Analysis of the optimal size of the government consumption

Josheski, Dushko and Lazarov, Darko and Koteski, Cane

Goce Delcev University-Stip, Goce Delcev University-Stip, Goce Delcev University-Stip

25 August 2011

Analysis of the optimal size of the government consumption

Dushko Josheski [1]
University Goce Delcev Stip
Darko Lazarov [2]
University Goce Delcev Stip
Cane Koteski [3]
University Goce Delcev Stip

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. Also Panel estimation techniques have been applied, FE and RE estimation. 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,Panel data, Fixed effect estimation, Random effects estimation, GLS , Pooled OLS

[1] dusko.josevski@ugd.edu.mk
[2] darko.lazarov@ugd.edu.mk
[3] cane.koteski@ugd.edu.mk

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].

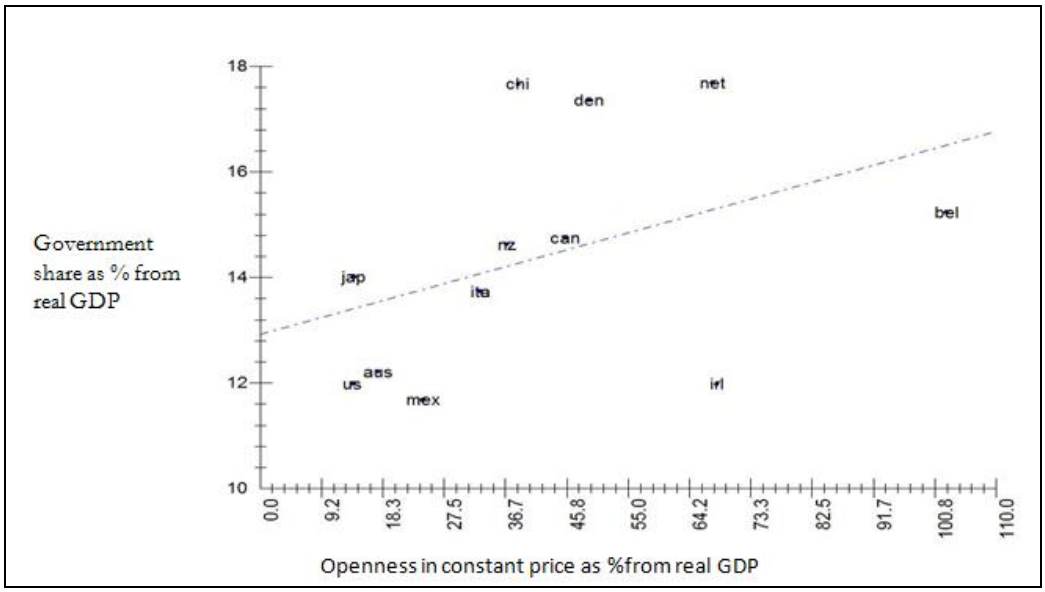
STATA 10 Variables	Description	obs.	mean	Std,deviation	minimum	maximum
REALGDPPER~A	**Real GDP per capita (Lasperye) constant price index 2005**	695	17269,8	8777.58	2741.787	42897.42
GOVREALGDP~E	**Government consumption as a part fo real GDP per capita % constant price index 2005**	695	14.4311	3.175982	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 chosen group of 12 countries, with standard deviation $\pm$ 3,17%,, minimum is 7,26% from 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**

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 from which government size as a percentage from the real GDP , enters the zone where the

[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.

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)	Coefficient	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 $x^* = \left| \frac{\hat{\beta}_1}{(2 * \hat{\beta}_2)} \right| = \left| \frac{68,62279}{(2 * 3,819869)} \right| = 8,982349\%$

[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.

Panel estimation techniques

In the previous section we used Pooled OLS to estimate the optimal size of the government. Now we are going to apply Panel estimation techniques. Here year is the time variables, while Panel ID variable is fcode2 for each country.

Fixed effects estimation

In the fixed effect estimation Panel ID variable is fcode2 there are 694 observations from 12 countries in this estimation results are as follows. In this regression overall fit is more than 99 %. There are 56 observations per group.

Fixed effect estimation results [12]

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	66.14722	0.061
Government consumption as a share of Real GDP per capita in % in constant prices from 2005 squared	GOVSHARESQ~D,	-2.499048	0.015
Private consumption as a share of Real GDP per capita in % in constant prices from 2005	CONREALGDP~E	-25.43965	0.000
Investment consumption as a share of Real GDP per capita in % in constant prices from 2005	INVREALGDP~E	-37.95461	0.000
Openness in constant prices from 2005 in %	OPENNESS	-10.40926	0.000
Exchange rate, US=1	xrat	1.844617	0.000
Terms of trade in constant prices from 2005	rgdptt	1.027499	0.000
Population in 000	pop	5.214396	0.614
US=1 , Purchasing parity	ppp	-0.7509224	0.552
Constant	_cons	2144.018	0.003
R^2 overall		0.9976	
F-тест , Ho : variables in the model are jointly insignificant (Type I probability error is reported)		Prob > F = 0.0000	

From the above data and using the Armey curve, optimal size of the government is computed as follows

$$x^{*} = \left| \frac{\hat{\beta}_1}{(2 * \hat{\beta}_2)} \right| = \left| \frac{66{,}14722}{(2 * 2{,}499)} \right| = 13{,}23474\%$$

So according to fixed effect estimator optimal size of the government is 13,23% as share of real GDP .

[12] See Appendix 4 fixed effect estimation

Random effects estimation[13]

Here we run Generalized effects least squares regression, group variable or Panel ID is fcode2 . Fit of the regression within , between and overall is higher than 99%.

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	66.73584	0.059
Government consumption as a share of Real GDP per capita in % in constant prices from 2005 squared	GOVSHARESQ~D,	-2.825552	0.006
Private consumption as a share of Real GDP per capita in % in constant prices from 2005	CONREALGDP~E	-28.06088	0.000
Investment consumption as a share of Real GDP per capita in % in constant prices from 2005	INVREALGDP~E	-39.79737	0.000
Openness in constant prices from 2005 in %	OPENNESS	-7.964498	0.000
Exchange rate, US=1	xrat	2.13594	0.000
Terms of trade in constant prices from 2005	rgdptt	1.019866	0.000
Population in 000	pop	1.5050583	0.886
US=1 , Purchasing parity	ppp	-2.598202	0.019
Constant	_cons	2466.676	0.001
R^2 overall		0.9972	
F-тест , Ho : variables in the model are jointly insignificant (Type I probability error is reported)		Prob > F = 0.0000	

From the above data and using the Armey curve, optimal size of the government is computed as follows

$$x^* = \left| \frac{\hat{\beta}_1}{(2 * \hat{\beta}_2)} \right| = \left| \frac{66{,}73584}{(2 * 2{,}82552)} \right| = 11{,}81\%$$

So according to fixed effect estimator optimal size of the government is 11,81% as share of real GDP .

[13] See Appendix 5

So in conclusion three estimators used in this paper Pooled OLS estimation technique, and Random effects estimator as well as Fixed effect estimator gave similar results. Highest government size we got with Fixed effects estimation above 13 percent on average.

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

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

------------------------------------------------------------------------------
             |               Robust
REALGDPPER~A |      Coef.   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
      rgdptt |    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
```

Appendix 4 Fixed effects estimation

```
Fixed-effects (within) regression               Number of obs      =       694
Group variable: fcode2                          Number of groups   =        12
R-sq:  within  = 0.9974                         Obs per group: min =        56
       between = 0.9948                                        avg =      57.8
       overall = 0.9966                                        max =        60
                                                F(9,673)           =  28681.03
corr(u_i, Xb)  = -0.1477                        Prob > F           =    0.0000

------------------------------------------------------------------------------
       rgdpl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          kg |   66.14722   35.24133     1.88   0.061    -3.048958    135.3434
   kgsquared |  -2.499048    1.02489    -2.44   0.015    -4.511414   -.4866816
          kc |  -25.43965   6.524323    -3.90   0.000    -38.25013   -12.62918
          ki |  -37.95461   6.149009    -6.17   0.000    -50.02816   -25.88107
       openk |  -10.40926   1.447341    -7.19   0.000    -13.25111   -7.567418
      rgdptt |   1.027499   .0043421   236.64   0.000     1.018974    1.036025
        pop1 |   5.214396    10.3338     0.50   0.614    -15.07597    25.50476
         ppp |  -.7509224   1.261643    -0.60   0.552    -3.228152    1.726307
        xrat |   1.844617   .5050376     3.65   0.000     .8529786    2.836256
       _cons |   2144.018   728.7016     2.94   0.003     713.2161     3574.82
-------------+----------------------------------------------------------------
     sigma_u |  376.28763
     sigma_e |  379.42172
         rho |  .49585286   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(11, 673) =    21.12             Prob > F = 0.0000
```

Here ki-is investment consumption as % to GDP, kg- is government consumption as percentage to GDP, kc-is private consumption as ercentage to GDP, openk- is trade openness in %, rgdptt-are terms of trade , and pop1 is population.

Appendix 5 Random effects estimator

```
Random-effects GLS regression                   Number of obs      =       694
Group variable: fcode2                          Number of groups   =        12

R-sq:  within  = 0.9974                         Obs per group: min =        56
       between = 0.9969                                        avg =      57.8
       overall = 0.9972                                        max =        60

Random effects u_i ~ Gaussian                   Wald chi2(9)       = 256332.87
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

------------------------------------------------------------------------------
       rgdpl |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          kg |   66.73584   35.38226     1.89   0.059    -2.612102    136.0838
   kgsquared |  -2.825552   1.032548    -2.74   0.006    -4.849309   -.8017949
          kc |  -28.06088   6.373354    -4.40   0.000    -40.55242   -15.56933
          ki |  -39.79737   5.983248    -6.65   0.000    -51.52432   -28.07042
       openk |  -7.964498   1.198611    -6.64   0.000    -10.31373   -5.615264
      rgdptt |   1.019886    .003788   269.24   0.000     1.012462    1.027311
        pop1 |   1.505083   10.53671     0.14   0.886    -19.14648    22.15665
         ppp |  -2.598202   1.107924    -2.35   0.019    -4.769693   -.4267106
        xrat |    2.13594   .4834925     4.42   0.000     1.188312    3.083568
       _cons |   2466.676   719.0929     3.43   0.001      1057.28    3876.073
-------------+----------------------------------------------------------------
     sigma_u |  155.00182
     sigma_e |  379.42172
```

Here ki-is investment consumption as % to GDP, kg- is government consumption as percentage to GDP, kc-is private consumption as ercentage to GDP, openk- is trade openness in %, rgdptt-are terms of trade , and pop1 is population.

References:

[1] Armey, D. and Armey, R. (1995). "The Freedom Revolution: The New Republican House Majority Leader Tells Why Big Government Failed, Why Freedom Works, and How We Will Rebuild America, ",*Washington, D.C.; Regnery Publishing Inc.*

[2] Barro, R. (1988). "Government Spending in a Simple Model of Endogenous Growth," *NBER Working Paper 2588*

[3] Grossman, P. (1987). The optimal size of government, Public choice, vol.56

[4] Carlstrom, C. and Gokhale, J. (1991). "Government Consumption, Taxation, and Economic Activity," *Federal Reserve Bank of Cleveland Economic Review, 3rd Quarter, pp. 18-29*

[5] Heitger, B. (2001). "The Scope of Government and Its Impact on Economic Growth in OECD Countries," *Kiel Institute of World Economics; Kiel Working Paper No. 1034*

[6] Pevcin, P. (2004). "Does Optimal Size of Government Spending Exist?," *University of Ljubljana*

[7] Pevcin, P. (2004). "Cross-country Differences in Government Sector Activities", *Zb. Rad. - Sveuc. u Rij„ Ekon. fak„ god. 22. Sv. 2, str. 41-59*

[8] Rahn, R. and Fox, H. (1996). "What Is the Optimum Size of Government," *Vernon K. Krieble Foundation*

[9] Olson, M. (1982). The rise and decline of nations: Economic growth stagflation, and social rigidities. New Haven: Yale University Press

[10] Scully, G. (2003). "Optimal taxation, economic growth and income inequality," *Public Choice 115: 299–312*

[11] Scully, G. (2008). "Optimal Taxation, Economic Growth and Income Inequality in the United States," *National Center for Policy Analysis, Policy Report No. 316*