Measuring the Influences of Foreign Trade on the Rate of Economic Growth

Ahmet UÇAR

Perhaps the most fundamental proposition of international trade theory is that trade allows a country to achieve a higher real income than would otherwise be possible.[1] The proposition that trade causes economic growth is a rich in international economic theory. From Adam Smith's discussion of specialization and the extent of the market, the economists interested in the determination of standards of living have also been interested in trade. But despite the great effort, there is little persuasive evidence concerning the effect of trade on income. Even so, how best to estimate and test for the effects of trade on economic growth remain a challenge to-date, mainly because of the joint determination of the empirical measures of both trade and economic growth[2]. This paper puts forth the basic difficulties of estimating the affects of trade on growth and enlightens on the recent trend aimed to measure the real affect of trade with controlling for the endogeneity of trade by using geographical exogenous variables[3]. Nevertheless geography is a powerful determinant but not sufficient to explain widely the affect of trade on income. Because trade is really a complex phenomenon and there are many factors involve in. But the aim is to measure trade's REAL affect with an exogenous explanatory instrument. Because geography is the most powerful exogenous explanatory instrument it is used for this aim and it has been proofed that trade causes the economic growth.

a) Endogeneity of Trade

To estimate trade's impact on income, many cross-country regressions of income per person on the ratio of exports or imports to GDP (and other variables) have been created[4]. Such regressions typically find a moderate positive relationship. The problem is that the trade share may be endogenous[5]: as **Elhanan Helpman** (1988), **Colin Bradford**, Jr. and **Naomi**

Chakwin (1993), **Rodrik** (1995a), and many others observe, countries whose incomes are high for reasons other than trade may trade more.

Using measures of countries' trade policies in place of (or as an instrument for) the trade share in the regression does not solve the problem[6]. For example, countries that adopt free-market trade policies may also adopt free-market domestic policies and stable fiscal and monetary policies. Since these policies are also likely to affect income, countries' trade policies are likely to be correlated with factors that are omitted from the income equation. Thus they cannot be used to identify the impact of trade[7].

b) Constructing an Alternative Instrument

Efforts to estimate the effects of international trade on a country's real income have been hampered by the failure to account for the endogeneity of trade. Thus, a regression model is needed to measure real affect of trade on income which is based on exogenous instruments which are not affected by income or by government policies and the other factors that influences income. Also the instruments must not affect income except through their impact on trade.

As the literature on the gravity model of trade demonstrates, geography is a powerful determinant of bilateral trade[8]. It has been verified that the same is true for countries' overall trade: simply knowing how far a country is from other countries provides considerable information. For example, the fact that New Zealand is far from most other countries reduces its trade; the fact that Belgium is close to many of the world's most populous countries increases its trade.

Equally important, countries' geographic characteristics are not affected by their incomes or other factors that influence income. More generally, it is difficult to think of reasons that a country's geographic characteristics could have important effects on its income except through their impact on trade. Thus, countries' geographic characteristics can be used to obtain instrumental variables estimates of trade's impact on income.

Country's income may be influenced by the amount its residents trade with foreigners; it may also be influenced by the amount its residents trade with one another. And just as geography is an important determinant of international trade, it is also an important determinant of within-country trade.

In particular, residents of larger countries tend to engage in more trade with their fellow citizens simply because there are more fellow citizens to trade with. For example, Germans almost surely trade more with Germans than Belgians do with Belgians. Also country size and proximity to other countries are negatively correlated. Because Germany is larger than Belgium, the average German is farther from other countries than the average Belgian is. Size increases with-in country trade when decreasing the international trade.

Thus in using proximity to estimate international trade's effect on income, it is necessary to control for country size. Similarly, in using country size to test whether within-country trade raises income, it is necessary to control for international trade.

Under the direction of these findings, Frankel & Romer offered the basic form of geography based model. In their regression there is no place for the typical and strong

variables (capital and labor) and even there is no place for trade itself. This is because of the definition of Y as well as the joint determination of trade and Y.[9] For example, if trade is a flow, it is part of Y; if it is a capacity (stock), it is included in capital. So it is a must that to extract the trade from the regression and the other variables which trade may affect. Because large part of countries' trade is with their immediate neighbors and being a landlocked country has negative affect on foreign trade border sharing and landlockedness dummy variable added to regression. In the first regression, income is a function of proximity, area, population, border sharing and landlockedness.[10]

Y = *f* (P, N, A, B, L)

First review of the new model came from Hall and Jones in the same year with suggesting the latitude variable which means the distance from equator[11].

Rodriguez and Rodrik have criticized the Frankel-Romer results on the grounds that they are not robust to the inclusion of a country's latitude and institutional measures.[12] Because geography may affect public health (and hence the quality of human capital) through exposure to various diseases. It influences the quality of institutions through the historical experience of colonialism, migrations, and wars. It determines the quantity and quality of natural endowments, including soil fertility, plant variety, and the abundance of minerals. The geographically-determined component of trade may be correlated with all these other factors, they re-run the Frankel-Romer income regressions adding three summary indicators of geography: (i) distance from the equator (used in Hall and Jones 1999); (ii) the percentage of a country's land area that is in the tropics[13]; and (iii) a set of regional dummies.

c) Empirical Results

Frankel & Romer focus on two samples. The first is the full set of 150 countries covered by the Penn World Table (1985). Their second sample is the 98-country sample considered by N. Gregory Mankiw et al. (1992). The countries in this sample generally have more reliable data; they are also generally larger, and thus less likely to have their incomes determined by idiosyncratic factors.

The regression shows a statistically and economically significant relationship between trade and income. The *t*-statistic on the trade share is **3.5**; the point

TABLE 3—TRADE AND INCOME

	(1)	(2)	(3)	(4)
Estimation	OLS	IV	OLS	IV
Constant	7.40	4.96	6.95	1.62
	(0.66)	(2.20)	(1.12)	(3.85)
Trade share	0.85	1.97	0.82	2.96
	(0.25)	(0.99)	(0.32)	(1.49)
Ln population	0.12	0.19	0.21	0.35
	(0.06)	(0.09)	(0.10)	(0.15)
Ln area	−0.01	0.09	−0.05	0.20
	(0.06)	(0.10)	(0.08)	(0.19)
Sample size	150	150	98	98
R^2	0.09	0.09	0.11	0.09
SE of regression	1.00	1.06	1.04	1.27
First-stage F on excluded instrument		13.13		8.45

* The dependent variable is log income per person in 1985. The 150-country sample includes all countries for which the data are available; the 98-country sample includes only the countries considered by Mankiw et al. (1992). Standard errors are in parentheses.

estimate implies that an increase in the share of one percentage point is associated with an increase of 0.9 percent in income per person. The regression also suggests that, controlling for international trade, there is a positive (though only marginally significant) relation between country size and income per person.

Irwin & Terviö used data from the pre-World War I period (1913), the interwar period (1928), the Great Depression (1938), the early postwar period (1954), and several years in the later post-war period (1964, 1975, 1985, 1990), they find that the main result of Frankel and Romer is confirmed throughout the whole century: countries those trades more as a proportion of their GDP have higher incomes even after controlling for the endogeneity of trade[14].

	1913-A	1913-B	1928-A	1928-B	1938-A	1938-B	1954	1964	1975	1985	1990
Trade Share	0.65 (0.69)	1.68* (0.86)	2.37 (3.93)	1.28 (2.61)	7.62 (7.24)	2.70 (3.76)	4.91* (2.62)	3.54 (3.13)	2.24 (0.96)	2.85* (0.91)	3.30* (1.33)
Log of Population	-0.15 (0.14)	-0.03 (0.12)	0.05 (0.33)	-0.08 (0.18)	0.29 (0.43)	-0.13 (0.14)	0.30 (0.22)	0.45 (0.32)	0.36 (0.13)	0.40* (0.12)	0.43* (0.14)
Log of Area	0.23 (0.13)	0.00 (0.09)	0.29 (0.17)	-0.04 (0.06)	0.18 (0.10)	-0.01 (0.06)	0.26 (0.18)	0.01 (0.09)	-0.00 (0.07)	0.00 (0.07)	0.02 (0.10)
Constant	-2.15 (1.61)	-2.34* (1.35)	-4.49 (5.43)	-0.47 (2.24)	-6.39 (5.35)	-0.20 (1.67)	-1.96 (4.70)	0.42 (5.16)	2.54 (2.11)	2.37 (1.98)	1.69 (2.72)
N	23	36	29	41	29	41	69	124	131	146	113
Hausman F (p-value)	0.70 (0.41)	4.13* (0.05)	0.02 (0.90)	0.55 (0.46)	0.44 (0.51)	0.68 (0.20)	6.25 (0.20)	0.88 (0.35)	1.48 (0.23)	5.62* (0.02)	5.10* (0.03)
MSE	0.75	0.75	0.58	0.55	0.73	0.54	1.23	0.95	0.99	1.10	1.22
Ratio of 2SLS/OLS Coefficients on Trade	3.6	3.8	0.8	0.4	2.0	0.4	6.7	3.2	1.9	2.5	3.3

Frankel and Romer's estimates suggest a one percentage point increase in the trade share increases per capita income by 2 or 3 percent. But in Irwin & Terviö's samples, a one

* Indicates significant at the 10 percent level.

percentage point increase in the trade share increases per capita income by 3.0 percent, on average. Our estimated OLS effect of trade on income is somewhat larger than Frankel and Romer's, which helps to account for the larger 2SLS coefficient estimates that we find.

d) The affects of Trade on the Components of Income

The results thus far provide no information about the mechanisms through which trade raises income. To shed some light on this issue, Frankel & Romer decompose income and examine trade's impact on each component.

The first decomposition they use is;

$$ln\ (Y_i / N_i) = a/(1-a)\ ln\ (K_i / Y_i) + \Phi(S_i) + ln\ A_i$$

where K and N are capital and labor, S is workers' average years of schooling, $\Phi()$ gives the effects of schooling, and A is a productivity term.

The second decomposition is simpler. They write log output per worker in 1985 as the sum of its value at the beginning of the sample (1960) plus the change during the sample period[15].

$$ln\ (Y_i / N_i)_{1985} = ln\ (Y_i/N_i)_{1960} +$$

$$[\ ln\ [(Y_i / N_i)_{1985} - ln\ (Y_i / N_i)_{1960}\ ]$$

In doing so, they obtain information about the channels through which trade affects income.

TABLE 4—TRADE AND THE COMPONENTS OF INCOME

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable	$\frac{\alpha}{1-\alpha}\ln(K_i/Y_i)$		$\phi(S_i)$		$\ln A_i$		$\ln(Y/N)_{1960}$		$\Delta\ln(Y/N)$	
Estimation	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Constant	−0.72	−1.29	0.10	−0.37	7.47	3.05	7.45	4.27	−0.50	−2.65
	(0.34)	(0.93)	(0.30)	(0.81)	(0.74)	(2.84)	(1.03)	(3.07)	(0.39)	(1.66)
Trade share	0.36	0.59	0.18	0.37	0.27	2.04	0.38	1.66	0.45	1.31
	(0.10)	(0.36)	(0.08)	(0.31)	(0.21)	(1.10)	(0.29)	(1.19)	(0.11)	(0.65)
Ln population	0.02	0.04	0.06	0.07	0.21	0.32	0.09	0.17	0.12	0.18
	(0.03)	(0.04)	(0.03)	(0.03)	(0.06)	(0.11)	(0.09)	(0.12)	(0.03)	(0.06)
Ln area	0.04	0.07	−0.01	0.01	−0.13	0.08	−0.02	0.13	−0.03	0.07
	(0.02)	(0.05)	(0.02)	(0.04)	(0.05)	(0.14)	(0.07)	(0.15)	(0.03)	(0.08)
Sample size	98	98	98	98	98	98	98	98	98	98
R^2	0.13	0.13	0.09	0.08	0.14	0.06	0.03	0.02	0.24	0.20
SE of regression	0.32	0.33	0.28	0.29	0.69	0.92	0.96	1.06	0.36	0.47
First-stage F on excluded instrument		8.45		8.45		8.45		8.45		8.45

Note: Standard errors are in parentheses.

Results show that trade increases income through each component of income. For the first decomposition, the estimated impacts of trade on physical capital depth and schooling are moderate, and its estimated impact on productivity is large. The estimates imply that a one-percentage point increase in the trade share raises the contributions of both physical capital depth and schooling to output by about one-half of a percentage point, and the contribution of productivity to output by about two percentage points. For the second decomposition, trade's estimated effects on both initial income and subsequent growth are large. Here the estimates imply that a one-percentage point increase in the trade share raises both initial income and the change over the sample period by about one and a half percentage points. Further, in every case, the estimates suggest that country size, controlling for international trade, is beneficial.

e) Robustness

A natural question is whether the results are robust. Luxembourg and Singapore are major outliers in the relationship between the actual and constructed trade shares in every regression. Dropping either or both of these observations, however, does not change the basic pattern of the results.

A second concern is the possibility that systematic differences among parts of the world are driving the results. That is, it could be that IV estimates of the impact of trade arise because the countries in certain regions of the world have systematically higher constructed trade shares given their size and also have systematically higher incomes. In this case, findings might be the result not of trade, but of other features of those regions. To address this concern, the regressions re-estimated with the continent dummy variable the results were not changed seriously.

As an alternative way of considering the impact of differences across parts of the world, as Robert E. Hall and Charles I. Jones indicates[16], countries' distance from the equator as a control variable was included. This variable may reflect the impact of climate, or it may be a proxy for omitted country characteristics that are correlated with latitude.

Finally, one can imagine reasons that virtually all the variables used in finding the geographic component of countries' trade might have some endogenous component that is correlated with the error term in the income equation. For example, whether countries have access to an ocean may be endogenous in the truly long run, and may be determined in part by

other forces that affect income[17]. Similarly, population is endogenous in the very long run. To check that no single variable that could conceivably be endogenous is driving the results, the construction of the instrument and the regressions were redone in five ways: omitting the landlocked variable from the bilateral trade equation; excluding population from this equation; omitting all interactions with the common-border dummy from this equation; using total population rather than the labor force both in measuring countries' sizes and in computing income per person; and excluding area from both equations. None of these changes has a major effect on the results.

Not surprisingly, using more information in constructing the instrument increases the precision of the estimates of trade's effect on income. But the estimated effect of trade is not systematically different when one moves to the alternative instrument; this supports the argument that it is a valid instrument.

f) Conclusion

How international trade affects standards of living is an old question, it is a difficult one to answer. The amounts that countries trades are not determined exogenously. As a result, correlations between trade and income cannot identify the effect of trade.

This paper addresses this problem by focusing on the component of trade that is due to geographic factors. Some countries trade more just because they are near well-populated countries and some trade less because they are isolated. Geographic factors are not a consequence of income or government policy, and there is no likely channel through which they affect income other than through their impact on a country's residents' interactions with

residents of other countries and with one another. As a result, the variation in trade that is due to geographic factors can serve as a natural experiment for identifying the effects of trade.

The results of the experiment are consistent across the samples and specifications of many economists show: trade raises income. The relation between the geographic component of trade and income suggests that a rise of one percentage point in the ratio of trade to GDP increases income per person by at least one-half percent. Trade appears to raise income by spurring the accumulation of physical and human capital and by increasing output for given levels of capital. In the same time, this is why of the two basic elements of growth models capital and labor was excluded from the income equations to measure the real affect of trade.

The results also suggest that within-country trade raises income. Controlling for international trade, countries that are larger—and that therefore have more opportunities for trade within their borders—have higher incomes. The point estimates suggest that increasing a country's size and area by one percent raises income by one-tenth of a percent or more. And the estimates suggest that within-country trade, like international trade, raises income both through capital accumulation and through income for given levels of capital.

There are two important caveats to these conclusions. First, the effects are not estimated with great precision. The hypotheses that the impacts of trade and size are zero are typically only marginally rejected at standard significance levels. In addition, the hypothesis that the estimates based on the geographic component of trade are the same as the estimates based on overall trade are typically relatively far from rejection. Thus, although the results bolster the case for the benefits of trade, they do not provide decisive evidence for it.

The results are that they cannot be applied without qualification to the effects of trade policies. There are many ways that trade affects income, and variations in trade that are due to geography and variations that are due to policy may not involve exactly the same mix of the various mechanisms. Thus, differences in trade resulting from policy may not affect income in precisely the same way as differences resulting from geography.

Nonetheless, the estimates of the effects of geography-based differences in trade are at least suggestive about the effects of policy-induced differences as widely accepted by literature[18]. The point estimates suggest that the impact of geography-based differences in trade is quantitatively large.

Notes

[1] **Samuelson**'s (1939, 1962) two papers are among the classic articles on the gains from trade, but even **Adam Smith** discussed how a country open to international trade would increase "the exchangeable value of its annual produce.

[2] See *Does Trade Cause Growth? - A Comment by* **V. Heinrich Amavilah.**

[3] Trend refers, **Jeffrey A. Frankel**(1999), **David Romer**(1999), **Francisco Rodríguez**(2000), **Dani Rodrik**(2000), **Douglas A. Irwin** (2001), **Marko Terviö** (2001), **Francisco Alcalá** (2003) and **Antonio Ciccone** (2003).

[4] For example, **Michael Michaely** (1977), **Gershon Feder** (1983), **Roger C. Kormendi** and **Philip G. Meguire**(1985**), Stanley Fischer** (1991, 1993), **David Dollar** (1992), **Ross Levine and David Renelt** (1992), **Sebastian Edwards**(1993), **Ann Harrison** (1996), **Edwards** (1995) and **Dani Rodrik** (1995b).

[5] See *Does Trade Raise Income* **Jeffrey A. Frankel** & **David Romer**(The American Economic Review1999), 377

[6] See Ibid, 386

[7] See **Sala-i-Martin, Xavier.** "*Comment*", in Olivier Jean Blanchard and Stanley Fischer, eds., *NBER macroeconomics annual 1991*. Cambridge, MA: MIT Press, 1991, pp. 368 –78.

[8] For example, **Hans Linneman** (1966), **Frankel** (1995) and **Frankel** (1997).

[9] See Cf. Temple, 1998.

[10] See *Does Trade Raise Income,* **Frankel** & **Romer,** Ibid 377

[11] See **Hall, Robert and Charles Jones** (1999) "Why Do Some Countries Produce So Much More Output per Worker than Others?" *Quarterly Journal of Economics*, Feb., 114, no.1, 96

[12] This is the most comprehensive critique of the theory. See *Trade Policy and Economic Growth:A Skeptic's Guide to the Cross-National Evidence* **Francisco Rodríguez** & **Dani Rodrik** (2000), 3.

[13] See **Radelet, Steven, Jeffrey D. Sachs,** and **Jong-Wha Lee**, *"Economic Growth in Asia."* HIID Development Discussion Paper, 1997.

[14] See *Does Trade Raise Income? Evidence from the Twentieth Century* by **Douglas A. Irwin, Marko Terviö.** (July 18, 2001)

[15] See *Does Trade Raise Income,* **Frankel** & **Romer,** Ibid 397

[16] See **Hall, Robert and Charles Jones** (1999), Ibid 114

[17] The potential endogeneity of characteristics of borders other than whether countries are landlocked is unlikely to cause serious difficulties, for two reasons. First, the location of borders is largely determined by forces other than government policies and other determinants of current income; that is, the endogenous component of borders appears small. Second, because the estimates control for within-country trade, what is key to estimates is the overall distribution of population, not the placement of country borders.

[18] Based on the mentioned papers of Jeffrey A. Frankel, David Romer, Francisco Rodríguez, Dani Rodrik, Douglas A. Irwin, Marko Terviö, Heinrich V. Amavilah , Francisco Alcalá and Antonio Ciccone.

Bibliography

Alcalá, Francisco and Antonio Ciccone , "Trade and Productivity," CEPR *Discussion Paper Series no 3095*, London, (2001)

Amavilah, V. Heinrich "Does Trade Cause Growth?" - A Comment, Phoenix, (1999)

Dollar, David, and Aart Kraay, "Institutions, Trade, and Growth," *Journal of Monetary Economics*, February,50 (*1*), (2003)pp. 133-162.

Frankel, Jeffrey A. *Regional trading blocs in the world trading system*. Washington, DC: Institute of International Economics, (1997).

Frankel, Jeffrey, and Romer, David, "Does Trade Cause Growth?" *American Economic Review* 89, no. 3, (June 1999), 379-399.

Frankel, Jeffrey A. and Romer, David. "Trade and Growth: An Empirical Investigation." *National Bureau of Economic Research (Cambridge, MA) Working Paper No. 5476*, (March 1996).

Frankel, Jeffrey A.; Romer, David and Cyrus, Teresa L. "Trade and Growth in East Asian Countries: Cause and Effect?" *National Bureau of Economic Research Working Paper (Cambridge, MA) No. 5732*, (August 1996).

Hall, Robert and Charles Jones "Why Do Some Countries Produce So Much More Output per Worker than Others?" *Quarterly Journal of Economics*, (Feb 1999), 114, no.1, 83-116.

Irwin, Douglas, and Marko Tervio, "Does Trade Raise Income? Evidence from the Twentieth Century" NBER Working Paper 7745. Cambridge, MA (2000).

Jones, Charles I.. "Comment on Rodriguez and Rodrik, Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence." *NBER Macroeconomics Annual 2000*. MIT Press, Cambridge (2000) Available at http://www.stanford.edu/~chadj.

Radelet, Steven, Jeffrey D. Sachs, and **Jong-Wha Lee**, "Economic Growth in Asia." *HIID Development Discussion Paper*, (1997)

Rodríguez Francisco and Dani Rodrik "Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence" forthcoming *NBER Macroeconomics Annual*. Cambridge, MA, (2000)

Rodrik, Dani, Arvind Subramanian, and Francesco Trebbi, "Institutions Rule: The Primacy of Institutions over Geography and Integration in Economic Development," *NBER Working Paper no 9305*, Cambridge, MA (2002).

Rose, Andrew and Frankel, Jeffrey A., "An Estimate of the Effect of Common Currencies on Trade and Income," *Quarterly Journal of Economics*, (2002 May), *117*(2), pp. 437-466.

Sala-i-Martin, Xavier. "*Comment*," in Olivier Jean Blanchard and Stanley Fischer, eds., *NBER macroeconomics annual 1991*. Cambridge, MA: MIT Press, (1991), pp. 368 –78.

APPENDIX

TABLE A1—BASIC DATA

Country	Actual trade share	Constructed trade share	Area (thousands of square miles)	Population (millions)	Income per worker
Algeria	49.66	13.97	919.595	4.859	13434
Angola	69.10	11.51	481.354	3.512	1742
Benin	76.99	42.20	43.483	1.874	2391
Botswana	121.28	24.03	231.800	0.370	6792
Burkina Faso	52.42	14.10	105.870	4.150	940
Burundi	30.82	24.86	10.747	2.539	986
Cameroon	57.67	15.79	183.569	3.831	3869
Cape Verde Islands	118.02	45.11	1.557	0.120	2829
Central African Republic	65.23	15.13	241.313	1.309	1266
Chad	61.43	12.00	495.755	1.791	1146
Comoros	67.06	46.77	0.863	0.181	1400
Congo	112.81	25.77	132.046	0.760	6878
Djibouti	117.06	70.97	8.958	0.105	4647
Egypt	51.97	11.75	386.900	12.719	7142
Ethiopia	34.13	8.44	472.432	18.385	705
Gabon	100.18	30.65	103.346	0.420	9672
Gambia	89.14	52.20	4.093	0.358	1609
Ghana	21.29	18.87	92.100	4.468	2237
Guinea	71.80	23.95	94.926	2.243	1583
Guinea-Bissau	62.74	42.24	13.948	0.425	1354
Ivory Coast	78.19	16.58	124.502	4.030	3740
Kenya	51.69	12.48	224.960	7.980	2014
Lesotho	152.42	20.66	11.720	0.743	2028
Liberia	79.63	29.81	43.000	0.811	2312
Madagascar	30.99	9.90	226.660	4.498	1707
Malawi	54.09	12.67	45.747	3.180	1171
Mali	73.60	12.80	482.077	2.332	1686

TABLE A1—*Continued.*

Country	Actual trade share	Constructed trade share	Area (thousands of square miles)	Population (millions)	Income per worker
Mauritania	141.56	23.44	397.953	0.533	2674
Mauritius	109.10	31.11	0.787	0.577	7474
Morocco	58.50	12.71	172.413	6.714	6427
Mozambique	18.38	11.11	308.642	7.290	1417
Namibia	119.81	21.31	317.818	0.380	8465
Niger	51.27	12.37	489.206	3.343	1098
Nigeria	28.53	8.68	356.700	30.743	2874
Reunion	53.14	39.92	0.969	0.216	7858
Rwanda	30.65	26.20	10.169	3.005	1539
Senegal	70.63	19.87	75.954	2.758	2688
Seychelles	111.95	84.98	0.175	0.029	7058
Sierra Leone	19.15	27.81	27.700	1.372	2411
Somalia	25.64	14.89	246.199	2.774	1574
South Africa	55.43	8.90	471.440	11.240	9930
Sudan	21.34	10.97	967.491	7.121	2436
Swaziland	118.71	56.87	6.704	0.277	5225
Tanzania	21.03	10.97	364.900	10.266	975
Togo	105.52	41.47	21.925	1.277	1516
Tunisia	71.33	23.83	63.379	2.280	8783
Uganda	22.54	12.97	91.343	6.236	1224
Zaire	53.15	8.97	905.365	12.321	1136
Zambia	76.96	13.81	290.586	2.274	2399
Zimbabwe	56.40	11.27	150.699	3.135	3261
Bahamas	124.11	38.03	5.382	0.097	29815
Barbados	130.30	56.10	0.166	0.127	12212
Belize	183.27	87.48	8.866	0.049	8487
Canada	54.48	4.97	3851.809	12.595	31147
Costa Rica	63.19	23.37	19.652	0.920	9148
Dominica	103.09	75.08	0.305	0.030	6163
Dominican Republic	64.24	22.37	18.704	1.912	7082
El Salvador	52.21	28.91	8.260	1.564	5547
Grenada	120.63	81.25	0.133	0.039	4502
Guatemala	24.94	22.04	42.042	2.262	7358
Haiti	38.44	20.44	10.714	2.514	2125
Honduras	54.15	27.58	43.277	1.307	4652
Jamaica	131.89	22.19	4.411	1.059	4726
Mexico	25.74	4.52	761.600	24.669	17036
Nicaragua	36.60	23.46	50.180	0.980	5900
Panama	70.96	23.56	29.761	0.760	10039
Puerto Rico	136.74	22.75	3.515	1.101	21842
St. Lucia	165.77	68.83	0.238	0.057	5317
St. Vincent & Grenadines	152.17	79.41	0.150	0.042	5796
Trinidad & Tobago	61.90	30.33	1.980	0.441	25529
United States	18.01	2.56	3540.939	117.362	33783
Argentina	17.10	5.60	1072.067	10.798	14955
Bolivia	30.27	8.06	424.162	1.978	5623
Brazil	19.34	3.03	3286.470	49.609	10977
Chile	53.85	7.25	292.132	4.303	9768
Colombia	26.33	7.54	439.735	9.433	9276
Ecuador	47.63	11.42	109.484	2.820	9615
Guyana	109.95	25.92	83.000	0.280	3573
Paraguay	49.58	10.43	157.047	1.226	6241
Peru	39.42	7.03	496.222	6.107	8141
Suriname	82.99	30.96	63.251	0.124	10883
Uruguay	47.86	17.07	68.040	1.169	10216
Venezuela	40.76	8.94	352.143	5.789	18362
Bahrain	188.70	71.82	0.240	0.178	22840

TABLE A1—*Continued.*

Country	Actual trade share	Constructed trade share	Area (thousands of square miles)	Population (millions)	Income per worker
Bangladesh	25.78	10.31	55.598	27.684	4265
Bhutan	62.54	37.74	17.954	0.575	1504
China	19.44	2.30	3689.631	612.363	2166
Hong Kong	209.52	35.88	0.398	3.516	16447
India	15.04	3.29	1229.737	295.478	2719
Indonesia	42.66	4.47	735.268	62.136	4332
Iran	15.20	10.06	636.293	13.540	13847
Iraq	49.22	19.14	169.235	4.105	15855
Israel	85.80	54.17	8.020	1.602	21953
Japan	25.54	5.47	143.574	75.526	18820
Jordan	113.50	68.18	37.297	0.601	15655
Korea, Republic of	67.86	14.36	38.031	16.608	10361
Kuwait	96.45	42.55	6.880	0.640	35065
Laos	13.80	27.32	91.429	1.758	2739
Malaysia	104.69	16.82	128.328	6.217	10458
Mongolia	82.72	13.52	604.829	0.894	3966
Myanmar	13.16	10.74	261.220	16.613	1332
Nepal	31.29	13.26	54.463	6.958	2244
Oman	87.06	34.19	82.030	0.368	31609
Pakistan	34.00	8.04	310.400	28.567	4249
Philippines	45.84	8.84	115.830	19.945	4229
Qatar	80.94	69.56	4.412	0.166	36646
Saudi Arabia	79.97	14.98	865.000	3.652	28180
Singapore	318.07	48.90	0.220	1.189	17986
Sri Lanka	62.93	13.94	25.332	5.786	5597
Syria	37.23	37.44	71.498	2.556	17166
Taiwan	94.62	17.92	13.895	8.262	12701
Thailand	51.20	9.45	198.455	26.793	4751
United Arab Emirates	89.66	33.42	32.000	0.694	38190
Yemen	49.34	16.83	128.560	2.369	6425
Austria	81.27	36.64	32.375	3.528	23837
Belgium	151.34	52.46	11.781	4.071	27325
Bulgaria	85.99	31.12	42.823	4.417	9662
Cyprus	107.57	54.39	3.572	0.310	13918
Czechoslovakia	69.45	21.07	49.383	8.137	7467
Denmark	72.99	30.89	16.631	2.780	23861
Finland	57.50	21.64	130.119	2.493	23700
France	47.17	15.26	211.208	24.882	27064
Germany, West	61.52	18.47	96.010	28.085	27252
Greece	53.97	27.01	50.961	3.800	16270
Hungary	82.32	26.92	35.920	5.195	10827
Iceland	81.83	33.08	39.709	0.127	23256
Ireland	118.84	33.85	26.600	1.342	19197
Italy	46.06	13.97	116.500	22.714	27189
Luxembourg	211.94	281.29	0.999	0.157	30782
Malta	160.86	98.14	0.122	0.119	15380
Netherlands	118.76	35.84	16.041	5.855	28563
Norway	86.00	23.54	125.049	2.043	28749
Poland	35.07	13.84	120.728	19.235	8079
Portugal	77.95	18.78	35.550	4.540	11343
Romania	41.62	18.80	91.699	11.275	4021
Spain	43.51	12.38	194.885	13.732	21169
Sweden	69.02	18.22	173.800	4.238	26504
Switzerland	77.69	32.57	15.941	3.222	29848
Turkey	44.40	11.26	300.947	21.829	7091
United Kingdom	56.87	13.47	94.247	27.684	22981
Soviet Union	18.28	3.68	8600.387	142.801	13700

TABLE A1—*Continued.*

Country	Actual trade share	Constructed trade share	Area (thousands of square miles)	Population (millions)	Income per worker
Yugoslavia	57.88	25.82	39.449	10.475	11417
Australia	35.28	4.07	2966.150	7.391	28960
Fiji	89.13	18.56	7.078	0.232	9840
New Zealand	65.25	8.19	103.884	1.438	26039
Papua New Guinea	94.52	10.17	178.704	1.660	3374
Solomon Islands	123.60	25.12	10.954	0.088	5109
Tonga	102.25	43.40	0.288	0.030	6022
Vanuatu	123.33	30.86	4.707	0.042	5707
Western Samoa	92.17	32.77	1.093	0.050	5388

Notes: Actual trade share—Ratio of imports plus exports to GDP, 1985 (Penn World Table, Mark 5.6, Series OPEN).

Constructed trade share—Aggregated fitted values of bilateral trade equation with geographic variables. (See text, Section I, subsections B–D.)

Area—Rand McNally (1993).

Population—Economically active population, 1985 (Penn World Table, Mark 5.6, constructed from real GDP per capita (RGDPCH), real GDP per worker (RGDPW), and total population (POP): RGDPCH*POP/RGDPW).

Income per worker—Real GDP per worker, 1985; 1985 international prices (dollars) (Penn World Table, Mark 5.6, Series RGDPCH).