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Abstract

This paper studies the effect of Finnish tax reforms in the mid 1990s on the economic activity and tax avoidance decisions of the owners of small businesses. The reforms reduced income tax rates and increased tax planning incentives for small business owners. They applied only to unincorporated firms. We utilize both a theoretical model and empirical data. The empirical strategy is to use the reforms as a natural experiment to estimate the causal impact of the reforms. The results imply that entrepreneurs react to tax incentives along both real and avoidance margins, while the latter elasticity is larger.

JEL-Code: H250, H240, H220.

Keywords: entrepreneurs, small businesses, tax incidence.

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1 Introduction

Myriad economic policies have been targeted at small businesses (Buss 2001). Specifically, entrepreneurial income is tax favored over labor income to promote entrepreneurial activity. The normative reason for this is to make the tax system for entrepreneurs as effective as possible. Empirically, a typical, and challenged (Chetty 2009 and Piketty *et al.* 2013) method for measuring the efficiency loss is the elasticity of taxable income (ETI) (Feldstein 1999).

There are two reasons to depart from measuring just one ETI for all, and to separately understand the different components of ETI. Firstly, ETI depends on the tax base. In particular, some components of the tax base are easier to avoid than others. Thus they lead to elasticities of different sizes (Slemrod and Kopczuk 2002, Kopczuk 2005 and Piketty *et al.* 2013). More precisely, the income tax rate may affect entrepreneurial effort a little, while specific accounting rules in combination with taxation may lead to great tax avoidance opportunities. For proper policy design, the size of these elasticities should be known. Secondly, if different activities have different social welfare costs, they do not lead to the same social welfare losses (Chetty 2009). In the present context, tax evasion, an illegal activity, may incur higher social costs than tax avoidance, legal tax planning.

This paper studies the economic activity decisions of entrepreneurs using theory and data. We look at real responses, like effort, and tax avoidance decisions. We build a theoretical model that explores the effort and tax planning decisions of an entrepreneur in an intertemporal framework. In the model, increasing effort entails a utility cost and shifting income within the firm affects income taxes. We find that this tax system leads to tax avoidance. The entrepreneur shifts income within the firm over time. In this environment we study the effects of reducing the income tax rate and increasing the benefits from income shifting. The result is that this reform increases (decreases) effort and tax planning if the entrepreneur cares more (less) about future consumption. The effort in this model could also be interpreted as tax evasion, which entails a utility cost.

Empirically, we analyze a causal link between the tax system for firms and

the behavior of entrepreneurs. We study Finnish tax reforms that reduced the income tax burden and increased the incentives for tax planning.[1] Only unincorporated firms were affected, leaving incorporated firms as a control group. In data these two groups resemble each other in being of similar size and developing similarly over time. Furthermore, there were no other tax reforms or policy changes affecting these two groups at the time of the reforms. This allows us to utilize a natural experimental approach. To measure the impact of the tax change, we construct an exogenous measure for changes in the marginal tax rate and tax planning opportunities for each firm.

We study both the economic activity and tax avoidance of entrepreneurs. We study the former from the effect of the tax reforms on the output of firms. Since the firms in question are small labor intensive firms, where the entrepreneurs themselves work, their economic activity forms a large part of the value added the firm produces. By estimating the elasticity of taxable income we also show that income from such firms reacted to the reforms. We approximate the relative importance of real and tax avoidance channels by showing how different components of the accounts of a firm reacted to the reforms. Furthermore, to find alternative evidence of tax planning, we utilize a specific feature of the tax reform, an increase in incentives to engage in tax planning by accumulating net assets over time.

The results indicate that decreasing the marginal tax rate of an entrepreneur increases the turnover and output of her firm. Our main specification indicates that a 10 per cent reduction in the marginal tax rate leads to a 1.5 per cent increase in turnover. We find larger effects for those who experienced a greater change in their tax incentives. We estimate the elasticity of taxable income (ETI) to be 0.35. Our main results pass various robustness checks.

The overall ETI provides certain welfare implications, but more decomposed information is needed for any detailed policy contribution (Chetty 2009 and Slemrod and Kopczuk 2002). Therefore we attempt to break down ETI into real and tax avoidance responses. We use a novel decomposition

[1]The reform and tax incentive changes are previously discussed in Kari *et al.* (1998).

method and firm accounting information to explain where the overall ETI comes from. The results suggest that the increase in turnover resulted partly from an increase in the real responses of the entrepreneur. Labor demand or investments did not increase. Moreover, the real response seems to explain only one third of the total ETI. The remaining two thirds may come from tax avoidance channels, through the use of capital depreciation rules, fringe benefits, etc.

As further evidence of tax planning, we find that some entrepreneurs paid more wages to themselves. Moreover, under the tax system in Finland, accumulating assets within a firm reduces the income tax liability of the entrepreneur. We find a positive asset accumulation response. Our results are in line with Sivadasan and Slemrod (2008), who study income shifting within firms in India. They use a similar comparison between partnerships and corporations as we do and find that firms responded to tax incentives by shifting income from profits to wages.

We contribute to earlier literature by studying the responses of firms to tax incentives along the intensive margin. Earlier literature has focused more on the extensive margin, entry and switching legal forms (Gordon and Mackie-Mason 1994, Mackie-Mason and Gordon 1997, Goolsbee 1998 and 2004). Entry into a risky entrepreneurship could be encouraged with proper incentives (Kerr and Nanda 2009 and Cullen and Gordon 2007). We also contribute by showing that the tax reforms did not increase labor demand. This is in line with earlier literature that has found that payroll tax reductions lead to very little labor demand effects (Korkeamäki and Uusitalo 2009) and some wage bill increases (Bennmarker *et al.* 2009).

The rest of the paper proceeds as follows: Section 2 presents the macroeconomic conditions at the time of the reforms and describes the institutional aspects of firm taxation. Section 3 presents a theoretical model that explores how an entrepreneur responds to changes in tax incentives. Section 4 presents the econometric specification and discusses identification issues. Section 5 presents the data and descriptive statistics derived from them. Section 6 presents the results and robustness checks. Section 7 concludes the study.

2 Economic conditions and institutions

2.1 Macroeconomic situation surrounding the reforms

The mid 1990s was a period of economic growth in most developed countries. In particular, the Finnish economy was already recovering from a deep recession in 1993 - 1994, when the tax reforms took place, from 1997 onwards.

The severity of the recession and the subsequent growth can be seen from figure 1, where the development of Finnish GDP per capita and the unemployment rate is compared with neighboring Sweden and the OECD average. The vertical line marks the year 1997, when the first reform took place. In the early 1990s GDP fell heavily and unemployment rose compared to other countries. However, when the reforms took place, the Finnish economy had already been growing for a few years. Furthermore, there is no visible deviation from the general time trends in Finland in 1997. This suggests that the reforms did not have significant macroeconomic consequences. This is not a concern for the current study, since the reforms were targeted at a small part of the Finnish economy.

2.2 The institutional background

The tax system for all income in Finland is the Nordic Dual Income Tax (DIT) system that has been in place since 1993 (Nielsen and Sörensen 1997 and Kanniainen *et al.* 2007). Capital income from firms is imputed, which is a variant of the imputed income method (Boadway and Bruce 1984).

In general, the motivations for the DIT system include attempts to reduce distortion on incentives to save and to limit incentives for tax arbitrage through a proportional capital tax system. At the same time, progressive earned income taxation maintains the ability to redistribute more income from the rich to the poor. The weak point of the system is horizontal equity, since labor income may be heavily taxed, whilst similar work as an entrepreneur need not be.

The institutional setting for legal forms in Finland is typical for Europe, and resembles that of e.g. the UK (Crawford and Freedman 2010). The main

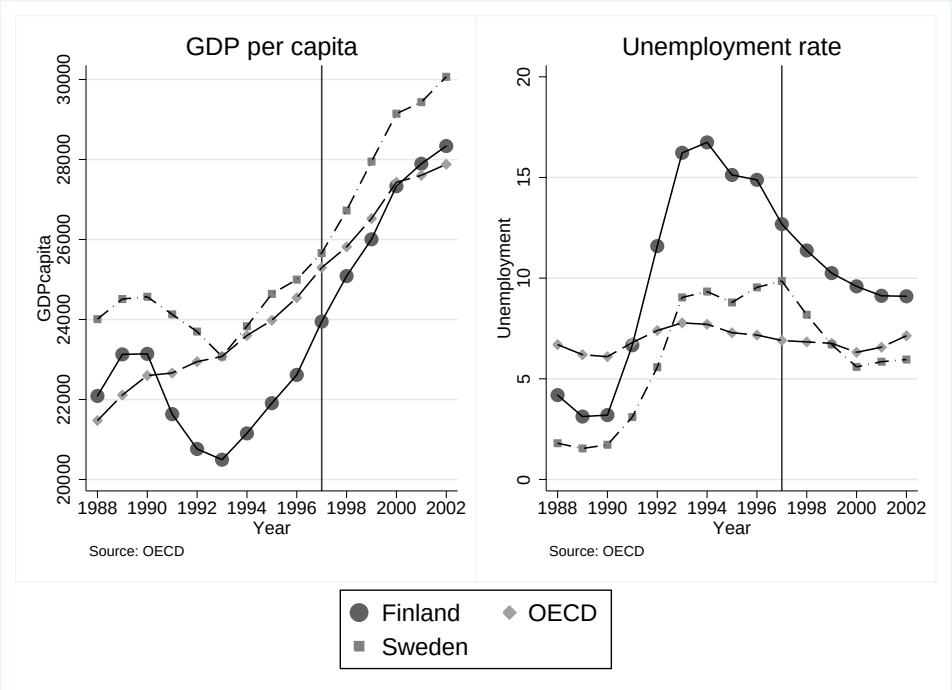

Figure 1: GDP per capita and unemployment in Finland, Sweden and the OECD average over time.

three legal forms are sole proprietors, partnerships and corporations. The former two are in our treatment group and the latter in our control group, although we drop sole proprietors from the analysis.[2] The tax liability for the income from a firm across these legal forms was very similar in Finland at the time of the reforms.

We present an outline of a profit and loss calculation in Finland in table 1, since that interacts with the tax system we study. The calculation starts with turnover, which is the producer price value of sales. In a small labor intensive firm, the turnover consists largely of the activity of the entrepreneur. The operating margin also includes other income. To get to the profit (the taxable income), costs are subtracted from operating margin. The important cost items are wages, investments and purchases. Wages reduce the profit of

[2]The reason for this omission is that although the reforms in principle affected sole proprietors, in practice they did not. The practical reason is that these firms did not have enough assets for the reform to affect them, see figure B1.

the firm, but if the entrepreneur pays wages to herself, they are added to her taxable earned income. Purchases are typically goods the firm bought for selling. In this case they are tightly linked to turnover. Purchases that the firm does not sell and investments increase the net assets of the firm, which in turn influence the tax burden of the firm, see below.

+Turnover		+Other Income				=	Operating + margin
-Purchase	-Investment	-Wage	-Rent	-Deduction	-Expense	=	-Total cost
						=	Profit

Table 1: Profit and loss calculation

Income from firms is taxed as part of the personal income of the owner, and is split into capital and earned income by a predetermined rule (Lindhe *et al.* 2004). The split is made according to a fixed share of the net assets of the firm in the previous year. Capital income tax rate, τ_C, in Finland was a proportional 28% in 1997 and earned income tax function, T_E, was progressive, with the lowest tax rates being zero and the highest tax rates being over 60%. Depending on their income, for most entrepreneurs, $\tau_C < T'_E \equiv \partial T_E/\partial(y-C)$. For partnerships and sole proprietors, total income, y, from the firm faces a total tax burden, T, according to the formula:

$$T = C * \tau_C + T_E(y - C) \tag{1}$$

where C is the imputed capital income.[3] The remaining part of income, $y - C$, is earned income.[4]

Corporations were in the same DIT tax system, with separate capital and earned income tax rates, as partnerships and sole proprietors, but the details differ somewhat. Corporate income tax was applied to them, but there was the system of imputed credits in place that credited the corporate income

[3]If the firm has C larger than y, the owner only pays capital income tax.

[4]A typical partnership had 32,000 euros income and 33,000 euros net assets. The imputed capital income C was 7,200 euros. Thus the income taxed as earned income is $32,000 - 7,200 = 24,800$. The τ_C was 28%, and τ_E 35%. The total tax burden is $7,200 * 0.28 + 24,800 * 0.35 = 10,696$ euros. The average tax rate is $10,696/32,000 = 0.33$.

tax for an entrepreneur against her income tax liability. Thus the total tax burden for income from a corporation was

$$\begin{aligned} T &= D * \tau_C + T_E(y - D) \\ D &= \min(d, C) \end{aligned}$$

where d is the actual dividends paid out to shareholders and D is the part taxed as capital income. The distinction between incorporated and unincorporated firms is that the former could choose how much income to take out as capital income up to a fixed limit whereas the latter did not have a choice. This allows for income smoothing across periods. Prior to 1997, the upper limit for corporations C and the fixed share for partnerships were the same.

We define the marginal tax rate as the marginal increase in taxes for a marginal increase in income from a firm. Thus the marginal tax depends on the extent of income splitting. Furthermore, the marginal tax rate depends on the total amount of earned income of a taxpayer, since the earned income tax schedule is progressive.

2.3 The reforms

We study the tax reforms of 1997 and 1998, which affected the income taxation of income from unincorporated firms, i.e. partnerships and sole proprietors. The reforms changed the predetermined rule governing the income splitting rule between capital and earned income. In the DIT tax system a fixed share of the net assets of the previous year are imputed as capital income. The imputation for capital income C in equation (1) as a formula is:

$$C_{it} = p(A_{it-1} + k * \max(Dbt_{it}; 84,000) + xWL_{it-1})$$

where p is the share of net assets imputed as capital income C_{it}. The net assets in parentheses include actual net assets A_{it}, half of long term debt Dbt_{it} up to a limit of 84,000 euros and the wage sum WL_{it} of firm i in year t. k and x are parameters that changed in the tax reforms.

The 1997 reform increased the share of the net assets calculated as capital

income and also widened the base calculated as net assets. More precisely, the reform increased p from .15 to .18 and x from 0 to 0.3, effectively adding a third of the wage sum to net assets. Thus the imputed capital income increased as a result. This in turn reduced the total tax burden T in equation (1) provided that $\tau_C < T'_E$, which applies to most entrepreneurs.

The 1998 reform ended a transitional rule where half of the absolute value of long term debt *Dbt* up to 84,000 euros had been added to the asset side of net assets (ITL 1992). This changed k from 1 to 0. Therefore, the 1998 reform reduced the C of those firms that had long term debt. As a result the tax burden increased, when $\tau_C < T'_E$. A significantly lower number of firms were affected by the 1998 than the 1997 reform.

The reforms affected the total tax burden $T = C * \tau_C + T_E(y - C)$ by changing C, assuming now a nonlinear earned income tax rate T_E from earned income $y - C$. The effect of changing C on the tax burden is $\partial T/\partial C = \tau_C - \partial T_E/\partial(y - C)$, which is negative (the tax burden is reduced), when $\tau_C < T'_E$. Given fixed C, the marginal tax rate (increase in the tax burden from extra income) is:

$$MTR = \frac{\partial T}{\partial y} = \frac{\partial T_E}{\partial(y - C)}$$

which is positive. The reforms changed C. The effect of a marginal change in C on the MTR with a given y is:

$$\frac{\partial MTR}{\partial C} = -\frac{\partial^2 T_E}{\partial(y - C)^2}$$

which is negative as long as earned income tax rate is progressive ($T''_E > 0$), as it is in the Finnish tax system.

In sum, the reforms affected the total tax burden by shifting the tax schedule left or right and also affected marginal tax rates by changing the amount of income taxed as earned income. Both the average and marginal tax rate schedules were shifted in a similar fashion.

Figure 2 presents the actual marginal and average tax rate schedules as a function of total income (y). In both panels, the level of net assets and wages

paid are fixed. The two together imply a certain imputed capital income. The figure presents the pre-reform tax schedule as a solid line and the post-reform schedule as a dashed line. There is a dip in the tax schedules: for the very lowest income the tax rate is higher than for an interval of incomes after that, until the tax rate increases again in a stepwise manner.

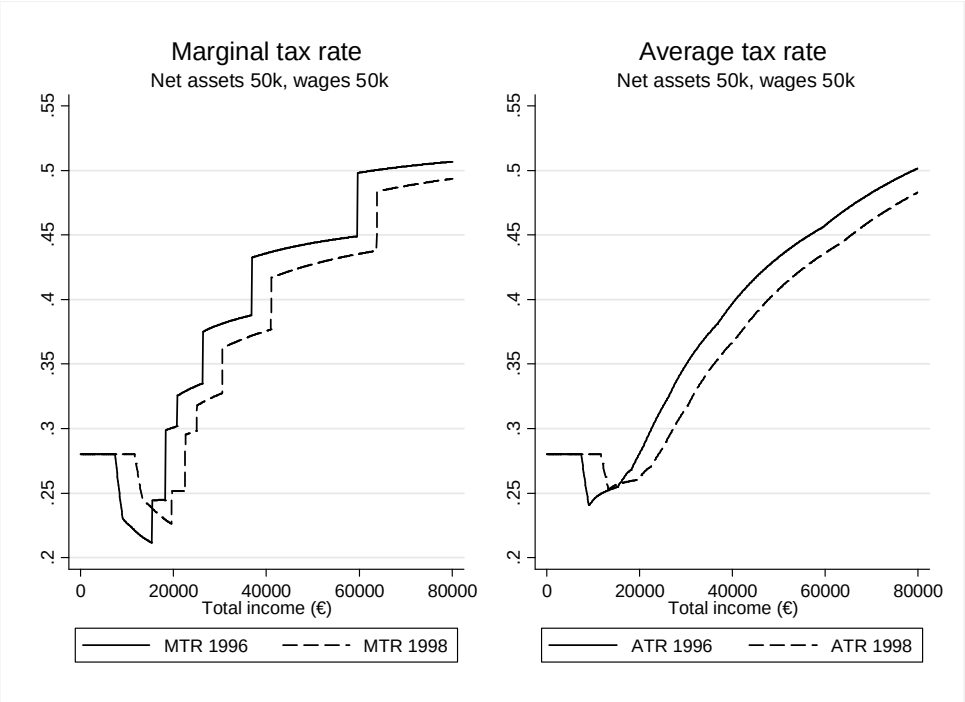

Figure 2: Marginal and average tax rates before and after the two reforms

Note: Figure shows the marginal and average tax rate schedules of total income from an unincorporated company before and after the two reforms in 1997 and 1998.

Figure 2 clearly shows that for a typical entrepreneur the reforms shifted the marginal and average tax rate schedules to the right. Most entrepreneurs have the annual income above the dip region. There the marginal and average tax rates declined fairly equally across income levels.

The reasons for the reform are not perfectly clear. The overall reason is that the tax reforms from 1991 to 1993 significantly reduced the tax burden of incorporated firms relative to that of unincorporated. Therefore, the main reason to reform the tax system for unincorporated firms was to retain tax

neutrality across legal forms of firms. The motivation for the 30% wage sum added to the net assets rule has not been published, and thus remains unclear.

Although the 1997 reform had been planned for a while, significant details were changed at the last minute (HE 105/1996). It was only in September 1996 that the government announced that there was going to be a new tax rule. Thus affected firms did not have time to anticipate this reform. The law was passed in the last weeks of 1996 and there was not much discussion about it in the Finnish media prior to the end of 1996.

3 A Model of entrepreneurial choices

We now explore how tax incentives affect the economic activity of entrepreneurs. In the DIT system, in principle, the larger the net assets of a firm, the smaller the income tax burden of the entrepreneur. This creates motives to either produce more income and accumulate assets, or enjoy the reduced tax burden through greater immediate consumption. We present a theoretical model that specifies how the effects of the tax system depend on the preferences of the entrepreneur. In this way the model is related to Kanniainen *et al.* (2007) and Carroll *et al.* (2001). In contrast to earlier literature, we additionally model tax planning choices in an intertemporal setting.

We employ a two period model featuring a utility maximizing entrepreneur. She produces income by exerting effort in a firm. The entrepreneur enjoys utility from consumption and dislikes effort. In the first period, the entrepreneur makes endogenous activity and income transfer choices and in the second period the income is exogenous. The world ends at the second period and all the remaining income and assets are consumed.

Income transfers across the two periods can occur either from the entrepreneur's private consumption, or within her firm without an interest rate. We assume savings do not earn interest within the firm, since we want to focus on the tax motives for it. Saving within the firm is motivated by the DIT tax system. The tax function in the model is increasing continuously with income, and is progressive. However, it is decreasing with net assets of

the firm. Thus an entrepreneur may want to accumulate net assets. Empirically, to increase net assets, a firm can either invest or even buy presumably unproductive inputs, like paintings to decorate the office. These are counted as net assets in the next period but incur costs and therefore reduce income in the current period. Later the firm can sell these assets, which then creates a positive income flow.

We write the inter temporal utility function of an entrepreneur in a separable utility form

$$u(c_1) + h(e_1) + \delta u(c_2)$$

where c_1 and e_1 refer to consumption and effort in period 1 and c_2 consumption in period 2. The utility function has the standard properties: $u_c > 0$, $u_{cc} < 0$, $h_e < 0$ and $h_{ee} < 0$. The discount factor is $0 < \delta < 1$.

The entrepreneur has a firm that produces income y_i in period $i = 1, 2$. In the first period production, ne_1, $n > 1$, is proportional to effort. In the second period, the entrepreneur earns only exogenous income Y. An entrepreneur may transfer income, m, within firm from period 1 to period 2. The income functions for the two periods are:

$$y_1 = ne_1 - m$$

$$y_2 = Y + m$$

The entrepreneur consumes income from the firm, but has to pay taxes on that income. We write the periodic budget constraints as follows:

$$c_1 = y_1 - T_1(y_1, \mu(A)) - R$$

$$c_2 = y_2 - T_2(y_2, \mu(A + m)) + rR + A$$

where T_i is the periodic tax function in period i, R is the income transfer from private consumption with an interest rate $r \geq 1$ and A is the exogenous

net assets of the firm. T_i is a function of two arguments: income y_i, and μ that is a function of exogenous net assets within the firm A, $\mu(A)$. We denote $T_i(y, \mu(A)) = T_i(y, A)$ to simplify the notation. The tax function is increasing and progressive with income, $\frac{\partial T_i}{\partial y} = T_{iy} > 0$, $T_{iyy} > 0$, and the net assets reduce the tax liability linearly, $\frac{\partial T_i}{\partial A} = T_{iA} < 0$, $T_{iAA} = 0$.[5] The parameter μ reflects the size of the influence of net assets on the tax rule in the actual tax system we study. We assume $T_{i\mu} < 0$ and $T_{i\mu\mu} < 0$.

We insert the periodic budget constraints in the utility function and get the inter-temporal objective function:

$$\begin{aligned} U &= u_1\left(ne_1 - m - T_1\left(ne_1 - m, A\right) - R\right) + h(e_1) \\ &+ \delta u_2\left(Y + m - T_2\left(Y + m, A\right) + rR + A\right) \end{aligned}$$

This objective function is maximized with respect to the endogenous variables: e_1, m and R. We present all the first order conditions (FOC) in appendix A. The FOC for m is

$$\frac{\partial U}{\partial m} = -u_{1c}(1 - T_{1y}) + \delta u_{2c}\left(1 - T_{2y} - T_{2A}\right) = 0$$

This conditions reveals that transferring income from period one to period two depends on the marginal utilities of consumption, the tax function and the discount factor. The sign of m depends on exogenous parameters, but with reasonably forward looking entrepreneurs (δ not too small), m is positive.

Intuitively, start from a fixed net assets, A, and consider what happens if we increase m from zero. Also, set the incomes $y_1 = y_2$. Increasing m is beneficial since the second period taxes are reduced due to the term $-T_{2A} > 0$. Increasing m also reduces y_1 and increases y_2. However, with progressive income taxation consumption increases in the second period at a lower phase. Therefore m cannot increase without a limit, and there is an

[5]The main results are also qualitatively the same with $T_{AA} > 0$. They are not presented here, since this assumption introduces complicated terms without adding anything interesting to the model.

inner solution for optimal m. Thus increasing income transfers within a firm are tax motivated. The tax system leads to tax planning within firms.

We study what happens if the tax system is changed. We introduce a marginal change to the parameter μ, the effect of assets on the tax function. Increasing μ reduces income tax, but not at the same rate as changing income. This corresponds to the actual tax system we study.

The second order conditions and the derivation of the following results is presented in the appendix. We utilize Cramer's rule and obtain the following results:

$$\frac{\partial e_1^*}{\partial \mu} \gtrless 0 \;\Rightarrow\; \frac{T_{1\mu}}{T_{2\mu}} \gtrless \delta r \frac{u_{2cc}}{u_{1cc}}$$

and

$$\frac{\partial m^*}{\partial \mu} \gtrless 0 \;\Rightarrow\; \frac{T_{1\mu}}{T_{2\mu}} \gtrless \delta r \frac{u_{2cc}}{u_{1cc}}.$$

These results imply that increasing μ, increases (decreases) the effort of the entrepreneur and savings within the firm when the entrepreneur is relatively patient (impatient). One clear result is that the effect of increasing μ on effort and saving within the firm goes in the same direction.

We present the intuition of these effects with parametrized functional forms. Assume the utility is logarithmic for consumption and that μ has the same effect in the two periods ($T_{iy\mu} = 0$). The above results simplify to:

$$\frac{\partial e_1^*}{\partial \mu}, \frac{\partial m^*}{\partial \mu} \gtrless 0 \;\Rightarrow\; 1 \gtrless \frac{c_1}{c_2}$$

where the equilibrium effort and transfers within the firm are increasing with μ when consumption is smaller in the first period than in the second period. The result depends on whether or not the entrepreneur cares more about future than present consumption.

In summary, we found that the DIT tax system may induce tax planning by means of increasing unprofitable assets within the firm. Furthermore, reducing tax liability by reforming the tax rule may lead to an increase (decrease) in the net assets and effort choices, if an entrepreneur is (not) forward looking. Lastly, effort and tax planning change to the same direction in response to tax reform.

The model abstracts away from a number of empirically relevant matters. The main point of the model was to study choices that incur (utility) costs. If we replace effort with costly tax evasion, the main intuition would not change.

4 Econometric specification

The tax reforms applied only to unincorporated firms, as described in section (2.2). Therefore, partnerships comprise the treatment group and corporations the control group. We estimate the causal effect of the tax reforms on the treatment group as a whole. We also estimate to what extent changes in the marginal tax rate affect turnover and income. The usual problem is that there are unobserved factors that would lead to spurious regression results. Thus we first use corporations as a control group that represents general time patterns in the economy. Second, we control for residual unobserved heterogeneity by allowing for firm specific time trends.

We assume that the logarithmic outcome for firm i in year t depends on time and group variables according to the following equation:

$$lny_{it} = w_{it} + \eta_i + t\alpha_i + \lambda_t + \gamma X_{it} + \varepsilon_{it}$$

where w_{it} indicates potentially continuous treatment, η_i is an indicator for the firm specific effect and $t\alpha_i$ denotes a firm-specific linear trend. λ_t is a general time trend, X_{it} is a vector of other covariates and ε_{it} is an error term. We take the first difference of this and obtain:

$$\triangle lny_{it} = \beta_1 DD_{it} + \alpha_i + \upsilon_t + \gamma \triangle X_{it} + \nu_{it} \tag{2}$$

where DD_{it} is the binary differences-in-differences indicator, having the value one for all the after treatment observations for the treatment group and zero otherwise. This measures the total effect of treatment on all post treatment observations of the treatment group. α_i is an unobserved firm specific factor and υ_t is a general time trend for all firms and ν_{it} is the residual error term.

The identifying assumption behind equation (2) is that the treatment

and control group have a systematic relationship. In expectation, and in the absence of the treatment, they should develop in the same direction after controlling for the firm specific linear trends and common time trends. The treatment should not be part of this underlying equation, and thus exogenous. By modeling the treatment with the DD variable, we identify its dynamic effect on the outcome of the treatment group. We have relaxed the standard DD assumption by allowing for unobserved firm specific linear time trends, since the firms behave heterogeneously over time.

We think that our underlying assumptions are realistic, since the firms in the two groups are located in the same industries and face the same demand conditions. Furthermore, in the data description section we will demonstrate that corporations and partnerships are indeed of similar size and that the proportional change in turnover in the two groups follows a similar trend over time.

Given the above assumptions, the coefficient β_1 identifies the extent of proportional change in the outcome due to the reforms. Therefore, it identifies all effects that are specific to the treatment group at the time of the reforms. The marginal tax rates changed heterogeneously due to the reforms and in some cases even in different directions. Therefore β_1 is the average treatment effect on treated of the whole reform.

We also estimate the elasticity of outcome with respect to the marginal tax rate (MTR). We cannot regress the actual marginal tax rates against the outcomes, since MTR is correlated with the outcomes. Instead, we utilize the variation coming from the changes in the tax legislation. The predetermined characteristics of each firm determine the size of the tax change. The predetermined characteristics include the total income of an entrepreneur, the firm's average net assets and wage sums for the years 1994 to 1996. We calculate this change for each firm, and regress that against the changes in outcome in place of the DD indicator in equation (2):

$$\triangle lny_{it} = \epsilon \triangle lnMTR(I_{96})_{it} + \alpha_i + \gamma \triangle X_{it} + \nu_{it} \tag{3}$$

where $\triangle lnMTR(I_{96})_{it}$ is the change in the exogenous log marginal tax rate,

and the coefficient ϵ is the elasticity of y with respect to the marginal tax rate.

The identifying assumptions behind equation (3) are largely the same as in equation (2): the control and treatment group should behave in similar manner over time in the absence of the treatment conditional on control variables. However, the independent variable is now different as it takes continuous values. These values differ from zero only when there are changes in the tax laws. The continuous independent variable identifies the elasticity, and the size of the change it causes in the dependent variable. It takes into account that the reforms usually induced a negative change in the independent variable, but in some cases positive. Since the independent variable differs from zero only for the years 1997 and 1998, we shorten our time span for the estimation. In this way the regression does not include too many years with zero changes. We only estimate equation (3) for the years 1995 to 1999.

To make the change in marginal tax rates exogenous by using the tax law changes is largely similar as in the elasticity of taxable income (ETI) literature. The ETI literature often focuses on top income shares and top marginal tax rates, whereas we have changes throughout the distribution. The mean reversion problems inherent in the focus on top income are discussed in Gruber and Saez (2002) and Saez *et al.* (2012). Since our variation spans over the distribution, we do not have a similar problem. Moreover, the identification works, since the treatment and control groups have similar income distributions. The remaining problem in our case is whether or not the treatment and control groups behave in a similar way over time. We defend this assumption with a graphical analysis in section 5.

We also estimate the ETI using an instrumental variables approach. The instrument is the change in the tax law. The identification relies on the validity of the instrument, it needs to be exogenous and strong. The independent variable is now the net of tax rate, which is essentially one minus the marginal tax rate in equation (3). In the first stage, we estimate the effect of the instrument on the actual net of tax rate. In the second stage, this variation is regressed against taxable income, similar to equation (3).

We perform this with and without the control group. The latter is similar to Gruber and Saez (2002) and it only relies on differential variation in the net of tax rates across the treatment group.

5 Data description

We use comprehensive tax record panel data for the years from 1994 to 2000. The data come from the Finnish Tax Administration and include every firm liable to taxation in Finland. The data set contains information on the financial statements and tax records of Finnish businesses, as well as information on the taxation of business owners. We are able to follow individual firms over time and calculate their tax rates from the data. In the analysis, partnerships form the treatment group and corporations the control group.

The most relevant outcome variable for our analysis is turnover, the output of a firm. It summarizes the size of the activities of firms. The variable that determines the extent to which the tax reforms affected the marginal tax rates of firms is the net assets of the previous year. Figure 3 shows the distributions of these two variables in our treatment and control groups, in euros. The distributions are kernel densities and are calculated from pooled pre reform (1994 - 1996) observations for each firm. We capped the distribution of turnover at 400,000 euros and net assets at 100,000 euros for illustrative purposes; there are only thin tails in the distributions above these points. The distributions of the two groups resemble each other fairly well. Intuitively, there are as many small corporations as there are partnerships in the data. Thus, their outcome and tax variables have a good chance to develop in a similar manner over time.

For various reasons, we needed to limit the estimation sample. Table 2 presents how the mean of turnover in 1996 and the sample size develop when we further limit the sample in each step. Firstly, we are interested in the intensive margin responses the firms need to remain in the sample through the reforms. We exclude firms that exit the sample after 1996. Secondly, in order to focus on similar firms, we delete all consolidated firms (with

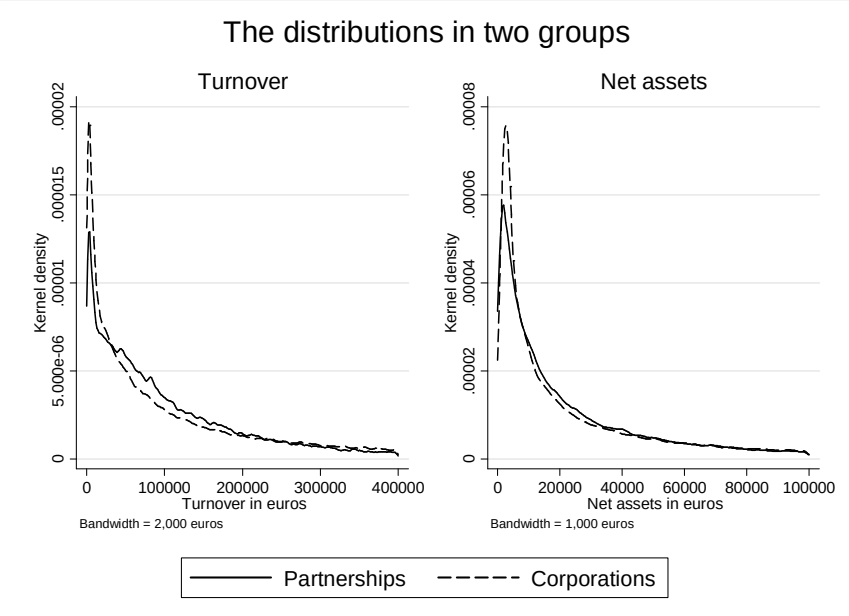

Figure 3: Turnover and net asset distributions: Partnerships and corporations

international trade). The rationale here is that these firms are large, like Nokia, and do not resemble our treatment group, which consists largely of small businesses. Thirdly, we exclude a small fraction of firms for which we do not observe the variables needed to calculate the marginal tax rate.

In addition to turnover and net assets, the data contain all the important tax information for our analysis. Table 3 presents the descriptive statistics of the main variables in our analysis for the estimation sample pooled for the years 1996 to 1998. The table is divided according to treatment status into partnerships (treatment group) and corporations (control group).

The first five variables in table 3 describe the items in the profit and loss calculation. The profit side includes turnover and other income. The cost side, which is subtracted from the profit side, consists of total inputs (wage bill and purchases), investments and capital depreciation. Partnerships had average of 246,000 euros turnover, and after costs they were left with income of 23,000 euros, which is the entrepreneur's income from firm. Some of the wages may have been paid to the entrepreneur as well. Outside of the profit

	Restriction rule	Whole sample	Exit firms	Consolidated firms	Unable to form MTR
Corpor.	N	63,353	48,098	42,864	36,957
	Mean	2,326,449	2,601,729	1,073,855	443,078
	% deleted	-	24.1	10.9	13.8
Partners	N	28,719	17,338	17,338	16,516
	Mean	218,457	254,461	254,461	245,793
	% deleted	-	39.6	-	4.7

Table 2: Description of sample restriction for turnover and sample size for 1996

and loss calculation are assets, a stock variable. Comparing partnerships and corporations, it is evident that on average corporations are bigger. The mean for corporations is larger, since they have a longer right tail in the size distribution, but there are a lot of smaller corporations as well, as is evident from figure 3.

Table 3 also contains the imputed marginal tax rate (MTR), which has an important role as an explanatory variable in our consequent regression analysis. We impute the MTRs for each firm by applying to the pre reform income the changes in the tax code for each year, as explained earlier in sections 2.2, 4 and described in figure 2. For some owners the pre reform income information was missing. Thus, to be able to calculate the imputed MTRs, we needed first to impute income for those who had missing income information. We imputed the incomes according to other observational characteristics of the firms. Those were assets, output of the firm and the cost variables described in table 3. The share of observations replaced in this way is 16% of the estimation sample.

Firm type	Stats	Turnover	Input (TOT.)	Wage	Purch.	Income	MTR
Partners	Mean	245,793	163,004	31,409	131,594	22,848	.365
	SD	676,447	490,130	73,443	449,154	28,555	.091
N = 49,548							
N of firms = 16,516							
Corpors.	Mean	443,078	298,280	83,416	214,864	128,437	.278
	SD	847,829	669,828	175,817	580,862	258,684	.134
N = 110,871							
N of firms = 36,957							

Table 3: Descriptive statistics in euros for the years from 1996 to 1998

Note: Mean and standard deviation (SD) are in euros. Number of observations (N) and number of firms (N of firms) are the count statistics in the data.

Table B1 in the Appendix illustrates how treatment and control group firms are located in different industries in the data. The table shows that in each industry the two groups are represented in a comparable way. The corporations are on average larger, since in each industry there are few very large firms. Our analysis below relies more on behavior of a typical firm. Thus these few large firms do not hinder our ability to compare corporations and partnerships.

Table 4 presents descriptive statistics for partnerships and their owners. Total labor income consists of all labor income from all sources and Labor income is the labor income from the firm. The table gives similar statistics for capital income. For entrepreneurs, on average 75% of all income comes from the firm. Thus the firm is the place where entrepreneurs are employed (themselves), rather than a capital investment. The average number of owners per firm is two. This also supports the view that entrepreneurs are tightly linked to their firm, instead of being distant investors in a firm.

From table 4 it is evident that the firms in the treatment group do not have many employees: 30% of partnerships have no employees and on average they have 4 employees. This suggests that an entrepreneur exerts her own effort in the firm. Therefore there is a link between the output of the firm and the effort or hours of work that the entrepreneur puts in.

	Tot. labor income	Tot. capital income	Labor income	Capital income	Employees
Mean	26,828	6,777	20,420	4,773	4.05
Median	22,058	2,877	16,830	2,224	2
	Share no employees	N of owners per firm	△lnMTR from 96 to 97		
Mean	0.306	1.98	-0.037		
N = 72,786					

Table 4: Descriptive statistics in euros for partnerships

Note: The mean and median statistics are in euros for all the variables except for number of employees (Employees), which gives the average number of employees.

Figure 4 describes the proportional changes in imputed MTRs and tax burdens from 1996 to 1998 for partnerships. As the figure shows, the reforms induced a lot of variation in the MTRs of the treatment group, both increases and decreases. Mostly the tax burden either declined or did not change. Furthermore, the total tax burden changed by several hundreds or even thousands of euros due to the reforms.[6]

Figure 5 presents the trends over time in proportional growth in turnover in the treatment and control groups. The left panel in the figure presents the means of the changes in logarithmic turnover.[7] The right panel presents the coefficients from a fixed effects regression. It plots in each year the difference between the treatment and the control group in the change in log turnover. Both panels present clearly the jump in the treatment group (partnerships) at the time of the 1997 reform. There is no deviation from the overall trend in the control group (corporations). In other years the trends in the two groups follow each other rather well, which gives credibility to the estimation strategy.

[6]Sole proprietors were excluded from the analysis, since on average their MTRs did not change at all. This is a result of their small net assets and income levels. This is shown in figure B1 in the appendix.

[7]Figure B4 in the appendix offers a similar graph for other outcomes.

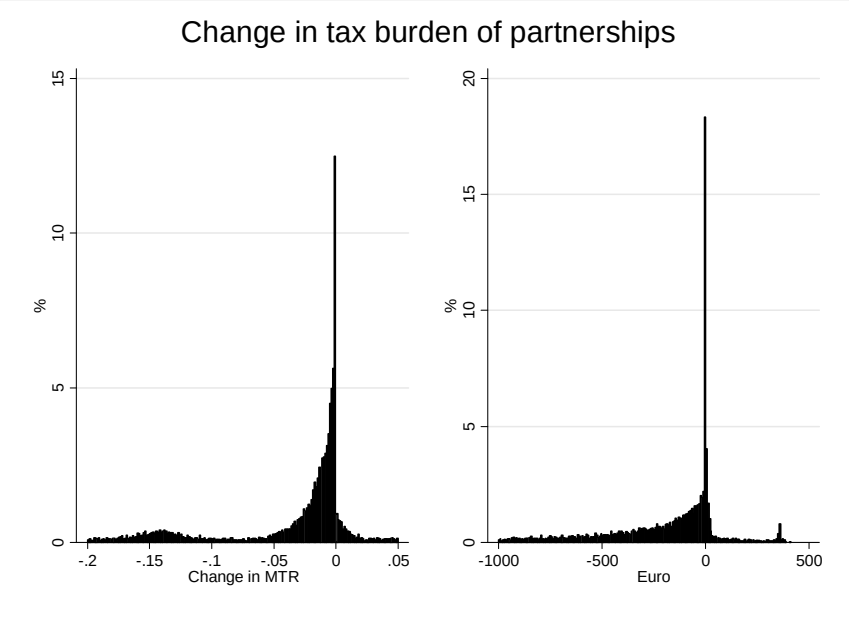

Figure 4: Distribution of proportional changes in MTRs and tax burden in euros for partnerships

Note: The figure shows the distribution of changes in imputed marginal tax rates and tax burden from 1996 to 1998 due to the double reform.

6 Results

This section presents the regression results, first on the turnover (output) of firms and then on other outcomes. We perform the estimations by applying the natural experimental method described in section 4 to the firm-level data described in section 5. Partnerships form the treatment group and corporations the control group. The outcomes are in the change in logarithmic form measuring changes in the growth rate. The estimates are from fixed effect model, which controls firm specific unobserved linear time trends.

Table 5 presents the main estimation results, where the outcome is the change in log turnover. These estimates are performed for the years 1994 to 2000. Columns (1) and (2) measure the average effect of the reform on the overall growth in turnover. Column (1) presents the DD estimation results of the fixed effects regression without additional controls. Column (2) adds to this year indicators, a linear time trend for the treatment group and firm

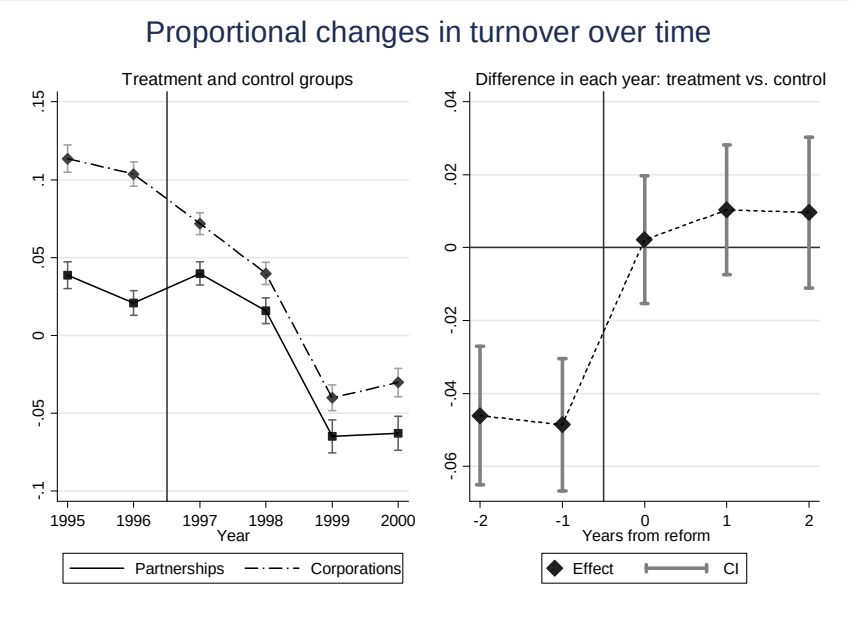

Figure 5: Development of turnover growth rate in partnerships and corporations

Note: The figure compares the proportional change in turnover between partnerships in the treatment group and companies in the control group. The effects are from a fixed effect regression where change in logarithmic turnover is regressed against the interaction between the year and treatment group indicators. The 95% confidence intervals (CI) are calculated from robust standard errors.

level controls as presented in the table. The control variables are measured in millions of euros and are in changes. The results indicate that the reforms induced turnover to grow 5% faster in the treatment group. This result is comparable with the jump at the time of the reforms in the treatment group trend in figure 5.

Columns (3) and (4) measure the size of the proportional change in turnover induced by the change in marginal tax rates. The independent variable (MTR) is imputed for each firm from pre reform data and could be different for each firm. The data for these estimates spans from 1995 to 1999. Column (3) presents the results without and column (4) with the same firm level control variables as in column (2). These results indicate that the elasticity of turnover with respect to MTR is -0.15.[8]

[8]The results with the net of tax rate as the explanatory variable in place of the marginal

The results in the table appear to be fairly robust to different specifications. Moreover, the DD point estimates do not change when adding the covariates, year indicators and linear time trend for the treatment group. The marginal tax rate model is robust to adding the covariates in differences (and levels). We also implemented a placebo reform for 1999, which yielded a zero result.[9]

An additional worry is whether the results are truly statistically significant. The presented results are block bootstrapped, where the whole sample is divided into 20 bins according to the size of the change in tax incentives induced by the reform. For example, one bin includes all firms that had no change in tax incentives. As an alternative set of blocks we used industry classification codes (20 blocks) and firms. These produced similar but slightly smaller standard errors than those shown here. We conclude that the presented results are not very sensitive to the method of calculating the standard errors.

In order to study whether the effect depends on the size of the change in the incentives, we divide the sample into two groups. For the large change group there was a decline in the tax rate in excess of -5% and for the small change group the decline in the marginal tax rates was between -5% and -0.5%. To be able to claim that the response to the reform can be related to the change in the marginal income tax rate, we should see a larger change for those whose tax incentives changed more.

Table 6 presents the divided sample results for the change in log turnover. The table first presents the average proportional changes in marginal tax rates, second the DD and third the elasticity estimates. The results indicate that turnover increased more in the large tax change group than in the small change group. The elasticity estimate for the former group is -0.2 and small and statistically insignificant for the latter group. Figure B2 in the appendix presents graphically the proportional changes in turnover and marginal tax rates for the two groups over time. The divided sample results indicate the

tax rate produces similar point estimates.

[9]This last check is presented in an earlier version of the paper (Harju and Kosonen 2012).

	(1) DD	(2) DD	(3) Δln MTR	(4) Δln MTR
DD	0.053***	0.053***		
	(0.015)	(0.016)		
△lnMTR			-0.149***	-0.143**
			(0.056)	(0.056)
△Other income		0.009		-0.024
		(0.108)		(0.159)
△Rents		1.419***		1.680***
		(0.406)		(0.547)
△Interest expenses		0.366		0.325
		(0.375)		(0.403)
△Other expenses		0.091		0.017
		(0.146)		(0.221)
N	308,456	308,456	210,602	210,602
R^2	0.008	0.010	0.002	0.005
N of firms	53,473	53,473	52,654	52,654

Note: Fixed effects regressions comparing the change in log turnover in partnerships and corporations. Columns (1) and (2) present a standard DD specification. Column (2) adds covariates to the simple specification in column (1). The firm level controls are changes in other income, rents, interest and other expenses in millions of euros. The time controls are indicators for each year and a linear time trend for the treatment group. Columns (3) and (4) regress the changes in marginal tax rates on the changes in log turnover for the years from 1995 to 1999. Column (4) adds firm level controls. The standard errors are clustered for 20 tax measurement groups, and are presented in parentheses:*** p<0.01, ** p<0.05, * p<0.1.

Table 5: Main estimation results

change in the marginal tax rates caused the change in turnover, and not another aspect of the tax reform.

Since the marginal tax rates changed in the reform, we are able to perform welfare analysis. In this, the elasticity of taxable income (Feldstein 1999) is an important parameter. We needed to construct an approximate income for the control group that does not include fixed other expenses and financial costs. These are a small share of the total cost structure. As a result our approximate income is close to the true income.

Table 7 presents our ETI results. The outcome is the change in log income in columns (1) and (2) and the change in log turnover in column (3). The independent variable is the change in the log net of tax rate, as in Gruber and

	Divided by △lnMTR	
	<-0.05	-0.05<△ < -0.005
△lnMTR	-0.156	-0.018
DD	0.055***	0.032**
	(0.016)	(0.016)
N	234,414	251,767
R^2	0.010	0.010
N of firms	40,714	43,696
△lnMTR	-0.234***	0.013
	(0.033)	(0.111)
N	229,756	247,109
R^2	0.007	0.007
N of firms	39,900	42,882
N treated	3,757	6,739

Note: Fixed effects regressions for the change in log turnover. lnMTR is the log of the imputed marginal tax rate. The results are divided according to the size of the change in the marginal tax rate between 1996 and 1997. The table shows the average change in marginal tax rates, a DD estimate and an elasticity estimate for both groups. The same set of control variables is used as in the main estimations. The block bootstrapped standard errors are in parentheses:*** p<0.01, ** p<0.05, * p<0.1.

Table 6: Results divided by the change in the MTRs

Saez (2002). Column (1) presents the DD instrument model estimated for both treatment and control groups. The true net of tax rate is instrumented with the variation induced by the reform, following again Gruber and Saez (2002). Column (2) presents the result without the control group, which is now very similar to Gruber and Saez's (2002) estimate. Fortunately, the variation induced by the reform applied to a substantial part of the firm distribution and was not correlated with income in a straightforward way. That reduces the mean reversion and endogeneity problems (see Saez *et al.* 2012 for a discussion of the problems). The results in columns (1) and (2) are very similar and indicate that the ETI for the treatment group is around 0.35. This is in line with earlier estimates for entrepreneurs (Saez *et al.* 2012). Column (3) just confirms that we obtain a similar estimate for turnover using

the net of tax rate instead of the marginal tax rate.

	(1)	(2)	(3)
	DD-IV	IV	DD-IV
Outcome	Δln Income	Δln Income	Δln Turnover
$\triangle$ln(1-MTR)	0.345**	0.350***	0.145**
	(0.116)	(0.109)	(0.048)
1st stage	2.086***	2.085***	2.103***
	(0.041)	(0.042)	(0.037)
F test	4,236	4,047	4,821
N	142,196	50,391	181,148
R^2	0.002	0.002	0.004
N of firms	41,686	13,310	45,258

Table 7: Elasticity of taxable income and turnover

It may be that from a policy perspective the ETI is not the only relevant parameter (Slemrod and Kopczuk 2002 and Chetty 2009). Instead, it is important to separate the real economic and tax avoidance responses. A naive solution for separating these two would be to compare output and income elasticities. Unfortunately, the naive approach has two problems. Firstly, the size of the elasticities is not comparable, since they indicate proportional changes of different means. Our elasticity estimate for turnover is 0.15 and for income 0.35. The elasticity formula is $\frac{dy}{d(1-\tau)}\frac{1-\tau}{y}$. If y in the formula is larger, a change of the same size, dy, leads to a smaller elasticity. Currently, turnover is ten times larger than income. If the same increase in turnover in euros showed up in income, the elasticity would be ten times larger, 1.5.

Secondly, the output could increase because of changes in the profit margin. On the other hand the income from the firm could increase because the profit margin or tax avoidance increased. Thus comparing output and income elasticities do not directly reveal the role of real and tax avoidance margins. Instead, comparing output and input elasticities does reveal the former and then it is possible to deduce the latter. Consider an increase in turnover, the output value. If this increase resulted from more items sold with zero profit margin, the income from the firm would not have increased. The dy in the elasticity formula would be zero, and thus the income elasticity would

be zero. Then again, if the extra turnover come from sales with a positive profit margin, the income from the firm would have increased. Therefore, an output elasticity of a given size may translate into input elasticities of different sizes even without tax avoidance interfering the statistics. We do not know the relative importance of tax avoidance, if we just observe the two elasticities, income and output elasticity.

We propose a rough decomposition that takes into account the two problems. The solution to the first problem, the different bases, is to reweight purchases, other inputs and income. We reweight each variable to equal the turnover of the firm. After the weighting the proportional changes in each measured variable reflect the size from the new (turnover) rather than the old base. The procedure compares the pre reform turnover and the statistic to be reweighted. The weight is the difference between the two, turnover and reweighted variable. The weight is added as a constant for each observation of the firm. After reweighting the weighted variables are on average larger, but the size of their variance in euros is original.

The solution to the second problem, changes in the profit margin, is to decompose the change in turnover and compare that with changes in purchases, investments and labor demand. If their combined elasticity were smaller than the elasticity of turnover, the real income from the firm has increased. In equation the estimation procedure is:

$$\frac{\triangle turnov.}{turnov.} = \frac{\triangle purch.}{turnov.} + \frac{\triangle invest}{turnov.} + \frac{\triangle labor}{turnov.}$$

where we compare the relative changes in turnover in the left hand side with relative changes in purchases, investments and labor demand in the right hand side. All changes are relative to the pre reform turnover of the firm. If the right hand side is smaller than the left hand side, it suggests that the real income has increased. We need to assume that purchases do not increase for other reasons than for increasing the sales (e.g. increasing the stocks).

Table 8 presents the decomposition results. The table shows the reweighted elasticities, in column (1) for purchases 0.11, in column (2) for investments 0 and in column (3) for income 0.1. We also estimate whether the labor

demand responded to the reforms in column (3) in table 9. It seems to be unaffected by the reforms. The sum of columns (1) and (2) in table 8 is 0.11. The labor demand was not affected by the reforms. This produces total input elasticity of 11%. Since the turnover elasticity is 15% in table 5, the implied increase in real income is about 3 - 4%.

To deduce the importance of tax avoidance, we compare this results with the observed income elasticity. The observed elasticity of taxable income as a proportional change from turnover is 10%, as table 8, column (3) shows. The only difference between this and the ETI estimate of 0.35 in table 7 is the weighting. The observed real income elasticity is 3 - 4% and the observed total income elasticity 10%, when the bases have been normalized. The two thirds difference between these figures comes from tax avoidance channel. Tax avoidance comes from entrepreneurs utilizing firm accounting rules. They can shift income between accounts and utilize capital depreciation rules etc.

	(1)	(2)	(3)
Outcome	Δln Purchases	Δln Investments	Δln Income
$\triangle$ln(1-MTR)	0.113***	-0.019	0.098***
	(0.023)	(0.015)	(0.017)
N	180,228	180,764	179,063
R^2	0.005	0.000	0.016
N of firms	45,081	45,258	45,105

Table 8: Break down of turnover elasticity as a share of turnover

We also investigate for additional channels of response. Figure B4 in the appendix presents how other outcome variables developed over time in the treatment and control groups. The figure presents the growth rate for those firms that had positive pre and post reform observations, for the years from 1995 to 1999, in the outcome variable. It is evident that in general the treatment and control groups develop in a similar manner over time in the figure. Therefore the requirement for common time trends seems to hold for the other outcome variables.

Table 9 presents the results for total assets, number of employees, and

wage sum. We estimate the last only for firms that do not have employees. We present for each outcome a DD specification according to equation (2). We find a positive and statistically significant effect for wage sum for firms that did not have employees. This indicates that entrepreneurs paid more wages to themselves. Total assets increased as a response to the reform. This indicates tax planning, since in the new tax system it was more favorable to have larger assets. This is what our theory model predicts for relatively patient entrepreneurs. Both the wage sum and assets regressions suggest other methods of tax planning than the tax avoidance result above. The number of employees did not respond to the reform. This supports the story that the increase in output came from increased entrepreneurial activity.

	△ln Wage sums	△ln Assets	△ln Employees
DD	0.093***	0.056***	-0.014
	(0.031)	(0.021)	(0.010)
N	57,950	292,973	145,602
R^2	0.005	0.005	0.009
N of firms	14,297	53,419	30,754

Note: Fixed effects regressions for the change in logarithmic wage sums, total assets and number of employees. The explanatory variable is a DD indicator. The same set of control variables is used as in the main estimates. The block bootstrapped standard errors are in parentheses:*** p<0.01, ** p<0.05, * p<0.1.

Table 9: Other outcomes

7 Conclusion

This paper studied how the economic activity and tax avoidance decisions of entrepreneurs depend on tax incentives. We studied entrepreneurial choices both using a theoretical model and by analyzing empirically tax reforms that altered income tax rates and tax planning possibilities.

The theoretical model presented a conjecture of how real economic activity, like effort, and tax planning decisions depend on the features of the tax system. We found that the tax system creates motives to save within the firm even at a lower interest rate than one would have on the capital

markets. Moreover, a tax reform that both lowers marginal income tax rates and increases these tax planning incentives has ambiguous theoretical predictions. The reform increases the economic activity and tax motivated saving of the entrepreneur if she cares enough about future consumption relative to present consumption. Otherwise both are reduced.

The empirical analysis of the Finnish income tax reforms investigated in which direction and by to what extent the behavior of entrepreneurs changed. We were able to perform a credibly causal analysis with the help of a control group not affected by the reforms. To study the changes in entrepreneurial activity, we looked at the output value of their firms. We showed that this variable measures changes in the economic activity of entrepreneurs, since they themselves work in their small firms, which do not have many employees. Furthermore, the activity of entrepreneurs is the only input that reacted to the reforms. The main result indicates that the average effect of the income tax reform was to increase turnover by 5%. The elasticity of turnover with respect to the marginal tax rate was -0.15. These main estimation results passed various robustness checks, making them more credible.

The divided sample results revealed that the turnover of those firms whose owner's tax incentives changed more also responded more. These results imply that the stronger the incentives, the greater the response is. This result is in line with the finding in the elasticity of taxable income literature that more salient (bigger) tax changes induce a greater response (Gruber and Saez 2002 and Saez *et al.* 2012).

The elasticity of taxable income (ETI) is relevant for deadweight loss calculations (Feldstein 1999). We found that income from firms increased as a response to the increased net of tax rate. From this we estimated the ETI to be 0.35. This estimate is in the range found in the literature for entrepreneurs (see Saez *et al.* 2012 for discussion). An ETI of this magnitude suggests that entrepreneurs are relatively responsive to their income taxation, but that the revenue maximizing tax rate could be higher than the present one. This estimate also suggests that the tax revenue of the Finnish government declined by two thirds of the size of the tax bill as a result of the reforms.

For welfare analysis it is also useful to break ETI down into components

relating to real responses and tax avoidance responses (Slemrod and Kopczuk 2002 and Chetty 2009). However, it is not straightforward to disentangle these by looking at different elasticities. We provided new insight into this by approximating the contribution of different components to the ETI. The method normalized every component to be a proportional change in the turnover of the firm. Under a no profit margin increase assumption, the normalized elasticities of different components should sum up to the ETI. If the income component has a larger elasticity than implied by this, we expect the remaining part to come from the tax avoidance channel. Also, we estimate the extent of profit margin changes. The results suggest that the contribution of the real response was one third and the tax avoidance response two thirds of the ETI. Thus for policy it would be more relevant to limit the possibilities for tax planning through the use of firm accounting rules than a reduced tax rate.

We studied other channels for tax planning in addition to tax avoidance through the utilization of firm accounting rules. We found that entrepreneurs paid more wages to themselves. Wages are additional income from the firm on top of profit. Also, entrepreneurs increased their asset accumulation, which under the tax system in Finland is tax planning. Our theory model predicts that if entrepreneurs increase their effort decisions, they also start accumulating assets within the firm as a response to the tax reform. In this way our empirical results confirm our theoretical analysis.

It should be noted that some of the increase in the output of firms could have resulted from less tax evasion. Tax evasion is by definition illegal and possibly entails a utility cost. Therefore it is not surprising that tax avoidance responds more, which in this case is just shifting income around in the accounts, which do not entail a utility cost.

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Appendix A

First order conditions and Cramer's rule derivations

This appendix presents the derivation of the main theoretical results. We start by presenting the derivation of the first order and second order conditions. Then we present how changing the tax parameter μ affects the optimized endogenous variables.

Take the inter temporal objective function of an entrepreneur:

$$\begin{aligned} U &= u_1\left(ne_1 - m - T_1\left(ne_1 - m, A\right) - R\right) + h(e_1) \\ &+ \delta u_2\left(Y + m - T_2\left(Y + m, A\right) + rR + A\right) \end{aligned}$$

Next we take the first order conditions with respect to e_1, R and m:

$$\frac{\partial U}{\partial e_1} = u_{1c} n \left(1 - T_{1y}\right) + h_e = 0 \tag{4}$$

$$\frac{\partial U}{\partial R} = -u_{1c} + \delta u_{2c} r = 0 \tag{5}$$

$$\begin{aligned} \frac{\partial U}{\partial m} &= -u_{1c}(1 - T_{1y}) + \\ &\quad \delta u_{2c} \left(1 - T_{2y} - T_{2A}\right) = 0 \end{aligned} \tag{6}$$

We take the second order conditions form the first order conditions

$$\frac{\partial^2 U}{\partial e_1 \partial e_1} = -u_{1c} n^2 T_{1yy} + u_{1cc} \left(n \left(1 - T_{1y}\right)\right)^2 + h_{ee} < 0$$

$$\frac{\partial^2 U}{\partial e_1 \partial m} = \frac{\partial^2 U}{\partial m \partial e_1} = -u_{1cc} n \left(1 - T_{1y}\right) \left(1 - T_{1y}\right) + u_{1c} n T_{1yy} > 0$$

$$\frac{\partial^2 U}{\partial R \partial R} = u_{1cc} + \delta u_{2cc} r^2 < 0$$

$$\frac{\partial^2 U}{\partial e_1 \partial R} = \frac{\partial^2 U}{\partial R \partial e_1} = -u_{1cc} n \left(1 - T_{1y}\right) > 0$$

$$\frac{\partial^2 U}{\partial m \partial m} = u_{1cc}(1 - T_{1y})^2 + \delta u_{2cc}(1 - T_{2y} - T_{2A})^2 + u_{1c} \left(-T_{1yy}\right) + \delta u_{2c} \left(-T_{2yy}\right) < 0$$

$$\frac{\partial^2 U}{\partial R \partial m} = \frac{\partial^2 U}{\partial m \partial R} = u_{1cc} \left(1 - T_{1y}\right) + \delta r u_{2cc}(1 - T_{2y} - T_{2A}) < 0$$

The sign of the determinant H must be negative for the second order conditions of this model to be fulfilled

$$H = \begin{vmatrix} \frac{\partial^2 U}{\partial e_1 \partial e_1} & \frac{\partial^2 U}{\partial e_1 \partial R} & \frac{\partial^2 U}{\partial e_1 \partial m} \\ \frac{\partial^2 U}{\partial R \partial e_1} & \frac{\partial^2 U}{\partial R \partial R} & \frac{\partial^2 U}{\partial R \partial m} \\ \frac{\partial^2 U}{\partial m \partial e_1} & \frac{\partial^2 U}{\partial m \partial R} & \frac{\partial^2 U}{\partial m \partial m} \end{vmatrix}$$

We insert into the second order conditions the arbitrage condition derived from the first order conditions that $r\left(1-T_{1y}\right)=1-T_{2y}-T_{2A}$. For example, developing by the first term of the determinant, we have $\frac{\partial^2 U}{\partial e_1 \partial e_1}$, which is negative multiplied by the square determinant as follows:

$$\begin{aligned}
& \frac{\partial^2 U}{\partial R \partial R}\frac{\partial^2 U}{\partial m \partial m}-\frac{\partial^2 U}{\partial R \partial m}\frac{\partial^2 U}{\partial m \partial R} \\
= \quad & \left(1-T_{1y}\right)^2\left(u_{1cc}+\delta u_{2cc}r^2\right)\left(u_{1cc}+\delta u_{2cc}r^2-\frac{1}{\left(1-T_{1y}\right)^2}\left(u_{1c}T_{1yy}+\delta u_{2c}T_{2yy}\right)\right) \\
- \quad & \left(1-T_{1y}\right)^2\left(u_{1cc}+\delta u_{2cc}r^2\right)^2>0
\end{aligned}$$

Developing all the terms in a similar fashion as above, we obtain the following signs for the terms of the determinant H:

$$\begin{aligned}
H \quad = \quad & \underbrace{\frac{\partial^2 U}{\partial e_1 \partial e_1}}_{-}\underbrace{\begin{vmatrix} \frac{\partial^2 U}{\partial R \partial R} & \frac{\partial^2 U}{\partial R \partial m} \\ \frac{\partial^2 U}{\partial m \partial R} & \frac{\partial^2 U}{\partial m \partial m} \end{vmatrix}}_{+} - \underbrace{\frac{\partial^2 U}{\partial R \partial e_1}}_{+}\underbrace{\begin{vmatrix} \frac{\partial^2 U}{\partial e_1 \partial R} & \frac{\partial^2 U}{\partial e_1 \partial m} \\ \frac{\partial^2 U}{\partial m \partial R} & \frac{\partial^2 U}{\partial m \partial m} \end{vmatrix}}_{+} \\
+ \quad & \underbrace{\frac{\partial^2 U}{\partial m \partial e_1}}_{+}\underbrace{\begin{vmatrix} \frac{\partial^2 U}{\partial e_1 \partial R} & \frac{\partial^2 U}{\partial e_1 \partial m} \\ \frac{\partial^2 U}{\partial R \partial R} & \frac{\partial^2 U}{\partial R \partial m} \end{vmatrix}}_{+} < 0
\end{aligned}$$

The sign of the H determinant is negative, and the second order conditions are fulfilled as long as the following condition is fulfilled from the second square determinant:

$$\frac{1}{r}\frac{T_{2yy}}{T_{1yy}}<\delta r^2\frac{u_{2cc}}{u_{1cc}}$$

In this case the first two terms in the H determinant in the first line above dominate the second square determinant. Since the first line is negative when the condition stated above holds, the whole H determinant is negative and the second-order condition holds.

We next derive the effect the parameter μ in the model has on the optimum values of the endogenous choice variables using Cramer's rule. Take first the derivative with respect to μ from the first order conditions for R and

m in equations (5) and (6).

$$U_{R\mu} = u_{1cc}T_{1\mu} - \delta u_{2cc}rT_{2\mu}$$

$$U_{m\mu} = u_{1cc}T_{1\mu}\left(1 - T_{1y}\right) - \delta\left(u_{2cc}\left(1 - T_{2y} - T_{2m}\right)T_{2\mu}\right)$$

Here we assume that $T_{yA}, T_{AA} = 0$ and $T_A < 0$, and transferring income within the firm (m) affects the tax function in a negative and linear way. Utilizing a condition from FOC it follows that $U_{R\mu}\left(1 - T_{1y}\right) = \left(1 - T_{1y}\right)\left(u_{1cc}T_{1\mu} - \delta u_{2cc}rT_{2\mu}\right) = U_{m\mu}$. The effect of a change in μ on optimal effort is:

$$\frac{\partial e_1^*}{\partial \mu} = \frac{\begin{vmatrix} 0 & \frac{\partial^2 U}{\partial e_1 \partial R} & \frac{\partial^2 U}{\partial e_1 \partial m} \\ -U_{R\mu} & \frac{\partial^2 U}{\partial R \partial R} & \frac{\partial^2 U}{\partial R \partial m} \\ -U_{m\mu} & \frac{\partial^2 U}{\partial m \partial R} & \frac{\partial^2 U}{\partial m \partial m} \end{vmatrix}}{H}$$

This complicated calculation is manipulated into:

$$\begin{array}{cc} & \left(u_{1cc}T_{1\mu} - \delta u_{2cc}rT_{2\mu}\right) \\ * & u_{1cc}\left(T_{1yy} + \dfrac{1}{r}T_{2yy}\right) \end{array}$$

where the second line is always negative by the concavity of the utility function and the convexity of the tax function. Thus the effect of the special tax rule on effort is determined by the first line above. Therefore the effect is positive as long as

$$\frac{\partial e_1^*}{\partial \mu} \gtrless 0 \Longleftrightarrow \frac{T_{1\mu}}{T_{2\mu}} \gtrless \delta r \frac{u_{2cc}}{u_{1cc}}$$

A similar calculation is performed for m. Cramer's rule produces the following determinant, the sign of which has to be determined:

$$\frac{\partial m^*}{\partial \mu} = \frac{\begin{vmatrix} \frac{\partial^2 U}{\partial e_1 \partial e_1} & \frac{\partial^2 U}{\partial e_1 \partial R} & 0 \\ \frac{\partial^2 U}{\partial R \partial e_1} & \frac{\partial^2 U}{\partial R \partial R} & -U_{R\mu} \\ \frac{\partial^2 U}{\partial m \partial e_1} & \frac{\partial^2 U}{\partial m \partial R} & -U_{m\mu} \end{vmatrix}}{H}$$

We calculate this by inserting and arranging terms. The effect of the

special tax rule on m^* turns out to depend on the same condition as for e^*:

$$\frac{\partial m^*}{\partial \mu} \gtrless 0 \iff \frac{T_{1\mu}}{T_{2\mu}} \gtrless \delta r \frac{u_{2cc}}{u_{1cc}}$$

Appendix B: Figures and tables

This appendix presents additional tables and figures to the main text.

For sole proprietors, the reforms did not on average change tax burden. The left panel of figure B1 presents the change in MTRs for sole proprietors due to the reforms. A large proportion of them are at zero and the bulk of the data is within a one per cent change in absolute value. The right panel of the figure presents the proportional change in the main outcome for sole proprietors and compares that with corporations. There is no clear deviation from the general trend for sole proprietors at the time of the reform.

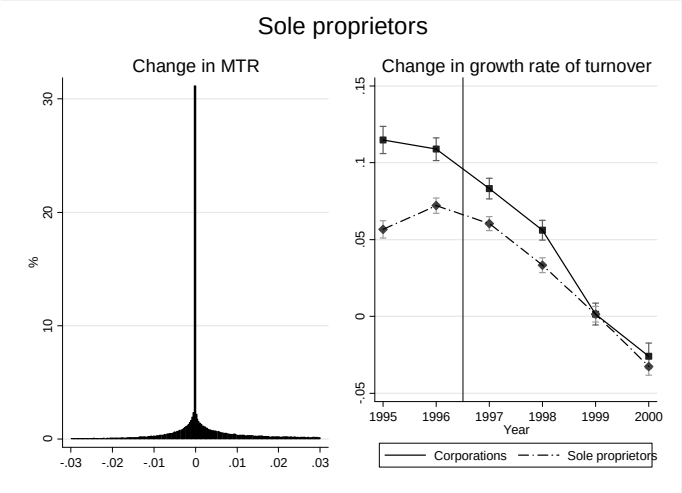

Figure B1: Sole proprietors: Changes in marginal tax rates and change in the mean of growth of corporations and sole proprietors

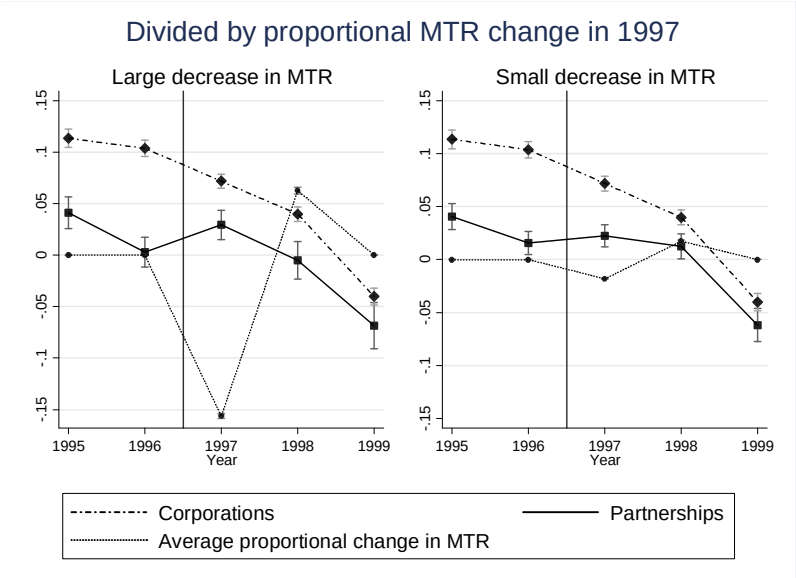

Figure B2: Divided sample description by the size of change in tax incentives

Note: The figure compares proportional change in MTRs and the development of turnover according to the pre reform size of the MTR .

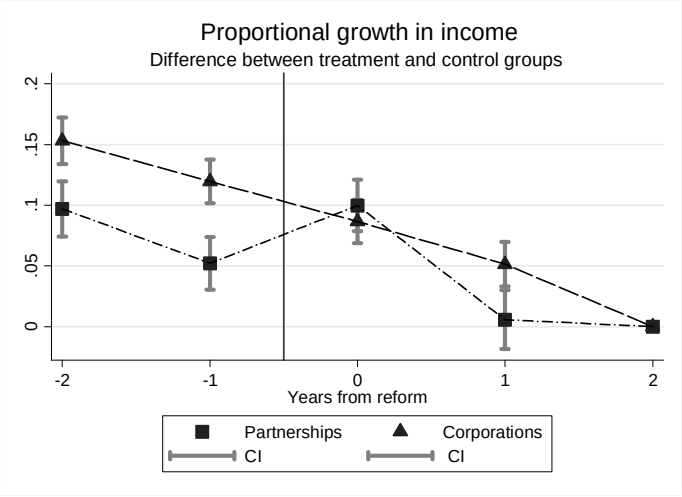

Figure B3: Proportional change in income for partnerships and corporate owners

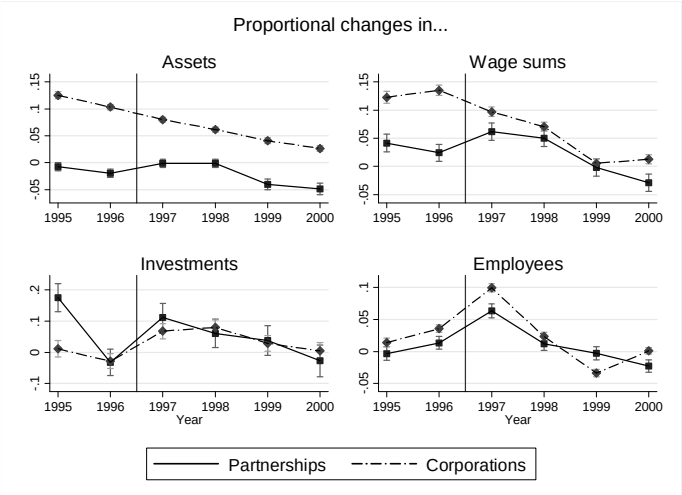

Figure B4: Proportional changes in different outcome variables over time for partnerships and corporations

Note: The figure compares the mean of the proportional change in profits, wage sums, investments and number of employees.

	Treatment		Control	
Industrial classification	Turnover	N	Turnover	N
Agriculture, forestry, fishing and mining	198174	568	361011	818
Manufacturing	206458	2323	714823	5995
Construction	194804	2366	454217	4752
Wholesale and retail sale	408944	5134	663083	10021
Accommodation and food services	206255	935	427033	1253
Transportation and storage	313818	1559	598067	1793
Real estate	98198	2311	226365	9133
Education	103296	171	145387	300
Other	113618	1149	271093	2892
Total	254909	16516	483917	36957

Note: Turnover is the average for years 1994 to 1999 and N is the number of firms.

Table B1: Industrial decomposition of treatment and control groups