

THE EFFECTS OF TAX STRUCTURE ON ECONOMIC GROWTH IN OECD COUNTRIES

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Major Paper presented to the
Department of Economics at the University of Ottawa
In partial fulfillment of the requirements of the M.A. Degree

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April 2011

Abstract

In this paper, I examine the impact of the tax structure on economic growth in a set of fourteen OECD countries over the period 1965 – 2000. To do this, I introduce indicators of taxation structure in the growth regression model of Coulombe and Tremblay (2006). The results indicate that, controlling for the overall size of the government, there is a significant and positive correlation between economic growth and the proportion of tax revenues raised through goods and services taxes, and a positive and significant relationship between growth and the proportion of revenues from corporate taxes. I also found a positive relationship between growth and social security contributions as a share of total revenues, and a negative relationship between growth and total tax revenues as a share of GDP, though these results are less robust. Overall, the paper shows that tax structure is important in the study of growth determinants and a better understanding can contribute to growth promoting tax policies.

1. Introduction

The determinants of economic growth and the effects of the public sector are widely discussed in the economics literature. It is commonly thought that taxation has a negative effect on economic growth. However, there is a fairly small amount of empirical literature that explores this relationship. The majority of papers on this topic study the effects of total taxation on economic growth and obtain mix results ranging from zero effect to a large negative effect. Growth theories dictate that taxes that impact investment in physical and human capital will have an effect on economic growth. This suggests that the structure of taxation may have an impact on growth over and above the impact of the overall level of taxation. However, there is relatively little empirical literature focusing on studying the tax structure and analyzing how various taxes influence growth. Karras and Furceri (2009), Gordon and Lee (2005) and Widmalm (2001) are notable contributions to this area, though their results differ.

The objective of this paper is to contribute to this literature by examining the impact of the tax structure on economic growth in a set of fourteen OECD countries over the period 1965 – 2000. To do so, indicators of taxation structure will be introduced in the growth regression model of Coulombe and Tremblay (2006). The analysis also draws from Widmalm (2001) for this paper, by similarly studying the growth impact of tax structure indicators constructed as the share of government revenues raised through taxes on goods and services, taxes on personal income, taxes on corporations, social security contributions, and property taxes. All tax indicators are defined by OECD Revenue Statistics. These taxes make up the five largest sources of tax revenues for OECD members. The effect of total tax revenue, as a share of GDP, is also studied. Contrary to Widmalm, I use a more complete model of growth that includes, among other variables, indicators of human capital which were found to be one of the main drivers of

growth by Coulombe and Tremblay (2006). Along with a set of common growth determinants as control variables, I will regress each tax indicators on GDP per capita and GDP per worker (labour productivity), in a panel of 14 highly developed OECD countries.

My key results indicate that, controlling for the overall size of the government, there is a significant and positive correlation between economic growth and the proportion of tax revenues raised through goods and services taxes, which is in line with the idea that consumption or indirect taxation is less harmful to growth than other taxes. Consumption taxes are also considered to have a positive impact on savings, which can lead to increases in investment. Similar to Widmalm, and somewhat surprisingly I obtain a positive and significant relationship between growth and the proportion of revenues from corporate taxes. This could suggest a well-designed corporate tax system in the countries studied, such that the taxes are neutral in firms' investment decisions. I also found a positive relationship between growth and social security contributions as a share of total revenues, and a negative relationship between growth and total tax revenues as a share of GDP, though these results are less robust. The relationship between social security contributions and growth could be attributed to workers' expectations of future benefits. The relation between total tax revenues and growth is consistent with common theory that taxation in general has a negative effect on growth.

The paper is organized as follows. Section 2 presents an overview of the existing literature. In Section 3, the data is presented with an explanation of its sources. Section 4 shows the methodology used for the regression analysis. In Section 5, the empirical results are presented and discussed, and in Section 6, I draw some conclusions, and discuss the limits of my study.

2. Literature review

In the endogenous growth literature, it is widely accepted that fiscal policy has important implications for long term economic growth, through various channels, including through effect on the accumulation of human and physical capital. Tax policies affecting this accumulation or, in other words affecting investment, will have an impact on economic growth. Barro and Sala-i-Martin (1992) show that tax policies that encourage investment have the potential to increase economic growth. This implies that personal and corporate taxes, in particular, may have a negative effect on economic growth, due to their influence on investment. However, it is important to study the tax structure as a whole, since the tax system and tax base vary across countries. While there are an increasing number of papers that address the effect of taxation on economic growth, the analysis of how the tax structure affects growth is still fairly limited especially at the empirical level.

Galli and Padovano (2001) study the effects of the estimated marginal income tax rates on economic growth for 23 OECD economies. Consistent with endogenous growth theories, their panel regressions find a robust and negative correlation of long-run economic growth with both high marginal tax rates and tax progressivity.

Enger and Skinner (1996) study the impact of a major tax reform on long-run growth rates. To do so, they consider how a 5 percentage point cut in marginal tax rates affects growth and find it increases real GDP growth rates from about 0.2 to 0.3 percentage points.

Easterly and Rebelo (1993) found a fragile relationship between taxation and economic growth, but suggested that income taxes' effects on growth may matter more in developed economies, as the importance of income taxes seems to rise with income. Their findings are based on a cross-sectional analysis of approximately 100 countries over the period 1970-1988.

Myles (2000) presents a review of the theoretical and empirical evidence on the effects of taxation on economic growth. He determined that there was little evidence of correlation between tax and growth rates and any effects found appeared to be very small. He also noted that it is more important to look at the tax structure, rather than the level of total taxation, since various taxes can affect growth rate differently.

A few papers study the effects of direct taxation and indirect taxation on economic growth and suggest placing less emphasis on direct taxation in a tax system. Romero-Ávila and Strauch (2008), through their analysis of 15 European Union countries over the period 1960 to 2001, find that direct taxation negatively affects growth in GDP per capita through its impact on private capital accumulation. They also found a mixed and insignificant correlation between social security contributions and growth, and mixed results for indirect taxation in general. A note by the European Commission (OECD, 2006) suggested that a move to indirect taxation could be beneficial for some countries, but did not find evidence that such a move is growth promoting in all cases.

Two country-specific papers, Sinderen (1993) on the Netherlands and Branson and Lovell (2001) on New Zealand, are also worth mentioning. Sinderen found that a reduction in taxes on wages and taxes on profits promoted economic growth. Branson and Lovell found that reducing overall tax burden was more beneficial to economic growth than changing the tax structure (i.e. changing the mix of direct and indirect taxation). They also found that direct taxation has an adverse effect on economic growth.

Kim (1999) studies growth in the United States and East Asia in a model containing financial, human, and physical capital, and indicators from a general tax system. He finds that about 30% of the difference in growth rates across countries can be explained by their different

tax structure. He also found that labour taxes were at least as important as capital taxes in explaining the difference in growth rates.

Arnold et al. (2008) study the effects of tax structure on growth and suggest a movement of a government's revenue base from income (direct) taxation to indirect taxation, such as consumption taxes. In order of harmfulness to economic growth, they find the following ranking: corporate taxes, personal income taxes, consumption taxes, and taxes on property. They found a highly significant negative correlation of total tax revenue with economic growth, a highly significant and negative correlation between growth and income taxation, a highly significant and positive correlation between growth and consumption taxes, and a highly significant and positive correlation between growth and property taxes. They also found a weak, but negative correlation between social security contributions and growth. All taxes were measured as a share of GDP and regressed on GDP per capita.

Karras and Furceri (2009) studies the changes of various taxes as a percent of GDP on economic growth rates in a panel of 19 European economies (all OECD members). They find an increase of total tax rate by 1% will decrease real GDP per capita by 0.5% to 1% in the long term. They also find indicators of increases in social security contributions and goods and services taxes having a higher and negative effect on economic growth, when compared to increases in income taxes. All the results were statistically significant and reported negative effects on economic growth, with the exception of property taxes.

Gordon and Lee (2005) use cross-country fixed regressions to determine the impact of changes in the tax structure on economic growth. The paper focuses mainly on corporate tax rates, since they find that the net effects of personal income tax rates on economic growth are unclear and the results are insignificant. For corporate tax rates, they obtain a significant and

negative correlation, and estimates that a decrease in the corporate tax rate by 10 % point will increase economic growth by 1 to 2 % point. All other tax variables tested were insignificant in their model.

In a theoretical study of the different tax indicators in a model with technical progress, Weidmer (2002) finds that income taxes have a negative effect on economic growth and consumption taxes have a positive effect. He also suggests that capital gains taxes can have a positive effect on economic growth in an economy with an asset bubble.

The most similar paper to this one is Widmalm (2001), who use a pooled cross-sectional dataset for 23 OECD economies for the period of 1965 to 1990, and a sensitivity analysis based on Leamer's (1983) extreme bounds analysis to test the effects of the tax structure on economic growth. She finds evidence that the overall tax structure affects growth, and obtains robust results of a negative effect on economic growth from personal income taxes. She also found robust evidence that tax progressivity is negatively correlated with economic growth. The analysis on other tax indicators failed to produce robust results.

3. Data

The empirical analysis will be conducted by regressing the growth of GDP per capita and GDP per worker on indicators of the tax structure and other standard determinants of growth, including human capital, investment, the fertility rate, the degree of openness to trade, and the size of the government. I use pooled cross sectional data consisting of five-year periods (1965 to 2000) for fourteen OECD countries.¹ To study the effects of the tax structure on economic growth, I look specifically at revenues from social security contributions (employers and

¹ The countries are: Belgium, Canada, Denmark, Finland, Germany, Ireland, Italy, Netherlands, Norway, New Zealand, Sweden, Switzerland, United Kingdom, and the United States.

employees), goods and services taxes, corporate taxes (income, profits and capital gains), personal income taxes (income, profits and capital gains), and property taxes (includes: recurrent

Table 1:

Personal Income Taxes as a Share of Total Tax Revenue, 5 Year Averages							
	1965 - 1969	1970 - 1974	1975 - 1979	1980 - 1984	1985 - 1989	1990 - 1994	1995 - 1999
Belgium	22.4	27.4	34.4	36.5	33.7	31.6	31.6
Canada	25.9	33.1	33.1	34.6	37.4	39.1	37.5
Denmark	43.1	53.5	53.1	52.4	50.4	53.4	52.5
Finland	35.7	40.8	37.6	36.8	36.6	33.6	30.8
Germany	26.5	29.3	30.0	28.7	28.9	27.4	25.3
Ireland	17.7	21.9	27.3	30.6	33.1	31.9	30.7
Italy	11.2	12.5	19.4	25.4	26.8	26.4	25.5
Netherlands	28.0	27.5	26.7	23.4	20.2	24.4	16.6
New Zealand	40.4	50.2	57.3	59.8	54.2	46.3	43.8
Norway	39.2	33.4	31.3	26.0	25.6	25.9	26.2
Sweden	47.9	46.3	43.1	40.0	38.6	36.1	33.8
Switzerland	34.9	36.3	39.4	38.5	38.6	39.0	36.0
United Kingdom	32.7	33.3	36.5	28.3	26.5	29.4	27.7
United States	33.7	35.5	35.9	39.2	37.6	35.7	38.4

taxes on immovable property, taxes on net wealth, and taxes on gifts and inheritance). The tax indicators, obtained from OECD Revenue Statistics, are presented as shares of total tax revenues and 5-year period averages, and adhere to the OECD's classification. I also study the effects of total tax revenues as a percent of GDP, also obtained from OECD.

To show the importance of the five tax indicators over time, the 5-year average of revenues from each tax type as a share of total tax revenues for the fourteen OECD countries are presented in Tables 1 to 5. As Table 1 shows, revenue from personal income taxes as a share of total tax revenues has had some significant changes over time, with half of the countries

increasing their share of revenues, and the other half, decreasing. Despite these changes, the average of all the countries' share for each period remains at around a third of total tax revenues.

Table 2:

Goods & Services Taxes as a Share of Total Tax Revenue, 5 Year Averages							
	1965 - 1969	1970 - 1974	1975 - 1979	1980 - 1984	1985 - 1989	1990 - 1994	1995 - 1999
Belgium	37.6	32.6	27.7	27.0	25.5	26.2	25.6
Canada	36.9	33.1	32.3	33.0	29.3	26.2	24.7
Denmark	42.3	35.7	36.9	36.6	34.1	32.4	32.8
Finland	41.9	37.3	32.7	34.9	34.4	31.6	30.7
Germany	32.4	29.4	26.3	27.2	25.4	27.6	27.9
Ireland	52.9	49.7	46.4	45.2	43.4	40.1	39.7
Italy	39.6	35.8	29.2	25.7	26.6	27.5	26.8
Netherlands	27.8	26.4	25.5	24.8	25.9	25.6	28.3
New Zealand	27.9	25.0	23.2	24.3	29.4	34.8	35.1
Norway	39.1	40.3	37.8	35.3	38.1	36.9	37.5
Sweden	31.1	29.1	23.8	24.5	24.9	26.0	25.9
Switzerland	32.5	27.6	22.4	21.7	21.8	20.3	21.9
United Kingdom	30.8	28.1	25.6	29.4	31.3	33.9	34.3
United States	20.7	20.3	18.6	18.6	18.0	18.1	17.0

Personal income taxation is consistently an important and one of the largest sources of tax revenues for many countries.

Goods and services taxes also provide a large source of tax revenues for the OECD countries (Table 2). However, with the exception of the Netherlands, New Zealand, and the United Kingdom, revenues from goods and services taxes have declined in their importance, though it still remains a high source of income. In Table 3, it is shown that the revenues from corporate taxation as a share of total tax revenue have not changed much for most countries.

There are three notable exceptions: New Zealand, Norway, and the United States. By 2000, all countries have less than 11% of total tax revenues from corporate taxation.

Table 3:

Corporate Taxes as a Share of Total Tax Revenue, 5 Year Averages							
	1965 - 1969	1970 - 1974	1975 - 1979	1980 - 1984	1985 - 1989	1990 - 1994	1995 - 1999
Belgium	6.1	7.0	5.6	4.6	5.3	4.6	6.5
Canada	13.3	11.5	11.9	9.0	8.3	6.1	9.8
Denmark	3.5	2.7	3.3	3.4	4.7	3.9	5.2
Finland	6.7	4.5	4.4	4.0	3.3	2.8	7.5
Germany	7.3	5.1	5.3	5.2	5.6	3.9	4.0
Ireland	8.0	6.6	4.8	4.2	3.4	6.9	10.1
Italy	7.0	6.7	7.5	8.8	10.0	9.6	8.4
Netherlands	7.4	6.8	6.7	6.4	7.3	7.1	9.7
New Zealand	19.8	15.2	10.5	7.5	8.2	8.8	10.9
Norway	3.6	2.9	4.7	15.5	9.8	8.6	10.5
Sweden	5.1	4.0	3.4	3.2	4.3	3.8	5.6
Switzerland	8.1	8.3	7.6	6.4	7.2	7.2	7.1
United Kingdom	6.3	8.2	6.3	9.9	11.4	7.4	9.9
United States	16.1	11.9	11.7	8.2	8.3	8.9	9.8

Though they vary in percentage, most countries have increased their share of total tax revenues from social security contributions over time, except Denmark and Italy who show slight decreases (Table 4). New Zealand reports zero revenues from social security contributions. Finland, Germany, Sweden and Switzerland show significant increases in their share of revenues from social security contributions. Revenues from property taxes as a share of total tax revenue, shown in Table 5, are fairly consistent throughout time, except for Ireland, who showed a large

decrease in share during the early 1980's, but has since been increasing slightly. In general, share of revenues from property taxes are below 10% of total tax revenues.

Table 4:

Social Security Contributions as a Share of Total Tax Revenue, 5 Year Averages							
	1965 - 1969	1970 - 1974	1975 - 1979	1980 - 1984	1985 - 1989	1990 - 1994	1995 - 1999
Belgium	30.0	29.5	29.1	29.4	32.6	34.1	32.0
Canada	8.4	9.2	10.9	12.0	13.2	13.6	13.7
Denmark	3.7	2.2	0.8	2.2	2.4	2.1	2.4
Finland	7.4	12.4	20.7	21.9	22.4	29.4	28.4
Germany	27.6	31.2	33.9	35.6	36.9	38.2	40.0
Ireland	7.4	9.4	13.7	14.6	14.3	15.0	13.3
Italy	35.0	39.5	40.4	36.0	33.9	32.0	31.4
Netherlands	32.6	36.2	37.7	41.8	42.6	38.6	40.0
New Zealand*	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Norway	14.7	20.5	23.6	21.4	24.0	25.7	23.1
Sweden	14.0	16.3	24.7	27.9	25.2	28.0	27.1
Switzerland	14.8	18.4	22.5	25.1	22.9	25.0	26.0
United Kingdom	14.5	15.5	18.1	17.2	18.1	17.9	17.4
United States	14.7	17.5	20.7	23.3	25.4	25.5	24.0

*New Zealand receives no revenues from social security contributions. *OECD Revenue Statistics*

Table 6 presents the total tax revenues as a share of GDP in 5 year averages for the countries considered. Most of the countries receive a similar percentage of revenues from taxes as a share of GDP, with the United States and Switzerland at the lower end with close to 30% of GDP, and Denmark and Sweden at the higher end at nearly 50% of GDP. Total tax revenues as a share of GDP have increased over the time period studied for all of the countries. This indicates the increasing importance of revenues from taxation in the OECD economies.

Table 5:

Property Taxes as a Share of Total Tax Revenue, 5 Year Averages							
	1965 - 1969	1970 - 1974	1975 - 1979	1980 - 1984	1985 - 1989	1990 - 1994	1995 - 1999
Belgium	3.5	3.5	3.2	2.6	2.9	3.4	3.8
Canada	13.4	11.2	10.0	9.3	9.4	10.8	10.4
Denmark	7.4	5.9	5.9	5.0	4.6	4.0	3.5
Finland	3.2	2.1	2.3	2.2	3.0	2.4	2.3
Germany	5.6	4.3	3.8	3.3	3.1	2.9	2.7
Ireland	14.0	12.3	7.8	4.2	4.2	4.5	4.9
Italy	6.8	5.4	3.4	3.1	2.5	3.9	5.1
Netherlands	3.7	2.9	3.2	3.4	3.6	3.8	4.7
New Zealand	11.4	9.2	8.5	7.9	7.0	6.0	5.6
Norway	2.8	2.3	2.0	1.8	2.4	2.8	2.6
Sweden	1.6	1.2	1.0	1.2	3.5	3.5	3.5
Switzerland	9.7	9.3	8.1	8.3	9.6	8.5	9.0
United Kingdom	14.1	13.3	12.3	12.5	12.6	8.7	10.4
United States	14.8	14.9	13.1	10.7	10.8	11.8	10.8

Overall, the OECD countries considered here show a consistency in their tax structure when it comes to corporate taxation and property taxation. They also show a shift away from goods and service taxes and a shift towards social security contributions. However, as shown in Table 6, total tax revenues as a share of GDP has increased for all of the countries. Along with possible improvements in tax administration and tax collection, the changes (or lack of) each country has made in their tax mix indicates a reduction in distortions and a shift towards a more efficient taxation system.

Table 6:

Total Tax Revenue as a Share of GDP, 5 Year Averages							
	1965 - 1969	1970 - 1974	1975 - 1979	1980 - 1984	1985 - 1989	1990 - 1994	1995 - 1999
Belgium	33.6	35.3	41.2	42.7	43.6	42.5	44.4
Canada	27.9	31.0	30.9	32.5	33.7	35.8	36.3
Denmark	32.0	40.6	40.2	43.2	48.2	47.0	49.3
Finland	31.7	33.3	37.9	37.1	41.1	45.1	46.3
Germany	32.4	33.4	35.9	35.8	36.1	36.4	36.7
Ireland	27.2	28.7	29.6	33.5	35.2	34.0	31.9
Italy	26.1	25.5	26.3	32.5	35.4	39.8	41.9
Netherlands	34.6	38.0	41.5	42.7	43.9	44.2	40.5
New Zealand	24.7	27.2	30.4	31.4	34.1	35.9	34.2
Norway	32.3	37.7	40.6	42.5	42.5	40.5	41.7
Sweden	35.5	39.3	45.8	47.1	50.5	48.4	49.8
Switzerland	18.5	20.2	25.0	26.0	26.2	26.2	28.1
United Kingdom	33.0	34.0	33.7	36.7	36.5	33.7	34.7
United States	25.8	25.9	25.7	26.0	26.1	27.2	28.6

The human capital indicators used are from Coulombe and Tremblay (2006) and are based on the results of the International Adult Literacy Survey (IALS) from 1994 to 1998. They are direct measures of skills based on test scores. The IALS tested the skills of a representative sample of individuals, 16 to 65 years of age, by measuring their abilities to succeed in a range of everyday tasks with varying difficulty. There were three measures of literacy used, prose, quantitative, and document, but for the purposes of this study, the average of all three is taken to represent the literacy variable. The IALS was carefully designed to test the participants equally, such that neither would have an advantage based on their circumstances (language, culture, etc.).

As detailed in Coulombe et al. (2004), synthetic time series for 1965 to 2000 are constructed from the age distribution of test results, and are used as proxies for human capital investment in each time period. Coulombe and Tremblay's (2006) human capital indicator is used here since it provides comparability across countries and it provides a direct measure of human capital quality, which cannot be done with indicators based on enrolment rates or other available measures. It does however fail to consider migration and the changes in human capital quality during a lifetime. Nonetheless, their indicator was found to be one of the main drivers of economic growth among OECD countries.

Fertility rates, averaged over 5-year periods, are from United Nations database. The rest of the data, which are from the Penn World Tables 6.1., are: GDP per capita, GDP per worker, government expenditures, investment, exports, and imports. Government expenditures and investment are given as a share of GDP and averaged over 5-year periods. Trade data is used to calculate the openness variable by taking the sum of exports and imports as a share of GDP, and adjusting for countries' size as measured by population and land area.² Openness is also averaged over 5-year periods. The Penn Table data are given in purchasing power parity (PPP) exchange rates, which enable a comparison across the OECD countries in real-quantity terms.

4. Methodology

In order to study the relationship between economic growth and selected tax indicators, I use a convergence-growth framework.³ The methodology follows closely Coulombe and Tremblay (2006). The dependent variables, either GDP per capita or GDP per worker are denoted as $Y_{i,T}$, where i is country and T is period. Their growth rates, $\Delta Y_{i,t}$, are determined by their initial level, a set of control variables $I_{i,T}$, the specific tax variable $S_{i,T}$, and a stochastic

² Serge Coulombe and Jean Francois Tremblay, "Literacy and Growth," *The B.E. Journal of Macroeconomics* 6, 2 (2006): 5.

³ Based on the theoretical analysis of Mankiw et al. (1992) and Barro and Sala-i-Martin (1992).

term, $v_{i,T}$. All variables are defined as the logarithm deviations from the cross-sectional sample mean and the growth rate is as follows:

$$\Delta Y_{i,t} = F(Y_{i,t-1}, S_{i,t-p}, I_{i,t-p}, \varepsilon),$$

where p is the number of lags (0 or 1) used for the S and I variables, and $t=1, \dots, T$.

To study the convergence-growth relationship, I use pooled cross-sectional data. The benefit of using panel data is it allows for the study of the time-series evolution of cross-sectional data during the period studied (1965 to 2000) and is useful when dealing with a limited number of countries with comparable history. To account for correlations in the business cycle, data is presented in 5 year periods to eliminate fluctuations and to allow for variations over time. I use the deviations from the cross sectional mean for the Y , S , and I variables in order to account for trends and shocks in the data and to give unbiased results. As Coulombe and Tremblay (2006) notes, this is comparable to adding $T-1$ time dummies to the panel regressions. Also, I use cross-country fixed effects in the regressions, to control for time-invariant heterogeneity. The model can be seen as a two-way error component regression model:

$$\Delta Y_{i,t} = \beta Y_{i,t-1} + \alpha S_{i,t-p} + \alpha I_{i,t-p} + v_{i,t},$$

$$\text{where } v_{i,t} = \mu_i + \lambda_i + \varepsilon_{i,t}.$$

Thus, the benchmark growth model is as follows:

$$\Delta Y_{i,t} = \beta Y_{i,t-1} + \alpha S_{i,t} + \alpha_1 I(k)_{i,t} + \alpha_2 I(h)_{i,t-1} + \alpha_3 I(f)_{i,t} + \alpha_4 I(o)_{i,t} + v_{i,t}, \quad (1)$$

where $i = 1, \dots, 14$ for the GDP per capita regressions to represent the 14 countries in the sample. For the labour productivity regressions, $i = 1, \dots, 13$, since Germany is excluded from the sample due to unreliable productivity data. The periods are represented as $t = 0, \dots, 7$, where 0 refers to 1965 and 7 to 2000 for those variables measured at one point in time, and for those measured in 5-year periods, 1 = 1965-1969, 2 = 1970-1974, ..., 7 = 1995-1999. The initial growth rate, $Y_{i,t-1}$

refers to period 1. $I(k)_{i,t}$ is the 5-year average of investment as a share of GDP, $I(h)_{i,t-1}$ is the human capital indicator, $I(f)_{i,t}$ is the 5-year average of the fertility rate, and $I(o)_{i,t}$ is the 5 year average of the openness variable, defined as the sum of exports and imports as a share of GDP. The openness variable is included since the large increase in international openness during the studied time period is an important development for advanced economies. The variable for which the study is based on is $S_{i,t}$, the 5-year average of revenues from each tax type as a share of total tax revenues. The taxes considered are: taxes on personal income, taxes on corporation, taxes on goods and services, social security contributions, and property taxes. Total tax revenues as a percent of GDP, averaged over 5-year periods is studied as a possible indicator as the $S_{i,t}$ variable. I also study a growth model with the inclusion of government expenditures as a share of GDP, $E_{i,t}$, in the control variables to check for robustness in the results. This is an extended form of (1):

$$\Delta Y_{i,t} = \beta Y_{i,t-1} + \alpha_1 S_{i,t} + \alpha_2 I(k)_{i,t} + \alpha_3 I(h)_{i,t-1} + \alpha_4 I(f)_{i,t} + \alpha_5 I(o)_{i,t} + \alpha_6 E_{i,t} + v_{i,t}. \quad (2)$$

For both models, I use generalized least squares (GLS) and, to account for heteroscedasticity, cross-sectional weighted regressions.

5. Presentation of Results and Discussion

The regression results using equation (1) for the conditional convergence of GDP per capita and GDP per worker are presented in Tables 7 and 8, respectively, for the 5 tax indicators. The results using the same variables, with the inclusion of government expenditures as per equation (2) are presented in Tables 9 and 10 for the conditional convergence of GDP per capita and GDP per worker, respectively. The estimated annual convergence speeds are highly significant in all regressions at the 1% level of significance with the exception of the labour productivity regression involving corporate taxation (significant at the 5% level). They are

Table 7:

Growth of GDP per Capita without controlling for Government Expenditures					
Initial GDP	-0.079*	-0.056*	-0.056*	-0.058*	-0.067*
	-0.013	-0.014	-0.012	-0.015	-0.015
Literacy	0.111*	0.074**	0.074**	0.106*	0.081**
	-0.036	-0.034	-0.034	-0.035	-0.035
Investment	0.039*	0.031*	0.049*	0.040*	0.035*
	-0.007	-0.008	-0.009	-0.009	-0.007
Fertility rate	-0.008	-0.013	-0.019**	-0.018***	-0.012
	-0.011	-0.01	-0.009	-0.01	-0.011
Openness ratio	0.016**	0.009	0.014**	0.022*	0.014
	-0.008	-0.007	-0.007	-0.006	-0.01
Social Security contributions	0.009*				
	-0.001				
Good and Services Tax		0.025*			
		-0.008			
Corporate Tax			0.011*		
			-0.003		
Personal Income Tax				-0.009	
				-0.007	
Property Tax					-0.012**
					-0.005
Adjusted R2	0.579	0.531	0.513	0.476	0.463
# of observations	88	95	95	95	81

Note: in all tables, *represents 1% level of significance, ** 5%, and *** 10%.

calculated as $-\log(1 + 5\beta) / 5$, based on equation (1), and the use of the average coefficient on initial GDP. The average annual convergence speed of GDP per capita is around 7.7% and 6.6%, when social security contribution is excluded. This is higher than those estimated by Coulombe and Tremblay (2006), but is in line with Islam's (1995) OECD sample. The estimated convergence speeds when government expenditure is included in the control variables remains around the same at 7.0%. The estimated annual convergence speeds for labour productivity are

smaller at around 4.2%, without government expenditures, and 3.2% when government expenditure is included.

Table 8:

Growth of GDP per Worker without controlling for Government Expenditures					
Initial GDP	-0.051*	-0.041*	-0.022**	-0.046*	-0.072*
	-0.011	-0.011	-0.009	-0.013	-0.011
Literacy	0.131*	0.099*	0.06	0.122*	0.097*
	-0.042	-0.037	-0.041	-0.04	-0.035
Investment	0.037*	0.032*	0.064*	0.038*	0.015***
	-0.01	-0.009	-0.008	-0.011	-0.008
Fertility rate	-0.006	0.004	-0.006	-0.003	0.013
	-0.009	-0.009	-0.006	-0.009	-0.01
Openness ratio	0.039*	0.021**	0.023**	0.035*	0.032*
	-0.007	-0.009	-0.01	-0.007	-0.005
Social Security contributions	0.005				
	-0.005				
Good and Services Tax		0.017**			
		-0.008			
Corporate Tax			0.014*		
			-0.003		
Personal Income Tax				-0.002	
				-0.007	
Property Tax					-0.011*
					-0.004
Adjusted R2	0.583	0.612	0.747	0.572	0.75
# of observations	83	90	90	90	76

The regressions show robust results for the investment, literacy, and openness variables. Investment as a share of GDP is found to be positive and highly significant at the 1% level, for all regressions in both equations (1) and (2), with the exception of the one where property taxes are regressed on GDP per worker without controlling for government expenditures, which is significant at the 10% level. The human capital indicator (literacy) was overall significant at the 5% level in each case with a few exceptions, and they all contained the expected positive sign. The openness ratio has an estimated positive effect on growth rates in all cases and is significant

at the 5% level for all, except the GDP per capita regression for both the goods and services tax and property tax in equation (1).

Table 9:

Growth of GDP per Capita controlling for Government Expenditures					
Initial GDP	-0.062*	-0.056*	-0.058*	-0.055*	-0.066*
	-0.011	-0.013	-0.011	-0.013	-0.013
Literacy	0.127*	0.080**	0.085**	0.111*	0.088*
	-0.039	-0.034	-0.032	-0.034	-0.033
Investment	0.040*	0.031*	0.048*	0.039*	0.032*
	-0.007	-0.008	-0.008	-0.008	-0.007
Fertility rate	-0.015***	-0.006	-0.009	-0.009	0.001
	-0.009	-0.01	-0.01	-0.01	-0.011
Openness ratio	0.031*	0.015**	0.016**	0.026*	0.021*
	-0.008	-0.007	-0.007	-0.006	-0.008
Government expenditures	-0.010*	-0.011*	-0.010**	-0.012*	
	-0.003	-0.004	-0.004	-0.004	
Social Security contributions	0.009*				
	-0.001				
Good and Services Tax		0.021*			
		-0.008			
Corporate Tax			0.008**		
			-0.003		
Personal Income Tax				-0.009	
				-0.006	
Property Tax					-0.005
					-0.004
Adjusted R2	0.644	0.549	0.540	0.519	0.533
# of observations	88	95	95	95	81

Fertility rates had the predicted negative sign in the majority of cases, but were not found to be statistically significant. An important note is that the explanatory power of the regressions increases when government expenditures as a share of GDP is included in the control variables.

Controlling for common growth determinants, social security contributions as a share of total tax revenues are significant at the 1% level in the GDP per capita regressions, and indicate a

Table 10:

Growth of GDP per Worker controlling for Government Expenditures					
Initial GDP	-0.036*	-0.026**	-0.028*	-0.023**	-0.040*
	-0.01	-0.01	-0.009	-0.011	-0.011
Literacy	0.100**	0.061***	0.061	0.080**	0.071**
	-0.04	-0.037	-0.04	-0.037	-0.034
Investment	0.036*	0.036*	0.052*	0.041*	0.023*
	-0.009	-0.008	-0.008	-0.009	-0.008
Fertility rate	0.003	0.009	0.009	0.011	0.017***
	-0.009	-0.009	-0.008	-0.009	-0.01
Openness ratio	0.044*	0.030*	0.028*	0.036*	0.038*
	-0.008	-0.009	-0.01	-0.009	-0.007
Government expenditures	-0.018*	-0.018*	-0.013*	-0.019*	-0.022*
Social Security contributions	0.008***				
	-0.004				
Good and Services Tax		0.013			
		-0.008			
Corporate Tax			0.010**		
			-0.004		
Personal Income Tax				-0.009	
				-0.007	
Property Tax					-0.007
					-0.005
Adjusted R2	0.718	0.691	0.771	0.709	0.703
# of observations	83	90	90	90	76

positive effect on economic growth. However, in the labour productivity cases, the results were not significant, though they still maintained the positive sign. This could suggest that the impact of social security contributions on economic growth is subject to labour market effects. The positive correlation could be due to the fact that social security contribution has a smaller impact on the labour market due to the associated future benefits that workers expect to receive. For instance, the impact on labour supply may not be as large as for income taxation. However, as

Arnold et al. (2008) point out, it is very difficult to determine the relationship between future benefits and social security contributions since the relationship varies among the OECD economies.⁴

Goods and services taxes as a share of total tax revenues show a positive sign in all regressions, which is in line with the theory that consumption (or indirect) taxation is not as harmful to investment as other forms of taxation. The results are significant at the 1% level for the GDP per capita regressions, but are more fragile for the labour productivity regressions. It is significant at the 5% level when government expenditures is excluded from the control group, and is insignificant when the variable is included. When a tax structure is more focused on consumption taxes instead of income taxes, this tends to have a positive impact on aggregate savings in an economy, which can lead to an increase in aggregate investment. Most of the goods and services taxes in the set of countries studied are value-added taxes (VAT), which are considered to be highly efficient taxes when compared to other taxation types. Specifically, VATs are usually designed to avoid taxing firms' inputs, since the taxes paid by firms at intermediate stages of production are credited against tax liabilities on sales of final goods. VATs are also created to exempt the full value of exported goods. As a result, the international competitiveness of countries that are more dependent on these taxes in their tax structure tends to be higher, which could partially explain the positive effect on growth that was obtained.

Similar to Widmalm (2001), corporate taxation as a share of total tax revenues was found to have a positive effect on economic growth in all cases. However, the results are more robust in this study, as it is significant at the 5% level in all regressions, whereas Widmalm only obtained weak results. Widmalm suggested that a positive correlation could be attributed to the large presence of monopolies in the OECD economies, or to the possibility that the ratio of corporate

⁴ Jens Arnold et al., "Tax and Economic Growth," *OECD Economics Development Working Papers* 620 (2008): 23.

taxes to total tax revenues does not fully capture the effects that corporate taxation has on firms' incentives.⁵ The positive effect could also be explained by the idea that a well designed corporate tax system (i.e. a system that is designed to tax economic rents) will tend to be neutral with respect to firms' investment and production decisions. This would allow a government to raise revenues without imposing any distortions on the economy. Therefore, an efficient corporate tax system could have a lower efficiency cost than other taxes, and if so, a higher reliance on corporate taxes would tend to be growth-promoting.

Personal income taxes as a share of total tax revenue showed a negative correlation with economic growth in all cases, however, all the results were statistically insignificant. The negative signs follows the theory that direct taxation and/or progressive taxation has a negative effect on economic growth, since it impacts investment in physical and human capital.

Property taxes as a share of total tax revenues show a negative correlation with economic growth, and the results are significant at the 5% level in both GDP per capita and GDP per worker regressions where government expenditures is excluded. These results are slightly more robust than Widmalm (2001), who showed a weak relation with a mixed result of positive and negative correlations. Property taxes, another form of direct taxation, could reduce economic growth by discouraging investment.

An interesting observation about the above results is that the growth effects of the different tax indicators do not change very much when controlling for government expenditures as a share of GDP. This suggests that the effects of the tax structure on growth are not very dependent on government size. It would have been expected, a priori, that the efficiency cost of varying taxes would be different at different levels of taxation.

⁵ Frida Widmalm, "Tax structure and growth: Are some taxes better than others?" *Public Choice* 107 (2001): 209.

Table 11:

Total Tax as a Share of GDP				
	GDP per Capita		GDP per Worker	
Initial GDP	-0.058*	-0.059*	-0.023**	-0.034*
	-0.012	-0.014	-0.009	-0.01
Literacy	0.096*	0.087**	0.035	0.033
	-0.036	-0.037	-0.035	-0.033
Investment	0.033*	0.032*	0.025*	0.011***
	-0.009	-0.009	-0.007	-0.006
Fertility rate	-0.01	-0.017***	0.011	0.015**
	-0.01	-0.009	-0.008	-0.007
Openness ratio	0.021**	0.017**	0.020**	0.008
	-0.008	-0.008	-0.008	-0.006
Government expenditures	-0.011*		-0.017*	
	-0.004		-0.004	
Total tax as % of GDP	-0.017	-0.016	-0.037*	-0.046*
	-0.012	-0.013	-0.012	-0.009
Adjusted R2	0.522	0.456	0.73	0.815
# of observations	95	95	90	90

Using the same models, I also test for total tax revenues as a share of GDP. The results are presented in Table 11. Initial GDP had the expected negative values for all regressions and is significant at the 5% level, indicating conditional convergence. Literacy, investment, and openness all had their expected signs, as in the previous regressions. Fertility rates were significant at the 10% level in the regressions without controlling for government expenditures. They also had their expected negative signs in the GDP per capita regressions, but had positive signs in the labour productivity regressions. Total tax as a share of GDP shows a negative effect on economic growth in all cases. However, the results are insignificant when GDP per capita is the dependent variable and highly significant for the labour productivity regressions at the 1% level. Not only are the results significant in the labour productivity regressions, but also, the coefficients are higher, indicating a larger effect than in the GDP per capita regressions. These results could indicate that taxation may generate greater disincentives for those decisions

involving investment in capital, investment in R&D, and adoption of new technologies, when compared to decisions involving the labour supply and employment.

6. Conclusion

This paper has studied the relationship of economic growth with the tax structure of 14 OECD economies from 1965 to 2000. Specifically, share of revenues from the goods and service tax was found to have a significant and positive effect on economic growth, when tested for both GDP per capita and labour productivity, indicating robustness. This result supports economic theory that consumption taxes or indirect taxes can be growth promoting, or at least less harmful to growth than other tax types as indicated by Arnold et al. (2000). Similar results were found for corporate taxation. The results could be due to the narrow range of OECD countries used, the relatively high degree of market power in the countries considered, or the fact that a well-designed corporate tax system may impose relatively little distortions compared to other taxes. Social security contributions also indicated a positive effect on economic growth, though the results were less robust than the previous two indicators. A possible explanation could be that social security contributions have less of an impact on labour supply, in comparison to income taxes because of the expected future benefits associated with social security contributions. Total taxation had the expected negative sign, but was only significant when regressing on labour productivity, perhaps because of less disincentives in labour decisions when compared decisions involving investment. The model failed to find robust results for personal income taxes and property taxes, though they had the expected negative signs, which supports the idea of direct taxation having an adverse influence on growth.

My analysis of the tax structure has some limitations. One is the choice of the human capital indicator. As noted by Coulombe and Tremblay (2006), using literacy tests averages is

not a perfect measure of human capital over the course of a lifetime.⁶ A second limitation involves the choice of the control variables. Growth literature has suggested several determinants of growth, and while I tried to pick the relevant variables and to restrict the number to five or six, there may be an omitted-variable bias. There could also be arguments for using different indicators for selected control variable (ex. Fertility growth rates versus population growth rates). This paper is also limited in its use of just 14 OECD economies. Though it does provide indications for similar, developed countries, it does not give indicators for the impact of different tax variables on growth in developing countries. Overall, the paper makes a contribution to the theory that tax structure is important in the study of growth determinants, and suggests that further empirical study is required to support efficient and growth promoting tax policy decisions.

⁶ Coulombe and Tremblay, "Literacy and Growth," 4.

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