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The Effects of Debt Burden on Economic Growth in Heavily Indebted Developing Nations

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This paper investigates the effects of debt burden on economic growth in sixteen hevily indebted developing nations by extending the production function approach applied by others to explore the relationship between export growth and the growth of output. This paper asserts that during the 1970's and 1980's, the growth of a nation's debt burden played a significant role in influencing the productivity of labor and capital and, hence, should also be included to explain economic growth in these nations. This study finds a significant negative relationship between the growth of debt burden and economic growth in the heavily indebted developing nations especially during the 1971-1979 period.

I. Introduction

Even though the negative relationship between debt burden and growth for the heavily indebted developing nations is well accepted in the economics profession, little empirical evidence supports this proposition. This paper attempts to remedy this problem by extending the standard export-growth production model to allow for debt burden to influence economic growth.

In recent years, much attention has been focused on the feasibility of promoting economic growth through exports. Studies focusing on various aspects of the question of the relationship between exports and growth, including Michaely (1977), Balassa (1978), Tyler (1981), Kavoussi (1984), and Ram (1985 and 1987), have found a significantly positive relationship

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between export growth and the growth of output.

During the 1980's the question of how to promote economic growth in developing nations became even more complicated due to the severe debt burdens which many of the developing nations were facing. Due to heavy borrowing as a consequence of the increase in oil prices during 1973-74, many nations found much of the foreign exchange earned through their export production given over to servicing the debt. After the second large increase in the price of oil in 1979 and the subsequent introduction of anti-inflationary macroeconomic policies by the developed nations, the situation facing developing nations worsened dramatically. Beginning with Costa Rica's default in 1981, followed by Mexico in 1982, the serious, long run nature of the debt problems of the heavily indebted developing nations began to be recognized.

Although not challenging previous empirical studies of the positive effects of exports on the growth of output, this paper argues that for heavily indebted developing nations during the 1970's and 1980's, the growth of a nation's debt burden and debt overhang played a significant role in influencing the productivity of labor and capital, and hence the growth of a nation's debt should be included in the standard export-growth production function models for the growth of output in these nations.

By concentrating on the debt burden of heavily indebted nations, this study focuses on nations for whom the large debt burden many have affected the economic rewards associated with exports. Although for less debt burdened nations the accumulation of debt may be associated with high rates of economic growth, for the heavily indebted nations the reverse has been true. In terms analogous to Krugman's (1989) debt relief Laffer Curve for the heavily indebted nations a decrease in debt burden would improve the likelihood of economic growth and, hence, repayment, while an increase in debt burden would have the reverse consequences.

The results reported in this paper support the inclusion of the growth of debt burden in the standard export-growth production model for heavily indebted nations, especially during the 1971-1979 period. During that period, the results indicate that the growth of a nation's debt burden adversely affected their economic growth.

The organization of the paper is as follows: the second section extends the export-growth production function model to allow for the inclusion of the growth of a nation's debt burden and discusses other tests performed to investigate the relationship between debt, exports and growth; the third section explains the results of the estimation of the "debt burden —

growth'' production function model, the results of a Chow Test for a break in the model in 1980, and the results of a Spearman rank correlation test for the growth of exports and the growth of debt burden; and the the final section summarizes and concludes the paper.

II. Extension of the Export-Growth Models

Work focusing on the relationship between the growth of exports and the growth of output in developing nations has largely been based on a standard production function model:

(1) $y = y(K,L)$

where y, L, and K are measures of output, labor, and capital, respectively. These studies have extended the function to allow exports, as well as labor and capital, to be arguments, as in equation (2);

(2) $y = y(K,L,X)$

where X is a measure of exports. These researchers assert that exports may be viewed as an input because of higher productivity of capital and labor due to the benefits of comparative advantage and that exports may ease the foreign exchange constraint which also would increase the productivity of other factors employed.

Although for many of the developing nations the growth of exports plays an important role in influencing the growth of output, during the 1970's and 1980's the large accumulation of debt, and, in particular, private debt, played an equally important role in influencing growth. As Krueger (1987) expalins, conventional wisdom held that increased access to international capital markets was a positive development for both the developed and the developing nations:

> "Capital-poor developing countries ... had relatively high marginal products of capital and low savings rates, whereas rich countries had relatively lower marginal products of capital and higher savings rates; a flow of investible resources from rich to poor countries therefore appeared to be economically efficients, as well as desirable on humanitarian grounds.''[1]

Certainly, South Korea is an example of a nation that was described as heavily indebted, but successfully implemented an export-oriented

[1] Anne O. Krueger, "Origins of the Developing Countries' Debt Crisis 1970 to 1982,'' *Journal of Development Economics,* Vol. 27 (1987), p. 165.

development strategy. However, the conventional wisdom was challenged by the debt servicing problems of many nations during the 1980's when it became evident that it was possible for nations to become overwhelmed by debt. For heavily indebted nations, the fact that growth in exports only led to the payment of interest and principal on the debt inhibited incentives for investment and growth in these nations, a phenomena often referred to as debt overhang.

To investigate the relationship between a nation's debt burden and economic growth, debt burden was added as an argument in the production function similar to the addition of exports in the empirical studies discussed above:

$$(3)\ y = y(K,L,DB)$$

where DB is a measure of a nation's debt burden. Debt burden can be viewed as an argument in the production function due to its effects on the productivity of labor and capital in a manner similar to the inclusion of exports in the production function. In as much as a nation has a significant debt burden, the need to service it debt will influence how labor and capital will be used in the production process. In particular, if the gains of the productivity increase are to foreign creditors and not domestic agents, there is little incentive to increase the productivity of capital or labor. In terms of the analogy to Krugman's debt relief Laffer Curve, for a nation on the downward sloping portion of the curve, an increase in debt burden will decrease economic growth.

Making the standard assumptions in equation (3) that the input elasticities of output are constant, technical change is Hicks-neutral, and the rate of technical change can be written as a linear function of the rate of growth in a nation's debt burden, the equation can be rewritten in the following estimable form:

$$(4)\qquad y_g = b_0 + b_1K_g + b_2L_g + b_3DB_g$$

In this work, y_g is measured as the percentage change in real gross domestic product, K_g as the ratio of real gross domestic investment to real GDP,[2] L_g as the percentage change in population, and DB_g as the rate of change in the ratio of long term debt service on public and publicly guaranteed debt to the exports of goods and services denominated in

[2] As in Ram (1985), K_g has been replaced by the real investment to real output ratio, which approximates the change in K to real output ratio. The estimated coefficient on K_g, therefore, is an estimate of the marginal physical product of capital.

dollars.[3] Although it would be preferable to use the percentage change in the economically active population or the labor force, that data is generally considered to be less reliable.

Equation (4) was estimated for the following heavily indebted nations during the period 1971 to 1987: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Ivory Coast, Jamaica, Mexico, Nigeria, Peru, Philippines, Uruguay, Venezuela, and Yugoslavia. These are the "High Indebted Countries" as defined in the *World Debt Tables,* with the exception of the exclusion of Morocco due to the lack of consistent data.

To compare the results of the data set with previous studies of economic growth in developing nations, equation (2) was estimated for the 16 nations listed above for the time period 1071-1987.[4] Making similar assumptions as in equation (4), the estimation of (2) took the form of equation (2') below where X_g is the rate of change in real exports.

$$(2') \qquad y_g = b_0 + b_1K_g + b_2L_g + b_3X_g$$

In addition, to allow for technical change to be a function of both the growth of exports and the growth of a nation's debt burden the following equation was estimated for the nations listed above:

$$(5) \qquad y_g = b_0 + b_1K_g + b_2L_g + b_4DB_g + b_5X_g$$

Due to the inability of several of the heavily indebted nations to fully service their debt during the latter half of the data set, it was anticipated that the data on long term debt service measured as long term interest and principal payments as a percent of exports of goods and services in dollars would not accurately portray the real debt burden of these nations. The real debt burden of these nations would best be measured by long term interest and principal obligations, rather than payments, as a percent of exports of goods and services in dollars. Using the publicly available data on long term interest and principal payments may obscure the relationship between debt burden and output. Since most nations began experiencing difficulty in meeting all of their debt obligations in the early 1980's, the data set was divided into two periods, 1971-1979 and 1980-1987, in order to isolate the problems with measuring debt burden.

[3] Data on long term debt burden and exports of goods and services denominated in dollars are from the *World Debt Tables.* Data on real gross domestic product, real gross domestic investment, real exports, and population are from the *World Tables.*

[4] Due to data limitations, for some nations the data set was smaller than the 1971-1987 period. Exact time periods are listed in the appendix.

Equations (4), (2'), and (5) were reestimated for the nations above for the two subperiods. Chow Tests were conducted to test for the significance of the break at 1980.

Finally, to further investigate the potential negative impact of the growth of a nation's debt burden, the relationship between real export growth and the growth of a nation's debt burden was examined for the 16 heavily indebted nations. Although this paper argues that the growth of a nation's debt buden negatively affects output due to the impact on the productivity of labor and capital, it may be that this impact is compounded by a negative relationship between the growth of debt burden and the growth of exports. To this end, Spearman rank correlation coefficients for the growth of exports and the growth of a nation's debt burden were calculated for the whole sample period and the two subperiods.

III. Results

The results of the pooled, cross-sectional and time-series, estimations of equations (4), (2'), and (5) for heavily indebted nations during the 1971-1987 period are reported in Table 1.[5]

The results of the estimations of equations (2') and (5) indicate the importance of the growth of exports in determining economic growth, consistent with the results from previous studies. This is especially interesting given that most of the nations included in the sample followed an inward-looking, rather than an export-oriented development strategy during this time period. The results of the estimation of equation (4) indicate that the growth of a nation's debt burden negatively affected economic growth over this period. However, in the estimation of equation (5), the presence of the growth of exports negates the significance of the growth of debt burden in the heavily indebted nations. As discussed earlier, one possible cause of this result could be a problem in measuring a nation's debt burden during periods in which a nation is not meeting all of its debt obligations.

The results for the estimations of equation (4), (2'), and (5) for the two subperiods follow in Table 2.[6] Also included in Table 2 are the results

[5] Due to evidence of autocorrelation, all three of the equations were estimated by an AR1 process. In terms of the significance and estimated signs of the coefficients, the results of the OLS and AR1 estimations were the same.

[6] Due to evidence of autocorrelation, all three equations during the 1970-1979 subperiod were estimated using an AR1 process. Again, in terms of the significance and estimated signs of the coefficients, the results of the OLS and AR1 estimations were the same.

Table 1

REGRESSION RESULTS

Dependent Variable: y_g
Sample Period: 1971-1987
Number of Observations: 241

Estimated Coefficients
(t-statistics in parenthesis)

Eq.	Constant	K_g	L_g	DB_g	X_g	$R(adj)^2$
(4)	−0.02	0.16***	0.71*	−0.02**		0.13
	(−1.33)	(3.29)	(1.66)	(−1.99)		
(2')	−0.03*	0.15***	0.68*	0.11***		0.22
	(−1.76)	(3.38)	(1.73)	(5.83)		
(5)	−0.03*	0.15***	0.70*	−0.01	0.10***	0.23
	(−1.76)	(3.44)	(1.77)	(−1.04)	(5.52)	

Notes: * indicates significance at the 10% level.
** indicates significance at the 5% level.
*** indicates significance at the 1% level.

from a Chow Test testing the equality of the coefficients over the subperiods.

In the estimations of equations (2') and (5) for both subperiods a significant positive relationship between the growth of exports and economic growth is again indicated.

In addition, the results of the estimation of equations (4) and (5) from 1971-1979 strongly indicate that the growth of a nation's debt burden in the sample nations did significantly, and negatively, affect economic growth. The estimated coefficient of DB_g in both equations (4) and (5) for this subperiod is significant at the 1% level and the coefficient is negative, supporting the hypothesized relationship between DB_g and Y_g. Also in equation (5), the addition of DB_g to the export-growth model, equation (2'), adds to the explanatory power of the model as evidenced by the increase in the adjusted R^2.

The results of the estimation of equations (4), (2'), and (5) for the period 1980-1987 offer little support for the inclusion of the growth of debt burden to the economic growth model. The growth of debt burden is not a significant explanatory variable in either the estimation of equa-

Table 2

REGRESSION AND CHOW TEST RESULTS

Dependent Variable: y_g

Estimated Coefficients
(t-statistics in parenthesis)

Sample Period: 1971-1979
Number of Observations: 123

Eq.	Constant	K_g	L_g	DB_g	X_g	$R(adj)^2$
(4)	0.01	0.04	1.43***	−0.04***		0.14
	(0.54)	(0.57)	(2.58)	(−2.91)		
(2′)	0.01	0.05	1.20**	0.10***		0.22
	(0.23)	(0.68)	(2.27)	(4.58)		
(5)	0.01	0.05	1.30**	−0.03**	0.09***	0.26
	(0.26)	(0.74)	(2.47)	(−2.50)	(4.32)	

Sample Period: 1980-1987
Number of Observations: 118

Eq.	Constant	K_g	L_g	DB_g	X_g	$R(adj)^2$
(4)	−0.02	0.12**	0.13	−0.004		0.02
	(−1.16)	(2.41)	(0.28)	(−0.46)		
(2′)	−0.02	0.12**	0.21	0.11***		0.10
	(−1.52)	(2.48)	(0.47)	(3.21)		
(5)	−0.03	0.12**	0.22	0.006	0.12***	0.10
	(−1.55)	(2.43)	(0.48)	(0.65)	(3.23)	

Result of Chow Test

Equation	F-Statistic
(4)	7.58***
(2′)	5.77***
(5)	7.57***

Notes: * indicates significance at the 10% level.
** indicates significance at the 5% level.
*** indicates significance at the 1% level.

tion (4) or equation (5). The growth of exports, however, is a significant explanatory variable in the estimations of equations (4) and (5). In addition, the explanatory power of the model, as measured by the ajdusted R^2, is much lower than in any of the estimations in the other time periods. Again, these results may be due to the absence of a variable which measures the true debt burden of a nation. If such a variable were available, a better indication of the importance of the growth of a nation's debt burden would be obtained.

The estimations of equations (4), (2'), and (5) for the two subperiods also provide an interesting perspective about the utilization of labor and capital in the heavily indebted nations during these two time periods. The results indicate that labor rather than capital was a constraint in the production process during the 1971-1979 period, while capital rather than labor was a constraint during the 1980-1987 period. This result is not surprising for two, not mutually exclusive, reasons: first, because of the heavily indebted nations' ability to borrow during the 1970's and difficulties with repayment during the 1980's; and, second, due to the existence of negative real rates of interest during the 1970's but positive and relatively high real rates of interest during the early 1980's.

The F-statistics corresponding to the Chow Test support the division of the data into the two subperiods. For all three equations estimated, the hypothesis that the coefficients are equal across the two subperiods is rejected at the 1% level of significance.

The results of the Spearman rank correlation test for the correlation between the growth of exports and the growth of a nation's debt burden are reported in Table 3. They indicate that the correlation between the growth of exports and the growth of a nation's debt burden is significant at the 10% level in the 1980-1987 and the sign of the correlation coefficient is negative. This negative correlation between the growth of exports and the growth of nation's debt burden for the 1980-1987 subperiod provides evidence that debt overhang may have been a problem during the 1980's with the growth of debt burden inhibiting the growth of real exports.

The lack of correlation between the two variables during the 1971-1979 period may indicate that prior to 1980 the debt burden of these nations, albeit substantial, did not serve as a disincentive for export growth. Although the results discussed previously indicate a negative relationship between the growth in a nation's debt burden and the growth of output during the 1971-1979, the negative impact of debt burden on exports is not evident until after 1980. After 1980, the growth of debt burden on these nations was so severe as to not only affect the productivity

Table 3

SPEARMAN RANK CORRELATION COEFFICIENTS
(t-statistics in parenthesis)

Sample	Correlation Coefficient Between DB_g and X_g
1971-1987	−0.41 (−1.58)
1971-1979	0.31 (1.18)
1980-1987	−0.43* (−1.66)

Notes: * indicates significance at the 10% level.
** indicates significance at the 5% level.
*** indicates significance at the 1% level.

of capital and labor but also to discourage export growth, thus making it difficult for nations to fully service their debt.

IV. Summary and Conclusions

This paper extends the export-growth model to allow for the growth of a nation's debt burden to influence economic growth. Arguing that during times of heavy debt burden, the growth of a nation's debt burden may reduce the productivity of labor and capital in effect influencing technical change, debt burden was introduced as an argument in the standard production function and export-growth models. The results of the estimation of equations investigating the relationship between a nation's debt burden and economic growth, particularly for the 1970-1979 time period, indicate that the growth of a nation's debt burden negatively impacts economic growth. The results from the 1980-1987 period are limited by the lack of data which measure the debt service, both interest and principal payments, a nation is obligated to pay.

Although the focus of this paper is on the relationship between debt burden and economic growth and not on different policies advocated to solve the current debt problems facing the developing nations, the results support arguments made in favor of debt reduction as a means of promoting economic growth in these nations. The results in this paper pro-

vide further support of the existence of a debt relief Laffer Curve and the problem of debt overhang.

This study is limited by the problems associated with pooled, cross-sectional and time-series, studies. Such studies impose a similar structure on very different types of nations and the results are not necessarily applicable to any one individual nation. Yet, since so many nations are facing similar debt problems, there is much to be learned from a model such as this which provides insight into the generic problems resulting from heavy debt burdens.

Data Appendix

Nation	Time Period	Nation	Time Period
Argentina	1971-1987	Jamaica	1971-1987
Bolivia	1979-1987	Mexico	1971-1986
Brazil	1971-1987	Nigeria	1971-1987
Chile	1971-1982	Peru	1971-1985
Colombia	1971-1987	Philippines	1971-1987
Costa Rica	1980-1987	Uruguay	1971-1987
Ecuador	1971-1985	Venezuela	1975-1987
Ivory Coast	1971-1987	Yugoslavia	1971-1987

References

Belassa, B., "Exports and Economic Growth: Further Evidence," *Journal of Development Economics,* 5, 1978.

Kavoussi, R.M., "Export Expansion and Economic Growth: Further Empirical Evidence," *Journal of Development Economics,* 14, 1984.

Krueger, A.O., "Origins of the Developing Countries Debt Crisis: 1970 to 1982," *Journal of Development Economics,* 27, 1987.

Krugman, P.R., "Market-Based Debt-Reduction Schemes," in Jacob A. Frenkel, Michael P. Dooley, and Peter Wickham, eds., *Analytical Issues in Debt,* International Monetary Fund, 1989.

Michaely, M., "Exports and Growth: An Empirical Investigation," *Jour-*

nal of Development Economics, 4, 1977.

Ram, R., "Exports and Economic Growth in Developing Countries: Evidence from Time-Series and Cross-Section Data," *Economic Development and Cultural Change,* 36, 1, 1987.

_____, "Exports and Economic Growth: Some Additional Evidence," *Economic Development and Cultural Change,* 33, 2, 1985.

Tyler, W.G., "Growth and Export Expansion in Developing Countries: Some Empirical Evidence," *Journal of Development Economics,* 9, 1981.

The World Tables, 1988-89 edition, The World Bank, 1989.

World Debt Tables: External Debt of Developing Countries, Vol. I & II, Country Tables, 1989-90, The World Bank, 1989.

_____, Vol. III, Country Tables, 1970-79, The World Bank, 1989.