A RE-EXAMINATION OF THE LINDER HYPOTHESIS: A RANDOM-EFFECTS TOBIT APPROACH

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ABSTRACT

This paper examines one of the main theories of international trade, the Linder hypothesis, using data from the OECD countries. The paper makes two primary contributions. First, significant empirical evidence is found in support of Linder's hypothesis regarding demand similarity for 18 of the 19 OECD countries under investigation here. Second, the use of a censored dependent variable in this analysis corrects a major methodological shortcoming in the existing literature by including data on all potential trading partners, even when the given OECD country has a zero or negative desire to export to that potential trading partner.

KEYWORDS: international trade, panel data, censored regression

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1. INTRODUCTION

The purpose of this study is to provide some insight into the factors that influence trade behavior through an examination of the empirical validity of one postulate of the Linder theory, one of the main theories of international trade. In order to properly direct international trade policy, it is important to understand the factors that motivate countries to export and import particular goods. There is some question, at present, as to whether or not the leading theories of international trade adequately describe these motivations. Our analysis seeks to provide answers to this question.

The model that has dominated international trade theory for much of this century is the "factor proportions" theory which was originally put forth by Heckscher in 1919 and later refined by Ohlin and Samuelson. This model predicts that comparative advantage in trade should be determined by a country's relative factor endowments. That is, a country which is relatively well endowed with capital should export those goods which are relatively capital intensive and should import those goods which are relatively labor intensive, and *vice versa*. This implies that trade will occur between countries that are *dissimilar* with respect to their factor endowments. Furthermore, since trade alters the demand for a country's factors, one should anticipate resistance to trade from owners of the relatively scarce factor.

However, much of the empirical research on international trade has indicated that the stylized facts are not well explained by the factor proportions theory. In particular, the bulk of international trade occurs between developed countries—countries that presumably would be relatively *similar* in their factor endowments. Indeed, developed countries typically send at least three-quarters of their exports to other developed countries. Thus, a country such as the United States, which is relatively well endowed with capital, has been found to import primarily capital-

intensive products. This "paradox" was noted first by Leontief (1953), but other studies (see for example Deardorff 1984, Maskus 1985 and Bowen, *et al.* 1987) have found evidence that casts doubt on the empirical validity of the factor proportions framework.[1] Francois and Kaplan (1996, p. 244) conclude that "…the empirical linkage of these theories to the bulk of modern trade remains somewhat tenuous."

One of the best-known alternatives to the Heckscher-Ohlin-Samuelson factor proportions model of international trade came from Linder (1961). While the former model is primarily supply-side oriented, Linder's argument focuses primarily on the demand side of the economy. Linder reasoned that countries with similar demand patterns would be more likely to trade with each other since each country's manufacturing sector would already be producing products demanded by consumers in other countries. This would explain the preponderance of trade between high-income countries, much of which is of the intra-industry variety, which the factor proportions model cannot explain.

Our analysis of this issue offers two primary contributions. First, we provide strong empirical evidence of the validity of Linder's hypothesis regarding demand similarity[2] for 18 of the 19 OECD countries under investigation here. While an enormous amount of attention has been devoted to this postulate of Linder's theory within the last three decades, the issue of its empirical validity has never been satisfactorily resolved. Second, our analysis corrects a rather serious econometric flaw in the existing literature. In particular, previous analyses of Linder's

1. It should be noted that Leamer (1980) is skeptical of the methodology used by Leontief, and is dubious about the existence of the Leontief "paradox".

2. Linder's theory is a rich one. In addition to his hypothesis that trade intensity is positively related to demand similarity, Linder also proposed several other postulates, including the hypothesis that trade patterns depend in part on the distribution of income within countries (see Francois and Kaplan, 1996 for details).

hypothesis have excluded data on potential trading partners when a given country had a negative or zero desire to export to those potential trading partners. The bias created from such an exclusion is likely to cast considerable doubt on the validity of the findings of these previous studies. Our analysis includes information on all potential trading partners, even when the country under investigation exported zero dollars worth of goods and services to that potential trading partner. As a result, we make use of the Tobit estimation procedure to appropriately account for the censored nature of the dependent variable of our model.

The plan of the rest of this paper is as follows. The next section briefly reviews previous empirical investigations of the Linder hypothesis. Section 3 presents our theoretical model and discusses the estimation methodology. Section 4 provides a discussion of the empirical results and a brief concluding section follows.

2. THE LINDER HYPOTHESIS

As noted above, there has been no shortage of empirical tests of Linder's hypothesis that trade tends to be more intense between countries with similar demand patterns. Many early studies (Hufbauer 1970, Fortune 1971, Sailors, *et al.* 1973, Hirsch and Lev 1973, and Kohlhagen 1977) found considerable evidence in support of the Linder hypothesis. However, several subsequent efforts took issue with perceived shortcomings in the earlier literature. Many of these early studies were criticized for their failure to take into account the effects of geographical proximity on trade intensities. After correcting for this and various other shortcomings, Hoftyzer (1975), Greytak and McHugh (1977), Qureshi, *et al.* (1980), and Kennedy and McHugh (1980)

Our paper's purpose is to examine only the demand similarity hypothesis. Throughout the balance of our paper, we refer to this demand similarity postulate as the "Linder hypothesis."

each found little or no evidence in support of the Linder theory. These studies employed simple correlation analysis.

More recently, however, a number of studies have taken different approaches to the task of testing the Linder hypothesis. Broadly speaking, these studies model trade following the gravity model approach in a multiple regression context. This approach focuses on the interaction between two variables: the resistance to movement, and the attraction between masses. In the context of the Linder model, Hanink (1988) interprets the former as distance between countries: the more separated are countries, the less intense will the trade between them be. The attraction between masses is reflected by Linder's hypothesis that countries with similar demand patterns will trade more intensely with each other. Bergstrand (1989), who builds on the large literature that uses gravity models to study international trade, made the theoretical link between the Linder model and the gravity model specification. Two early gravity model studies found little or no evidence to support Linder's hypothesis (see Hoftyzer 1984, and Kennedy and McHugh 1983). However, Thursby and Thursby (1987), Hanink (1988 and 1990), Greytak and Tuchinda (1990), Bergstrand (1990), and McPherson, *et al.* (1998) each found evidence supporting Linder's hypothesis. In short, there seems to be little evidence to refute the view of Greytak and Tuchinda (1990, p. 57) that "…the empirical validity of Linder's model of international trade is an open question…".

There is, however, a serious flaw in the existing literature on the empirical validity of the Linder hypothesis. Previous analyses of this phenomenon have routinely excluded data from those countries that receive zero dollars worth of goods and services from the country under investigation. That is, in previous studies, if the country under investigation did not trade with a

given country, then data on that potential trading partner were omitted from the sample.[3] Inferences drawn from such analyses will surely be misleading. In particular, if for example the omitted countries have per capita incomes that are similar to the country under investigation, then there will be a bias towards *accepting* Linder's hypothesis. If, on the other hand the excluded countries tend to have rather different per capita incomes in comparison with the country under investigation, then there will be a bias towards *rejecting* the Linder hypothesis. In the data used in our analysis, the latter situation applies. In our sample, the "excluded" countries have per capita incomes that are only about 30% of that of the "included" countries, on average. This being the case, we expect that the earlier literature has tended to view the Linder hypothesis in an incorrectly pessimistic light. Indeed, the failure of previous analyses to appropriately model the dependent variable of this model must call into question the validity of their empirical results.

3. THEORETICAL MODEL AND METHODOLOGY

Following much of the empirical work on the Linder hypothesis, this research employs a regression technique. We consider the validity of the Linder hypothesis for each of the nineteen countries that were members of the OECD as of 1990.[4] In order to assess the effects of trade for each of these nineteen countries across many potential trading partners as well as across time, a panel data set is used. This data set includes observations on 161 potential trading partners of each of the OECD countries, observed at annual intervals over the period from 1990 to 1995.[5] Thursby and Thursby (1987) provide one of the few studies that has previously used panel data in

3. The exception is McPherson, *et al.* (1998) which deals with the Linder theory from the perspective of developing countries.

4. These countries are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, the UK and the US.

5. This data set is not characterized by balanced panels.

studying the Linder hypothesis. In addition, in order to measure properly economic behavior with all potential trading partners, our analysis makes use of a censored dependent variable. This is a specification that all previous analyses on the Linder effect have failed to incorporate. A theoretical description of the censored panel data model is given below.

A. The Random-Effects Tobit Model

There are two distinct advantages that a panel data model offers over the traditional linear regression model. First, a panel data model is able to capture both cross-section and time-series variation in the dependent variable under investigation. Second, a panel data model is able to measure not only the effects that observable variables have on the dependent variable, but also the effects of relevant unobservable or non-measurable influences. Observable variables are incorporated into the model in the usual way. The means by which the unobservable variables are incorporated into the model depends upon whether a fixed-effect (FE) or random-effects (RE) model is used in estimation. In the RE model, the unobservable or non-measurable factors that differentiate cross-section units are assumed to be best characterized as randomly distributed variables. The cross-section units of our analysis are the potential trading partners of the given OECD country. These trading partners vary quite dramatically by their culture, religion, political philosophy, distance from one another, and many other factors, and it may be quite reasonable, therefore, to assume that the differences between them are randomly distributed. As such, we feel that the use of the RE model is well suited to the analysis of the Linder hypothesis. The general form of the RE model is as given below:

$$\mathbf{Y}^{*}_{\mathbf{itj}} = \mathbf{X}_{\mathbf{itj}}\,\beta_{\mathbf{j}} + \mathbf{u}_{\mathbf{ij}} + \varepsilon_{\mathbf{itj}} \qquad (1)$$

where: “j” indexes the 19 OECD countries of our analysis (that is, this equation is estimated 19 separate times, once for each of the OECD countries under investigation); “i” indexes cross-

section units (potential trading partners of OECD country "j") such that i = 1, 2, . . . , N; and, "t" indexes time series units such that t = 1, 2, 3, . . . , T. The matrix $\mathbf{X_{itj}}$ is of dimension (NT x K) and contains data on the observable explanatory variables of the model for OECD country "j". The effects of relevant unobservable variables and time-invariant factors that characterize trading partner "i" in the model for OECD country "j" are captured by the (NT x 1) vector $\mathbf{u_{ij}}$. These factors include variables such as distance, cultural or religious characteristics and colonial heritage. The stochastic disturbances of the model for OECD country "j" are captured by the (NT x 1) vector $\boldsymbol{\varepsilon}_{\mathbf{itj}}$. Since both $\mathbf{u_{ij}}$ and $\boldsymbol{\varepsilon}_{\mathbf{itj}}$ incorporate randomly distributed stochastic components of the model, we may combine these terms to form the composite error term as:

$$\omega_{itj} = \mathbf{u}_{ij} + \varepsilon_{itj} . \tag{2}$$

The composite error term is assumed to be normally distributed with the following characteristics:

$$\omega_{itj} \sim N(\mathbf{0}, \Sigma), \qquad \Sigma = \begin{bmatrix} \sigma_u^2 & \sigma_u \sigma_\varepsilon \\ & \sigma_\varepsilon^2 \end{bmatrix} \tag{3}$$

The variable $\mathbf{Y^*_{itj}}$ in equation (1) is a latent variable which represents an unobservable index of ability or desire on the part of OECD country "j" to export some non-zero quantity of goods and services to potential trading partner "i" at time "t". We assume that these exports will take on a positive value if this measure of ability or desire is positive. Similarly, we assume that exports will take on a value of zero if this measure of ability or desire is zero or negative. As such, we construct the observable left-censored dependent variable $\mathbf{Y_{itj}}$ used in estimation as:

$$\mathbf{Y}_{itj} = \begin{cases} \mathbf{Y}^*_{itj} & \text{if } \mathbf{Y}^*_{itj} > 0 \\ 0 & \text{if } \mathbf{Y}^*_{itj} \le 0 \end{cases} \tag{4}$$

Since the nature of trade relations in the OECD countries is such that each country trades with a relatively small number of partners, $\mathbf{Y_{itj}}$ will contain a significant number of zero observations as

well as many positive observations. Because of the censored nature of this dependent variable, it will be necessary to use a random-effects Tobit (weighted maximum likelihood) estimation procedure to obtain unbiased, consistent and efficient estimates of the parameters in the vector β_j.

The use of this censored dependent variable in our model provides a significant contribution to the existing literature on the empirical validity of the Linder hypothesis. As noted earlier, in previous analyses of the Linder hypothesis, if country "j" happened to export zero dollars worth of goods and services to country "i", then data on country "i" has been excluded from the sample. This clearly is inappropriate from an econometric perspective, since such an omission will lead to biased and inconsistent parameter estimates. In particular, this exclusion will over estimate the effect of those countries that receive a non-zero dollar amounts of goods and services from country "j". It follows, then, that if the excluded countries are largely dissimilar from country "j" in terms of per capita income, there would have been a tendency in the earlier literature towards rejecting the Linder hypothesis. This situation applies to many countries that have been analyzed in the past and, indeed, applies to the countries examined in our analysis. As evidence of this fact, consider the data presented in Table 1. These data show that the average per capita income of those countries to which a given OECD country *does not* export are largely dissimilar from the average per capita income of that given OECD country. This finding further highlights the need to include information on *all* potential trading partners of the country under investigation, regardless of whether or not a non-zero amount of goods and services is traded.

B. The Linder Model

Since Linder did not specify a formal model of his hypothesis, there is no clearly defined specification that should be used to test this theory. The model used here generally follows the well-established gravity model literature on the determinants of trade flows. These models

typically specify that trade flows should be a function of 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 measurement of each of these variables is described below.

The dependent variable of our analysis is a measure of trade intensity. This variable is the dollar value of exports from OECD country "j" to potential trading partner "i" at time "t" (measured in thousands of constant 1987 dollars).[6] This variable is denoted "$EXPORTS_{itj}$".[7]

In order to control for differences in the sizes of the economies of each trading partner of OECD country "j", our regression includes a variable that measures the level of real GDP in trading partner "i" at time "t" (measured in billions of constant 1987 dollars). This variable is denoted "$OUTPUT_{itj}$". Linder (1961, p. 110) himself argued that a smaller country would almost certainly have a greater trade volume with a larger trading partner than with a smaller one. Consequently, it is anticipated that the coefficient on this variable should be positive.

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 "$EXCHANGE_{itj}$", is constructed as described in equation (5) below:

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6. Although Linder believed that his theory applied to trade in manufacturing, and perhaps services, most empirical work has used total trade data. Kennedy and McHugh (1983) found evidence that using data on total trade rather than manufacturing trade does not significantly affect the results. In any case, for the time period in question over 80% of exports from the OECD countries in our sample was made up of manufactured products (OECD, *Trade By Commodities, Series C*, 1998).

7. Data on the dependent variable of our analysis, EXPORTS, were obtained from the International Monetary Fund's *International Trade Statistics Yearbook* (1997) and from the World Bank's *World Development Indicators on CD-ROM* (1997). Data used to construct the exogenous variables were obtained from the World Bank's *World Development Indicators on CD-ROM* (1997).

$$\text{EXCHANGE}_{itj} = \left[\frac{e_{itj} \times p_{it}}{p^{*}_{tj}} \right] \quad (5)$$

In this formulation: e_{itj} is the exchange rate of potential trading partner country "i", at time "t" (measured in units of the currency of OECD country "j" per unit of the currency of potential trading partner "i"); p_{it} is the GDP deflator in potential trading partner "i" at time "t"; and, p_{tj}^{*} the GDP deflator of OECD country "j" at time "t". Since an increase in this variable should increase the exports from OECD country "j" to potential trading partner "i", we expect the coefficient on "EXCHANGE_{itj}" to be positive.

The Linder effect is captured through a variable that measures the degree of similarity between the per capita income[8] levels of the given OECD country and each potential trading partner. This variable, which we denote as "LINDER_{itj}", is calculated as the absolute difference in the level of real per capita GDP in OECD country "j" and potential trading partner "i" at time "t" (measured in hundreds of constant 1987 dollars). If the Linder hypothesis is supported by the data of this analysis then the coefficient on this variable should be negative and statistically significant.

It also may be the case that trade policy affects trade intensity. For example, certain countries may not import much due to import restrictions. Ideally, some measure of trade policy (e.g., average tariff level) should be included in the regression in order to control for this effect.

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8. It has become common in recent years to use data adjusted for purchasing power parity (PPP) in empirical studies of international economic relationships (see, for example, Summers and Heston 1996). However, PPP-adjusted income figures are not available for a large number of countries in our data set—particularly for the smaller countries that comprise the censored observations of our dependent variable. Choosing to use PPP-adjusted data in our analysis would mean excluding the censored observations from our sample. This would seriously bias our results and so we have chosen to employ per capita income figures that are not adjusted for PPP. In addition, the use of PPP-adjusted data is most often useful and important when one is

Unfortunately, relevant data on trade intensity are not available for many of the countries in our analysis, making the inclusion of such a variable impossible.

Re-writing the model expressed in equation (1) in terms of the specific variables defined above and in terms of the composite error term, the model to be estimated in this analysis may be expressed as:

$$\mathbf{EXPORTS}_{itj} = \beta_1 + \beta_2\, \mathbf{OUTPUT}_{itj} + \beta_3\, \mathbf{EXCHANGE}_{itj} + \beta_4\, \mathbf{LINDER}_{itj} + \omega_{itj} \qquad (6)$$

We note, again, that relevant time-invariant factors such as distance and other non-measurable variables are controlled for in this random-effects model through the inclusion of the model's stochastic component, ω_{itj}. The finding of a negative and statistically significant estimate for β_4 in the above model would provide empirical evidence in favor of the Linder hypothesis.

4. EMPIRICAL RESULTS

Initial empirical results were obtained by applying the maximum-likelihood random-effects Tobit estimation procedure to equation (6) above. This equation was estimated nineteen times, once for each OECD country under investigation. In addition, since it is well known that Tobit models often suffer from a non-ideal error variance, we computed a likelihood ratio statistic to test for the presence of this violation. When the null hypothesis of ideal error variance was rejected, an appropriate correction was applied to the model. The results of estimation of the marginal effects for the random-effects Tobit model are displayed in Table 2.[9] These results are overwhelmingly in support of the Linder hypothesis. For 18 of the 19 OECD countries under

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making growth rate comparisons across countries. In a case such as the model used in our paper, the use of PPP-adjusted data would not be as relevant.

investigation (in particular, for all countries but Denmark), the estimated marginal effect on the Linder variable is negative and statistically significant at the 95% level of confidence or better. It follows, then, that each of these 18 countries is more likely to trade with partners which have per capita income levels similar to their own, *ceteris paribus*. This result presents, for the first time, significant and econometrically valid empirical evidence in favor of the validity of the Linder hypothesis for this group of OECD countries.

The estimated marginal effects on the remaining variables of the model provide additional insight into the relevant factors affecting trade flows. In particular, the results on the OUTPUT variable indicate that for eleven of these OECD countries, the relative size of a trading partner's economy has a positive and significant effect on trade. The results for these eleven countries support our *a priori* expectations that OECD countries tend to export more to countries with relatively large economies. For the remaining eight OECD countries however, the OUTPUT variable is not significant at any reasonable level of confidence. This result would suggests that for these eight countries that after controlling for factors such as differences in per capita income, relative prices and time-invariant factors such as distance, the relative size of trading partners' economies is not a significant factor in determining trade flows. The results on the exchange rate variable indicate that for all but three of the 19 OECD countries under investigation, the estimated marginal effect of this variable is positive and statistically significant. This finding implies that an appreciation of the exchange rate of potential trading partner country "i" (or, a depreciation of the exchange rate of OECD country "j") would increase the level of exports from OECD country "j" to potential trading partner "i", consistent with our *a priori* expectations.

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9. As is well known, the estimated parameters from a Tobit model have no direct interpretation and so we do not report these estimates here in order to conserve space. A complete list of these estimates is available

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 were no difference then, presumably, our analysis would have little to offer regarding the Linder hypothesis beyond what has been presented in previous literature. To investigate this issue, we re-computed the parameter estimates of the random-effects model given by equation (6) while *excluding* the censored observations on the dependent variable. That is, these recomputed estimates were obtained from a random-effects panel data model applied to a data set that excludes those observations on the dependent variable which took on a value of zero. As such, this estimation procedure excludes relevant information on those countries with which no trade occurs.[10]

The results of the random-effects model excluding the censored observations are markedly different from those of the random-effects Tobit model presented in Table 2. Most interestingly, there is statistically significant evidence in support of the Linder hypothesis for *only one* country (the UK) when the censored observations are excluded from the data set. In addition, for three of the countries under investigation, the Linder variable is actually *positive* and statistically significant—the exact opposite of what Linder hypothesized. These results clearly indicate for the majority of countries under investigation here that there is no significant evidence to support Linder's hypothesis when the censored nature of the dependent variable is ignored.

These findings clearly indicate the need to consider the dependent variable of this analysis in the econometrically appropriate context. Had one chosen to estimate this model simply as a random-effects model and not as a random-effects Tobit model, the conclusions that would be

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from the authors upon request.

10. The results of this analysis have been omitted for space considerations but are available in their entirety from the authors upon request.

drawn from such results would be quite different. This may be one of the reasons why previous empirical analyses on the validity of the Linder hypothesis have not found overwhelmingly positive evidence in support of this theory.

5. CONCLUSIONS

This paper provides some insight into the factors that influence trade by uncovering empirical evidence in support of the Linder hypothesis. We find support for this theory at the 95% level of confidence or better for all but one of the 19 OECD countries under investigation here. Our results indicate that these countries trade more intensively with economies that have per capita incomes similar to their own. Our approach analyzes the Linder hypothesis within the context of a panel data set. In this way, we have been able to capture both time-varying and time-invariant factors that affect trade intensity.

The results of this analysis provide strong evidence of the importance of modelling the trade relationship within the appropriate context. Evidence of this can be seen by comparing the results of our random-effects Tobit model with those of a simple random-effects model. These findings imply that the inability of previous empirical investigations to find support for the Linder hypothesis may be due, at least in part, to their failure to consider this issue in the context of a censored dependent variable. One must be suspicious of the results from empirical analyses which ignore this consideration since such results would be biased and inconsistent and inferences drawn from these results would be misleading.

While this paper does not conclusively demonstrate the applicability of the Linder hypothesis to *all* countries, it does present some intriguing evidence on the possible validity of this theory. A more complete treatment of this issue would involve applying this analysis to a wider variety of countries.

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Table 1. Average Per Capita Income[†] of OECD Countries and Potential Trading Partners

OECD Country:	Average per capita income of countries to which the OECD country *does not* export	Per capita income of the OECD country
Australia	2,355	13,587
Austria	2,240	17,552
Belgium	2,213	16,259
Canada	2,056	15,699
Denmark	2,030	21,159
Finland	2,281	18,042
France	2,307	17,633
Germany	2.284	22,928
Ireland	1,999	11,587
Italy	2,379	14,894
Japan	2.157	23,767
Netherlands	2,226	16,760
New Zealand	2,836	11,363
Norway	1,944	23,462
Spain	2,108	8,833
Sweden	1,963	19,364
Switzerland	2,253	27,065
UK	1,926	12,882
US	2,135	19,855

Data are reported in constant 1987 dollars. Averages are computed over the period from 1990 to 1995.

[†] See footnote number 8.

Table 2. Random-Effects Tobit Estimates, Marginal Effects

Country:	Constant	Output	Exchange	Linder
Australia	21.787*	0.3484**	0.3032 E–5	–2.4519**
	(9.271)	(0.1196)	(0.1074 E–4)	(0.1141)
Austria	8416.7	22.149	7.7303**	–1.8974**
	(5481.2)	(2529.5)	(0.6843)	(0.1370)
Belgium	36041.0**	–0.0157	0.2319	–5.7734**
	(2429.3)	(0.2214)	(0.1772)	(0.1859)
Canada	–642.89**	0.5754 E–5	0.2526 E–3**	–0.0641**
	(120.27)	(0.1470 E–4)	(0.2065 E–4)	(0.0096)
Denmark	3108.4	0.1064 E–3	0.9747 E–3	–0.3221
	(0.2458 E9)	(139.170)	(7.7081)	(25473)
Finland	5529.9**	774.86**	2.8582**	–0.5027**
	(793.49)	(256.65)	(0.3275)	(0.0499)
France	48915.0**	35.041	31.022**	–7.2731**
	(8936.80)	(3515.20)	(2.4911)	(0.2560)
Germany	1315.7**	108.80*	0.1987**	–0.0983**
	(142.29)	(55.151)	(0.0437)	(0.0062)
Ireland	394.61**	51.519**	0.2322**	–0.1425**
	(47.93)	(19.97)	(0.0331)	(0.0037)
Italy	2143.50**	686.12**	2.480**	–0.6386**
	(726.90)	(202.12)	(0.3375)	(0.0392)
Japan	–254.16	4.3065	1.7817**	–0.2734**
	(1659.70)	(538.86)	(0.5048)	(0.0429)
Netherlands	3689.22**	705.86*	2.2124**	–0.7765**
	(890.06)	(335.94)	(0.2351)	(0.0307)
New Zealand	382.55	965.37**	3.3189**	–0.6508**
	(416.68)	(166.80)	(0.1629)	(0.0254)
Norway	1427.51**	65.458*	0.2913**	–0.1414**
	(112.20)	(39.241)	(0.0704)	(0.0040)
Spain	–1277.50**	623.55**	1.8374**	–0.3335**
	(368.29)	(104.41)	(0.0938)	(0.0303)

CONTINUED

Table 2. Continued

Country:	Constant	Output	Exchange	Linder
Sweden	0.1619**	0.0063	0.1635 E–5	–0.1955 E–4**
	(0.0082)	(0.0040)	(0.2892 E–5)	(0.2705 E–6)
Switzerland	0.2185**	0.0082	0.6091 E–4**	–0.2653 E–4**
	(0.0141)	(0.0054)	(0.5383 E–5)	(0.3868 E–6)
UK	3535.30**	860.91**	3.1390**	–0.9211**
	(444.88)	(94.235)	(0.5290)	(0.0443)
US	1016.20*	85.451**	0.1610**	–0.2047**
	(66.702)	(22.043)	(0.0414)	(0.0029)

Numbers in parentheses beneath parameter estimates are the estimated standard errors. One asterisk indicates statistical significance at the 95% level of confidence; two asterisks indicate significance at the 99% level of confidence.