

Top Marginal Tax Rate and Economic Growth: Accounting for the Quality of Institutions

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Abstract

This paper investigates the impact of top marginal tax rates on economic growth in a panel data set of 26 OECD countries during 1985-2015 controlling for a well-established set of determinants of economic growth. As it is well known, in spite of the economic intuition, there is no evidence of any negative relationship between growth and marginal income taxation. In order to shed some light on this relationship, we try to capture whether the quality of institutions is playing a role in this framework. Our proxy of institutional quality is expected to positively affect growth. Moreover, the resilience to the distortionary effects from taxation is likely to depend on the availability of the right institutions. We find that only a higher quality of institutions induces more economic growth. By contrast, the role of marginal taxation is either negligible or statistically insignificant. This suggests that quality of institutions is a key variable in explaining economic growth, whereas the omission of this variable could lead to erroneously assign a central role (either positive or negative) to top marginal tax rates on growth.

JEL Classification: H24, H71, O43.

Keywords: top marginal taxation; taxation and growth; quality of institutions.

1. Introduction

In the last decades, the impact of top marginal tax rates on economic growth has received an enduring interest. On one hand, it plays a role in the recent European policy debate on the desirability of introducing growth-oriented tax reforms. On the other hand, the economic literature reveals an interest in it because of the increase in income inequality among many OECD countries. Traditionally top marginal tax rate cuts have been suggested as growth-oriented tax reforms because they should produce efficiency gains in terms of a higher labor supply by top earners. Lindsey (1987) and Feldstein (1995) suggest that a cut of the top marginal tax rate encourages top earners, who benefit of tax advantage, to make a greater productive effort, and therefore it may be a conductor of higher income growth for the whole economy. By contrast, other scholar argue that a decrease in top marginal income taxation is considered no-welfare improving because its impact on income inequality – cuts of top marginal tax rate are indicated as a driving force of the recent surge in upper incomes [Alvaredo et al. (2013); and Piketty, Saez, and Stantcheva (2014)]¹ – largely outweighs increases in economic efficiency (if any)

Examining the impact of top incomes concentration on economic growth in the United States, Cynamon and Fazzari (2015) find that a rise in inequality between the bottom 95% and the top 5% has a detrimental effect not just for those at the bottom but also for economic growth because of its

¹ Recent upper income distribution has been explained in a number of ways. On one hand, economic factors have been indicated as driving forces of rising in inequality. This category would include explanations based on skill-biased technological change (SBTC) [Autor et al. (1998), Autor et al. (1999), Autor et al. (2003), and Autor et al. (2006)]. However, it is suggested that SBTC hypothesis might only narrowly explain income inequality distribution [Gordon and Becker (2005), and Piketty et al. (2014)]. International trade is also defined as an explanation of rising in income inequality due to labor demand shift favoring high-skilled workers [Borjas and Ramey (1995), and Feenstra and Hanson (1999)]. An alternative hypothesis of the increase in top percentile income share, related in some way to SBTC category, is based on the “superstar” phenomenon, proposed by Rosen (1981), who suggests that compensation for “superstars” grows more and more over time than compensation for others [Sherwin Rosen (1981), Gordon and Becker (2005)]. Besides, it is suggested that tax reforms involving an income shifting from corporate to personal tax base could explain the recent income distribution [Slemrod (1996) and Gordon and Slemrod (2000), Bakija (2013)]. Finally, it is suggested that upper incomes concentration has been driven by top earners’ rent extraction behaviors favored by both social norms and institutional changes [Piketty and Saez (2007), Bakija et al. (2012), Bakija (2013), and Bell and Van Reenen (2014)] and drops in top marginal tax rates [Piketty et al. (2014)].

implications in terms of a weak recovery rate, as it has happened after the Great Recession. determined by the growth path of household demand.² By estimating the calibrated effects of shifting in income distribution in the United States, Cynamon and Fazzari (2015) suggest that economic growth is almost 10% lower than what it could be when considering the income distribution existing in the 1960s - 1970s. Also, Saez (2015) remarks that the Great Recession has depressed the top 1% income share only temporarily, while the bottom 99% income share has been experiencing a lower recovery. Between 2009 and 2012, the top 1% income share has grown by 34.7%, while the bottom 99% income share has increased only by 0.8%, reaching an income level which it is still far below what it was before the Great Recession.

This paper investigates the impact of top marginal tax rate on real Gdp per capita, as previously done by Piketty et al. (2014) and Milasi (2013), but it deals with this issue once controlling for a well-established set of growth determining economic factors. Namely, in order to make our study consistent with the bulk of the empirical growth literature, our analysis accounts for the effects of gross investments share in Gdp, population growth, and human capital indicators. Moreover, in order to shed some new light on the poorly-established relationship between economic growth and top marginal tax rate, we especially focus on capturing whether the quality of institutions would play a role in this setting.

Our proxy of institutional quality is expected to positively affect the real Gdp per capita. The economic literature suggests that the better the institutional quality is, the more economically successful the societies are. The idea is that “good” economic institutions represent an inter-related

² Traditional consumer theory and evidence from previous recessions suggest that the consumption-income ratio should rise in recession. After the Great Recession, however, the consumption-income ratio rises substantially for the top 5%, while, it declines significantly for the bottom 95%, as argued by Cynamon and Fazzari (2015). They suggest that the explanation of this different consumption path, which has never happened in previous recessions, lies in the end of the ability of the bottom 95% to borrow more to finance an unsustainable consumption path. Indeed, for decades, the bottom 95%, despite rising in inequality and their stagnating incomes, maintained high consumption by increasing household debt – they indicate that debt-income ratio grew almost 12 times more for those at the bottom 95% than for those at the top 5% between 1980 and 2007. Cynamon and Fazzari (2015) sustain that demand drag from rising in inequality was postponed by household borrowing, and when Great Recession constrained the access to new debt, the bottom 95% experienced a downward consumption pace.

“cluster of things” causing the prosperity of countries. For instance, the literature indicates that the enforcement of property rights ensures individuals who are generally risk adverse, and thus creates an incentive to invest, innovate and participate to economic activity (Acemoglu, Johnson, and Robinson, 2001, 2002, 2005).

Far from being detrimental to growth, at first look, our regression analysis would even suggest that top marginal tax rate would positively affect growth. However, once controlling for the quality of institutions, top marginal tax rate becomes statistically insignificant, while, apart from traditional determinants, only the quality of institutions would induce more growth. This suggests that quality of institutions is a key variable in explaining economic growth, and the omission of this variable may lead to erroneously assign a role (whether positive or negative) to top marginal taxation on economic growth.

The paper consists of six sections. The second section illustrates the literature background. The third section introduces the data, and discusses some descriptive evidence about the link between growth and top marginal tax rate. The empirical methodology and the results are presented in the fourth and fifth sections, respectively. Finally, section six reports our conclusions.

2. Literature background

A number of empirical studies have examined the impact of taxatin on growth. Most have focused on average tax rates, while fewer researches have used the top marginal tax rate. In one strand of the empirical literature, researchers have found an insignificant or positive effect of top marginal tax rate on growth. For instance, Piketty et al. (2014), using yearly data on 18 OECD countries from 1960 to 2010, do not find any statistically significant correlation between growth in real Gdp per capita and top marginal tax rate. Consequently, they argue that a significant fraction of the increasing in top incomes comes mostly from the bargaining-compensation elasticity rather than more real economic activity - that is, surge in upper incomes mostly come at the expense of lower incomes, in form of

rent-seeking, in contrast to additional productive effort. On the same vein, Lee and Gordon (2005), using cross-country data during 1970-1997; Dahlby and Ferede (2012), exploiting data from 10 Canadian provinces over the period 1977-2006; and Gale et al. (2015) do not find statistically significant effect of top personal income tax rates on economic growth.³ At an extreme point, recent results by Milasi (2013) show that an increase in top marginal tax rate is positively correlated to an increase in economic growth. Thus OECD' current top tax rates might be below their growth-maximizing level, estimated to be above 50% supposing the additional tax revenues are aimed at financing an efficient and growth-maximizing public expenditure.

In another strand of the literature, however, the top marginal tax rate has been found to impact negatively the economic growth (e.g., Recent contributions include Gemmell et al., (2014) and Mertens (2015). The latter simulates the effect of changing the top 1% marginal tax rate on upper income earners and real Gdp. In particular, he finds that a one percent drop of marginal tax levied to top 1% income earners, while determining as expected an increase in average top 1% income share, also leads to a rise in real Gdp of up to 0.34 percent after two years. This positive effect on real Gdp, together with a positive spillover on incomes outside of the top 1%, is seen as evidence that the increase in upper incomes derives from a larger productive effort rather than a shifting from corporate to personal income, namely tax avoidance.⁴ These results are consistent with the propositions of Feldstein (2006), who states that taxes have a negative impact on growth because of their influences on total factor productivity, and ultimately efficiency losses in resource allocation. In this case, a standard supply-side elasticity mechanism is playing a major role. The lower the top marginal tax rate, the greater the economic activity by top taxpayers (who make a greater productive effort), and the higher overall Gdp growth. A wide strand of empirical literature has found a negative link between top marginal tax rate and top earners labor offer at the individual level. Lindsey (1987) analyzed

³ The latter come to this conclusion after checking for the robustness of a previous result by Reeds' (2008), who actually found a negative impact of tax revenue on growth.

⁴ See Slemrod (1996) for more details.

behavioral response of American top earners after a fiscal policy change (ERTA) acted in 1981, finding a rise of their taxable income share relative to the one before the cut of top marginal tax rate. Also, Feenberg and Poterba (1993), using tax return data from 1951 to 1990, examined the surge in top income share in the 1980s highlighting that while it increased gradually in the early 1980s, it rose considerably in the end of 1980s. This would suggest that a fraction of the increase in the upper incomes share derived from the reduction of top marginal tax rate acted in the 1986 Tax Reform Act. Yet, Feldstein (1995) has compared individual tax returns before and after the 1986 tax reform, which reduced tax rates significantly for upper earners, finding a substantially higher taxable income elasticity of top taxpayers, indicating that high top marginal tax rates determine relevant deadweight losses.

A related stream of literature focuses on the relevance of other channels of response through which top marginal tax rate influences top earners taxable income. A tax-avoidance response has been remarked by Slemrod (1996). By considering a tax avoidance elasticity for effect, a lower top marginal tax rate entails a lower incentive of taxpayers to shift part of their taxable income in another form or in another time period that is subject to more favorable taxation.⁵ Tax avoidance and tax evasion constitute the two main forms of “sheltering behaviors”. According to Chetty (2009), taking into account of the different nature of these behaviors vis à vis genuine variations in labour supply has relevant consequence on welfare loss computation. He indicates that the simple concept of taxable income elasticity as measure of the deadweight loss is not suitable whether the marginal social cost of sheltering does not equal the tax rate. For instance, this equivalence might be unsatisfied when individuals try to avoid taxation through charitable contributions, so that some costs of sheltering do not fully fall in real resource costs but can be transferred across agents. Thus, omitting the possibility of no-equivalence between marginal social cost of sheltering and tax rate causes an overestimation

⁵ The relevance of tax avoidance response among high-income earners, and its implications on policy recommendations have been stressed by severe researchers [see, e.g., Gordon and Slemrod (2000), Saez et al. (2012), Slemrod and Gillitzer (2014)].

of the deadweight losses, which will not be as large as predicted even if high-income earners, known to report significant behavioral response, are considered.

For the scope of this paper, the main point is that sheltering behaviors are not reducing Gdp! In order to shed some light on tax avoidance magnitude, Harju and Matikka (2015) try to split overall taxable income elasticity (ETI) in “real” and income-shifting elasticities. By exploiting Finnish Tax Administration data set, they estimate a standard model without splitting of ETI and a second model with splitting of ETI in real and income-shifting elasticities. They find that the income-shifting elasticity has a prominent role on the overall taxable income elasticity, as compared to the real response component, which is relatively small.

Piketty et al. (2014) sustain that upper incomes concentration has been mostly driven by top earners’ rent extraction behaviors favored by drops in top marginal tax rates⁶. This channel of response to income taxation is named bargaining-compensation elasticity and entails that the lower the top marginal tax rate is, the greater the incentive of top taxpayers to act a more aggressive bargaining. By contrast where top marginal tax rates are very high, the net reward for more aggressive bargaining will be modest.⁷ The bargaining hypothesis is also supported by Campbell and Lusher’ (2015) analysis By using a difference-in-difference approach, they examine how much international trade and SBTC have contributed to the increase in income inequality, considering that manufacturing sectors that are more exposed either to international trade.. They find that both international trade and SBTC do not explain to a greater extent the rising in inequality. Hence, they use an international

⁶ Another strand of literature suggest that rent extraction behaviors of top earners are favored by social norms and institutions changes [Piketty and Saez (2007), Bakija et al. (2012), Bakija (2013), and Bell and Van Reenen (2014)]. Social norms and institutions changes, such as labor and financial deregulations, would have increased rent-seeking behavior because it would have reduced preexisting limit in paying high compensations at “managers” [Piketty and Saez (2007), and Bakija (2013)]. Bell and Van Reenen (2014) indicate that rents-extraction may derive from both lack of product market competition within the sector and implicit or explicit guarantees of bailout by governments, which might encourage bankers to take risky asset as shareholders could benefit from huge positive gains, and at the same time they could suffer small losses thanks to subsidies and garantes received in case of negative trend.

⁷ According to Kaplan (2012), who compared compensation growth of CEO and other highly paid workers, CEO’ pay “has remained relatively constant or declined”. He indicates these as evidence that CEO’ rising pay was a result of increasing in demand for CEO’ skills and other highly paid occupations rather rent-seeking behavior. Yet, Bakija et al. (2012) and Bakija (2013) analyse the percentage change of pre-tax income going to top 1% by occupation, and show that income growth rates across occupations in the top 1% present different patterns. Especially, they stress that 70% of the pre-tax income growth going to top 1% concerns executives, managers, supervisors, entrepreneurs and financial professionals. Given those considerations, Bakija (2013) suggests that the heterogeneity in pre-tax income variation within top 1% cannot be explained by tax reasons, while, it would partially depend on institutional factors, such as corporate governance issues, which might have encouraged behavior aimed at seeking rent.

dataset of 18 countries to test alternative causes. Their results show that the level of top 1% income share depends on lagged values of top marginal tax rate, and indicate these as supporting evidence for bargaining compensation hypothesis.

On the whole, accounting for those “no-real” effects, together with the idea that the surge in upper incomes mainly comes at the expense of lower incomes, in form of rent-seeking, in contrast to additional productive effort might have fundamental consequence on policy recommendations because of an overestimation of welfare losses, and a misunderstanding of efficiency-equity costs of top marginal tax rate variations.

3. Growth and Top Marginal Tax Rate: some descriptive evidence

In this section, firstly, we illustrate our data and sources. Afterwards, we report some evidence to account for the evolution of top marginal tax rate and economic growth over the long-run, and examine the relationship between top marginal tax rate and economic growth across 26 OECD countries during the period 1985 to 2015.

As previously mentioned, for our analysis we use panel data for 26 OECD countries for the period 1985 – 2015. The sample period is chosen with regard to data limitations on quality of institutions information. We estimate our models with fifthly average data to correct for business cycle issues.

As summarized in table 1, the main source of our dataset is the OECD Statistics database. Our data on top marginal tax rates, real Gdp per capita, population growth rate, tax revenue over Gdp, and tax decentralization are obtained from OECD Statistics. Data on investments and Gini index come from World Bank (WDI) database. Data on years of schooling, as proxy for human capital, derive from Penn World Table (PWT).

The source of our proxy of institutional quality is the International Country Risk Guide (ICRG) index, which covers the period from 1984 to the present, and is obtained from QOG Standard Database.

Table 1 shows a brief description of the data, reported on annual and fifthly terms. Basic summary statistics are also shown in table 1.

Table 1: Statistics and Source

Variables	Obs	Mean	Standard Deviation	Obs	Mean	Standard Deviation	Source
Real Gdp per capita	780	33519.90	12512.44	182	32481.08	12539.28	OECD Statistics
Top marginal tax rate	757	0.46	0.11	181	0.48	0.12	OECD Statistics
Gross investments in Gdp	754	22.99	3.79	182	23.01	3.48	World Bank (WDI)
Population growth rate	754	0.71	0.59	182	0.71	0.57	OECD Statistics
Human capital	702	2.88	0.36	182	2.85	0.38	Penn World Table (PWT)
Quality of Institutions	728	0.86	0.15	182	0.85	0.15	QOG Database (ICRG)
Tax revenue over Gdp	777	33.61	8.15	182	33.31	8.22	OECD Statistics
Fiscal decentralization	771	0.12	0.09	181	0.11	0.09	Elaborations on OECD data
Gini Index	375	33.42	6.65	147	33.48	6.54	World Bank (WDI)

Sources: Our Elaborations.

Table 2 shows economic growth rates by countries over period 1985-2015. It illustrates also variation in marginal tax rates and quality of institutions. Considering the relationship between economic growth rates and marginal tax rate change, a “heterogeneous” picture seems to emerge, that is, it is noticeable the fact that countries which have implemented large cuts of top marginal tax rates are those countries experiencing growth rates both larger and smaller than the sample average.

For instance, both Ireland and Italy acted a considerable cut of marginal tax rates, however, Ireland lives a huge increase in economic growth, while, a decreasing rate of economic growth is showed by Italy. Also, Asian countries reveal similar behaviour. Indeed, comparing the economic growth and marginal tax rate variations of Japan and Korea we can observe similar paths.

By contrast, considering the relationship between economic growth and quality of institutions, we can note that all countries, except Turkey, experiencing growth rates larger than the sample average are also those countries that have either achieved or maintained level of institutional quality larger than the sample average (e.g., Austria, Finland, Iceland, Ireland, Japan, Korea, Luxembourg, and Norway).

Table 2: Variations in economic growth, marginal tax rates and quality of institutions⁸

Country	Economic Growth Rate	Marginal Tax Rate	Marginal Tax Rate	Quality of Institutions	Quality of Institutions
	<i>1985-2015</i>	<i>1985</i>	<i>2015</i>	<i>1985</i>	<i>2015</i>
Australia	1.8435	0.60	0.47	0.94	0.91
Austria	1.7245	0.62	0.47	0.90	0.93
Belgium	1.5611	0.74	0.53	1	0.89
Canada	1.3798	0.45	0.48	1	0.92
Denmark	1.3288	0.55	0.56	1	0.97
Finland	1.7465	0.51	0.50	1	0.99
France	1.3082	0.64	0.54	0.94	0.78
Germany	1.6097	0.56	0.48	0.97	0.92
Greece	0.7770	0.62	0.48	0.51	0.61
Iceland	1.5625	0.38	0.46	1	0.96
Ireland	3.5305	0.63	0.48	0.79	0.87
Italy	1.0099	0.69	0.49	0.75	0.57
Japan	1.5890	0.83	0.50	0.89	0.86
Korea	5.4195	0.66	0.41	0.55	0.69
Luxembourg	2.8468	0.58	0.43	1	0.94
Mexico	0.9060	0.55	0.31	0.51	0.47
Netherlands	1.7246	0.72	0.52	1	0.94
New Zealand	1.2617	0.61	0.33	1	0.94
Norway	1.7752	0.54	0.40	0.98	0.95
Portugal	1.8412	0.71	0.53	0.65	0.74
Spain	1.7604	0.67	0.50	0.71	0.75
Sweden	1.6240	0.83	0.57	1	0.95
Switzerland	1.0620	0.26	0.42	1	0.87
Turkey	2.6095	0.60	0.36	0.50	0.50
United Kingdom	1.8599	0.60	0.48	0.96	0.85
United States	1.6742	0.54	0.44	0.96	0.83
Sample average	1.8206	0.6	0.47	0.87	0.83

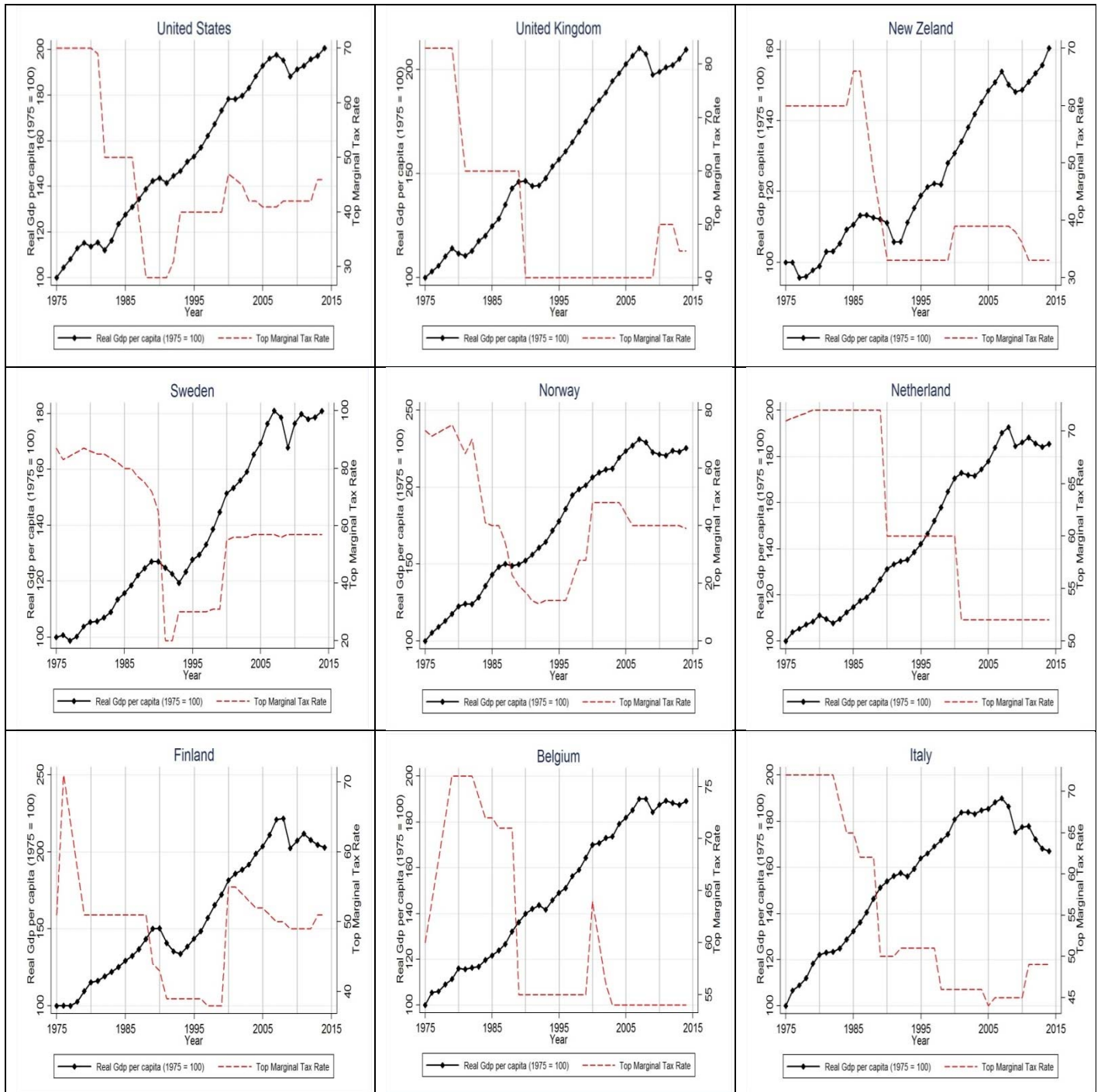
A “heterogeneous picture” also emerges in figure 1, which present a graphical analysis of the relationship between economic growth and marginal tax rate by countries, reported only for 12 countries of our sample, over the period 1975-2015⁹. It is shown that the United States and the United Kingdom, which implemented a considerable reduction of top marginal tax rates, show an economic

⁸ Table 2 is elaborated by using fifthly average observations.

⁹ In the elaboration of figure 1 we exploit data for the period 1975-2015 in order to examine cross-country relationship between the evolution of real Gdp and the reduction of marginal tax rate before and after the main cuts of marginal tax rates which were mostly implemented from 1979 onwards.

growth rate similar or even smaller than other countries (e.g. France, Germany, Sweden, and Finland) which have not experienced a sharp decrease in top marginal tax rate.

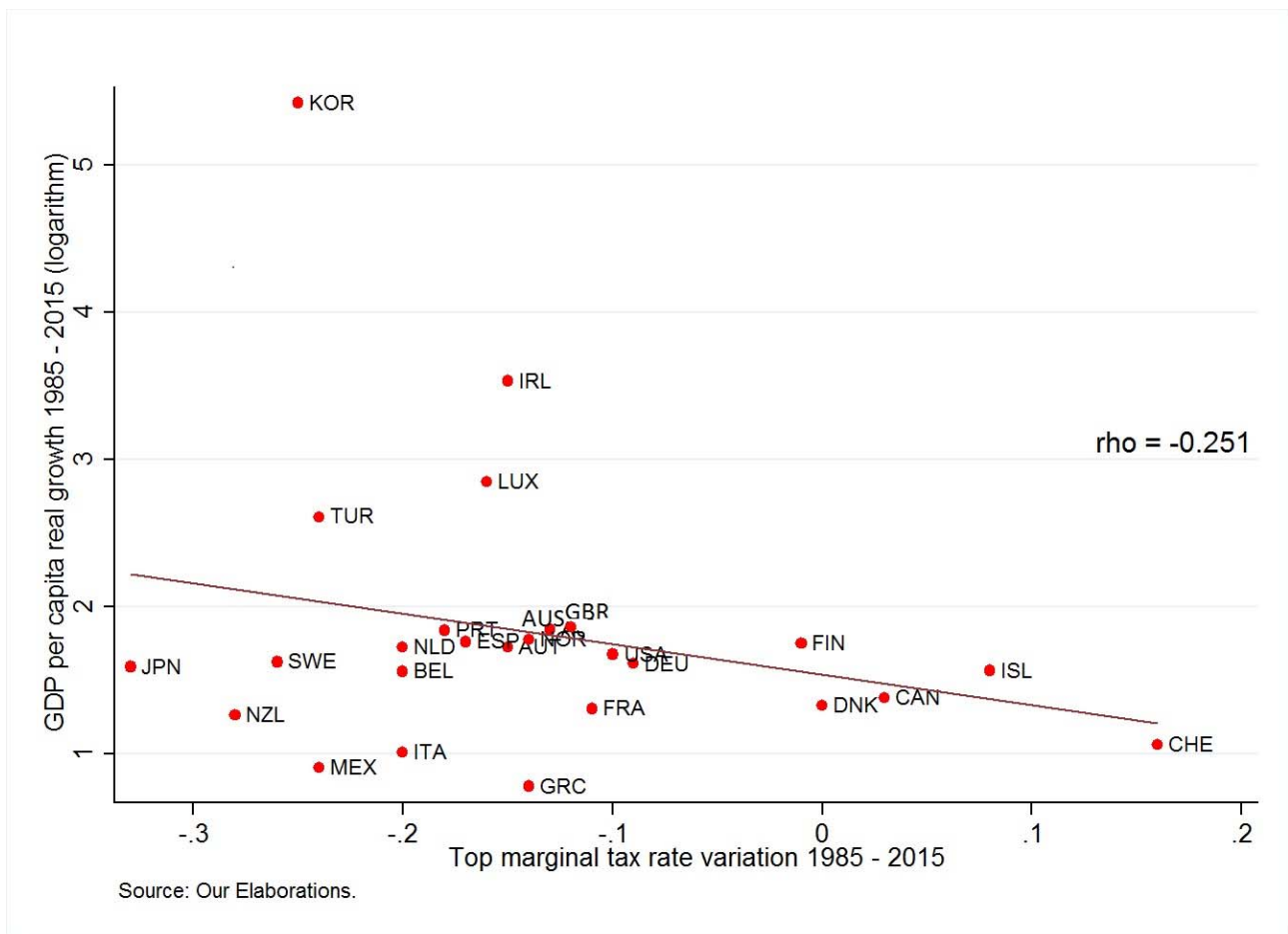
Figure 1: Real Gdp per capita and marginal tax rate by countries



Sources: our elaboration.

Figure 2 presents the relationship between the evolution of real Gdp per capita and the variation of marginal tax rate over the period 1985 – 2015. It highlights a negative correlation equals to -0.25 between growth rate of real Gdp per capita and change in top marginal tax rate¹⁰. This graph, thus, would support the standard supply side hypothesis which indicates that larger economic growth is linked to lower top marginal tax rates as a consequence of increasing in productive effort of upper earners.

Figure 2: Real Gdp per capita and marginal tax rate¹¹



Finally, figure 3 illustrates the relationship between real Gdp per capita and quality of institutions during the period 1985 – 2015, and highlights a positive correlation equals to almost 0.32. This result

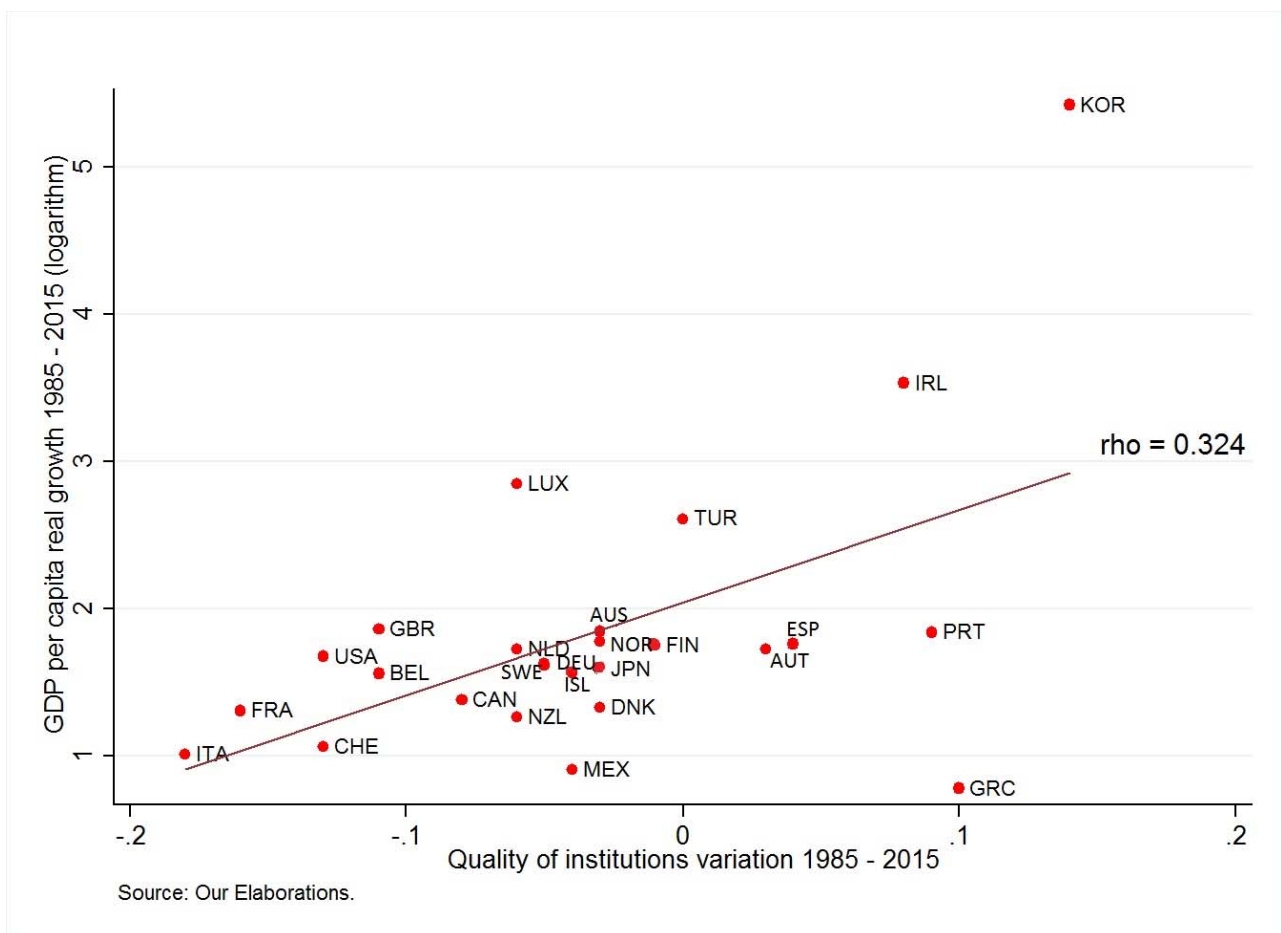
¹⁰ Comparing the economic growth rate and change in marginal tax rate over the period 1975-2015 we observe a more pronounced negative correlation, which equals almost to -0.39.

¹¹ Figure 2 is elaborated by using fifthly average observations.

supports the idea that the better the institutional quality is, the more economically successful the societies are.

According to Acemoglu et al. (2001, 2002, and 2005), “good” economic institutions represent an inter-related cluster of things causing the prosperity of countries. For instance, the literature indicates that the enforcement of property rights ensures individuals who are generally risk adverse, and thus creates an incentive to invest, innovate and participate to economic activity.

Figure 3: Real Gdp per capita and quality of institutions¹²



¹² Figure 3 is developed through fifthly average observations.

4. Empirical Strategy

In order to investigate whether top marginal tax rate affects economic growth, we have estimated the following model:

$$\log(Gdp_{it}) = \alpha + \beta \times \log(\text{net of tax rate}_{it}) + \gamma \times \log(X_{it}) + \varepsilon_{it}$$

The model is estimated for 26 OECD countries over the period 1975 - 2015. To make our analysis consistent with main empirical growth approaches, mostly Islam (1995) model, all variables are expressed in logarithms and are fifthly average. Using a specification with fifthly average allows controlling for economic cycle fluctuations, and serial correlation issues. In detail: Gdp is measured as real Gdp per capita. Net of tax rate denotes our variable of interest, and is measured as (1 – top marginal tax rate). The X vector denotes our well-established set of control variables. It contains: the lagged dependent variable to capture the process of country convergence; the gross investments share in Gdp; the population growth rate; and years of schooling as a proxy for the level of human capital. Moreover, it includes a proxy for tax decentralization, measured as the ratio between local tax revenue and total tax revenue, and the tax revenue over Gdp variable, which indicates the share of a country's output that is collected by the government through taxes. Yet, it contains a proxy for income inequality constructed using Gini index and a measure of quality of institutions based on International Country Risk Guide (ICRG) index. ICRG index uses different governmental aspects in order to qualify the quality of institutions. In particular, it measures the institutional quality by considering the quality of the bureaucracy, the political corruption, the likelihood of government repudiation of contracts, risk of government expropriation, and overall maintenance of the rule of law.

Different methods are available for the estimation of an empirical growth model. Considering the growth changes over time and the limited number of countries, the panel data approach can be one. It offers significant advantages, firstly, because it is more informative, hence, it provides estimates more efficient, and especially because it allows controlling for unobserved heterogeneity, even if it

can take technical issues, particularly, in the context of growth, as highlighted by Durlauf, Johnson, and Temple (2005).

Growth empirical literature suggests that growth models should include some dynamics in lagged output, in the sense that in an empirical growth model the current output is regressed on controls and lagged output, as we can see in Islam (1995) approach.

Assume to estimate following regression with panel data

$$y_{it} = \rho y_{it-1} + \beta x_{it} + u_{it} \quad (1)$$

$$i = 1, \dots, N ; t = 2, \dots, T$$

$$y_{it-1} = \rho y_{it-2} + \beta x_{it-1} + u_{it-1} \quad (2)$$

$$u_{it} = a_i + \varepsilon_{it} ; u_{it-1} = a_i + \varepsilon_{it-1} . \quad (3)$$

Ols estimates would be biased because of unobserved heterogeneity, that is, the standard Ols assumption of no-correlation between the error term and the explanatory variables would be violated, since a_i is part of the process that generates y_{it-1} .

Islam (1995) indicates that empirical growth literature usually assumed that all countries presented an identical aggregate production function, although there was a broad acknowledgment that the production function may be different across countries. This practice was mostly induced by econometric reasons because of using single cross-country specifications. Indeed, Islam (1995) states that such unobserved country-specific factors of production function are correlated with the explanatory variables included in the model, and thus an omitted variable issue arises. However, using panel data approach alone do not solve problem of unobserved heterogeneity but it requires adopting special empirical strategy.

Panel data approach with individual effects has the advantage to correct omitted variable bias, and therefore to allow for unobservable country-specific factors, such as production function, to differ across countries, as highlighted by Islam (1995). In terms of individual effects, they would be either “fixed” or “random”. Nevertheless, in the growth context the random effects estimator is not suitable because it requires independence between individual effects and explanatory variables, e.g. it requires

that initial level of technology is independent on initial level of income. By contrast, fixed effects estimator (Fe) does not need this independence restriction, and ensures that any omitted variables, which are constant over time, will not bias estimations, although there is correlation between the omitted and the explanatory variables.

As indicated in equation (3), the error term is constituted of two components: an individual-specific error term a_i and an idiosyncratic error term ε_{it} , where the individual-specific error term does not change over time, namely it is a time-constant factor, and represents the time-constant unobserved heterogeneity.

Fe strategy is based on the within transformation, which consists in averaging the regression model (1) over time for each i such that

$$y_i = \rho y_i^{-1} + \beta x_i + a_i + \varepsilon_i. \quad (4)$$

Then, the average equation (4) is subtracted from the regression model (1) such that

$$y_{it} - y_i = \rho(y_{it-1} - y_i^{-1}) + \beta(x_{it} - x_i) + (\varepsilon_{it} - \varepsilon_i). \quad (5)$$

This model can be estimated by Fixed-Effect estimator. In particular, as can be seen, the within estimator has the advantage to remove the time-constant error term from the transformed equation, hence, it allows for overcoming the time-constant unobserved heterogeneity issue. On the other hand, a drawback of implementing fixed-effect estimator in growth models is the loss of all between variation, as Barro (1998) and Temple (1999) argue, but especially the within groups estimator could still achieve biased estimations because of the non-negligible correlation between the transformed lagged dependent variable and the transformed error term¹³. Indeed, we have that

$$y_{it-1} - y_i^{-1} = y_{it-1} - \frac{y_{it} + \dots + y_{it-1} + \dots + y_{iT-1}}{T-1} \quad (6)$$

$$\varepsilon_{it} - \varepsilon_i = \varepsilon_{it} - \frac{\varepsilon_{i2} + \dots + \varepsilon_{it-1} + \dots + \varepsilon_{iT}}{T-1} \quad (7)$$

$$Cov\left(-\frac{y_{it-1}}{T-1}; -\frac{\varepsilon_{it-1}}{T-1}\right) \neq 0 \quad (8)$$

¹³ For more details see Nickell (1981), Caselli et al. (1996), Durlauf et al. (2005).

Since the Fixed-Effect estimator has to satisfy the standard assumption of strict exogeneity implying no-correlation between independent variables and idiosyncratic error term, thus, it still provides biased estimations, which are inconsistent as the correlation between transformed lagged dependent variable and transformed error term does not disappear when N will tend to infinity¹⁴. Bond et al. (2001) note that Ols and Fe estimators are biased in opposite directions: Ols estimator is biased upwards, while, Fe estimator is biased downwards. Thus, they stress that a consistent estimator should lie between these two parameters.

In particular, we have to deal with an endogeneity problem. An approach used to tackle the bias deriving from endogeneity is the Generalized Method of Moments (Gmm). There are several reasons because the Difference and System Gmm estimators fit for growth context. In particular, they allow for the presence of fixed individual effects, which are likely in panel set-up. Moreover, they deal with the dynamic process and endogenous regressors, which are the case for growth models.

The Difference Gmm, firstly, applies the first-difference transformation which eliminates the fixed effects, as does also Within Group estimator, but further predetermined and endogenous transformed variables are instrumented with untransformed lags, which are orthogonal to the error term. However, Difference Gmm (Gmm-dif), which was developed by Arellano – Bond (1991), built on Holtz-Eakin, Newey, and Rosen' (1988) work, performs poorly in presence of persistent series¹⁵.

System Gmm (Gmm-sys), developed and studied by Arellano and Bover (1995) and Blundell and Bond (1998), augments the Arellano – Bond (1991) method with original equations in levels, such that predetermined and endogenous variables in levels are instrumented with lagged first differences. Roodman (2009a) sustains that System Gmm increases efficiency as “past changes may be more predictive of current levels than past levels are of current changes” when persistent series are faced. On the other hand, it requires an extra strict assumption to be satisfied. It involves that “changes in

¹⁴ See Nickell (1981) for more details.

¹⁵ See Roodman (2009a, 2009b) and Bond et al. (2001).

any instrumenting variable w are uncorrelated with the fixed effects”, as Roodman (2009a) wrote¹⁶.

Algebraically, it means

$$E[\Delta w_{i,t-1} \varepsilon_{it}] = E[\Delta w_{i,t-1} \mu_i] + E[w_{i,t-1} v_{it}] - E[w_{i,t-2} v_{it}] = 0. \quad (9)$$

$$E[\Delta w_{i,t-1} \mu_i] = 0 \text{ for } i = 1, \dots, N. \quad (10)$$

To satisfy this further assumption, Blundell and Bond (1998) indicate a restriction on initial conditions as a sufficient condition. To see this, consider the following autoregressive model without controls

$$y_{it} = \rho y_{it-1} + \mu_i + v_{it}. \quad (11)$$

$$E[\mu_i] = 0, E[v_{it}] = 0, E[v_{it} \mu_i] = 0 \text{ for } i = 1, \dots, N \text{ and } t = 2, \dots, T. \quad (12)$$

Now consider equation (11) for $t=2$ and y_{i1} as

$$y_{i1} = \frac{\mu_i}{(1-\rho)} + e_{i1} \quad (13)$$

$$y_{i2} = \rho y_{i1} + \mu_i + v_{i2}. \quad (14)$$

Subtracting y_{i1} from both side of equation (14), and substituting y_{i1} with equation (13) we find

$$\Delta y_{i2} = (\rho - 1)e_{i1} + v_{i2}. \quad (15)$$

Therefore, assumption (10) is satisfied if

$$E[e_{i,1} \mu_i] = 0 \text{ for } i = 1, \dots, N \quad (16)$$

Bond et al. (2001) indicate stationary means of the first moments of both lagged dependent variable and independent ones as sufficient conditions to satisfy equation (10). In growth context, assumption of constant means may be reasonable for investment rates and population growth rates, but it is less plausible for the per capita Gdp series. However, they suggest that “the inclusion of time dummies allows for common long-run growth in per capita GDP, consistent with common technical progress, without violating the validity of the additional moment restrictions used by system GMM estimator”¹⁹

¹⁶ See Roodman (2009a).

¹⁷ Conditioning on μ_i , we obtain $E[y_{i,t} | \mu_i] = E[y_{i,t-1} | \mu_i]$. Thus, $y_{it} = \frac{\mu_i}{(1-\rho)} + v_{it}$.

¹⁸ See Bond et al. (2001) for more details.

¹⁹ Bond et al. (2001) state that “the inclusion of time dummies is equivalent to transforming the variables into deviations from time means (i.e. the mean across the N individual countries for each period). Thus any arbitrary pattern in the time means is consistent with

Taking into account for these issues arising in growth analysis with dynamic panel data models, we opt for testing the relation between top marginal tax rate and real Gdp per capita by using Within Group and System Gmm estimators. We prefer using Gmm-System than Gmm-dif because this methodological is more efficient in growth contest. Indeed, Gmm-sys has much greater precision in estimating autoregressive parameters using persistent time series, as this is the case for Gdp series²⁰.

5. Results and discussion

The following tables report results on the relationship between net of tax rate and real Gdp per capita during 1985-2015 using alternative panel estimators: Within Group and Gmm System²¹.

The models reported in Table 3 are estimated by Within Group estimator. Model 1 represents our base model, which construction mostly follows the empirical growth contributions of Islam (1995) and Mankiw, Romer, and Weil (1992). It includes, as independent variables, the lagged dependent variable, the gross investments share in Gdp, population growth rate, human capital and net of tax rate, our variable of interest. As expected, the impact of investments on growth would be positive, a 10% increase in investments can lead to an almost 3% rise of growth, and population growth rate affects negatively economic growth, a 10% rise in population growth rate could cause an almost 0.5 decrease in growth. These results are consistent with neoclassical theories, as developed by Ramsey (1928), Solow (1956), Cass (1965), and Koopmans (1965), and as empirically shown by a sharp strand of empirical literature (e.g. Mankiw et al. [1992], and Islam [1995]), which argue that investments and population growth rates have a positive and negative effect on economic growth of long-run, respectively.

Model 1 also shows that net of tax rate is not statistically significant. This empirical result on a non-statistically significant effect of top marginal tax rate on economic growth may induce interesting

a constant mean of the transformed series for each country". Hence, the inclusion of time dummies alter the variables into deviations from time means; thus, a stationary means of per capita Gdp series cannot be an unreasonable condition.

²⁰ See Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998), Bond et al. (2001) for more details.

²¹ Tables are reported in appendix 1.

implications concerning the relationship between top marginal tax rate and top earners labor offer. In particular, it would stand in contrast to the supply-side elasticity hypothesis, proposed by Lindsey (1987) and Feldstein (1995), who affirm that the lower the top marginal tax rate is, the greater the economic activity of top earners is, and consequently the larger the economic growth would be.

In the subsequent specifications, we include additional control variables. Models 2 and 3 include tax revenue over Gdp and tax decentralization variables, respectively, yielding similar results as in model 1. Indeed, net of tax rate is still statistically insignificant, while, investments and population growth rates would affect positively and negatively economic growth, respectively. Model 2 also shows that an increase in tax revenue over Gdp has a statistically insignificant effect on economic growth. Conversely, model 3 reveals that the effect of tax decentralization on economic growth is significantly negative. Therefore, it ascribes a detrimental effect to tax decentralization supporting the flypaper effect theory, which states that tax decentralization affects negatively economic growth because local government exploits revenue resources, as intergovernmental grants, in order to pursue personal interests instead of maximizing voter's utility.

Models 4 and 5 are specular to models 2 and 3 including a proxy of institutional quality. They both do show that quality of institutions has a significant positive effect on economic growth. Specifically, it shows that a 10% increase in institutional quality can determine an almost 1.2% rise in real Gdp per capita suggesting that quality of institutions is a key-determinant of long-run economic growth. It is worth noting that the coefficient of net of tax rate is still not statistically significant, while, investment and population growth rates confirm their respective positive and negative effects on real Gdp per capita. On the other hand, we can observe that the average tax rate is still not statistically significant, and tax decentralization becomes statistically insignificant through the inclusion of institutions quality variable.

Moreover, we try to examine whether marginal tax rate variations might have a different effect in "Good" institutions versus "Bad" institutions. We can test this hypothesis by multiplying the net of

tax rate and the institution quality dummy variable to make a new variable called an interaction term²².

For this reason, we construct a dummy of institutions quality measure, and interact it with net of tax rate. Dummy of institutions quality (IqD) divides our country sample in either “Good” or “Bad” institutions²³. Model 6 shows results with our interaction term.

Firstly, we observe that the coefficient on net of tax rate is positive and statistically significant, telling us we can expect that increasing net of tax rates leads to more economic growth in “Bad” institutions. Specifically, a 10% increase in marginal tax rates can cause an almost 1.8% decrease in real Gdp per capita. At the same time, the coefficient on the interaction term is negative and statistically significant, suggesting that for every 10% rise in marginal tax rates we can expect an almost 2% increase in real Gdp per capita in “Good” institutions as compared to “Bad” institutions. Overall, from a 10% increase in marginal tax rates might derive an almost 0.2% increase in long-run economic growth in “Good” institutions²⁴.

This result seems to be consistent with rent-extraction theory and PSS’ (2014) statements suggesting that upper incomes concentration derives mostly from rent-extraction behaviors, which we think could be stronger and more aggressive when the institutions are weak. It is also in line with Chetty’ (2009) considerations about implications of sheltering behaviors on welfare loss computation, and consequently an overestimation of deadweight losses. Indeed, our model 6 would indicate that significant behavioral response to change in marginal tax rates concerns mainly “Bad” institutions which are expected to report several tax evasion and tax avoidance behaviors as compared to “Good” institutions. The previous results of investments are robust to follow specification (model 7), which controls for inequality level; however, net of tax rate and inequality levels are statistically

²² The interaction term is named “IqD*Ntr Interaction” in results tables reported in appendix 1.

²³ Institutions quality dummy (IqD) takes value 1, defining individual country as “Good” institution, when the average value of Icrq index over complete time period is larger than the sample median value, and vice-versa IqD takes value 0, defining individual country as “Bad” institution, when the average value of Icrq index over complete time period is lower than the sample median value.

²⁴ As robustness check, we construct our institutions quality dummy variable by using either different indexes or methods of computation. Firstly, we make our dummy by dividing our quality of institutions measure in two quartiles, and multiplying each quartile with net of tax rate. Values of our proxy of institutional quality below 0.85 belong to first quartile; and remaining higher values belong to second quartile. Thus, institutions dummy equals to 1 when values of quality of institutions are larger than 0.85, and vice versa. Results reported in model 6 still hold. Finally, we use corruption and rule of law measures developed by World Governance Indicator instead of Icrq index. In this case, however, estimations do not confirm results showed in model 6.

insignificant²⁵. Considering the statistically insignificant effect of the inclusion of inequality level, we disregard model 7 in the following table, and focus on the explaining power of quality of institutions.

Table 4 shows results from Gmm System estimations. As previously indicated, since the Fixed Effect estimator has to satisfy the standard assumption of strict exogeneity implying no correlation between lagged dependent variable and idiosyncratic error term, Fe estimations would probably suffer from endogeneity issues. An approach used to tackle the bias deriving from endogeneity is the estimator of Generalized Method of Moments which, as previous highlighted, takes differences in order to solve omitted variable biases, and then instruments the explanatory variables using their lagged values in order to solve the bias issue arising from the endogeneity of independent variables.

Nevertheless, the Gmm estimators tackle the problem of instrument proliferation. A possible technique to limit its explosion is to “collapse” instruments matrix. Specifically, it should create one instrument for each variable and lag distance, rather than one for each time period²⁶.

Our base model confirms that investment ratio has a positive effect on growth. Moreover, first model suggest that a 10% increase in human capital affects positively economic growth by almost a 3.6%, however, this result is not confirmed in all following specifications. Differently from Within Group estimations, especially, first regression reveals that net of tax rate has a statistically significant and negative effect on growth, namely, it would suggest that a 10% increase in top marginal tax rate leads to approximately 2% increase in economic growth. This result is in line with the analysis by Milasi (2013) who shows that a top marginal tax rate increase could induce more economic growth, and affirms that OECD’ current top tax rates might be below their growth-maximizing level, which has been estimated to be above 50% by Milasi (2013). Therefore, an increase in top tax rates, he argues, could be beneficial for economic growth whether the additional tax revenues are aimed at financing an efficient and growth-maximizing public expenditure.

²⁵ Similarly to ICRG index, we have divided the Gini index in four quartiles and multiplied each quartile with net of tax rate. Though, we omit results because they are not statistically significant.

²⁶ See Roodman (2009b) for more details.

The previous results of investments ratio and net of tax rate are robust to follow specifications (model 2 and 3), which controls for average tax rate and tax decentralization; however, average tax rate and tax decentralization coefficients are statistically insignificant.

As in the Within Group estimations, models 4 and 5 include the continuous proxy of institutional quality. Investments still has a positive and statistically significant effect on economic growth. Also, quality of institutions still presents a positive impact on long-run economic growth. Specifically, it shows that a 10% increase in institutional quality may determine an almost 2.5% rise of growth. Moreover, it is worth noting that the coefficient of net of tax rate is still not statistically significant suggesting that the institutions quality is a leading factor of long-run economic growth, rather than net of tax rate.

Finally, controlling for the interaction term between institutions quality dummy variable and net of tax rate, we find that the coefficient of the interaction term is negative and statistically significant, suggesting that for every 10% rise in marginal tax rates we can expect an almost 3% increase in real Gdp per capita in “Good” institutions as compared to “Bad” institutions.

Overall, since moving from first three models (1, 2, and 3) to models 4 and 5 net of tax rate becomes no statistically significant in each specification, while, quality of institutions shows always a statistically significant and positive coefficient, this would suggest that quality of institutions represents the key factor explaining growth rather than net of tax rate. Our results, therefore, support the empirical literature suggesting that the better the institutions are, the more economically successful the societies are.

6. Conclusions

This paper investigates the impact of net of tax rate on economic growth in a panel data set of 26 OECD countries from 1985 to 2015 controlling for a well-established set of determinants of economic growth. Especially, at first glance it would seem that net of tax rate has a negative effect on economic growth indicating that an increase in top marginal tax rate would affect positively economic growth. However, this result is not robust when we include a proxy for institutional quality, and control for endogeneity issues. Indeed, controlling for quality of institutions, we find that net of tax rate becomes no statistically significant indicating that it does not affect economic growth, while the impact of quality of institutions on growth is positive, namely, a 10% increase in institutional quality would determine an almost 2% rise of economic growth. This result suggests that quality of institutions rather than net of tax rate represents the leading factor in explaining growth.

An open question concerns the impact of top marginal tax rate on current upper income distribution. In particular, our results might suggest that a cut of top marginal tax rate did not determine a higher productive effort among top earners which would explain the surge in upper incomes. At the same time, they do not imply that a cut of top marginal tax rate has caused the huge increase in top 1% income share due to a more aggressive bargaining effort acted by top earners. Indeed, considering the heterogeneous picture emerging from our descriptive analysis, the link between top marginal tax rate and recent upper incomes concentration do not directly appear very clear.

According to Bakija (2013), the heterogeneity in pre-tax income variation within top 1%, together with the fact that cuts of top marginal tax rates affect workers similarly, would suggest that upper incomes distribution might be explained by non-tax factors, while, it would partially depend on institutional aspects, such as corporate governance issues, which might have encouraged behavior aimed at seeking rent. Also Bargain et al. (2014) emphasize that tax policies affect differently tax brackets. In particular, they find that policy effects are larger in the 95th to 99th percentile than in the top 1st percentile of the income distribution, and indicate these as evidence that a significant fraction

of the increasing in top 1% income share does not come from tax policy changes, but other driving forces play a role.

In conclusion, we find non-univocal evidence about the impact of top marginal tax rate on economic growth. Nevertheless, our results certainly suggest that quality of institutions represents a key determinant in explaining economic growth, and that its effect on economic growth merit serious consideration.

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Appendix 1

Table 3: The impact of marginal tax rate cuts

Dependent Variable: Real Gdp per capita							
Years: 1985 - 2015							
Variables	(Fe)	(Fe)	(Fe)	(Fe)	(Fe)	(Fe)	(Fe)
	(Model 1)	(Model 2)	(Model 3)	(Model 4)	(Model 5)	(Model 6)	(Model 7)
NetTaxRate (Ntr)	0.0028 [0.0221]	0.0031 [0.0218]	0.0059 [0.0223]	0.0028 [0.0206]	0.0049 [0.0211]	0.1875** [0.0761]	0.0077 [0.0229]
LaggedDependentVariable	0.7533*** [0.0431]	0.7515*** [0.0483]	0.7515*** [0.0432]	0.7255*** [0.0382]	0.7285*** [0.0375]	0.7271*** [0.0282]	0.7009*** [0.0400]
Investments	0.3068*** [0.0345]	0.3059*** [0.0359]	0.2991*** [0.0292]	0.2900*** [0.0364]	0.2872*** [0.0323]	0.2668*** [0.0293]	0.2948*** [0.0489]
PopulationGrowthRate	-0.0529*** [0.0188]	-0.0509** [0.0201]	-0.0532*** [0.0169]	-0.0404** [0.0181]	-0.0428** [0.0185]	-0.0494*** [0.0156]	-0.0191 [0.0321]
HumanCapital	-0.0969 [0.0823]	-0.1066 [0.0728]	-0.0858 [0.0825]	-0.1016 [0.0757]	-0.0916 [0.0858]	-0.1682* [0.0931]	-0.0526 [0.0766]
AverageTaxRate		0.0213 [0.0591]		0.0044 [0.0632]		-0.0401 [0.0658]	0.079 [0.0524]
TaxDecentralization			-0.0198** [0.0094]		-0.0137 [0.0095]	-0.0351*** [0.0098]	
IstitutionsQuality				0.1332** [0.0627]	0.1143* [0.0566]		
IqD*Ntr Interaction						-0.2061** [0.0797]	
Inequality							0.0319 [0.0483]
Constant	1.8029*** [0.4150]	1.7598*** [0.3882]	1.7872*** [0.4135]	2.1586*** [0.3413]	2.1050*** [0.3665]	2.3635*** [0.3109]	1.9433*** [0.3753]
F statistic	405.84	390.47	474.48	445.6	476.02	434.53	402.47
Adjusted R-squared	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Observations	179	179	179	179	179	179	145
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of country	26	26	26	26	26	26	26

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Robust standard error in brackets.

Table 4: The impact of marginal tax rate cuts

Dependent Variable: Real Gdp per capita						
Years: 1975 - 2015						
Variables	(Gmm-System) (Model 1)	(Gmm-System) (Model 2)	(Gmm-System) (Model 3)	(Gmm-System) (Model 4)	(Gmm-System) (Model 5)	(Gmm-System) (Model 6)
NetTaxRate (Ntr)	-0.2004** [0.0905]	-0.1208 [0.0737]	-0.1978* [0.1032]	-0.0197 [0.0643]	0.0173 [0.0763]	0.0834 [0.1104]
L.lngdp	0.9039*** [0.0422]	0.9043*** [0.0691]	0.8693*** [0.0300]	0.8371*** [0.0720]	0.8444*** [0.0760]	0.9111*** [0.0756]
Investments	0.3399*** [0.0952]	0.3618*** [0.0757]	0.2651** [0.1032]	0.2991*** [0.0822]	0.2686*** [0.0755]	0.3119*** [0.1097]
PopulationGrowthRate	-0.0296 [0.0356]	-0.0184 [0.0468]	0.0155 [0.0417]	-0.0042 [0.0376]	-0.0067 [0.0420]	-0.0389 [0.0596]
HumanCapital	0.3637*** [0.1318]	0.173 [0.1317]	0.3859*** [0.1093]	-0.0699 [0.1290]	-0.1318 [0.1674]	-0.0376 [0.2344]
AverageTaxRate		0.129 [0.1059]		0.0436 [0.0794]		0.107 [0.1390]
TaxDecentralization			0.0021 [0.0287]		0.0005 [0.0204]	-0.0383 [0.0397]
IstitutionsQuality				0.2474** [0.1080]	0.2726* [0.1420]	
InstitutionsQualityDummy (IqD)						-0.1508* [0.0887]
IqD*Ntr Interaction						-0.3128** [0.1421]
Constant	-0.5391 [0.6661]	-0.8009 [0.5976]	0.0154 [0.6179]	0.7785 [0.8264]	1.0485 [1.0904]	-0.3974 [0.8506]
Arellano-Bond test for AR(1)	[-2.02]**	[-2.12]**	[-1.74]*	[-2.03]**	[-2.21]**	-1.32
Arellano-Bond test for AR(2)	0.25	-1.04	-0.06	-0.16	-0.87	-1.53
Hansen test of overid. restr.	15.27	16.04	14.95	13.78	13.35	11.68
Difference-in-Hansen tests	1.98	4.37	3.25	0.69	0.68	1.26
R-squared	0.9769	0.9815	0.9776	0.9863	0.9863	0.9739
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	179	179	179	179	179	179
Instruments	46	46	47	46	47	46
Number of country	26	26	26	26	26	26

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Robust standard error in brackets. Gmm estimations might suffer from instruments proliferation. We tackle this problem through the technique of "collapsing" the instruments matrix.