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Human Capital Accumulation and Public Sector Growth

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Abstract

The present paper takes a fresh theoretical and empirical look into the relationship between Wagner's law and economic development. It introduces human capital into a classic two-sector model of unbalanced growth. It shows that, as an economy develops, changes in the relative returns to human capital and unskilled labor, as a result of changes to their relative scarcities, could have a significant impact on the size of the government sector, depending in part also on the difference in relative factor intensities between outputs of the private and government sectors. This conjecture is broadly supported by empirical evidence based on a cross-section analysis of a large sample of developed and developing countries.

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Contents

Summary

This paper takes a fresh theoretical and empirical look at the relationship between Wagner's law and economic development. It introduces human capital into a classic two-sector model of unbalanced growth and investigates the role this variable plays in determining the relative sizes of the private and government sectors over time.

It shows that, as an economy develops, changes in the relative returns to human capital and unskilled labor, as a result of changes to their relative scarcities, could have a significant impact on the size of the government sector, depending in part on the difference in relative factor intensities between the outputs of the two sectors. Specifically, as human capital accumulates with rising income, the average cost of government employees falls as a share of GDP, thus compensating for the lower productivity growth in this sector than in the private sector. The principal insight obtained from the analysis is that the validity of Wagner's law is income dependent.

The above theoretical conjecture receives broad support from the data on a number of alternative measures of the size of the government sector in a large sample of industrial and developing countries. They persuasively suggest that Wagner's law tends to hold for low- to middle-income countries, but not for high-income countries. These results imply that the government share of national income in the richer countries might witness a declining trend in the future.

I. Introduction

The relationship between a country's economic development and its government expenditure (*g*) expressed as a share of its gross domestic output (GDP) has been the subject of empirical investigation in the past of a vast body of literature over the past several decades. Starting with the work of Adolph Wagner, many economists have hypothesized that such a relationship should be a positive one. This positive relationship has come to be called Wagner's law. Unfortunately and, perhaps, not surprisingly, the empirical results have been inconclusive. 1/

In one of the most comprehensive efforts to date in testing the validity of Wagner's law, an effort covering a sample of 115 countries and using the well-known Summers and Heston (1984) per capita income data set, Ram (1987) found mixed support for Wagner's law when he used time-series data and no support when he used cross-section data. Moreover, his results were sensitive to the choice of sample period and sample composition. The generally nonrobust relationship between per capita income (*y*), used as a proxy for economic development, and *g* seems to accord well with Musgrave's (1969) earlier observation that (in addition to *y*) factors such as changes in technology and population, as well as cultural, political, and social characteristics, could be important determinants of government expenditure growth.

While the inevitably complex interactions among the factors noted by Musgrave may well suggest that the empirical unscrambling of their individual influences is likely to be extremely difficult if not impossible, it is reasonable to expect that the total impact of such factors on government expenditure would be broadly similar in countries at not too divergent levels of economic development. In other words, in testing the empirical validity of Wagner's law, using cross-section data, some grouping of the countries (on the basis of their levels of development) would seem to be desirable. Indeed, Musgrave (1969) himself stated (without presenting formal results) that the positive relationship between *y* and *g*, as implied by Wagner's law, broke down for low income countries and actually turned negative for high income countries.

In a similar vein, Gandhi's (1971) empirical investigation discovered that the support for Wagner's law found by some researchers, based on country samples covering both developed and developing countries, disappeared when only developing countries were included in the samples. 2/ The already mentioned study by Ram (1987) failed to provide support for Wagner's law when groups of developed and developing countries were taken separately.

1/ See Mueller (1989) for a review.

2/ In fact, Wagner's law is also not supported by cross-section evidence from developed countries.

II. An Alternative Hypothesis

The present paper takes a fresh theoretical and empirical look into the relationship between Wagner's law and economic development. The point of departure for our analytical framework is Baumol's (1967) two-sector macroeconomic model of unbalanced growth, which since its publication has been the most influential and widely used paradigm to underpin Wagner's law with a theoretical foundation (see Lybeck (1988)).

Baumol described an economy comprising a sector with positive productivity growth (the progressive sector), and a sector with no productivity growth (the stagnant sector). In the context of evaluating Wagner's law, the progressive sector could be taken to represent the private sector, and the stagnant sector the government sector. Economy-wide wages are, however, determined by the private sector's wage level. Hence, the unit cost of output of the government sector tends to rise over time. Furthermore, "if despite the change in their relative costs and prices the magnitude of the relative outputs of the two sectors were maintained, perhaps.....[because] demand for the product in question were sufficiently price inelastic or income elastic.....[then] more and more of the total labor force must be transferred to the [stagnant] sector.....[which] must lead to a declining rate of growth [of total output in the economy] relative to the rate of growth of the labor force" (Baumol (1967; pp. 418-19)). In other words, if the relative output of the government sector is not allowed to fall even as its unit cost rises, then g would rise over time. 1/

The Baumol model contains a single factor of production, undifferentiated labor (L). To study adequately the relationship between g and y, however, it seems important to incorporate into the analysis the effects of a second factor of production, human capital (H). Human capital has been shown to be an important explanatory variable for economic growth in the recent growth literature. Its relevance in the present context is suggested by the fact that the scarcity of H relative to L tends to fall as y rises. As an economy develops, changes in the relative returns to H and L, as a result of changes to their relative scarcities, could, therefore, have a significant impact on the behavior of g, depending in part also on the difference in relative factor intensities between outputs of the private and government sectors. Putting it differently, as countries develop, the relative wage of government employees, which is largely influenced by the relative scarcity of human capital, would fall with respect to the countries' per capita income, thus reducing the cost of public sector activities as a share of GDP.

1/ Similar implications of the Baumol model as applied to the progressive and stagnant service sectors in an economy are discussed in Baumol, Blackman, and Wolff (1985).

If, as it seems likely especially at low per capita income levels, the government sector, on average, is more H intensive than the private sector, then an accumulation in H would confer, all other things constant, some implicit productivity growth (or reduction in the unit cost of output) to this sector relative to the private sector. At low levels of y, however, the growth rate in H, relative to that in L, would tend to be low, so that this effect might not be sufficient to fully counter the explicit productivity growth in the private sector. Hence, the outcome of the Baumol model, and thus Wagner's law, is likely to prevail. In other words, over some range of low values for y, the unit cost of output in the government sector would rise with y, on account of the relatively high returns to the scarce factor H it uses more intensively.

As a country becomes richer, the rate of accumulation of H tends to increase relative to L. The relative wage of more educated people, who are the ones more frequently hired by the government sector, falls as they become more abundant. At some high levels of y, the rate of accumulation of H might well overtake that of L. As a consequence, the relative returns to H could fall, or alternatively the implied productivity growth through H in the government sector could rise, sufficiently so that g may actually fall with a rising y over some range of high per capita income levels. Should this occur, the outcome of the Baumol model would be reversed and Wagner's law negated.

How well the above line of reasoning accords with reality is clearly an empirical question. Some strong but indirect support for the hypothesis advanced in this paper is provided by Heller and Tait (1984) on international comparisons of government employment and pay. As these authors put it: "Whereas in the OECD countries the government average wage is approximately 1.7 times the per capita income, in the developing countries it is approximately 4.4 times that income 1/.....Some of the differences between the developed and developing countries.....may reflect the high educational requirements associated with public sector employment and the relative scarcity value of educated workers" (p. 17).

The intuition discussed above is developed analytically in the following section based on an extension of the Baumol model. In Section IV, we present new empirical results which strongly suggest that government expenditure shares and per capita income levels are positively related at low per capita income levels, but such a relationship turns negative at high per capita income levels. These results also suggest the potentially important impact of the accumulation of human capital on the behavior of government expenditure shares in cross-section country data.

1/ The authors also found that, broadly speaking, the more advanced countries or regions within each of the OECD and developing country groupings had lower relative public sector wages: 1.5 in Sweden and Canada compared to 2.5 in Ireland; 1.2 in Singapore compared to 15.1 in Burundi; and 2.9 in Asia and Latin America compared to 6.1 in Africa.

III. Analytical Framework

A minimum extension of Baumol's two-sector model that would be useful in analyzing the aspects of Wagner's law discussed in the preceding section is the addition of a second factor of production. The presence of a second factor in the model allows the introduction of a difference in the intensity in the use of this factor between the two sectors of an economy and hence the generation of a potential countervailing force which could compensate for any difference in the rates of explicit productivity growth between the two sectors. A natural candidate for this second factor is human capital, whose rate of accumulation tends to be positively related to income. 1/ To maintain a close resemblance to the original Baumol model, we have attempted to retain as many structural features of that model as possible.

The economy is assumed to have two sectors: a government (Baumol's stagnant) sector (sector 1) which experiences no productivity growth, and a private (Baumol's progressive) sector (sector 2) which experiences productivity growth at a constant rate r. At any given time t, the output (Y) of each sector is produced by a Cobb-Douglas technology employing both labor (L) and human capital (H). For simplicity, assume that H takes a disembodied form representing, for example, the general education level of the labor force which benefits both sectors in a nonrivalrous and nonexcludable manner. The production functions of the two sectors can then be written as

(1) $$Y_{1t} = \alpha \cdot H_t^{\delta} \cdot L_{1t}^{1-\delta}, \quad 1 > \delta > 0, \quad \alpha > 0, \text{ and}$$

(2) $$Y_{2t} = \beta_t \cdot H_t^{\theta} \cdot L_{2t}^{1-\theta}, \quad 1 > \theta > 0,$$

where δ and θ are, respectively, the human capital intensities of sector 1 and sector 2, and

(3) $$\beta_t = e^{r \cdot t},$$

with β_0 initialized at unity. If human capital accumulates at a constant rate ρ, then

(4) $$H_t = e^{\rho \cdot t},$$

1/ The accumulation of physical capital also tends to correlate positively with income. However, choosing human over physical capital as the second factor of production, in addition to its conceptual relevance, simplifies substantially the analytics of the model by abstracting from the need to consider the determination of intersectoral allocations of capital in addition to that of labor, since human capital could take the form of a public good (see below). Also, there is no presumption that the government sector is more physical-capital intensive than the private sector.

with H_0 also initialized at unity. Note that this formulation implies that both sectors experience some (but possibly unequal) productivity growth stemming from human capital accumulation as a public good.

The marginal products of labor (w) in the two sectors are given by

(5) $w_{1t} = (1 - \delta)\cdot Y_{1t}/L_{1t}$ and

(6) $w_{2t} = (1 - \theta)\cdot Y_{2t}/L_{2t}$.

Time-differentiating equation (6), the rate of change in the marginal product of labor in sector 2 is

(7) $\dot{w}_{2t}/w_{2t} = r + \theta\cdot(\rho - \dot{L}_{2t}/L_{2t})$,

where a dot over a variable denotes its time derivative.

Following Baumol, suppose that the economy-wide wage rate (W) is set equal to the marginal product of labor in sector 2:

(8) $W_t = w_{2t}$.

Furthermore, assume that at some initial time $t = 0$ the allocation of labor between the two sectors is such that their marginal products of labor are equal:

(9) $W_0 = w_{10} = w_{20}$.

Then, by equation (7), the wage rate for both sectors will grow according to

(10) $W_t = W_0\cdot exp\{[r + \theta\cdot(\rho - \dot{L}_{2t}/L_{2t})]\cdot t\}$.

The unit cost (C) of sector 2's output is constant over time, since from equations (6) and (8) it can be seen that

(11) $C_{2t} = W_t\cdot L_{2t}/Y_{2t} = (1 - \theta)$.

For sector 1's output, however, its unit cost

(12) $C_{1t} = W_t\cdot L_{1t}/Y_{1t}$

may grow, stay constant, or decline over time, depending on the relative magnitudes of the various parameters of the model. To ascertain its behavior, time-differentiate equation (1) to obtain the growth rate of sector 1's output as

(13) $\dot{Y}_{1t}/Y_{1t} = \delta\cdot\rho + (1 - \delta)\cdot\dot{L}_{1t}/L_{1t}$.

Hence, substituting equations (10) and (13) into equation (12), the unit cost of sector 1's output can be stated as

$$(14) \qquad C_{1t} = \frac{L_{1t} \cdot W_0 \cdot exp([r + \theta \cdot (\rho - \dot{L}_{2t}/L_{2t})] \cdot t)}{Y_{10} \cdot exp([\delta \cdot \rho + (1 - \delta) \cdot \dot{L}_{1t}/L_{1t}] \cdot t)}.$$

The behavior of C_{1t} would become tractable if some assumptions on the demand side were stipulated. Suppose, as in the Baumol model, the demand elasticities for both outputs are unitary. Then the ratio of outlays on them would be a constant:

$$(15) \qquad \frac{C_{1t} \cdot Y_{1t}}{C_{2t} \cdot Y_{2t}} = \frac{W_t \cdot L_{1t}}{W_t \cdot L_{2t}} = \frac{L_{1t}}{L_{2t}} = A,$$

where A is some constant. This implies that the proportions of the labor force distributed between the two sectors are fixed over time. If the total labor force grows at the constant rate n, then employment in both sectors would also grow at this same rate:

$$(16) \qquad \dot{L}_{1t}/L_{1t} = \dot{L}_{2t}/L_{2t} = n.$$

Substituting equations (5) and (16) into equation (14) yields

$$(17) \qquad C_{1t} = \frac{(1 - \delta) \cdot exp([n + r + \theta \cdot (\rho - n)] \cdot t)}{exp([\delta \cdot \rho + (1 - \delta) \cdot n] \cdot t)}.$$

Hence, whether the unit cost of sector 1's output rises or falls over time can be immediately determined from equation (17):

$$(18) \qquad \dot{C}_{1t}/C_{1t} \gtrless 0 \text{ as } (\delta - \theta) \cdot (n - \rho) + r \gtrless 0.$$

It is clear from equation (18) that the basic proposition of Baumol's unbalanced growth model, that is, the unit cost of output of the government sector will rise without limit over time, is automatically satisfied only if $(\delta - \theta)$ and $(n - \rho)$ have the <u>same</u> sign. For example, if the human capital *intensity in sector 1 is higher than that in sector 2, then its unit output* cost will rise only if the growth rate of the labor force is also higher than that of human capital. Sector 1's unit output cost <u>may</u> fall, however, if $(\delta - \theta)$ and $(n - \rho)$ have opposite signs.

In most countries, and particularly in poorer countries, it can be argued that the government sector is more human-capital intensive than the private sector, that is, $\delta > \theta$. 1/ However, in low income countries, the growth in total labor force tends to exceed that in human capital, that is $n > \rho$. For this reason, the unit cost of the output of the government sector rises over time with income, thus supporting Wagner's law. In contrast, the rate of human capital accumulation tends to exceed total labor force growth in high income countries, that is, $n < \rho$. In this case, the unit cost of government output will fall, thus invalidating Wagner's law, if ρ exceeds n by more than the ratio of the productivity growth in the nongovernment sector to the difference in the human-capital intensities between the two sectors. Specifically,

(19) $$\dot{C}_{1t}/C_{1t} < 0 \text{ as } \rho - n > r/(\delta - \theta).$$

Hence, the present augmented model of unbalanced growth is capable of providing a consistent explanation of the possible change in the relationship between government expenditure shares and per capita income levels as one moves from low to high ranges of per capita income.

IV. Empirical Evidence

A new cross-section analysis of Wagner's law in relation to particular country income groupings is presented in this paper using the most recent data from the Government Finance Statistics and the World Economic Outlook, both collected by the International Monetary Fund. An ordinary least square procedure is employed to estimate three variants of the following equation:

$$ln(g) = a + b \cdot ln(y) + u,$$

where g (expressed as a share of GDP) is either (1) total government wage expenditure; (2) total "exhaustive" (or resource-using) government expenditure (i.e., total government expenditure less cash subsidies and current transfers); or (3) total government expenditure; y is real per capita GDP, and u is the error term. The entire sample consists of 94 countries, although for the exhaustive government expenditure variant of the equation, the constraint on data availability relating to subsidies and current transfers reduces the sample size to 58 countries. The estimation is performed on data averaged for the 1986-90 period. The regression results are reported in the Table.

1/ As noted earlier, the term "human capital" in the present model is used to denote the general education level of the labor force, and not the level of job-specific labor skills. On average, the general education level of a worker in the government sector tends to be higher than that of a worker in the private sector in most countries but especially in poor countries.

Table. Cross-Section Elasticities of Alternative Measures of Government Expenditure as a Share of GDP with Respect to Real GDP Per Capita, 1986-90 Period Average Data

Dependent Variable	All Countries	Real GDP Per Capita 1/ High	Real GDP Per Capita 1/ Middle-Low
Government wage expenditure	0.018	-0.875 a/	0.173 a/
	(0.51)	(-2.89)	(3.19)
Sample size	94	23	71
Government exhaustive expenditure 2/	-0.061 b/	-0.521 a/	0.041
	(-2.03)	(-3.04)	(0.68)
Sample size	58	20	38
Government total expenditure	0.082 a/	-0.159	0.082 b/
	(3.56)	(-0.87)	(2.04)
Sample size	94	23	71

Sources: International Monetary Fund: Government Finance Statistics and World Economic Outlook.

1/ In U.S. dollars (high: > 6,000; middle-low: ≤ 6,000).
2/ Government total expenditure less subsidies and current transfers.

a/ Statistically significant at the 1 percent level.
b/ Statistically significant at the 5 percent level.

Note: t ratios are in parentheses.

Among the three variants of government expenditure estimated, one would expect a priori that the wage expenditure variant, being the most relevant to the theoretical considerations discussed in the preceding sections, would provide the best empirical support to our argument. It is evident from the Table that this is in fact the case. The estimated elasticity of government wage expenditure share with respect to real GDP per capita is positive and statistically significant for middle-low income countries (thus supporting Wagner's law), but is negative and statistically significant for high income countries (thus rejecting Wagner's law). However, when the two country groups are combined, the statistical significance of the relationship between government wage expenditure and real GDP per capita disappears.

While the regression results based on the other two expenditure variants are less clear cut, it is indeed remarkable that the signs of the estimated elasticities of all three measures of government expenditure are the same under each country income grouping--negative for high income countries and positive for middle-low income countries. This strongly suggests that the validity of Wagner's law is highly income-dependent, that is, when one moves across the income spectrum from middle-low to high per capita income countries, the influence of factors which are positively correlated with income levels seems to dominate first, but is then overtaken by the influence of factors which bear a negative correlation to income at high income levels. We have argued that accumulation of human capital as reflected by increasing educational achievements of the population is an important factor.

The findings reported in the Table suggest that tests of Wagner's law based on cross-section country data can be misleading if countries are not appropriately grouped. Hence, these findings are in partial accordance with Musgrave's (1969) and Gandhi's (1971) findings noted earlier concerning the importance of income levels for the validity of Wagner's law. However, these earlier researchers had concluded that Wagner's law actually did not hold for developing countries. In contrast, the present investigation has provided strong evidence that exactly the reverse seems to be true.

V. Concluding Remarks

This paper has re-examined the question of whether there is an inevitable rise of the public sector as a share of national income as hypothesized a century ago by Adolph Wagner and treated rigorously more recently in an influential article by William Baumol (1967). We have argued that there is no such inevitability. One major reason is that as countries develop and accumulate more human capital (as reflected by increasing educational achievements of the population), the average cost of government employees expressed as a share of GDP falls, thus compensating for the lower productivity growth in the public sector. If the conclusion of this paper is correct, it implies that the government share of national income in richer countries might witness a declining trend in the future.

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