# Taxation of Dividend Income and Economic Growth

## – The Case of Europe

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# Taxation of dividend income and economic growth: The case of Europe

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*Abstract*

More recently researchers have turned to analyze how the tax structure, rather than the overall tax level, affects economic performance. For instance, several papers have investigated how taxation on corporate and individual (labor) income influences growth. Taxation of dividend income may also influence growth via its impact on investments and firm behavior. Within the academic community there is conflicting views about the impact taxation of dividends has on firm behavior and, hence, on economic performance. According to the "traditional view", taxation of dividends is distortionary and increases the cost of equity. According to the "new view", taxation of dividends does not influence the marginal cost of capital and consequently has no impact on investment decisions. To our knowledge, this paper is the first study to explore how tax rates on dividends affect economic growth, by using panel data from 1990 till 2008 for 18 European countries. We find that taxation of dividend income negatively influences economic growth, a result that corroborates the old view of dividends taxation as distortionary and also has some policy implication for the European countries in question.

**JEL classification:** H21 ; H24 ; H25 ; O40

**Keywords**: Economic growth, taxation of corporate income, taxation of personal income

## 1. Introduction

As the globalization process and international mobility of resources have intensified so has tax competition and the pressure under which domestic tax systems are put. As a consequence research has turned its focus to more and more study how different taxes, rather than the overall tax level, affect economic behavior. For instance, it is by now pretty well established that the corporate tax rate negatively affects investments, influences where profits are reported, and negatively affects economic growth. Consequently, corporate tax rates have declined worldwide. The average rates in the EU members and OECD were 41.6 and 41.0 percent, respectively in 1990, in 2014 these rates had declined to 24.3 and 25.3 percent, respectively (OECD, Tax database, 2015). At the same time the less mobile tax bases have seen increased tax burdens. For instance, the share of property taxation over total tax revenues has almost doubled from 0.8 (EU) and 0.6 (OECD), respectively to 1.3 (EU and OECD) percent of total tax revenues in 2013 (OECD, Tax Revenue Statistics).

A tax that has received considerable attention in the academic community for decades is the dividend taxation. The controversy about the potentially detrimental effects of the dividend tax on investments and firm behavior has been debated since the 1970s, and is still far from resolved. Whether the "new view" - which claims that dividend taxation is irrelevant for firms' investment decisions and hence to be considered a lump sum tax - or the "traditional view" - which claims that the dividend taxation affects capital costs and thereby investment decisions - more accurately describes reality is still debated. As a result numerous studies have been undertaken in order to test the two views. Commonly the effect a change in dividend taxation has on amounts of dividends distributed has been tested. Even though the empirical results are somewhat mixed most studies tend to support the "traditional view" (Zodrow 1991). Despite this finding, the direct effect of the dividend tax on overall economic performance is basically unstudied. Recent studies on the structure of taxation and economic growth tend to treat personal income in aggregate (Arnold 2008, OECD 2010). Personal income is heterogeneous, both as it often groups labor and capital income together and is taxed at progressive rates, and therefore is likely to have different distortionary effects and, hence, different effects on economic performance.

Despite the lack of research on the dividends tax effect on economic growth the Bush administration implemented a dividend tax cut in 2003 in order to boost the US economic

performance ("Jobs and Growth Tax Relief Reconciliation Act"). The effect of this cut has been studied and generally found to have increased dividends distributed and induced a more efficient distribution of investments across firms (Chetty & Saez 2006).

This paper examines the correlation between income taxation, in general, and taxation of dividends in particular and economic growth. This is done by studying how taxation of corporate, top labor income as well as dividend income impact economic growth in 18 European countries during the period 1990 to 2008.[1] We follow standard growth estimation techniques with country and year fixed effects to determine the effect of income tax rates on GDP per capita growth.

The paper is organized as follow. The next section gives a brief summary of the literature on taxation and economic growth. Section 3 provides a more detailed review of the different views of dividend taxation and the effects on investment and firm behavior. Section 4 describes the method and section 5 the data. Section 6 presents the results, section 7 provides some sensitivity analysis, and finally section 8 concludes the paper.


## 2. Literature on taxation and economic growth

There is a vast literature on how taxation distorts individuals' and firms' decisions concerning for example how much labor individuals supply, how hard they work, how and where investments are made, and where firms choose to locate production and profit. Numerous studies have investigated how corporate and labor taxation, and not least the taxation of dividends affect individuals' and firms' behavior.

There is also a sizable literature documenting the overall effect of government size on economic growth. Though the results are scattered, recent literature tends to find that government size, typically measured as total government expenditures as a fraction of GDP, is negatively correlated with economic growth in rich economies (see e.g., Fölster & Henrekson 2001, Romero-Avila & Strauch 2008, and Bergh & Karlsson 2010).

The reason government expenditures are thought to influence economic growth negatively is the distortionary effect of taxation. Studies analyzing the correlation between overall government expenditures and economic growth are, hence, using an indirect way to study how taxation affects economic growth. It is likely that not only the aggregated total tax burden

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[1] The countries included are Austria, Belgium, Denmark, Finland, France, Germany; Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and UK.

but also the disaggregated structure of taxation matters for economic growth. Some taxes are thought to be more distortionary than others as different taxes have more or less mobile tax bases. For instance, high corporate tax rates are often assumed to be more harmful for economic activities than taxation of property. Hence, various taxes have different effects on the *level* of economic activity. Whether these effects carries over to impact also the *growth rate* is less clear, however.[2] A study by Easterly (1993) provides empirical evidence that distortions are negatively correlated with growth rates. Several studies have analyzed the direct link between taxation of typically personal income and economic growth (see e.g., Koester & Kormendi 1989, Plosser 1992, Slemrod 1995, Padovano & Galli 2001 and 2002, Leibfritz, Thornton & Bibbee 1997, Dowrick 1993). The results from this literature are equally scattered, however.[3]

Recent research has turned to investigate economic growth and the structure of taxation, primarily using tax measures from tax revenues, and economic growth. The results from these studies are mixed and, hence, hard to draw policy implications from. For example, Dowrick (1993) finds personal income taxes to have a negative impact on economic growth while his results indicate no such relationship for corporate tax rates and economic growth. This is consistent with Widmalm's study (2001) that investigates the GDP growth effect of the tax structure, defined as the proportion of tax revenues stemming from taxes on personal income, corporate income, property taxes, taxes on goods and services, and taxes on wages, and a measure for tax progressivity. Her results reveal a negative correlation between the proportion of tax revenues from personal income taxes and economic growth, while no such correlation is found for the proportion of corporate tax revenues. This may seem surprising as the corporate tax rate is commonly thought to be more distortionary than taxation of personal income. Arnold (2008) use annual panel data for 21 OECD countries to study the link between tax structure and

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[2] This relates to the difference between neoclassical growth models developed by Robert Solow in the 1950s and the endogenous growth models developed by Paul Romer and Robert Lucas in the 1980s. In the neoclassical growth models taxes have no permanent effects on per capita GDP growth, regardless of the distortionary effects of the taxes. In the endogenous growth models they do, however.

[3] Plosser (1992) finds tax burdens measured as the share of revenues from income and profit taxes to GDP to be negatively correlated with GDP growth while Koester & Kormendi (1989) detect no statistically significant relationship between taxes and economic growth. Contrary, Padovano & Galli (2001) observe tax rates to negatively and statistically significantly impact growth. In a later paper, Padovano & Galli (2002), confirm the negative correlation between marginal tax rates and economic growth but find average taxes to have an insignificant impact. Contrary to these findings Leibfritz, Thornton & Bibbee (1997) obtain a negative correlation between both average and marginal tax rates and economic growth. Dowrick (1993) finds personal income taxes to have a negative effect on growth.

economic growth. His tax measures are also based on tax revenues obtained from different taxes. Unlike previous studies Arnold uses annual data and the estimations are based on a standard empirical model and a government budget constraint enabling evaluation of revenue-neutral changes in the tax structure. The results indicate that a stronger reliance on income taxes imply significantly lower levels of GDP per capita than the use of taxes on consumption and property. Among the income taxes, he finds corporate income taxes to be associated with lower levels of GDP per capita than personal income taxes (cf. OECD 2010). Xing (2012), however, shows that Arnold's result is not robust under different assumptions about heterogeneity across countries and the underlying econometric model and finds no robust ranking among corporate income taxes, personal income taxes and consumption taxes.

Kneller et al. (1999), also control for the government budget constraint and study not only the tax structure by dividing taxes into distortionary and non-distortionary taxes (measured as tax revenue as a share of GDP) but also the expenditure structure by dividing expenditures into productive and non-productive. Their results lend support to distortionary taxes reducing growth and productive spending enhancing growth. A later study by Gemmell et al. (2007) confirms this result.

Alfonso & Alegre (2011) estimate the impact of fiscal policies (measured as shares of GDP and with a focus on government expenditures) on long term economic growth in 15 EU countries using a dynamic GMM model. They find a negative impact of public consumption and social security contributions on economic growth, while a positive impact of public investment on economic growth.

A shortcoming of these studies is that they tend to use backward looking average tax measures based on tax revenues. As distortions from taxation to a large degree are influenced by forward looking marginal tax rates it may be more fruitful to analyze the link between marginal tax rates and economic growth. An exception to this is the study by Lee & Gordon (2005). They estimate the impact of statutory corporate and personal income tax rates and the value added tax rate on GDP per capita growth using panel data from 70 countries during the time period 1970 to 1997. Results show a significant negative correlation between statutory corporate tax rates and growth but no significant correlation between top statutory personal income tax rates and growth. When they restrict the sample, by including an OECD-dummy, the corporate tax rate effect on

growth for the OECD countries becomes nearly zero, suggesting that the corporate taxation is less harmful to growth in more developed countries than in less developed countries.

Another shortcoming with existing studies analyzing the structure of taxation is that they tend to aggregate personal income, grouping labor and capital income together. As income from labor and capital may have very different incentive effects and, thus, affect economic growth differently this may be problematic as will be discussed in greater detail below.

## 3. Taxation of income, firm behavior and economic growth

There are several reasons to expect both corporate and personal taxation of labor and dividend income to impact economic growth. Starting with the dividend taxation, the main focus of this paper and the tax of which the effects are perhaps the most controversial, there are several reasons to expect this tax to influence growth via its impact on investment and firm behavior. Indeed, Bush's aim with the "Jobs and Growth Tax Relief Reconciliation Act" of 2003, that reduced double taxation of dividends, was to boost economic growth. However, within the academic community the logic behind this act can be debated as there is no consensus about the impact taxation of dividends has on firm behavior and, hence, on economic performance. The two competing views have quite different implications about the abolishment of double taxation.[4]

According to the "new view" taxation of dividends does not influence the marginal cost of capital and consequently has no impact on firms' investment decisions (Auerbach 1979, Bradford 1981). Dividend taxation can be regarded as a lump-sum tax. The argument behind this result is that firms finance their activities through retained earnings and thus avoid double taxation. Instead of issuing new equity existing profits are reinvested rather than distributed to shareholders, and no dividend tax is therefore triggered. According to this view future dividend taxes are already capitalized in share prices implying that a reduction in dividend taxation would result in windfall gains to existing shareholders who would benefit from increasing stock prices. Abolishing double taxation would, hence, be undesirable and result in large revenue losses to the government and leave capital costs of investments unchanged but provide large windfall gains to existing shareholders. Moreover, even though taxation of dividends may lower domestic savings

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[4] In many countries business profits are subject to double taxation. Profits are first taxed at the corporate level and then again when the remaining profits are made available to the owner by either dividend or capital gains taxation.

it is thought not to impact the amount of investments made as domestic capital is replaced by foreign. In small open economies foreign capital is assumed to be a perfect substitute for domestic capital, making taxation of dividends irrelevant for firms' investment costs.[5] According to the new view, we would not expect a negative relationship between dividend taxation and economic growth; on the contrary, if assumed to be a lump sum tax it is an efficient tax to use. Empirical support for the new view of equity is found by e.g., Lindhe (2002) for Sweden, and Auerbach & Hassett (2002, 2006) for the US; the latter also observing that firm equity behavior depends on firm-specific characteristics.

Contrary to the "new view" the "traditional view" or "old" view assumes that taxation of dividend is distortionary as it reduces available amount of equity capital for firms and investments (Feldstein 1970, Poterba & Summers 1985). An increase in the dividend tax rate will raise the effective tax rate on investment income and discourage investment. In addition, an increased tax rate will discourage the amount of payouts and reduce the amount of capital available for new investments. There is empirical evidence supporting this hypothesis. For instance, Becker et al. (2013), Poterba (2004), Nam et al. (2010) and Chetty & Saez (2005, 2006) find that higher dividend tax rates are associated with lower distributed dividends and thereby available capital for financing investments in other and new firms.[6] As the dividend tax locks in capital in mature firms, it reduces the allocative efficiency and harm new and small firms with potentially better returns. Chetty & Saez (2010) have demonstrated that this effect of dividend taxation gives rise to high social costs.

The "new view" is based on assumptions whose practical relevance can be questioned. Or as Zodrow (1991, p. 507) puts it: "The theoretical models underlying the new view are simple and elegant, but are problematic because they generally are based on the increasingly questionable assumptions that share repurchases are precluded". Above that, it is presumed that the firm already exists and is mature enough to make sufficient profit to finance a marginal

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[5] Research shows that in reality there is a home bias which means that foreign capital does not constitute a satisfactory substitute for domestic saving as investors are not indifferent to where they invest (see e.g. the review of Karolyi & Stulz (2003), French & Poterba (1991), Dahlqvist et al. (2003), Sendi & Bellalah (2010)).

[6] Illustrating the incentive effect of the dividend tax, Hanlon & Hoopes (2014) find that firms responded to the expected increase in the dividend tax rate in January 2011 and January 2013 by paying out special dividends in the period prior to the tax increase and by shifting the timing of regular dividends to the low-tax period.

investment. For firms lacking profits, or for entrepreneurs with unrealized business concepts, the tax on dividends affects the cost of finance and, hence, the investment decision. The different views may be relevant for different evolutionary steps in a firm's life cycle. For new firms there are no existing profits that can be reinvested and these firms are exposed to double taxation. For established firms with growth potentials the profits can be reinvested and generate new returns; these firms then avoids double taxation. For mature firms the dividend tax provides a tax wedge and may make reinvestment of profit profitable for the firm even though the capital may generate a better return elsewhere (in a world without double taxation).

The "new view" also ignores issues with asymmetric information. There are several aspects of asymmetric information that are relevant for taxation of dividends. First, as already mentioned the dividend tax tends to lock in capital and due to the principal-agent problems between management and owners the capital kept in the firm may not be used where it maximizes the wealth of the owners but rather the utility of the management (Chetty & Saez 2010, Gordon & Dietz 2006). Second, due to asymmetric information external financing is higher than for internal financing. An entrepreneur looking to finance an investment has, in many cases, better information about the investment's expected return than an external financier (however in other cases it can be the reverse); the external financier then requires a premium for providing capital. A business with internal capital does not need to acquire external capital and can thereby avoid the extra premium associated with asymmetric information as well as costs associated with issuing equity.

Additional effects of personal capital taxation has been pointed out by Keuschnigg & Nielsen (2004) who show how both dividend and capital gains taxes inhibit entrepreneurs' efforts and lead to social welfare losses. They model entrepreneurs' and venture capitalists' effort and show that since profit is shared effort is reduced, and introducing a tax on capital income further reduces effort of both the entrepreneur and the venture capitalist and lead to social welfare losses. Moreover, Poterba (1989) shows that high levels of personal capital taxation negatively impact not only the supply but also the demand for risk-willing capital; by reducing individuals' incentives to become entrepreneurs. Dividend taxation also distorts the type of investments that are made. Investments which generate continuous returns, such as dividends and interest, are disadvantaged in relation to investments that generate increases in value. Capital gains tax also leads to investors retaining their investments in order to avoid paying tax, a behavior that

prevents optimal composition of the investment portfolio. A further consequence of high double taxation, as studied by Huizinga & Vogel (2009), is the organizational corporate structure following a purchase. Countries with high levels of international double taxation are, according to Huizinga and Vogel, less inclined to win over the parent company's location.

In summary, there are many arguments for dividend taxation influencing firm behavior, primarily small firms and new business creations. Dividend taxation and limited access to international capital markets (relative to large established businesses) put small and new firms at a disadvantage. Small and new start-up businesses are largely dependent on their own capital or access to domestic risk capital markets. A report from the OECD (2010) confirms this statement as it finds that larger companies that have access to foreign capital markets are less affected by dividend taxation than smaller businesses lacking access to foreign capital.

Turning to taxation of personal labor income, it may influence economic growth by affecting human capital investments, supply of labor, and work effort. Proportional income taxes do not influence education decisions as the government shares equally in the forgone earnings and the future return from education (Trostel 1993). Progressive income taxes discourage education, however, as taxes saved while in school are less than taxes paid on future returns to education (Heckman et al., 1998). An extensive literature on incentives and work effort finds a positive relationship between the two (see e.g., Ehrenberg 1990 and Prendergast 1996), for reviews), suggesting that higher taxes, i.e. lower net return, increase production costs and lower efficiency. Similar results have been found in the tax response literature, with several studies revealing that especially high-income earners respond to lower net-returns by reducing effort rather than reducing hours worked (see e.g., Gruber & Saez 2002).

With regard to taxation of corporate income, it reduces the net return to investments and could lower the return on innovations and reduce the amount spent on research and development, thereby impacting growth negatively. In addition, corporate taxation discourages investments both domestically and internationally by reducing foreign direct investment, and hence hampers economic growth.[7] Other studies suggest the corporate taxation reduces productivity. Schwellnus & Arnold (2008) and Vartia (2008), for example, analyze the impact of corporate income taxation on firm productivity using a large data set of firms and industries across OECD countries.

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[7] There is a sizable literature documenting a negative relationship between corporate tax rates and FDI (see e.g., De Mooij & Ederveen (2006) and Feld & Heckemeyer (2011)).

Both papers find a negative effect of corporate income taxes on productivity, and hence indirect evidence of corporate taxes harming growth.

Furthermore, both corporate and labor income taxation may affect entrepreneurial activity (see e.g., Johansson 2008), which enhances economic growth by creating new ideas and promoting technological change. There are several ways through which taxes can affect the amount of entrepreneurial risk-taking. Obviously, the impact of the two income taxes depends on how entrepreneurial income is taxed in individual countries. In countries where entrepreneurial income is taxed at lower rates than personal income, high personal income tax rates encourage individuals to become entrepreneurs in order to avoid highly taxed personal income.[8] The treatment of losses may also influence entrepreneurial activity. The classical Domar & Musgrave (1944) result suggests that higher taxes encourage risk-taking as the government, by allowing loss offsetting, shares the risk with the entrepreneur (cf. Myles 2009). Progressive taxation, however, discourages risk-taking as losses push entrepreneurs into low tax brackets reducing the value of the loss offset, while profits push entrepreneurs into high marginal tax brackets reducing the net profit for the entrepreneurs (see e.g., Gentry & Hubbard 2000). In addition, tax avoidance and evasion are much easier for entrepreneurs (self-employed) to undertake than for employees supporting a positive relationship between personal income taxes and entrepreneurship. There also seems to be a link between labor taxation and FDI.[9] Labor taxation has also been found to influence factor productivity and entrepreneurship. Industry-level evidence from OECD countries (OECD 2010) suggests a negative relationship between top marginal tax rates on personal income and long-run levels of total factor productivity, especially in countries with high entry level rates, suggesting that high top statutory personal income tax rates hurt firm entry. This is also consistent with results from Sweden, showing that high marginal tax rates on personal income retard firm start-ups (see Hansson 2010).

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[8] It is important to note that the definition of entrepreneurship is vague, even though most scholars agree that it is important to differentiate between entrepreneurship and self-employment.

[9] Several papers have established a negative link between labor taxes and FDI (Hajkova et al. 2006, Hansson & Olofsdotter 2011). Hajkova et al. (2006) even find the impact of labor taxes on FDI to be substantially larger than that of cross-border effective average and marginal corporate tax rates

After reviewing the literature, it seems fair to conclude that the empirical evidence of a relationship between both the level of taxation and the structure, respectively, and economic growth is weak, and that there is a need for further research to clarify this relationship.

Our study analyzes how taxation of corporate and personal income impact economic growth. Like Lee & Gordon (2005), we also use marginal tax rates on corporate and personal income as our tax measures rather than measures based on tax revenues.[10] Economic theory predicts marginal tax rates to matter for the distortions introduced to individuals' and firms' choices. According to theory they influence decisions concerning the amount of investments to undertake, additional income to earn, and entrepreneurial effort, and are, hence, the relevant tax rates for economic growth. Average tax rates, on the other hand, influence the discrete decisions whether to invest or work at all. Additionally, average rates are more correlated with government expenditures than marginal rates, and may hence effect economic growth positively, while marginal tax rates should, according to theory, be negatively correlated with growth. The difficulty lies in determining what marginal tax rate to use as different rates apply to different levels of income (due to various rates but also due to exemptions, credits, and depreciation allowances). To avoid some of these issues we choose to use the top marginal tax rate on both personal and corporate income.

Unlike Lee & Gordon we also analyze the impact taxation of dividends has on economic growth. Even though there is a sizable literature documenting the impact of dividend taxation on investment costs and the allocation of investment, the direct link between the dividend tax and economic growth has to our knowledge been unstudied. We also focus on European countries as the effect of taxation on economic growth likely varies greatly between rich and developing countries.

In addition, our analysis takes into account that the tax structure may have both distortionary as well as non-distortionary components and that government expenditure structure may contain both productive and non-productive components (cf. Kneller et al. 1999, Gemmell et al. 2007). Disregarding this dimension may bias the results as shown by Kneller et al. (1999). More specifically, adding fiscal variables in an ad-hoc manner without taking into account the government budget constraint can lead to misspecification and incorrect conclusions. Instead, the way a tax is used or public expenditure financed need to be controlled for. We follow Kneller et

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[10] Even though we use tax rates based on tax revenues as a sensitivity test.

al. (1999) and Gemmell et al. (2007) and control for productive public expenditures and leave out non-productive spending. This means that an increase in a particular tax rate should be interpreted as the effect of raising a particular (distortionary) tax and spending the obtained revenues on non-productive activities. Consequently, we leave out the assumed non-distortionary taxes on consumption and property.

## 4. Empirical method

We estimate the effect of tax rates on economic growth using a fixed effects regression model, a standard approach within the literature capable of accounting for many unobservable factors that may be confounded with the functioning of the tax system. The fixed effects estimator may remedy the problem of omitted variable bias as long as these are constant over time. Factors such as national culture, legal-political institutional infrastructure, and government efficiency are factors that have been found to influence growth and are likely to be correlated with tax rates. Omitting such factors would lead to biased estimates.

The regression model can be written as:

$$g_{it} = X'_{it0}\beta + Z'_{it}\gamma + \mu_i + \delta_t + \varepsilon_{it} \tag{1}$$

The dependent variable, $g_{it}$, denotes economic growth for country $i$ at time period $t$ and is measured as the difference of logarithmic per capita GDP. $X_{it}$ is a vector of measures of corporate and personal income tax rates in year $t$. $Z_{it}$ is a vector of explanatory variables including the variables initial income (per capita GDP in year t-2), national investment, openness (exports and imports as a share of GDP), growth rate of the labor force, together with government productive spending[11] and government surplus.

The $\mu_i$ terms are fixed country effects (i.e., unmeasured shocks). These terms account for time-invariant determinants of economic growth that vary among the countries in our sample. If $\mu_i$ were correlated with $X_{it0}$ in equation (1), then estimators that failed to include the country-

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[11] Table A1 in the Appendix shows the functional classification of expenditures and revenues into distortionary and non-distortionary, productive and non-productive categories, respectively, in accordance with Kneller et al. (1999).

specific fixed effects would yield inconsistent estimates of the effect of taxation on economic growth.

The $\delta_t$ terms are sample-wide period effects. These terms account for trends that affect the economic growth in each of the countries similarly, such as business cycles. Tax rates are likely affected by these events and a model failing to account for such trends would confound those trends with the effects of changing tax rates. The terms $\beta$ and $\gamma$ are parameters to be estimated. The $\varepsilon_{it}$ terms are idiosyncratic disturbance terms that vary by country and time period, and are assumed to be independently and identically distributed with mean zero and variance $\sigma_\varepsilon^2$.

Studies on taxes and growth may suffer from several statistical problems. One of them is the endogeneity problem. Tax rates may both influence economic growth and be influenced by economic growth. High taxes may cause lower growth rates, but periods of low growth rates may require raised tax rates in order to finance increased expenses on, for example, higher unemployment rates. To investigate this potential problem, we complement the analysis with regressions using 1-year lags on all explanatory variables.

To remove business cycle effects it has been common in the literature to use 5-year averages. The persistency of tax rates over time also motivates averaging over time instead of using annual data. In order to take this into consideration, we also run regressions based on averaging, but in order to obtain sufficient observations we use 4-year averages for per capita GDP growth and the other explanatory variables.[12] However, the variable for initial income per capita has a 4-year lag, taking on the first value in the previous 4-year period, whereas the tax rate variables take on the initial values in each (current) 4-year period.

As argued earlier, the analysis of the effect of taxes on economic growth may produce more accurate results if it uses forward looking marginal tax rates, our explanatory variables of interest, rather than backward looking average tax measures based on tax revenues. However, as a robustness test we regress GDP growth per capita on the latter type of tax measure as well, more specifically, the share of tax revenues from individual capital income, individual labor income and corporate income.

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[12] Kneller et al. (1998) have shown that the results are somewhat sensitive to how the 5-year averages are constructed.

## 5. Data

We focus on institutionally fairly similar countries and our dataset is a panel of 18 European countries covering the period from 1990 to 2008. The dataset contains OECD data on GDP per capita and its growth rate, national investment as a share of GDP, exports and imports as a share of GDP (openness), the growth of the labor force and the government budget surplus. Data from IMF Government Finance Statistics Yearbook (GFSY) are used to construct the variable measuring government productive spending as share of GDP. Data on the various statutory tax rates come from the European Tax Handbook of the International Bureau of Fiscal Documentation (IBFD), the World Tax Database from the Office of Tax Policy Research (OTPR) at the University of Michigan, and OECD Tax Database (top marginal statutory tax rate in dividend income at shareholder level).[13] Table 1 shows a summary description of the variables and their sources. Due to data limitations on government productive spending as a share of GDP our data end in 2008. Apart from this limitation, the financial crises starting in 2008 motivates our choice of time period.

Figure 1 illustrates the development for corporate income tax rates and the top marginal tax rates on personal income and shareholders' top tax rate on distributed dividends (annual averages). The corporate tax rate (blue line in Figure 1) and top marginal tax rate on labor income (red line in Figure 1) have both experienced considerable reductions in the decade preceding the starting year of our period of study. The decline has continued from 1990 and onwards, particularly with regards to the corporate income tax which has gone from a rate above 35 percent to roughly 25 percent. The average top marginal tax rate on labor income has decreased from over 50 percent to nearly 45 percent. The average top tax rate on dividends (green line in Figure 1) has also declined during the 90s and 00s, but on a smaller scale, from a mean rate at nearly 25 percent to 20 percent. The variation over time and across countries is substantial when it comes to all taxes, but in particular for the dividend taxation. In the beginning of the time period Greece had a dividend taxation of 50 percent, this rate was then reduced to zero and then rose to 10 percent 2009. Across countries the rate varies from over 30 percent in Italy to zero rates in e.g., Greece and United Kingdom.

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[13] Data on the corporate tax rate range from 1970 to 2010, while data on the top marginal tax rate on personal income cover the period from 1975 to 2010. The top tax rate shareholders face on distributed profits range from 1990 to 2011.

## 6. Results

Table 2 reports the results from the fixed-effect regression of the dividend income tax rates, and the other two income taxes and GDP per capita growth. The first four columns refer to model specifications where only the dividend tax is included. Columns 1 and 2 contrast the regression results when we include and exclude initial income, respectively. We make this comparison based on the argument that the control for initial income may capture too much of the effect of other explanatory variables, considering that we are studying countries that are quite similar in terms of GDP. Columns 3 and 4 show the results from our investigation of the temporal aspect of how taxes affect growth. Considering that it may require some time for individuals and corporations to adjust to changes in tax rates, it may not be the tax rate for this year but rather the previous year that impacts on current growth.

The coefficient for the dividend tax is negatively and statistically significant in columns 1 and 2. The coefficient is somewhat larger in size when excluding initial income but by and large is not that affected by the inclusion of initial income. Specifically, the coefficient corresponds to a semi-elasticity of almost 0.001, meaning that a one percentage point increase in taxation of dividends corresponds to 0.001 percent lower GDP per capita growth. Surprisingly, national investments are negatively correlated with GDP per capita growth. Openness positively and statistically significantly (only at 10 percent in column 2) correlates to per capita GDP growth, while government surplus, government productive spending, and labor force growth are all insignificantly correlated with the growth rate. Using 1-year lags of explanatory variables (note that initial income continues to have a two-year lag), we observe that the dividend tax loses significance when we also account for initial income. The dividend tax estimate is weakly significant in column 4 and slightly smaller compared to the estimate in column 2, where we consider "current" effects. The effects of other variables which were significant in $t$ are now larger and estimates more significant.

Columns 5 to 8 present the results of models specifications corresponding to those in columns 1-4 but with the addition of corporate income tax and top marginal tax rates on labor income. The results show the same pattern as in columns 1-4. Interestingly the other income

taxes are insignificant in all specifications.[14] That the corporate income tax rate is insignificantly correlated to growth is somewhat surprising. To test whether that is due to studying a relatively recent time period when corporate tax rates have in general been low, we exclude the dividend tax rate from the specification in order to maximize the time periods for the corporate tax rate and the top marginal tax rate on labor income. However, this does not change the results, possible due to small differences between countries when it comes to corporate taxation. This is also consistent with results from Lee & Gordon (2005), who find the effect of the corporate tax rate to be of less importance for growth in OECD countries compared to developing countries. The only income tax that achieves statistical significance is the dividend tax rate.

Table 3 shows results of using 4-year averages instead of annual measures in order to control for business cycle effects. Basically the same pattern appears here as before. The dividend tax rate estimates are significant, although only weakly in specifications including initial income.

As a robustness test we also consider tax rates based on tax revenues. Table 4 presents estimates from regressions using income taxes as shares of tax revenues on GDP growth, based on annual data. Again, the findings are similar compared to Table 2. The dividend tax rate is significantly correlated with per capita GDP growth in the lagged specifications (columns 3, 4, 7, and 8). Compared to Table 2, the estimates are similar in magnitude but more significant. Interestingly, the corporate income tax measure is positively and statistically significant in three of four specifications. This could reflect that countries with competitive corporate tax rates are able to attract business activities and increase their tax base. Indeed, the correlation between corporate tax rates and tax revenues obtained is negative with a correlation coefficient of -0.214.[15] This suggests that tax rates measures based on tax revenues poorly represent the distortionary effect of taxation. Lastly, Table 5 reports results from regressions on income taxes as share of tax revenues and GDP growth, using 4-year averages. Again, the dividend tax is the only tax rate that indicates a negative correlation between tax rates and economic growth.

## 7. Sensitivity analysis

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[14] We have also tested specifications including only one tax at the time following Myles' (2009) result that tax regressions deliver better results when each form of tax is included separately. The corporate and labor tax rates are insignificant when included separately as well, however.

[15] Corresponding correlation coefficients for top labor tax rates and tax revenues from labor taxation as share of total tax revenues is -0.024, and between dividend tax rates and tax revenues from private capital income taxation as share of total tax revenues is -0.090.

Recently researchers in the field of economic growth have turned to the use of pooled mean group (PMG) estimators to allow for heterogeneous short term effects (Ojede & Yamarik 2012). Unfortunately, our data is not long enough in time to allow us to perform a PGM estimation. In order to deal with the time effect and to find long term effects of dividend taxation on economic growth we instead re-run the fixed effects model but lag the tax rate variables with up to 6 time lags.[16] The top part of Table 6 reports the result for the dividend tax in isolation, corresponding to rows 1-4 in Table 2, while the bottom part reports the results for all three tax rates, corresponding to rows 5-8 in Table 2. In addition, the table reports the results when the specification includes and excludes initial income, respectively. The results strengthen the hypothesis that the dividend tax hurts economic growth in the long run. For the corporate and labor tax rate the results provide no support of a negative correlation between these taxes and economic growth.

In order to deal with potential endogeneity we also estimate the correlation using the GMM estimator developed by Arellano & Bond (1991) that controls for endogeneity by using lagged values of the levels of the endogenous and of the predetermined variables as instruments. More specifically, we run a two-step system GMM for dynamic panel data (as developed by Arellano & Bover 1995) treating all variables as endogenous and using robust standard errors. The negative correlation between economic growth and the dividend tax remains though the significance level is reduced.[17]

Our data end in 2008 but by excluding government productive spending the data period can be extended to 2010. Expanding the time period to 2010 does not change the results in any major way. The fit of the model is slightly reduced as well as the magnitude of the coefficient of the dividend tax.

The corporate tax rate has previously often been found to be negatively correlated with economic growth. We do not find that to be the case in our sample. To further investigate whether this is due to the sample of countries (supporting Gordon & Lee's (2005) result that the corporate tax rate is less harmful in OECD countries) or to the tax measure used, we alternatively use effective forward looking corporate tax rates instead of statutory and rates based on tax revenues. More specifically, we use the forward looking marginal and average effective tax rates

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[16] Gemmell et al. (2007) argue that up to 8 annual time lags are required. Due to data limitations we use 6 annual time lags.

[17] The coefficient for the dividend taxation is -0.037 with a t-statistic of -1.56.The other two tax rates are insignificant. Results are not presented but can be obtained from the authors.

developed by Devereux et al. (2002). The correlation between these tax measures and economic growth is also insignificant, however.

Additionally, we investigate whether membership in EU/EMU affects the correlation between taxes and economic growth or not. We do so by including a dummy for EU- and EMU-membership, respectively. While EU-membership seems to have a positive impact on economic growth, the inclusion of the EU-dummy does not change the correlation between tax rates and economic growth. Including the EMU-dummy has no bearing on the results what so ever.


## 8. Conclusions

Intensified competition between countries and increasing demand for publicly financed services pressure individual countries' tax systems to be designed in efficient ways. In order to design efficient tax systems it is crucial to know how distortive and harmful different taxes are to economic growth. This paper provides some insights into the relationship between taxation of income, in particular dividend income, and economic growth. We do so by studying the correlation between statutory tax rates on corporate and personal income and economic growth in 18 European countries during the period 1990 to 2008.

Our results suggest that the dividend tax rate may be distortionary, and more harmful to economic growth than corporate and labor income taxes; thus supporting the traditional view of dividend taxation. Results are robust over several different specifications and tax measures. However, results may be country-group specific as we study countries with similar characteristics and not applicable to other regions. Adjustments of corporate and labor income taxes may be more well-tuned in Europe than in developing countries. However, our results suggest that the dividend tax rate can be adjusted in order to boost economic growth.

Table 1. Variable description. All variables are annual averages, unless stated otherwise

| Variable | Obs | Mean | Std. Dev. | Min | Max | Description |
|---|---|---|---|---|---|---|
| ln GDP growth per capita | 342 | 0.05 | 0.03 | -0.06 | 0.19 | Logarithmic average annual growth rate of GDP per capita |
| Initial income | 342 | 24817.70 | 9198.63 | 9159.50 | 78523.30 | GDP per capita with two-year lag, current prices millions US $ |
| Investment | 342 | 21.40 | 3.06 | 14.89 | 35.18 | National investment as share of GDP |
| Openness | 342 | 87.47 | 50.27 | 35.39 | 324.36 | Exports and imports of goods and services as percent of GDP |
| Government budget surplus | 341 | -1.53 | 4.52 | -14.03 | 18.77 | Central government budget deficit as percent of GDP |
| Government productive spending | 243 | 20.83 | 4.04 | 8.56 | 29.22 | Central government productive spending as percent of GPD |
| Labor force growth | 333 | 0.39 | 1.05 | -4.08 | 5.06 | Average annual growth rate of labor force, percent |
| Dividends tax | 334 | 21.16 | 10.19 | 0.00 | 50.00 | Statutory tax rate in individual dividend income |
| Corporate tax | 339 | 32.16 | 6.46 | 12.50 | 53.00 | Statutory tax rate on corporate income |
| Top marginal tax on pers labor income | 329 | 48.62 | 8.41 | 23.20 | 71.00 | Top marginal statutory tax rate on individual labor income |
| Ind. capital income tax | 294 | 0.00 | 0.01 | 0.00 | 0.06 | Revenue from individual capital income tax, as percent of total tax revenues |
| Corporate income tax | 342 | 0.08 | 0.04 | 0.01 | 0.29 | Revenue from corporate income tax, as percent of total tax revenues |

| | | | | | Revenue from individual labor income, as percent of total tax revenues |
|---|---|---|---|---|---|
| Ind. labor income tax | 315 | 0.25 | 0.11 | -0.01 | 0.54 |

Table 2. Economic growth and income taxes (statutory rates).
Country fixed effects.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | t | t | t-1 | t-1 | t | t | t-1 | t-1 |
| Initial income | -1.59e-06 | | -2.23e-06* | | -1.57e-06 | | -2.01e-06* | |
| | (9.98e-07) | | (1.12e-06) | | (9.63e-07) | | (1.10e-06) | |
| Investment | -0.00121 | -0.00151* | -0.00184*** | -0.00232*** | -0.000976 | -0.00123 | -0.00132*** | -0.00169** |
| | (0.00102) | (0.000796) | (0.000621) | (0.000784) | (0.00120) | (0.000931) | (0.000412) | (0.000593) |
| Openness | 0.000483** | 0.000230* | 0.000667** | 0.000293 | 0.000491** | 0.000248* | 0.000676** | 0.000347* |
| | (0.000181) | (0.000119) | (0.000254) | (0.000184) | (0.000198) | (0.000129) | (0.000263) | (0.000195) |
| Government budget surplus | 0.00180 | 0.00163 | 0.000483 | 0.000168 | 0.00175 | 0.00160 | 0.000200 | -7.97e-05 |
| | (0.00143) | (0.00127) | (0.000890) | (0.00103) | (0.00155) | (0.00141) | (0.000990) | (0.00111) |
| Government productive spending | -0.000320 | -0.000166 | 0.000525 | 0.000676 | -0.000237 | -7.71e-05 | 0.000434 | 0.000544 |
| | (0.000596) | (0.000570) | (0.000468) | (0.000498) | (0.000635) | (0.000625) | (0.000464) | (0.000490) |
| Labor force growth | 0.00287 | 0.00369* | -0.000780 | 0.000385 | 0.00256 | 0.00337 | -0.000613 | 0.000487 |
| | (0.00173) | (0.00201) | (0.00139) | (0.00176) | (0.00182) | (0.00205) | (0.00147) | (0.00177) |
| Dividends tax | -0.000934** | -0.00119*** | -0.000501 | -0.000845* | -0.000924* | -0.00121** | -0.000523 | -0.000860** |
| | (0.000343) | (0.000320) | (0.000365) | (0.000417) | (0.000442) | (0.000440) | (0.000365) | (0.000375) |
| Corporate tax | | | | | -5.56e-05 | -0.000130 | 0.000485 | 0.000493 |
| | | | | | (0.000574) | (0.000522) | (0.000427) | (0.000389) |
| Top marginal tax on pers labor income | | | | | 0.000203 | 0.000313 | 0.000462 | 0.000572 |
| | | | | | (0.000553) | (0.000572) | (0.000430) | (0.000472) |
| Observations | 233 | 233 | 216 | 216 | 227 | 227 | 210 | 210 |
| R-squared | 0.457 | 0.441 | 0.455 | 0.427 | 0.448 | 0.432 | 0.450 | 0.427 |
| Number of code | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All specifications include year fixed effects.

Table 3. Economic growth and income taxes (statutory rates), 4-year averages.
Country fixed effects

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Initial income | -3.82e-06*** | | -3.34e-06*** | |
| | (8.37e-07) | | (7.72e-07) | |
| Investment | -0.00131* | -0.00172** | -0.000729 | -0.000997* |
| | (0.000682) | (0.000599) | (0.000533) | (0.000527) |
| Openness | -3.86e-05 | 0.000202 | -0.000251 | -1.40e-05 |
| | (0.000457) | (0.000608) | (0.000504) | (0.000612) |
| Government budget surplus | 0.00170* | 0.00119 | 0.00123 | 0.000852 |
| | (0.000828) | (0.00127) | (0.000897) | (0.00123) |
| Government productive spending | 0.000823*** | 0.000226 | 0.000820*** | 0.000313** |
| | (0.000170) | (0.000134) | (0.000153) | (0.000142) |
| Labor force growth | 0.00554 | 0.0115*** | 0.00565* | 0.0110*** |
| | (0.00331) | (0.00358) | (0.00319) | (0.00329) |
| Dividends tax | -0.000435* | -0.000824** | -0.000537* | -0.000988** |
| | (0.000232) | (0.000355) | (0.000296) | (0.000345) |
| Corporate tax | | | 0.000413 | 0.000217 |
| | | | (0.000276) | (0.000302) |
| Top marginal tax on pers labor income | | | 0.000548 | 0.000749 |
| | | | (0.000529) | (0.000640) |
| Observations | 74 | 74 | 72 | 72 |
| R-squared | 0.686 | 0.541 | 0.734 | 0.628 |
| Number of code | 18 | 18 | 18 | 18 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All specifications include controls for 4-year time periods.

Table 4. Economic growth and income taxes (share of tax revenue).
Country fixed effects.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | t | t | t-1 | t-1 | t | t | t-1 | t-1 |
| Initial income | -1.90e-06* | | -1.87e-06* | | -2.55e-06** | | -2.23e-06** | |
| | (9.86e-07) | | (9.95e-07) | | (9.54e-07) | | (7.78e-07) | |
| Investment | -0.00182 | -0.00198* | -0.00134* | -0.00158 | -0.00166 | -0.00190** | -0.00112 | -0.00146 |
| | (0.00135) | (0.00110) | (0.000753) | (0.000908) | (0.00102) | (0.000859) | (0.000695) | (0.000883) |
| Openness | 0.000515** | 0.000204* | 0.000568** | 0.000244 | 0.000703*** | 0.000262** | 0.000623** | 0.000226 |
| | (0.000177) | (9.93e-05) | (0.000251) | (0.000195) | (0.000174) | (0.000107) | (0.000214) | (0.000193) |
| Government budget surplus | 0.00210 | 0.00184 | 0.000107 | -0.000205 | 0.000779 | 0.000853 | -0.000800 | -0.000811 |
| | (0.00150) | (0.00131) | (0.000741) | (0.000884) | (0.00102) | (0.00130) | (0.000880) | (0.00108) |
| Government productive spending | -0.000153 | 3.82e-05 | 0.000232 | 0.000382 | -0.000353 | -5.86e-05 | 0.000248 | 0.000434 |
| | (0.000661) | (0.000676) | (0.000478) | (0.000536) | (0.000584) | (0.000648) | (0.000452) | (0.000551) |
| Labor force growth | 0.00350* | 0.00472** | 0.000127 | 0.00123 | 0.00369* | 0.00516** | 0.000305 | 0.00140 |
| | (0.00190) | (0.00215) | (0.00123) | (0.00150) | (0.00196) | (0.00219) | (0.00126) | (0.00158) |
| Ind capital income tax | -0.00141 | -0.00402 | -0.00779*** | -0.0102*** | -0.000347 | -0.00384 | -0.00863*** | -0.0114*** |
| | (0.00277) | (0.00261) | (0.00212) | (0.00195) | (0.00298) | (0.00303) | (0.00183) | (0.00198) |
| Corporate income tax | | | | | 0.00329** | 0.00233** | 0.00157* | 0.000789 |
| | | | | | (0.00121) | (0.000841) | (0.000793) | (0.000693) |
| Ind labor income tax | | | | | 0.000534 | 0.000429 | -0.000624 | -0.000741 |
| | | | | | (0.000679) | (0.000800) | (0.000468) | (0.000496) |
| Observations | 215 | 215 | 205 | 205 | 215 | 215 | 205 | 205 |
| R-squared | 0.462 | 0.439 | 0.488 | 0.468 | 0.497 | 0.457 | 0.499 | 0.474 |
| Number of code | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All specifications include year fixed effects.

Table 5. Economic growth and income taxes (share of tax revenue), 4-year averages.
Country fixed effects.

|  | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Initial income | -3.56e-06*** | | -3.78e-06*** | |
| | (7.78e-07) | | (8.75e-07) | |
| Investment | -0.000873 | -0.000903 | -0.000971 | -0.000783 |
| | (0.000804) | (0.000642) | (0.000872) | (0.000685) |
| Openness | -0.000190 | 0.000110 | -0.000222 | 0.000103 |
| | (0.000459) | (0.000625) | (0.000509) | (0.000633) |
| Government budget surplus | 0.00127* | 0.000663 | 0.00116 | 0.00121 |
| | (0.000707) | (0.00107) | (0.00104) | (0.00149) |
| Government productive spending | 0.000724*** | 0.000167 | 0.000798*** | 0.000193 |
| | (0.000134) | (0.000117) | (0.000144) | (0.000127) |
| Labor force  growth | 0.00657* | 0.0126*** | 0.00682* | 0.0126*** |
| | (0.00361) | (0.00375) | (0.00352) | (0.00418) |
| Ind capital income tax | -0.00514*** | -0.00782** | -0.00361* | -0.00674** |
| | (0.00128) | (0.00305) | (0.00180) | (0.00298) |
| Corporate income tax | | | 0.000656 | -0.000248 |
| | | | (0.000645) | (0.000803) |
| Ind labor income tax | | | 0.00104* | 0.000674 |
| | | | (0.000573) | (0.000601) |
| Observations | 70 | 70 | 70 | 70 |
| R-squared | 0.709 | 0.589 | 0.723 | 0.597 |
| Number of code | 16 | 16 | 16 | 16 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All specifications include controls for 4-year time periods

Table 6. Estimation results for different lags

| GDP growth per capita | (1) t | (2) t-1 | (3) t-2 | (4) t-3 | (5) t-4 | (6) t-5 | (7) t-6 |
|---|---|---|---|---|---|---|---|
| <u>Incl. initial income</u> | | | | | | | |
| Dividends tax | -0.00093** | -0.00040 | -0.00020 | -0.00033* | -0.00039** | -0.00055** | -0.00082* |
| | (0.00034) | (0.00033) | (0.00045) | (0.00018) | (0.00016) | (0.00023) | (0.00042) |
| | | | | | | | |
| <u>Excl. initial income</u> | | | | | | | |
| Dividends tax | -0.0012*** | -0.00070* | -0.00046 | -0.00048* | -0.00047** | -0.00062** | -0.00089* |
| | (0.00032) | (0.00036) | (0.00049) | (0.00026) | (0.00022) | (0.00026) | (0.00046) |
| | | | | | | | |
| <u>Incl. initial income</u> | | | | | | | |
| Dividends tax | -0.00092* | -0.00033 | -0.00046 | -0.00031* | -0.00041** | -0.00063*** | -0.00095*** |
| | (0.00044) | (0.00033) | (0.00028) | (0.00016) | (0.00016) | (0.00018) | (0.00029) |
| | | | | | | | |
| Corporate tax | -5.56e-05 | 0.00066** | 0.00058* | 0.00032 | 0.00039 | 0.00124** | 0.0022*** |
| | (0.00057) | (0.00031) | (0.00029) | (0.00038) | (0.00041) | (0.00049) | (0.00039) |
| | | | | | | | |
| Top marginal tax on pers labor inc | 0.00020 | 0.00038 | 0.00016 | 0.00028 | 0.00019 | -7.79e-05 | 0.00017 |
| | (0.00055) | (0.00050) | (0.00052) | (0.00056) | (0.00048) | (0.00047) | (0.00053) |
| | | | | | | | |
| <u>Excl. initial income</u> | | | | | | | |
| Dividends tax | -0.0012** | -0.00059** | -0.00064** | -0.00044* | -0.00049** | -0.00068*** | -0.00099*** |
| | (0.00044) | (0.00028) | (0.00028) | (0.00023) | (0.00020) | (0.00019) | (0.00029) |
| | | | | | | | |
| Corporate tax | -0.00013 | 0.00066** | 0.00060* | 0.00033 | 0.00043 | 0.00128** | 0.00222*** |
| | (0.00052) | (0.00027) | (0.00033) | (0.00043) | (0.00044) | (0.00050) | (0.00040) |
| | | | | | | | |
| Top marginal tax on pers labor inc | 0.00031 | 0.00050 | 0.00020 | 0.00031 | 0.00016 | -8.20e-05 | 0.00015 |
| | (0.00057) | (0.00052) | (0.00053) | (0.00054) | (0.00044) | (0.00046) | (0.00051) |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All specifications include year fixed effects.

Figure 1. Corporate tax rates, top marginal tax rates on personal dividend and labor income. Annual means.
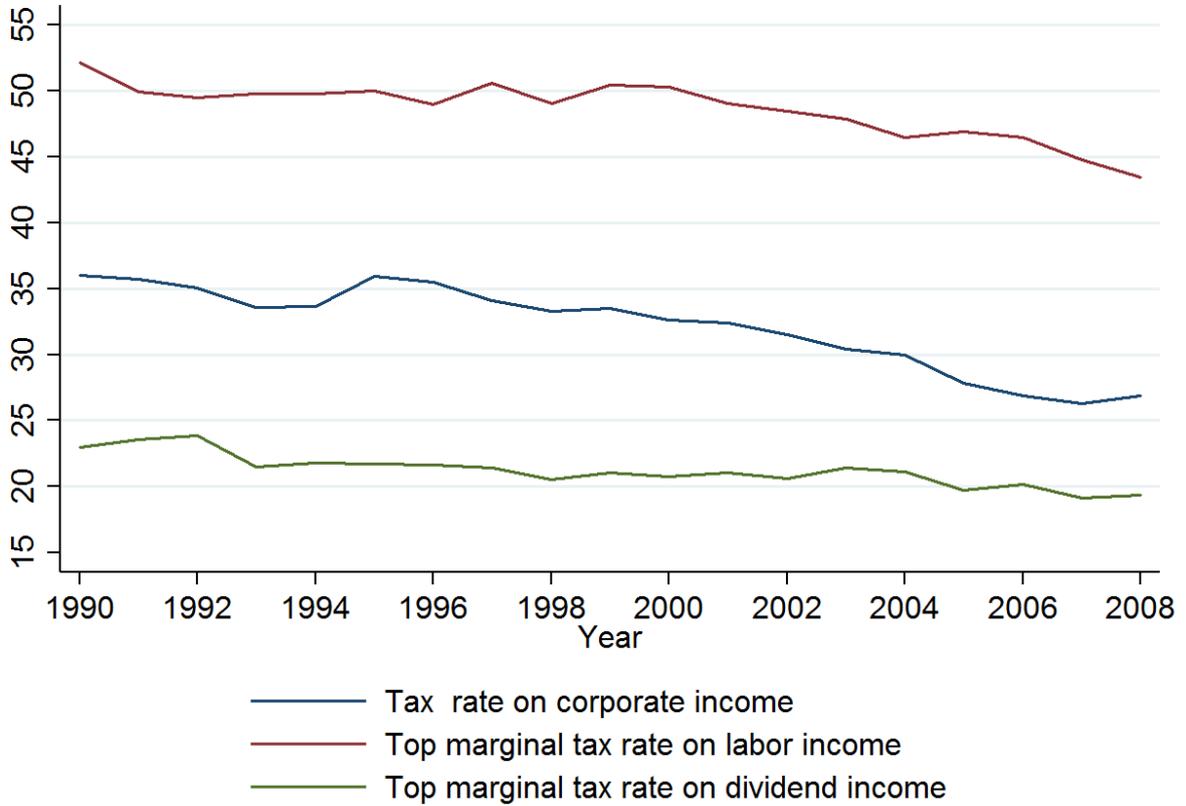
## Appendix

Table A1.
Theoretical aggregation of functional classifications

| Theoretical classification | Functional classification |
|---|---|
| Distortionary taxation | Taxation on income and profit |
| | Social security contributions |
| | Taxation on payroll and manpower |
| | Taxation on property |
| Non-distortionary taxation | Taxation on domestic goods and services |
| Other revenues | Taxation on international trade |
| | Non-tax revenues |
| | Other tax revenues |
| Productive expenditures | General public services expenditure |
| | Defence expenditure |
| | Educational expenditure |
| | Health expenditure |
| | Housing expenditure |
| | Transport and communication expenditure |
| Unproductive expenditures | Social security and welfare expenditure |
| | Expenditure on recreation |
| | Expenditure on economic services |
| Other expenditures | Other expenditure (unclassified) |

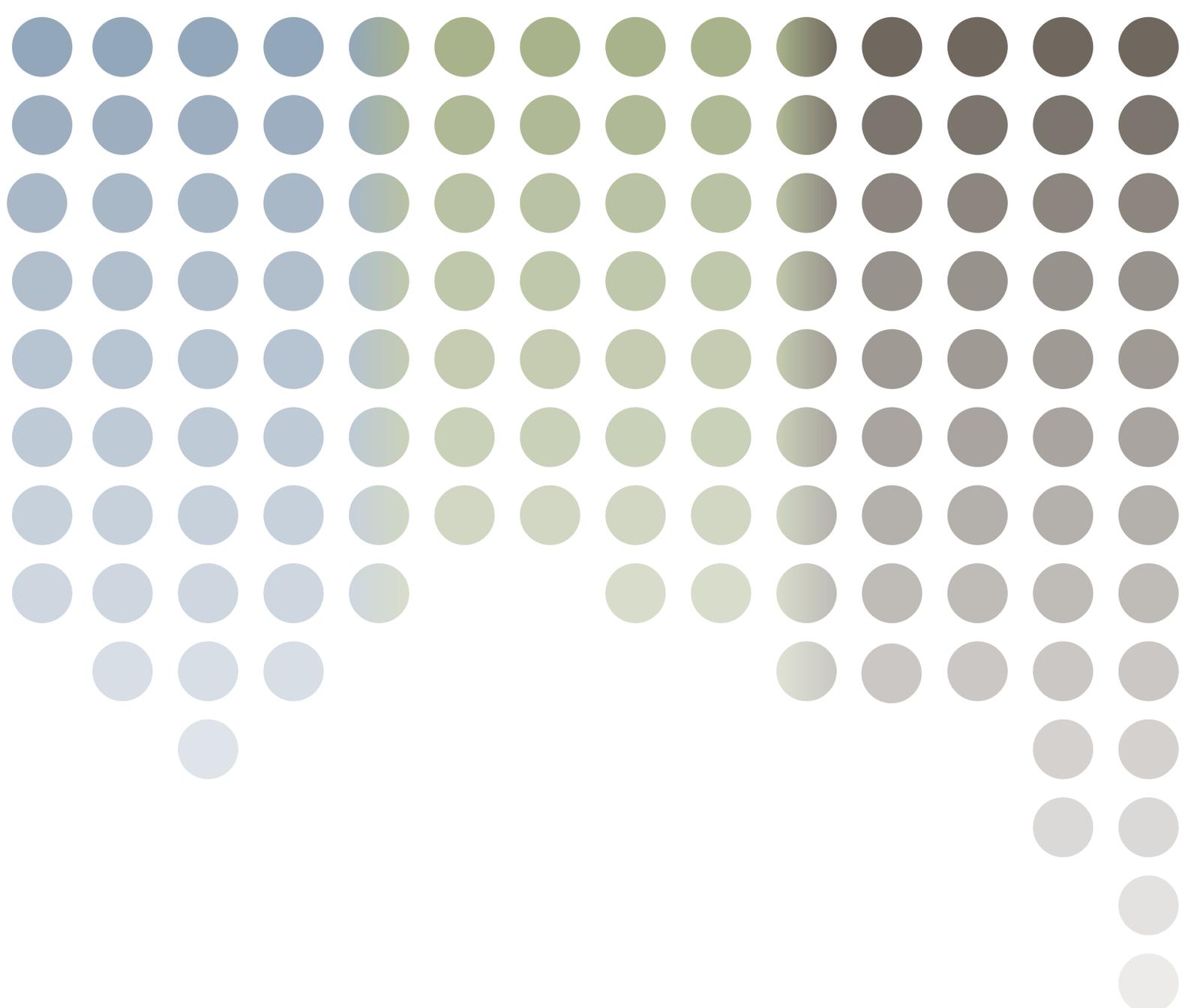Source: Kneller et al. (1999), Table 1, p. 177.

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