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Sokolovskyi, Dmytro

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Introduction

The article is directed toward an investigation of principles of government economic behavior. More precisely, her object of research is the use of the tax burden to regulate the economy. As is known ones of the main functions of taxes are fiscal function, when the government collects taxes in order to fulfill the budget for providing its own economic and social policy, and also regulatory function, consisting in the adjustment of the state's economic policy and of appropriate economic relations.

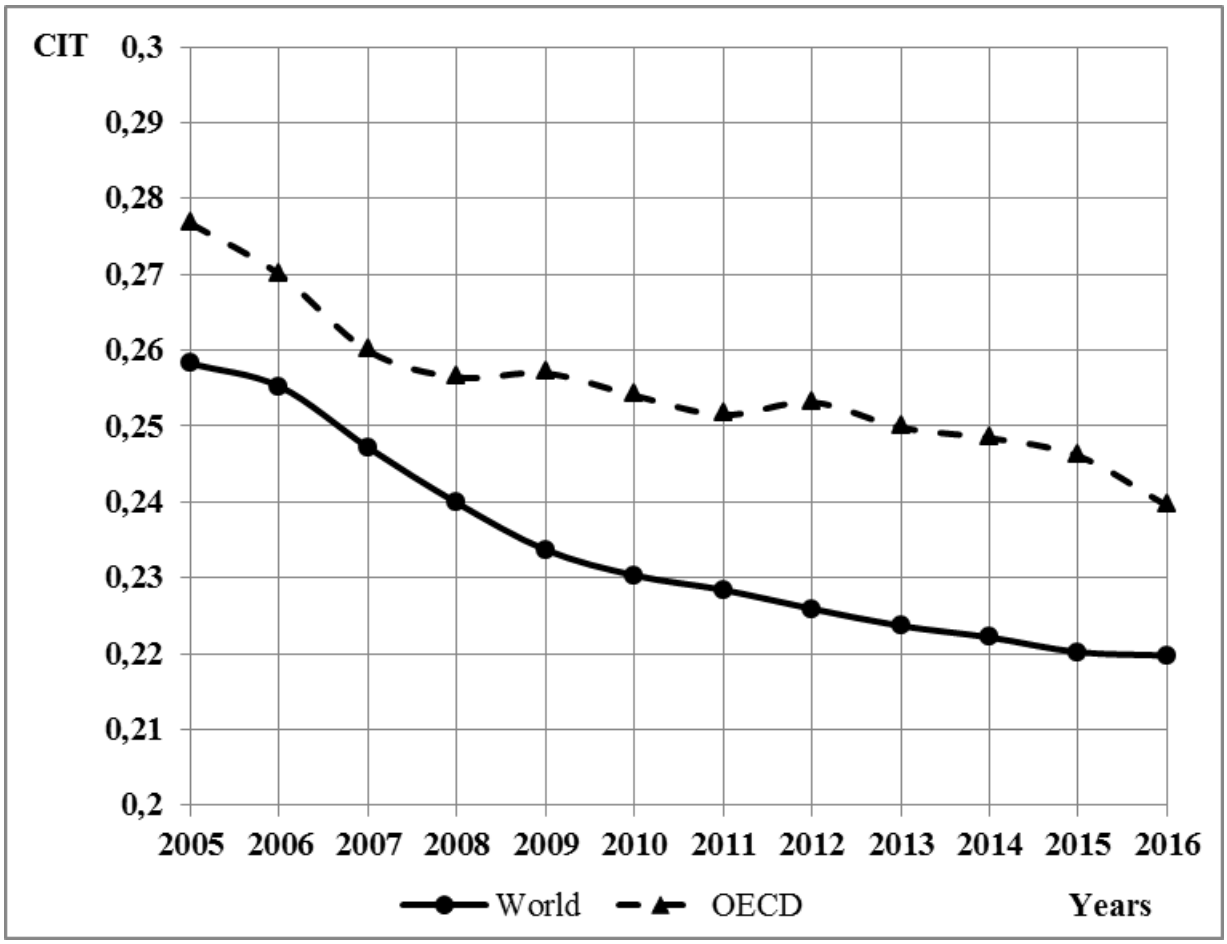
The research of tax behaviour of governments cover in fiscal direction the problems of budgeting, issues of optimal taxation rate for maximizing of budget revenue (see e.g. Mirrlees, 1971, Atkinson and Stiglitz, 1972, Aiyagari et al, 2002). On the other hand, in the area of economy's regulation research of tax behaviour is a key tool for clarification the mechanism of functioning of incentives for economic development of the country. Usually, by increasing taxes the government, *ceteris paribus*, aims to raise budget revenue. Reducing the tax burden it induces the additional investment inflow caused by improvement of economic environment. Under this fiscal aspect the government faces the contradiction between the need to fulfill budget and to improve the economic climate by means of adjustment of the tax burden.

So, a government has three alternative variants of tax behaviour, namely, to reduce the tax rate in order to improve economic conditions and to attract new investors; to increase the tax rate as a way to raise budget revenue; or to fix the tax rate, i.e. refuse to use this tax instrument at all.

The generally recent trend is decreasing of CIT rate. The analysis of CIT rate for 113 countries for which statistics are available from 2005 till 2016 (Corporate tax

rates table, 2017) shows as for this time horizon the average CIT rate reduced by 3,84%: from 25,82% to 21,98% (for OECD countries even more – by 4,72%: from 27,67% till 23,95%) (Fig. 1).

Fig. 1. CIT change in world and OECD countries from 2005 till 2016 years



It shows that governments use not only the financial component, but also the regulator when choosing their tax decisions. Certainly there are many factors influencing the choice of governments, but can assume in generally government tax behavior is based on analysis of macro-economic's indicators. It is a main hypothesis of this research. Therefore the purpose of research is check dependence of government tax behaviour on selected indicators.

Literature review

The theme financial behaviour, in particular, tax behaviour was taken up by (O. Weber, J. Fooken, B. Herrmann), (A. Krishna, J. Slemrod), (A. Laffer, W. Winegarden, J. Childs), who specifically investigated the issue of tax regulation to optimize the economic activity of agents.

The government tax behavior

The large part of research focused on the patterns of government tax behavior in different economic conditions.

Mirrlees et al. (2011) in the final report from the Mirrlees Review "Tax by design" developed some important patterns of the government's tax behavior, notably, they underlined the central role of redistribution in the tax and benefit system and the importance of maintaining neutrality.

Weber et al. (2014) investigated the government behavior and taxation. They found that behavioral economic factors can significantly influence tax compliance, and if well applied, usually cause an increase in compliance; these behavioral factors affect decision-making in ways that are important for making good tax policy.

Another set of papers studies the aspects of government behavior influenced by different institutional factors. Thus, Krishna & Slemrod (2003) analyzed the tax behavior of the government aiming to minimize the perceived burden addressing particularly to the ethical and normative implications of price presentation in the tax system. Avi-Yonah (2011) found general conditions under which taxation as regulation makes sense: it should apply to small numbers of taxpayers; the taxpayers are sophisticated and able to deal with complex tax incentive and the regulatory goal is clear and related to the level of the tax.

Leicester et al. (2012) analyzed behavioral aspects of government's tax and benefit policy intervention taking into account such behavioral insights like bounded rationality, framing, time inconsistency, social preferences etc.

The administrative techniques and institutions for the management of tax complexity were investigated by Freedman (2015). She concluded that institutions can also improve tax systems and sometimes reduce complexity, but this simplification will only be achieved if the institutions are conceptually coherent with clear tax policy objectives.

Pecorino (1995) investigated tax rates and tax revenues in a model of growth through human capital accumulation. The relationship between tax rates and the present value of tax collections is analyzed in an endogenous growth setting. In such a model, income taxation may reduce the size of the tax base in current and future periods through both labor supply and growth rate effects.

Laffer et al. (2011) estimated the economic burden caused by complexity of the Tax Code. They outlined that the potential benefits to economic growth could be from a reduction in tax complexity. Under establishment of the low rate flat tax on a broad tax base the inefficiencies caused by tax code complexity, notably, administrative costs, time costs, and compliance costs would be substantially reduced. As a result, overall economic efficiency would increase, as well as the growth in income and wealth.

Analysis of mutual influence of CIT and FDI

Romer, C. D. and Romer, D. H., (2010) investigated the impact of tax changes on economic activity. Authors identified the size, timing, and principal motivation for all major postwar tax policy actions. It allows us to separate legislated changes into those taken for reasons related to prospective economic conditions and those taken for more exogenous reasons.

Schraztenstaller, Wagener and Kohler-Toglhofer (2005), Feld and Heckemeyer (2008) etc. confirm the negative relation between corporate taxation and foreign direct investment (FDI), i.e. that lower taxation rate represents stimulate the inflow of FDI and conversely.

Becker (2009) confirm the corporate taxation increase results in a decrease of tax revenues because the lower inflow of FDI into the economy. However, this statement does not always correspond to practical research. Fuller pattern on the issue

is given by the model (Chalk, 2001) that analyze classical graphical model of conditions of increasing the tax revenue due to the reduction of the tax burden. This analytical model of the optimal tax burden is rather abstract; it is could be used in arbitrary economic system.

Other models of fiscal (notably tax) behavior and the impact of tax changes on the state of the economy were considered, in particular, in the works of Wanniski, 1978, Judd, 1985, Chamley, 1986, Laffer, 2004, Trabandt and Uhlig, 2011, Werning, 2007).

Tax behaviour in EU and OECD countreis

Afonso and Hauptmeier (2003) analyzed the determinants of government's fiscal behaviour in EU countries. Their results show that the existence of effective fiscal rules, the degree of public spending decentralization, and the electoral cycle can impinge on the country's fiscal position.

Joumard and Kongsrud (2003) studied the government economic and fiscal behavior in the process of decentralization in OECD countries. They analyzed the spending side, the revenue side and the macroeconomic perspective of fiscal relations across government levels. The authors developed a set of parameters (size of jurisdictions, overlapping responsibilities, social transfers and redistributive goods, tax competition, fiscal rules and market discipline etc.) in order to assess fiscal relations across different levels of government.

Another cross-country analysis was made by Bessard (2009), who calculated the tax oppression index (including the weight of the tax burden, the legitimacy of the tax system and the protection of financial privacy) for 30 OECD countries in order to evaluate the OECD's fight against harmful tax competition and "tax havens". He showed that the only ones to gain from this fight are unreformed high-tax states, to the detriment of their residents and their prosperity.

Macek (2014) evaluated the impact of taxes on the economic growth OECD countries by the regression analysis, based on the model (Mankiw, Romer and Weil, 1992).

In summary, we can conclude that current studies mainly investigate the government tax behaviour (policy) from the standpoint of expediency of certain regulatory and adjustment measures. Any government considers its own economy as perfect or its own tax system as optimal. But at the same time by no means all of them use the proposed instruments in order to improve the situation.

The studies of the causes of this fact, which we evaluate as important, are not sufficiently covered in the existing literature. Notably, we consider the insufficiently exhaustive and clear answer about government's tax behaviour when it chooses the direction of change of the tax burden in certain economic conditions.

Consequently the purpose of this paper is to determine factors and conditions, which influence on government's decision related to the choice of certain type of tax behaviour. This allowed us to set the following tasks:

- ✓ to define a set of potential indicators, based on which the government makes a decision concerning certain economic (tax) behaviour;
- ✓ to identify if such a dependence in fact exists;
- ✓ to analyze which indicators influence more over the government's economic behaviour;
- ✓ to define principles (nature) of the government response, i.e. under what conditions the government intend to increase the tax burden, to reduce it or to keep it at the same level;
- ✓ to define the character of government behaviour.

Data and methodology

In the article we analyze the economic behaviour of OECD governments, which for the purposes of study can be regarded as adjustment of the corporate tax burden. It should be noted that in some countries, like Germany, the CIT rates, established by local authorities, differ by region. In this case we used a weight-average tax burden, adjusted by some central government.

Now the task is to examine the possible impact of the actual economic efficiency of the country on government's economic behaviour (i.e. on the changes of tax rates). GDP is the generally accepted indicator of power of the economy in the context of the world economic system while GDP per capita could be considered as indicator of the wealth of the economy.

The selection and rationale of indicators

Governments resolve on change of CIT rate, i.e. we have tax behavior.

However because it is the behaviour of governments, that is, organizations, we do not consider the majority of indicators used by different theories of economic behavior.

The government uses macroeconomic indicators, therefore, the task arises to check,

firstly, whether are government decisions independent of these indicators?

second, if they are dependent of those indicators whether government behaviour is rational or not?

It is generally admitted that Gross domestic product (GDP) calculated in one way or another is the best matched characteristic of the country economic power. As distinct from the power of the country's economy, its wealth is determined by GDP, normalized to country population – GDP per capita.

On the other hand, as already noted above, decrease of CIT rate is an instrument of improve the investment climate. Therefore is advisable to consider the eventual influence of the value FDI (nominal, per capita, & per GDP) to change of CIT rate.

Sometimes it can find the name “investment attractiveness”, but then it is should talk about her absolute value, and for the normalized investment attractiveness should use derived indicator: ratio of FDI to GDP. In order to simplify the terminology for the last indicator we use the term “attractiveness of investment climate”.

In a priori, we do not reject any of the above indicators for evaluate the efficiency (power, wealth) of economy. Further in order to evaluate the efficiency of economy (in terms of power and wealth) we provide the formal estimation of the correlation between the changes of CIT rates and each of the selected indicators.

Rationale for sample

We chose the OECD countries for the analysis according to the following considerations. The more powerful are the economies, the less they are influenced by different externalities, and, consequently, their behaviour can be explained principally by internal factors and parameters of the economic system. Therefore, OECD countries, among which there are the most developed countries of the world, are the most representative for the analysis and estimation of the correlation between economic indicators of country and government’s behaviour.

In addition to the above, the use in the sample the institutionally established group of countries increases the representativeness of the input data. Moreover, the available data for OECD countries is sufficiently complete and calibrated and the sample itself is sufficiently large: for example, more than 25% of all countries with available data on above indicators are OECD countries.

The analysis of governments’ behaviour related to adjustment of the corporate tax burden in OECD countries

In order to determine principles of the government’s behaviour we investigate the correlation between changes of CIT rates and five selected indicators, which could be considered as characteristics of country’s generalized economic efficiency:

- ✓ GDP,
- ✓ FDI,

- ✓ GDP per capita,
- ✓ FDI per capita,
- ✓ FDI/GDP.

We explore the data for 12 years (2005-2016) for 34 OECD member countries, because there are no reliable data for CIT rate for previous years.

The CIT rate change is calculated as the difference between the last and first indicator values.

Methodology

The basic element of the analysis is the eventual tax rate change by governments of OECD countries. Three options of government's reaction to the state of macroeconomic indicators are investigated: increase CIT tax rate, decrease CIT tax rate and CIT tax rate invariance. Obviously, these three options are exhaustive.

The difficulty creates a small size sample (34 countries) that can may cause a random or artificial statistical correlation. The method of preventing this was as follows:

- ✓ for each of 5 macroeconomic indicators and for each of 3 trends tax behaviour a distributions matrix is formed for any possibly pairs *(i, j)*, where *i* and *j* – first and last elements of the sample: $X_k\left(i=1:N,\ j=1:N\right)$
- ✓ where $x_k(i, j)$ – [non-]confirmation of the hypothesis about a certain type of dependence of change of CIT tax rates from the indicator *k* for the sample from *j* till *i* country (for convenience we will denote the confirmation of the dependence hypothesis by $x_k(i, j)=1$; non-confirmation – by $x_k(i, j)=0$);
- ✓ $k=1, 2, ..., 5$ – number of indicator from the set {GDP, FDI, GDP per capita, FDI per capita, FDI/GDP};
- ✓ $N=34$ – number of OECD countries;
- ✓ the indicators values in every case are ascending sort.

It allow to track not only single values but also areas for which there is a dependence of the tax behavior from a particular indicator. The presence of such areas increases the probability of the conclusion of the dependence. By combination

of for 3 tax rate change trends for each indicator possible to conclude about valid availability or absence of government tax behaviour, that dependence from this indicator.

Such method of analysis we will designate as integral testing of hypothesis of independence of government tax behaviour from macroeconomic indicators.

For confirmation or rejection of the independence hypothesis we use binomial asymptotic confidence interval for the mean. Binomial distribution взято (вибрано), because

- ✓ analyzed events – the change annual tax rates by countries – for each of 3 investigated cases are discrete: the event (tax rate increase, tax rate decrease or invariance of tax rate) occurs or no;
- ✓ it is assumed, the government of each country makes decision regardless of the governments of other countries. We assume, governments of countries from different indicator's values use different strategies, but the each government uses a certain strategy. Therefore it is desirable, that samples of countries, for which is observed increase, decrease and invariance trends change of CIT tax rates, do not intersected and in aggregate covered the whole set of countries that is their intersection was equal to $\varnothing$ and union was equal to *{1:N}*.

A dependence estimate government tax behaviour is determined on the на basis of whether it get *m* (the actual number of elements of sample for which is confirmed trend) in confidence limits:

$$\left(\bar{m} - t_\alpha \sqrt{\frac{\bar{m}\left(n-\bar{m}\right)}{n}};\ \bar{m} + t_\alpha \sqrt{\frac{\bar{m}\left(n-\bar{m}\right)}{n}} \right)$$

or no. I.e. for our task $\forall k = 1,2,\ldots 5$ and all pairs $\left(i,j\right),\ i = 1,2,\ldots N,\ j = 1,2,\ldots N,\ i \le j$ we analyze the trueness of expression:

$$m_{kij} \in \left(\bar{m}_k - t_\alpha \sqrt{\frac{\bar{m}_k\left(n_{kij}-\bar{m}_k\right)}{n_{kij}}};\ \bar{m}_k + t_\alpha \sqrt{\frac{\bar{m}_k\left(n_{kij}-\bar{m}_k\right)}{n_{kij}}} \right),$$

where

$$n_{kij} = j - i + 1;$$

$$m_{kij} = \sum_{l=i}^{j} x_{kl};$$

$$\bar{m}_k = \sum_{l=1}^{N} x_{kl}.$$

If so, the deviation of the actual number of sample elements confirming the trend does not go beyond the statistical error;

otherwise, there is likely dependence of indicator from sample parameters, that is government tax behaviour of countries, that got to the sample, differs from average over all OECD countries.

The obtained results are presented in the Tables 1, 2.

Table 1. CIT rates in OECD countries, 2005-2016 yr.

Country	2005 yr	2016 yr	Changes of CIT rates, (2016 – 2005), yr
Australia	0,3	0,3	0
Austria	0,25	0,25	0
Belgium	0,3399	0,3399	0
Canada	0,361	0,265	–0,096
Chile	0,17	0,255	0,085
Czech Republic	0,24	0,19	–0,05
Denmark	0,28	0,22	–0,06
Estonia	0,23	0,2	–0,03
Finland	0,26	0,2	–0,06
France	0,3333	0,3333	0
Germany	0,3834	0,2979	–0,0855
Greece	0,29	0,29	0
Hungary	0,16	0,09	–0,07
Iceland	0,18	0,2	0,02
Ireland	0,125	0,125	0
Israel	0,31	0,24	–0,07
Italy	0,3725	0,24	–0,1325
Japan	0,4069	0,3086	–0,0983
Korea, Rep.	0,275	0,22	–0,055
Luxembourg	0,2963	0,2708	–0,0255
Mexico	0,29	0,3	0,01
Netherlands	0,296	0,25	–0,046
New Zealand	0,33	0,28	–0,05
Norway	0,28	0,24	–0,04
Poland	0,19	0,19	0
Portugal	0,275	0,21	–0,065
Slovak Republic	0,19	0,21	0,02
Slovenia	0,25	0,19	–0,06
Spain	0,35	0,25	–0,1
Sweden	0,28	0,22	–0,06
Switzerland	0,213	0,1777	–0,0353
Turkey	0,2	0,2	0
United Kingdom	0,3	0,19	–0,11
United States	0,4	0,4	0

Source: (Corporate tax rates table, 2017); authors' calculations

Table 2. Based macro-economic factors in OECD countries, 2016 yr., $bn

Country	GDP	FDI	GDP per capita	FDI per capita	FDI/GDP
Australia	1339,1	38,639	56311	1625	0,029
Austria	377,0	4,302	43775	500	0,011
Belgium	455,1	–20,797	40324	–1843	–0,046
Canada	1550,5	55,685	43249	1553	0,036
Chile	240,8	20,457	13416	1140	0,085
Czech Republic	185,2	2,479	17548	235	0,013
Denmark	295,1	1,671	51989	294	0,006
Estonia	22,5	–0,652	17119	–497	–0,029
Finland	231,9	17,023	42311	3105	0,073
France	2418,8	34,969	36206	523	0,014
Germany	3363,4	46,227	41313	568	0,014
Greece	194,9	1,141	18002	105	0,006
Hungary	121,7	–2,624	12364	–267	–0,022
Iceland	16,6	1,039	50173	3141	0,063
Ireland	283,7	203,463	61134	43843	0,717
Israel	299,4	11,510	35728	1373	0,038
Japan	4123,3	–0,042	32477	0	0,000
Korea	1377,9	5,042	27222	100	0,004
Luxembourg	57,8	24,596	101450	43175	0,426
Mexico	1143,8	32,056	9005	252	0,028
Netherlands	750,3	101,789	44300	6010	0,136
New Zealand	173,8	–0,135	37808	–29	–0,001
Norway	386,6	–4,513	74400	–869	–0,012
Poland	477,1	14,067	12555	370	0,029
Portugal	198,9	0,633	19222	61	0,003
Slovak Republic	87,3	1,151	16088	212	0,013
Slovenia	42,8	1,680	20727	814	0,039
Spain	1199,1	25,299	25832	545	0,021
Sweden	495,6	16,682	50580	1702	0,034
Switzerland	670,8	119,714	80945	14446	0,178
Turkey	717,9	16,957	9126	216	0,024
United Kingdom	2858,0	50,439	43876	774	0,018
United States	18036,6	379,434	56116	1180	0,021

Source: (World Development Indicators, 2017); authors' calculations

Results

The available statistics were considered regarding to the above trends. I.e. we divided OECD countries and their data into three groups:

1) countries which reduced the corporate tax burden during 2005-2016,
2) countries which increased the corporate tax burden, and
3) countries having a CIT rate in 2016 equal to the level of 2005.

In addition, all countries were arranged by each of five indicators.

The obtained results are presented in the Tables 3-7.

The indicators GDP, FDI, GDP per capita, FDI per capita, FDI/GDP in tables 3-7 are ranked in ascending order.

Table 3. Ratios of the GDP indicators to the change of CIT rates in OECD countries (in the order of increasing of GDP), $bn

GDP, 2016 yr.	Change of CIT rate (2016 – 2005, yrs.)	GDP, 2016 yr.	Change of CIT rate (2016 – 2005, yrs.)
20,047	0,02	467,956	0
23,338	–0,03	471,364	0
44,709	–0,06	514,460	–0,06
58,631	–0,0255	668,851	–0,0353
89,769	0,02	777,228	–0,046
125,817	–0,07	863,712	0
184,969	–0,05	1046,923	0,01
192,691	0	1204,616	0
195,305	–0,05	1237,255	–0,1
204,837	–0,065	1411,246	–0,055
238,503	–0,06	1529,760	–0,096
247,028	0,085	1858,913	–0,1325
304,819	0	2465,454	0
306,900	–0,06	2647,899	–0,11
317,745	–0,07	3477,796	–0,0855
371,076	–0,04	4940,159	–0,0983
390,800	0	18624,475	0

Source: authors' calculations

Table 4. Ratios of the GDP per capita indicators to the change of CIT rates in OECD countries (in the order of increasing of GDP per capita), $

GDP per capita, 2016 yr.	Change of CIT rate (2016 – 2005, yrs.)	GDP per capita, 2016 yr.	Change of CIT rate (2016 – 2005, yrs.)
8208,556	0,01	39416,359	–0,05
10862,600	0	40341,408	–0,11
12421,319	0	41236,267	0
12814,950	–0,07	42069,598	–0,0855
13792,926	0,085	42157,928	–0,096
16535,917	0,02	43402,863	–0,06
17727,493	–0,03	44676,346	0
17930,164	0	45669,815	–0,046
18491,940	–0,05	49927,820	0
19839,643	–0,065	51949,271	–0,06
21652,278	–0,06	53549,701	–0,06
26639,741	–0,1	57638,159	0
27538,806	–0,055	59976,943	0,02
30674,836	–0,1325	63861,922	0
36854,968	0	70911,757	–0,04
37175,742	–0,07	79890,524	–0,0353
38900,569	–0,0983	100573,140	–0,0255

Source: authors' calculations

Table 5. Ratios of the FDI indicators to the change of CIT rates in OECD countries (in the order of increasing of FDI), $bn

FDI, 2016 yr	Change of CIT rate (2016 – 2005, yrs.)	FDI, 2016 yr	Change of CIT rate (2016 – 2005, yrs.)
–29,948	0	15,332	–0,06
–17,717	–0,0353	16,758	0
–16,428	–0,04	18,352	–0,1325
–9,537	–0,06	26,857	–0,0255
–1,183	0,02	32,106	–0,096
0,742	–0,03	32,117	–0,1
1,462	–0,06	33,930	0,01
1,935	–0,05	34,905	–0,0983
3,061	0	35,408	0
3,548	0,02	37,013	0
6,407	–0,06	42,049	0
6,497	–0,05	52,474	–0,0855
9,214	–0,065	68,715	–0,07
10,827	–0,055	79,163	0
11,903	–0,07	153,975	–0,046
12,225	0,085	292,993	–0,11
12,307	0	479,415	0

Source: authors' calculations

Table 6. Ratios of the FDI per capita indicators to the change of CIT rates in OECD countries (in the order of increasing of FDI per capita), $

FDI per capita, 2016 yr.	Change of CIT rate (2016 – 2005, yrs.)	FDI per capita, 2016 yr.	Change of CIT rate (2016 – 2005, yrs.)
–3538,252	0,02	653,650	0,02
–3423,710	0	682,613	0,085
–3139,329	–0,04	691,511	–0,1
–2116,208	–0,0353	707,867	–0,06
–1735,638	–0,06	884,803	–0,096
154,781	0	892,445	–0,065
211,268	–0,055	1117,957	–0,06
266,035	0,01	1392,589	–0,07
274,852	–0,0983	1483,671	0
284,811	0	1548,161	–0,06
302,836	–0,1325	1742,824	0
412,319	–0,05	3261,606	0
441,604	0	4463,826	–0,11
529,295	0	6998,867	–0,07
563,336	–0,03	9047,557	–0,046
615,184	–0,05	16585,330	0
634,761	–0,0855	46069,738	–0,0255

Source: authors' calculations

Table. 7. Ratios of the FDI/GDP indicators to the change of CIT rates in OECD countries (in the order of increasing of FDI/GDP)

FDI/GDP, 2016 yr.	Change of CIT rate (2016 – 2005, yrs.)	FDI/GDP, 2016 yr.	Change of CIT rate (2016 – 2005, yrs.)
–0,0766	0	0,0298	–0,06
–0,0590	0,02	0,0318	–0,03
–0,0443	–0,04	0,0324	0,01
–0,0400	–0,06	0,0327	–0,06
–0,0265	–0,0353	0,0333	–0,05
0,0071	–0,0983	0,0349	0
0,0077	–0,055	0,0356	0
0,0099	–0,1325	0,0375	–0,07
0,0105	–0,05	0,0395	0,02
0,0142	0	0,0450	–0,065
0,0144	0	0,0495	0,085
0,0151	–0,0855	0,0791	0
0,0159	0	0,1107	–0,11
0,0209	–0,06	0,1981	–0,046
0,0210	–0,096	0,2597	0
0,0257	0	0,4581	–0,0255
0,0260	–0,1	0,5461	–0,07

Source: authors' calculations

From the Tables 3-7 it can be seen that 21 OECD countries have reduced the CIT rates (the 1st group), 9 countries did not make any changes (2nd group) and 4 countries have increased the rates (the 3rd group). For each of these groups we statistically tested the hypotheses about independence of selected efficiency indicators and the CIT rate. The essence of testing was as follows.

There were checked all possible combinations 3 above behavioural types and 3 OECD countries groups with different values of efficiency indicators: countries with high, middle (intermediate) and low efficiency.

We divided OECD countries into three groups according to values of their efficiency indicators: countries with high, middle (intermediate) and low efficiency.

In order to confirm assumption about the relationship between the trend of the change of the CIT rate and certain efficiency indicator, the number of economies in the corresponding groups should be in the 95% confidence interval.

The obtained results are presented in Table 8.

Table 8. The results of statistical hypothesis test of independence changes the CIT rate on indicators efficiency of economics

Indicator	**number of countries in the sample meeting the criteria**	**C.I. (95%)**
The tax change	**increase**	
Number of countries meeting the criteria: 4 of 34		
low GDP	2 of 7	[0,28; 1,37]
low FDI	2 of 10	[0,56; 1,79]
low GDP per capita	3 of 8	[0,37; 1,51]
low FDI per capita	2 of 8	[0,37; 1,51]
high FDI/GDP	2 of 10	[0,56; 1,79]
The tax change	**invariance**	
Number of countries meeting the criteria: 9 of 34		
middle GDP	6 of 16	[2,73; 3,85]
high FDI	5 of 9	[1,05; 3,72]
high GDP per capita	4 of 9	[1,05; 3,72]
high FDI per capita	4 of 9	[1,05; 3,72]
middle FDI/GDP	6 of 15	[2,57; 5,47]
The tax change	**decrease**	
Number of countries meeting the criteria: 21 of 34		
high GDP	7 of 11	[3,49; 10,10]
middle FDI	11 of 15	[5,76; 12,77]
middle GDP per capita	14 of 15	[5,76; 12,77]
middle FDI per capita	12 of 17	[6,97; 14,03]
low FDI/GDP	7 of 9	[2,45; 8,67]

Source: authors' calculations

Thus from the table 8 it can be seen that for all OECD countries the vast majority of hypotheses for independence between the trend of changes of the CIT tax rates and values of efficiency indicators (11 of 15, 73,3%) are rejected with 0,95 probability. This shows that there is the mutual interaction between changes of the corporate tax burden and economic efficiency of countries according to all measurement methods. The obtained conclusion provides an answer to one of the tasks of our study which concerns the implicit dependence between government's tax behaviour and each of five indicators of the economic efficiency for OECD countries.

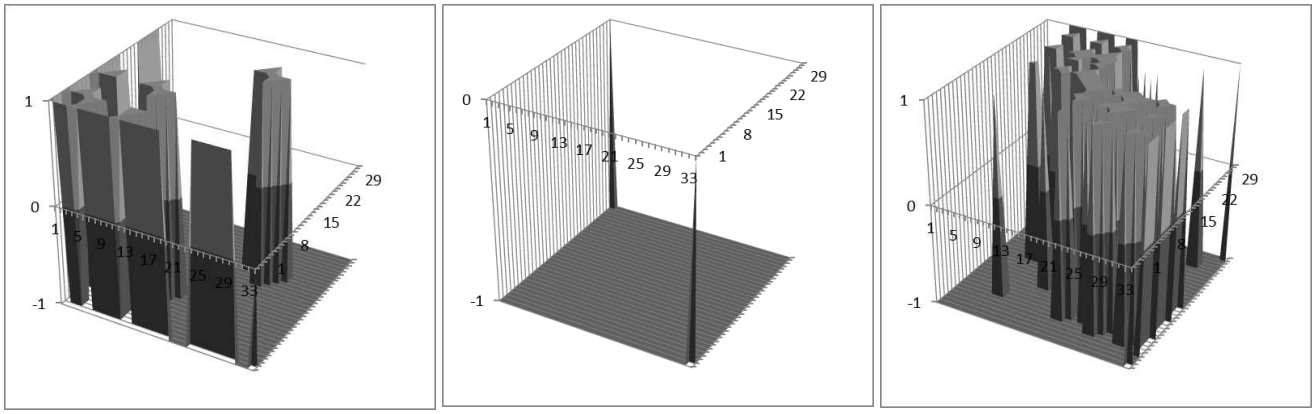
Moreover the above assumption that the government tax behaviour could be characterized as satisfier's behavior is confirmed. Besides can assume that not only tax behaviour could be considered as satisfying but also any other economic behaviour of the government.

Graphically, hypothesis testing for 3 possibly trends for each of 5 macroeconomic indicators is showed on fig. 2-6, where a "peaks" on graphs below are indicate non-confirmation of the hypothesis about a certain type of independence of change of CIT tax rates (tax rate increase, tax rate decrease and tax rate invariance) from the certain indicator (GDP, FDI, GDP per capita, FDI per capita and FDI per GDP) for the sample defined by the coordinates on the graph.

It could see that tax rate increase trends and tax rate invariance trends have enough large areas of confirmation of dependence of government tax behaviour on the value of the certain indicator for all 5 indicators. At once the tax rate decrease trend responds with a probability of 95% only to GDP per capita.

Fig. 3a, b, c shows the above areas of confirmation of dependence government tax behaviour on GDP per capita. It is be seen that the propensity for tax rate increase is typical of countries with least or biggest GDP per capita; the propensity for tax rate invariance is typical of countries with biggest GDP per capita; propensity for tax rate decrease is typical of countries with middle GDP per capita.

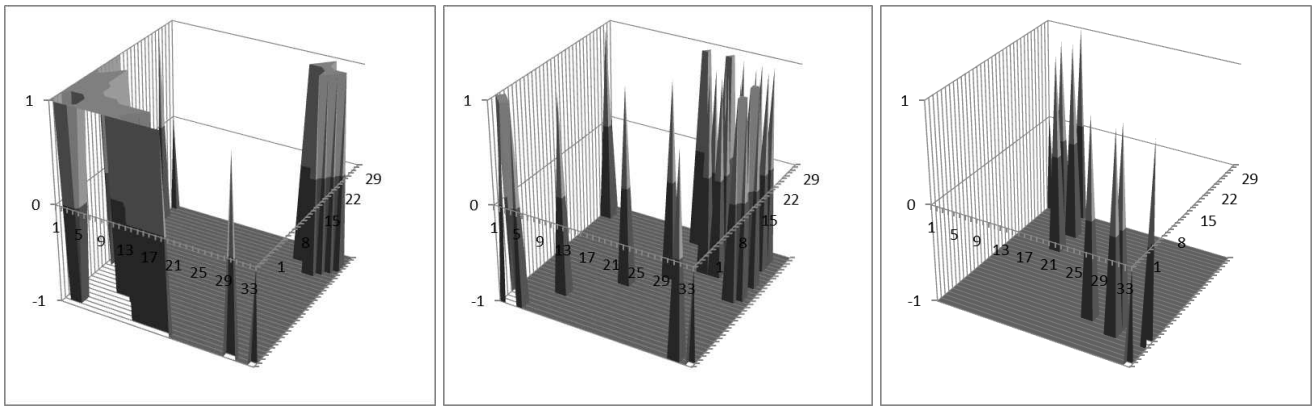
Fig. 2. Results of integral testing of hypothesis of independence of government tax behaviour from GDP



a) tax rate increase b) tax rate decrease c) tax rate invariance

axis of abscissas – first elements of the sample;
axis of ordinates – last elements of the sample;
axis of applicates*:* –1 – confirmation of the independence hypothesis;
1 – non-confirmation of the independence hypothesis

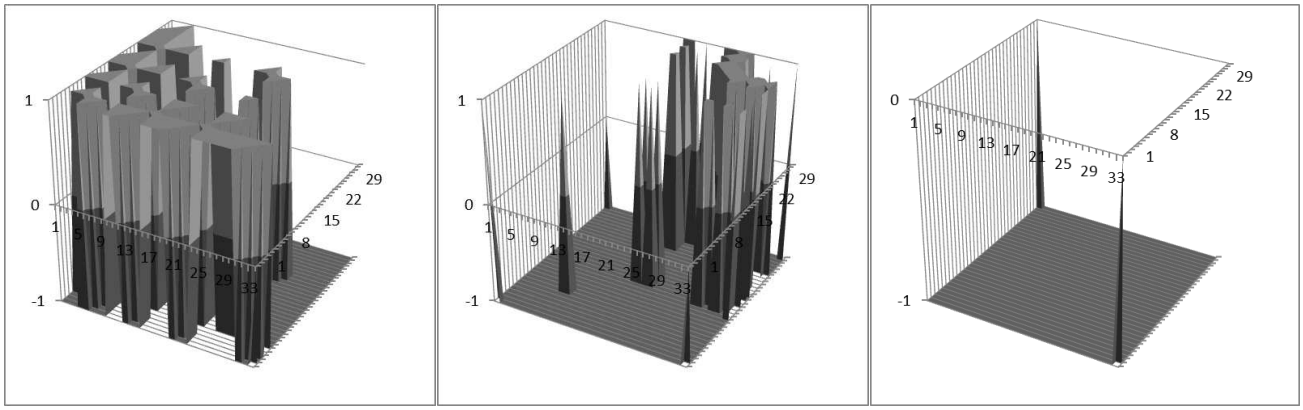
Fig. 3. Results of integral testing of hypothesis of independence of government tax behaviour from GDP per capita



a) tax rate increase b) tax rate decrease c) tax rate invariance

axis of abscissas – first elements of the sample;
axis of ordinates – last elements of the sample;
axis of applicates*:* –1 – confirmation of the independence hypothesis;
1 – non-confirmation of the independence hypothesis

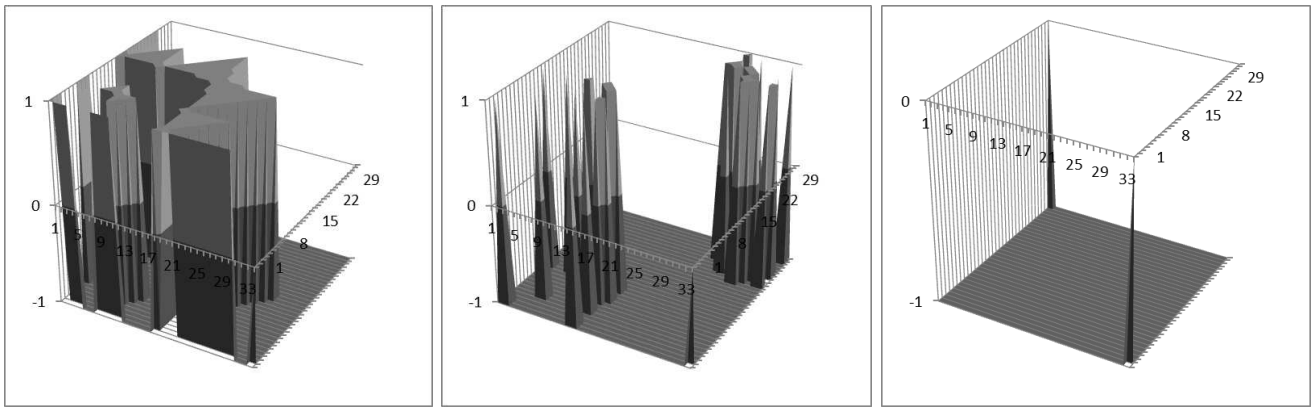
Fig. 4. Results of integral testing of hypothesis of independence of government tax behaviour from FDI



a) tax rate increase b) tax rate decrease c) tax rate invariance

axis of abscissas – first elements of the sample;
axis of ordinates – last elements of the sample;
axis of applicates*:* –1 – confirmation of the independence hypothesis;
1 – non-confirmation of the independence hypothesis

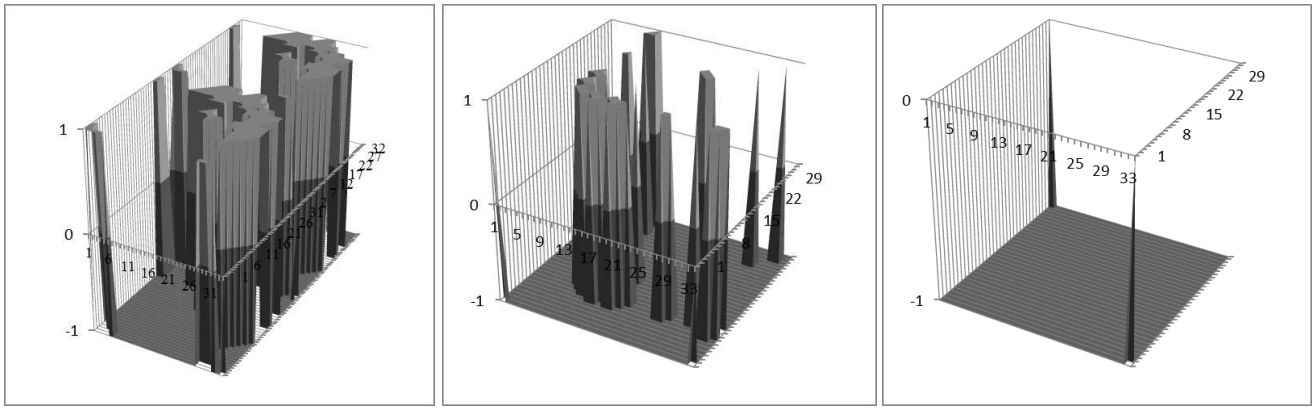
Fig. 5. Results of integral testing of hypothesis of independence of government tax behaviour from FDI per capita



a) tax rate increase b) tax rate decrease c) tax rate invariance

axis of abscissas – first elements of the sample;
axis of ordinates – last elements of the sample;
axis of applicates*:* –1 – confirmation of the independence hypothesis;
1 – non-confirmation of the independence hypothesis

Fig. 6. Results of integral testing of hypothesis of independence of government tax behaviour from FDI/GDP



a) tax rate increase b) tax rate decrease c) tax rate invariance

axis of abscissas – first elements of the sample;
axis of ordinates – last elements of the sample;
axis of applicates*:* –1 – confirmation of the independence hypothesis;
1 – non-confirmation of the independence hypothesis

The behaviour of countries with low and middle GDP per capita is completely consistent with of agent–maximizer's behaviour: the countries with low GDP per capita rationally increase tax rate, for countries with the a large enough but not the maximum GDP per capita the fiscal function of taxes is already no so important, in return they use the regulatory function, seeking to improve the economic climate in the country because decreasing corporate tax rate. At once the countries with maximum GDP per capita do not pay enough attention to both fiscal and regulatory functions, keeping the fixed tax rate. Such behaviour is typical for "satisfactory" tax behaviour (satisfier's behaviour[1]).

[1] Here, in order to describe the behavior, we used the term "satisfiers" introduced by Simon (1955, 1956), who distinguished the "maximizers", aiming to maximize their own profit, and "satisfiers", for whom it is enough to be profitable.

Discussion

These observations can be explained as follows.

In general OECD countries tend to reduce the corporate tax burden in order to compensate for investors the potential loss of their profits. But this policy has its limits, since the taxes cannot be reduced incessantly. Thus, the low-efficient economies risk to face the underpayment of taxes and/or problems with provision of social benefits or to face the significant budget deficit. So, the these governments try to ensure the certain required level of budget revenue, notably, by increasing the corporate tax burden in order to collect more taxes.

When the country achieves the minimum required level of budget revenue the government attempts to improve the investment climate in the economy, so the trend changes to the opposite, i.e. to the reduction of the tax burden.

This behaviour is typical for countries with intermediate economic efficiency, while a large number of developed (the most efficient) countries are satisfied with this situation, maintaining the current CIT rates. Consequently, one part of the most efficient economies similarly reduces the CIT rate aiming to improve the tax climate and to increase the tax base, while the rest of them does not consider the reasons for changing taxes and they keep the status quo. So the behaviour of the most efficient economies varies from maximizers to satisfiers.

And the opposite is true: the most of states with fixed CIT rates are among the most effective ones; the greater part of countries which increase the corporate tax burden are among the less efficient ones and the majority of countries with reduced tax pressure have the intermediate efficiency. In each of the above cases “majority” means the 60% and more of the total number of countries.

I.e. it is sufficiently obvious that the efficiency of the economy is the main factor which influences on decision making on reduction, increase or maintaining the tax burden. The trend is the following: if the country is not among the economically efficient leaders and at the same time the risks of budget imbalances are insignificant, it tends to attract investment by reducing the corporate tax burden. Almost 40% of OECD countries adopted this way.

Conclusion

1. In order to study the government's tax behaviour, the factors and conditions determining the decision-making, we analyzed its possible correlation with set of indicators of efficiency of economies, based on GDP and FDI, nominal and per capita, as well as the ratio of FDI to GDP.
2. It found the correlation between the government's tax behaviour (defined as the difference between corporate tax burden at the beginning and the end of period) and each of selected indicators.
3. The analysis allowed us to divide the all OECD countries into three groups according their tax behaviour: that increase their CIT tax burden, that reduce it and that does not use the tax instruments, notably, in order to attract the foreign investors.
4. It is found, government's tax behaviour depends the most systemically on the indicator as GDP per capita, for each group of its values (low, middle, high) there is a separate statistically valid trend (increase, decrease and invariance of CIT tax rate).
5. For the rest indicators such statistically verified connection is observed only for or increase trend and invariance trend of CIT tax rate.
6. The government tax behaviour can be characterized as satisfying, i.e. governments in general act as satisfiers. In less efficient economies governments primarily aim to achieve the required level of budget revenue, so they tend to increase the tax burden. Governments of the economies with moderate efficiency which do not face the acute problem of budget fulfillment, consider the improvement of the economic climate and attraction of new investors by reducing the corporate tax burden as one of their main goals.
7. The more "satisfied" are governments of the most efficient countries, many of whom does not use the regulatory function of the corporate tax, since they are satisfied with the current state of the country economy.
8. However in general there is a trend related to the reduction of the tax burden, which can be considered not only as intention to attract the new investment, but

also as the fight for investors. Under specific conditions such fight could lead to a “race to the bottom” situation, i.e. to the inefficient state of all economic systems participated in this race. Thus, determining the reasons, factors and conditions favoring the race to the bottom between OECD and other countries require the further investigation.

Reference

Afonso, A., Hauptmeier, S. (2009). Fiscal behaviour in the European Union rules, fiscal decentralization and government indebtedness. *Working Paper Series no. 1054*, European Central Bank.

Aiyagari, S.R., Marcet, A., Sargent, T.J. and Seppala, J. (2002). Optimal taxation without state-contingent debt. *Journal of Political Economy*, 110(6): pp.1220–1254.

Atkinson, A.B. and Stiglitz, J.E. (1972). The structure of indirect taxation and economic efficiency. *Journal of Public Economics*, 1(1): pp.97–119.

Avi-Yonah, R.S. (2011). Taxation as Regulation: Carbon Tax, Health Care Tax, Bank Tax and Other Regulatory Taxes. *Accounting, Economics, and Law*, 1(1), pp.1–10.

Becker, J. (2009). Taxation of Foreign Profits with Heterogeneous Multinational Firms. *Working Paper no. 2889*, Center for Economic Studies.

Bessard, P. (2009). Tax burden and individual rights in the OECD: an international comparison. Lausanne: Institut Constant de Rebecque.

Chalk, N. A. (2001). Tax Incentives in the Philippines: A Regional Perspective. *IMF Working Papers, WP/01/181*.

Chamley, C. (1986). Optimal taxation of capital income in general equilibrium with infinite lives. *Econometrica*, 54(3), pp.607–622.

Feld, L., Heckemeyer, J. (2008). FDI and Taxation: A Meta-Study. *ZEW Working Paper no.* 08-128.

Freedman, J. (2015). Managing tax complexity: the institutional framework for tax policy-making and oversight. in Evans C. and Krever R. (ed.) *Tax Simplification,* Kluwer Law International. *Working Paper Series no. WP 15/08*, Oxford University Centre for Business Taxation, pp.1–26.

Joumard, I., Kongsrud, P. M. (2003). Fiscal relations across government levels. *OECD Journal: Economic Studies*, 36(1), pp.155–229.

Judd, K.L. (1985). Redistributive taxation in a simple perfect foresight model. *Journal of Public Economics*, 28(1): pp.59–83.

Corporate tax rates table (2017) *KMPG*. [online] Available at: <https://home.kpmg.com/xx/en/home/services/tax/tax-tools-and-resources/tax-rates-online/corporate-tax-rates-table.html>. [Accessed 19/01/2018].

Krishna, A., Slemrod, J. (2003). Behavioral Public Finance: Tax Design as Price Presentation. *International Tax and Public Finance,* 10, pp.189–203.

Laffer, A. (2004). The Laffer Curve: Past, Present, and Future. *Heritage Foundation Backgrounder*, 1765(1 June 2004), pp.1–18.

Laffer, A.B., Winegarden, W. and Childs, J. (2011). The Economic Burden Caused by Tax Code Complexity. The Laffer Center for Supply-Side Economics.

Leicester, A., Levell, P. and Rasul, I. (2012). Tax and benefit policy: insights from behavioural economics. IFS Commentary C125. The Institute for Fiscal Studies.

Macek, R. (2014). The Impact of Taxation on Economic Growth: Case Study of OECD Countries. *Review of Economic Perspectives*, 14(4), pp.309–328, doi: 10.1515/revecp-2015-0002.

Mankiw, G., Romer, D. and Weil, D. (1992). A Contribution to the Empirics of Economic Growth. *The Quarterly Journal of Economics*. 107 (2), pp.407–437.

Mirrlees, J.A. (1971). An exploration in the theory of optimum income taxation. *Review of Economic Studies*, 38(114), pp.175–208.

Mirrlees, J., Adam, S., Besley, T., Blundell, R., Bond, S., Chote, R., Gammie, M., Johnson, P., Myles, G. and Poterba, J. (2011). The Economic Approach to Tax Design. in *Tax by design*, Oxford: Oxford University Press, pp.21–45.

Pecorino, P. (1995). Tax rates and tax revenues in a model of growth through human capital accumulation. *Journal of Monetary Economics*, 36(3), pp.527–539. doi:10.1016/0304-3932(95)01224-9.

Romer, C.D. and Romer, D.H. (2010). The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks. *American Economic Review*, 100(3), pp.763–801; doi:10.1257/aer.100.3.763.

Schratzenstaller, M., Wagener, A. and Kohler-Toglhofer, W. (2005). Company Taxation in an Enlarged European Union. *Monetary Policy and the Economy*, 5(1), pp.96–102.

Simon, H. (1955). A Behavioral Model of Rational Choice. *The Quarterly Journal of Economics*, 69(1), pp.99–118.

Simon, H. (1956). Rational Choice and the Structure of the Environment. *Psychological Review*, 63(2), pp.129–138.

World Development Indicators (2017) *The World Bank*. [online] Available at: <https://data.worldbank.org/indicator/>. [Accessed 19/01/2018].

Trabandt, M. and Uhlig, H. (2011). The Laffer Curve Revisited. *Journal of Monetary Economics*, 58(4), pp.305–327.

Wanniski, J. (1978). Taxes, Revenues and the "Laffer Curve". *The Public Interest*, 50, pp.3–16.

Weber, O., Fooken, J. and Herrmann, B. (2014). Behavioural Economics and Taxation. *Working paper no.* 41, Luxembourg: Office for Official Publications of the European Communities.

Werning, I. (2007). Optimal fiscal policy with redistribution. *The Quarterly Journal of Economics*, 122(3): pp.925–967.