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Export Expansion and Growth at Different Stages of Development*

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This paper empirically examines the role of export expansion in the economic growth of countries at different levels of development. Results from a switching regression model with data-determined group selection indicate that exports contribute to growth through both a sector-externality effect and a factor-productivity effect for middle income countries, but only through a factor-productivity effect for low income countries. The difference in the magnitude of the contribution of export expansion to growth between the two groups of countries is not large, but the contribution is greater for middle income countries.

I. Introduction

This paper empirically investigates the differences in the nature and magnitude of growth from export expansion between low income countries and middle income countries. After nearly two decades of empirical work, considerable evidence has accumulated suggesting that export expansion is positively related to growth for less developed countries (LDCs).[1] There persists, however, the suspicion that at-

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1 The empirical work originates with Michalopoulos and Jay (1973) and is further developed in Michaely (1977), Heller and Porter (1978), Balassa (1978b), Michaely

tempts to increase exports with more outward-oriented policies is simply not appropriate for all LDCs in all cases. One particular concern is that export expansion does not contribute to growth in the same way and to the same degree for the low income countries as it does for the middle income countries. Theories of industrialization certainly suggest that an economy may need to reach some critical size (or degree of industrialization that may be associated with economic size) in order to benefit from export-led growth. The previous empirical literature has not fully addressed this issue. This paper provides a more comprehensive investigation.

II. Background and Literature Review

The underlying hypothesis regarding the contribution of export expansion to overall economic growth in less developed countries is that export expansion positively influences growth because it will increase the efficiency of resource allocation, increase capacity utilization, allow taking advantage of scale economies, and promote technical change (Balassa, 1985). The results of most of the studies indicate that, on average, export expansion is positively and significantly related to growth for particular groupings of less developed countries (Michaely, 1977; Heller and Porter, 1978; Balassa, 1978b, 1985; Krueger, 1978; Tyler, 1981; Feder, 1982; and Kavoussi, 1984). Others are less optimistic and find that favorable market conditions or country selection were the driving forces behind the results obtained (Heller and Porter, 1978; Rana, 1988; and Singer and Gray, 1988). Still others suggest that a positive statistical relationship does not indicate causality and have undertaken causality studies with mixed results (Jung and Marshall, 1985; and Chow, 1987). Several of the authors indicate that they have an *a priori* expectation that the relationship will only hold once a given level of development is obtained. These development levels are described variously as "middle income LDCs" (Michaely, 1977; Tyler, 1981), "relatively rich LDCs" (Heller and Porter, 1978), "semi-industrialized LDCs" (Feder, 1982), and "newly industrializing countries" (Chow, 1987). Indeed with the exception of Kavoussi (1984) and Moschos (1989), low income countries are specifically excluded from this type of investigation. Kavoussi (1984) divides LDCs into a low income group and a middle income group for analysis by taking the World Bank's designation of $360 GNP per capita (in real 1978 US dollars) as the

(1979), Tyler (1981), Feder (1982), Kavoussi (1984), Balassa (1985), Rana (1988), and Moschos (1989), among others.

dividing point and he finds that the correlation between export expansion and growth is not limited to middle income countries; low income countries benefit as well. These studies (as well as Krueger (1978) and Balassa (1978b), both of whom selected ten countries for their studies) arbitrarily determine the appropriate country group for analysis. Undoubtedly, data availability played a crucial role in country selection for many of the investigations. The most comprehensive of these studies (Kavoussi, 1984) has seventy-three countries; the rest have fewer.

Of the previous analyses, only Rana (1988), Krueger (1978), and Balassa (1978b) have more than one observation per country. Krueger's analysis allows for country-specific fixed underlying growth rates but is limited by the fact that it does not control for labor force and capital. Rana allows for random effects by utilizing a Fuller-Batesse estimation procedure.

Moschos (1989), following the lead of Kavoussi (1984), considers the hypothesis that low income countries and middle income countries may benefit differently from export expansion. The innovation of Moschos (1989) was to allow the definition of the groups to be determined by the data, by employing a switching regression analysis. Moschos finds, among other things, that, contrary to the commonly held *a priori* view, low income countries benefit *more* from export expansion than do middle income countries (Moschos, 1989:99). There are some problems with the Moschos paper, however. Moschos perpetuates a shortcoming of the previous literature first pointed out in Feder (1982) by estimating a model that implicitly imposes an unintentional restriction on the more general model that Feder derives.[2] In fact, this restriction is a testable hypothesis that we find to be clearly rejected by the data. A second, less serious problem exists. The procedure of the switching regression estimation necessitates a test of whether at discrete splits the estimated parameters in the two equations represent statistically different structures. Moschos utilized a Chow test which implicitly assumes that the variances of the two sets of observations are equal. This is unlikely to be the case. The result is that Moschos' tests for significant splits may be erroneous.

The objective of this paper is to clarify the issue of whether the level of development has implications for the export expansion-growth

2 Specifically the restriction requires that the elasticity of output in the non-export sector with respect to the output of the export sector be equal to a term involving the factor productivity differentials between the export and the non-export sectors. This issue is explicitly examined in sectin III.

relationship. Specifically, the questions of whether or not lower income countries benefit more or less from export expansion or in different ways is considered. The improvement of this analysis over that of Moschos (1989) is made possible by the utilization of a richer (and more recent) data set and a more general base model.[3] This more general model allows us to find differences in the *nature* of the contribution of exports to growth as well as in the *magnitude,* and also avoids the implicit restriction embodied in the Moschos analysis. The more general model, which is used in its single equation form by Feder (1982), allows for separate measurements of a *sector-externality effect* and a *factor-productivity effect* associated with export expansion.

The data set utilized here allows for consideration of a larger group of countries than are included in previous studies. Second, the data set provides a longer time series than has previously been used. This allows for specific countries to actually progress from the lower income group to the middle income group, suggesting that structural change actually occurs at a certain income level, not just that there are structural differences between countries that only happen to be at different income levels.[4]

The following section (section III) presents the underying theoretical model utilized for the empirical analysis. Section IV discusses the data used for this paper and the methodology for determining whether or not the level of development has an effect on the relationship between export expansion and growth. Section V presents the results of the empirical analysis outlined in Section IV. Section VI concludes the paper.

III. Theoretical Model

This section derives the theoretical framework of the models estimated in Section IV. This is essentially the Feder (1982) model with some minor modifications.

3 This more general model is developed fully in section III. Sectin III illustrates the restriction implied by the model utilized in the Moschos (1989) paper. It is difficult to interpret the parameters of the model in Moschos (1989), Kavoussi (1984), Tyler (1981), Balassa (1978b) and Michalopoulos and Jay (1973) except to take them as a (perhaps unlikely) special case of the more general Feder model (which is used here).

4 For example, since some countries progress from the low income group to the middle income group, we can rule out that the income grouping is merely picking up region effects.

First we assume an economy with two sectors, export and non-export, so GNP is equal to the sum of the output from each sector. Let Y = GNP, N = output of non-export sector, and X = output of export sector. Then:

$$(1) \qquad Y = N + X.$$

Then we specify production functions for N and X such that the production of X may provide an externality for N. Then:

$$(2) \qquad N = F(K_n, L_n, X),$$

$$(2b) \qquad X = G(K_x, L_x),$$

where $K_n + K_x = K$ and $L_n + L_x = L$.

The subscripts on K and L refer to the sectors.

Let the dot notation symbolize the change of the overstruck variable. From (1):

$$(3) \qquad \dot{Y} = \dot{N} + \dot{X}.$$

Let the subscripts on F and G refer to the marginal products with respect to the subscripted inputs. Taking total derivatives of (2a and 2b), letting I = K and substituting into (3) yields:

$$(4) \qquad Y = F_K\, I_n + F_L\, \dot{L}_n + F_X\, \dot{X} + G_K\, I_x + G_L\, \dot{L}_x.$$

Note that the partial derivative of F with respect to X (F_X) captures the *sector-externality effect* of export expansion and measures the positive externality of the export sector on the non-export sector.

Suppose that the respective marginal products in each sector are not equal, Specifically, let:

$$(5) \qquad G_K = (1 + \delta)\, F_K \text{ and } G_L = (1 + \delta)\, F_L.$$

Note that δ allows one to capture the productivity differentials between the export and the non-export sectors or the *factor-productivity effect,* which measures the gain due to the higher productivity of factors in the export sector. Using (5), (4) becomes:

$$(6) \qquad \dot{Y} = F_K\, I_n + F_L\, \dot{L}_n + F_X\, \dot{X} + (1 + \delta)F_K\, I_x + (1 + \delta)F_L\, \dot{L}_x.$$

Combining terms, (6) simplifies to:

(7) $\dot{Y} = F_K\, I + F_L\, \dot{L} + F_X\, \dot{X} + \delta(F_K\, I_x + F_L\, \dot{L}_x).$

Data is readily available for the dependent variable and the first three RHS variables of (7), but not for the last two RHS variables. Therefore an alternate expression for the last two terms in the equation above is derived. Start with the total differentiation of (2b):

(8) $\dot{X} = G_K\, I_x + G_L\, \dot{L}_x.$

Substituting into (8) from (5) and manipulating yields:

(9) $\dfrac{\dot{X}}{(1+\delta)} = F_K\, I_x + F_L\, \dot{L}_x.$

Note that the last two terms of (7) are the same as the right hand side of (9).

Substitute from (9) into (7) and simplify.

(10) $\dot{Y} = F_K\, I + F_L\, \dot{L} + [F_X + (\dfrac{\delta}{1+\delta})]\, \dot{X}.$

Now let $F_K = \alpha$ and $F_L = \beta(Y/L)$[5] and substitute these into (10) and divide by Y. This yields:

(11) $\dot{Y}/Y = \alpha(I/Y) + \beta(\dot{L}/L) + [F_X + (\dfrac{\delta}{1+\delta})]\,(\dot{X}/Y).$

This is the basis for the estimating equations (16) in the first switching regression model where the parameter, γ, represents the entire bracketed expression proceding $(\dot{X}/Y)$. Note that the parameter estimated for the export variable $(\dot{X}/Y)$ includes both a *sector-externality effect* (F_X) as well as the productivity differential (δ) or the *factor-productivity effect.* Ideally we want to be able to separately identify the *factor-productivity effect* and the *sector-externality effect.* To do this let F have a specific separable form as follows:

[5] As Feder (1983:62) notes, this suggests that there exists a linear relationship between the marginal product of labor in the non-export sector and the average output of labor in the economy. For supporting arguments see Bruno (1968).

(12) $N = F(K_n, L_n, X) = X^{\theta}\, \Psi(K_n, L_n)$.

Now the partial derivative of F with respect to X is (using also that $N = Y - X$):

(13) $$F_X = \theta \frac{N}{X} = \theta \frac{Y}{X} - \theta.$$

Substituting (13) into (11) and manipulating yields:

(14) $$\dot{Y}/Y = \alpha(I/Y) + \beta(\dot{L}/L) + [\frac{\delta}{(1+\delta)} - \theta](\dot{X}/Y) + \theta(\dot{X}/X).$$

This is the basis for the estimation equations (17) in the second switching regression model where the parameter, φ, represents the entire bracketed expression preceding $(\dot{X}/Y)$. This allows for separate identification of δ.

Furthermore, as Feder (1982) points out, if one assumes that:

(15) $$\theta = \frac{\delta}{1+\delta}$$

then equation (14) collapses into the form of the equation estimated in Michalopoulos and Jay (1973), Balassa (1978b), Tyler (1981), Kavoussi (1984), and Moschos (1989). Certainly *a priori* it would seem that the equality in (15) is unlikely to hold, calling into question the results from estimations that implicitly impose this restriction.

IV. Data and Methodology

The primary data source is the World Tables of Economic and Social Indicators, 1960-1986.[6] This data set includes annual data for 27 years for 126 countries. After dropping observations with missing data 110 countries remained in the sample. Next, OECD member countries and other high income countries were dropped leaving a sample of 85 countries.[7] Up to four time periods, or observations, for each country

[6] This data was acquired through the Inter-university Consortium for Political and Social Research in machine readable format (tape).

[7] Specifically, Australia, Austria, Belgium, Canada, Denmark, Finland, France, West Germany, Iceland, Ireland, Israel, Italy, Japan, Kuwait, Luxembourg, the Netherlands,

are used: 1960-1966, 1966-1973, 1973-1979, and 1979-1986; reslting in 276 useable observations. The annual data are not used because, as Feder (1982) notes, there is substantial noise in the annual data that tends to be eliminated by the procedure of averaging. Furthermore, the potential problem of lagged responses is less severe when using averages across a multiple year time period rather than annual data (Feder, 1982).[8]

Two models are estimated. Estimation of the first model (equations (16)) will provide information on how the *magnitude* of the contribution of export expansion to growth differs between low and middle income countries. Estimation of the second model will allow us to identify differences in the *nature* as well as the *magnitude* of the contribution of export expansion to growth between the two groups of countries. Both models capture export expansion's contribution to growth through both a *sector-externality effect* and a *factor-productivity effect*. The second model is differentiated from the first in that it allows for separate identification of the two effects. The *sector-externality effect* measures the positive externality of the export sector on the non-export sector. The *factor-productivity effect* measures the gain due to the higher productivity of factors in the export sector (indicating, when positive and significant, that fewer than optimal resources are allocated to the export sector). A switching regression formulation of the model with an unknown sample selection criterion is utilized to allow for differences associated with per capita income levels. The switching regression model is described in Goldfeld and Quandt (1976: Chap. 2). The sample selection criterion is real GNP per capita in 1986 US dollars (as a measure of the level of development).

The first model is the simpler specification of the two estimated and is based on equation (11):

$$(16)\qquad (\dot{Y}/Y)_{it} = r_1 + \alpha_1(I/Y)_{it} + \beta_1(\dot{L}/L)_{it} + \gamma_1(\dot{X}/Y)_{it} + e_{it}$$
$$\text{for it if } GNPc_{it} \geqslant \mu$$

and

$$(\dot{Y}/Y)_{it} = r_2 + \alpha_2(I/Y)_{it} + \beta_2(\dot{L}/L)_{it} + \gamma_2(\dot{X}/Y)_{it} + u_{it}$$
$$\text{for it if } GNPc_{it} < \mu.$$

New Zealand, Norway, Saudi Arabia, Spain, Sweden, Switzerland, the United Arab Emirates, the United Kingdom, and the United States were excluded.

8 Multiple year time periods are also used in Michaely (1977), Balassa (1978b), 1985), Tyler (1981), Rana (1988), Singer and Gray (1988), and Moschos (1989).

The subscript i refers to the country, and the subscript t to the time period. Y is GNP, so $\dot{Y}/Y$ is its annualized growth rate; I is Gross Domestic Investment for the period; L is labor (population), so $\dot{L}/L$ is the annualized growth rate of labor; and X is exports, so $\dot{X}/Y$ is the simplified form of the annualized growth rate of exports weighted by the proportion of exports in GNP (that is, $\dot{X}/Y = (\dot{X}/X)(X/Y)$). The μ is the level of real GNP per capita (GNPc) at which the structural split occurs. The r's are the intercepts and are interpreted as the underlying rate of growth of Y. The α's and β's are structural parameters and the γ's are reduced-form parameters. β_1 and β_2 are interpreted (loosely) as elasticities of output with respect to labor in the non-export sector.[9] α_1 and α_2 are interpreted as marginal products of capital in the non-export sector. γ_1 and γ_2 capture both the differential of factor productivities between the export and the non-export sectors (the *factor-productivity effect*) and the externality of the export sectors on the non-export sectors (the *sector-externality effect*). In this form (equations (16)), separate identification of the two effects is not possible. The structural parameters that measure the two effects can be recaptured in the second specification (equations (17) below).

This second version of the model allows for the separation of the two effects picked up by the parameters on the export variables (γ_1 and γ_2) in equations (16). This specification is based on equation (14) and is given as:

$$(17)\quad (\dot{Y}/Y)_{it} = r_1 + \alpha_1(I/Y)_{it} + \beta_1(\dot{L}/L)_{it} + \varphi_1(\dot{X}/Y)_{it} + \theta_1(\dot{X}/X)_{it} + e_{it}$$
$$\text{for it if } GNPc_{it} \geqslant \mu$$

and

$$(\dot{Y}/Y)_{it} = r_2 + \alpha_2(I/Y)_{it} + \beta_2(\dot{L}/L)_{it} + \varphi_2(\dot{X}/Y)_{it} + \theta_2(\dot{X}/X)_{it} + u_{it}$$
$$\text{for it if } GNPc_{it} < \mu.$$

The variables are defined as for equations (16) above with the addition of $\dot{X}/X$ which is the annualized growth rate of exports (un-weighted). The parameters α_1, α_2, β_1, and β_2 are interpreted as in equations (16), though they, of course, are not constrained to have the same point estimates. θ_1 and θ_2 are interpreted as the elasticities of output in the non-export sector with respect to the level of exports and thus measure

9 We must be willing to assume that the ratio of output to labor in the non-export sector is similar to that in the economy as a whole to strictly interpret these parameters as the stated elasticities.

the *sector-externality effect* of exports. φ_l and φ_2 are not interpreted the same way that γ_1 and γ_2 are in equations (16). The parameter pairs φ_1 and θ_1, and φ_2 and θ_2 can be usd to identify δ, the difference in the factor productivities between the export and the non-export sectors. Specifically, δequals the percentage by which the marginal factor productivities are higher in the export than in the non-export sectors and is calculated as:

(18) $\delta_1 = (\varphi_1 + \theta_1)/[1 - (\varphi_1 + \theta_1)]$ if $GNPc_{it} \geqslant \mu$

and

$\delta_2 = (\varphi_2 + \theta_2)/[1 - (\varphi_2 + \theta_2)]$ if $GNPc_{it} < \mu$.

The procedure followed for estimating each of the two model specifications is similar. First the individual equations in each pair are estimated (using OLS) where discrete values of μ (GNP per capita) are chosen to divide the data set into the low and middle income groups.[10] At each discrete value of μ, the log-likelihood function value for the equation system is calculated to determine the split that is best supported by the data.[11] Then a Wald test is performed to determine if the parameters in the two equations represent statistically different structures at the split yielding the maximum log likelihood function value.[12] Specifically, the Wald test is used to test the null hypothesis that $\alpha_1 = \alpha_2$, $\beta_1 = \beta_2$, and $\gamma_1 = \gamma_2$ in the first model and that $\alpha_l = \alpha_2$, $\beta_1 = \beta_2$, $\theta_1 = \theta_2$ and $\varphi_1 = \varphi_2$ in the second.

The specification for both models allows the marginal products of labor to vary across countries and time periods.[13] Rana (1988) and Balassa (1985, 1978b) have not found the labor variable to be significant. Balassa (1985) attributes this to the use of labor force data instead of employment data and the fact that both countries with and without surplus labor are included in his studies. We have available only population growth as a proxy for labor force growth. This is not

10 The discrete values for μ used for the split were 200, 250, 300, 350, 400, 450, 500, 550, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, and 2000. The units of μ are real 1986 US dollars.

11 This procedure is outlined in Quandt (1958) and has been used recently by Field (1988), and Hotchkiss (1991).

12 The Wald test is chosen over a Chow test to allow for unequal variances between the two sets of observations. See Honda (1982).

13 The elasticity of output with respect to labor is estimated (as constant across countries and time periods). The average product of labor varies across countries and time periods, hence so does the marginal product.

optimal, particularly for the lowest income countries where the problems of unemployment and labor surplus mentioned by Balassa (1985) would appear to be most severe.[14]

Both model specifications force the marginal product of capital to be equal across observations in each income group. This is theoretically implied by the assumption of perfect mobility of capital within the income group.[15] Furthermore, it allows the elasticity of output with respect to capital to vary across countries and time periods. There are enough degrees of freedom to attempt and test a specification in which country dummy variables are interacted with the I/Y variable, allowing the marginal product of capital to vary across countries. This is done and, using an F test on each of the single equations, the parameters on these country-capital interaction variables are not found to be statistically significant. Lacking empirical support, these interaction variables are omitted from the equations.

Our general methodology can be criticized for its single equation (per income group) approach and use of aggregate data. We defend this on the grounds that the data necessary for a more detailed analysis are simply not available for consistent time series for low income LDCs. Furthermore, we do not attempt to say anything about specific individual countries, but rather we seek to gain insight on and to compare the general orders of magnitude for certain parameter values for low and middle income countries as groups. The methodology used in this paper enables one to uncover substantial information with the aggregate data.

V. Estimation Results for the Switching Regression Models

In the estimation of the first model (equations (16)), the Wald test results indicate that there is no separating (split) value of GNPc at which the parameters for the low income group are significantly different frm those for the middle income group. This indicates that the appropriate model is the single equation version (with no splitting of the data set). The parameter estimates for the single equation version of the first model are presented in Table 1, column 1.

14 The limited availability of labor force data would significantly reduce the number of countries, especially at the lower income levels, in our sample.

15 Caves (1992: Chap. 2) discusses the validity (or lack thereof) of the assumption of international capital mobility.

Table 1
PARAMETER ESTIMATES

Dependent Variable = $\dot{Y}/Y$

Variables	Model: Equations (16)	Model: Equations (17) GDPc≥\$450	GDPc<\$450
Intercept	0.0146°	0.0067	0.0046
	(0.0079)	(0.0097)	(0.0145)
L/L	0.4556*	0.4995*	0.3181
	(0.2057)	(0.2255)	(0.4593)
I/Y	0.0462*	0.0461°	0.1429**
	(0.0229)	(0.0279)	(0.0411)
X/Y	0.7201**	0.4502**	0.4802**
	(0.0604)	(0.1006)	(0.1577)
X/X	—	0.1570**	0.0460
	—	(0.0358)	(0.0367)
R^2=	0.39	0.43	0.50
N=	276	194	82
countries	85	65	34
log(L)	549.04		564.57

Notes: Standard errors are in parentheses.
°, *, ** indicate significance at the 90%, 95%, and 99% level, respectively.

The maximum likelihood function value for the second model (equations (17)) is obtained when the data are split at \$450.[16] The parameter estimates for the second model are given in Table 1, columns 2 and 3. Column 2 provides the parameter estimates for the middle income countries as determined by the data, and column 3 provides the parameter estimates for the low income countries. The Wald test results indicate that the parameter estimates for the middle income group and those for the low income group are significantly different from one another at the 99% level for the split at \$450.[17]

16 Moschos (1989) orders his countries by real GDP per capita and finds the switch point occurs just before Indonesian (Moschos, 1989:98, fn. 7), which in 1970 (the first year of his data) had a GNPc = US\$90. Using the US GNP deflator this is equivalent to \$244.50 in real 1986 US dollars (the switching variable of our analysis).

17 A likelihood ratio test indicates that the likelihood function's maximum value (obtained when the data are split at \$450) is significantly different from the likelihood

Recall that the parameter estimates for the labor ($\dot{L}/L$) variable are interpreted (loosely) as an elasticity of output with respect to labor in the non-export sector. For the first model, this elasticity is positive and significant. In the second model, for the low income group (GNPc $450), the point estimate is positive, but not significant. This tends to indicate that surplus labor may have been the prevalent situation in many of the observations in the low income group. For the middle income group (GNPc $450), the point estimate is both positive and significant, as expected. The parameter estimates for the capital (I/Y) variable are interpreted as marginal products of capital in the non-export sectors. These estimates are positive and significant in all cases. The point estimate is higher for the low income group in the second model, perhaps indicating a relative scarcity of capital inputs.[18]

In the first model, the parameter on exports ($\dot{X}/Y$) picks up both the *sector-externality effect* and the *factor-productivity effect*. Though we can not separately identify the two effects in this model, it is clear that the combined magnitude of the two effects is both positive and significant. The finding that the single equation model best fits the data when the two effects are jointly captured in the estimation process suggests that the overall magnitude of the contribution of export expansion to growth does not systematically differ between low and middle income countries when the model is correctly specified.[19] This is at variance with the implicit assumption found in much of the earlier work in this area that low income countries can not be expected to benefit from export growth.

The parameter estimates for the two export variables ($\dot{X}/Y$, $\dot{X}/X$) in the second model allow for the separation of the two export effects. The parameter estimate on $\dot{X}/Y$ is positive and highly significant in both specifications and for both country groups (low and middle income); this significance rejects the model specifications estimated by

function values of all other splits expect for those at $200, $800, and $2000. The Wald test, however, indicates that at these splits one cannot reject common parameter values for the low and middle income groups. Therefore, models with these splits ($200, $800, and $2000) are dominated by the model with no split. The model with no split is in turn dominated by the model with a split at $450 (based on the value of the likelihood function).

18 Khan and Knight (1988) find that import compression resulting from official attempts to achieve external balance results in shrinking the imports of capital inputs that may be required for export industries.

19 Moschos' (1989) model is equivalent to our model with a questionable implicit restriction, described by equation (15). Moschos (1989) found the contribution of exports to growth is greater in the lower income group of countries than in the higher.

Michalopoulos and Jay (1973), Balassa (1987b), Tyler (1981), Kavoussi (1984), and Moschos (1989). The parameter on $\dot{X}/X$ is interpreted as the elasticity of non-export output with respect to exports and measures the *sector-externality effect.* This externality is positive and significant in the middle income country group, but is insignificant in the low income countries. This indicates that the *nature* of the contribution of exports to growth is different for low income countries as compared to middle income countries. Specifically, countries may need to first attain a minimum level of development (GNPc > \$450) before the export sector positively impacts the other sectors of the economy.[20]

Using the point estimates on both export variables and referring to equations (18), the difference, δ, in the marginal factor productivities in the export and non-export sectors can be identified and it measures the *factor-productivity effect.* Specifically, for the middle income countries, $\delta_1 = 1.55$. This indicates that, on average, the factors used in the export sectors are 155% more productive (at the margin) than those used in the non-export sectors. For the low income countries, $\delta_1 1.11$.[21] That there is a greater marginal factor productivity differential for middle income countries than for low income countries is further evidence of the difference in *the nature* of the contribution of exports to growth between the two groups of countries. That the factor productivity differentials are so large suggests that resource allocation is significantly distorted from the optimal allocation and that, therefore, productivity gains could be had with the allocation of more resources to the export sectors in both groups of countries.

Finally, it is interesting to note that when the second model is estimated the parameter estimates on the capital and labor variables differ substantially between middle and low income countries. Yet this difference (between the contribution of capital and labor in the two groups of countries), is not great enough to cause the switching regression model to be selected as the one that best fits the data when the first model specification is used. However, once the difference in *the nature* of the contribution of exports to growth is captured in the

20 Consistent with generalizations from theories of industrialization, this finding suggests, perhaps, that the type of exports likely to be more closely associated with low income countries (primary products) will not generate the positive *sector-externality effect* that production of those products more closely associated with middle income countries (manufactured products) would.

21 The δ_1 ($= 1.55$) for the middle income countries has a standard error of .5199 and is significant at the 99% level, while the δ_2 ($= 1.11$) for the low income countries has a standard error of .4364 and is significant at the 95% level. The procedure for calculating the variance of the nonlinear restriction is found in Greene (1990: 228-230).

second model, the differences between low and middle income countries are now great enough to require the switching regression estimation.[22]

VI. Conclusion

This paper has undertaken the task of empirically examining the significance of the stage of development on the difference in both the *nature* and the *magnitude* of the contribution of exports to growth. This issue is examined using switching regression versions of the Feder (1982) models which capture the contribution of export expansion to growth from both a *sector-externality effect* and a *factor-productivity effect*. The switching regression estimation of the second model (equations (17)), which allows separate identification of the two effects, indicates that the level of GNP per capita (as a measure of the level of development) that best distinguishes low income countries from middle income countries is US$450 (in real 1986 dollars).

The empirical results indicate that the differences in the contribution of export expansion to growth in low and middle income countries do, in fact, arise from differences in both the *magnitude* and the *nature* of the contribution. Concerning the *nature* of the contribution, we have found that while the contribution of exports to growth in low income countries is solely due to factor productivity differentials between the export and non-export sectors (the *factor-productivity effect*), middle income countries also benefit from a positive *sector-externality effect* from the export sector which is not enjoyed in low income countries.

Although the *magnitude* of the contribution of exports to growth was found to be greater in the middle income countries the benefit to low income countries is substantial. The difference in the *magnitude* of the contribution of exports to growth is due to both the lack of a significant *sector-externality effect* for low income countries, as well as the greater productivity differentials (the *factor-productivity effect*) in the middle income countries. For the model specification that did not allow for separate identification of the two export expansion effects, the difference in the magnitudes of the export expansion effects was not significant enough to require separate estimation for low and middle income countries. This suggests that the difference in the magni-

22 Using real GDP from the Heston and Summers (1988) data for the switching variable produced results similar to our findings here (though for a smaller group of countries). These results are reported in the Appendix.

tude of the contribution of exports to growth between low and middle income countries should not be considered to be very large.

Appendix

In Summers and Heston (1988), real GDP in US dollars is calculated using the concept of purchasing power partiy rather than the trade-based exchange rates utilized in the World Tables Data. The issue of the exchange rates only comes into play for our switching variable because all of the other variables are comparble since they are growth rates. In the case of the money denominated variables, they are *real* growth rates (i.e., values are deflated with the local GNP deflator).

Table A1

PARAMETER ESTIMATES

Dependent Variable = $\dot{Y}/Y$

Variables	Model: Equations (1)	Model: Equations (2) GDPc≥\$1200	GDPc<\$1200
Intercept	0.0145°	-0.0187	0.0095
	(0.0085)	(0.0155)	(0.0125)
L/L	0.2668	0.6513*	0.4528
	(0.2262)	(0.3233)	(0.3892)
I/Y	0.0519*	0.1290**	0.0372
	(0.0242)	(0.0462)	(0.0283)
X/Y	0.7894**	0.5234**	0.5807**
	(0.0704)	(0.1519)	(0.1660)
X/X	—	0.2072**	0.0494
	—	(0.0523)	(0.0520)
R^2 =	.39	.46	.43
N=	227	105	122
countries	70	33	33
log(L)	449.86		465.37

Notes: Standard errors are in parentheses.
°, *, ** indicate significance at the 90%, 95%, and 99% level, respectively.

It has been suggested that using the Summers and Heston data as a source for the switching variable might produce different results. We found, however, that the results do not differe in any substantial way. Nevertheless, results using real GDP in US dollars from the Summers and Heston data are reported in Table A1, below.

The principle difference is that the "optimal" value of the switching variable is higher using the real GDP per capita as calculated by Summers and Heston than when using the real GNP per capita from the World Tables. This is not surprising, however, given that using trade based exchange rates tends to "underestimate" GNP (or GDP) in (particularly, lower income) LDCs. Although the number of useable observations is reduced (from 276 to 227) because the Summers and Heston data covers fewer countries, the general conclusionss drawn in the text do not differ with these results.

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