too, which implies that we also estimate specifications with one-year and two-year lags for the tax variables.

Micro data estimates are obtained from fixed effects regressions on panel data. The tax variables are obtained from calculations at the individual level, using income data and the tax function. As with the macro regressions, the tax on dividends is used to operationalize the tax on capital income. We also estimate specifications with one- and two-year lags.

It follows that an important part of our empirical strategy is to explore the relationship between income mobility and taxes, using two separate identification methods. Although results vary depending on whether the micro data or aggregate data are used, we obtain results that point in the same direction: increased marginal tax on both wage income and capital is associated with a reduction in income mobility. Thus, our results support the findings of Alloza (2021). Moreover, we find that negative effects are more pronounced for the tax on capital income. By way of example, in one of our micro specifications we obtain an estimate of 0.005 for the effect of tax on capital income, which means that a 1 percentage point increase in the marginal tax on capital income decreases mobility by 0.5 percentage point when mobility is measured as a change of income decile from one year to the next.

The rest of the paper is organized as follows. In Section 2 we discuss how taxation may influence income mobility. Section 3 describes the administrative register data that we have used in the present study. We use the data to describe developments in income mobility in recent decades, together with descriptions of the main tax variables in the same period. Section 4 presents the specification of the macro regression model and estimation results, while Section 5 discusses specifications and results for the micro panel data approach. Section 6 concludes the paper.

2 Income mobility, tax and welfare

The welfare implications of the effects of income tax on income mobility are hard to discern for several reasons. First, whether income mobility is desirable or not is open to question, and second, it is difficult, at least theoretically, to obtain a clear understanding of how taxation may influence income mobility. This latter is the reason why we argue that there is a need for more empirical evidence, such as that provided by the present study.

With regard to whether income mobility increases social welfare or not, we adopt the convention of considering income mobility to be positively valued. But it should be noted that intragenerational income mobility is a multifaceted concept, and it is not always given that higher income mobility is associated with welfare gains. The reason why we regard income mobility as socially

[4]The dual income tax system was introduced throughout the Nordic countries in the early 1990s – the Norwegian version was in place from 1992.

desirable is its contribution to equal opportunities and reduced income inequality in the long-run (Atkinson, Bourguignon, and Morrisson, 1992; Maasoumi, 1998; Fields and Ok, 1999a; Fields, 2008; Jenkins and Van Kerm, 2009; Kopczuk, Saez, and Song, 2010; Jäntti and Jenkins, 2015). For example, if higher annual income inequality is associated with increased relative income mobility, it is likely that income inequality measured over several years is lower. Hence, longer-term inequality might fall (Jenkins and Van Kerm, 2006; Bonhomme and Robin, 2009; DeBacker et al., 2013; Splinter, 2022), and welfare might increase, even though annual income inequality may rise. This is referred to as the "mobility offsetting" argument. In this perspective, increased income mobility due to a tax change is valued positively. On the other hand, income mobility is also associated with aversion to income fluctuations and to future risk, as emphasized by Gottschalk and Spolaore (2002). Moreover, when one applies an ex-ante perspective to income mobility and allows the agents to be forward-looking, income mobility can be seen as a sign of general income uncertainty, which is also considered to have a negative effect on welfare (Creedy, Halvorsen, and Thoresen, 2013).

Although the relationship between taxes and income mobility does not capture a dominant position in the tax literature, income mobility is an intrinsic part of several key reasonings. The literature on horizontal equity (or inequity), which we will return to soon, reminds us that taxes may treat individuals inequitably. Thus, a starting point could be that taxation generates mobility as a result of taxes affecting agents differently. Mobility might also result from taxpayers responding heterogeneously to the same tax. Given that the present study discusses the effects of taxes on both capital and labor income, there are several sources of tax treatment heterogeneity and heterogeneous responses. As a result, there is substantial uncertainty as to how taxes affect income mobility.

According to the conventional view of optimal taxation, higher taxes reduce labor supply and income (Blundell and MaCurdy, 1999; Feldstein, 1995; Keane, 2011; Saez et al., 2012). Although the labor supply literature does not measure outcomes in terms of income mobility, such labor supply behavioral effects may cause mobility effects too, for example because of response heterogeneity. However, in order to distinguish income mobility from labor supply-induced income concentration or income spread, we focus on income mobility expressed as positional change. Other mobility measures, such as income mobility expressed as reduced long-term inequality, are likely to be more exposed to such effects.[5]

Income mobility is also one of the mechanisms behind tax redistributional effects. Given that both vertical and horizontal effects can be distinguished when redistribution is measured, taxes both compress income distribution and rerank individuals (Atkinson, 1980; Plotnick, 1981) in the conversion from the pre-tax to the post-tax income distribution. Thus, mobility can be treated as a byproduct of the direct effects of taxation. It follows that from this perspective income mobility can be seen as an indicator of horizontal inequity. The close relationship between income mobility and horizontal equity is apparent in, for example, King (1983).

In a discussion of income mobility and the contribution of taxes, a perspective where taxes play a role in stabilizing income also emerges (Kniesner and Ziliak, 2002; Dolls, Fuest, and Peichl, 2012; DeBacker et al., 2013; Bibi, Duclos, and Araar, 2014; Larrimore, Mortenson, and Splinter, 2016; Garcia-Medina and Wen, 2018). Then the tax system is seen as providing implicit insurance by dampening the variability of disposable income and consumption. It thereby acts as an economic stabilizer, contributing to equalizing permanent income. There is also a related literature that discusses income dynamics and the tax system as an insurance device (Wen and Gordon, 2014; Blundell, Graber, and Mogstad, 2015; Arulampalam and Papini, 2023).

[5] See Section 3.2 for details on various mobility measures.

3 Key variables of the empirical approach

3.1 Administrative register data used

The primary data source of the present analysis is Income and wealth statistics for households (Statistics Norway, 2021) for 29 years (1993–2021), which can be turned into a panel data set. Recall that these data are used to produce estimates of developments in annual income mobility from 1994 to 2021, which are used in the macro data regressions, and in particular, to obtain estimates of the relationship between income mobility and tax using a micro panel data approach.

Data are compiled from various administrative and statistical registers and then linked to all household members by means of a personal identification number. The main data providers are the Tax Administration and the Labour and Welfare Administration (NAV). The single most important source is the income tax return register. This register provides detailed information on all kinds of taxable income and wealth, e.g., wages and salaries, self-employment income, income from property and taxable pensions, non-financial and financial assets as well as liabilities. Another important source is the tax register, which contains information on personal income and wealth taxes and social security contributions. NAV is the source of all types of tax-free transfers (e.g., family allowance, support to single parents etc.) as well as different types of pension income (e.g., old age and disability pensions). In addition to tax registers and social security registers, some other income and wealth data, for example data on scholarships and student debt, come from other administrative registers (the State Educational Loan Fund).

Our data series starts in 1993, which was the first year in which personal income tax data were available in electronic form for the whole Norwegian population. We have applied sample selection rules. First, individuals under the age of 26 and above the age of 62 are excluded. The age restriction is imposed on each individual annual data set before combining them into a panel data set. Second, students who receive a loan from the State Educational Loan Fund and show no signs of being active in the labor market are excluded. Finally, persons who receive disability benefits or pensions are not included in the data set.

Income mobility is measured in terms of individual disposable income, which is the sum of all income components (wage income, self-employment income, capital income and government transfers) minus taxes. Interest rate expenses are not deducted.[6] Given our focus on the influence of tax rates on income mobility, we address individual mobility; however, acknowledging that income mobility is often measured at the household level.

3.2 Developments in income mobility and taxes

3.2.1 Income mobility 1993–2021

In the following we present the main variables of our empirical investigations. First, we describe income mobility over the period for which we have data, 1993–2021, corresponding to the dependent variable of the macro and micro data regressions. Next, in Section 3.2.2, we present the tax variables used in the regressions.

In the macro data regressions, we show the results for two choices of mobility index. Given that we focus on mobility change in the ranking order of individuals, we employ two indices for positional movements, the King index (King, 1983) and the Average Rank Jump measure (Bartholomew, 1973).[7]

If we define income mobility as the transformation $x \rightarrow y$, from one year to the next, the King

[6] Mainly because there are no returns on housing on the income side.

[7] See Fields (2008) and Jäntti and Jenkins (2015) for further details about mobility indices.

index, M_K, is expressed as

$$M_K = 1 - \exp\left[-\frac{\gamma}{N}\sum_{i=1}^{N}\frac{|z_i - y_i|}{\mu(y)}\right], \tag{1}$$

where γ is the observer's degree of immobility aversion, z_i is the income level agent i would have obtained if his or her ranking order had not changed during the process $x \to y$, and $\mu(y)$ is the mean income of distribution y.

The Average Rank Jump measure, M_{ARJ}, is the other positional mobility measure used, defined as

$$M_{ARJ} = \sum_i |\text{rank}(y_i) - \text{rank}(x_i)|, \tag{2}$$

where subscript i refers to the individual. It follows that M_{ARJ} measures the number of income class boundaries crossed by an individual (upward or downward), averaged over all individuals(Jäntti and Jenkins, 2015).

In Figure 1 we describe developments in income mobility over the period 1994–2021. We also derive descriptions based on a selection of other measures of mobility in the income mobility literature – the Hart measure (Hart, 1976), the income flux measure of Fields and Ok (1999b), and Shorrocks' index of income mobility as a reduction in the inequality of longer-term income (Shorrocks, 1978). The Hart index and the Fields and Ok index of income flux can be expressed as

$$M_H = 1 - \text{corr}(\log(x_i), \log(y_i)) \tag{3}$$

and

$$M_{FO} = \frac{1}{N}\sum_{i=1}^{N}|\log(y_i) - \log(x_i)|. \tag{4}$$

The Shorrocks index of mobility as a longer-term income inequality equalizer is equal to the ratio of inequality in average income over a number of years (T) to the weighted average of single-year inequality values, expressed as

$$M_S = \frac{I[Y(T)]}{\sum_{k=1}^{k=T} w_k I(Y^k)}, \tag{5}$$

where I symbolizes an inequality index, $I(Y^k)$ is inequality in period-k incomes, and w_k are weights reflecting the proportion of aggregate T-averaged income received in period k ($w_k = \mu_k/\mu$). The inequality index used here is the generalized entropy index for a high degree of inequality aversion, GE(0).[8]

Finally, in the bottom graph in Figure 1 we also show developments in average "decile change". This is the dependent variable in the micro data analysis, based on panel data fixed effects regressions, which we will return to in Section 5. The metric is a dummy variable, defined by the difference in decile rank (1 to 10) from x to y, taking the value 1 if there is a change in decile rank, 0 if not. Figure 1 shows that between 40 and 50 percent of individuals change decile from one year to the next over the period.

Although graph of the different mobility indices for the period 1994–2021[9] are not identical, there are some common characteristics. For example, all measures except the King index show lower mobility in 2021 than in 1993. The three indices we use in our empirical analyses, the King index, the Average Rank Jump and the Decile Change, all show that income mobility decreases somewhat after 2005 before increasing again towards the end of the period. However, the period leading up to 2005 is shown differently by the three indices: increase over time (King index), decrease (Average Rank Jump) and inverse U-shape (Decile Change).

[8] GE(0) corresponds to the mean log deviation.

[9] Note that as 1993 is the first year of our data series, we cannot calculate indices for that year.

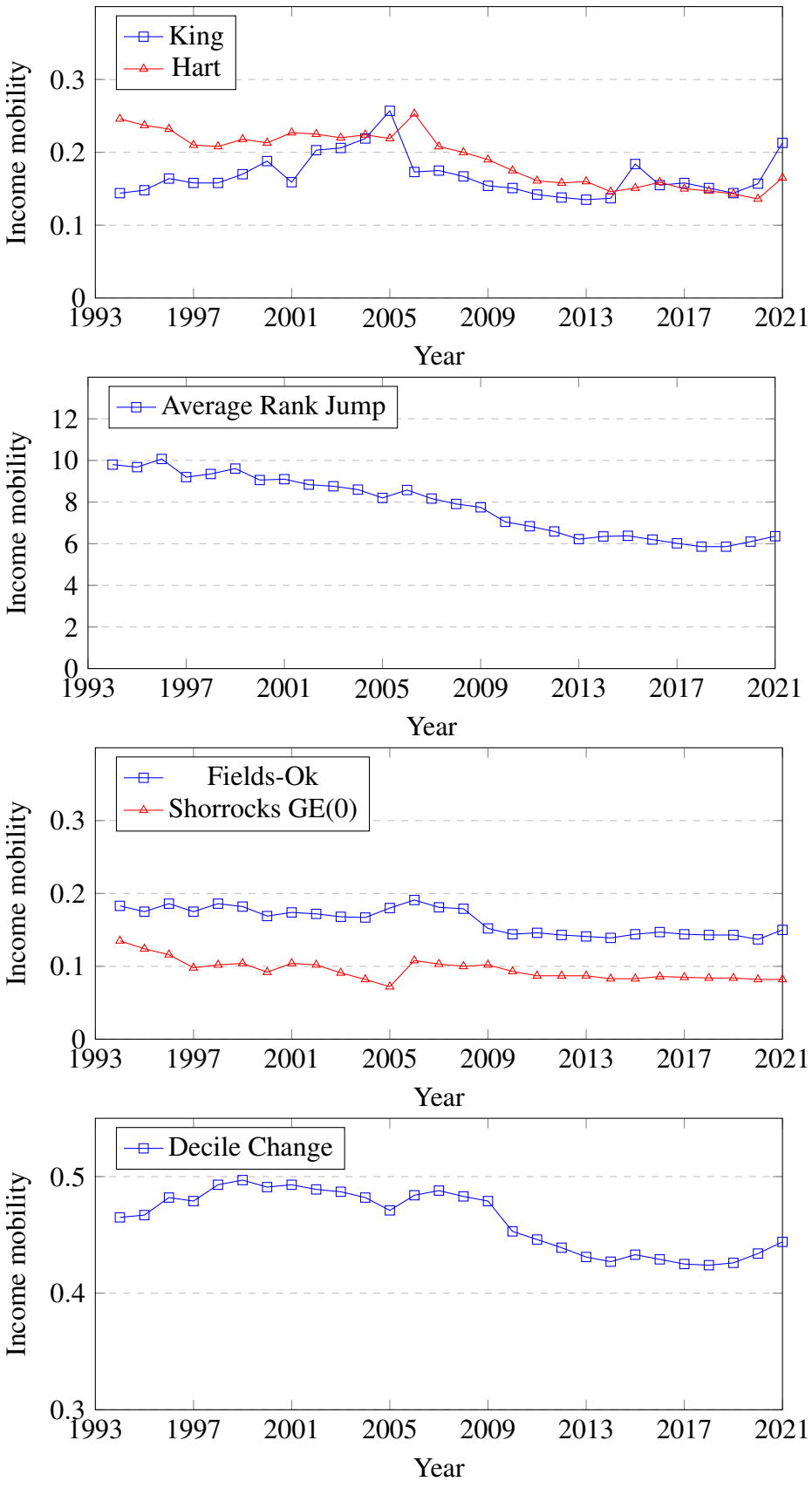

Figure 1: Estimates of income mobility 1994–2021

3.2.2 Taxation of earnings and capital income, 1993–2021

The personal income tax system in Norway is classified as a dual income tax system (Sørensen, 2005). This system combines a low proportional tax rate on capital income and progressive tax rates on labor income. The Nordic countries implemented dual income tax systems in the 1990s, in the case of Norway through the 1992 tax reform. The Norwegian version had a flat 28 percent tax rate levied on corporate income, capital and labor income coupled with a progressive surtax applicable to labor income. Double taxation of dividends and capital gains was abolished, as taxpayers receiving dividends were given full credit for taxes paid at corporate level, and the capital gains tax system exempted gains attributable to retained earnings taxed at corporate level.

Notably, the post-1992 tax system adhered to the principle that the tax rate on personal capital income should equal the corporate tax rate. Labor earnings were taxed at the same basic rate as capital income, but supplemented by a surtax schedule with a number of brackets and a 7.8 percent national insurance contribution. The top marginal tax rates for wage earners and owners of small businesses (the self-employed and owners of closely held firms) were 48.8 percent and 51.7 percent, respectively, in 1992.

The 1990s saw increasing pressure on the dual income tax system, resulting in numerous "patches." As these were not entirely successful, the reform of 2006 was an attempt to create a system that would prevent taxpayers from transforming labor income into capital income in order to benefit from the lower flat rate applied to the latter. In particular, the tax design of 1992 proved vulnerable to tax-motivated organizational restructuring (Thoresen and Alstadsæter, 2010). As the wedge between the top marginal tax rate on labor income and the tax on capital income increased over time, taxpayers faced increasing incentives to transform labor income into capital income for tax purposes, and it became necessary to reform the system. The main innovation of the reform was to introduce a surtax on capital income from businesses, including dividends and capital gains, in excess of a risk-free rate of return perceived as the normal rate of return.[10] This move brought the effective marginal tax rate on above-normal returns up to 48.2 percent. In parallel, the top marginal tax rate on wage income was cut from 55.3 to 47.8 percent. Narrowing the gap between these tax rates was thus designed to erode the tax saving brought about by income shifting.

Recent demand for revisions of the Norwegian tax system, resulting in the tax adjustments of 2013–2019, were mainly attributable to developments along another tax dimension: the closer integration of markets as a result of globalization has motivated various countries to reduce their corporate tax rates (Devereux, Griffith, and Klemm, 2002). A tax on corporate profits of 28 percent was low at the time of its introduction in 1992, but in subsequent decades Norway was left behind in the international tax competition, ending up with statutory tax rates well above the average in the OECD, the EU-28 and neighboring countries. The main feature of the 2013–2019 tax adjustments, designed to improve Norway's international tax position, was a gradual lowering of the corporate tax rate, down to 22 percent in 2019.

Owing to the link with the basic tax rate on general personal income (ordinary income), another consequence of this tax reduction was a cut in the flat-rate part of the tax on labor earnings as well as on personal capital income. Together these cuts obviously implied a significant loss of tax revenue, and a major challenge was to offset at least a part of the foregone revenue. The main move was the introduction of more steps in the schedule for the progressive part of the tax on labor income. To distinguish the new schedule from the old one, the term bracket tax was adopted to reflect the larger number of steps in the new step-wise linear income tax on earnings (in excess of the flat rate, now 22 percent). In 2021, the top marginal tax rate on wage income was 46.4 percent.

Given the link between the corporate tax rate and the basic tax rate on personal capital income, the reduction in the corporate tax rate also implied a reduction in the taxation of dividends. To main-

[10] The objective of the risk-free return allowance is to counteract distortions in household investments and the financing structure of companies as a result of dividend taxation.

tain the desired level of dividend tax, dividend income in excess of the risk-free return allowance is multiplied by an adjustment factor, and thereafter added to ordinary income.[11] As the corporate tax rate (and the tax on ordinary income) was gradually reduced from 2014 to 2019, the adjustment factor was increased correspondingly.

Recall that we use different representations of the tax rates on capital income and earnings in the macro data and micro data regressions. In the macro regressions we employ the statutory top marginal tax rates on earnings and dividends in addition to the (average) overall tax rate. In the micro data regressions, the marginal tax rates are calculated based on individuals' actual income. The marginal tax on capital income is operationalized in the form of the marginal tax on dividends and capital gains, including corporate tax. After 2006, the tax is calculated on income exceeding the risk-free rate of return. Alternatively, we could have used the tax rate on interest income, which would have meant a rate of 28 percent in the period 1993–2013 before a gradual decrease to 22 percent in 2019 where it has remained.[12]

Developments in all tax variables over the period 1993–2021 are presented in Figure 2. It shows the radical change in tax on dividends caused by the 2006 tax reform.[13] Moreover, we note that the 2013–2019 tax adjustments modestly reduced the top tax rate on earnings.

As regards the taxation of earnings, we note that, despite differences in level, the pattern of the average effective marginal tax rate largely shadows the top marginal tax rate. Furthermore, after the top marginal tax rate rose to above 55 percent in the period leading up to the tax reform in 2006, the reform brought it back down to below 50 percent, where it remains.

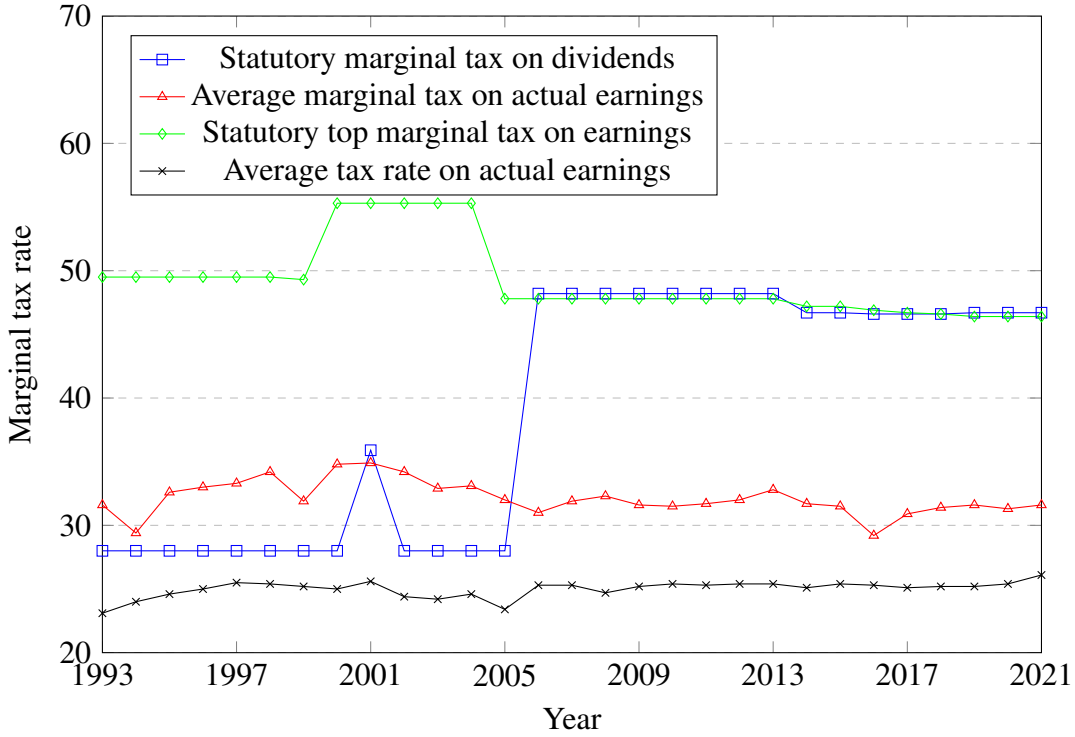

Figure 2: Marginal tax rates on labor and capital income, 1993–2021

[11]For 2021, the adjustment factor was 1.44 and the maximum effective tax rate on dividend income (including corporate tax) became 46.7 percent $(22\% + (1 - 0.22)(1.44\text{x}22\%)$.

[12]The same pattern would have been achieved if income was assumed to be in the income range of the risk-free rate of return.

[13]The hike in the marginal tax rate in 2001 is attributable to a temporary tax increase on dividends and capital gains that year.

4 Macro evidence

4.1 An autoregressive distributed lag model

In the following we employ macroeconometric methods to estimate the relationship between tax variables and income mobility when the latter is represented by the King index and the Average Rank Jump index. The econometric method that we apply takes into account that we are not necessarily dealing with stationary variables. This is most particularly the case for the income mobility series, but the tax series may not be stationary either. We are interested in estimating a long-run relationship between the two measures of income mobility and tax rates. Pesaran, Shin, and Smith (2001) present a method that enables us to include both stationary and integrated time series within the same model without needing to pre-test the order of integration of the variable series before estimating the parameters of interest.

In our context it does not seem relevant to specify a vector autoregressive (VAR) model that includes all the series we are interested in, because it is hard to justify why there should be feedback from income mobility to any of the tax rates. Also, given the relatively small sample size (1994–2021), a statistically well-specified VAR model could be hard to find. We have therefore opted for a single-equation framework. We specify a standard autoregressive distributed lag (ARDL) model in equilibrium correction form. The lag length is chosen to achieve desired statistical properties of this specification. Next, we test the joint hypothesis that the parameters for the level terms of the equilibrium correction form are all zero or not. We compare the F-statistics with the upper and lower bounds, as seen in Table CI(iii) in Pesaran et al. (2001), to determine whether there is any significant long-run relationship between measures of income mobility and tax rates.

We will here focus only on the long-run part of the models, while detailed results for the complete models are available from the authors on request. The long-run equation of interest is a simple linear relationship between an index of income mobility, IM, and the three tax rates,

$$IM = \alpha_0 + \alpha_1 MTRL + \alpha_2 MTRC + \alpha_3 ATR, \tag{6}$$

where α_0 is an intercept and tax rates are reported in Figure 2: $MTRL$ is the top marginal tax rate on wage income, $MTRC$ is the top marginal tax rate on dividends, and ATR is the average tax rate. Recall that the ATR variable is calculated based on the micro data. Note that the explanatory variables, as a point of departure, is from the second year of the mobility measure calculation, year y in the transformation $x \to y$ (or for a given year, t, when the preceding year is $t-1$).

We have explored the implications of including a linear deterministic trend in the regressions but, using standard t-tests, found it highly insignificant for both the King index and the Average Rank Jump index as the dependent variable. Therefore, the results shown are for models without a trend. However, we also include short-run effects of the full ARDL model unless either they were highly insignificant or deleting them led to significant results for residual diagnostics.

Estimation results are presented in terms of three different model specifications, Model (A), Model (B), and Model (C). Model (A) is the most comprehensive model, Model (B) is simply a more parsimonious version of Model (A) where we have deleted insignificant short-run effects. Finally, Model (C) is a more restricted version, in which clearly insignificant (long-run) estimates have been set to zero.

4.2 Estimates for the King index of income mobility

Table 1 shows estimation results for Equation (6) where income mobility according to the King index estimates is used as the dependent variable. In this case we were unable to find a reasonable statistical model that includes the years 2020 and 2021. This may be due to the pandemic. 2021 is an outlier according to our estimates, and Figure 1 may reveal the reason. The King measure of

income mobility (top graph of Figure 1) shows clearly higher mobility in 2021 relative to other years compared to descriptions provided by the other mobility indices,[14] and we see no changes in tax rates that can explain this. We also used an impulse dummy for 2015 and stopped estimation at 2019 (or introduced dummies for 2020 and 2021) to achieve a statistical model with no autocorrelation, no heteroskedasticity and an error term that could be considered Gaussian. This means that the estimation results presented in Table 1 are based on a 1994–2019 sample with a dummy for 2015.

The estimation results show that we can reject that a long-run relationship between income mobility and taxes does not exist. The F-test when all variables in levels are excluded is clearly higher than the upper level of the F-tests in Table CI(iii) in Pesaran et al. (2001) The top marginal tax rate on labor income (MTRL) is clearly insignificant, whereas the coefficient for the tax rate on capital income (MTRC) is negative but not significant at standard t-levels. The average tax rate also enters with a significantly negative sign. We carried out a number of specification tests, which were all satisfactory.[15]

The point estimates signify that taxation of capital has small effects on income mobility. The effect of a 1 percentage point increase in the marginal tax rate on capital income causes a reduction in the King index of 0.003 according to Model (C) where this effect is significant the 10% level. Given that estimates of King mobility index are found to range from 0.13 to 0.26, this represents a very small effect on income mobility. The negative effect of the average tax rate (ATR) is much larger. We will return to the effect of the average tax rate when discussing results for the Average Rank Jump measure of mobility.

Looking at Figure 1 and Figure 2, one may hypothesize that the expected tax rate on capital income is more important for income mobility than the current and lagged levels of tax rates. The data resulting from use of the King income mobility measure provide some support for this. The tax rates for capital income as well as for the top marginal tax rate on labor are proposed by the Norwegian government to the Storting (parliament) each October of the year before the tax rates come into effect. Thus, agents can form expectations about these tax rates before they are set and in almost all cases the rates are known by November the previous year, suggesting that there could be perfect foresight (rather than expectations). Moreover, in times of tax reform the information often precedes implementation by a longer period. For example, the increase in the capital income tax rate in 2006 was known to the public years in advance, which led to adjustments, see Alstadsæter and Fjærli (2009) and Thoresen, Bø, Fjærli, and Halvorsen (2012).

We accordingly tested a specification which included both leads and lags. However, we found that the fit of the model was much worse compared to Model (C). Furthermore, in this model, the $MRTC$ variable has no long-run effect because the lead and lagged levels cancel out, while in the long-run higher marginal tax rates on labor income ($MTRL$) increase income mobility. However, increased income mobility due to higher tax on labor income is not consistent with other findings of the present study.

4.3 The Average Rank Jump measure as the dependent variable

Next, we use the Average Rank Jump measure of income mobility to obtain estimates. Table 2 shows the estimation results for the long-run part of the ARDL model. Model (A) is a quite general specification that includes an impulse dummy for 1997 in order to achieve a satisfactory statistical model. Test results, based on Pesaran et al. (2001), suggest that we cannot reject the possibility that

[14] Figure 1 shows that all indices pick up an increase in income mobility from 2020 to 2021, but the effect is largest for the King index.

[15] The following tests were employed: test of Harvey (1981) for up to second order residual autocorrelation, test for first order autoregressive conditional heteroskedasticity of Engle (1982), normality test of Doornik and Hansen (2008), tests for residual heteroskedasticity of White (1980), and a test for functional form misspecification (RESET) of Ramsey (1969).

Table 1: Estimation results for long-run part of the ARDL using the King index as a measure of income mobility

	(A)	(B)	(C)
MTRL	-0.0007	0.0005	0 (restr.)
	(0.0046)	(0.0031)	
MTRC	-0.0032	-0.0031	-0.0030*
	(0.0023)	(0.0020)	(0.0018)
ATR	-0.1121*	-0.1132***	-0.1114***
	(0.0560)	(0.0043)	(0.0384)
σ	0.0043	0.0037	0.0035
F statistic	$F(16,6)=51.63$	$F(13,9)=87.48$	$F(7,16)=109.1$
F all levels=0	$F(12,10)=7.67$	$F(9,13)=12.92$	$F(4,19)=15.37$
F upper	4.35	4.35	4.85

Notes: Estimation by OLS regressions, standard errors in parentheses. One, two, and three stars indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 2: Estimation results for the long-run part of the ARDL using the Average Rank Jump index as a measure of income mobility

	(A)	(B)	(C)
MTRL	0.0876	-0.0213	0 (restr.)
	(0.1816)	(0.1810)	
MTRC	-0.2289***	-0.2243***	-0.2182***
	(0.0598)	(0.0378)	(0.0271)
ATR	0.0832	0.6436	0.6625
	(0.8899)	(0.5278)	(0.5008)
σ	0.1324	0.1204	0.1168
F statistic	$F(14,10)=8.62$	$F(10,16)=15.36$	$F(9,16)=18.11$
F all levels=0	$F(10,14)=3.65$	$F(6,18)=4.62$	$F(8,17)=4.62$
F upper	4.35	4.35	4.85

Notes: Estimation by OLS regression, standard errors in parentheses. One, two, and three stars indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

the level terms are all zero. Model (B) is the same model as (A) but excluding insignificant effects of variables in difference form. The F-test is now significant, and the exclusion of the level terms is rejected. Model (C) is the same as Model (B) except that we have set the level term for the top marginal tax rate on wages at zero, based on the results of Model (B).[16] As for Model (A), we cannot reject that the level terms are all zero as the Pesaran-Shin-Smith F-test is within the inconclusive bounds.

Qualitatively, the results presented in Table 2 regarding the effects of marginal tax rates are close to those we found when using King index estimates as the dependent variable. A higher marginal tax rate on capital income reduces income mobility, while the effect of the top marginal tax rate on labor is clearly insignificant. As with the King index, the effect of the marginal tax rate on capital income is small; the parameter estimate is larger, but this is for an income mobility measure with estimates ranging from 5 to 11. A higher average tax rate will if anything now increase income mobility, which is the opposite of what we found for the King index analysis. However, as the effect is clearly insignificant, we are cautious about assigning any weight to this result.

[16] Detailed results are available from the authors on request.

Table 3: Descriptive statistics for data sets used in the micro data approach, means for selected years

	1993	2000	2007	2014	2021
Decile change dummy	–	0.49	0.49	0.43	0.44
EMTRL	31.6	34.8	31.9	31.7	31.6
EMTRC	28.0	28.0	48.2	46.7	46.7
Age	41.4	42.1	43.1	43.0	43.2
Child benefit	5,401	5,615	6,132	6,986	6,548
Debt	254,405	361,837	699,027	1,016,112	1,398,942
Other transfers	13,580	15,189	20,642	24,726	28,286
Number of obs.	1,830,490	1,987,419	2,108,564	2,249,601	2,307,998

Notes: EMTRL is the effective individual marginal tax rates on labor income and EMTRC is effective individual marginal tax rates on capital income. Figures for child benefit and debt are in Norwegian kroner (NOK) and not inflation-adjusted. 2021 average exchange rates: 1 euro=NOK 10.17 and 1 USD=NOK 8.60.

5 Micro panel data results

As already noted, a major advantage of the present study is that we have access to administrative register data for the whole population of Norway for almost 30 years (1993–2021).[17] Importantly, these data can be turned into a panel data set. So far in this study, the micro panel data have only been used to measure income mobility from one year to the next. In the following we use these data to obtain estimates of the income mobility and tax relationship by means of fixed effects panel data regressions.

In order to obtain fixed effects estimates, we establish an unbalanced data set. This is obtained by focusing on individuals aged between 25 and 63 in the empirical investigation, which means that individuals enter and leave the data set depending on their age. In Table 3 we present descriptive statistics for the data set used. The table shows a large degree of stability in variables over time, with the exception of debt, which has increased in real terms.

Recall that our dependent variable in the micro panel data regressions is a dummy variable which takes the value 1 if the individual has moved in the transformation $x \rightarrow y$ (or from a year $t-1$ to year t), the value 0 if the individual has not moved. A movement is defined as a shift in the decile ranking, for example if the individual moves from decile 4 in year $t-1$ to decile 6 in year t. The dummy variable is referred to as MD_{it}.[18]

We then let movements be explained by the effective individual marginal tax rates on labor and capital income in year t, $EMTRL_{it}$ and $EMTRC_{it}$, respectively, a number of time-varying control variables, Z_i, fixed year effects, θ_t, and an individual fixed effect, γ_i:

$$MD_{it} = \beta_1 EMTRL_{it} + \beta_2 EMTRC_{it} + Z_{it}\lambda + \theta_t + \gamma_i + \varepsilon_{it}, \tag{7}$$

where ε_{it} is a genuine error term.

$EMTRL_{it}$ and $EMTRC_{it}$ are obtained from calculations for each individual and each year based on their labor and capital income.[19] However, there may well be an endogeneity problem in Equation (7), as a move measured by income is also likely to affect marginal tax rates. This makes it advisable to also obtain estimates for specifications in which the marginal tax variables are expected

[17] As already noted for the macroeconometric regressions, the time series is somewhat short. However, this is outweighed by the advantage of having access to a large micro data set for each of these years.

[18] As our data series starts in 1993, we do not obtain a mobility measure for 1993, see Table 3.

[19] Note the difference from the macro regressions in Section 4, where the marginal tax rates are represented by statutory tax rates.

to a larger degree to be predetermined. Thus, tax variable representations are obtained by letting $EMTRL$ and $EMTRC$ be lagged by one and two years, resulting in $EMTRL_{t-1}$ and $EMTRC_{t-1}$ for lag 1 and $EMTRL_{t-2}$ and $EMTRC_{t-2}$ for lag 2. Moreover, as it can be argued that mobility responses to taxation are slow, a lagged relationship could represent a more realistic model. To be specific, the lag 1 specification is expressed as $MD_{it} = \delta_1 EMTRL_{it-1} + \delta_2 EMTRC_{it-1} + Z_{it}\lambda + \theta_t + \gamma_i + \varepsilon_{it}$,, which also signifies that control variables for period t are used, irrespective of the time period of the tax variables. Age-squared, child benefit support, debt, other transfers, and year dummies are included as control variables. The child benefit variable captures the effect of children. We find, as expected, that estimation results are very little affected by whether control variables are included or not.

We employ a fixed effects linear probability model to estimate Equation (7) and the alternative specifications with lagged tax variables. An advantage of the linear probability model is that the results are relatively straightforward to interpret. An estimate of (say) 0.005 for one of the tax variables means that a one-unit increase in the tax rate is associated with a 0.5 percentage point increase in the probability that there is mobility, i.e., that the dummy variable MD equals 1.

The results reported in Table 4 are consistent with the macro regression results. As with the results reported in Section 4, we find a negative estimate for the marginal tax on capital income and that the effects of the marginal tax on labor income are smaller than the effects on capital income. In contrast to the macro regression results, which do not suggest that the effects of the marginal tax on earnings are significant, the results of Table 4 point to the effects of the marginal tax on labor income also being negative.

All three specifications yield negative results for the tax variables, regardless of whether the variables are lagged or not. However, we note that the capital income estimate for the lag 1 specification, Model (2), is larger than those obtained for Models (1) and (3): -0.05 compared with -0.005.[20]

If we focus on estimates of Model (1) and Model (2), we see that the estimate for the marginal tax rate on labor income is -0.003, which means that the probability of mobility (a decile shift) decreases by 0.3 percentage point when the marginal tax rate is increased by 1 percentage point. The effect of capital income taxation is somewhat larger: a 1 percentage point increase in the marginal tax on capital income reduces mobility by 0.5 percentage point according to Models (1) and (3) and by 5 percentage points according to Model (2).[21]

6 Conclusion

This paper adds to the limited empirical literature on how taxation influences income mobility. Although income mobility is a multifaceted concept, and it is not always certain that higher income mobility is associated with welfare gains, we assume that income mobility is associated with equal opportunities and reduced income inequality in the long-run. We therefore argue that income mobility should be given weight in the design of the tax system and thus it becomes important to know how income mobility is influenced by taxation (and other policies).

The relationship between taxation and income mobility is discussed in terms of both macro and micro regressions. The dependent variables in the macro regressions are two series of income

[20] We also estimated a simplified version of Equation (7) by means of a random effects probit model, with only the tax variables in year t as explanatory variables (in addition to year dummies). Reassuringly, we find negative estimates for the marginal effects of both tax variables for the probit estimation too.

[21] Alloza (2021) reports that a 1 percentage point increase in marginal tax rates causes a reduction of around 0.5 percentage point in the probability of a change to a different income quintile. This magnitude is obviously hard to compare with our results, as Alloza (2021) measures mobility in terms of quintile change, not decile change (as in the present study), and the data are from another country (the US).

Table 4: Estimation results for fixed effects linear probability models

	(1)	(2)	(3)
EMTRL	-0.003***		
	(4×10^{-5})		
EMTRC	-0.005***		
	(1×10^{-4})		
EMTRL, lag 1		-0.003***	
		(4×10^{-5})	
EMTRC, lag 1		-0.052***	
		(5×10^{-4})	
EMTRL, lag 2			-0.002***
			(4×10^{-5})
EMTRC, lag 2			-0.005***
			(6×10^{-4})
R-square	0.424	0.685	0.656

Notes: Only parameter estimates for the tax variables of Equation 4 are reported, with robust standard errors in parentheses. One, two, and three stars indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

mobility based on indices of income mobility as positional movements, the King index of King (1983) and the Average Rank Jump measure of Bartholomew (1973). In the micro data estimations we employ a dummy variable for decile rank change as the dependent variable.

Alloza (2021) is one of the few previous studies of this relationship, but in contrast to that study we let income mobility be explained by marginal tax rates on both capital and labor income. Like Alloza (2021), we find a negative relationship between income mobility and marginal tax rates. Although marginal tax rates on both capital and labor income reduce income mobility, there are differences in the magnitude of effects: the results suggest that the marginal tax on capital income tax is more important for income mobility than the tax on labor income. The results of both the macro regressions and the micro panel data regressions support this finding.

It follows that given the positive value assigned to income mobility, the results indicate that high tax rates have a detrimental effect. Higher taxes not only increase efficiency losses (or excess burdens), as is conventionally found, but also reduce income mobility. As this should be given weight in the design of tax systems, as argued here, our results provide support for keeping taxes low.

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