

Do High Taxes Lock-in Capital Gains? Evidence from a Dual Income Tax System

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Abstract

The purpose of this paper is to study whether investors' willingness to realize capital gains falls when the marginal tax rate on capital gains is raised. We use a rich register-based panel data set covering almost 8% of the Swedish population. The results indicate that a 10% increase in capital gains tax rate reduces the number of realizations of capital gains with 8.7% and the realized amount, given the decision to realize, with 1.9%. In addition, we find that wealthy individuals seem to respond more to changes in capital gains tax rates than less-wealthy.

Keywords: capital gains realizations; tax avoidance; panel data

JEL-codes: H24; H31

1 Introduction

It has long been realized (see e.g., Seltzer 1951; Holt and Shelton 1962) that higher capital gain tax rates can create a lock-in effect, i.e., investors are less willing to realize capital gains when the marginal tax rate on capital gains is relatively high. This may create welfare losses by preventing investors from diversifying portfolios (Auerbach 1988), reduce tax revenues (Feldstein et al. 1980; Hendershott et al. 1991), and prevent investors from undertaking new investments (Meade 1990). Previous empirical studies have found that realizations of capital gains are negatively correlated with the capital gains tax rate, while quantitative estimates of tax elasticities differ widely. Cross-section studies (e.g., Feldstein et al. 1980; Minarik 1981) produce high elasticities (i.e., above unity), while time-series studies (e.g., Auerbach 1989; Jones 1989; Gillingham and Greenlees 1992) yield lower elasticities (between -0.5 to -0.9).

The purpose of this paper is to study how marginal taxes affected realizations of capital gains in Sweden during the period 1993-1995. This case is of particular interest because a major tax reform was implemented in 1991. From this year, capital gains were taxed separately from ordinary income at a flat rate of 30%. Later on, policymakers also implemented several capital gain tax rates, making it possible to empirically test how responsive realizations of capital gains are to tax rates.

Previous empirical studies of lock-in effects of higher capital gains tax rates have used data from the US. In the US tax system individual capital gains are taxed jointly for the household members as ordinary income at

progressive rates. This means that an investor have an incentive to realize capital gains when the sum of the household members ordinary income is temporarily low. Auten and Clotfelter (1982) and Burman and Randolph (1994) suggested that because of this cross-section studies have measured the transitory effect on capital gains realizations behavior, while time-serie studies have measured the permanent effect. These researchers therefore used panel data to distinguish between these effects. Their results indicated that the transitory effect generally was much larger than the estimated permanent effect.¹

Another problem that arise in a progressive tax rate system is that assets with relatively large accumulated gains are more costly to sell compared to assets with smaller accumulated gains. The data usually do not contain any information regarding specific assets in an individual portfolio, meaning that previous studies have not been able to control for the size of accrued gains. In addition, when capital gains are taxed as ordinary income subject to a progressive tax scale, realizations of capital gains and marginal tax rates on capital gains are endogenously determined.

Our study of the Swedish dual income tax system avoids several methodological problems associated with previous studies. First, the flat tax rate on capital gains and the observed tax changes during the study period makes it possible to include a direct measure of the tax treatment of capital gains in the empirical analysis. Second, a flat capital gains tax rate means that the marginal tax rate does not depend on the volume of accrued capital gains.

¹However, the results depend on the definition of the temporary and permanent effect. As noted by Auten and Clotfelter (1982, p. 629), this implies that: "The definition of the correct marginal tax rate on realizations of capital gains is not unambiguous".

Third, the realization of capital gains and the capital gains tax rate are in this case not endogenously determined. Hence, the Swedish institutional tax setting during the 1990s provides an unique opportunity to test whether changes in the taxation of capital gains influence realizations of capital gains. Fourth, household members are taxed individually in Sweden, whereas the US tax system is based on joint taxation. This makes it possible to test for gender differences in realization behavior.

To study the possible lock-in effect of capital gains tax rates, a longitudinal data-base, called LINDA (Longitudinal INdividual DAta for Sweden), collected from register-based accounts by Statistics Sweden was used. This data covers approximately 8% of the Swedish population annually. Therefore, in addition to the benefits of studying a dual income tax system where capital gains are taxed at a flat rate, we have access to a much larger and more comprehensive data-set than those that have been used in previous empirical studies.

Our results indicate that higher taxes on capital gains prevent investors from realizing capital gains. According to the estimated elasticities, a 10% increase in the capital gains tax rate reduces the number of realizations with 8.7% and the realized amount, given that the individual has decided to realize capital gains, with 1.9%. In addition, elderly and individuals with high taxable income seem to realize capital gains more often. On the other hand, no gender difference in the decision whether to realize any capital gains is found, but the results indicate that women realize smaller amounts of capital gains compared to men.

Capital gains realization behavior seem, moreover, to be different be-

tween individuals that have taxable wealth and those that have no registered taxable wealth. According to the results, wealthy individuals are more sensitive to changes in capital gains tax rates than less-wealthy individuals. This finding is in accordance with results previously presented by Auerbach and Siegel (2000), indicating that tax avoidance strategies are more common among wealthy tax-payers. It also seems to exist a gender difference in realization behavior between individuals that have reported taxable wealth and those that have not.

The rest of this paper is organized as follows: Section 2 contains a description of the data and the tax policy changes in Sweden during the 1990s. The empirical methods for studying how sensitive realizations of capital gains in Sweden were to marginal tax rate changes are described in Section 3. The results corresponding to the full sample are presented and commented in Section 4, while the results for the wealthy and less-wealthy individuals, respectively, are presented in Section 5. Finally, Section 6 concludes the paper.

2 Data and Institutional Details

In 1991, policymakers in Sweden implemented a tax reform that has been classified as the most far-reaching tax reform in any western industrialized country in recent decades (Agell et al. 1998). Before the 1991 tax reform, capital gains were (as in most other countries) taxed as ordinary income at progressive rates; creating incentives for investors to realize their capital gains when their income was temporarily low. In addition, capital gains

on long-term holdings were taxed more favorably compared to short-term capital gains since investors were allowed to exclude 60% of capital gains realized after two years.

All this changed with the 1991 tax reform. In fact, the Swedish tax reform in 1991 was more far-reaching than the often studied US Tax Reform Act of 1986. In the latter, tax cuts were estimated to reduce tax revenues with 1-2% of GDP; whereas pre-estimates of the 1991 tax reform in Sweden suggested a tax revenue loss due to rate cuts corresponding to approximately 6% of GDP (see Agell et al. 1998). Marginal tax rates were dramatically lowered, various tax shelters were eliminated, the value added tax (VAT) was broadened, and the corporate tax rate was reduced from 57% to 30%.

A notable feature of the Swedish tax reform was that ordinary income and capital income became taxed separately, with capital gains taxed at a flat rate of 30%. However, already in 1992 the newly elected non-socialistic government reduced the capital gains tax-rate to 25%, followed by a further reduction to 12.5% in 1994. Finally in 1995 uniform 30% taxes were reinstated when the Social democratic party regained legislative. The capital gains tax rate has remained unchanged since then.²

To test whether high taxes on capital gains creates a lock-in effect, we use a dataset compiled by Statistics Sweden called Longitudinal INdividual DAta for Sweden (LINDA) during the period 1993-1995. The years after 1995 are excluded because of the rapid transformation of the Swedish capital

²The tax rate changes were implemented in January and were announced a couple of months before the implementation dates when the budget for the coming fiscal year was presented. This means that they to some degree were anticipated and that a negative relation between capital gains realizations and capital gains taxes to some extent could reflect timing behavior.

market from 1996 onwards. In 1996, the first internet stock-trading site was opened in Sweden, soon followed by several others. This led to a drastic decrease in capital market transaction costs after 1995. This will cause bias in our estimations of the effects of capital gains taxation on realization behavior since we do not have access to any empirical measure of transaction costs at the individual level.

LINDA is a very comprehensive panel data set that consists of two different samples; a population sample and an immigrant sample. The former, a representative sample for the population in Sweden (including immigrants), is used in this study. The population sample covers approximately 3.35% of the Swedish population annually. For each sampled individual, information on all family members have been added to the data set. This means that LINDA, on average, cover 697,956 individuals per year during the sample period, or approximately 8% of the population.

The main data source in LINDA is the Income Register (Inkomst- och förmögenhetsstatistiken). The Income Register is based on the tax reports that all residing individuals in Sweden are obliged to send to the Swedish Tax Authority (Riksskatteverket, RSV). LINDA also include a number of individual background characteristics from the Population and Housing census (Folk- och bostadsräkningen), such as age, sex, marital status, education and household size.

LINDA has some drawbacks. The income data in LINDA are based on filed tax reports. This means that the data are contingent on the tax legislation in a particular year, i.e., definitions may change over time due to changes in tax legislation. Capital gains include, moreover, income from

sales of stocks, bonds, and real estate. We would have preferred to be able to discern the different kinds of capital income since the responsiveness to tax changes may be different for stocks than, for example, real estate. Another consideration is that wealth is reported only if it exceeds 800,000 SEK (corresponding to USD 105,960 during the study period).³

Definitions of the variables included in the empirical analysis, as well as their means and standard deviations, are given in Table 1. The variables included are further discussed in Section 3.

Table 1 About Here

3 Empirical model

In every period a number of investors will choose not to realize any capital gains, which creates a censoring problem to the statistical analysis of capital gains realizations. To make our results comparable with previous studies, the following Heckman two-step selection model was used to analyze the decision to realize net gains together with the amount of capital gains actually realized

$$R_{it}^* = \alpha_0 + \alpha_1 R_{it-1} + \alpha_2 \tau_t^g + \alpha_{3j} \mathbf{X}_{it} + \varepsilon_1 \quad (1)$$

$$\ln G_{it} = \beta_0 + \beta_1 \tau_t^g + \beta_{2j} \mathbf{X}_{it} + \gamma Mills + \varepsilon_2 \quad \text{if } R^* > 0 \quad (2)$$

$$G_{it} = 0 \quad \text{otherwise}$$

³Using the average exchange rate (7.55) during the period 1993-1995.

where R_{it}^* is a latent index of individual i 's decision to realize capital gains at time t , and G_{it} represents net capital gains realized.⁴ The purpose of this paper is to study changes in individual realization behavior due to changes in capital gains taxation, *ceteris paribus*. As such, we want to exclude increases/decreases in capital gains realizations due to changes in the underlying stock portfolio. Since we do not have any individual measure on the value of the individual stock portfolio, the amount of capital gains realized have been discounted using the OMX stock index using the year 1992 as the base.

In order to control for habit formation, realizations of capital gains in the previous period (R_{it-1}) is included as an exogenous variable in the criterion function. The capital gains tax rate (τ_t^g) and a vector of non-tax variables (\mathbf{X}_{it}) are included in both equations. Equation (1) and (2) are estimated using Heckman's two-step procedure. This means that an inverse Mills ratio is included in the second step to control for sample selection. Finally, α_0 - α_{3j} , β_0 - β_{2j} ($j = 1, 2, \dots, 9$) and γ are parameters to be estimated, while ε_1 and ε_2 are normally distributed error terms. From the estimations of equation (1) and (2), elasticities of the type $\partial \ln G_{it} / \partial \ln x_{it}$ are calculated. The resulting elasticities give the percentage change in capital gains realized when x_{it} changes by 1%.

\mathbf{X}_{it} is a vector of non-tax variables that are assumed to influence both the decision whether to realize any net gains and the amount realized given that

⁴One could of course try other estimation strategies as well. One novel estimation strategy could have been to use propensity score matching methods using the data from the 30 percent tax regime as the "untreated" observations and then comparing the two "treatments" to reduce taxes to 25 and 12.5 percent, respectively.

the individual has decided to realize net gains. The vector include household size, age, dividend payments, wealth, income, loss of income, marital status, sex, educational attainment and interest deductions. Dividend payments, wealth, income and loss of income are lagged one period in order to avoid possible endogeneity problems.

As taxes affect the cost and benefits of realize capital gains (Burman and Randolph, 1994), the null hypothesis that $\tau_t^g = 0$ is expected to be rejected when estimating equation (1) and (2). Turning to the vector of non-tax variables, the size and the composition of the portfolio might influence the decision to realize capital gains and the amount of capital gains realized. The hypotheses to be tested are therefore individuals with relatively high income, wealth, and dividend payments relatively often realize higher amounts of capital gains compared to individuals with lower income, wealth, and dividend payments. Interest deductions is included as an explanatory variable to provide indirect information on whether the portfolio include real estate property that are relatively costly to sell.

In the US tax setting, elderly people have an incentive not to realize capital gains in later part of life as capital gains are not taxed at death, the so-called step-up in basis in death (see Auten and Joulfaian 2001). However, no such incentive existed in the Swedish tax system during the studied period. According to the life-cycle hypothesis, older individuals in Sweden should thus be more likely to realize capital gains, and to realize higher amounts, compared to younger individuals. Capital gains realization behavior may also depend on the level of educational attainment. It is possible that highly educated individuals are more active investors compared to in-

dividuals with less education. This implies that educational attainment should be positively related to the decision to realize capital gains as well as the realized amount of capital gains. Household size and marital status are other household characteristics that are included in the estimated model as control variables. Finally, sex is included as an explanatory variable to test whether there seem to exist gender differences in capital gains realization behavior.

4 Results from our primary specification

The estimation results from equation (1) and (2), i.e., the determinants of the decision whether to realize any capital gains and the amount of capital gains realizations given that the individual has decided to realize capital gains, are presented in Table 2.

Table 2 About Here

As the tax effects are the main focus of this paper, let us start by presenting the estimated tax coefficients and their corresponding elasticities. The coefficient associated with τ_t^g is negative in the criterion function, indicating that individuals are less likely to realize capital gains when the capital gains tax rate is relatively high. In addition, given that individuals have decided to realize gains, the results from the level equation indicate that they realize less capital gains when the capital gains tax rate is high. These results support previous findings from the US (Auten and Clotfelter 1982; Burman and Randolph 1994; Bogart and Gentry 1995; Auerbach and Siegel 2000), suggesting that higher taxes on capital gains create a lock-in effect.

The estimated tax elasticity in the criterion and level equation is -0.87 and -0.19, respectively. This implies that a 10% increase in the capital gains tax rate will reduce realizations of capital gains with 8.7% and the amount of realized gains with 1.9%.⁵ Changes in capital gains tax rates thus seem to have a larger effect on the decision whether the individual should realize any capital gains. The estimated tax elasticity with respect to capital gains realizations is smaller than the transitory tax elasticities reported by Auten and Clotfelter (1982), Burman and Randolph (1994) and Auerbach and Siegel (2000), but larger than their reported permanent tax elasticities. Our estimated tax elasticity seem to be within the range of elasticities (-0.5 to -0.9) often reported in time-series studies (see e.g., Auten and Cordes 1991) and is slightly higher than the elasticity (-0.65) found by Bogart and Gentry (1995) when studying aggregated state-level realizations in the US.⁶

Turning to the vector of non-tax variables, both the decision to realize capital gains and the amount realized seem to be positively related to individual income, wealth and dividend payments. These results are expected and in accordance with previous findings (see e.g., Auten and Clotfelter

⁵It should be noted that the elasticities reported in the paper are not constant, but rather a function of the value of the independent variables. As such, we have also calculated the elasticities for our main variable of interest, the capital gains tax rate, at the three tax levels used in Sweden during the years under study. Regarding the probability of realizations, the results show that when the tax rate is 12.5 percent, the elasticity is -0.46, when the tax rate is 25 percent, the elasticity is -0.97 and when the tax reaches 30 percent, the elasticity equals -1.21. As for the size of realizations, the results show that when the tax rate is 12.5 percent, the elasticity is -0.11. When the tax rate is 25 percent, the elasticity is -0.21 and when the tax is 30 percent, the elasticity equals -0.25.

⁶Note that lock-in effect can be present even if tax rate elasticities are not statistically significant determined. A high tax rate that discourage realisation of capital gains might, for example, also encourage strategies involving a higher frequency for realising losses. Higher taxes on capital gains might also lead investors to engage more in tax evasion strategies that cannot be observed by the researcher.

1982; Burman and Randolph 1994). According to the presented elasticities in Table 2, a 10% increase in taxable income for the individual will increase realizations of capital gains with 2.3% and the amount realized with 0.7%; while the size effects of taxable wealth and dividend payments are negligible. Also, individuals that suffered a loss of income of 20 percent or more in the previous year were more inclined to realize capital gains, but in smaller amounts than other individuals.⁷

Moreover, as indicated by the parameter on R_{it-1} , individuals that have realized capital gains in period $t - 1$ are more likely to realize capital gains in period t . Other household characteristics that seem to influence capital gains realization behavior are age, marital status, and educational attainment. The results presented in Table 2 indicate that older individuals are more likely to realize capital gains and also to realize larger amounts of capital gains than younger individuals. The estimated elasticities suggest that this effect is rather large, a 10% age increase will increase capital gains realizations with 3.1% and the amount realized with 6.5%.⁸ This result is in accordance with the life-cycle hypothesis of saving and consumption, but in contrast to previous findings on US data (Auten and Clotfelter 1982; Burman and Randolph 1994).

⁷Models including a dummy variable for individuals that lost more than 10 or 30 percent of their income in the previous year have also been estimated. All qualitative results remain the same as presented in this paper.

⁸Calculating the elasticities at different values of the independent variable has also been done for different ages of the individual. The results show that the elasticity of capital gains realizations with respect to age increases with age. At age 20, the elasticity regarding the probability of realizations is equal to 0.19, while at age 60 it has increased to 0.53. The elasticities relating to the size of realizations are equal to 0.39 at age 20, and at age 60 it has increased to 1.17.

The fact that age can have a different effect on capital gains realizations in US and Sweden can be explained by different institutional tax designs. In US, the capital gains tax can be avoided altogether at death (the so-called step-up in basis at death, see Auten and Joulfaian 2001), while accrued capital gains in Sweden during the study period were taxed at death. Thus, older US taxpayers can avoid taxation by taking advantage of the step-up in basis at death, while Swedish taxpayers face no such incentive. The results indicate, moreover, that married individuals and taxpayers that have at least enrolled three years in higher education are more likely to realize capital gains and to realize larger amounts; while individuals that are living in large households realize smaller amounts of capital gains less often than individuals residing in small households, holding income and all other effects constant.

As described in Section 2, Swedish tax payers are taxed individually. This means that we, in contrast to previous studies, can study whether capital gains realization behavior differ between men and women. According to the results presented in Table 2, the estimated parameter associated with the gender dummy is not statistically significant at the conventional 5%-level in the criterion function. As such, there does not seem to exist a gender difference in the decision whether to realize any capital gains during the period under study. On the other hand, when women decide to realize capital gains, they seem to realize smaller amounts compared to men. Finally, the Mills-ratio coefficient is positive and statistically significant different from zero. This suggests that an empirical model that does not consider sample selectivity would have produced biased parameter estimates.

5 Lock-in effects among the wealthy

The lock-in effect of taxes on capital gains realizations may differ between different subgroups of the population. It is, for example, well known (see e.g., Auerbach et al. 2000) that tax avoidance strategies are more common among wealthy tax-payers. This is especially true for highly moveable tax bases such as capital gains. In comparison to other tax-payers, wealthy individuals also have less problems with liquidity constraints and often face lower transaction costs.

Auerbach and Siegel (2000) have previously shown that wealthy individuals in the US (>10 million US dollar) behave differently with respect to capital gains realizations than other tax payers. Their results indicated that the transitory elasticity of realizing capital gains with respect to the marginal tax rate was much higher for wealthy individuals, suggesting that this group, on average, engages more in tax avoidance strategies compared to the group of other investors.⁹

To study whether realization behavior differ between income classes in Sweden, we divided our sample into two different groups. One group of households has no reported taxable wealth, whereas the other group has taxable wealth (i.e., wealth that exceeds 800,000 SEK) registered at the Swedish tax authority. The results presented in Table 3 and Table 4 show that 13.7% of the wealthy individuals realized capital gains during the study period; while the corresponding figure for the less-wealthy individuals was 6.3%.

⁹Note that these investors also might engage more in tax evasion strategies. However, tax evasion is illegal and therefore difficult to detect.

Table 3 About Here

Table 4 About Here

The results regarding the effects of capital gains taxation on both the decision to realize, as well as the amount of capital gains realized, show that the group reporting taxable wealth is, on average, more responsive to changes in capital gains taxation. The elasticities presented in Table 3 and Table 4 indicate that a 10% increase in the capital gains tax rate reduces realizations of capital gains with 11.8% for the wealthy tax-payers, whereas the corresponding figure for the less-wealthy is 8%. The amount realized, given the decision to realize capital gains, is reduced by 3.1% and 1.4% for the wealthy and less-wealthy, respectively. These findings coincide with results previously presented by Auerbach and Siegel (2000).

When turning to the effects of family composition on realization behavior some other interesting results emerge. It seems to exist a gender difference in realization behavior between individuals that have reported taxable wealth and those that have not. According to the results presented in Table 3 and Table 4, it is less common for females than males to realize capital gains among wealthy tax-payers. However, in the group not reporting taxable wealth, the opposite result was found.

In addition, the effects of age on realization behavior is larger for the group reporting taxable wealth. The results indicate that a 10% increase in age is followed by a 9.4% increase in capital gains realizations among the wealthy individuals, whereas the size of this effect is 1.6% among the less-wealthy group. Two reasons come to mind. First, wealthy people face

larger tax incentives to allocate capital income to later parts of life. Second, since there was an allowance of 10,000 SEK (USD 1,325) in the taxation of gifts during the years under study, older people might realize some of their capital each year and give this to their children in order to avoid taxation at death.

Finally, having low income and a large family increases both the probability to realize capital gains, as well as the amounts realized, more among the individuals that have no reported taxable wealth. The elasticities reported in Table 3 and 4 indicate that a 10% income increase correspond to a 3.1% increase in capital gains realizations, whereas the wealthy tax-payers only increase their capital gains realizations with 0.73%. A 10% increase in family size reduces capital gains realizations and the amount realized with 2.8% and 1.8%, respectively, for the group that have no reported taxable wealth. According to the estimation results, this effect is much smaller in size for wealthy individuals. It is likely that the less-wealthy group is more sensitive to changes in income and family size, which can explain these findings.

6 Summary and Conclusions

A number of empirical studies (see e.g., Auten and Clotfelter 1982; Burman and Randolph 1994; Bogart and Gentry 1995; Auerbach and Siegel 2000) have previously studied the effect of taxation on capital gains realizations in the US. Capital gains are in the US tax system (as well as in most other tax systems) taxed as ordinary income at progressive tax rates, creating

a number of methodological problems to the estimation of tax elasticities. It is, for example, difficult to empirically distinguish between transitory and permanent income, the size of accrued capital gains matter but cannot typically be controlled for, and realizations of capital gains and tax rates are clearly endogenously determined.

In this paper, we have used a comprehensive panel data set (LINDA) from Sweden covering, on average, 697,956 individuals per year during the period 1993-1995. It is argued that the Swedish dual income tax system avoids several of the methodological problems that have been present in previous studies based on US data. First, since capital gains are taxed at a flat rate, it is possible to include direct tax measures in the empirical analysis. As capital gains are taxed separately from ordinary income at a flat tax rate, individuals cannot lower their marginal capital gains tax rate by realizing capital gains when their income is temporarily low. Hence, there is no need to distinguish between transitory and permanent income effects. Second, in the Swedish dual income tax system, the marginal tax rate on capital gains will not depend on the size of accrued gains. Third, the capital gains tax rate is clearly exogenously given when capital gains are taxed at a flat tax rate. Fourth, as the Swedish tax system is based on individual taxation, it is also possible to control for gender differences in capital gains realization behavior.

The results presented in this paper indicate that higher taxes on capital gains are associated with both less capital gains realizations and smaller amounts of capital gains realizations given that the individual has decided to realize gains. Our results thus confirm previous findings from the US,

suggesting that higher capital gains taxes are associated with a lock-in effect. According to the results presented in the paper, a 10% tax increase will reduce capital gains realizations with 8.7%. This result is within the range of elasticities often reported in time-series studies.

A number of other household characteristics were also found to influence realizations of capital gains. Elderly and individuals with high taxable income, for example, seem to realize capital gains relatively often. These effects are quite large in size, while the influence of wealth, dividend payments, interest deductions and education on realization behavior are rather small. The individual taxation of household members in the Swedish tax system made it possible to study whether capital gains realization behavior differed between men and women. For the whole sample, no gender difference was found when the decision whether to realize any capital gains was studied. However, when women decided to realize capital gains, they seemed to realize smaller amounts of capital gains compared to men.

Finally, it was found that capital gains realization behavior differed between individuals that have taxable wealth and those that have no registered taxable wealth. According to the results, wealthy individuals seemed more sensitive to changes in capital gains tax rates than less-wealthy individuals. This indicates that tax avoidance strategies are more common among wealthy tax-payers. Investors (especially wealthy investors) might also engage more in tax evasion strategies when capital gains tax rates are high, implying that the response of capital gains realisations to tax rate changes is higher than reported in this study.

It is of interest to note that dynamic models of optimal taxation suggest

that capital income should not be taxed at all (Jodd, 1985; Chamley, 1986) because any tax will in the long-run leave the after-tax return on capital gains unchanged, while increasing the pre-tax return. This will discourage savings, reduce the capital stock and ultimately have a negative influence on aggregate output in the economy. Capital income is also highly elastic and responds quickly to tax rate changes (Feldstein et al., 1980), especially in a world where capital markets become more globalized. As summarized by Mankiw et al (2009, p. 21) these distortions are: *"...so large as to make any capital income taxation suboptimal compared with labor income taxation, even from the perspective of an individual with no savings"*. Our results thus support these findings, suggesting that higher taxes on capital gains yield large distortions that the policymakers want to avoid.

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Table 1: Means, standard deviations and definitions of variables

Variable	Mean (SD)	Definition
Capital gains	2649 (91665)	Realized capital gains, include net gains accrued from sales of stocks, bonds, other securities and real estate.
Capital gains/OMX	4.89 (1.48)	Realized capital gains divided by the average value of the OMX Stockholm 30 share index in period t.
Capital gains tax rate	0.22 (0.07)	The tax on capital gains paid by individuals residing in Sweden.
Income (L)	98176 (119578)	Taxable income from work and businesses in period t-1.
Loss of income (L,D)	0.04 (0.20)	Dummy, equal to one if the individual lost more than 20 percent of his/her income in period t-1.
Wealth (L)	77466 (1004732)	Taxable wealth in period t-1, recorded if wealth exceeds 800,000 SEK.
Dividend payments (L)	480.56 (11097)	The sum of dividend payments received in period t-1.
Interest deductions	6299 (24219)	Interest deductions
Family size	3.25 (1.57)	Number of members in the household.
Age	33.18 (23.03)	Age of the individual
Sex (D)	0.51 (0.50)	Dummy, equal to one if the individual is a female.
Marital status (D)	0.42 (0.49)	Dummy, equal to one if married or cohabiting.
Education (D)	0.11 (0.24)	Dummy, equal to one if the individual has attended at least three years of higher education.

Table 2. Estimated coefficients and elasticities (standard errors in parantheses)

Independent variable	Criterion function	Elasticity	Level equation	Elasticity
Constant	-1.58*		3.89*	
	(0.008)		(0.028)	
Capital gains tax rate	-1.86*	-0.87*	-0.84*	-0.19*
	(0.019)	(0.009)	(0.045)	(0.01)
Income (L)	1.14E-06*	0.23*	6.66E-07*	0.07*
	(1.02E-08)	(0.002)	(2.36E-08)	(0.002)
Loss of income (L,D)	0.12*	0.009*	-0.20*	-0.008*
	(0.006)	(0.0005)	(0.015)	(0.0006)
Wealth (L)	7.35E-08*	0.01*	4.61E-08*	0.004*
	(1.00E-9)	(0.0002)	(1.42E-9)	(0.0001)
Dividend payments (L)	3.98E-06*	0.004*	4.37E-06*	0.002*
	(9.79E-08)	(0.0002)	(1.17E-07)	(0.0001)
Interest deductions	3.80E-06*	0.05*	-1.23E-06*	-0.008*
	(5.29E-08)	(0.0007)	(6.06E-08)	(0.0004)
Family size	-0.041*	-0.27*	-0.038*	-0.13*
	(0.001)	(0.009)	(0.003)	(0.01)
Age	0.004*	0.31*	0.020*	0.65*
	(0.0001)	(0.006)	(0.0002)	(0.01)
Sex (D)	-0.00002	-0.00002	-0.22*	-0.11*
	(0.003)	(0.003)	(0.008)	(0.004)
Marital status (D)	0.21*	0.18*	0.14*	0.06*
	(0.004)	(0.003)	(0.001)	(0.004)
Education (D)	0.24*	0.06*	0.27*	0.03*
	(0.005)	(0.001)	(0.01)	(0.001)
Previous capital gains	0.98*	0.15*		
	(0.004)	(0.0007)		
Mills ratio			0.14*	
			(0.01)	
Number of obs.	2,093,867		151,462	

Notes: The asterisk * denote significance at the 1% level.

Table 3. Estimated coefficients and elasticities for the wealthy (standard errors in parantheses)

Independent variable	Criterion function	Elasticity	Level equation	Elasticity
Constant	-1.64* (0.023)		5.69* (0.072)	
Capital gains tax rate	-2.89* (0.05)	-1.18* (0.023)	-1.41* (0.11)	-0.31* (0.024)
Income (L)	2.69E-07* (2.37E-08)	0.073* (0.006)	2.42E-07* (2.89E-08)	0.04* (0.004)
Loss of income (L,D)	0.25* (0.019)	0.012* (0.0009)	-0.33* (0.032)	-0.009* (0.0009)
Wealth (L)	3.01E-08* (1.05E-9)	0.044* (0.002)	1.74E-08* (1.43E-9)	0.014* (0.001)
Dividend payments (L)	2.21E-06* (1.14E-07)	0.011* (0.0006)	2.96E-06* (1.29E-07)	0.008* (0.0004)
Interest deductions	4.55E-06* (1.61E-07)	0.039* (0.001)	-7.20E-07* (1.39E-07)	-0.003* (0.0006)
Family size	-0.005 (0.004)	-0.029 (0.023)	0.014* (0.009)	0.047* (0.03)
Age	0.016* (0.0003)	0.94* (0.018)	0.009* (0.0007)	0.30* (0.02)
Sex (D)	-0.06* (0.008)	-0.057* (0.008)	-0.21* (0.017)	-0.10* (0.008)
Marital status (D)	0.20* (0.012)	0.19* (0.011)	-0.075* (0.024)	-0.04* (0.012)
Education (D)	0.33* (0.011)	0.10* (0.003)	0.11* (0.020)	0.02* (0.003)
Previous capital gains	0.97* (0.010)	0.34* (0.004)		
Mills ratio			-0.15* (0.02)	
Number of obs.	205,440		28,220	

Note: The asterisk * denote significance at the 1% level.

Table 4. Estimated coefficients and elasticities for the less-wealthy (standard errors in parantheses)

Independent variable	Criterion function	Elasticity	Level equation	Elasticity
Constant	-1.58* (0.008)		3.24* (0.031)	
Capital gains tax rate	-1.69* (0.02)	-0.80* (0.09)	-0.64* (0.049)	-0.14* (0.011)
Income (L)	1.59E-06 * (1.13E-08)	0.31* (0.002)	1.47E-06* (3.91E-08)	0.14* (0.004)
Loss of income (L,D)	0.11* (0.007)	0.009* (0.0006)	-0.17* (0.016)	-0.007* (0.0007)
Wealth (L)	n/a	n/a	n/a	n/a
Dividend payments (L)	4.77E-06* (1.79E-07)	0.002* (0.00009)	6.86E-06* (2.53E-07)	0.002* (0.00006)
Interest deductions	3.50E-06* (5.64E-08)	0.048* (0.0008)	-9.68E-07* (6.76E-08)	-0.006* (0.0004)
Family size	-0.042* (0.001)	-0.28* (0.009)	-0.055* (0.004)	-0.18* (0.012)
Age	0.002* (0.0001)	0.16* (0.008)	0.018* (0.0003)	0.59* (0.01)
Sex (D)	0.023* (0.003)	0.025* (0.003)	-0.21* (0.008)	-0.11* (0.004)
Marital status (D)	0.18* (0.004)	0.15* (0.003)	0.15* (0.011)	0.06* (0.004)
Education (D)	0.19* (0.005)	0.043* (0.001)	0.23* (0.011)	0.025* (0.001)
Previous capital gains	0.97* (0.004)	0.13* (0.0006)		
Mills ratio			0.42* (0.01)	
Number of obs.	1,888,427		123,242	

Note: The asterisk * denote significance at the 1% level.