

Bredesen, Ivar; Strobel, Susann

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Ivar Bredesen* and Susann Strobel**

Trade as an Engine of Growth: The Lewis versus Riedel Controversy Revisited

Is there a stable quantitative relationship between the exports of developing countries and prosperity in developed countries? The controversy between Lewis and Riedel on this question is taken up anew in this paper and examined in the light of ten years of added data and by estimating additional relationships.

In his 1979 Nobel lecture, W. Arthur Lewis¹ put forward the proposition that there is a stable quantitative relationship between exports of less developed countries (LDCs) and prosperity in developed countries (DCs). Trade is seen as an engine of growth, but since the DCs at the time were undergoing a severe recession following, inter alia, oil price shocks, Lewis was pessimistic as to the continued operation of trade as an engine of growth for LDCs. Instead, he suggested increased reliance on South-South trade to take up the slack left by the developed countries.

In 1984, Lewis' contention of a stable and mechanical relationship was severely attacked by James Riedel.² Riedel argues that Lewis' presumption is based on unrealistic theoretical assumptions. He presents statistical evidence showing that the quantitative relationship which Lewis believes to have been stable for a period of over 100 years is in fact very unstable and can be expected to remain so.

To our knowledge no empirical research on this controversy has been published since, and this paper seeks to fill this gap by reestimating Riedel's equations with 10 years of added data and also to shed further light on the issue by estimating additional relationships.

The point of departure for the Lewis–Riedel controversy on trade as an engine of growth for LDCs is Lewis' contention that a stable relationship between economic growth in DCs and export growth in LDCs exists. In Lewis' own words, "The growth rate of world trade in primary products over the period of 1873 to 1913 was 0.87 times the growth rate of industrial production in developed countries, and just about the same relationship, about 0.87, also ruled in the two decades to 1973... We need no elaborate statistical proof that trade depends on prosperity in the industrial countries."³

* Finnmark College, Alta, Norway.

** Institute of World Economics, Kiel, Germany. The authors would like to thank Mr. Matthew McQueen of Reading University who suggested this study to us and for helpful comments on an earlier draft. Mr. Rolf Langhammer of the Kiel Institute of World Economics also provided useful suggestions for which we are grateful.

Riedel attacks this contention on several grounds, and a brief recapitulation of his points is warranted. Firstly, Riedel asserts that Lewis' view implies very limited substitutability between the products LDCs produce and those produced in DCs. From this it follows that LDCs' prospects of gaining increased market shares through price competition are limited. Riedel also criticises Lewis' contention that relative prices are unimportant, and that the LDC–DC trade link has, in terms of physical volume, been not much affected by price. It has proved complex to model the "trade as an engine of growth" theory formally. Riedel alternatively suggests that a looser standard Walrasian model of world trade may in practice be an appropriate framework. He claims that, "...the procedure is to solve a simultaneous system of supply and demand functions which yield a set of reduced form equations defining the relationship between the market clearing price and quantity of exports and each of the exogenous variables that enter into the determination of supply and demand."⁴

Riedel argues that the coefficient measuring the impact of a given change in DC income on the quantity exported of a given LDC product will depend, inter alia, on LDC market share, the elasticity of substitution between LDC and DC goods in the market, elasticity of supply for LDC and DC products as well as income elasticity of demand. These parameters vary from product to product, and Riedel therefore asserts that the relationship between aggregate export performance and income growth in DCs will vary among LDCs due inter alia to differences in export

¹ W. Arthur Lewis: The slowing down of the engine of growth, in: American Economic Review, Vol. 70, No. 4, pp. 555–564. Reprinted in: Mark Gersovitz (ed.): Selected Economic Writings of W. Arthur Lewis, New York University Press, 1983.

² James Riedel: Trade as an engine of growth in developing countries, in: The Economic Journal, 1984, pp. 56–73.

³ W. Arthur Lewis, op. cit., p. 556. Lewis considers world trade in primary products an acceptable proxy for LDC exports and the growth rate of industrial production in the developed countries as a proxy for prosperity in the developed countries.

⁴ James Riedel, op. cit., p. 59.

composition. The relationship can furthermore be expected to change as the export patterns of LDCs change in their economic growth and structural change process. Riedel tests this point on a product but not on a country level. This study seeks to fill this gap by examining the relationship for various groups of LDCs, in addition to product-based estimations.

Structural Change in LDC Exports

As was mentioned above, Lewis argues that South-South trade must be promoted to take up the slack left by the reduced demand for LDC exports in DCs. It is therefore illuminating to examine structural change in the destination of LDC exports, and also structural change in the goods composition. Table 1 below, computed from GATT data, shows the very substantial changes which have occurred in the structure of LDC exports with respect to both destination and goods composition from 1960 to 1987, 1987 being the latest year for which data is available.

Important contributions dealing with the structure of LDC exports both on a commodity and destination basis are the studies by Havrylyshyn and Wolf⁵ (hereafter referred to as HW) as well as a study by Lall.⁶ The studies by HW and Lall in part take opposite views as to the changing structure in the destination of LDC exports, and it is interesting to contrast their findings with Table 1, having the benefit of data confirming what actually happened. The HW analysis covers a time period from 1963 to 1977 and it concludes that, excluding fuel, the share of trade among LDCs in their total trade remained fairly constant over this period with a share of 22–23%, whilst a slight increase to 24% was observed from 1975–1977.

On a commodity basis, HW find that there is a strong downward trend in the share of trade among LDCs for manufactures, with LDC shares of 40%, 27% and 25% in 1963, 1971 and 1977 respectively. For primary products the trend was the opposite, with the share increasing from 16% to 23% from 1973 to 1977. Based on these findings, HW reach the overall conclusion that DCs have been, and probably will continue to be, the most dynamic market for LDC exports. Examining Table 1 for 1960 and 1970 gives similar results to those of HW, but an examination of the data for 1981 shows clearly that the share of LDCs in LDCs' total exports has increased considerably, reaching 32.8%

of total exports and 39.1% for manufactures. This trend in the late 1970s was detected by Lall, who subsequently takes a much more positive view on the prospects for continued expansion in South-South trade. Indeed, Lall asserts that, "... it is also possible that *intra-South trade has a momentum of its own*, based upon distinct features of such trade, and that a resumption of growth in the North will not eat into its share."⁷

Table 1 tells a different story, though, and confirms HW's gloomy prediction. The high share of intra LDC trade observed in 1981 cannot be interpreted as a momentum in South-South trade; it follows simply from the fact that exports to the DCs suffered a setback. Hence the intra LDC share had to rise even if absolute levels did not change very much. After 1981 LDCs' exports to DCs again gained momentum, and by 1987 the share of intra LDC exports in total non-fuel LDC exports had fallen to 22.5%, similar to the share observed in 1970. The share of manufactures had fallen even more, and was, at 23.6%, lower than at any time since 1960.

Table 1 also demonstrates the effect of the industrialization efforts in LDCs. The share of primary products has been steadily declining whilst manufactures have been increasing to such an extent that by 1987 they actually constituted 2/3 of total LDC non-fuel export earnings. Overall, there is clearly no case for the frequently held

Table 1
The Structure of LDC Exports
(selected years 1960-1987, in per cent)

	1960	1970	1981	1987
Total exports	100	100	100	100
Food	29.5	26.1	11.6	13.8
Agr. raw materials		9.6	3.0	4.0
Ores and minerals ¹	27.9	5.7	2.3	2.4
Fuels	28.0	32.6	59.9	29.7
Manufactures	14.0	24.9	21.3	47.1
Total non-fuel exports	100	100	100	100
Food	41.0	38.7	28.9	19.6
Agr. raw materials		14.3	7.5	5.7
Ores and minerals ¹	38.8	8.5	5.8	3.4
Manufactures	19.7	37.0	53.2	67.0
Share of DCs in LDCs' exports				
Total non-fuel exp.	72.1	70.1	56.8	69.9
Food	72.9	73.2	54.1	69.5
Agr. raw materials		62.9	56.4	63.1
Ores and minerals ¹	73.2	86.5	77.0	73.8
Fuels	63.3	76.2	73.6	68.3
Manufactures	66.6	67.4	54.6	70.3
Share of LDCs in LDCs' exports				
Total non-fuel exports	19.0	19.7	32.8	22.5
Food	18.1	16.1	27.5	18.6
Agr. raw materials		19.9	29.1	25.9
Ores and minerals ¹	14.1	5.0	15.1	18.8
Fuels	29.5	20.6	24.0	28.9
Manufactures	29.7	26.6	39.1	23.6

¹ For 1960, "ores and minerals" includes agricultural raw materials.
Source: GATT: International Trade, various issues.

⁵ Oli Havrylyshyn and Martin Wolf: Recent trends in trade among developing countries, in: European Economic Review, Vol. 21 (1983), pp. 333-362.

⁶ Sanjaya Lall: Trade Between Developing Countries, in Singer, Hatti and Tandon: Challenges of South-South Cooperation (part 2), 1988, pp. 389-413.

⁷ Ibid., p. 396.

view that LDCs are dependent on exports of primary products alone. It is equally clear, however, that the aggregate data mask a wide diversity of export structures among LDCs. Figure 1 examines the changing structure of exports for four groups of LDCs.

The Latin American countries have a fairly balanced export structure, but with a steadily growing share of manufactures in total export earnings. For Africa fuel exports are totally dominating. The structural change towards more manufactured goods has been very slow, and primary products still make up a large part of total export earnings. The developing West Asian countries are still totally dependent on fuel exports. For the other Asian developing countries or maybe more appropriately newly industrialized countries (NICs) exports of manufactures have grown tremendously over the entire period. In 1986,

the share of manufactures was 68.8%, which contrasts sharply with Africa's figure of 10%.

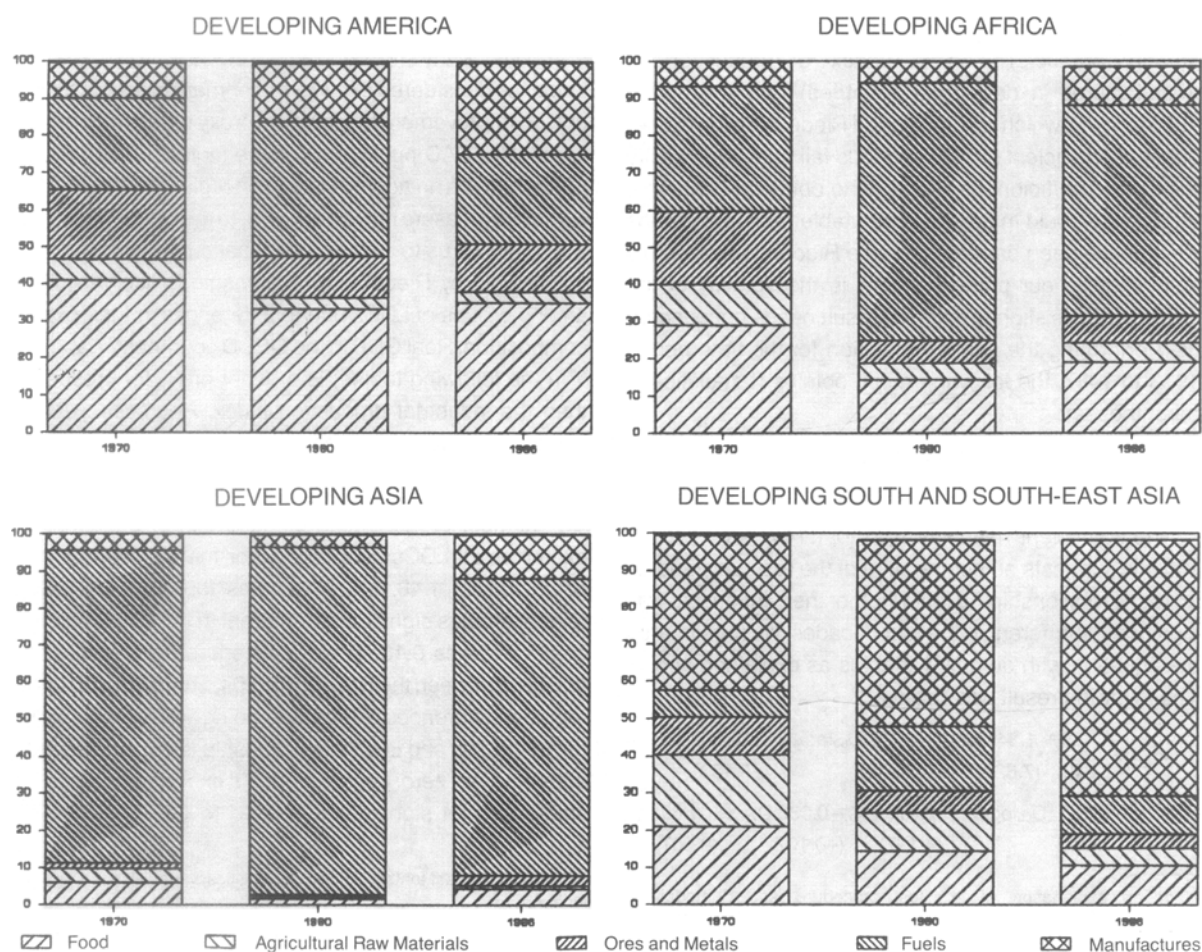
Lewis obtained his celebrated 0.87 coefficient by regressing the logarithm of the quantum index of world trade in primary products (X_A) on the logarithm of an index of world production of manufactures (I_M). As Riedel points out, this coefficient can be interpreted as a measure of the income elasticity of demand only if one accepts Lewis' assumption that relative price changes are unimportant and that export supply is infinitely elastic. These assumptions are unrealistic, and given this fact the coefficient is problematic to interpret and its value may be expected to be unstable.⁸

The issue of the stable relationship between LDC exports and DC income is especially important, given Lewis' claim of the 100 year stable link. A statistical test which examines this must be used. This is frequently carried out by the Chow test procedure, but the use of

⁸ Cf. also James Riedel, *op. cit.*, p. 66.

Figure 1

Export Structure of Different Country Groups for 1970, 1980 and 1986



Source: UNCTAD: Handbook of International Trade and Development Statistics, 1988, Table 3.2.

dummy variables is more convenient.⁹ The overall conclusion derived from the Chow and dummy variable tests are the same, but for our purpose the dummy variable approach, which was also used by Riedel, offers some advantages. The equation to be estimated is specified as follows:

$$Y_i = a_1 + b_1 X_i + b_2 (D_i X_i) + a_2 D_i + u_i$$

where Y_i is the dependent variable, X_i is the explanatory variable and D_i is the dummy variable taking the value one for the period under consideration and zero elsewhere. a_2 is the differential intercept and b_2 is the differential slope coefficient. b_2 indicates by how much the slope coefficient differs between the periods. We shall exclusively use logarithmic models, and by adding b_1 and b_2 we obtain the slope coefficient for the period in which the dummy variable D_i is equal to 1. If b_2 is statistically significant we can conclude that the relationship is unstable. The intercept dummy $a_2 D_i$ has no particular economic interpretation.

The Lewis Relationship

Regressing X_A (volume index of world exports of primary products)¹⁰ on I_M (index of production of manufactures in developed countries)¹¹ for the period 1953 to 1977, which was the period Riedel considered, we obtain a coefficient of 1.00 and thus fail to obtain exactly the same coefficient as Riedel, who obtained 0.83. This divergence could in part be attributable to data revisions which have been carried out since Riedel undertook his study, but as our prime concern is the stability of the coefficient this slightly different result needs not concern us. Performing the same regression for the time period 1953 to 1987, the following result obtains (t statistics in parentheses):

$$\log X_A = -0.717 + 1.144 \log I_M \quad \text{RBAR}^2 = 0.967 \quad \text{D.W.} = 0.325 \\ (-4.660) \quad (31.475)$$

The coefficient has increased to 1.144, but the D.W. statistic suggests autocorrelation of the residuals and an unstable relationship. To test whether the relationship was significantly different in the four decades, we reestimated the equation with dummy variables as explained above. The following result was obtained:

$$\log X_A = -1.455 + 1.341 \log I_M - 0.727 (D_{60} \log I_M) - 0.027 (D_{70} \log I_M) \\ (-2.249) \quad (7.622) \quad (-3.941) \quad (-0.133) \\ -0.165 (D_{80} \log I_M) + 2.870 D_{60} - 0.085 D_{70} + 0.669 D_{80} \\ (-0.632) \quad (4.197) \quad (-0.107) \quad (0.607)$$

⁹ For an explanation of this test procedure, see Damodar N. Gujarati: *Basic Econometrics*, 2nd edition, 1988, pp. 446-448.

¹⁰ United Nations: *Annual Statistical Yearbook*, various issues; United Nations: *Yearbook of International Trade Statistics*, issues 1981 and 1987, special table G.

$$\text{RBAR}^2 = 0.995 \quad \text{D.W.} = 1.694$$

$D_{60} = 1$ for observations 1960–69 and zero otherwise

$D_{70} = 1$ for observations 1970–79 and zero otherwise

$D_{80} = 1$ for observations 1980–87 and zero otherwise

The coefficient for the 1950s takes a value of 1.341. In the 1960s the coefficient takes the value of 0.614 ($= 1.341 - 0.727$), which is significantly different from the 50s at the 1% level. Further statistical tests reveal that the slope coefficient did not differ significantly in the 50s, 70s and the 80s. We therefore cannot escape the conclusion that the relationship has remained remarkably stable with the exception of the 1960s, albeit with a slope coefficient higher than that observed by Lewis. This result still does not tell us very much. What we have documented is that there is a fairly stable relationship between industrial production and trade in primary products, but we cannot infer from this that a mechanical link between DC prosperity and LDC exports exists. The proxy for LDC exports is too inaccurate to be meaningful and more rigorous tests are needed. These are carried out below.

LDC Export Volumes and Real OECD GDP

As was clearly shown in Table 1, LDCs as a group can no longer be considered exporters of primary products alone, and an improvement to the Lewis proxy must therefore be found. UNCTAD publishes volume indices of exports of LDCs, both on an aggregate and on regional levels.¹² This summary measure may be superior to the Lewis index, and it also allows us to examine regional differences. As was pointed out by Riedel, the relationship is likely to differ among groups of LDCs due to differences in their export composition. Real GDP in the OECD countries¹³ (labelled Y in the following tables) is a better proxy for prosperity than the industrial production index. Regressing these variables for the time period 1965 to 1987 gives the results presented in Table 2.

A number of interesting points emerge. Equation (2) examines all LDCs as a group. For the 60s we obtain a coefficient of 1.48, which (as was found in the Lewis relationship) is significantly different in the 70s, when the coefficient was 0.18. The coefficient is not significantly different between the 60s and the 80s. There are also large regional differences. Africa was doing well in the 1960s, but in the 70s and 80s the relationship is not significantly different from zero. Latin America's exports appear to be stable but not significantly related to OECD GDP. The

¹¹ United Nations: *Monthly Bulletin of Statistics*, various issues, special table A.

¹² UNCTAD: *Handbook of International Trade and Development Statistics*, 1988, table 2.1.

¹³ OECD: *Economic Outlook*, various issues.

Table 2
Regression of LDC Export Volume Indices on
OECD Real GDP 1965 to 1987

Region:	Const	LogY	D ₇₀ logY	D ₈₀ logY	D ₇₀	D ₈₀	RBAR ²	D. W.
(1) Total LDCs	1.91 3.89	0.59 5.37					0.55	0.50
(2)	-1.90 -1.02	1.48 3.31	-1.30 -2.24	-0.28 -0.53	4.97 2.32	0.88 0.38	0.84	1.50
(3) Africa	5.83 7.58	-0.28 -1.64					0.07	0.47
(4)	-5.32 -2.09	2.37 3.87	-2.96 -4.29	-2.27 -3.09	12.70 5.35	9.26 2.91	0.75	1.75
(5) Latin America	2.03 5.88	0.57 7.43					0.70	0.92
(6)	4.94 2.53	-0.12 -0.25	0.42 0.79	0.94 1.66	-1.73 -0.77	-4.03 -1.65	0.77	1.63
(7) West Asia	6.41 5.06	-0.42 -1.50					0.05	0.24
(8)	-3.45 -0.87	1.88 1.98	-2.04 -1.90	-2.64 -2.31	8.97 1.97	11.23 2.27	0.77	1.19
(9) South East Asia	-7.98 -21.80	2.75 32.68					0.98	0.78
(10)	-2.59 -1.66	1.46 3.92	1.42 3.36	1.87 4.18	-6.06 -3.40	-8.15 -4.19	0.99	1.96

Note: t statistics for this and the following tables are given below the coefficient values.

West Asian countries mainly consist of oil exporters,¹⁴ and the instability observed in equation (8) is to a large extent caused by fluctuating oil prices. The performance of developing South East Asian countries¹⁵ is well known. Equations (9) and (10) show that export volumes have outpaced OECD GDP growth over the entire period, with a steadily increasing growth rate. These results indicate that supply rather than demand factors have determined growth.

We also re-estimated the equations with a dummy variable designed to test for structural change in the pre-post oil price shock periods. The results are shown in Table 3. Basically, the same results emerge. Latin America's significant coefficient for the post 1974 period is due to an export boom in 1975.

Fuel exports are likely to influence these results. We attempted to correct for this by removing fuel exports from total export earnings.¹⁶ To arrive at real figures the net-of-fuel export earnings must be discounted. This presents

¹⁴ For a precise listing of countries belonging to this group, see UNCTAD: Handbook of International Trade and Development Statistics, 1988, p. 20.

¹⁵ For a precise listing of countries, see footnote 14.

¹⁶ United Nations: Yearbook of International Trade Statistics, various issues.

¹⁷ UNCTAD: Handbook of International Trade and Development Statistics, 1988, table 2.1.

some problems as no net-of-fuel unit value index is available and it cannot easily be calculated as only value data and no data on product mix are available. Regional unit value indices for exports are published by UNCTAD, but only inclusive of fuel. An approximation had to be made, and we arrived at the conclusion that for African exports a unit value index for exports of primary products is appropriate. For Latin America and South East Asia we used a unit value index for non oil producing LDCs.¹⁷ The estimation results are given in Table 4.

It again becomes apparent that Africa's exports are not related to OECD GDP at all. The coefficient fails to take significant values and the corrected R² is practically zero. Another interesting fact is that South East Asian exports outpaced real GDP growth in the OECD countries no less than 5 times in the 1980s. Our results so far demonstrate clearly that the coefficient measuring the link between LDC exports and DC prosperity is unstable in both a time series and a cross section respect.

Table 3
Regression of LDC Export Volume Indices on
Real OECD GDP 1965 to 1987

Region:	Constant	LogY	D ₇₄ logY	D ₇₄	RBAR ²	D. W.
(1) Total LDCs	-3.04 -3.06	1.76 7.52	-1.37 -4.78	5.87 4.67	0.79	0.89
(2) Africa	-2.56 -1.93	1.70 5.46	-2.45 -6.39	10.51 6.27	0.69	1.05
(3) Latin America	2.74 -3.93	0.41 2.51	0.72 3.56	-3.31 -3.74	0.86	1.77
(4) West Asia	-5.29	2.33 -2.41	-4.29 4.51	18.81 -6.75	0.68 6.76	0.69
(5) South East Asia	-5.21	2.09 -6.79	1.14 11.61	-5.02 5.12	0.99 -5.17	1.76

Note: D₇₄ = 1 for observations 1974 - 87 and zero otherwise

Table 4
Regression of LDC Non-Fuel Export Volumes on
Real OECD GDP 1970 to 1986

Region:	Constant	LogY	D ₈₀ logY	D ₈₀	RBAR ²	D. W.
(1) Africa	7.01 1.99	-0.40 -0.52			-0.04	1.41
(2)	8.52 1.21	-0.73 -0.46	4.59 1.54	-21.54 -1.56	0.02	1.75
(3) Latin America	0.77 0.70	1.16 4.77			0.56	0.77
(4)	3.52 2.29	0.54 1.58	2.97 4.56	-13.79 -4.59	0.80	1.66
(5) South East Asia	-8.46 -9.01	3.29 15.97			0.94	1.04
(6)	-5.95 -3.91	2.73 7.97	2.23 3.45	-10.32 -3.46	0.96	1.86

Product Regressions

As was also done by Riedel, focusing on commodity groups allows us to examine the link between LDC exports and DC prosperity more precisely. Table 5 gives the results of regressing LDC export volumes for different commodity groups on real OECD GDP for 1970 to 1987. To obtain real values, the total non-fuel export values were deflated by a non oil producing LDCs unit value index for exports, and the other series were deflated by LDC product specific export unit value indices.¹⁸

Regression (1) shows that total non-fuel exports grew more than twice as rapidly as OECD real GDP. There is positive autocorrelation of the residuals indicating instability, and regression (2) shows that growth of LDC exports was significantly faster in the 80s than in the 70s with a coefficient of 3.85. Regressions (3) and (4) show that this rapid growth is to a large extent attributable to the particularly rapid growth of exports of manufactured goods. For the 1970s overall we obtain a coefficient of 3.41, while Riedel obtained 4.08 for the period 1970-77. For the period 1980-87 we obtain a coefficient of 4.73. It is interesting to contrast this with Lewis' question,¹⁹ "... could the whole problem (of reduced DC growth) be solved simply by increasing the growth of manufactured exports to MDCs (more developed countries), in substitution for primary products? ...I do not think that it can be done, ...it would indeed be more appropriate to assume that MDCs will take less manufactures from LDCs rather than more." Our findings indicate that Lewis' pessimism did not pass the test of time. Exports of manufactures has by far been

the most dynamic sector, even though not all LDCs have been able to transform their economies into producing more manufactures. Our findings therefore clearly confirm the conclusion reached by Riedel that, "The thesis that prosperity in developed countries fuels exports by developing countries clearly cannot be applied to manufactures, that is unless one is prepared to argue that a radical shift in preferences favouring LDC manufactures occurred in the 1970s."²⁰ We cannot see that any change in preferences has taken place in the 1980s either; if anything, protectionism has increased.

Table 1 also confirmed that LDCs did not find markets outside the DCs in the 1980s as the share of DCs increased considerably. This fact and the other findings discussed so far indicate that supply rather than demand is of foremost importance. Equations (5) and (6) consider agricultural raw materials. The relationship appears to be stable, but the coefficient is very small or even negative. Equations (7) and (8) examine food exports, and in the 1980s food exports appear to have grown faster than OECD GDP. The coefficient for the 1970s is not significant, and adding the dummy variable did not remove the problem of autocorrelation of the residuals, indicating an unstable relationship. Over the entire period the coefficient is 0.92, which is quite close to Lewis' coefficient. We have also examined the behaviour of individual product groups including food, agricultural and non-agricultural raw materials at the more disaggregated 3 digit SITC level for the period 1961 to 1986.²¹ We attempted to include sugar in our analysis to facilitate comparison with Riedel, but volumes of LDC exports of sugar appear to have been revised considerably and a consistent series on sugar exports could not be constructed from the GATT data. For the time period also examined by Riedel, our results are equal to those of Riedel for the product groups in question. Riedel did not examine bananas, cotton, rubber and alumina which we decided to include since they are all important export products. The results are given in Table 6.

The results are to a large extent self explanatory. Equations (1) through (4) examine cocoa and coffee, which are among the most important export crops for several LDCs. In his 1984 study Riedel quotes evidence asserting that demand for coffee is very little price and income elastic, and it can therefore be expected to bear a weak relationship to real OECD GDP. This is fully

Table 5
Regression of LDC Export Volumes on
Real OECD GDP 1970 to 1987

	Constant	LogY	D ₈₀ logY	D ₈₀	RBAR ²	D. W.
(1) Total non-fuel exports	-2.39 -2.44	2.11 9.88			0.84	0.59
(2)	-2.70 -2.33	2.19 8.46	1.66 2.30	-7.88 -2.34	0.89	0.98
(3) Manufactures exports	-11.10 -18.24	3.84 28.60			0.98	1.15
(4)	-9.19 -9.48	3.41 15.60	1.32 2.68	-6.06 -2.65	0.99	1.84
(5) Agricultural raw materials exports	6.55 17.90	-0.23 -2.89			0.30	1.88
(6)	7.58 10.25	-0.46 -2.79	0.43 1.37	-1.95 -1.34	0.33	2.12
(7) Food exports	1.76 1.67	0.92 3.98			0.47	0.73
(8)	5.65 3.57	0.04 0.13	2.69 4.01	-12.39 -3.99	0.72	1.33

¹⁸ GATT: International Trade 1987-88, table AF3.

¹⁹ W. Arthur Lewis, op. cit., pp. 287-288.

²⁰ James Riedel, op. cit., p. 68.

²¹ World Bank: Commodity and Price Trends, editions August 1980 and 1988/89. This source inter alia gives physical volume of exports making deflations unnecessary.

confirmed in our findings and the coefficient also appears stable. The same can be said for cocoa, so that overall the growth prospects for these crops appear to be dismal. Prospects for tea (equations 5 and 6) appear brighter, with a coefficient exceeding one in the 1980s. The other food crops considered in equations (7) through (12) also seem to be weakly related to OECD GDP when the three decades are taken together. Riedel also tests if adjustment to market disruptions for some food exports take the form of price, rather than quantity adjustment, which runs contrary to Lewis' contention. For four out of six cases this hypothesis is confirmed, sugar being an exception. The fact that demand shifts dominate in the sugar case is not

surprising when one considers the very widespread trade restriction for that commodity.

We have also examined the relationship between OECD GDP and LDC exports for three raw materials; cotton, rubber and alumina. Equations (13) and (14) examine cotton, and with the exception of the 1970s where a negative turn was observed, the coefficient appears stable. The dismal experience in the 1970s may partly be attributable to the introduction of synthetic materials. Rubber is examined in equations (15) and (16), and here the relationship appears remarkably stable with a coefficient of 0.65 for the whole period.

Equations (17) and (18) examine alumina, and perhaps surprisingly a negative development appears to have taken place over the three decades as a whole. Demand for alumina has steadily increased in OECD countries, and the very substantial swings observed over the three decades are presumably due to supply shocks.

We also ran a separate set of regressions for the above goods dividing the period under consideration in 1974, but the results do not add any information in addition to that already given in Table 6.

Conclusions

W. Arthur Lewis' contention that a stable link between world exports of primary products and industrial production in developed countries exists cannot be rejected out of hand. With the exception of the 1960s our findings show that the link is fairly stable, albeit with a coefficient of more than one, i.e. in Lewis' terminology the LDC engine is turning faster. But we cannot from this result accept Lewis' hypothesis on trade as an engine of growth for LDCs. Using more appropriate proxies for LDC exports and DC prosperity we have shown that the link between LDC exports and OECD income is unstable, and it also varies greatly between different regions of LDCs. In particular, South and South East Asian countries have experienced export growth rates far exceeding output growth in OECD countries, while Africa's export performance does not seem to be linked to OECD GDP at all. There seems to be a very weak or non-existent link between LDC exports of several primary commodities. Manufactures has by far been the most dynamic sector, which is contrary to Lewis' "prediction" in 1980.

We of course accept that economic growth or lack of such in the OECD countries or indeed generally through a repercussion or spillover effect will influence economic development in LDCs. But a stable demand driven link does not exist, and the extent to which LDCs have been able to reap benefits from developments in the world economy is first and foremost a question of supply, not demand.

Table 6
Regression of the Volume of Selected LDC Food and Raw Materials Exports on Real OECD GDP 1960 to 1986

Commodity	Const	LogY	$D_{70}\log Y$	$D_{80}\log Y$	D_{70}	D_{80}	RBAR ²	D. W.
(1) Cocoa	6.63 19.24	0.09 1.09					0.08	1.28
(2)	6.65 8.13	0.08 0.40	-0.95 -2.82	1.37 1.81	4.21 2.89	-6.31 -1.81	0.40	2.03
(3) Coffee	6.43 26.18	0.38 6.75					0.65	1.36
(4)	6.04 8.64	0.48 2.77	-0.46 -1.58	0.76 1.17	1.96 1.58	-3.56 -1.19	0.69	2.01
(5) Tea	3.65 15.95	0.66 12.60					0.87	0.67
(6)	5.00 13.54	0.33 3.66	0.28 1.87	0.81 2.36	-1.20 -1.84	-3.50 -2.22	0.96	2.43
(7) Bananas	5.93 22.37	0.62 10.26					0.81	0.54
(8)	4.41 9.97	0.99 9.14	-0.70 -3.82	-1.19 -2.91	3.03 3.86	5.27 2.80	0.94	2.29
(9) Copra	16.06 13.76	-2.16 -8.06					0.73	0.74
(10)	11.49 4.58	-1.05 -1.70	-1.42 -1.37	1.06 0.46	6.21 1.39	-5.84 -0.55	0.86	2.29
(11) Ground-nuts	14.25 19.93	-1.76 -10.72					0.83	1.08
(12)	7.70 5.02	-0.13 -0.34	-2.53 -4.00	-0.57 -0.40	10.47 3.84	1.64 0.25	0.91	2.42
(13) Cotton	8.50 4.87	-0.18 -0.20					0.09	1.11
(14)	5.39 5.63	0.58 2.47	-1.74 -4.42	0.21 0.23	7.49 4.40	-1.46 -0.36	0.51	2.31
(15) Rubber	5.12 30.09	0.65 16.67					0.92	1.24
(16)	5.13 11.02	0.65 5.64	0.02 0.08	0.60 1.39	-0.03 -0.03	-2.80 -1.41	0.94	2.00
(17) Alumina	-0.06 -0.09	1.71 10.70					0.83	0.36
(18)	-1.87 -1.66	2.14 7.70	-1.75 -3.76	-3.55 -3.40	7.86 3.92	16.19 3.37	0.95	1.53