Trade, Government Consumption, and Economic Growth in Upper-Middle Income Countries

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Abstract

Esfahani (1991) shows that the statistically significant correlation between export promotion and economic growth in semi-industrialized countries (SICs) has been mainly attributable to the role of exports in reducing import "shortages", which have impeded output growth in these countries. As a result, export-promotion policies as a superior development strategy in SICs play an important role in those that cannot secure sufficient foreign aid or investment. Esfahani (1991) also develops a simultaneous equations model to address the simultaneity bias between GDP and export growth rates. In this paper we extend the model developed by Esfahani (1991) by incorporating the contribution of government consumption to output growth and test it using a sample of 27 upper-middle income economies.

Key Words: Trade, government consumption, economic growth, export.

I. Introduction

Throughout the 1970s and the 1980s, statistically significant correlations found between export promotion and output growth have provided empirical support for export-promotion policies as a superior development strategy for middle-income countries that are semi-industrialized [see, for instance, Michalopoulos and Jay (1973), Michaely (1977), Balassa (1978, 1985), Tyler (1981), Feder (1982), and Kavousi (1984)]. The explanation for this observation has been due to externalities of competition in world markets such as a more efficient use of resources, scale economies, as well as various labor training and "demonstration" effects. Esfahani (1991), however, argues that this explanation neglects the role of exports in SICs as the main source of foreign exchange for the much required importation of intermediate and capital goods. His other contribution to the development literature is in terms of methodology since he addresses the long recognized simultaneity bias as export growth may itself be brought about by an increase in ouput.

In the present study we have chosen to incorporate the effect of the expansion of government consumption used an input on output growth. Moreover, we also address the simultaneity bias between output growth and government consumption growth as the demand for government consumption may also be a function of economic growth, as stated by Wagner's Law of Expanding State Activity. Thus, after specifying equations that relate export growth, import growth, and government consumption growth, we then estimate a four-equation system of GDP, export, import, and government consumption growth models simultaneously. The paper is organized as follows. In section II we develop a basic model similar to Esfahani's (1991) but extend it to take into account the contribution of government consumption to output. We then test this model using a sample of 27 upper-middle income countries for the 2000-2008 period. The data are taken from the *2010 World Development Indicators.* Section III summarizes the empirical results while the final section gives concluding remarks.

II. The Basic Model

In deriving the GDP growth equation, we shall make use of the traditional approach of introducing G as an "input" in the aggregate production function Y = f(L, K, G, M, X) where Y is GDP, L is labor, K is capital, G is government consumption, M is imports of agricultural raw materials, fuels, ores and metals as intermediate goods, and X is exports. In order to capture the externality effects of exports on output in terms of more efficient use of resources, scale economies, and labor training and "demonstration" effects, we add as input manufactured exports. Let t_x be the share of manufactures in total exports. Manufactured exports then will simply be t_xX. To account for the extent of the import shortage, following Esfahani (1991) we include another variable, r_mM, where r_m is the residual term in the regression of total import-GDP ratio on its determinants such as log of GDP per capita, its square, the log of the size of the labor force, its square, and the log of area, and its square. The rationale for the inclusion of the residual of this regression is that it captures how much a country's share of imports in the GDP deviates on its "expected" value. The greater the import shortage translates into a lower share and thus a lower value for r_m. The impact of r_mM on output is expected to be negative.

The aggregate production function can now be rewritten as:

$$Y = f(L, K, G, M, r_mM, X, t_xX) \quad (1)$$

By totally differentiating this function and manipulating the expression one gets the "standard form":

$$y = \alpha_K(I/Y) + \beta_L l + \alpha_G(G/Y)g + \alpha_M(M/Y)m + \alpha_{rM}r_M(M/Y)m + \alpha_X(X/Y)x + \alpha_{tX}t_X(X/Y)x \quad (2)$$

where a lower case letter implies the growth rate of the variable, I is investment, α_i is the marginal product of factor i in the economy, and β_L is the elasticity of aggregate output with respect to labor.

In deriving the per capita growth of government consumption equation we shall make use of the following model of the share of government consumption in the national income:

$$G/Y = \theta_0 + \theta_1 \log Y_{pc} + \theta_2(\log Y_{pc})^2 + \theta_3 \log L + \theta_4(\log L)^2 \quad (3)$$

Rewriting G/Y as G_{pc}/Y_{pc} and differentiating (3), one obtains:

$$(G/Y)g_{pc} = (G/Y)y_{pc} + \theta_1 y_{pc} + \theta_2 \log Y_{pc} y_{pc} + \theta_3 l + \theta_4 \log L l \quad (4)$$

Similarly, the per capita growth of exports equation is derived as follows:

$$(X/Y)x_{pc} = (X/Y)y_{pc} + \eta_1 y_{pc} + \eta_2 \log Y_{pc} y_{pc} + \eta_3 l + \eta_4 \log L l \quad (5)$$

and the per capita growth of imports equation is:

$$(X/Y)m_{pc} = (X/Y)y_{pc} + \gamma_1 y_{pc} + \gamma_2 \log Y_{pc} y_{pc} + \gamma_3 l + \gamma_4 \log L l \quad (6)$$

Since the aggregate production function is assumed to exhibit constant returns to scale, we can rewrite (2) as

$$Y_{pc} = \alpha_K(I/Y) + \beta_L l + \alpha_G(s_G)g_{pc} + \alpha_M(s_M)m_{pc} + \alpha_{rM}r_M(s_M)m_{pc} + \alpha_X(s_X)x_{pc} + \alpha_{tX}t_X(s_X)x_{pc} \quad (7)$$

where s_i is the share of the i^{th} input in the GDP.

Note that since the area of a country does not change over time, the growth version of this variable is excluded from the model as its value will be zero everywhere. We can now estimate simultaneously equations (4)-(7) using two-stage least squares. Equations (4)-(6) are used in the first stage to obtain fitted values to replace the actual values of the endogenous variables $(s_G)g_{pc}$, $(s_M)m_{pc}$, and $(s_X)x_{pc}$. These fitted values are then used in the second stage to estimate equation (7). The software algorithm is the nonlinear system estimation method of SPSS.

III Empirical Results

Table gives results of the regression of the share of imports in the GDP on the log of per capita GDP, its square, the log of area, its square, the log of the labor force, and its square. The goodness of fit of the model to the data is quite good as indicated by the value of 0.495 of the adjusted coefficient of determination.

Table 1: Regression results for 27 upper-middle income countries Dependent variable: Import share in gross output

	Coefficient Estimate	*t-Statistic*
Intercept	2432.630	2.9166
LNLABOR	-3.581	-0.4010
(LNLABOR)^2	0.373	0.1283
LNPGNI	-522.895	-2.7639*
(LNPGNI)^2	28.859	2.6942*
LNAREA	-0.702	-0.0724
(LNAREA)^2	-0.449	-0.4248

Adjusted $R^2 = 0.495$

*Significant at the 1 percent level.

Only the log of per capita GDP and its square are statistically significant, but the coefficient estimate of the log of per capita GDP does not have the expected positive sign. These results are similar to those found by Esfahani (1991).

Using a backward elimination stepwise method we arrive at a revised model the regression results of which are reported in Table 2. We observe that the goodness of fit of the model to the data is higher as indicated by the higher value of 0.539 of the adjusted coefficient of determination.

We also note that the log of area is now statistically significant at the 1 percent level and its coefficient estimate does have the expected negative sign as area reduces the need for imports because countries with larger areas are usually endowed with a greater variety of complementary natural resources and within them there is a greater opportunity for different regions to trade with each other rather than importing from abroad.

Table 2: Regression results for 27 upper-middle income countries Dependent variable: Import share in gross output (Revised model)

	Coefficient Estimate	*t-Statistic*
Intercept	2473.820	3.117
LNPGNI	-527.453	-2.926*
$(LNPGNI)^2$	29.031	2.845*
LNAREA	-6.733	-4.163*

Adjusted $R^2 = 0.539$
*Significant at the 1 percent level.

Table 3: OLS regression results for 27 upper-middle income countries. Dependent variable: GDP growth rate

	Coefficient Estimate	*t-Statistic*
Intercept	3.309	1.341
$r_M s_M m$	0.108	0.858
k^*	0.070	0.880
l	-0.462	-1.949**
$s_X x$	0.788	5.964*
$s_G g$	0.343	0.447
$s_M m$	-4.149	-1.565
$t_X s_X x$	-0.856	-2.910*

Adjusted $R^2 = 0.793$
*Significant at the 1 percent level.
**Significant at the 5 percent level.

We next use the residuals of the above regression to estimate equation (2), the results of which are reported in Table 3. We note that the goodness of fit of the model to the data is very good as indicated by the high value of 0.793 of the adjusted coefficient of determination. We observe the coefficient estimate of the export growth variable is relatively large and the variable is highly statistically significant. As in the case of Feder's (1982) study, by multiplying the export growth rate by the export share in GDP, we are able to capture the influence of the relative importance of exports in the economy on the impact of export promotion on GDP growth rate. All else equal, a one-percent increase in the growth rate of exports during the 2000-2008 period could have resulted in an increase of 0.788 percent in the GDP growth rate. This is a considerable impact considering that one-percentage point increase in the investment-GDP ratio is expected to only lead to a 0.07 percent increase in the GDP growth rate. We also observe that the inclusion of the variable $t_X(s_X)x$ does not change the magnitude of the impact of the export growth variable on GDP growth, even though the former variable is statistically significant.

However, the coefficient estimate of the variable $t_X(s_X)x$, which is used to capture the impact of manufactured exports on GDP growth rate, has the unexpected negative sign. This may be an indication that non-manufactured exports may have larger externality effects than manufactured ones. Krueger (1983), for example, finds that in many instances exports of upper-middle income countries have lower direct labor coefficients per unit of international value added than import competing products, while one would expect that it should be the other way around given the factor endowments of these countries relative to those of their trading partners. We note that the import growth rate variable is barely statistically significant while its coefficient estimate (α_M) does not have the expected positive sign. On the other hand, αr_M is positive, but the variable $r_M s_M m$ is not statistically significant. In this OLS regression we also find that the government consumption growth rate variable is not statistically significant even though its coefficient estimate has the expected positive sign. The results of the OLS regression based on equation (2) would yield unbiased estimates of the externality effect of both export and government consumption growth if external conditions and government policy exclusively determined export performance and the contribution of government consumption to output growth.

Nevertheless, as Esfahani (1991) points out, it is hard to assume that export performance is independent from GDP growth and, as indicated by Dao (1995), the demand for government services is itself a function of income growth as postulated by Wagner's law. An increase in productivity or in the availability of resources in a country may lead to an increase in output growth, which in turn may result in more export growth. As indicated in the previous section, we can handle the simultaneity bias problem by simultaneously estimating equations (4), (5), and (6) with a per capita version of equation (2), i.e., with equation (7).

We note that equation (7) is not only compatible with (4), (5), and (6), it contains one less parameter than (2), which results in higher estimation efficiency. Results of the 2SLS of equation (7) are reported in table 4. We note that the goodness of fit of the model to the data is very good as indicated by the high value of 0.767 of the adjusted coefficient of determination. We also observe that the investment-GDP ratio variable is now highly statistically significant, unlike the case in which single equation of (2) is estimated by OLS. A one-percentage point increase in the value of this variable is expected to lead to a 0.245 percent increase in per capita GDP growth rate.

Table 4 Regression results for 27 upper-middle income countries. Simultaneous equation for GDP growth

	Coefficient Estimate	*t-Statistic*
Intercept	-3.549	-1.733
k*	0.245	2.948*
$s_X x_{pc}$	0.674	4.227*
$t_X s_X x_{pc}$	-0.271	-0.689
$s_M m_{pc}$	-0.161	-1.212
$r_M s_M m_{pc}$	-0.181	-0.419
$s_G g_{pc}$	2.211	3.038*

Single-equation adjusted $R^2 = 0.767$
*Significant at the 1 percent level.

This is a greater impact than that estimated by OLS single equation estimation. The magnitude of the effect of per capita export growth is somewhat less (0.674 as opposed to 0.788). Nevertheless, it is still considerable relative to the effect of the share of investment in the GDP. Table 5 presents the regression results when $t_X s_X x_{pc}$ is excluded from the model. We note that the role of manufactured exports is not statistically significant in explaining cross-country variations in per capita GDP growth rates. In fact, removing this variable from the model causes the per capita import growth rate variable to become statistically significant at the 5 percent level even though the coefficient estimate of the latter has the unexpected negative sign. We next re-estimate the model while excluding the $r_M s_M m_{pc}$ variable and finds that the regression results remain unaffected, as reported in Table 6. This finding suggests that upper-middle income countries included in this sample may not have experience import shortage, at least for the period under study, which is from 2000 to 2008.

Table 5 Regression results for 27 upper-middle income countries. Simultaneous equation for GDP growth ($t_X s_X x_{pc}$ excluded)

	Coefficient Estimate	*t-Statistic*
Intercept	-3.590	-1.777
k*	0.243	2.965*
$s_X x_{pc}$	0.657	4.223*
$s_M m_{pc}$	-0.209	-1.891**
$r_M s_M m_{pc}$	-0.260	-0.631
$s_G g_{pc}$	2.281	3.206*

Single-equation adjusted $R^2 = 0.772$
*Significant at the 1 percent level.
**Significant at the 5 percent level.

Table 6: Regression results for 27 upper-middle income countries. Simultaneous equation for GDP growth ($t_X s_X x_{pc}$ and $r_M s_M m_{pc}$ excluded)

	Coefficient Estimate	*t-Statistic*
Intercept	-3.351	-1.712
*k**	0.232	2.938*
$s_X x_{pc}$	0.663	4.329*
$s_M m_{pc}$	-0.213	-1.954**
$s_G g_{pc}$	2.285	3.257*

Single-equation adjusted $R^2 = 0.779$
*Significant at the 1 percent level.
**Significant at the 5 percent level.

Export Growth Equation (5)

	Coefficient Estimate	*t-Statistic*
Intercept	4.069	4.352
$y_{pc} lnY_{PC}$	0.105	0.103
y_{pc}	-1.621	-0.172
l	-0.645	-1.176
llnLABOR	-0.013	-0.058

Import Growth Equation (6)

	Coefficient Estimate	*t-Statistic*
Intercept	6.415	6.976
$y_{pc} lnY_{PC}$	2.166	2.147**
y_{pc}	-20.930	-2.253**
l	-1.081	-2.005**
llnLABOR	-0.071	-0.326

**Significant at the 5 percent level.

Government Consumption Growth Equation (4)

	Coefficient Estimate	*t-Statistic*
Intercept	0.859	5.279
$y_{pc} lnY_{PC}$	-0.085	-0.478
y_{pc}	0.574	0.350
l	-0.211	-0.873
llnLABOR	0.020	0.474
urb	-0.037	-0.175

On the other hand, we find that per capita government consumption growth is highly statistically significant and its coefficient estimate does have the expected positive sign. As far as the feedback from per capita GDP growth to export, import, and government consumption growth is concerned, we note that the interaction term between per capita GDP growth rate and log of per capita GDP exerts a strong and positive impact on per capita import growth rate.

IV. Summary and Conclusion

In this paper I test a model which is more comprehensive than that developed by Esfahani (1991) in the sense that it incorporates government consumption growth as an additional factor explaining per capita GDP growth using a sample of 27 upper-middle income economies. The following concluding remarks may be made:

1. When taking account of the simultaneity bias, 2SLS estimation of the system of four growth equations yields superior results such as the statistical significance of the investment-GDP ratio in explaining cross-country variations in per capita GDP growth rates as opposed to this variable not having a significant effect when using OLS estimation.

2. Manufactured exports do not seem to exert a statistically significant effect on per capita output growth, suggesting that non-manufactured exports may have larger externality effects than manufactured ones.

This finding is consistent with Krueger's study in which exports of upper-middle income countries in several cases have lower direct labor coefficients per unit of international value added than importing competing products.

3. The evidence does not seem to support Wagner's law of expanding state activity when 2SLS nonlinear estimation of the system of four growth equations is applied to the data.

4. Unlike Esfahani (1991) we did not find that the major contribution of exports to the GDP growth rate is to give relief to the import shortage confronted by many upper-middle income economies, at least for the period considered by this study, i.e. from 2000 to 2008. On the other hand, we do find, like Esfahani (1991) that the share of manufactures in total exports does not seem to enhance the externality effect. This may be due to distortions in both factor and product markets of the manufacturing sector in many upper middle-income countries having an offsetting effect to any external economies of participation in international markets.

5. Like Esfahani (1991), this study also finds that area has a negative effect of the share of total imports in the GDP and this variable is strongly significant relative to the log of GDP per capita and the square of the latter variable.

6. The role of government consumption growth in promoting output growth is significant and positive. This is an aspect that has been neglected in the economic development literature.

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