Effective Tax Rates in the EU: An updated database over 1995-2017*

Ilias Kostarakos‡
(Economic Social Research Institute and Trinity College Dublin)

Petros Varthalitis¶
(Economic Social Research Institute and Trinity College Dublin)

January 8, 2020

Abstract

In this paper we compute a unified database of effective tax rates for 27 EU countries over the 1995-2017 period. To do this, we follow the methodology developed in Mendoza et al. (1994) while we also incorporate the most recent revisions introduced by Carey and Rabesona (2002). Our database consists of the effective tax rates on labour and capital income, on consumption, on corporate income and social security contributions. The full database in excel format is available online at `https://sites.google.com/site/ikostarakos/effective-tax-rates`

*__Acknowledgements__: This paper was developed as part of the joint research programme "Macroeconomy, Taxation and Banking" between the ESRI, the Department of Finance and Revenue Commissioners. We are grateful for helpful comments of the programme steering committee. We would like to especially thank Martina Lawless, Kieran McQuinn, Dimitris Papageorgiou and Stelios Sakkas for many helpful suggestions and comments. We would also like to thank participants at the ESRI seminar series for useful comments. Any errors and the views expressed in this paper are our own.

†The Economic and Social Research Institute (ESRI), Whitaker Square, Sir John Rogerson's Quay, Dublin 2, Ireland. Email: petros.varthalitis@esri.ie

‡Department of Economics, Trinity College Dublin, Dublin 2, Ireland.

§The Economic and Social Research Institute (ESRI), Whitaker Square, Sir John Rogerson's Quay, Dublin 2, Ireland. Email: petros.varthalitis@esri.ie

¶Department of Economics, Trinity College Dublin, Dublin 2, Ireland.

1 Introduction

The effects of fiscal policy on macroeconomic performance have been a key policy issue. In particular, for the European Union countries which are subject to complex and different national tax systems, international comparisons are almost infeasible. This often hampers the design of effective fiscal policy at the international level. Thus, the construction of appropriate tax indicators that allow international comparisons among European countries is a pre-requisite for conducting effective and well informed fiscal policy.

The aim of this paper is to construct a unified database of tax indicators, namely Effective Tax Rates, for a sample of 27 European Union countries over 1995-2017. To do this, we follow the methodology developed in Mendoza et al. (1994) while we incorporate the revisions introduced in Carey and Rabesona (2002). Effective tax rates are computed as ratios of the realised tax revenues over an approximation of the corresponding tax base using publicly available National Accounts and Tax Revenue data. These tax indicators measure the net effect of tax burden incorporating tax exemptions, deductions and credits of each country's tax system. Thus, they are suitable for international comparisons among countries with different tax structures. In addition, they indicate potential shifts in the tax mix and the tax burden on the various sources of income. Following the seminal paper of Mendoza et al. (1994) several papers compute effective tax rates for various group of countries and across different time periods. For example, Martinez-Mongay (2000) employ a sample of 15 EU countries, US and Japan over 1970-2001 to compute effective tax rates. Carey and Tchilinguirian (2000) and Carey and Rabesona (2002) focus on sample of OECD countries over the 1975-2000 period, Trabandt and Uhlig (2011) provide an effective tax rate database for several EU countries and US while Papageorgiou et al. (2012) compare Greece with the rest of Euro Area. Since 1998, the European Commission publishes annual reports that compute implicit tax rates for the EU countries (see European Commission 1998–2006 and European Commission 2007-2019). Finally, McDaniel (2007) employs an alternative methodology and constructs effective tax rates for 15 OECD countries over the period 1950-2003.

Our contribution to this literature is the following. First, we construct an updated unified database for the European Union countries. Second, along with the standard effective tax rates on consumption, capital and labour income, we augment our database with effective tax rate series on corporate income and social security contributions for employers and employees.

The rest of the paper is as organized as follows. Section 2 reports our dataset and sources. In section 3 we compute the effective tax rates while in section 4 we present some reuslts. The full database in excel format is available online at `https://sites.google.com/site/ikostarakos/effective-tax-rates`.

2 Data

Our sample consists of annual data for the EU countries over the period 1995-2017. Data are extracted from the Eurostat database. In particular, we employ data from the Annual National Accounts Series (nama_10_gdp), the Non-Financial Annual Sector Accounts (nasa_10_nf_tr) and the Tax Aggregates of Annual Government Finance Statistics (gov_10a_taxag).[1] Table 1 contains the variables used, along with their ESA 2010 codes.

[1] Notice that for some countries, e.g. for Spain, data from the sectoral accounts are only available after 1998. Moreover, we exclude Croatia from the sample due to extensive data limitations.

Table 1: Data

Tax Revenue Data	
ESA 2010 Code	Definition
D2	Taxes on production and imports
D214B	Stamp taxes
D214C	Taxes on financial and capital transactions
D214F	Taxes on winnings from lottery or gambling
D29	Other taxes on production
D29H	Other taxes on production n.e.c.
D59A	Current taxes on capital
$D51^{nfc}$	Taxes on income paid by non-financial corporations
$D51^{fc}$	Taxes on the income and profits of corporations including holding gains
D51A_C1	Taxes on individual or household income including holding gains
D51B_C2	Taxes on income paid by financial corporations
D91	Capital taxes
National Accounts Data	
$B2A3G^{hh}$	Gross Operating Surplus and mixed income of households
$B2A3G^{nfc}$	Gross Operating Surplus and Mixed Income – non-financial corporations
$B243G^{fc}$	Gross Operating Surplus and Mixed Income – financial corporations
$B2A3G^{total}$	Gross Operating Surplus and Mixed Income – total economy
D1	Compensation of Employees
$D41P^{hh}$	Interest Income Paid – households
$D41R^{hh}$	Interest Income Received – households
D611	Employers' actual Social Security Contributions
D613	Households actual Social Security Contributions
P2	Intermediate Consumption – government
P3	Households and NPISH final consumption expenditure
$P51C^{hh}$	Consumption of Fixed Capital – households
$P51C^{nfc}$	Consumption of Fixed Capital – non-financial corporations
$P51C^{fc}$	Consumption of Fixed Capital – financial corporations
$P51C^{total}$	Consumption of Fixed Capital – total economy

3 Computing the Effective Tax Rates

In this section we present the formulas employed for the computation of effective tax rates. In particular, we calculate effective tax rates for the factors of production, i.e. labour and capital, consumption, corporate income and social security contributions. We mainly follow the methodology developed in Mendoza et al. (1994), incorporating a number of revisions introduced in Carey and Rabesona (2002). Our approach is closely related to the one followed by Papageorgiou (2012) and more recently by Dellas et al. (2017).

Following the theoretical model developed in Mendoza et al. (1994), each effective tax rate is defined as the ratio of the tax revenues to the associated tax base. The numerator measures the difference between post- and pre-tax valuations of labour and capital income and consumption and is equal to the realized tax revenues from each tax heading. The denominator measures the income derived from labour and capital and consumption at pre-tax valuations and thus corresponds to the tax base. It is approximated using the associated aggregate macroeconomic variables. Thus, the effective tax rates, τ, are given by:

$$\tau = \frac{\text{tax revenues}}{\text{tax base}}$$

In what follows, we use time series listed in Table 1 in order to compute the associated tax revenues and tax bases for each tax category. For clarity, we keep the notation of Eurostat. We start by computing the effective tax rate (ETR) on consumption in section 3.1 and the ETRs on labour and capital income in sections 3.2 and 3.3 respectively. ETRs on corporate income and social security contributions are presented in sections 3.4 and 3.5, while, the combined consumption and labour tax rate is presented in section 3.6.

3.1 Effective Tax Rate on Consumption

In order to compute the ETR on consumption we follow Carey and Rabesona (2002). That is we compute the tax rate in gross terms, i.e. the tax base (the denominator) includes indirect tax revenues.[2] The effective tax rate on consumption, τ^c, is given by:

$$\tau^c = \frac{D2 - D214C - D214F - D29}{P3 + P2}$$

where the numerator is tax revenues from indirect taxation, that is, taxes on production and imports, $D2$, from which we deduct taxes on financial and capital transactions, $D214C$, taxes on winnings from lottery and games, $D214F$ and other taxes on production, $D29$, as these tax headings are mainly capital taxes. The denominator is the pre-tax value of consumption which corresponds to the consumption tax base. Using data from National Accounts, we can define the latter as post-tax consumption expenditures. That is the denominator is equal to the sum of the final consumption expenditure of households, $P3$, and the intermediate consumption of government, $P2$.[3]

3.2 Effective Tax Rate on Labour

A well documented problem related to the computation of effective tax rates on labour and capital income is that tax revenue sources do not provide a breakdown of revenues from personal income tax into its two sources, namely labour and capital income. To address this issue, we follow Mendoza et al. (1994) and compute these effective tax rates in two steps. First, we compute the average tax rate on household income, τ^h, which is defined as the sum of the labour and capital income of households. Second, we apply this common tax rate to the components of households' income to obtain the associated tax revenues. Below, we present the formula for household's average tax rate on total household income, τ^h:

$$\tau^h = \frac{D51A\_C1}{(D1 - D611 - D613) + (BA43G^{hh} - P51C^{hh}) + (D41\_r^{hh} - D41\_p^{hh})}$$

The numerator is total tax revenues from taxes levied on household income, $D51A\_C1$. The denominator is the pre-tax household income, i.e. the sum of the wage and non-wage income of households. The latter is defined as the sum of the entrepreneurial and net interest income

[2] This allows for better comparability with the effective tax rates on labour and capital, as well as for the computation of the combined effective tax rate on labour and consumption. Moreover, this modification is important since the relevant tax burden affecting labour supply decisions includes both labour and consumption taxes.

[3] Mendoza et al. (1994) exclude indirect tax revenues from the tax base. If we exclude indirect taxation from the computation of the consumption tax rate, results indicate that there is a small difference in the level of the tax, however the trend remains the same. We report that the correlation coefficient of the two tax series is 0.99.

of households. Using the National Accounts data, pre-tax household income is equal to the sum of the following components: first, compensation of employees, $D1$, minus the actual social contributions paid by employers, $D611$, and households, $D613$, second, household entrepreneurial income which is approximated by the difference between gross operating surplus and mixed income, $B2A3G^{hh}$, and the consumption of fixed capital of households, $P51C^{hh}$, and, third, the net interest income of housholds, which is equal to the difference between interest income received,$D41\_r^{hh}$, and interest income paid by households, $D41\_p^{hh}$.

Having computed τ^h, we can now define the ETR on labour as the ratio of taxes levied directly on labour income and the share of households' income that is allocated to labour divided by the pre-tax labour income. Following Carey and Rabesona (2002) and Papageorgiou et al. (2012), we assume that social contributions are deducted from the taxable income of households.[4] Moreover, the tax base is equal to the compensation of employees, that is, the sum of wages and salaries of employed labour and social contributions.[5] The ETR on labour income, τ^l, is computed as:

$$\tau^l = \frac{\tau^h(D1 - D611 - D613) + D611 + D613}{D1}$$

where the numerator is tax revenues from labour income, defined as the labour income of households, $(D1-D611-D613)$, taxed at the common personal income tax rate, τ^h, plus social security contributions paid by employers, $D611$, and households, $D613$, respectively. The denominator is equal to the compensation of employees, $D1$.

The effective tax rate on labour income essentially provides an estimate of the average tax burden on labour levied across all income classes. As such, it does not provide any information regarding the shifting of the tax burden and the redistribution that might occur between high- and low-income tax payers (see European Commission (2018)).[6]

3.3 Effective Tax Rate on Capital Income

The effective tax rate on capital income represents the average tax burden imposed on all sources of capital income. In general, it is the most complex of the effective tax indicators both in terms of its calculation and interpretation (see European Commission (2018)). [7]

The ETR on capital is defined as the ratio of tax revenues from capital income, which are equal to the sum of the capital income of households, taxed at the common rate τ^h, and taxes levied on the income and profits of corporations and on capital goods, divided by the pre-tax valuation of capital income. The capital income of households, HCI, stems from two sources, namely, the net operating surplus (i.e. entrepreneurial income) and the net interest income:

[4] When the social security contributions of employees are treated as non deductible this results in an overstatement of the effective tax rate on labour (as a larger proportion of the income of households will be allocated to labour income) – see Carey and Rabesona (2002).

[5] This is in contrast to Mendoza et al. (1994), who use a narrower tax base consisting only of wages and salaries on employed labour

[6] We note that the European Commission utilizes data that are not publicly available and are directly provided by the Member States in order to split the revenues from personal income into its labour and capital components. Essentially, these are confidential tax data on the individual tax payer level for more details see European Commission 2018). As a result, this may imply some differences in the levels of the tax rates computed in this paper and the European Commission's estimates, however, we report that the main figures and trends are almost identical.

[7] This is due to a number of factors including, among others, the existence of time lags in the collection of the relevant revenues (e.g. the ability to defer taxation due to previously incurred losses). Also, capital gains, which constitute a significant percentage of the overall capital income, are not included in the computation of the effective tax rate on capital income due to the fact that they are not part of the production process. This leads to an overestimation of the effective tax levied on capital income.

$$HCI = (B2A3G^{hh} - P51C^{hh}) + (D41r^{hh} - D41p^{hh})$$

where $B2A3G^{hh}$ is the gross operating surplus of households, $P51C^{hh}$ is the consumption of fixed capital of households and $D41r^{hh}$ and $D41p^{hh}$ are the interest income received and paid by households respectively. The effective tax rate on capital income, τ^k, is given by:

$$\tau^k = \frac{(\tau^h * HCI) + CAPT}{B2A3G^{total} - P51C^{total}}$$

where the numerator is tax revenues from capital income, defined as the sum of household's capital income, taxed at the rate τ^h, and tax revenues from capital income of corporations, $CAPT$,[8] while the denominator is the net operating surplus of the total economy, i.e. the difference between the gross operating surplus, $B2A3G^{total}$, and the consumption of fixed capital, $P51C^{total}$, for the total economy.

It should be mentioned that Carey and Rabesona (2002) compute the effective tax rate on capital in gross terms, i.e. they use the gross operating surplus of the total economy as the capital tax base. They state that the calculation of the net operating surplus requires country specific assumptions for the depreciation of capital. These assumptions vary substantially across countries making international comparisons problematic. [9]

3.3.1 Income of the Self-Employed

In our analysis so far, we have assumed as in Mendoza et al. (1994), that the entire income of the self-employed constitutes capital income. However, the self-employed receive both labour and capital income. Since the National Accounts and the Revenue Statistics do not breakdown taxes paid by self-employed into these categories, assigning the overall self-employed income into both categories requires a somewhat arbitrary imputation. Following Carey and Rabesona (2002) and Papageorgiou et al. (2012), we assume that the self-employed 'pay themselves' the same annual salary as that earned by the average employee and then multiply this imputed wage by the number of the self-employed in the economy. The imputed wage income of the self-employed is added to labour tax revenues and subtracted from capital tax revenues. We report that, overall, trends of the ETRs are identical. There are some differences in the levels; e.g. the ETR on labour is on average 2 percentage points lower when the income of the self-employed is accounted for, while the ETR on capital is on average higher by 4 percentage points. Results are available upon request.

3.4 Effective Tax Rate on Corporate Income

The effective tax rate on corporate income, τ^{corp}, is given by:

$$\tau^{corp} = \frac{D51^{fc} + D51^{nfc}}{(B2A3G^{fc} + B2A3G^{nfc}) - (P51C^{fc} + P51C^{nfc})} \quad (1)$$

[8] Following Dellas et al. (2017) CAPT is defined as the sum of taxes on the income and profits of corporations, D51B_C, taxes on financial and capital transactions, D214C, capital taxes, D91, current taxes on capital, D59A, taxes on winnings from lottery and games, D51D, stamp taxes, D214B, and other taxes on production, D29+D29H.

[9] We explore the implications of using a different tax base for the computation of the effective tax rate on capital income. In particular, we use Gross Operating Surplus (GOS) instead of Net Operating Surplus (NOS) as in Carey and Rabesona (2002). We report that the effective tax rate using GOS is smaller compared to the tax rate based on NOS; however these differences exhibit a large degree of variation in our sample. For example, in 15 out of 27 countries ETR on capital income is 10% higher on average when we use NOS as the capital tax base; while in 4 countries this difference is higher than 20%, namely Denmark, 20.3%, Belgium, 21.5%, France, 28.5% and Sweden, 40.8%.

The numerator is equal to the sum of taxes on income paid by financial and non-financial corporations, $D51^{fc}$ and $D51^{nfc}$ respectively. The denominator is the associated tax base, measured by the difference between gross operating surplus and mixed income, $B2A3G$, minus consumption of fixed capital ($P51C$), for financial and non-financial corporations, respectively.

We can further decompose the ETR on corporate income into tax rate levied on the corporate tax rate of non-financial,τ^{corp_nfc}, and the tax rate levied on financial corporations, τ^{corp_fc}:

$$\tau^{corp\_nfc} = \frac{D51^{nfc}}{B2A3G^{nfc} - P51C^{nfc}}$$

$$\tau^{corp\_fc} = \frac{D51^{fc}}{B2A3G^{fc} - P51C^{fc}}$$

3.5 Effective Tax Rate on Actual Social Contributions

Following Martinez-Mongay (2000) and Papageorgiou et al. (2012) we compute the effective tax rate on actual social contributions. This is an indicator of the so called non wage cost which is at the centre of the fiscal and competitiveness debate among EU policymakers. In particular this indicator will measure the wedge between the nominal wage paid by the employer and the actual wage received by the worker, before accounting for personal income taxes. It can be easily calculated as the ratio of total actual social contributions (i.e. actual social contributions by employers and households) over the compensation of employees:

$$\tau^{ssc} = \frac{D611 + D613}{D1}$$

The effective tax rate on actual social contributions can be further decomposed, so that we can obtain a measure of the tax burden on employers and employees. The indicator of the burden that is levied on the income of households can be defined as:

$$\tau^{ssc\_h} = \frac{D613}{D1}$$

while the respective tax rate on employers is defined as:

$$\tau^{ssc\_emp} = \frac{D611}{D1}$$

3.6 Combined Effective Tax Rate on Labour and Consumption

Following Carey and Rabesona (2002) we compute the combined effective tax rate on labour and consumption. This indicator provides a measure of the tax burden levied on net labour income. In particular, assuming that all net labour income is consumed, this ETR is calculated by adding to the ETR on labour income the ETR on consumption, adjusted for the share of net labour income in gross labour income. [10] Formally:

$$\tau^{lc} = \tau^{l} + (1 - \tau^{l}) * \tau^{c}$$

This combined ETR quantifies the effects of the tax burden on the choice between supplying labour or enjoying leisure.

[10] As Carey and Rabesona (2002) point out, this calculation is straightforward, given that workers cannot spend income that has already been taxed.

4 Results

4.1 Cross country comparison

Table 2 presents the 1995-2017 average ETRs on consumption and factors of production, i.e. labour and capital income. Similarly, Table 3 presents ETRs on corporate income, the combined labour/consumption tax burden and social security contribution on employees and employers.

Table 2: Main Effective tax rates

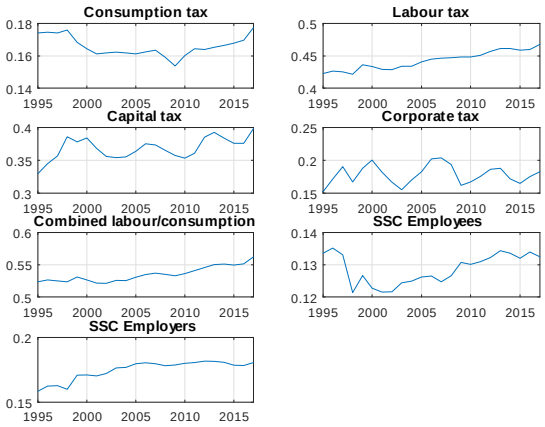
Country	Consumption	Labour	Capital
EU average	0.165	0.443	0.368
Austria	0.180	0.476	0.393
Belgium	0.176	0.298	0.130
Bulgaria	0.188	0.25	0.298
Cyprus	0.166	0.45	0.208
Czech	0.184	0.550	0.409
Denmark	0.260	0.372	0.134
Estonia	0.203	0.372	0.134
Finland	0.216	0.496	0.307
France	0.178	0.463	0.598
Germany	0.164	0.499	0.236
Greece	0.156	0.387	0.217
Hungary	0.250	0.423	0.235
Ireland	0.201	0.360	0.198
Italy	0.162	0.512	0.465
Latvia	0.161	0.335	0.269
Lithuania	0.160	0.358	0.115
Luxembourg	0.260	0.285	0.425
Malta	0.181	0.123	0.231
Netherlands	0.178	0.501	0.258
Poland	0.174	0.405	0.197
Portugal	0.178	0.299	0.288
Romania	0.151	0.325	0.150
Slovakia	0.168	0.423	0.194
Slovenia	0.210	0.375	0.291
Spain	0.136	0.323	0.305
Sweden	0.211	0.492	0.862
UK	0.131	0.351	0.349

Table 3: Other effective tax rates				
Country	Corporate	Labour/Consumption	SSC_H	SSC_EMP
EU average	0.178	0.535	0.129	0.175
Austria	0.142	0.571	0.158	0.160
Belgium	0.164	0.595	0.207	0.118
Bulgaria	0.345	0.430	0.187	0.061
Cyprus	0.220	0.380	0.131	0.071
Czech	0.195	0.551	0.238	0.150
Denmark	0.079	0.668	0.043	0.032
Estonia	0.079	0.499	0.242	0.017
Finland	0.194	0.605	0.198	0.074
France	0.275	0.559	0.220	0.129
Germany	0.135	0.581	0.163	0.201
Greece	0.221	0.482	0.154	0.174
Hungary	0.161	0.567	0.221	0.107
Ireland	0.104	0.489	0.121	0.056
Italy	0.173	0.591	0.259	0.106
Latvia	0.129	0.441	0.166	0.059
Lithuania	0.064	0.461	0.198	0.059
Luxembourg	0.225	0.471	0.060	0.093
Malta	N/A	0.212	N/A	N/A
Netherlands	0.175	0.589	0.157	0.232
Poland	0.263	0.487	0.131	0.207
Portugal	0.252	0.424	0.130	0.080
Romania	0.255	0.401	0.177	0.094
Slovakia	0.273	0.520	0.226	0.151
Slovenia	0.416	0.507	0.120	0.174
Spain	0.209	0.396	0.148	0.062
Sweden	0.187	0.600	0.153	0.020
UK	0.196	0.436	0.134	0.074

Note: For Malta there is no data availability.

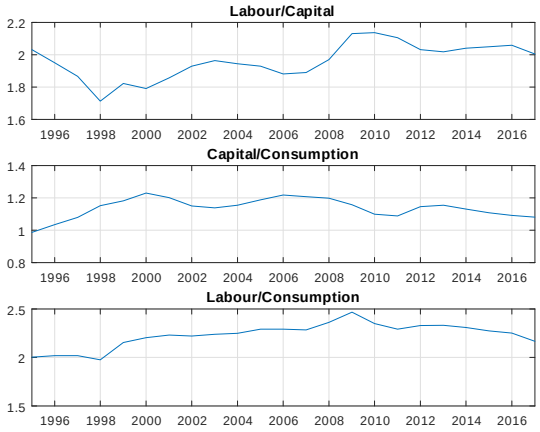
Figure 1 presents the effective tax rate for the European Union from 1995 to 2017. In particular, the effective tax rates of the EU are the arithmetic mean of the national effective tax rates of all the countries in our sample.

Figure 1: Effective tax rates in the European Union over 1995-2017



Finally, Figure 2 computes the relative effective tax rates which can be thought as a measure of the relative tax burden levied on the alternative tax revenue sources.

Figure 2: Tax burden in the European Union over 1995-2017



References

[1] Carey, D. and Rabesona, J. (2002). 'Tax ratios on labour and capital income and on consumption', OECD Economic Studies No. 35

[2] Carey, D. and Tchilinguirian, H. (2000). 'Average effective tax rates on capital, labour and consumption', OECD Economic Department Working Papers No. 258.

[3] Dellas, H., Malliaropoulos, D., Papageorgiou D. and Vourvachaki, E. (2017). 'Fiscal policy with an informal sector', Bank of Greece Working Paper Series No. 235.

[4] European Commission (1998-2006). 'Structures of the taxation systems in the European Union', Directorate General for Taxation and Customs Union.

[5] European Commission (2007-2019). 'Taxation trends in the European Union', Directorate General for Taxation and Customs Union.

[6] Martinez-Mongay, C. (2000). 'ECFIN's effective tax rates. Properties and comparisons with other tax indicators", Economic Paper No. 146, European Commission, Directorate for Economic and Financial Affairs

[7] McDaniel, C. (2007), "Average tax rates on consumption, investment, labor and capital in the OECD 1950-2003", Working Paper.

[8] Mendoza, E.G., Razin, A. and Tesar, L.T. (1994). 'Effective tax rates in Macroeconomics. Cross-country estimates of tax rates on factor incomes and consumption', Journal of Monetary Economics, 34

[9] Papageorgiou, D., Efthimiadis, T. and Konstantakopoulou, I. (2012). 'Effective tax rates in Greece', Centre for Planning and Economic Research Discussion Papers no. 124

[10] Uhlig, H. and Trabandt, M. (2011). 'The Laffer Curve revisited', Journal of Monetary Economics, 58(4) pp 305–327