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Cross-Base Tax Elasticity of Capital Gains*

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Abstract

This paper studies the cross-base tax elasticity of capital gains realizations to labor income taxes when capital gains are taxed at a separate proportional tax rate. Using a longitudinal panel of over 265,000 individuals in Sweden, this paper shows in a regression kink design that labor income taxes affect capital gains at the extensive and intensive margins. An increase in the marginal labor income tax rate increases the likelihood of realizing capital gains and the amount of realized capital gains. One implication of this result is that the excess burden of labor income taxation is affected by cross-base tax elasticities.

Keywords: Capital Gains, Cross-Base Elasticity, Income Taxes

JEL Classification: H21, H24

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1 Introduction

The estimation of elasticities of taxable income with respect to marginal income tax rates has long attracted the interest of economists (see Saez, Slemrod, and Giertz, 2012, for a literature review), since the elasticity of taxable income can be used to estimate the excess burden of income taxation (Feldstein, 1995, 1999; Chetty, 2009). However, the empirical estimation of the taxable income elasticity in the presence of tax avoidance and tax evasion is challenging. For example, le Maire and Schjerning (2013) show that intertemporal income shifting substantially reduces taxable income elasticities. In this paper, I empirically identify the cross-base tax elasticities of other income sources with respect to marginal labor income taxes.[1]

Individuals can generate income in the form of labor income and capital income such as capital gains. In many countries, capital gains are taxed at a separate tax schedule (e.g., the United States, Germany, Finland, Norway) and often at a fixed proportional tax rate (Finland, Japan, and Sweden). The literature on capital gains typically focuses on the direct effect of capital gains taxation. The resulting "lock-in effect" has been documented in theoretical[2] and empirical[3] studies. A higher capital gains tax rate reduces the propensity to realize capital gains and reduces the level of capital gains. Despite agreement that capital gains taxes affect individual portfolio decisions (e.g., Feldstein, Slemrod, and Yitzhaki, 1980; Auten and Clotfelter, 1982; Auerbach, 1988; Bergstresser and Poterba, 2002; Ivković, Poterba, and Weisbenner, 2005), there is no empirical evidence whether capital gains are also sensitive to labor income taxation.

This paper tests the potential cross-base tax sensitivity of capital gains to labor income taxes. If capital gains are taxed at a tax rate that is independent from the marginal tax rate on labor income or income from self-employment, individuals may be responsive to tax

[1] Dahlby and Ferede (2012) use provincial-level macro data from Canada and provide evidence of cross-base elasticities of personal income taxes and corporate income taxes.

[2] See, for example, Constantinides (1983); Auerbach (1991); Klein (1999); Poterba (2002).

[3] See, for example, Reese (1998); Poterba and Weisbenner (2001); Dai et al. (2008); Sialm (2009); Jacob (2013).

rate differences between labor and capital income. An increase in the labor income tax rate reduces net-of-tax labor income. In the presence of adjustment costs or hourly constraints (Chetty et al., 2011), a labor income tax increase reduces consumption while the labor supply remains unchanged. This, in turn, may result in increased capital gains realization activity to maintain the level of consumption. However, if individuals instead increase "on-the-job" leisure (Dickenson, 1999), capital gains realizations may not respond at all to changes in labor income taxes. In this case, cross-base tax elasticity may reflect a behavioral bias; individuals may perceive capital gains taxes as low compared to labor income tax rates.

I test the potential spillover effect of labor income taxes on capital gains realizations using the comprehensive micro panel data of over 265,000 Swedish individuals over 1991–2005. Estimation of this cross-base tax sensitivity involves econometric challenges since, for example, in the United States, long-term capital gains tax rates depend on the level of labor income and vice versa. The Swedish case offers a suitable setting to isolate the effect of labor income taxes on capital gains realizations and to overcome the endogeneity issue where the level of capital gains affects the marginal income tax rate. Since 1991, Sweden has had a dual income tax with progressive tax rates on labor income and income from self-employment. Capital income such as capital gains are taxed at a separate income schedule at a proportional tax of 30%[4] and there is no variation in capital gains tax rates across individuals. Hence, in the absence of cross-sectional variation in capital gains tax rates, identification of cross-base tax sensitivity stems from variation in labor income tax rates across individuals and over time.

I identify the cross-base tax sensitivity of capital gains realizations with respect to labor income taxes in a regression kink design. I exploit a large kink in the marginal labor income tax rate around which the labor income tax rate increases by 20 percentage points. I sort individuals into bins around the kink and analyze the change in the slope coefficient of total income on capital gains realization activity at the intensive and extensive margins. The critical assumption of this approach—random assignment around the kink—is confirmed. The distribution around the kink is smooth and bunching estimates are insignificant. This is in

[4] The tax rate was temporarily reduced to 25% in 1992 and 1993 and to 12.5% in 1994.

line with the argument of high adjustment costs mitigating the effect of taxes on the labor supply (Chetty et al., 2011). To study the extensive margin, I use the likelihood of realizing capital gains as a dependent variable. Average realized capital gains are used as a measure of the intensive margin. For both the extensive and intensive margins, the slope coefficient on income significantly increases from below the kink to above the kink. This indicates that taxpayers are (1) more likely to realize capital gains and (2) realize higher capital gains if they are subject to higher labor income tax rates.

The second step is to estimate elasticities using the approach of Auten and Clotfelter (1982), Burman and Randolph (1994), and Auerbach and Siegel (2000). The empirical model controls for three lags of income, wealth, socioeconomic characteristics, state fixed effects, year fixed effects, and individual fixed effects. The latter ensure that the identification of tax elasticities stems from changes in marginal income tax rates at the individual level and not from cross-sectional differences that are sticky over time. The inclusion of income and wealth controls for the availability of funds.[5]

The results suggest that an increase in the labor income tax increases the likelihood of an individual realizing capital gains. This is the opposite result from earlier studies on the elasticity of capital gains income with respect to capital gains taxes. The corresponding elasticity of the likelihood of realizing capital gains with respect to the marginal income tax rate amounts to 0.05. At the intensive margin—measured by the amount of realized capital gain—the elasticity of capital gains with respect to the marginal income tax rate is 0.04; that is, a 1% increase in the marginal tax increases realized capital gains by 0.04%. To put this result into perspective, if a taxpayer goes from the first tax bracket of 31% to the next tax bracket of 51%, the likelihood of realizing capital gains increases by 1 percentage point—4.3% of the sample mean—and average capital gains increase by 4%. The estimated elasticities are small but statistically significant. They are also in line with small labor supply elasticities and labor income elasticities (Saez, 2010; Chetty et al., 2011; Chetty, 2012; Saez, Slemrod,

[5] Since household portfolio data are not available, I cannot directly control for the penetration of capital gains assets in the regression.

and Giertz, 2012). The economic magnitudes of my estimates are also well below estimates for capital gains tax elasticity from other studies that are between -0.5 and -0.9 (e.g., Auten and Clotfelter, 1982; Burman and Randolph, 1994; Auerbach and Siegel, 2000; Daunfeldt, Praski-Ståhlgren, and Rudholm, 2010). Still, the results suggest that high tax rates in other tax bases incentivize (1) more individuals to realize capital gains and (2) individuals to realize higher capital gains.

Further, I test whether the spillover effect extends to other capital income sources as well. Using interest income as well as dividend income as dependent variables in the regression kink design, I again find evidence of cross-base tax sensitivities. The corresponding elasticity estimates suggest that a 1% increase in the labor income tax increases interest income by 0.1%. Similarly, dividend income increases by 0.022%. This indicates that the presence of different tax schedules leads to tax sensitivities across tax bases. One possible explanation, not testable due to data limitations, of this finding is that individuals rebalance their portfolio and include a larger share of dividend-paying stock as well as bonds with higher interest yields in their portfolios. Another explanation for my findings could be income shifting by self-employed and business owners (Pirttilä and Selin, 2011; Alstadsæter and Jacob, 2013). However, even when the self-employed are excluded from the sample, the cross-base tax sensitivity of interest income, dividend income, and capital gains is still statistically significant and close to the baseline estimate.

This study contributes to the literature on the elasticity of taxable income with respect to marginal income tax rates (see Saez, Slemrod, and Giertz, 2012, for a literature review). The implications of the elasticity of taxable labor income on the deadweight loss of an income tax (Feldstein, 1995, 1999), therefore, are affected not only by tax avoidance and tax evasion (Chetty, 2009), but also by the cross-base tax sensitivity of capital income to labor income taxes. Taxpayers increase income in other income sources such as capital gains in response to an increase in the labor income tax. This paper also contributes to a large body of empirical work studying the lock-in effect of capital gains taxes (Feldstein, Slemrod, and Yitzhaki, 1980; Auten and Clotfelter, 1982; Burman and Randolph, 1994; Poterba, 1987; Auerbach,

1988; Bergstresser and Poterba, 2002; Ivković, Poterba, and Weisbenner, 2005). My results indicate that capital gains realization decisions are additionally responsive to labor income taxes. Since many countries have separate tax schedules for capital gains, the lock-in effect depends on the level of capital gains taxes and, to some extent, on labor income taxes.

The remainder of the paper is organized as follows: Section 2 discusses the theoretical background. Section 3 presents institutional details and associated data. Section 4 presents the empirical estimation strategy, predictions, and empirical results. Section 5 concludes the paper.

2 Theoretical Analysis of Cross-Base Elasticities

This section illustrates the potential effect of labor income taxes on capital gains realization decisions. In a standard capital gains realization decision model (e.g., Constantinides, 1983), the optimal liquidation policy depends on the capital gains tax rate. Losses are immediately realized and capital gains are deferred. If the tax rate on capital gains tax rates decreases, individuals increase their capital gains realization activity and realize higher capital gains (e.g., Feldstein, Slemrod, and Yitzhaki, 1980; Auten and Clotfelter, 1982; Auerbach, 1988; Bergstresser and Poterba, 2002; Ivković, Poterba, and Weisbenner, 2005; Jacob, 2013).

Let me denote the decision to realize capital gains as a function of the capital gains tax rate τ^{CG}: $CG(\tau^{CG})$ with $\frac{\partial CG(\tau^{CG})}{\partial \tau^{CG}} < 0$; that is, a higher (lower) capital gains tax rate reduces (increases) capital gains realizations and the amount of income from realized capital gains (e.g., Feldstein, Slemrod, and Yitzhaki, 1980; Auten and Clotfelter, 1982; Burman and Randolph, 1994; Poterba, 1987; Auerbach, 1988; Bergstresser and Poterba, 2002; Ivković, Poterba, and Weisbenner, 2005). Further, j denotes the fraction of the portfolio that is reallocated. A higher j implies that overall capital gains increase. Similar to overall capital gains, the share of realized capital gains decreases in the capital gains tax rate, that is, $\frac{\partial j(\tau^{CG})}{\partial \tau^{CG}} < 0$.[6] Overall,

[6] One implicit assumption is that individuals realize gains. This corresponds to empirical evidence on the disposition effect and the tendency to hold losing stocks too long and to sell winning stocks too early (Shefrin and Statman, 1985; Odean, 1998). This tendency is further strengthened in my sample, since capital losses can only be fully deducted against other capital gains. Otherwise, only 70% are deductible.

the standard model of capital gains realizations does not predict any effect of changes in the labor income tax rate on capital gains realizations if there is a separately taxed income schedule for capital gains.

The link of capital gains realizations to labor income tax rates could be established through an extension of the canonical static labor–leisure model (e.g., Chetty, 2009). An individual chooses how much time to work, denoted l, at a fixed wage rate w. Labor income, wl, is subject to income taxation at the rate τ^{Labor}. The amount of time not spent on working is allocated to leisure. I denote the disutility from working as $\varphi(l)$. Additionally, I assume that the individual chooses the share of realized capital gains, j. Capital gains ($CG(j)$) are taxed at the fixed proportional tax rate $\overline{\tau^{CG}}$. The individual then maximizes his or her utility

$$\begin{aligned} \max_{l,j} \; & u(c,l) = c - \varphi(l) \\ & \text{s.t. } c = y + (1-\tau^{Labor})wl + (1-\overline{\tau^{CG}}) \cdot CG(j) \end{aligned} \tag{1}$$

where c is consumption and y is unearned income other than capital gains.[7] Prior studies implicitly include capital gains in unearned income and j does not enter the model as a choice variable (e.g., Chetty, 2009). This paper argues that the discretionary nature of capital gains is an important extension of the canonical static labor–leisure model. If we assume that individuals face very high adjustment costs and that an adjustment of hours in response to a change in the labor income tax is imperfect, the decision of how much time to work becomes fixed, $\bar{l}$. Then the individual can maximize his or her utility only with respect to j, the capital gains realization activity. A higher tax rate on labor income τ^{Labor} reduces the net-of-tax labor income and, thus, consumption. If adjustment costs are high, individuals cannot reduce the labor supply in response to the tax increase. Hence, they face the same disutility from working, $\varphi(\bar{l})$, but have lower consumption. This results in a reduction in overall utility. To keep the level of consumption and utility constant, individuals could increase capital gains

[7] If capital gains are not be sensitive to labor income taxes, the optimization problem is the same as for Chetty (2009). Capital gains income would then be included in unearned income y.

realization activity. Put differently, an increase in the tax rate on labor income, τ^{Labor}, may increase capital gains realization activity j, or $\frac{\partial j(\tau^{Labor})}{\partial \tau^{Labor}} > 0$.

However, if individuals instead increase on-the-job leisure (Dickenson, 1999), capital gains realizations may not respond at all to changes in labor income taxes. In other words, once individuals increase on-the-job leisure, an effect of labor income taxes on capital gains should not be observed. Hence, one implication of the labor–leisure model is that cross-base tax elasticity may simply reflect a behavioral bias. Relative to labor income taxes, individuals may perceive capital gains taxes as low and, thus, they increase capital gains realizations.

3 Institutional Setting and Associated Data

3.1 The Swedish Dual Income Tax

In 1991, Sweden implemented a dual income tax (see Agell, Englund, and Södersten, 1996, for a comprehensive overview on the reform). The dual income tax comprises two tax bases. Earned income, such as labor income or income from self-employment, is taxed at the progressive income tax rate. Marginal tax rates range from about 31% to 56%.[8] There are two kinks in the tax rate schedule. In the regression kink design below, I exploit the first kink, around which the marginal income tax rate increases by 20 percentage points, from 31% to 51%. Since 1991, the tax rate on capital income is 30%; that is, interest income, dividend income, and capital gains are taxed at a rate of 30%, independent of the level of earned income. Between 1992 and 1994, capital gains tax rates were temporarily reduced to 25% and 12.5%, respectively (see Jacob, 2013). Since capital gains tax rates apply similarly to all taxpayers, identification of the tax sensitivity stems from the variation in marginal income tax rates on earned income. Further, there is no difference in the tax treatment between long- and short-term capital gains since 1991. Table 1 presents the bottom and top marginal income tax rates for the 1991–2005 period.

[8] There is a standard deduction that reduces the marginal tax rate to 0%. I account for this standard deduction when computing the individual's marginal tax rate.

[Insert Table 1 about here]

3.2 Data

This study is based on a panel data set provided by Statistics Sweden (Longitudinal INdividual DAta, or LINDA) that covers the period 1991–2005 (see also Jacob, 2013). These data comprise a representative panel of 3.35% of the Swedish population, with information on income and socioeconomic characteristics, such as age, gender, marital status, and household size.[9] I restrict the sample in several ways. First, I require individuals to have information on income and socioeconomic characteristics for at least five consecutive years. I exclude observations where the individual's age is below 18. I exclude observations that are not within the 0.01th and 99.99th percentiles of the total income distribution. The final sample comprises 267,991 individuals and 3,003,513 observations.

3.3 Dependent and Independent Variables

Table 2, Panel A, presents variable definitions and summary statistics for the two capital gains measures for the 1991–2005 period. The variable $CG\_Realized_t$ is a dummy variable equal to 100 for individuals realizing capital gains in year t and zero otherwise. The variable CG is the SEK amount of realized capital gains in year t, in thousands. The amount of capital gains is defined as net realized capital gains over all transactions in one fiscal year. Monetary values are translated into real terms (base year 2000), using the Swedish GNP deflator provided by Statistics Sweden. In the sample, 22.5% of all individual–year observations involve capital gains. The average realized before-tax capital gain amounts to SEK 31,713 (USD 1 = about SEK 9.1718 in 2000). Using administrative tax data has several advantages but it also has limitations. I observe neither the number of transactions nor the timing of transactions. Further, the data do not allow identification of the type of asset that is sold. Hence, the

[9] Aggregated wealth information is only available above the tax-exempt wealth threshold. This threshold, for example, amounted to 900,000 Swedish kronor (SEK) in 2000.

empirical tests are based on the aggregate of all capital gains realizations of one taxpayer in one fiscal year.

[Insert Table 2 about here]

Panel B of Table 2 presents summary statistics for the socioeconomic variables that are included in the regression analysis. The variable $Income_t$ is the individual's total income in year t. Income comprises labor income, income from self-employment and partnerships, interest income, and dividends. I exclude capital gains from the income measure. The variable $Wealth_t$ is reported net wealth for tax purposes. Data on the asset mix of household portfolios are unfortunately not available from LINDA. The variable MTR is the marginal income tax rate on earned income, that is, labor income and income from unincorporated businesses. Income averages SEK 185,151 per year over the 1991–2005 period and varies considerably, from SEK 106,845 (25th percentile) to SEK 222,783 (75th percentile). The average marginal income tax rate on earned income is 35.59%. Socioeconomic variables include marital status, income composition, and information on household size.

4 Empirical Results

4.1 Non-Parametric Analysis of Cross-Base Tax Sensitivity

The simplest way of testing potential cross-base tax sensitivity is to analyze if capital gains realizations respond to the large kink in the Swedish tax code. The identification of the cross-base tax effect is based on a non-parametric regression kink design. In particular, I test if the additional central government tax of 20 percentage points, where the marginal income tax rate increases from 31% to 51%, affects the likelihood of realizing capital gains and the amount of realized capital gains. For this purpose, I sort individuals into bins of SEK 1,000 (about USD 109 at the 2000 exchange rate of 9.1718 SEK/USD) of earned income centered on the central government tax threshold in a given year. I then compute the percentage of individuals with capital gains in each bin to test the extensive margin (Figure 2). For the intensive margin, I use the average realized capital gain in each bin (Figure 3).

The key assumption of this approach is that the assignment variable, earned income in this case, is randomly distributed around the kink. I test whether this assumption is violated by looking at the distribution of earned income around the kink. Bunching around the kink point would indicate that the assignment is not random. Thus, the approach to identify an effect of labor income taxes on capital gains would be biased. I apply the methodology of Chetty et al. (2011) and estimate the excess mass around the kink point. I vary the range around the kink from SEK 2,000 to SEK 10,000 and obtain excess mass estimates between -0.024 and 0.035. Since these estimates are not significant at any conventional level (t-statistics < 1.12), I conclude that there is no bunching of earned income around the state tax threshold and, most importantly, that the assignment variable is randomly distributed around the kink. This result also implies that labor income is not sensitive to the state tax threshold above which the marginal income tax rate increases from 31% to 51%. This corresponds to the assumption of a fixed labor supply $\bar{l}$ in the model section above. Figure 1 presents the distribution of earned income around the kink and supports the insignificant excess mass estimates.

[Insert Figure 1 about here]

In general, high-income individuals are more likely to realize capital gains and to realize higher capital gains (e.g., Auerbach and Siegel, 2000). Therefore, I expect a positive slope of the income bin. In other words, capital gains realization activity increases in income. This is a general observation, independent of the tax rate increase around the kink. If the labor income tax rate has a positive effect on capital gains realizations, I expect this slope coefficient to be larger if individuals are above the kink. Put differently, high labor income tax rates would (1) increase the likelihood of realizing capital gains and (2) the amount of realized gains. Figure 2 presents the corresponding scatter plots with the income bin (in SEK around the threshold) on the horizontal axis and the percentage of individuals realizing capital gains on the vertical axis. Figure 3 uses average realized capital gains on the vertical axis. The vertical line indicates the kink at which the additional 20% tax on labor income applies. Both figures use a range of SEK 100,000 (about USD 10,903) in annual income around the

central government tax threshold. This narrow range ensures that individuals are similar and comparable in observable and unobservable characteristics. For example, within a range of about USD 11,000 income, it is reasonable to assume that there are no differences in the penetration of capital gains assets that could bias the results.[10]

[Insert Figure 2 about here]

[Insert Figure 3 about here]

Figure 2 indicates that the likelihood of realizing capital gains increases in income. Around the kink, the slope of the bin variable increases. Below the kink, an increase in income of SEK 1,000 is associated with an increase in the percentage of individuals realizing capital gains of 0.05. Above the kink, the slope coefficient increases to 0.09, an increase of about 80%. Since the difference in slope coefficients is statistically significant (t-statistic = 7.38), the increase in the marginal labor income tax rate increases the likelihood of realizing capital gains. The intuition of this result is as follows. Absent of the tax rate increase, individuals right of the kink would have been less likely to realize capital gains.

Similarly, Figure 3 shows that the increase in the marginal income tax rate affects the amount of realized capital gains. The slope coefficient increases from 0.1475 (below the kink) to 0.2784 (above the kink), or by 89%. The increase in slope coefficients is significant at the 5% level (t-statistic = 1.98). Again, this implies that, absent of the kink, individuals right of the kink would have realized lower capital gains. In sum, graphical analysis of the kink shows that a higher labor income tax rate has an effect at the extensive margin as well as at the intensive margin of capital gains realizations. In particular, capital gains are realized more often and higher capital gains are realized if the marginal tax rate on labor income increases.

[10] To test that the increasing penetration of assets for higher-income individuals does not explain this result, I repeat the analysis at pseudo-kinks. When moving the kink SEK 100,000 (SEK 200,000) upward, the slope coefficients of income are similar left and right of these pseudo-kinks.

4.2 Empirical Estimation of Cross-Base Elasticity

I next turn to the estimation of cross-base tax elasticities. Empirical models estimating capital gains tax elasticity use measures of permanent and transitory capital gains tax rates (e.g., Auten and Clotfelter, 1982; Burman and Randolph, 1994; Auerbach and Siegel, 2000). The key challenge of these models is that the decision to realize capital gains and the level of capital gains affect the marginal capital gains tax rate. Therefore, a compelling estimation requires an instrumental variables approach to obtain "first-dollar" marginal capital gains tax rates.

These empirical challenges do not apply in the setting used in the present paper. The marginal income tax rate on labor income is independent from the level of capital gains. Hence, the income tax rate is exogenous with respect to the level of realized capital gains and the decision to realize capital gains.[11] I follow the semi-log functional form of Auten and Clotfelter (1982), Burman and Randolph (1994), and Auerbach and Siegel (2000), but use the marginal income tax rate on labor income MTR instead of an instrumented capital gains tax rate. To test whether the decision to realize capital gains is affected by cross-base tax sensitivities, I use the following two-stage model:

$$CG\_Realized_{i,t} = \alpha_0 + \alpha_1 \cdot MTR_{i,t} + \boldsymbol{\alpha}\mathbf{X} + \alpha_i + \alpha_t + s_i + \epsilon_1 \tag{2}$$

$$Ln(CG)_{i,t} = \beta_0 + \beta_1 \cdot MTR_{i,t} + \boldsymbol{\beta}\mathbf{Z} + \beta_i + \beta_t + s_i + \epsilon_2 \text{ if } CG\_Realized_{i,t} > 0 \tag{3}$$

where $CG\_Realized$ is a dummy variable equal to 100 if individual i realizes capital gains in year t, $Ln(CG)$ is the natural logarithm of the SEK amount of realized capital gains of individual i in year t, and MTR is the marginal income tax rate on the labor income of individual i in year t. Equation (2) tests the effect at the extensive margin. A positive α_1 indicates that a higher labor income tax rate increases the likelihood that individuals realize

[11] One potential concern is that labor income and thus the labor income tax rate could depend on accrued capital gains; that is, an individual could reduce his or her labor supply because of the expectation of capital gains. To control for this effect, I rerun the regressions using lagged marginal income tax rates. I present this robustness test below.

capital gains. Equation (3) tests the intensive margin. In this case, a positive β_1 indicates that a higher labor income tax rate increases the level of realized capital gains, conditional on their realization. Theoretical models on capital gains realizations (e.g., Constantinides, 1983) would predict that $\alpha_1 = 0$ and $\beta_1 = 0$. That is, individuals base realization decisions on the absolute level of capital gains tax rates. However, if the non-parametric results hold, I would obtain positive coefficients, $\alpha_1 > 0$ and $\beta_1 > 0$.

The empirical model does not include the capital gains tax rate. Due to the lack of variation in capital gains tax rates across individuals, year fixed effects α_t and β_t soak up the variation of capital gains tax rates over time. The inclusion of year fixed effects thus has two effects. They control for the time-series variation in capital gains tax rates between 1992 and 1995, which is exploited by Daunfeldt, Praski-Ståhlgren, and Rudholm (2010). The advantage of my setting is that the identification of tax sensitivity is based on changes in the marginal tax rate on labor income. In contrast to the United States, where the long-term capital gains tax rate also depends on the level of labor income, identification of α_1 and β_1 in my setting stems only from changes in the labor income tax rate. Year fixed effects further control for the business cycle and macroeconomic effects on stock returns. I also include individual fixed effects. This ensures that identification of the effect of labor income taxes on capital gains realizations stems from changes in MTR at the individual level over time and not from differences in tax rates across individuals.

The vectors $\mathbf{X}$ and $\mathbf{Z}$ comprise individual-level control variables (see also Calvet, Campbell, and Sodini, 2009; Daunfeldt, Praski-Ståhlgren, and Rudholm, 2010; Jacob, 2013). I include three lags of income and three lags of taxable wealth. Since household portfolio data are not included in LINDA, I cannot directly control for the penetration of capital gains assets. I use income and wealth variables to proxy for the availability of capital gains assets. I additionally control for marital status, household size, and dummy variables for pension, social assistance, business income, and an increase as well as a decrease in household size. I include indicator variables equal to one if the individual resides in a small town, a large city, or the county capital, respectively. Vector $\mathbf{Z}$ additionally includes the inverse Mills ratio from estimating

equation (2) to control for sample selection. I include one lag of *CG_Realized* as exogenous variable when estimating the inverse Mills ratio (see also Daunfeldt, Praski-Ståhlgren, and Rudholm, 2010; Jacob, 2013). I also add state fixed effects to account for regional differences across the 21 counties in Sweden (s_i). My statistical inference is based on robust standard errors clustered at the individual level.

4.3 Cross-Base Tax Sensitivity of Capital Gains

Table 3 summarizes the regression results from estimating equations (2) and (3), using OLS.[12] The results suggest that labor income taxes have a positive effect on capital gains at the intensive and extensive margins. An increase in the marginal income tax rate on earned income increases the likelihood of an individual realizing capital gains. That is, higher income tax rates are associated with more individuals realizing capital gains (*extensive margin*). The corresponding elasticity of the likelihood of realizing capital gains with respect to the marginal income tax rate is significant and amounts to 0.047. Even though the resulting elasticity is small, the economic effects are sizable. For example, if a taxpayer goes from the first tax bracket (31%) to the next tax bracket (51%), the likelihood of realizing capital gains increases by 1 percentage point, or 4.3% of the sample mean.

[Insert Table 3 about here]

At the *intensive margin*, my results suggest that a higher income tax rate is associated with higher realized capital gains. The elasticity of capital gains with respect to the marginal income tax rate is again small (0.040) but statistically significant. Still, there are economic effects. If a taxpayer goes from the first tax bracket (31%) to the next tax bracket (51%), average realized capital gains increase by 4%. A 4% increase in capital gains amounts to about SEK 1,300, or 0.7% of average total income.

The economic magnitudes of my estimates are well below estimates for the elasticity of capital gains with respect to the capital gains tax rate. For example, Auten and Clotfelter (1982);

[12] I relax the assumption of estimating equation (2) with OLS below and present regression results from the first-stage probit regression, including one lag of $CG\_Realized_{i,t}$ as the exogenous variable.

Burman and Randolph (1994); Auerbach and Siegel (2000); Daunfeldt, Praski-Ståhlgren, and Rudholm (2010) estimate elasticities between -0.5 and -0.9. Jacob (2013), using Swedish data, estimates the response to capital gains tax rates around the introduction of the proportional income tax on capital gains. The estimated elasticities amount to -1.2 and -0.3 at the extensive and intensive margins, respectively. The comparison shows that capital gains tax elasticities are much larger than the cross-base elasticity. For example, for the amount of realized capital gains, the cross-base elasticity is about one-ninth of the elasticity of capital gains with respect to the capital gains tax rate.

The results for the control variables in Table 3 are in line with my expectations. For example, higher-income individuals are more likely to realize capital gains and also to realize higher capital gains. A 1% increase in total income increases the likelihood of realizing capital gains by 0.013% and increases the amount of realized capital gains by 0.005% (using two lags of income). In addition, the negative effect of age on the level of realized capital gains is in line with earlier evidence from the United States (Auten and Clotfelter, 1982; Burman and Randolph, 1994). Any change in household size ($HS\ Inc$ and $HS\ Dec$) or a move across municipalities ($Move$) increases the likelihood of realizing gains, as well as the level of capital gains. For example, an increase in household size, $HS\ Inc$, is associated with increasing the likelihood of realizing gains by 2.0 percentage points. The amount of realized gains increases by about 10%. Finally, if an individual generates income from self-employment ($BusInc$), the likelihood of realizing capital gains increases, as do the levels. The positive and significant inverse Mills ratio indicates the importance of controlling for selection in the empirical model. Otherwise the model will produce biased estimates, since both the decision to realize gains and the amount of realized gains are affected by MTR.

4.4 Robustness Tests

This section presents two robustness tests of the estimated effects. First, using MTR_t in estimating equations (2) and (3) could lead to reverse causality. Accrued capital gains could affect the labor–leisure decision and thus affect the marginal income tax rate. To test if my

results are robust to this potential explanation, I use one lag of MTR as the tax variable. Panel A of Table 4 presents the coefficient estimates and elasticities for MTR_{t-1}. The coefficient estimates and elasticities are still significant and somewhat larger than in my baseline tests. Therefore, my result of a positive effect of labor income taxes on capital gains realization activity cannot be explained by reverse causality.

[Insert Table 4 about here]

Second, one potential concern about the baseline results is that equation (2) is estimated using a linear probability model. Panel B of Table 4 therefore presents regressions results from the first-stage probit model, in which I also include the exogenous variable $CG\_Realized_{i,t-1}$. I present coefficient estimates using the current MTR and one lag of MTR. In both specifications, I obtain a positive and significant coefficient for MTR. Hence, the results are robust to alternative estimation methods. In sum, my results are consistent with a lock-out effect of labor income taxes. High tax rates in other tax bases incentivize (1) more individuals to realize capital gains and (2) individuals to realize higher capital gains.

4.5 Cross-Base Tax Sensitivity of Dividend and Interest Income

Cross-base tax sensitivity may not only affect capital gains income but also interest and dividend income. Sweden also taxes interest and dividend income at a flat tax rate of 30% that is independent from labor income tax rates. This tax treatment creates an income-shifting incentive from labor income taxes to capital income taxes (Pirttilä and Selin, 2011; Alstadsæter and Jacob, 2014; le Maire and Schjerning, 2013) and has been described as the Achilles heel of Nordic dual income taxes (Sørensen, 1994). To test whether changes in the labor income tax rate also affect the level of interest income and dividend income, I replicate the regression kink design presented in Figures 2 and 3 but use dividend income and interest income, respectively, as the dependent variables.

Panel A of Figure 4 presents the corresponding scatter plots with the earned income bin (in SEK centered around the threshold) on the horizontal axis and average dividend income

on the vertical axis. Panel B uses average interest income on the vertical axis. As for capital gains, average dividend income and interest income increase in overall earned income; that is, individuals with higher earned income also generate higher dividend and interest income. From below the kink to above the kink, the slope coefficient of the income bin increases from 0.010 to 0.023, or by over 230%. Since the difference in slope coefficients is statistically significant (t-statistic = 6.63), an increase in the marginal labor income tax rate positively affects dividend income. I find a similar result for interest income. The slope coefficient of the income bin in Panel B increases from 0.024 (below the kink) to 0.036 (above the kink), or by 49%. The increase in slope coefficients is significant at the 1% level (t-statistic = 8.35). These results show that labor income taxes also positively affect the level of dividend and interest income.

[Insert Figure 4 about here]

I next rerun equation (2) and use the natural logarithm of interest income and dividend income, respectively, as dependent variables to obtain elasticity estimates. Table 5 presents the coefficient estimates and corresponding elasticities for MTR. Both models include control variables and fixed effects. The results confirm the positive cross-base elasticity of interest and dividend income with respect to the marginal labor income tax rate. The resulting elasticities are 0.10 for interest and 0.02 for dividends and are statistically significant. These elasticity estimates again correspond to small labor supply elasticities and labor income elasticities (Saez, 2010; Chetty et al., 2011; Chetty, 2012; Saez, Slemrod, and Giertz, 2012). My results thus indicate that labor income tax rates have a positive and significant effect on interest and dividend income. Since I control for three lags of income, the cross-base elasticity is less likely to be driven by differences in overall income.

[Insert Table 5 about here]

The graphical evidence and estimation of elasticities suggest that dividend income and interest income are both sensitive to changes in labor income taxation. One potential explanation is that individuals invest in riskier assets when rebalancing their portfolios in response

to increases in labor income taxes. This explanation is, unfortunately, not testable, due to a lack of portfolio information in the data. For example, individuals could shift funds from a savings account to government or corporate bonds. This would increase interest income. Similarly, reinvestment of realized capital gains could result in a re-allocation of funds toward dividend-paying stocks, since the capital income tax rate is (perceived to be) lower than the labor income tax rate. Unfortunately, due to data limitations and a lack of information on portfolio composition, this explanation cannot be tested empirically.

4.6 Cross-Base Tax Sensitivity: Robustness to the Exclusion of the Self-Employed

One concern about my results is access to income shifting (Alstadsæter and Jacob, 2013). Not every taxpayer who is willing to shift income across tax bases has the opportunity to do so. Pirttilä and Selin (2011) show that income-shifting incentives of the dual income tax are captured by the self-employed. As a result, the elasticity of the taxable income of the self-employed decreases from 0.43—0.53 to 0.14-–0.20 once intertemporal income shifting is controlled for (le Maire and Schjerning, 2013). To ensure that my results are not entirely driven by a few individuals responding to tax changes (e.g., Chetty et al., 2013), I rerun all the tests, excluding the self-employed.

[Insert Table 6 about here]

Table 6 presents the resulting elasticities with respect to the marginal income tax rate. Column (1) shows the results for the likelihood of realizing capital gains. In Columns (2) through (4), I use the amount of realized capital gains, interest income, and dividend income, respectively, as the dependent variables. The estimated coefficients confirm the results from Tables 3 and 5. The MTR coefficients are similar to the baseline estimates and are statistically significant.[13] This suggests that the labor income tax rate has cross-base effects on capital gains, interest income, and dividend income. This result is not driven by self-employed individuals with access to income shifting.

[13] Note that the coefficient estimate for $Ln(CG)$ amounts to 0.0013. The standard error is 0.0007, which results in a t-statistic of 1.74.

5 Conclusion

This paper studies the cross-base elasticity of capital gains with respect to labor income taxes. When capital gains are taxed at a separate, proportional tax rate, this paper shows that the likelihood to realized gains and the level of capital gains is responsive to the marginal income tax rate on labor income and income from self-employment. This cross-base income elasticity also holds for interest income and dividend income.

My results have two main implications. The elasticity of taxable income with respect to marginal tax rates typically relates to the labor supply and labor income (see Saez, Slemrod, and Giertz, 2012, for a literature review). The results presented in this paper imply that labor income taxes can have spillover effects on other tax bases that are taxed at separate and independent tax schedules. Therefore, the implications of the elasticity of taxable income on the deadweight loss of a labor income tax (Feldstein, 1995, 1999) are affected by tax avoidance and tax evasion (Chetty, 2009) and by the cross-base tax sensitivity of capital income to labor income taxes. Hence, modeling the excess burden of an income tax should comprise all income sources that are potentially affected by labor income taxes.

Second, prior empirical work studies the lock-in effect of capital gains taxes (Feldstein, Slemrod, and Yitzhaki, 1980; Auten and Clotfelter, 1982; Poterba, 1987; Auerbach, 1988; Bergstresser and Poterba, 2002; Ivković, Poterba, and Weisbenner, 2005). Capital gains realization decisions are not only affected by capital gains tax rates. The tax rate on labor income additionally affects capital gains realization behavior. Many countries, such as the United States, Japan, and Germany, have separate tax schedules for capital gains income. Therefore, the lock-in effect depends on the level of capital gains taxes and, to some extent, on the level of labor income taxes. My findings show that labor income taxes have a lock-out effect.

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Figure 1: Distribution of Earned Income around the State Tax Threshold

This figure plots the empirical distribution of labor income around the state tax threshold (*Actual Distribution*). Each point represents the number of observations for each SEK 1,000 bin. The solid gray line is the counterfactual distribution using the methodology of Chetty et al. (2011).

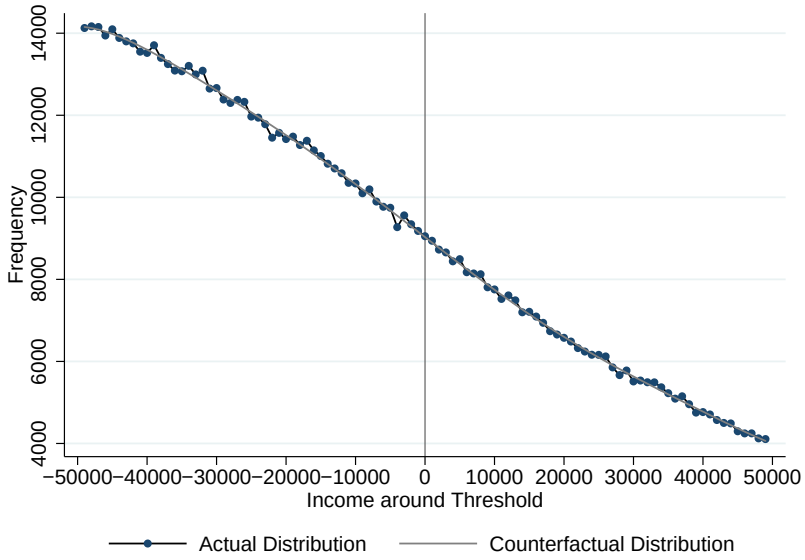

Figure 2: Labor Income Taxes and the Likelihood of Realizing Capital Gains

This figure plots the percentage of individuals realizing capital gains in each SEK 1,000 bin of earned income centered at the kink of the income tax rate schedule. The vertical line indicates the kink at which the additional 20% labor income tax applies. The black lines comprise predicted values of linear regressions allowing for different slopes around the kink.

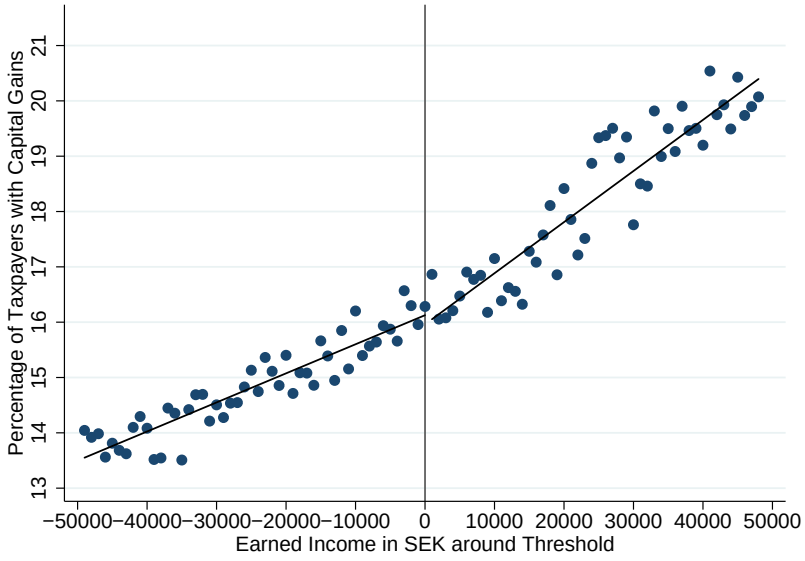

Figure 3: Labor Income Taxes and the Amount of Realized Capital Gains

This figure plots average realized capital gains in each SEK 1,000 bin of earned income centered at the kink of the income tax rate schedule. The vertical line indicates the kink at which the additional 20% labor income tax applies. The black lines comprise predicted values of linear regressions allowing for different slopes around the kink.

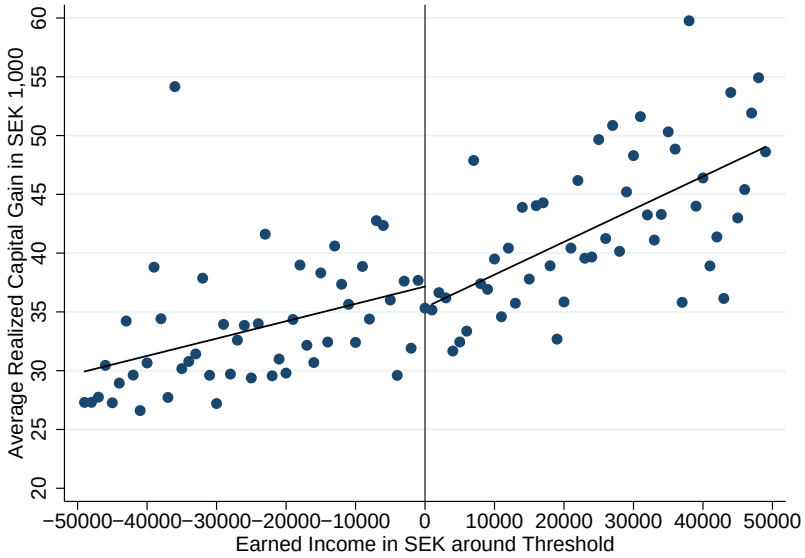

Figure 4: Labor Income Taxes and the Amount of Dividends and Interest

Panel A of this figure plots average realized dividend income (in SEK 1,000) in each SEK 1,000 bin of earned income centered at the kink of the income tax rate schedule. Panel B uses interest income (in SEK 1,000). The vertical line indicates the kink at which the additional 20% labor income tax applies. The black lines comprise predicted values of linear regressions allowing for different slopes around the kink.

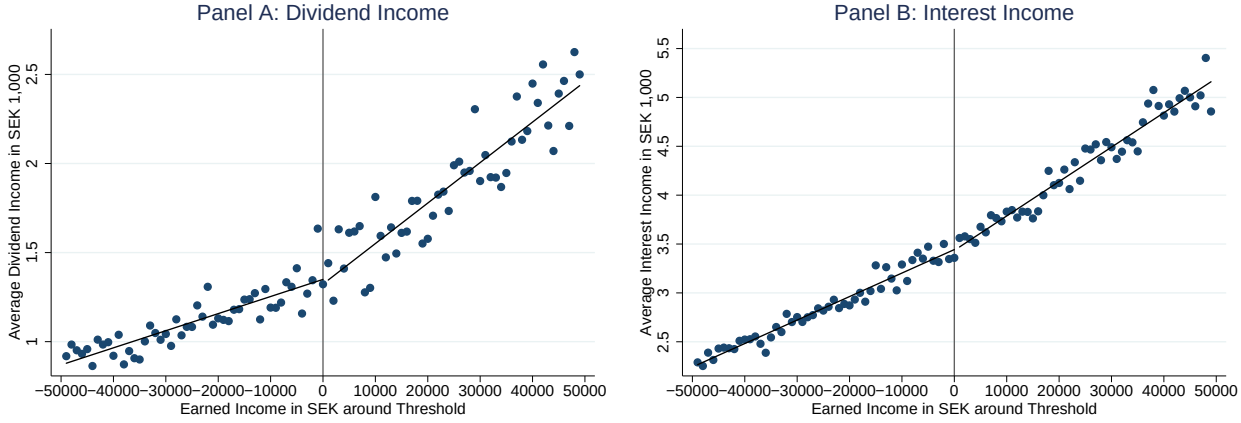

Table 1: Development of Marginal Capital Gains Tax Rates, 1991–2005

This table reports marginal income tax rates. Column (1) presents the lowest marginal income tax rate on labor income different from 0%. The top marginal tax rate on labor income is reported in column (3). Column (4) reports the number of income tax brackets. Column (5) presents the proportional capital gains tax rate (long and short term). The marginal tax rate does not apply to capital gains.

Year	Bottom Marginal Tax Rate	Top Marginal Tax Rate	Number of Tax Brackets	Capital Gains Tax Rate
1991	31.65%	51.65%	3	30%
1992	31.65%	51.65%	3	25%
1993	31.50%	56.50%	3	25%
1994	31.05%	56.05%	3	12.5%
1995	31.04%	56.04%	3	30%
1996	31.65%	56.65%	3	30%
1997	31.65%	56.65%	3	30%
1998	31.65%	56.65%	3	30%
1999	31.48%	56.48%	4	30%
2000	30.38%	55.38%	4	30%
2001	30.53%	55.53%	4	30%
2002	30.52%	55.53%	4	30%
2003	31.17%	56.17%	4	30%
2004	31.51%	56.51%	4	30%
2005	31.60%	56.60%	4	30%

Table 2: Summary Statistics, 1991–2005

This table reports summary statistics for capital gains variables (Panel A) and presents the basic distribution parameters for income, wealth, and demographic controls (Panel B). The variable *CG_Realized* is an indicator variable equal to 100 for individuals realizing capital gains and zero otherwise, *CG* is the Swedish krona (SEK) amount of realized capital gains in year t, *Income* is the individual's income in year t without capital gains, *Interest* is interest income, *Dividends* is the amount of dividends received in year t, and *Wealth* is reported wealth for tax purposes. All monetary values are reported in thousand SEK with base year 2000. The variable *MTR* is the first-SEK marginal tax rate on earned income, *Age* is the taxpayer's age in years, *Married* is a dummy equal to 100 if the individual is married and zero otherwise, *Town* is a dummy equal to 100 for individuals residing in towns (less than 10,000 inhabitants) and zero otherwise, *City* is an indicator variable equal to 100 for individuals residing in cities (more than 10,000 inhabitants) and zero otherwise, *Capital* is a dummy equal to 100 for individuals residing in the county's capital and zero otherwise, *Move* is a dummy equal to 100 if the individual moved from one municipality to another during year t and zero otherwise, *Household Size* is the number of family members in the household, *HS Inc* (*HS Dec*) is a dummy equal to 100 if the household size increases (decreases) from $t-1$ to t and zero otherwise, *BusInc* is a dummy equal to 100 if the individual reports income from self-employment and zero otherwise, and *SocAss* (*Pension*) is a dummy equal to 100 if the individual receives social assistance (pension) and zero otherwise.

Panel A: Capital Gains Variables

Variable	N	Mean	Standard Deviation	25th Percentile	Median	75th Percentile
CG_Realized	3,003,513	22.5104	41.7651	0.0000	0.0000	0.0000
CG	442,641	31.7130	76.5540	1.1693	5.7190	23.2310

Panel B: Income, Wealth, and Demographic Controls

Variable	N	Mean	Std. Dev.	P25	Median	P75
MTR	3,003,513	35.5945	9.4820	31.0500	31.6000	31.6500
Income	3,003,513	185.1505	328.8383	106.8449	162.2334	222.7829
Interest	3,003,513	2.5470	77.9838	0.0000	0.1509	1.345
Dividends	3,003,513	1.7565	24.4885	0.0000	0.0000	0.3810
Wealth	3,003,513	177.5772	1463.3060	0.0000	0.0000	0.0000
Age	3,003,513	50.6344	18.3408	35.0000	49.0000	65.0000
Married	3,003,513	0.4757	0.4994	0.0000	0.0000	1.0000
Town	3,003,513	11.5435	31.9546	0.0000	0.0000	0.0000
City	3,003,513	73.3269	44.2251	0.0000	100.0000	100.0000
Capital	3,003,513	34.5923	47.5668	0.0000	0.0000	100.0000
Move	3,003,513	10.1706	30.2261	0.0000	0.0000	0.0000
Household Size	3,003,513	2.1310	1.2573	1.0000	2.0000	3.0000
HS Inc	3,003,513	5.5017	22.8014	0.0000	0.0000	0.0000
HS Dec	3,003,513	5.2561	22.3155	0.0000	0.0000	0.0000
BusInc	3,003,513	5.8460	23.4611	0.0000	0.0000	0.0000
SocAss	3,003,513	34.7070	47.6038	0.0000	0.0000	100.0000
Pension	3,003,513	35.7313	47.9208	0.0000	0.0000	100.0000

Table 3: Effect of Labor Income Taxes on Capital Gains Realizations

This table presents the regression results on capital gains realization behavior estimated over the 1991–2005 period. The dependent and independent variables are defined in Table 2. Standard errors (s.e.) allow for heteroskedasticity and are clustered at the individual level. The superscripts ***, **, and * indicate the statistical significance at the 1%, 5%, and 10% levels, respectively.

	Likelihood of Realizing Gains			**Amount of Capital Gains**		
	Coefficient	(s.e.)	Elasticity	Coefficient	(s.e.)	Elasticity
MTR	0.020***	(0.004)	0.047	0.002**	(0.001)	0.040
Income_{t-1}	0.001***	(0.000)	0.013	0.000	(0.000)	0.003
Income_{t-2}	0.000**	(0.000)	0.005	0.000***	(0.000)	0.005
Income_{t-3}	0.000	(0.000)	0.001	-0.000	(0.000)	-0.001
Wealth_{t-1}	0.000	(0.000)	0.000	0.000***	(0.000)	0.004
Wealth_{t-2}	0.000	(0.000)	0.000	-0.000	(0.000)	-0.002
Wealth_{t-3}	0.000	(0.000)	0.000	-0.000	(0.000)	-0.001
Town	0.004	(0.003)	0.003	-0.000	(0.001)	0.000
City	0.004**	(0.002)	0.020	0.000	(0.000)	0.008
Capital	0.001	(0.002)	0.003	-0.000	(0.000)	-0.007
Move	0.010***	(0.001)	0.007	0.001***	(0.000)	0.012
Age	2.149	(3.057)	7.311	-0.020***	(0.003)	-0.641
Married	-0.841***	(0.127)	-0.027	0.027	(0.027)	0.009
Household Size	0.062	(0.042)	0.009	-0.004	(0.009)	-0.006
HS Inc	0.010***	(0.001)	0.004	0.001***	(0.000)	0.004
HS Dec	0.020***	(0.001)	0.007	0.002***	(0.000)	0.009
BusInc	0.007***	(0.002)	0.003	0.001***	(0.000)	0.007
SocAss	-0.003***	(0.001)	-0.008	0.000	(0.000)	0.001
Pension	0.010***	(0.001)	0.022	0.000	(0.000)	0.002
Inverse Mills				0.119***	(0.012)	0.101
Individual FE		Yes			Yes	
Year FE		Yes			Yes	
State FE		Yes			Yes	
Observations		3,003,513			442,641	
R-Squared		0.299			0.577	

Table 4: Labor Income Taxes and Capital Gains: Robustness Tests

This table presents the regression results on capital gains realization behavior estimated over the 1991–2005 period. The dependent and independent variables are defined in Table 2. Panel A uses one lag of MTR as the tax variable. In Panel B, the likelihood of realizing capital gains is estimated using a probit model. Standard errors (s.e.) allow for heteroskedasticity and are clustered at the individual level. The superscripts ***, **, and * indicate the statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Using One Lag of MTR

	Likelihood of Realizing Gains		Amount of Capital Gains	
	Coefficient	Elasticity	Coefficient	Elasticity
MTR_{t-1}	0.049***	0.118***	0.004***	0.110***
	(0.004)	(0.009)	(0.001)	(0.017)
Control Variables	Yes		Yes	
Individual FE	Yes		Yes	
Year & State FE	Yes		Yes	
Observations	3,003,513		3,003,513	
R-Squared	0.712		0.746	

Panel B: Probit Model of the Likelihood of Realizing Gains

	Tax Measure: MTR_t		Tax Measure: MTR_{t-1}	
	Coefficient	Elasticity	Coefficient	Elasticity
Tax Variable	0.012***	0.019***	0.012***	0.014***
	(0.000)	(0.000)	(0.000)	(0.000)
Control Variables	Yes		Yes	
Individual FE	Yes		Yes	
Year & State FE	Yes		Yes	
Observations	3,003,513		3,003,513	
R-Squared	0.712		0.746	

Table 5: Effect of Labor Income Taxes on Interest and Dividend Income

This table presents the regression results on interest and dividend income estimated over the 1991–2005 period. I use the natural logarithm of interest income and the natural logarithm of dividend income, respectively, as dependent variables. The independent variables are defined in Table 2. Standard errors (s.e.) allow for heteroskedasticity and are clustered at the individual level. The superscripts ***, **, and * indicate the statistical significance at the 1%, 5%, and 10% levels, respectively.

	Amount of Interest Income		Amount of Dividend Income	
	Coefficient	Elasticity	Coefficient	Elasticity
MTR	0.011***	0.103***	0.002***	0.022***
	(0.000)	(0.003)	(0.000)	(0.004)
Control Variables	Yes		Yes	
Individual FE	Yes		Yes	
Year FE	Yes		Yes	
State FE	Yes		Yes	
Observations	3,003,513		3,003,513	
R-Squared	0.712		0.746	

Table 6: Cross-Base Tax Sensitivities of Employed Individuals

This table presents the cross-base tax sensitivities estimated over the 1991–2005 period. I use the likelihood of realizing capital gains, the natural logarithm of interest income, and the natural logarithm of dividend income as dependent variables. The independent variables are defined in Table 2. Standard errors (s.e.) allow for heteroskedasticity and are clustered at the individual level. The superscripts ***, **, and * indicate the statistical significance at the 1%, 5%, and 10% levels, respectively.

	CG_Realized	Ln(CG)	Ln(Interest)	Ln(Dividends)
MTR	0.021***	0.001*	0.011***	0.002***
	(0.004)	(0.001)	(0.000)	(0.000)
Control Variables	Yes	Yes	Yes	Yes
Individual, Year, & State FE	Yes	Yes	Yes	Yes
Observations	2,827,928	403,804	2,827,928	2,827,928
R-Squared	0.304	0.590	0.714	0.750

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