Analysis of the optimal size of the government consumption

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Abstract

The aim of this paper is to investigate the size of the government in 12 OECD countries. Data are gathered from Penn Tables. Clustered robust OLS estimation techniques have been used. The functional form is quadratic is been used, to determine the point where the size of the government is optimal. Government consumption has been used as a proxy variable for government size.

Key words: Government size, Clustered robust OLS, quadratic equation, Armey curve

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Introduction

Government consumption has been subject of interest of the economists, which is continuously increasing lately. Size of the government consumption, her role, and public sector efficiency are becoming central issue in the policies and economic debates, especially in the conditions of financial and economic crises which we are witnessing now. This is especially emphasized in the Keynesian school about the government intervention in the crisis conditions, i.e. recessions.

In this paper, with a specific econometric analysis we will try to estimate optimal size of the government for a group of countries, i.e. the level of government consumption which generates positive effects in ratio with real GDP per capita.

Economic theory analyses two types of arguments that explain size of the public consumption in a different periods of time, and between different countries.

First category of arguments is that according to the Wagner's law, public consumption elasticity in relation to GDP is larger than 1. As the countries are more developed public services consumption is becoming bigger, and with it the need for the state to provide the same.

From another side, percentage of the government consumption is increasing as a result of the fact that wage growth of the public administration is not properly followed by the productivity growth, which means part of the wage growth is not result of their productivity[4], while prices of public services are relatively inelastic to the demand for those services.

Second category of arguments that explains public consumption has a political character. Public consumption is being abused for political purposes. In the time of elections governments increase government spending, without taking into account the economic arguments. Such a behavior gives incentive for higher public spending, higher then optimal and generates budget deficit, and also is a cause for low productivity of the economy. This trend is more likely, when government is made by more political parties and, when elections are held more often.

Subject of research in this paper will be analyzing the public spending, as a significant component of GDP, i.e. as a component of the total economic activity.

Methods of investigation that are being used in this article are econometric techniques for the basic estimations, mathematical models by which it is developed model for the problem that is a subject of analysis, descriptive statistics of the models .

[4] According to the economic logic, workers wage is determined by their productivity, i.e. the wage is determined by the marginal product of labor , $w = VMPL$

Empirical research of the optimal size of the government in a sample of 12 OECD countries

In this research we picked 12 **OECD** countries (**USA, Australia, Mexico, Japan, Italy, New Zealand, Chile, Canada Denmark, Ireland, Netherlands, Belgium**), macroeconomic data cover the period 1950-2007 year, same data for the specified variables are gathered from **PWT 6.3 Penn world tables** [5], this data base 188 countries. Our aim here is to check our variable of interest government spending as percentage to GDP and to estimate the optimal size of the percentage amount of the government in the real GDP. At the very beginning we are publishing descriptive statistics of the model and the description of the variables, and the variables definitions[6].

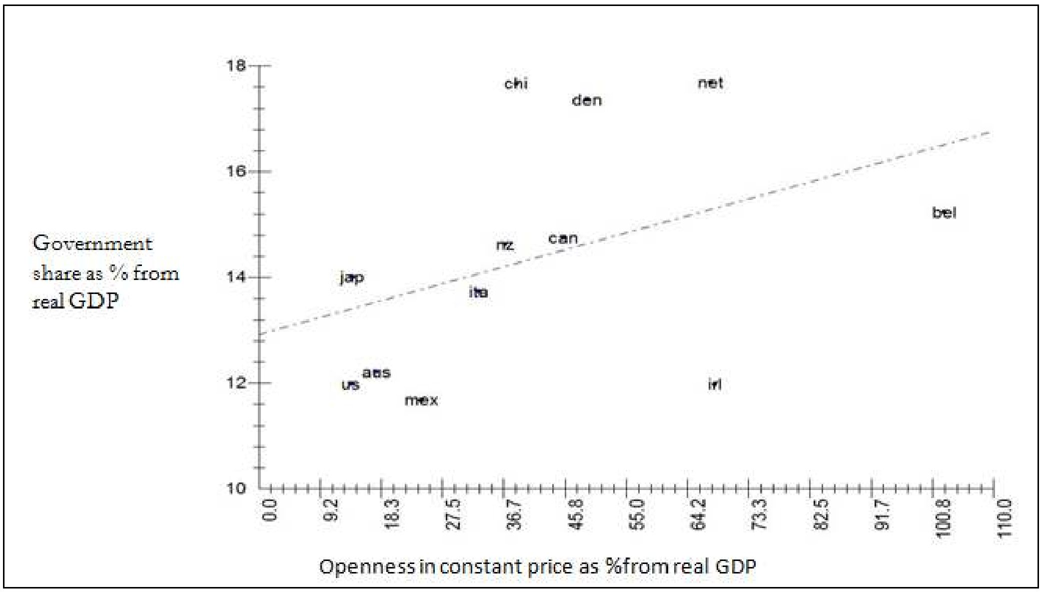
STATA 10 Variables	Description	obs.	mean	Std,deviation	minimum	maximum
REALGDPPER ~A	Real GDP per capita (Lasperye) constant price index 2005	695	17269,8	8777.58	2741.787	42897.42
GOVREALGDP ~E	Government consumption as a part fo real GDP per capita % constant price index 2005	695	14.4311	3.175982	7.262368	28.9391
CONREALGDP ~E	Private consumption as a part of GDP % constant price index 2005	695	57.4591	6.156967	42.46756	79.1054
INVREALGDP~ E	Investment consumption as part of real GDP % constant price index 2005	695	26.98611	5.197459	10.41108	43.10931
OPENNESS	Openness in constant 2005 prices as %	695	43.38808	33.54857	3.87714	171.4361
xrat	Exchange rate , US=1	695	36.69421	107.2811	.0000553	691.3975
rgdptt	Terms of trade in constant prices from 2005	695	17128.36	8760.543	2777.092	42835.22
pop1	Population growth in 000	695	1.071131	1.41803	.09304	36.84861
ppp	US=1 , Purchasing power parity	695	22.89975	59.76832	.0000371	250.1583

Descriptive statistics shows that we have 695 observations, variables that are subject of interest, are in percentages and in 2005(base year) constant prices. ***Government consumption*** as a percentage from GDP per capita , has mean from 14,43% from BDP per capita in the

[5] Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 6.3, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, August 2009. http://pwt.econ.upenn.edu/

[6] See **Appendix 1 Descriptive statistics of the model**

chosen group of 12 countries, with standard deviation $\pm$ 3,17%,, minimum is 7,26% from the GDP per capita. Participation of the ***consumption*** in real GDP per capita is greater and is 42,5% (minimum) to 79% (maximum) , while the mean of this variable is 57,5% of the real GDP capita. ***Investment consumption*** is on average 27% from the real GDP, with 10, 4% minimum and 43, 1% maximum from the real GDP per capita. ***Openness*** of the economy is measured as export plus import divided by real GDP per capita, on average in the chosen group of countries is 43,38% minimum with maximum of 171%, later are put in the table the descriptive statistics for ***population growth***, ***purchasing power parity***, and ***the terms of trade***, as well as the ***exchange rate***. Next will be plotted openness in constant prices as % of GDP , and the government share of GDP in % for the single countries[7].



On the plot are shown average values of the government consumption from the Real GDP per capita in % by constant prices from 2005, USA on average have smallest government and highest trade openness (17,65%,12,21%)[8], while highest government consumption as percentage from GDP per capita, have Chile (38,57%,17,67%), Netherlands (67,66%,17,69%), also Denmark (49,24%,17,36), highest trade openness on average has Belgium (102,57%,15,24%), New Zealand (36,92%,14,63%), Canada(45,64%,14,75%), Italy(32,95%,13,73%), Japan (14,01%,14,01%) on average have same government consumption as a part of real GDP per capita, but by the openness in constant price, Canada on average is the most open economy (45,64%), while New Zealand (36,92%) and Italy (32,95%) on average have similar trade openness . These are average data of the countries for the period 1950 to 2007. These data are averages of countries in the period from 1950 to 2007. Next we will publish the regression of Clustered Robust OLS, here we introduce a new variable GOVSHARESQ~D, that is the share of the government consumption from the Real GDP per capita in % by constant prices from 2005 squared, reason is that we want to find the point

[7] us-USA, aus- **Australia**, jap-Japan, mex-Mexico, ita-Italy, nz-New Zealand, chi-Chile, can-Canada,den-Denmark, irl-Ireland, net-Holand, bel-Belgium

[8] In the parentheses X coordinates i.e. openness, Y coordinates i.e. part of the government consumption as % of GDP.

from which government size as a percentage from the real GDP , enters the zone where the law of diminishing returns is true. Theory assumes U –curve between real GDP per capita and the government consumption as percentage to GDP per capita (government size)[9].

Dependent variable real GDP per capita(Lasperye) index in constant price from 2005 REALGDPPER~A	**(REALGDPPER~A)**	coefficient	P>|t
Government consumption as a share of Real GDP per capita in % in constant prices from 2005	GOVREALGDP~E	68.62279	0.105
Government consumption as a share of Real GDP per capita in % in constant prices from 2005 squared	GOVSHARESQ~D,	-3.819869	0.000
Private consumption as a share of Real GDP per capita in % in constant prices from 2005	CONREALGDP~E	-55.32876	0.000
Investment consumption as a share of Real GDP per capita in % in constant prices from 2005	INVREALGDP~E	-55.78914	0.000
Openness in constant prices from 2005 in %	OPENNESS	-6.226271	0.000
Exchange rate, US=1	xrat	2.371863	0.000
Terms of trade in constant prices from 2005	rgdptt	1.006269	0.000
Population in 000	pop	-11.60511	0.000
US=1 , Purchasing parity	ppp	-5.200712	0.000
Constant	_cons	4878.165	0.000
R^2		0.9976	
Ho :the model has no omitted variables - (Type I probability error is reported)		0.0123	
F-тест , Ho : variables in the model are jointly insignificant (Type I probability error is reported)		Prob > F = 0.0000	

This regression shows that all of the coefficients are statistically significant on all levels of statistical significance, except for the government consumption that is significant on 10%, investment and the general consumption are negatively correlated with the real output per capita, as well as the trade openness which is negatively and statistically significant correlated with the real output per capita. Exchange rate and the terms of trade are positively and statistically significant correlated with the output per capita. Purchasing power parity is negatively correlated with the output.Models explanatory power is 99,76%, Functional form according to Ramsey test is statistically significant at 6% ,according to the F-test we reject the null hypothesis that the variables are jointly insignificant, and we accept the alternative of statistical significance, Type I error probability is 0.0000.Optimal size of the government

[9] See **Appendix 2 Clustered robust Regression Real GDP per capita as dependent variable**

consumption as percentage to real GDP per capita is 8,98% [10].We reject the minus sign on 3.189869, estimated value from 8,98 percentage shows the size of the government consumption as share of real GDP per capita in the selected 12 OECD countries .Share of government consumption as percentage from the Real GDP per capita 9% had been in Mexico in the period from 1950 to 1961, and in USA from the period of 1997 to 2007.Size of the government consumption as percentage to real GDP per capita is 8,46% in USA , and in Mexico for the time period 1950-1961, government consumption as a share of the real GDP per capita is 7,71%. We are publishing regression with growth of Real GDP per capita (Lasperye 2) in constant prices from 2005[11].

Dependent variable is growth rate of real GDP per capita(Lasperye) index in constant price from 2005	(grgdpl2)	коефициент	P>|t
Government consumption as a share of Real GDP per capita in % in constant prices from 2005	GOVREALGDP~E	-0.1133135	0.056
Private consumption as a share of Real GDP per capita in % in constant prices from 2005 squared	CONREALGDP~E	-0.0557851	0.177
Investment consumption as a share of Real GDP per capita in % in constant prices from 2005	INVREALGDP~E	0.1333061	0.000
Openness in constant prices from 2005 in %	OPENNESS	0.014299	0.004
Exchange rate, US=1	xrat	0.0038683	0.002
Population in 000	pop	6.14e-06	0.038
Terms of trade in constant prices from 2005	rgdptt	-0.0001132	0.000
Time trend	tt	0.0002818	0.664
Constant	_cons	4.65191	0.250
R^2		0.1512	
Ho :the model has no omitted variables - (Type I probability error is reported)		0.0670	
F-тест , Ho : variables in the model are jointly insignificant (Type I probability error is reported)		Prob > F = 0.0000	

Date from this regression cover the period from 1950-2007 for every of the 12 selected OECD countries, functional form is good on 5% level of significance

[10] In the estimated equation from the previous page $\hat{\beta}_1$ >0, $\hat{\beta}_1$ <0, turning point (or the function maximum) always is achieved on the x two times over the absolute value of the coefficient x[2] $x^* = \left| \frac{\hat{\beta}_1}{\left(2 * \hat{\beta}_2\right)} \right| = \left| \frac{68,62279}{(2*3,819869)} \right| = 8,982349\%$

[11] See **Appendix 3 Growth rate of Real GDP per capita as dependent variable**

(p=0.0670).Government size as percentage of GDP is negatively correlated with the growth of real GDP per capita (if the share of the government consumption as a percentage to GDP increases by 1%, growth rate of the lower output per capita will decrease on average by 0.11%), household consumption is statistically insignificant variable, 1% increase in the investment consumption will induce increase in the real growth per capita by 0.13 %, openness is positively correlated with the growth rate of Real GDP per capita, 1% increase in the openness of the economy will induce increase in the growth rate of the country ,which is statistically and economically significant and its size is 0.13%,exchange rate and population in thousands, are positively and statistically significantly correlated with the growth rate of the Real GDP per capita. While the terms of trade are negatively correlated with the economic growth, terms of trade coefficient is statistically significant, but is very small in size. For the purpose of the analysis we have put time trend variable, but it is statistically insignificant. Explanatory power of the model is 0.1512.

Appendix 1 Descriptive statistics of the model

Variable	Obs	Mean	Std. Dev.	Min	Max
REALGDPPER~A	695	17269.88	8777.58	2741.787	42897.42

Appendix 1 Descriptive statistics of the model

Variable	Obs	Mean	Std. Dev.	Min	Max
GOVREALGDP~E	695	14.4311	3.175982	7.262368	28.9391
GOVSHARESQ~D	695	218.3289	99.99675	52.74199	837.4717
CONREALGDP~E	695	57.4591	6.156967	42.46756	79.1054
INVREALGDP~E	695	26.98611	5.197459	10.41108	43.10931
OPENNESS	695	43.38808	33.54857	3.87714	171.4361
xrat	695	36.69421	107.2811	.0000553	691.3975
rgdptt	695	17128.36	8760.543	2777.092	42835.22
pop1	695	1.071131	1.41803	.09304	36.84861
ppp	695	22.89975	59.76832	.0000371	250.158

Appendix 2 Clustered robust Regression Real GDP per capita as dependent variable

```
Linear regression                                      Number of obs =     694
                                                       F(  9,   684) =51679.07
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.9976
                                                       Root MSE      =  436.51
```

REALGDPPER~A	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
GOVREALGDP~E	68.62279	42.30704	1.62	0.105	-14.44447	151.6901
GOVSHARESQ~D	-3.819869	1.084127	-3.52	0.000	-5.948485	-1.691253
CONREALGDP~E	-55.32876	8.037879	-6.88	0.000	-71.11064	-39.54688
INVREALGDP~E	-55.78914	7.129281	-7.83	0.000	-69.78705	-41.79124
OPENNESS	-6.226271	.8385874	-7.42	0.000	-7.872786	-4.579757
xrat	2.371863	.5303301	4.47	0.000	1.330592	3.413133
rgdptt	1.006269	.0024466	411.30	0.000	1.001465	1.011072
pop1	-11.60511	1.706062	-6.80	0.000	-14.95486	-8.255363
ppp	-5.200712	.7723048	-6.73	0.000	-6.717085	-3.68434
_cons	4878.165	987.2677	4.94	0.000	2939.725	6816.604

Optimal size of the government= $\frac{68,62279}{(2*3,819869)} = 8,982349$

```
. estat ovtest

Ramsey RESET test using powers of the fitted values of REALGDPPERCAPITA
       Ho:  model has no omitted variables
                 F(3, 681) =      2.40
                  Prob > F =      0.0670
```

Appendix 3 Growth rate of Real GDP per capita as dependent variable

```
Linear regression                                      Number of obs =     694
                                                       F(  8,   685) =56193.99
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.9975
                                                       Root MSE      =  440.25

------------------------------------------------------------------------------
             |               Robust
REALGDPPER~A |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
GOVREALGDP~E |  -54.97017   12.02359    -4.57   0.000    -78.57768   -31.36266
CONREALGDP~E |  -59.97148   7.543113    -7.95   0.000    -74.78188   -45.16108
INVREALGDP~E |  -57.33537   7.156555    -8.01   0.000    -71.38678   -43.28395
    OPENNESS |  -6.066464   .8420864    -7.20   0.000    -7.719844   -4.413083
        xrat |    2.22217    .530325     4.19   0.000     1.180912    3.263427
     rgdpptt |    1.00502    .002357   426.40   0.000     1.000392    1.009647
        pop1 |   -11.8961   1.576968    -7.54   0.000    -14.99237   -8.799827
         ppp |  -5.191017   .7841655    -6.62   0.000    -6.730673    -3.65136
       _cons |   6156.366    787.851     7.81   0.000     4609.473    7703.259
------------------------------------------------------------------------------

. estat ovtest

Ramsey RESET test using powers of the fitted values of REALGDPPERCAPITA
       Ho:  model has no omitted variables
                 F(3, 682) =      3.53
                  Prob > F =      0.0147
```

```
  Source |       SS       df       MS              Number of obs =     683
-------------+------------------------------           F(  8,   674) =   15.01
       Model |  958.14866     8  119.768583           Prob > F      =  0.0000
    Residual |  5376.94493   674   7.9776631           R-squared     =  0.1512
-------------+------------------------------           Adj R-squared =  0.1412
       Total |  6335.09359   682  9.28899354           Root MSE      =  2.8245

------------------------------------------------------------------------------
     grgdpl2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
GOVREALGDP~E |  -.1133135   .0590718    -1.92   0.056    -.2293003    .0026733
CONREALGDP~E |  -.0557851   .0412452    -1.35   0.177    -.1367697    .0251994
INVREALGDP~E |   .1333061   .0360732     3.70   0.000     .0624767    .2041355
    OPENNESS |    .014299   .0048868     2.93   0.004     .0047039    .0238941
        xrat |   .0038683   .0012665     3.05   0.002     .0013816    .0063549
         pop |   6.14e-06   2.95e-06     2.08   0.038     3.35e-07    .0000119
      rgdptt |  -.0001132   .0000227    -4.98   0.000    -.0001578   -.0000686
          tt |   .0002818   .0006488     0.43   0.664    -.0009921    .0015557
       _cons |    4.65191   4.040022     1.15   0.250    -3.280633    12.58445
------------------------------------------------------------------------------

. estat ovtest

Ramsey RESET test using powers of the fitted values of grgdpl2
       Ho:  model has no omitted variables
                 F(3, 671) =      3.66
                  Prob > F =      0.0123
```

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