Mega Publishing Limited
Bulletin of Applied Economics, 2017, 4(1), 35-45 | June 1, 2017

Determinants of the size of government in high-income countries

Minh Quang Dao[1]

Abstract

This paper empirically assesses the determinants of the share of government consumption in the GDP in high-income countries at two points in time, namely the year 2000 and 2014 while taking into consideration the major issue of potential simultaneity bias by introducing interaction variables. Based on data from the World Bank and using a sample of twenty-six high-income economies in 2000, we find that the share of government consumption in the GDP growth is dependent upon the log of population, its square, the log of the labor force, and interaction terms between the square of the log of the labor force and the log of population, between the log of the labor force and its square, and between the log of population and the log of the labor force. For the year 2014 and using a sample of forty-five high-income countries we find that the size of government as measured by the ratio of government consumption in the GDP is dependent upon the log of per capita gross national income, the log of the labor force, the log of population, the log of urbanization (measured as the share of the urban population in the total population), and the interaction terms between the log of per capita gross income and that of urbanization, the log of urbanization and that of the labor force, and between the log of urbanization and that of population. Statistical results of such empirical examination will contribute towards a better understanding of the determinants of the size of government in high-income economies. Data for all variables are from the *2016 World Development Indicators*. We specify and estimate a semi log and quadratic model and observe that some coefficient estimates do not have the expected sign due to possible collinearity among some independent variables.

JEL Classifications: O10, O12
Keywords: Government Consumption Expenditure, Per Capita Gross National Income, Urbanization, Labor Force, High-Income Countries.

1 Introduction

[1] Eastern Illinois University, USA

Article Info: *Received*: March 1, 2016. *Revised*: March 21, 2016
Published online: April 10, 2017

This paper develops a model that is used to empirically test the effect of various factors on the share of government consumption in the GDP in high-income economies. It is based on previous work by Dao (1994a) using data for both developing and developed countries. It also relies upon a subsequent study by Dao (2014) focusing primarily on upper-middle economies. The present paper synthesizes earlier work and uses two sets of high-income countries at two points in time, namely the year 2000 and 2014. It aims at examining which factors statistically influence the size of government and how their impact has changed over time.

We begin the next section by giving a review of the literature on the determinants of government expenditures. We then specify a model of the share of government expenditures in the national income. Empirical results are reported in Section 3. We then summarize the paper and give concluding remarks in a final section.

2 Literature Review

Wagner (1958) states that the share of the public sector in the national output tends to increase with the level of economic development. In his own words, this is due to "the pressure from social progress and the resulting changes in the relative spheres of private and public economy."[2] Graziani (1887) offers an explanation in terms of the response of government to citizens' preferences. For instance, economic growth in industrializing countries means that "basic" material needs are becoming widely satisfied, and less urgent wants, including government services, will become new arguments in the citizens' utility functions. Graziani recognizes that while population growth may call for an increase in national defense, advances in technology may improve the efficiency of the provision of defense over time and result in a reduction in the growth of government consumption.

Bird (1971) points out that "Wagner's Law" has no predictive power for the future even though it appears to be satisfied by some aspects of past reality. This is because of two reasons: first, most developed economies today are well beyond the stage for which Wagner's reasoning seems to be valid; and second, the "law" itself does not really contain a substantive theory but rather is more of a philosophical theme or speculation.

Abizadeh and Gray (1985) use pooled time-series, cross-section data for 53 countries grouped into poor, developing, and developed countries by means of a Physical Quality of Life Index to test "Wagner's law" and find that this law only applies to the developing group of countries, but not for the poor, nor for the developed group.

Musgrave and Musgrave (1976) put an emphasis on the increasing complementarity between both public and private consumer and capital goods associated with an increase in per capita income. The growth of the industrial sector requires complementary inputs of secondary and higher education and of transport systems such as railroads and highways.[3]

---

[2] Consult the relevant passages from A. Wagner in Richard A. Musgrave and Alan Peacock (eds.), Classics in the Theory of Public Finance, New York: Macmillan, pp. 1-16.

[3] This, of course, is based on the assumption that these complementary inputs generate externalities which require public intervention.

Dao (1994a) develops a model of per capita spending for government consumption based on the assumption that the voter with average income is decisive. He shows that urbanization positively impacts public spending and that population density is not a good empirical proxy for interdependencies arising from the economic development process. He also derives a model of the size of government and tests it using data from a set of 105 countries. He finds that the share of government consumption in the GDP varies positively with the relative price of public sector output, which suggests a price-inelastic demand for government services, and that Wagner's law of expanding state activity is refuted by empirical evidence. The provision of these services may or may not exhibit economies of scale depending on the degree of publicness in government consumption.

Dao (1994b) uses the co-integration technique to test Wagner's law using data for the 1950-85 period for a sample of seven industrialized countries and finds weak empirical support for this law. This is probably due to two factors: one, the size of government may be a function of other factors besides per capita income; and two, there is the possibility of simultaneity bias as the growth of government consumption, viewed as an input in the production of private goods, also leads to higher per capita income.

Dao and Esfahani (1999) develop a competitive model of the size of government which implies that changes in the composition and the mobility of productive assets should be emphasized as important determinants of the size of government. They use the share of population over 65 years of age, the share of population 25 years and older with a high school or higher degree, the average rainfall in the wettest month of the yea, and the available agricultural land per capita as reasonable main explanatory variables.

The present study is aimed specifically at the identification of those factors which are important in explaining differences in the share of government consumption in the GDP among high-income countries.

3 A model of the size of government

In deriving the share of government consumption in the GDP equation we shall make use of the model developed by Dao (1994), which is as follows:

$$G/Y = \beta_0 + \beta_1 \log Y_{pc} + \beta_2 \log U + \beta_3 \log P \qquad (1)$$

where G is government consumption expenditures, P is population; Y_{pc} denotes *per capita* income, and U the level of urbanization.

We also wish to incorporate the effect of the size of the labor force on the size of government, following Dao (2014) and hence our statistical model becomes:

$$G/Y = \beta_0 + \beta_1 \log Y_{pc} + \beta_2 \log U + \beta_3 \log P + \beta_4 \log L \qquad (2)$$

where L denotes labor force, and all other variables as previously defined.
Finally, we include the square of all explanatory variables to complete the statistical model, which is as follows:

$$G/Y = \beta_0 + \beta_1 \log Y_{pc} + \beta_2 \log U + \beta_3 \log P + \beta_4 \log L + \beta_5 (\log L)^2 + \beta_6 (\log P)^2 + \beta_7 (\log U)^2 + \beta_8 (\log Y_{pc})^2 \qquad (3)$$

The inclusion of the level of urbanization implies that voters fully recognize the need for government action in addressing market failures in urbanized countries. As the population becomes more urbanized, there is a tendency for increased friction among its residents. As a result, there is the potential for higher levels of criminal activity and hence a need for an increase in police protection. Urbanization also may lead to inefficiency in the allocation of resources arising from the production and/or consumption of certain private goods. More urbanized economies have been increasingly concerned about problems related to public health, the ecological system, public safety, sanitation, and traffic congestion. Correcting these market failures may require government intervention. This is precisely the argument provided by Wagner (1958) when he expounds the law of expanding state activity[4]. Borcherding (1977), on the other hand, found that empirical research had not produced any evidence of a statistically significant relationship between urbanization and the level of public expenditures.

The inclusion of per capita gross national income stems from the theoretical explanation that if the income elasticity of expenditures on government consumption is greater than one then economically more developed economies spend a larger proportion of their GDP on government consumption.

The impact of population size on the share of government consumption in the GDP depends on the combined effect of three determinants: the price elasticity of the demand for government services, the degree of publicness in the consumption of these services, and whether or not their provision is subject to economies of scale. If, for example, the bulk of government services has characteristics of private goods, the demand for these services is price-inelastic, and their production is subject to rising per unit costs, then those countries that have large populations tend to have larger government sectors. On the other hand, if the provision of government services exhibit scale economies, then depending on the price elasticity of the demand for them, countries that have large populations may end up having relatively smaller public sectors. In addition, if the tax share of the decisive voter is 1/P then residents in countries with large populations may perceive that their tax burden is lower and, as a result, ceteris paribus, may demand a higher level of government spending. Data for all variables are from the *2016 World Development Indicators.*

4 Empirical Results

Table 1 gives least-squares estimates of regression coefficients in the share of government consumption in the GDP equation for a sample of twenty-five high-income countries[5]. The data year is 2000.

[4] Wagner (1958) supports his position by referring to both internal and external law enforcement, state participation in material production, and public provision of certain economic and social services such as public health and education, among others.

[5] The sample consists of the following countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Kuwait, the Netherlands, New Zealand, Norway, Portugal, Singapore, Slovenia, Spain, Sweden, Switzerland, United Kingdom, and the United States.

Table 1: Regression Results (Original Model): 2000

	Coefficient Estimates	*t-Statistics*
Intercept	-602.956	-0.642
lnLabor00sq	2.006	0.459
lnGNIpc00sq	-2.303	-0.306
LNpop00	21.532	0.819
lnUrb00	175.924	0.641
lnpop00sq	-2.233	-0.489
lnUrb00sq	-20.187	-0.635
lnGNIpc00	45.596	0.304
lnLabor00	-18.091	-0.899

$R^2 = 0.210$

The goodness of fit of the model to the data is not very good as indicated by the low value of 0.210 of the coefficient of determination. We observe that only none of the explanatory variables is statistically significant. Since the log of per capita GNI and its square do not seem to explain cross-country variations in the size of government, we drop this variable and re-estimate the model[6]. Results of this regression are reported in Table 2. We note that the goodness of fit of the model of the model is improved as shown by the higher value of 0.251 of the coefficient of determination. The log of the labor force variable is now significant at the 5 percent level. Using a backward stepwise elimination process we arrive at a revised model the results of which are presented in Table 3. We observe that in addition to the log of the labor force variable, the log of population variable is now significant at the 5 percent level, while the square of the latter variable is also significant at the 10 percent level. Population exerts a positive influence on the size of government, implying that in high-income economies it may be the case that the bulk of government services has characteristics of private goods and that the demand for these services tends to be price-inelastic, and that their production is subject to rising per unit costs.

Table 2: Regression Results (Per capita GNI omitted)

	Coefficient Estimates	*t-Statistics*
Intercept	-151.666	-0.277
lnLabor00sq	4.876	1.170
LNpop00	42.948	1.832
lnUrb00	64.746	0.254
lnpop00sq	-5.444	-1.261
lnUrb00sq	-7.416	-0.251
lnLabor00	-33.052	-1.843*

$R^2 = 0.251$

*Significant at the 5 percent level.

[6] We are able to include the United Arab Emirates in the sample as data on per capita GNI for this country was not readily available for the year 2000. The sample size thus is now 26, instead of 25.

Table 3: Regression Results (Revised Model)

	Coefficient Estimates	*t-Statistics*
Intercept	-10.735	-0.771
lnLabor00sq	4.904	1.258
LNpop00	42.671	1.956*
lnpop00sq	-5.533	-1.365**
lnLabor00	-32.263	-1.976*

$R^2 = 0.246$

*Significant at the 5 percent level.

We test for the presence of multicollinearity by running a correlation analysis of the four explanatory variables. Results of this test are reported in Table 4 in the form of a sample correlation coefficient matrix. We then proceed to re-estimate the model while including interaction terms in order to account for the possibility of simultaneity bias. Results of this regression are presented in Table 5.

Table 4: Sample correlation coefficient matrix

	lnLabor00sq	*LNpop00*	*lnLabor00*	*lnpop00sq*
lnLabor00sq	1			
LNpop00	0.951	1		
	15.009			
lnLabor00	0.956	0.998	1	
	15.971	**73.383**		
lnpop00sq	0.995	0.975	0.976	1
	46.984	**21.521**	**21.965**	

*Bold t-statistics imply statistical significance at the 10 percent or lower level

Table 5: Regression Results (with Interaction Terms)

	Coefficient Estimates	*t-Statistics*
Intercept	-405.811	-0.861
lnLabor00sq	-1977.186	-0.750
LNpop00	1589.076	0.821
lnLabor00	-1547.677	-0.796
lnpop00sq	-2032.590	-0.776
LnLabsqlnpop00	2689.609	0.769
LnLabLabsq00	-904.186	-0.775
Lnlabsqpopsq00	0.103	0.410
LnpopLnlab00	4004.228	0.762
LnpopLnpopsq00	894.396	0.769
LnlabLnpopsq00	-2680.900	-0.767

$R^2 = 0.363$

We note that the explanatory power of the model is increased as attested to by the higher value of 0.363 of the coefficient of determination. However, none of the explanatory variables seems to be statistically significant. Using a backward stepwise elimination process we arrive at a revised model the results of which are presented in Table 6.

Table 6: Regression Results (Revised Model with Interaction Terms)

	Coefficient Estimates	*t-Statistics*
Intercept	-69.426	-1.535
LNpop00	163.321	1.843*
lnLabor00	-112.470	-1.996*
lnpop00sq	-57.744	-1.612**
LnLabsqlnpop00	13.879	1.265
LnLabLabsq00	-13.791	-1.284
LnpopLnlab00	47.084	1.715**

$R^2 = 0.327$

*Significant at the 5 percent level.

**Significant at the 10 percent level.

The log of population exerts a positive impact on the size of government in high-income countries in 2000 while its square on the other hand negatively influences the share of government consumption in the national income. The log of labor force continues to have a negative effect on the size of government while the interaction term between population and the size of the labor force positively impacts the ratio of government consumption to gross domestic product.

We next re-estimate the model using data from a sample of forty-five high-income economies for the year 2014[7]. Results of the regression without interaction terms are presented in Table 7. We observe that the goodness of fit of the model is quite good as indicated by the value of 0.409 of the coefficient of determination. We speculate that this could partly be attributable to the fact that we have a much larger sample of high-income countries (45 in 2014 vs. 26 in 2000). Both the log of the size of the labor force and that of population are highly statistically significant at the 1 percent or lower level. In 2014, with the inclusion of 19 additional high-income economies, we note that the influence of population on the size of government continues to be positive, implying that the bulk of government consumption in these countries has characteristics of private goods, that the demand for public sector services is price-inelastic, and that the production of these services exhibits rising average costs. High-income countries tend to have larger government sectors, other things being equal.

[7] The sample consists of the following countries: Argentina, Australia, Austria, Bahrain, Belgium, Canada, Chile, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, Republic of Korea, Kuwait, Latvia, Lithuania, the Netherlands, New Zealand, Norway, Oman, Poland, Portugal, Qatar, Russian Federation, Saudi Arabia, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Trinidad and Tobago, United Arab Emirates, United Kingdom, United States, and Uruguay.

Table 7: Regression Results (Original Model): 2014

	Coefficient Estimates	*t-Statistics*
Intercept	-62.269	-0.314
lnLabor14sq	1.403	0.549
lnGNIpc14sq	-0.150	-0.082
lnGNIpc14	5.454	0.143
lnLabor14	-30.201	-2.818*
LnUrban14	8.332	0.592
LnPop15	32.307	2.440**
lnUrb14sq	-0.861	-0.423
lnPop15sq	-1.490	-0.592

$R^2 = 0.409$

*Significant at the 0.5 percent level.

**Significant at the 1 percent level.

Using a backward stepwise elimination process we arrive at a revised model the results of which are presented in Table 8. We observe that in addition to the log of the size of the labor force and that of population, the log of per capita gross national income and that of urbanization are now statistically significant. All else equal, a one percent increase in per capita gross national income is expected to lead to an increase of 2.2 percentage points in the share of government consumption in the GDP among high-income economies in the year 2014. This result seems to support the view that more developed economies tend to spend a larger proportion of their GDP on government consumption, implying that the income elasticity of public expenditures is greater than one.

Table 8: Regression Results (Revised Model)

	Coefficient Estimates	*t-Statistics*
Intercept	-31.812	-2.434
lnGNIpc14	2.214	2.159**
lnLabor14	-26.611	-4.826*
LnUrban14	2.379	1.481***
LnPop15	26.339	4.874*

$R^2 = 0.396$

*Significant at the 0.5 percent level.

**Significant at the 2.5 percent level.

***Significant at the 10 percent level.

We again test for the presence of multicollinearity by performing a correlation analysis of the four explanatory variables and present the results in Table 9 in the form of a sample correlation coefficient matrix. We next re-estimate the model while including interaction terms and report the results in Table 10. The goodness of fit of the model again is higher than when interaction terms.

Table 9: Sample correlation coefficient matrix

	lnGNIpc14	*lnLabor14*	*LnPop15*	*LnUrban14*
lnGNIpc14	1			
lnLabor14	0.143208435	1		
	0.949			
LnPop15	0.110613339	0.996930266	1	
	0.730	**83.496**		
LnUrban14	0.296843023	0.289751569	0.27565934	1
	2.038	**1.985**	**1.880**	

*Bold t-statistics imply statistical significance at the 10 percent or lower level

Table 10: Regression Results (With Interaction Terms)

	Coefficient Estimates	*t-Statistics*
Intercept	806.105	2.192
lnGNIpc14	-62.325	-2.066*
lnLabor14	267.046	1.546***
LnPop15	-252.462	-1.488***
LnUrban14	-189.599	-2.255*
lnGNIpcLnUrb	14.810	2.147*
LnLaborLnpop	0.010	0.037
LnUrbLnLab	-66.890	-1.709**
LnUrbLnPop	63.471	1.655***

$R^2 = 0.479$

*Significant at the 2.5 percent level.

**Significant at the 5 percent level.

***Significant at the 10 percent level.

are not included. All except for one variables are statistically significant. We note, however, that the log of per capita GNI now exerts a negative influence on the size of government while its interaction with the log of urbanization positively affects the ratio of government consumption to the GDP. This result is consistent with the need for government intervention to correct market failures that are associated with urbanization such as higher levels of criminal activity and problems related to public health, the environment, public safety, sanitation, and traffic congestion, as argued by Wagner (1958) when he expounds the law of expanding state activity. We also observe that the inclusion of interaction terms results in a negative impact of population on the size of government. Again, it is the interaction between population and urbanization that calls for a larger government sector in high-income economies in 2014. The inclusion of the interaction term between the log of the size of the labor force and that of urbanization results in a positive influence of the size of the labor force on the ratio of government consumption to the GDP.

5 Conclusion

In this paper we develop a model of the size of government based on two previous studies by Dao (1994a, 2014) and test it using two sets of high-income economies at two different points in time, namely 2000 and 2014. To account for the collinearity among explanatory variables we include interaction terms and find that such inclusion leads to better econometric results. For the year 2000, we use data from a sample of twenty-six high-income economies to empirically analyze the effect of per capita GNI, population, size of the labor force, and urbanization on the size of government. For the year 2014, we use a data set that involves forty-five high-income countries. Regression results show the following:

1. The regression results show unequivocally that the share of government consumption in the GDP not only is dependent on the log of population and that of the size of the labor force but also on interaction terms between these two variables in both samples of high-income countries examined in this study.
2. They also point out the important role of urbanization and the level of development as measured by per capita GNI in influencing the size of government, but only in the more recent sample, namely in 2014. Wagner's law of expanding state activity needs to be modified as it is the combined effect of per capita income and urbanization that leads to larger government sectors in high-income economies.
3. This is also true with respect to the impact of population size on the ratio of government consumption to the GDP. It is the combined effect of large populations and high degrees of urbanization that can lead to larger government sizes in high-income countries. Such countries with small populations and high levels of urbanization tend to have smaller government sectors (e.g., Singapore, Switzerland, United Arab Emirates, and Uruguay). The same holds for countries with small populations and low levels of urbanization, such as Trinidad and Tobago.

Acknowledgment: I would like to thank Thi Minh Chi Le for her support in the completion of this paper.

References

Abizadeh, S and Gray, J (1985), "Wagner's Law: A Pooled Time Series, Cross-Section Comparison", National Tax Journal, Vol. 8, No. 2 (June), pp. 209-18.

Bird, RM (1971), "Wagner's 'Law' of Expanding State Activity," Public Finance, Vol. 26, No. 1 (January), pp. 1-26.

Borcherding, TE (1977), "The Sources of Growth of Public Expenditures in the United States, 1902-1970," in Borcherding, TE (ed.) Budgets and Bureaucrats: The Sources of Government Growth, Durham, N.C.: Duke University Press.

Dao, M Q (1994a), "Determinants of the Size of Government," Journal for Studies in Economics and Econometrics, Vol. 18, No. 2, pp. 1-14.

_____ (1994b), "Government Consumption, Economic Growth and Co-integration: An Empirical Test of Wagner's Law," Studi Economici. No. 53, 1994/2, pp. 55-65.

_____ (2014), "Exports, Imports, Government Consumption and Economic Growth in Upper-Middle Income Countries", Progress in Development Studies, Vol. 14, Issue 2, pp. 197-204.

Dao, MQ and Esfahani, HS (1999), "Tests of a Competitive Model of the Size and Growth of Government", Journal of Economic Studies, Vol. 26, No. 3 (June), pp. 209-220.

Graziani, A (1887), *Intorno all'aumento progressive delle spese publiche*, Modena.

Musgrave, RA and Musgrave, P (1976), Public Finance in Theory and Practice, New York, NY: McGraw-Hill.

Wagner, A (1958), "Three Extracts on Public Finance," in Musgrave, RA and Peacock, AT, editors, Classics in the Theory of Public Finance.

World Bank (2016), World Development Indicators 2016. World Bank, Washington, DC.