IS THERE A CORRELATION BETWEEN GOVERNMENT EXPENDITURES, POPULATION, MONEY SUPPLY AND GOVERNMENT REVENUES?

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Public revenues have been the subject of a long debate. Meeting the demand for public financial resources is influenced by a combination of economic, social, demographic, monetary, political, military, psychological factors. There are many factors which determine more or less changes in government revenues. We have focused our attention on the government expenditures, population and money supply in order to quantify the degree of correlation with public revenues. This paper intends to measure the intensity of the relationship between these three factors and governments revenues. The paper aims to be an answer to the question from title, namely which is the strongest determinant of government revenues: government expenditures, population or money supply? Can government revenues be estimated starting from these three macroeconomic indicators? If the correlation between these indicators is very strong the paper intends to translate it in an econometric model by using unifactorial and linear regression.

Keywords: Government revenues, Government expenditures, Population, Money supply, Simple linear regression.

INTRODUCTION

Economics studies economic phenomena and processes on the premise that they are not carried out randomly, but they are carried out on the basis of its own laws, relatively stable and relatively repeatable. To illustrate the relation between economic variables, economists have tried to explain the intensity of a change of one variable on other and have transposed numerical their analysis. Cause-effect connections appear for the first time representatives of classical liberalism. None of quantitative methods can fully meet the economic reality which involves contradictory aspects.

In all countries there is an increasing demand for financial resources generated by the increasing social needs in a faster rhythm than GDP evolution. What affects revenues has been the subject of a long debate. Meeting the demand for public financial resources is influenced by a combination of economic, social, demographic, monetary, political, military, psychological factors. There are many factors which determine more or less changes in government revenues. We have focused our attention on the government expenditures, population and money supply in order to quantify the degree of correlation with public revenues. This paper intends to measure the intensity of the relationship between these three factors (as causal variables) and government revenues (as result variable).

The paper aims to be an answer to the question from title, namely which is the strongest determinant of government revenues: government expenditures, population or money supply? Can government revenues be estimated starting from these three macroeconomic indicators? If
the correlation between these indicators is very strong the paper intends to translate it in an econometric model by using unifactorial and linear regression. For analysing these economic phenomena it was used the econometric theory and some statistical measures. Regional series concentrated on a wide range of mondoeconomic types. Attention has focused both on developing countries and on developed countries.

The paper is organized as follows: Section 1 contains some approaches on government revenues analysis, Section 2 refers to data analyzed and methodology used, Section 3 presents the results and Section 4 highlights some conclusions.

The relationship between government revenue and government expenditure is important, given its relevance for policy especially with respect to the budget deficit. It has been investigated a number countries in both directions. All the papers in this field analyze the causal relationship between government revenue and government expenditure by using Granger causality test through cointegrated vector autoregression (VAR) methods. This was made for Namibia by Eita, Joel Hinaunye and Mbazima, Daisy (2008), for Romania by Câmpeanu Emilia Mioara and Cataramă Delia Florina (2007), for Korea by Wan Kyu Park (1998), for China by Xiao-Ming Li (2001), for Uganda by Edward B. Sennoga (2008), for Greece by George Hondroyiannis and Evangelia Papapetrou (1996), for nine Asian countries by Paresh Kumar Narayan (2004), for Egypt and Jordan by AboAl-Foul B. and Baghesani H. (2004), for Guinea Bissau by Francisco Galrao Carneiro, João Ricardo Faria, Boubacar Sid Barry (2004), for Pakistan by Zinaz Aisha and Samina Khatoon (2008), for Five South East Asian Countries by Ergun Dogan (2006), for GCC countries by Ugo Fasano and Qing Wang (2002), for Malaysia by Mithani, D.M., Goh Soo Khoo (1999), for Barbados by Tracy Maynard and Kester Guy (2009) etc. Owoye (1995) conducted a study of G7 countries and finds that the direction of causality runs from tax revenues to government expenditures in the case of Japan and Italy. Cheng (1999) in a study of eight Latin American countries detects a similar direction for Columbia, the Dominican Republic, Honduras and Paraguay.

The Economic Policy Committees of both the EU and the OECD have launched studies to examine the impact of ageing on the finances of public pension schemes and thus on public finances as a whole on the basis of internationally comparable projections. The impact of demographic changes differs from city to city and from region to region. But they influence nearly every sphere of life and affect almost every policy field. A report prepared by H. Ulbrich (1996) contains an examination about how population growth and inflation, separately and jointly, affect municipal finances over time in South Carolina (USA). The author concludes that population growth is a major driver of municipal revenue and spending growth in South Carolina. On the revenue side, more citizens also mean more houses and cars generating revenues from property taxes and building permits, and more revenue from local business licenses and service charges. This idea may be extrapolated at national level, where more people means more income tax, more VAT, more social contributions. A subject of many researches consists in the impact of population growth on tax revenues at local level. The impact of demographic change on tax revenue in Netherlands was analized by Kees Goudswaard and Hans van de Kar in 1994. Their paper stimulates the impact of demographic change on direct tax revenue for the Netherlands using extensive survey data and population projections. George Hondroyiannis and Evangelia Papapetrou (2007) analyzed the effects of demographic changes (low fertility rates and a high old-age dependency ratio) on fiscal developments (tax revenues too) in Greece over the period 1960 to 1995. The empirical evidence suggests that there is a long-run relationship between tax revenues and demographic variables. Their estimation results show that in the long-run the double-aging process—an increase in the old-age dependency ratio and a decrease in the fertility rate—will lead to a decrease in total tax revenues. Michael Hofmann, Gerhard Kempkes, Helmut Seitz (2008) intended to measure the effect of demographic changes on public revenues and expenditures by applying a method to the local, state and federal government sector as well as on the social security system in Germany.
In general the central government has a monopoly right to issue money, and that privilege is a source of revenue. Money creation can be integrated by the central government into national budgetary accounts. Seigniorage, government revenue received through creating money, is a relatively inexpensive means of raising funds. Seigniorage is profit from money creation, a way for governments to generate revenue without levying conventional taxes. Many papers analyze government revenues from money creation and seigniorage revenues.

DATA AND METHODOLOGY

Unifactorial model is frequently used to model economic phenomena due to the advantages it have: simplicity, efficiency and reduced cost for obtaining it. This model is only an assumption built on economic theory and it implies in our research that public revenues are a result of a multifaceted action. Such a model is based on the assumption that among the determinants of government revenues (variable results) is a determining factor “x” (government revenues, number of inhabitans, money supply value), the other factors influence is random. The latest category of factors is specified in the model through the “u” residual variable or they were invariable in the period under review and therefore do not make sense to specify them in model. Like any theoretical hypothesis, it may be true or false, “x” is or is not the determining factor of government revenues. Validation or invalidation of such a hypothesis is made by a statistical “experiment”.

The identification of model consists in choosing a mathematical function, with which it seeks to describe the values of public revenues depending on only one factor of influence. A unifactorial econometric model has the form y = f(x) + u, where:

y - Dependent variable’s values (government revenues);

x - Independent variables’ values (GDP, population, money supply)

u - Residual variable (other factors influence on the public revenues).

If f(x) = ax + b, then it follows that: y = ax + b + u

In a linear model the regression coefficient is the parameter of factorial variable and it indicates the meaning of the connection: a > 0 → direct relation or a < 0 → reverse relation. Solving an econometric model involves estimating the parameters “a” and “b” with a certain stochastic method. The method used is the method of least squares. Theoretical values of public revenues may be calculated by using parameters’ estimates. The econometric model parameters are the coefficients of regression function.

Since the econometric model is based on acceptance of some assumptions, it is necessary to be checked before using it as a relevant instrument. This check includes:

1. Testing the hypothesis which is based the econometric model estimation. Estimating parameters of a model is based on several assumptions:

   a) The variables “x” and “y” are not affected by errors of measurement.

   b) The residual variable homoscedasticity hypothesis - random variable (residual) has zero average and its dispersion is constant and independent of x.

   c) Residual values of variable “u” are unrelated. There is not a phenomenon of autocorrelation between errors. Errors’ autocorrelation detection was performed by using Durbin-Watson test, which involves calculating the “d” value. This empirical value, “d”, was compared with two theoretical values, d1 and d2, from Durbin-Watson distribution Table according to a significance level α, chosen arbitrarily, (α = 0.05 or α = 0.01 ), the number of exogenous variables (k) and the number of observed values (n, n ≥ 15). Durbin Watson (DW) is
a statistical test used to check the serial correlation of errors. If errors are not correlated, then the value of DW will be around 2.

\[ d = \frac{\sum_{i=2}^{n} (u_i - u_{i-1})^2}{\sum_{i=1}^{n} u_i^2} \]

d) Probability of residual variable is a normal one, the average is almost zero and the mean square deviation is \( \sigma \). The hypothesis of errors’ normality was checked by graphical method.

2. The check of significance of econometric model parameters estimators was done using “t” test. SPSS tests, by “t” test, the null hypothesis for each coefficient. This hypothesis supposes that a coefficient is null. Results appear as “T” test values and probabilities (P-value). If the associated probability is less relevant than that of 1%, 5% or 10%, then the null hypothesis is rejected and the coefficient is considered statistically significant.

3. The check of econometric model similarity aims to determine if the first hypothesis (e.g. population is the main factor of influence of government revenues) is correct or not by using analysis of variance (ANOVA) method. The intensity of the relationship between the two variables is measured by using \( R_y/x \) indicator, called the \textbf{correlation ratio}: \( R_y/x = 0 \) weak correlation ("x" and "y" are independent), \( R_y/x = 0.5 \) strong correlation, \( R_y/x = 1 \) a deterministic correlation. \( R^2 \) is called determination coefficient and it have the following meanings: \( R^2 = 0 \) – "x" is a factor (cause) of "y"; \( R^2 = 0.5 \) – "x" is a key factor of "y"; \( R^2 = 1 \) – "x" is the only factor of "y". The degree of determination expresses the extent to which variation depends on factors that tracked feature. \( R^2 \) is an indicator showing whether the regression model is well specified.

To determine whether two variables are associated and the degree of association was used \textbf{correlation coefficient}, denoted r. It takes values from -1 to +1, a zero value indicates no association, 1 value showing a perfect positive association (correlation), a -1 value indicates a perfect negative association. Checking the significance of the correlation ratio and thus of linear correlation coefficient is performed using Fisher–Snedecor test.

\[ r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{(\sum (x_i - \bar{x})^2)(\sum (y_i - \bar{y})^2)}} \]

The model similarity is checked by \textbf{F test (Fisher-Snedecor)}. F test measures how well the independent variables explain the evolution of the dependent variable. It determines whether the regression coefficients, both are zero in statistical terms. F test null hypothesis is that the regression coefficients are zero. If associated probability P-value is less relevant than 0.01, then the null hypothesis is rejected, which means that at least one of the regression coefficients is statistically significant. But if the P-value is more than 0.01, then the null hypothesis is accepted. This means that all the regression coefficients are considered statistically inconsequential.

\[ F = (n-2) \frac{R^2}{1-R^2} \]

Not all economic processes can be expressed by linear functions. If calculation shows that the linear model is irrelevant and statistical insignificant, then modeling will be done by another function.
One of the main problems that researchers are facing is the lack of time series data over a long period. In this study, annual data covering the period 1980 to 2010 are used since this is the period in which well-documented data are available for the analyzed countries. The unavailability of quarterly data dictated the use of annual data. This might pose a limitation to the study but with development of data and more data documentation we believe that similar studies could be undertaken.

Variables as subject to statistical analysis are:

- **Exogenous variable**, independent, explanatory (x): Government expenditures, the number of inhabitants and money supply. From the wide range of indicators calculated and reported worldwide we have chosen the time series provided by International Monetary Fund (for government revenues and population) and World Bank (for money supply).

  General government total expenditure includes all public spending, including purchases of non-financial assets and is expressed in billions in national currencies. Population represents the number of inhabitants of each country and it is expressed in thousands persons. Money supply takes into account the total amount of money in circulation outside banks and demand deposits, other than the public ones. This variable refers to the monetary aggregate M1 and is expressed in national currency of each country.

- **Endogenous variable**, dependent on the result (y): namely, the national government revenues collected from tax and non-fiscal methods. Revenues include all fees, taxes, social contributions, grants and other income. General government revenues are expressed in millions, current prices and national currency of each country. Source series is based on statistical data available on the World Economic Outlook October 2010 Indicators.

- **Random variable (u)** summarizes all the variables except “x” variables that influence the endogenous variable y, but not specified in the econometric model. These variable factors are considered accidental (non-essential).

The software used for data processing and statistical analysis is SPSS 18.00.

Usually, several methodological problems may be found in this kind of econometric studies. To put it concretely, tests have been performed without due consideration of stationarity of the series, the existence of cointegration, the selection criteria of optimal lag length, and the error structure assumptions.

**RESULTS**

Having some series of statistical variation of public revenues, the aim of this work paper was to choose a mathematical function, \( y = f(x) \), with which, knowing the values of independent variables, to better approximate the empirical values of public revenue (with small errors).

**Government expenditures**: The relationship between government expenditure and government revenue has attracted significant interest. This is due to the fact that the relationship between government revenue and expenditure has an impact on the budget deficit. Our paper tests whether government expenditure causes government revenue.

Hypothesis from which we start the analysis of public expenditure and public revenues changes is: public expenditure is a key factor influencing public revenues. After identifying and quantifying the relationship between the two variables, will be chosen a mathematical function by which we try to estimate the values of public revenues knowing the values of public spending. Analysis of the two variables was made on account of a series of data from the period 1980 -
2010 for a sample of eight countries from all continents: Africa (Botswana, Ethiopia, Madagascar), America (Canada, Panama, Paraguay), Asia (Bangladesh), Europe (Iceland).

The correlation between public spending and government revenues for these eight countries was quantified using Pearson’s coefficient. This coefficient takes values between 0.795 and 0.997 for the sample countries, reflecting a strong intensity of the relation between the two variables (except for Madagascar, where the correlation is moderate). The coefficient of determination $R^2$ shows that for these countries over 90% of the variation in public revenues can be explained by changes in public expenditure. Public spendings are a crucial factor in determining the dependent variable, the initial hypothesis is accepted. In graphical representation of correlogram for each country it could be observed a linear trend in variation of the endogenous variable and exogenous variable, which justifies a simple linear regression model. Estimate parameters of linear regression was performed using the method of least squares and were subject to audit results.

All regression coefficients of the sample countries have been positive, indicating a direct connection between public spending and public revenues. The check of econometric model for each country was obtained using various tests. In order to detect errors’ autocorrelation in Durbin Watson distribution table are chosen depending on 0.01 (two-tailed), $k = 1$ exogenous variable and 31 observed values, the two theoretical values $d_1 = 1.150$ and $d_2 = 1.270$. By comparing the values “d” obtained for each of the two limits, the test proved impracticable for Ethiopia and Paraguay ($d_1 < d < d_2$), for Bangladesh and Panama the initial hypothesis is accepted, so errors are not autocorrelated, but independent ($d > d_2$). Durbin Watson test for the other countries showed an average level of autocorrelation of errors, the Durbin Watson null hypothesis was rejected for them.

### Table 1. Government revenues and government expenditures model.

<table>
<thead>
<tr>
<th>Country</th>
<th>Durbin Watson Test</th>
<th>Test F</th>
<th>Sig.</th>
<th>Testul t</th>
<th>Sig.</th>
<th>RSR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simple linear regression</td>
<td>Parameter a (GE)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$y = ax + b$</td>
<td>Constant b</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bangladesh</td>
<td>1.454</td>
<td>3779,168</td>
<td>0.000</td>
<td>0.021</td>
<td>61,475</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>GR=1,285 GE+28533,971</td>
<td>5917,193</td>
<td>4,822</td>
<td>0.000</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Botswana</td>
<td>0.679</td>
<td>427,936</td>
<td>0.000</td>
<td>0.052</td>
<td>20,687</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>GR =1,073 GE -819,828</td>
<td>730,475</td>
<td>-1,122</td>
<td>0.271</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>0.403</td>
<td>713,703</td>
<td>0.000</td>
<td>0.035</td>
<td>26,715</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>GR =0,934 GE +45649,115</td>
<td>14009,674</td>
<td>3,258</td>
<td>0.003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Etiopia</td>
<td>1.188</td>
<td>4213,493</td>
<td>0.000</td>
<td>0.017</td>
<td>64,911</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>GR = 1,458 GE +28533,971</td>
<td>5917,193</td>
<td>4,822</td>
<td>0.000</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
By applying F-test was found that government expenditures explain the evolution of government revenues. In all eight cases it was achieved a “F” greater than 7.60 (F value from table), the degrees of freedom $V_1 = 1$ and $V_2 = 31$ and a significance level of 0.010, which means that the null hypothesis (variation in public spending does not differ from the random factor) is rejected. The level of significance is 0.000 in all cases and is below the level of relevance with that we work of 0.010, which means that at least one of the regression coefficients is statistically significant. Probability that the predictions of model to be of poor accuracy is below 1%.

After verifying the significance of the econometric model parameter estimators with “t” test it was found that for Canada, Madagascar, Ethiopia and Bangladesh the associated probability does not exceed 0.010 for both regression parameters, which means the statistical relevance of econometric model coefficients. Other countries have high levels of significance only for regression coefficient, while the constant parameter value has a low accuracy. From a sample of eight cases, for four of them the econometric model does not have high confidence due to presence of low significance constant in the mathematical formula. Residual values for all the countries have a normal distribution.

Example: Ethiopia is one of the analyzed countries where linear regression model $GR = 1091 \times GE + 1374.028$ confidently estimates public revenues thereafter. There is a strong correlation between the two variables. A unit increase in public expenditure of Ethiopia leads on average to a change in the same sense of public revenues by 1.091 monetary units.
variation of public revenues related to changes in the number of inhabitants. The coefficient of determination $R^2$ in Canada and Iceland show that over 90% of the variation of public revenues can be explained by changes in population size. The population is one of the key factors influencing the dependent variable, so the initial assumption is acceptable for them. The correlogram graphical representation for each country shows a linear trend in variation of the endogenous variable and exogenous variable, which justifies a simple linear regression model. Estimations of linear regression parameters was performed using the method of least squares and were subject to audit results.

**Box 1:** Government expenditures/Government revenues linear regression in Ethiopia.

All regression coefficients of the eight countries have been positive, indicating a direct association between changes in population and public revenues collected by state authorities. The econometric model’s check for each country was done using various tests. In order to detect errors’ autocorrelation according to 0.01 (two-tailed), $k = 1$ exogenous variable and 31 observed values, in Durbin Watson distribution table the two theoretical values are $d_1= 1.150$ and $d_2= 1.270$. By comparing the value “d” obtained with the two limits, for half of the cases the hypothesis is rejected, errors are autocorelate ($d < d_1$) and three countries achieved a high degree of positive autocorrelation of errors.
### Table 2. Population and government revenues model.

<table>
<thead>
<tr>
<th>Country</th>
<th>Durbin Watson Test</th>
<th>F test</th>
<th>Sig.</th>
<th>Simple linear regression ( y = ax + b )</th>
<th>Std. Error</th>
<th>Testul</th>
<th>Sig.</th>
<th>Parameter a (P)</th>
<th>GR =</th>
<th>P-</th>
<th>RSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>0,108</td>
<td>125,041</td>
<td>0,000</td>
<td>0,707</td>
<td>11,182</td>
<td>-8,788</td>
<td>0,000</td>
<td>0,707</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Botswana</td>
<td>0,110</td>
<td>96,781</td>
<td>0,000</td>
<td>2,992</td>
<td>9,838</td>
<td>-7,325</td>
<td>0,000</td>
<td>29,439</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Canada</td>
<td>0,610</td>
<td>1486,219</td>
<td>0,000</td>
<td>1,401</td>
<td>38,552</td>
<td>-29,359</td>
<td>0,000</td>
<td>54,025</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Etiopia</td>
<td>0,162</td>
<td>60,362</td>
<td>0,000</td>
<td>0,108</td>
<td>7,769</td>
<td>-5,546</td>
<td>0,000</td>
<td>0,841</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Islanda</td>
<td>0,384</td>
<td>1155,983</td>
<td>0,000</td>
<td>215,580</td>
<td>34,000</td>
<td>-29,535</td>
<td>0,000</td>
<td>7329,660</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Madagascar</td>
<td>1,767</td>
<td>26,397</td>
<td>0,000</td>
<td>48,430</td>
<td>5,138</td>
<td>-3,788</td>
<td>0,001</td>
<td>248,845</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Panama</td>
<td>0,212</td>
<td>97,313</td>
<td>0,000</td>
<td>0,304</td>
<td>9,865</td>
<td>-6,681</td>
<td>0,000</td>
<td>2,999</td>
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<td>Yes</td>
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<tr>
<td>Paraguay</td>
<td>2,962</td>
<td>27,321</td>
<td>0,000</td>
<td>622,385</td>
<td>5,227</td>
<td>-3,964</td>
<td>0,000</td>
<td>3253,178</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>

Source: Own calculations

Via “F” test was found that population explains the evolution of government revenues. In all eight cases there was achieved a “F” greater than 7.60, the degrees of freedom \( V_1 = 1 \) and \( V_2 = 31 \) and a significance level of 0.010, which means that the null hypothesis of F test is rejected. Although the significance level is 0.000 in all cases and is below the level of relevance 0.010,
values of F test are much lower than the values recorded for public spending. In this case, our econometric theory shows that at least one of the regression coefficients is statistically significant. But the population size is not a key causal factor of public revenue as public expenditure and gross domestic product are.

After verifying the significance of the econometric model parameters’ estimators with “t” test we found that in all cases P values of regression coefficients were near 0.000. Which means that estimates made using econometric models based on the population variable is not due to hazard, only in less than 1% of cases. Residual values for all the countries have a normal distribution.

Example: Canadian public revenues can be estimated using mathematical function GR (Government revenues) = 54.25 P (Population) -1,204,626.225. Between the two variables there is a strong connection. An increase in population of Canada with a person leads to a positive evolution of public revenues in this country by 54 monetary units.

Money supply: The amount of money in circulation in a country influences the amount of public revenue from national budgets? Initial hypothesis is that between money and government revenue is a direct connection of medium intensity. Analysis of the two variables was made on account of a series of data from the period 1980 - 2008 for a sample of eight countries: Bangladesh, Botswana, Canada, Ethiopia, Iceland, Madagascar, Panama, Paraguay.

The correlation between money and government revenue was quantified using Pearson’s coefficient. This coefficient takes values between 0.707 and 0.992 for the sample countries reflecting a great intensity of the two variables. Coefficient of determination R² calculated in these countries reveals that approximately 60-90% of the variation in public revenues can be explained by changes in money supply. Money is the explanatory variable of the public revenues, but not a decisive one, rather essential. Linear trend of variables for each country leads us to apply a simple linear regression model.

For these 8 countries the regression coefficients have registered positive values, indicating a direct connection between the exogenous variable, money supply, and endogenous variable, public revenue, the both evolving in one direction. In order to detect errors’ autocorrelation Durbin Watson test indicated a positive autocorrelation for six states and a negative errors’ autocorrelation for three countries. In the case of Madagascar and Paraguay errors are autocorelate, “d” value approaches 2.

Via the F-test it was shown that money partly explains government revenues in the analyzed countries. Although the significance is below of 0.010 in six countries, the probability that the predictions of this model are of poor accuracy is below 1%. “T” test for checking significance confirms the relevance of parameters in terms of statistics and the relevance of econometric model for Panama, Iceland, Canada and Botswana. Residual values for all the countries have a normal distribution, average value tends to zero.

Table 3. Money supply/Government revenues linear regression.
Table 4. Pearson coefficient summary.

<table>
<thead>
<tr>
<th>Country</th>
<th>Government expenditures</th>
<th>Population</th>
<th>Money supply</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pearson R2</td>
<td>Pearson R2</td>
<td>Pearson R2</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>0.996 0.992</td>
<td>0.901 0.812</td>
<td>0.990 0.981</td>
</tr>
<tr>
<td>Botswana</td>
<td>0.968 0.937</td>
<td>0.877 0.769</td>
<td>0.981 0.962</td>
</tr>
<tr>
<td>Canada</td>
<td>0.980 0.961</td>
<td>0.990 0.981</td>
<td>0.959 0.919</td>
</tr>
<tr>
<td>Etiopia</td>
<td>0.997 0.993</td>
<td>0.822 0.675</td>
<td>0.992 0.983</td>
</tr>
<tr>
<td>Iceland</td>
<td>0.976 0.952</td>
<td>0.988 0.976</td>
<td>0.894 0.799</td>
</tr>
<tr>
<td>Madagascar</td>
<td>0.795 0.632</td>
<td>0.690 0.477</td>
<td>0.753 0.568</td>
</tr>
<tr>
<td>Panama</td>
<td>0.977 0.954</td>
<td>0.878 0.770</td>
<td>0.977 0.954</td>
</tr>
<tr>
<td>Paraguay</td>
<td>0.996 0.991</td>
<td>0.696 0.485</td>
<td>0.707 0.500</td>
</tr>
</tbody>
</table>

Source: Own calculations

Table 4 shows a centralized situation of Pearson coefficients obtained in each case. For all sample countries we can say that public spending is a key determinant of government revenue. The evolution of the two indicators is directly proportional. Among the analyzed countries...
Madagascar stands, in which it was obtained the lowest correlation between expenditure and government revenue. As the amount of money in circulation is higher, the value of government revenue is increased, the two variables evolving in the same way. In the case of Paraguay and Madagascar previous statement no longer applies.

Regarding the relationship between evolution of citizens’ number and the evolution of public incomes two trends stand out: in developed countries (Canada, Iceland) correlation between the two variables has high intensity, while in developing countries (Ethiopia, Madagascar, Paraguay) it is met a low intensity.

CONCLUSIONS

All results can be summarized in the matrix table below. Horizontal can be found three exogenous variables ordered descending by intensity of correlation between them and government revenues. Orizontal can be seen the eight countries under review.

<table>
<thead>
<tr>
<th>Country</th>
<th>Government expenditures</th>
<th>Population</th>
<th>Money supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensity of relation by factor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bangladesh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botswana</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethiopia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iceland</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madagascar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panama</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paraguay</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The analysis undertaken in this paper allows us to divide the indicators in two categories. Among the determinants of public revenue are included public expenditures to be covered by state’s financial resources. Population and the amount of money in circulation or available to citizens are in the category of other key factors that influence variation of public revenues. In each country we can see which of the three factors present a higher level of influence on government revenues. There is no general rule for determining a uniform correlation. Take for example the case of Iceland. A research on three factors that determine government revenues in Iceland revealed that both public expenditure and the number of citizens can be classified as major factors of public revenues. Instead, in the case of Paraguay, Madagascar and Ethiopia variation number of people in these countries has a significant impact on the evolution of public revenues.

Based on the correlation and regression calculations made for 8 countries using data from 1980-2010, it can be concluded that the calculated results meet our expectations based on the
survey of the theoretical and empirical literature in the all cases of variables. General
government revenue growth seems to be very strong correlated with government expenditures,
correlation report value exceeds 0.900. So, the answer at the question from title is that all three
indicators are determinants of government revenues evolution and last two indicators’ intensity
may differ depending on the country.

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