INTERNATIONAL TRADE AND DEVELOPING COUNTIRES: AN EMPIRICAL INVESTIGATION OF THE LINDER HYPOTHESIS

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ABSTRACT

This paper presents empirical evidence in support of the Linder hypothesis for five of the six East African developing countries studied here: Ethiopia, Kenya, Rwanda, Sudan and Uganda. This finding implies that these countries trade more intensively with others who have similar per capita income levels, as predicted by Linder. The contributions of this research are three fold. First, we provide new information on the Linder hypothesis by focusing on developing countries. Second, ours is one of very few analyses to capture both time-series and cross-section elements of the trade relationship by employing a panel data set. Third, the empirical methodology used in our analysis corrects a major shortcoming in the existing literature by using a censored dependent variable in estimation.

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I. INTRODUCTION

The purpose of this research is to examine the empirical validity of one of the main theories of international trade, the Linder hypothesis, from the perspective of developing countries. While attention in development economics in recent years has focused increasingly on international trade issues, there is no clear consensus at present as to whether or not trade is beneficial to developing economies. Many economists have asserted that increased levels of trade on the part of developing economies is not only desirable but necessary if sustained economic growth and development are to occur. A smaller but equally vociferous group insists that trade only deepens the dependency of developing countries on the developed world and, in so doing, ensures continued underdevelopment. Whatever the effect of trade on the developing world, it is indisputable that trade has been expanding in most developing countries in recent years (see United Nations, 1997). It is essential, therefore, to gain an understanding of the existing trade patterns in developing countries and to gain an insight into how these patterns are changing.

The contributions of this paper lie in its attention to three factors. First, we consider the Linder hypothesis in the context of developing countries. The application of the Linder theory to developing economies has been neglected in the existing literature despite the growing need to understand the increasing levels of trade occurring in these countries. Second, our research extends the existing literature by estimating a fixed-effects panel data model. This methodology not only allows us to examine the validity of the Linder theory over a large number of countries but, also, allows us to capture relevant trends that have occurred over time. Despite the tremendous advantage that the use of panel data offers, relatively few analyses have employed data of this nature; only Thursby and Thursby (1987) have previously used combined time-series and cross-section data in studying the empirical validity of the Linder hypothesis. Third, our analysis makes use of a censored dependent variable in order to properly measure the economic behavior of all potential trading partners. This approach corrects a methodological shortcoming of previous analyses in which the magnitude of the Linder effect has been over or under estimated through the exclusion of information on those countries that have a zero or negative desire to export to a given country. The failure to model the Linder theory in this context must call into question

the econometric validity of existing empirical work in this area. Our analysis presents new and more accurate empirical evidence to explain existing trade patterns in developing countries.

The plan of the rest of this paper is as follows. The next section discusses the Linder hypothesis and its relationship to the competing "factor-proportions" theory. Section III reviews the existing literature on the empirical validity of the Linder hypothesis. Section IV presents the theoretical model used in our analysis and also discusses the fixed-effects Tobit estimation procedure employed here. A discussion of the empirical results is contained in section V. The final section offers conclusions and suggestions for future research. A description of data sources may be found in the first appendix.

II. INTERNATIONAL TRADE THEORY AND THE LINDER HYPOTHESIS

Some of the most basic questions that trade theory attempts to address involve patterns of trade: what determines why a country exports and imports certain goods, and with what countries does it exchange these goods? Since the early part of this century, the most widely used theory employed the factor-proportions model. Eli Heckscher pioneered this model in 1919, and Bertil Ohlin in 1933 and Paul Samuelson in 1949 subsequently amended it. This model posits that patterns of trade are determined by differences in relative factor proportions. In short, countries that are relatively well endowed with labor will tend to export goods that use labor relatively intensively in their production, while relative capital abundance implies relatively capital-intensive exports. This model, then, suggests that the pattern of trade is largely a supply-side phenomenon.

The Heckscher-Ohlin-Samuelson (HOS) model has been challenged in several ways. Leontief (1953), in examining import and export data from the United States in 1947, discovered that U.S. exports are on average relatively labor intensive while U.S. imports are relatively more capital intensive. Since the U.S. was and is widely perceived to be a capital abundant country relative to almost any other country, this finding seemed to contradict the HOS model and became known as the "Leontief Paradox". Some evidence regarding the developing-country case comes from Bharadwaj (1962) who found that the HOS model does not adequately explain bilateral trade between the U.S. and India. Bowen, Leamer and

Sveikavskas (1995) conclude from their study of 27 countries (some of which are developing countries) that the Heckscher-Ohlin model explains observed patterns of trade rather poorly. Even the studies that have found support for the Heckscher-Ohlin model have come under fire for data and methodology problems.[1] Deardorff (1984) states that the basic model is useful in understanding the commodity composition of international trade, but it is otherwise "fairly helpless".

Other researchers have noted that the HOS model suggests that a great deal of trade should occur between the developed and the developing world, since the differences in capital-labor ratios would be widest in such cases. However, the fact that the majority of international trade is conducted between developed countries, which typically have very similar factor endowments, seems to call into question the validity of this theory.

Finally, there are also theoretical reasons to question the validity of the factor-proportions theory as it pertains to developing countries. Many of the underlying assumptions of the factor-proportions theory are not likely to be satisfied in developing economies. For example, the assumptions of full employment, perfect factor mobility and identical technology across countries are largely untenable in the developing-country setting.

While some researchers have attempted to broaden the HOS model so that it better explains the stylized facts, others have developed alternative models. One such alternative was the theory proposed by Linder (1961). In contrast with the supply-side orientation of the HOS model, the Linder theory is primarily demand-side oriented. Linder believed that the pattern of trade derives from "overlapping demand". That is, countries generally produce goods for the domestic market and then export the surplus. It is reasonable to conclude, therefore, that countries that have an interest in acquiring this surplus would have demand patterns similar to those of the exporting country. Linder's prediction that most trade in the world should occur between similarly endowed countries is no paradox; it is, rather, the natural result of demand-driven trade. While Linder's theory was not put forth in the form of a mathematical model, it is nonetheless powerful and thought provoking.

Some researchers have argued that the economic characteristics of developing economies may preclude their inclusion in any studies of the Linder phenomenon. Hanink (1988), for example, noted that "... high levels of trade between similar, but poor, countries is unlikely." While this may have been true in Linder's day, significant levels of trade occur between developing countries in the present decade. As evidence of this fact, consider the data in Table 1, which lists, for each of the six East African countries of our analysis, the proportion of imports that originate from other developing countries. These data show, for these six countries, that approximately one-fifth to one-half of all imports originate from such sources.

[INSERT TABLE 1 HERE]

Even in Rwanda, a country that has historically imported a significant quantity from the industrialized world, the share of imports from other developing countries has been steadily rising. The six East African countries on which this paper focuses are by no means unique in this respect. Todaro (1997) reports that approximately one-third of all developing country imports come from other developing countries.

It is also worth noting at this time that the Linder theory was originally intended to apply only to manufactured goods. While a large proportion of the exports from developing countries consists of primary products, the majority of ***imports*** to developing countries consists of manufactured goods.[2] With regard to the developing economies of East Africa, in particular, it is typical for more than three-quarters of these imports to be manufactured (see United Nations, 1997). In addition, there are now many developing countries that are capable of producing manufactured goods for export. Further evidence of the applicability of the Linder hypothesis to today's developing countries comes from Linnemann and van Beers 1988 who note that "…one might expect at least a tendency towards similarity between a country's export vector of manufactures and its import vector of manufactures - irrespective, in principle, of its level of development."

III. A REVIEW OF EMPIRICAL TESTS OF THE LINDER HYPOTHESIS

The earliest tests of the Linder hypothesis used rank correlation analysis and generally found evidence favorable to the Linder theory (Sailors et. al., 1973 and Greytak and McHugh, 1977). These studies were heavily criticized, however, for their failure to employ regression analysis, a technique that could have controlled for the effects of distance on trade intensities. Numerous subsequent analyses that made use of the regression technique (and controlled for distance) found no support for the Linder model (see: Hoftyzer, 1984; Qureshi, et. al., 1980; Kennedy and McHugh, 1980; and Kennedy and McHugh, 1983, Linnemann and van Beers 1988, for example). A few analyses, however, were able to uncover evidence in support of the Linder hypothesis through the use of regression analysis (Fortune, 1971; Hirsch and Lev 1973; and Kohlhagen 1977).

Research on the Linder hypothesis within the recent decade has employed more advanced regression techniques with generally favorable results. After controlling for distance and exchange rate variability, Thursby and Thursby (1987) uncovered evidence in favor of the Linder theory using pooled data for 17 industrialized countries over the 1974-1982 time period. Hanink (1988 and 1990) used gravity models to show that the Linder hypothesis is supported in some instances. Greytak and Tuchinda (1990) found strong support for the Linder hypothesis using interstate U.S. data. Francois and Kaplan (1996) find some evidence of the Linder effect in their 36-country study of intra-industry trade. However, Chow, et al. (1994) find little indication of a Linder effect among East Asian newly industrialized countries.

There is, however, a serious flaw in many of these early studies of the Linder hypothesis: their exclusion of data from countries that trade zero amounts of goods and services to the country under investigation. From an econometric perspective, such an omission surely leads to biased results. In particular, if the omitted countries have per capita incomes that are similar to that of the country under investigation, there will be a bias toward accepting the Linder hypothesis. Conversely, if the omitted countries have per capita incomes that are very different from that of the country under investigation, then there will be a bias toward rejecting the Linder hypothesis. Clearly, the appropriate econometric approach would be to recognize the censored nature of the dependent variable and include data on all

potential trading partners, whether or not a non-zero amount of goods and services is actually exchanged. Only Hoftyzer (1984), which focused primarily on industrialized economies, has correctly recognized this requirement in previous research. The estimation methodology employed in Hoftyzer (1984), however, was not the appropriate technique for a censored data set.[3]

IV. THEORETICAL MODEL AND ESTIMATION METHODOLOGY

As with much of the existing empirical work on the Linder hypothesis, this research employs a regression technique. In order to analyze the effects of trade in both a time-series and cross-section context, as well as to take advantage of available data, a panel data set is used. This data set includes information on the six East African countries listed in Table 1 and is characterized by a large number of cross-section units which are observed at annual intervals over the period from 1984 to 1992.[4] Below is a discussion of the details of the fixed-effects Tobit model which is used to estimate this data.

The fixed-effects Tobit model

There are two basic conditions under which a fixed-effects regression model would be the most appropriate method to estimate a panel data set. The first condition is satisfied if the unobservable factors that differentiate cross-section units are best characterized as parametric shifts of the regression function. This implies that a separate intercept is required for each individual in the sample. Given the nature of the cross-section units under investigation in this analysis, this condition is likely to hold.[5] The second condition is satisfied if a relatively large proportion of the population is represented in the sample. This is most likely true in our analysis since the sample includes information on nearly all potential trading partners of each of the East African countries under investigation. It follows, then, that the fixed-effects model would be an appropriate model to employ in our investigation of the empirical validity of the Linder hypothesis. The form of this model is given by equation (1.) below:

$$(1.) \qquad \mathbf{Y}^{*}_{itj} = \mathbf{i}_j \alpha_{ij} + \mathbf{X}_{itj} \beta_j + \varepsilon_{itj}$$

where: "j" indexes the six East African countries of our analysis (that is, this equation is estimated six times, once for each East African country); "i" indexes cross-section units (potential trading partners of

East African country "j") such that i = 1, 2, . . . , N; and, "t" indexes time-series units such that t = 1, 2, 3, . . . , T. The matrix $\mathbf{i_j}$ is of dimension (NT × N) and contains a full set of intercept dummy variables representing each potential trading partner of East African country "j". The matrix $\mathbf{X_{itj}}$ is of dimension (NT x K) and contains observations on the independent variables of the model for East African country "j". The parameter vector α_{ij} is of dimension (N × 1) and contains country-specific "individual effects" for East African country "j". This "individual effect" captures relevant time-invariant factors and time-varying unobservable influences which differentiate the potential trading partners of East African country "j". The vector β_j is of dimension (K × 1) and contains the parameters on the exogenous variables for East African country "j". The stochastic disturbances for country "j" are captured by the (NT x 1) error vector, ε_{itj}.

The variable $\mathbf{Y^*_{itj}}$ in equation (1.) is a latent variable which represents an unobservable measure of desire or ability on the part of potential trading partner "i" to export some non-zero quantity to East African country "j". We assume that country "j" will receive a positive quantity of imports from trading partner "i" if this measure of desire or ability is positive. Similarly, we assume that country "j" will receive zero imports from trading partner "i" if this measure of desire or ability is zero or negative. As such, we construct the observable left-censored dependent variable, $\mathbf{Y_{itj}}$, which will be used in estimation:

(2.) $$Y_{itj} = \begin{cases} Y^*_{itj} & \text{if} \quad Y^*_{itj} > 0 \\ 0 & \text{if} \quad Y^*_{itj} \leq 0 \end{cases}$$

This variable will contain a significant number of zero observations as well as many positive observations. Since the model contains this censored dependent variable, it will be necessary to use a fixed-effects Tobit (weighted maximum likelihood) estimation procedure to obtain unbiased, consistent and efficient estimates of the parameter vectors α_{ij} and β_j.

The use of the censored dependent variable in our analysis provides a significant improvement over the existing literature on the empirical validity of the Linder hypothesis. In previous analyses, if

country “j” happened to receive zero dollars worth of imports from country “i” then data on country “i” was routinely omitted from the sample. This clearly is inappropriate, from an econometric perspective, since such an omission will lead to biased and inconsistent parameter estimates. Furthermore, this type of omission will tend to over estimate the effects of those trading partners who have a positive desire/ability to export to country “j” and, similarly, it will under estimate (or, not measure at all) the effects of those trading partners who have a zero or negative desire/ability to export to country “j”. This issue is of particular relevance when assessing the Linder hypothesis in the context of developing economies since these countries typically trade with a relatively small number of partners; the dependent variable in this case would surely include a large number of censored observations. The failure of previous empirical analyses to find evidence in support of the Linder hypothesis may be due, at least in part, to their failure to properly capture the censored nature of the dependent variable. We next detail the theoretical specification of the Linder model which is used in our analysis.

The Linder model

While Linder did not specify a formal model of his hypothesis, empirical tests of this theory have typically modelled some measure of trade intensity against the following variables: a measure of the size of each trading partner’s economy; a measure of relative prices between a given country and its trading partners; a measure of the difference in per capita incomes between a given country and its trading partners; and, relevant time-invariant factors such as distance. The form of our model follows this specification. The measurement of each of these variables is described below.

The dependent variable of our model, which measures trade intensity, is the value of imports received by East African country “j” from trading partner country “i”, expressed in terms of thousands of constant dollars. The choice of imports for this variable, rather than exports, is based on the notion that a relatively large proportion of exports from developing countries is comprised of primary products – the very type of goods to which Linder believed his theory would not apply. Imports to developing countries, on the other hand, are primarily comprised of manufactured goods and are, therefore, an appropriate

measure to use in testing the validity of the Linder theory. This variable will be referred to as "IMPORTS".

In order to control for differences in the size of each trading partner's economy, our model includes a variable that measures the level of real GDP in trading-partner country "i" (measured in thousands of constant dollars), denoted "OUTPUT". The coefficient on this variable is expected to be positive reflecting the notion that an increase in the level of output in a trading partner's economy would lead to an increase in the quantity of imports received from this trading partner.

In order to control for fluctuations in relative prices among trading partners, our model includes the real exchange rate as an independent variable. This variable, which we denote "EXCHANGE", is constructed as described in equation (3.) below:

$$(3.) \qquad \text{EXCHANGE}_{it} = \left[\frac{e_{it} \times p_{it}}{p^{*}_{it}} \right]$$

where: e_{it} is the nominal exchange rate of potential trading partner "i" at time "t" (measured in units of East African country currency per unit of potential trading partner "i" currency); p_{it} is the GDP deflator in potential trading partner "i" at time "t"; and, p_t* is the GDP deflator of the given East African country at time "t". Since an increase in this variable should decrease the level of imports, the coefficient on this variable should be negative.

The Linder effect is captured through a variable which measures the degree of similarity between the per capita income levels of the given East African country and each trading partner. This variable, which we denote as "LINDER", is the absolute value of the difference in the levels of real per capita GDP in the East African country and potential trading partner "i" (measured in thousands of constant dollars). Support for the Linder hypothesis would follow from the finding of a negative and statistically significant coefficient on this variable.

Finally, we note that the effect of distance and other relevant time-invariant factors will be incorporated into the model through the individual effects, α_{ij}, in equation (1.). This term captures

differences in cross-section units (potential trading partners of East African country "j") which are constant over time.

Re-writing the model expressed in equation (1.) for a given East African country and expressing the matrix of exogenous regressors in terms of the specific variables defined above produces the equation to be estimated in our analysis:

$$(4.) \qquad IMPORTS_{it} = \alpha_1 + \alpha_2 + \alpha_3 + \ldots + \alpha_N + \beta_1 OUTPUT_{it} + \beta_2 EXCHANGE_{it} + \beta_3 LINDER_{it} + \varepsilon_{it} .$$

In this representation, the "α" terms represent the different country-specific individual effects for each trading partner of the given East African country. The finding of a negative and statistically significant estimate for β_3 in this model would provide evidence in favor of the Linder hypothesis.

V. EMPIRICAL RESULTS

Initial empirical results were obtained by applying the maximum-likelihood fixed-effects Tobit estimation procedure to equation (4.) above. This equation was estimated six times, once for each East African country under investigation. In addition, since it is well known that Tobit models very often suffer from heteroskedasticity, especially when a large proportion of the observations on the dependent variable are censored (as is the case in this analysis), we computed likelihood ratio tests to test for the presence of multiplicative heteroskedasticity. Testing for this error violation is especially important since the presence of heteroskedasticity not only leads to inconsistent maximum likelihood estimates but also to unreliable inferences from hypothesis tests.[6] When the null hypothesis of homoskedasticity was rejected, a correction for heteroskedasticity was applied to the model. The results of estimation are displayed in Table 2.

[INSERT TABLE 2 HERE]

The results in Table 2 provide strong evidence in support of the Linder hypothesis for five of the six countries under investigation. In four of the six cases (Ethiopia, Kenya, Rwanda and Sudan), the

Linder hypothesis is supported at the 99% level of confidence. In one case (Uganda), evidence exists at the 95% level. Each of these five countries, therefore, is more likely to trade with countries that have per capita income levels that are similar to their own, other things equal. This is as predicted by Linder. Furthermore, these results indicate that the size of a trading partner's economy has a significant impact on imports (at the 95% level of confidence or better) in all five of these countries. For three of these countries (Ethiopia, Sudan and Uganda) the coefficient on this variable is positive, as expected. Interestingly, in the case of Kenya and Rwanda the coefficient on this variable is negative. This indicates that these two countries import less from countries whose economies are large, other factors equal. In addition, the results in Table 2 indicate that, after controlling for other factors, the real exchange rate does not appear to be a significant factor affecting trade intensity for any of the six countries analyzed here.

For each of the six countries under investigation here, much of the variation in imports seems to be the result of country-specific individual effects. These country-specific factors most likely include variables such as proximity, common linguistic or religious heritage, and colonial affiliation. The second appendix provides a complete list of the names of those countries for which the individual effect was statistically significant at the 95% level of confidence or better. For the most part, the countries with significant individual effects are consistent with *a priori* expectations. In particular, the individual effects on certain types of trading partners are, for the most part, consistently statistically significant. The individual effects tend to be significant and positive for those trading-partner countries that are industrialized nations, oil-exporting economies, neighboring countries, or countries that share common religious heritage or colonial ties. For example, in the case of Uganda, the individual effects are significant for Tanzania and Kenya, which are neighboring countries of Uganda, and the United Kingdom, which colonized Uganda. This means that after controlling for factors such as the size of a trading partner's economy, per capita income differences and real exchange rates, the given East African country tends to import more from the countries listed in the second appendix as a result of country-specific time-invariant factors.

Our attention turns now to the question of whether or not the results of this analysis would have been different if the censored nature of the dependent variable had been ignored, as has been the case in previous research. If there is no difference then, presumably, our analysis would have little to offer regarding the Linder theory beyond what has previously been presented in the literature. To examine this question, equation (4.) has been re-estimated as a simple fixed-effects model, excluding from the sample those observations that are censored, as would have been the case in earlier studies. The results of this estimation, which are contained in Table 3, present a striking contrast to those in Table 2. When the censored observations are excluded from the sample, the results for all six countries provide no support for the Linder hypothesis; the Linder variable is insignificant at all reasonable levels of confidence.[7] Clearly, the exclusion of the censored observations from the sample has a significant impact on the inferences which may be drawn from that data.

[INSERT TABLE 3 HERE]

VI. CONCLUSIONS AND FUTURE DIRECTIONS

Economists who are interested in studying and describing the development process must attempt to understand the factors that drive trade from the perspective of the developing country. This research has provided some insight into this phenomenon by uncovering empirical support for the Linder hypothesis for five developing East African countries: Ethiopia, Kenya, Rwanda, Sudan and Uganda. In particular, this research indicates that these countries trade more intensively with economies that have per capita income levels similar to their own. In the case of Tanzania, however, there appears to be no significant relationship between trade intensity and the similarity of per capita income levels between Tanzania and its trading partners.

The results of this analysis provide strong evidence of the importance of modelling the Linder relationship within the appropriate context. Considerable suspicion must be cast on those empirical analyses of the Linder hypothesis in which the censored observations on trade intensity have been excluded. It is well known that such an exclusion can result in biased and inconsistent parameter

estimates. The evidence presented here has shown that this can also result in misleading conclusions regarding the empirical validity of the Linder theory.

While this research does not conclusively demonstrate the applicability of the Linder hypothesis to ***all*** of the developing world, it does present some intriguing evidence on the possible validity of this theory in this setting. To date, the literature has not seriously tested this theory from the viewpoint of a developing country. A more complete treatment of this issue certainly would involve applying this estimation technique to a larger number of developing countries. However, should these results generalize to other developing countries, the implication is that the conventional factor-proportions view of trade is inadequate to explain trade in developing economies.

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APPENDIX: DATA SOURCES

For all countries except Uganda, data on the dependent variable of each of the models were obtained from the United Nations' *International Trade Statistics Yearbook* (1997). Data on the dependent variable for Uganda were taken from the Ministry of Finance and Economic Planning, *Statistical Bulletin*, 1992. For all countries except Uganda, the World Bank's *World Development Indicators* on CD ROM (1997) was the source for the variables used to construct the "Output" variable, the real exchange rates and the "Linder" variable. The Bank of Uganda's *Quarterly Economic Report* (1994) was the source for the variables used to construct Uganda's "Output" variable, real exchange rate and "Linder" variable.

APPENDIX: SIGNIFICANT COUNTRY-SPECIFIC INDIVIDUAL EFFECTS (at 95% or better)

Ethiopia	Kenya	Rwanda	Sudan	Tanzania	Uganda
Brazil*	Argentina	Belgium	Austria	Australia*	Kenya
China*	Brazil	Brazil	Bahrain	Austria*	Malaysia
Jordan	Canada	Canada	Bangladesh	France*	Pakistan
Kenya	China	China	Belgium	Iran	Tanzania
Saudi Arabia	France	Czechoslovakia	Canada	Kenya	UK
Tunisia*	Germany	France	Denmark	Spain	US*
	India	Germany	Egypt	UK	
	Iran	India	Finland	US	
	Italy	Iran	France		
	Japan	Italy	Germany		
	Malaysia	Japan	Greece		
	Netherlands	Kenya	Hong Kong		
	SACU	Netherlands	Ireland		
	Saudi Arabia	Spain	Italy		
	South Korea	UK	Kenya		
	Spain	US	Kuwait		
	Thailand	USSR	Libya		
	UAE		Netherlands		
	UK		Romania		
	US		Saudi Arabia		
	USSR		Singapore		
	Zimbabwe		South Korea		
			Sweden		
			Switzerland		
			UAE		
			UK		

Key: Countries denoted with an asterisk had negative individual effects.

Table 1. Average percent of imports originating from developing countries

Country:	Time Period	Percent of Total Imports
Ethiopia	1989-92	20.6
Kenya	1989-92	25.9
Rwanda	1986-90	24.5
Sudan	1984-88	46.9
Tanzania	1985-89	27.0
Uganda	1988-92	39.4

Source: International Trade Statistics Yearbook, 1997.

Table 2. Fixed-effects Tobit estimates

Country:	Output	Exchange Rate	Linder Variable	N	Time Period
Ethiopia	0.105* (0.053)	-0.067 (0.229)	-2.759** (0.890)	552	1989-92
Kenya	-0.199** (0.065)	-0.053 (0.113)	-3.088** (0.844)	552	1989-92
Rwanda	-0.030** (0.008)	-0.165 (0.646)	-0.613** (0.168)	715	1986-90
Sudan	0.034* (0.017)	-2.712 (4.725)	-3.544** (1.625)	722	1984-88
Tanzania	0.032 (0.025)	-2.667 (4.245)	3.698 (2.297)	723	1985-89
Uganda	0.032* (0.016)	0.004 (3.159)	-0.506* (0.234)	697	1988-92

Key: Estimated standard errors appear in parentheses. One asterisk indicates statistical significance at the 95% level of confidence; two asterisks indicates significance at the 99% level. Significant individual effects for each model are listed in the second appendix.

Table 3. Fixed-effects estimates

Country:	Output	Exchange Rate	Linder Variable	N	Time Period
Ethiopia	-0.489 (0.069)	-0.004 (0.027)	0.581 (4.579)	169	1989-92
Kenya	-0.222** (0.079)	0.005 (0.012)	-11.918 (8.219)	172	1989-92
Rwanda	-0.032** (0.010)	0.277 (1.019)	-0.294 (1.101)	144	1986-90
Sudan	0.026 (0.024)	-1.807 (5.173)	-1.862 (2.149)	216	1984-88
Tanzania	3.693* (2.276)	2.451 (9.036)	0.032 (0.029)	220	1985-89
Uganda	0.036* (0.018)	-1.979 (1.066)	-0.155 (1.520)	142	1988-92

Key: Estimated standard errors appear in parentheses. One asterisk indicates statistical significance at the 95% level of confidence; two asterisks indicates significance at the 99% level.

Endnotes

1. See Deardorff's criticism of Harkness (1978) in Deardorff (1984).

2. Our analysis will focus on the level of ***imports*** to each of the six East African countries under investigation here, further validating the application of the Linder theory to these developing countries.

3. While Hoftyzer (1984) assigns a value of zero to the dependent variable for those countries with which no trade occurs, a Tobit estimation procedure was **not** applied in estimation in this analysis. Instead, a linear OLS estimation technique is employed.

4. Due to the lack of availability of reliable data in the six East African countries of this analysis, not all years are covered in all of the six countries. Tables 1 through 3 each indicate the exact years which are covered for each of the six countries under investigation. In addition, these data sets are not characterized by balanced panels.

5. The cross-section units in this analysis are the various countries who are potential trading partners with each of the East African countries under investigation. Since each of these countries operate under their own autonomy, it might be reasonable to assume that the characteristics that differentiate them are autonomous.

6. See, for example, Maddala and Nelson (1975), Hurd (1979), Arabmazar and Schmidt (1982a & 1982b), and, Brown and Moffit (1982) for a discussion.

7. A detailed list of the significant individual effects for the fixed-effects (without Tobit) models has been omitted for space considerations. These results are available from the authors upon request.