Replication of "Does Trade Cause Growth?" by Jeffrey A. Frankel & David Romer

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Abstract

This paper is an attempt at replicating Frankel and Romer (1999), "Does Trade Cause Growth?". Frankel and Romer investigate the effects of international trade on income for a sample of 150 countries covered by the Penn World Table, and a more restricted sample of 98 countries considered by Mankiw et al. (1992). Their identification strategy involves constructing a geographic component of international trade, which is ultimately used as an instrument to uncover the causal relationship between trade and income. The key finding is a large but moderately significant positive association between trade and income. Although my replication results match those of the authors, I find the quality of the instrument to be the biggest threat to validity and discuss the implications of a potential correlation between the instrument and other determinants of income.

Keywords: international trade; income; instrumental variables; weak instrument

Introduction

Frankel and Romer's "Does Trade Cause Growth?" is one of the many empirical papers [1] that examine how trade between countries affects standards of living. This question is of particular interest to many empirical macroeconomists in that there seems to be a strong and time-persistent correlation between trade and economic growth for many countries. As noted by Dollar (1992), a large number of countries experienced

[1] e.g. Feyrer (2019), Dollar (2003), Irwin and Terviö (2002), Michaely (1977)

a rapid growth in the 1970s and the 1980s because of their outward-oriented policies. However, ascertaining whether this relationship between trade and growth is causal has been a particularly difficult endeavor. Using a sample of 150 countries from the Penn World Table and another sample of 98 countries (Mankiw et al, 1992), where countries in the latter sample are believed to have more reliable data, Frankel and Romer (1999) attempt to answer this question. They employ an Instrumental Variables (IV) approach to estimate the impact of international trade on income. Indeed, there are many reasons to believe that trade between countries is not exogenously determined: as argued in the paper, countries whose incomes are high for reasons other than trade may trade more. The instrument used is a constructed measure of the geographic component of trade, which, I argue, is not a very reliable one for reasons that will become clear in Section 4 of this paper. The IV strategy involves estimating an equation linking income per person to trade share and measures of countries' geographic characteristics (area and size). The key identifying assumption is that the instrument (constructed geographic component of trade share) and the geographic characteristics (area and size) are not correlated with the residuals of the income equation being estimated.

My replication results validate the authors' findings conditional on their identifying assumptions: trade has a large but moderately statistically significant positive effect on income. In addition, the IV estimates are larger than ordinary least-squares (OLS) estimates, suggesting that OLS even understates the effect of trade. The rest of this paper is organized as follows: Section 1 discusses data collection and presents summary statistics. Sections 2 and 3 present the econometric model and the estimation results, respectively, and Section 4 discusses the main threats to identification, including the strength of the instrument.

1 Data and Sample statistics

The data used in this replication exercise are obtained from the openICPSR webiste, under *Replication data for: Does Trade Cause Growth?*. They contain information from 1985 on bilateral trade, distance between countries, GDP and GDP per worker, population, area, actual and fitted trade shares, whether the countries are landlocked and whether they share a border. Additionally, the data cover the average investment to GDP ratio, the average population growth and the average years of schooling from 1960 to 1985. Table A1 (Appendix) reports values for actual and constructed trade shares, area, population and income per worker. In column (3) in particular, I calculated the constructed trade share following the same procedure as the authors, that is, by first estimating a bilateral trade equation and then aggregating the fitted values of that equation. This constructed trade share is the instrument used for the actual trade share in the main equation of the model. The details of how the constructed trade share is calculated are explained in the next section.

2 The Model

The objective is to estimate the effects of international trade on income by constructing a geographic component of international trade and using it as an instrument. This is because international trade is very likely to be endogenously determined, and countries' geographic characteristics are believed to be important determinants of international trade that affect income only through their impact on international trade.

First, a country's income can be expressed as a function of international trade, within-country trade and other factors:

$$\ln Y_i = \alpha + \beta T_i + \gamma W_i + \varepsilon_i, \tag{1}$$

where Y_i is income per person, T_i is international trade and W_i is within-country trade. Trade between a country and the rest of the world is a function of its proximity to other countries (P_i) and other factors:

$$T_i = \psi + \phi P_i + \delta_i \tag{2}$$

In a similar way, within-country trade is a function of a country's size (S_i) and other factors:

$$W_i = \eta + \lambda S_i + \nu_i \tag{3}$$

The key identifying assumption is that P_i and S_i are uncorrelated with the residuals in equations (1) and (3). This guarantees that if we have data on Y, T, W, P, and S, equation (1) can be estimated by instrumental variables. However, data on within-country trade do not exist. To overcome this problem, equation (3) is substituted in equation (1) to obtain:

$$\begin{aligned} \ln Y_i &= \alpha + \beta T_i + \gamma\left(\eta + \lambda S_i + \nu_i\right) + \varepsilon_i \\ &= \left(\alpha + \gamma\eta\right) + \beta T_i + \gamma\lambda S_i + \left(\gamma\nu_i + \varepsilon_i\right) \end{aligned} \tag{4}$$

The key identifying assumption implies that P_i and S_i are uncorrelated with $\gamma\nu_i + \varepsilon_i$, which guarantees that equation (4) can be estimated by instrumental variables, where P_i is the instrument for T_i. To estimate equation (4), data on Y, T, S, and P are needed. Y is measured as real income per person, and T is imports plus exports divided by GDP. S_i incorporates two natural measures of size, namely population and area, both in logs. Proximity (P_i) is measured using a weighted average of ease of exchange between a country and the rest of the world. The weights are chosen by first estimating an equation for bilateral trade equation, then obtaining the fitted values of trade between country pairs (i, j) as a share of country i's GDP, and finally aggregating over j

to obtain a geographic component of T_i (country i's total trade). It is specifically this geographic component of T_i that is used as a measure of P_i, that is, the instrument for T_i.

The bilateral trade equation is:

$$
\begin{aligned}
\ln\left(\tau_{ij}/\mathrm{GDP}_i\right) = {} & a_0 + a_1 \ln D_{ij} + a_2 \ln N_i + a_3 \ln A_i + a_4 \ln N_j + a_5 \ln A_j + a_6\left(L_i + L_j\right) \\
& + a_7 B_{ij} + a_8 B_{ij} \ln D_{ij} + a_9 B_{ij} \ln N_i + a_{10} B_{ij} \ln A_i + a_{11} B_{ij} \ln N_j \\
& + a_{12} B_{ij} \ln A_j + a_{13} B_{ij}\left(L_i + L_j\right) + e_{ij}
\end{aligned}
\tag{5}
$$

where D is distance between countries, measured as the great-circle distance between their principal cities, N is population, A is area, L is a dummy for whether a country is landlocked, and B is a dummy for whether two countries share a border. Rewriting this equation as:

$$
\ln\left(\tau_{ij}/\mathrm{GDP}_i\right) = \mathbf{a}'\mathbf{X}_{ij} + e_{ij} \tag{6}
$$

where $\mathbf{a} = \left(a_0,\ \ a_1, \ldots, a_{13}\right)$, and $\mathbf{X}_{ij} = (1, \ln D_{ij}, \ldots, B_{ij}\left[L_i + L_j\right])$, the estimate of the geographic component of country i 's overall trade share is:

$$
\hat{T}_i = \sum_{j \neq i} e^{\hat{\mathbf{a}}'\mathbf{X}_{ij}} \tag{7}
$$

Finally, the main equation used to estimate the effect of international trade on income (the income equation) is:

$$
\ln Y_i = a + bT_i + c_1 \ln N_i + c_2 \ln A_i + u_i, \tag{8}
$$

where T_i is instrumented with $\hat{T}_i$.

3 Estimation Results

3.1 The bilateral trade equation

Table 1 below reports the replication results for the bilateral trade equation. The 1985 bilateral trade data used is originally from the IFS Direction of Trade Statistics and contain trade data on 63 countries. One country from among those has a recorded bilateral trade of zero, and is therefore dropped from the estimation sample. Data on areas, common borders and landlocked countries are from Rand McNally (1993), and data on population are obtained from the Penn World Table.

Table 1: The Bilateral Trade Equation

	Variable	Interaction
Constant	-6.378***	5.095**
	(0.42)	(1.78)
Ln Distance	-0.852***	0.151
	(0.04)	(0.30)
Ln Population (i)	-0.239***	-0.292
	(0.03)	(0.18)
Ln Area (i)	-0.121***	-0.0572
	(0.02)	(0.15)
Ln Population (j)	0.609***	-0.137
	(0.03)	(0.18)
Ln Area (j)	-0.185***	-0.0691
	(0.02)	(0.15)
Landlocked	-0.361***	0.326
	(0.08)	(0.33)
N		3220
R-squared		0.3607
Root MSE		1.6435

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The results are the same as those of the authors. The main takeaway is that countries' geographic characteristics are indeed important determinants of trade, and their effects are all statistically significant at the 0.1% level.

3.2 The Quality of the Instrument

To defend that their instrument is a valid one, the authors analyze the correlation between the actual trade share and the constructed trade share in two regressions, one involving only the actual and constructed trade shares, and the other controlling for population and area in addition to those variables. Those size controls are added because size is a determinant of within-country trade and therefore, the component of the constructed trade share that is correlated with the size measures cannot be used to estimate the effect of trade on income. The replicated Table 2 below shows the results.

Table 2: Actual and Constructed Trade Shares

	(1)	(2)	(3)
Constant	46.41***	218.6***	167.0***
	(4.104)	(12.89)	(18.88)
Constructed trade share	0.991***		0.450***
	(0.104)		(0.124)
Ln population		-6.356**	-4.721*
		(2.086)	(2.055)
Ln area		-8.934***	-6.449***
		(1.702)	(1.774)
N	150	150	150
R-squared	0.3793	0.4761	0.5193
Root MSE	36.33	33.491	32.19

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The main message from these results is that after controlling for the size measures, the constructed trade share still carries a lot of information about actual trade share. Its t-statistic is 3.6 and corresponds to an F-statistic of 13.1, which, the authors argue, is enough to produce small standard errors in an IV setting.

3.3 Estimates of Trade's Effect on Income

Table 3 below presents results from the estimation of the income equation for the two samples. The results match those of the authors. The IV regressions (columns 2 and 4) are compared with OLS (columns 1 and 3). Because the instrument depends on the parameters of the bilateral trade equation, the IV standard errors need to be corrected. The authors do so by adding the term $(\partial\hat{\mathbf{b}}/\partial\hat{\mathbf{a}})\hat{\boldsymbol{\Omega}}(\partial\hat{\mathbf{b}}/\partial\hat{\mathbf{a}})'$ to the usual IV formula for standard errors, where $\hat{\mathbf{b}}$ is the vector of estimated coefficients from the income equation, $\hat{\mathbf{a}}$ is the vector of coefficients from the bilateral trade equation, and $\hat{\boldsymbol{\Omega}}$ is the estimated variance-covariance matrix of $\hat{\mathbf{a}}$.

Table 3: Trade and Income

	(1)	(2)	(3)	(4)
Trade Share	0.852***	1.97*	0.824*	2.96*
	(0.245)	(0.99)	(0.316)	(1.49)
Ln Population	0.121	0.192*	0.214*	0.351*
	(0.0640)	(0.09)	(0.0977)	(0.15)
Ln Area	-0.0131	0.0864	-0.0461	0.202
	(0.0552)	(0.010)	(0.0782)	(0.19)
Constant	7.396***	4.961*	6.954***	1.619
	(0.659)	(2.20)	(1.118)	(3.85)
N	150	150	98	98
adj. R^2	0.076	.	0.081	.
First-stage F on				
excluded instrument		13.13		8.45

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The OLS regression for the 150-country sample shows a positive relationship between trade share and income that is statistically significant at the 0.1% level. A one percentage point increase in trade share increases income per person by 0.9 percent. The IV regression for the same sample gives a larger coefficient for trade share (1.97), with a t-statistic of 1.99, which means the coefficient is only significant at the 5% level.

Moving to the 98-country sample, the results are qualitatively similar. Quantitatively, though, there is a considerable increase in the IV estimate and its standard error. A one percentage point increase in trade share now raises income per person by 2.97%, but the (corrected) t-statistic remains almost the same.

3.4 The channels through which trade affects income

To further analyze the mechanisms through which trade impacts income, the authors decompose income in two different ways. The first, following Hall and Jones (1999), assumes that a country's income is given by:

$$Y_i = K_i^{\alpha} \left[e^{\phi(S_i)} A_i N_i \right]^{1-\alpha}, \tag{9}$$

where K and N are capital and labor respectively, S is workers' average years of schooling, $\phi(\cdot)$ gives effects of schooling, and A is productivity. Following Klenow and Rodriguez-Clare (1997), Hall and Jones (1999) rewrite equation (9) as:

$$Y_i = (K_i/Y_i)^{\alpha/(1-\alpha)} \, e^{\phi(S_i)} A_i N_i. \tag{10}$$

Dividing through by N_i and taking logs gives:

$$\ln (Y_i/N_i) = \frac{\alpha}{1-\alpha} \ln (K_i/Y_i) + \phi (S_i) + \ln A_i. \tag{11}$$

Hall and Jones set a $\alpha = 1/3$ and consider $\psi(\cdot)$ be a piecewise linear function with coefficients based on microeconomic evidence. This allows estimating the components of equation (11), except $\ln A_i$, directly from the data. $\ln A_i$ is then calculated as a residual.

The second decomposition is represented by:

$$\ln (Y_i/N_i)_{1985} = \ln (Y_i/N_i)_{1960} + [\ln (Y_i/N_i)_{1985} - \ln (Y_i/N_i)_{1960}] \tag{12}$$

where the subscripts represent years. Here, too, both OLS and IV regressions are performed with each component of income as dependent variable and trade share as the main regressor. The size controls are included as well, and only the 98-country sample is considered since decomposition cannot be performed for the full sample. Table 4 below presents the replication results, which are the same as those the authors. The authors also perform a Hausman test (Hausman, 1978) of the hypothesis that the IV and OLS estimates are equal, and found no evidence that this hypothesis can be rejected. The results of the Hausman test are not reported in their paper.

Table 4: Trade and the Components of Income

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable	$\frac{\alpha}{1-\alpha}\ln(K_i/Y_i)$		$\phi(S_i)$		$\ln A_i$		$\ln(Y/N)_{1960}$		$\Delta\ln(Y/N)$	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Trade Share	0.364***	0.592	0.181*	0.370	0.266	2.04*	0.379	1.66	0.446***	1.31**
	(0.0957)	(0.36)	(0.0844)	(0.31)	(0.209)	(1.10)	(0.292)	(1.19)	(0.109)	(0.65)
Ln Population	0.0249	0.0397	0.0620*	0.0742*	0.206**	0.320**	0.0911	0.173	0.122***	0.178***
	(0.0296)	(0.04)	(0.0261)	(0.03)	(0.0645)	(0.11)	(0.0903)	(0.12)	(0.0339)	(0.06)
Ln Area	0.0414	0.0679	-0.0137	0.00822	-0.126*	0.0795	-0.0197	0.128	-0.0264	0.0734
	(0.0237)	(0.05)	(0.0209)	(0.04)	(0.0516)	(0.14)	(0.0723)	(0.15)	(0.0271)	(0.08)
Constant	-0.718*	-1.288	0.0982	-0.373	7.469***	3.051	7.454***	4.267	-0.500	-2.648*
	(0.339)	(0.93)	(0.299)	(0.81)	(0.738)	(2.84)	(1.033)	(3.07)	(0.388)	(1.66)
N	98	98	98	98	98	98	98	98	98	98
adj. R^2	0.106	0.051	0.063	0.013	0.113	.	-0.003	.	0.211	.
First-stage F on excluded instrument		8.45		8.45		8.45		8.45		8.45

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The results in Table 4 match those of the authors. For the first decomposition of income, a one-percentage-point increase in the trade share increases the contributions of capital depth, schooling, and productivity by 0.6, 0.4 and 2.0 percentage points respectively. However, the contribution of schooling is not statistically significant at the 5% level. Note that the standard errors in parentheses for the IV columns are the corrected standard errors, but they are only slightly different from the actual IV standard errors, expect for column (10). The results are qualitatively the same for the second decomposition of capital, with the coefficient on the 1960 growth rate of income being statistically insignificant in this case. For both decompositions, the IV estimates are significantly larger than the OLS estimates.

4 Threats to Validity

In this section, after a brief presentation of the authors' robustness analysis, I discuss some of the reasons why the instrument they chose may not be a very reliable one. Specifically, I explain why the exogeneity condition is likely to be violated and show how this may affect the quality of the IV estimates.

4.1 Authors' robustness check

In the Robustness section of their paper, the authors discuss some of the major weaknesses associated with their identification strategy, which I summarize in four points. They do not report their robustness results. First, removing the major outliers from the sample in columns (1) and (2) of Table 3 increases the IV estimate and its standard error. In addition, including Luxembourg in the regressions in columns (3) and (4) moderately reduces the IV estimate. Second, to address the concern that systematic differences between regions of the world could be driving the results, the regressions in Table 3 are re-estimated including a dummy variable for each continent. This significantly increases the standard errors of the IV estimates for the 150-country sample, and slightly raises the IV estimates for the 98-country sample. Third, by removing the countries with the poorest data from the samples (150 to 99 and 98 to 77), the standard errors of both the OLS and IV estimates increase moderately. Finally, the authors attempt to address the concern that the variables used to construct the instrument may be correlated with the error term in the income equation. To do so, they reconstructed the instrument and re-estimated the income equation in different ways. As they point out, these changes sometimes affect the IV estimates remarkably.

4.2 Large and Finite Sample Bias

The instrument (the constructed trade share) is a measure of proximity between countries, and the authors' key identifying assumption implies that proximity is not correlated with other determinants of income than international trade. However, there are some reasons to believe otherwise. One of those, as noted by the authors, is that the variables used to construct the instrument may have some endogenous component that is correlated with the error term in the income equation. For example, as they point out, population and a country's access to an ocean, among other geographic characteristics, may be endogenous in the long run. I would ideally test for the exogeneity condition using a Sargan test, but this test requires more than one instrument in our case and we only have one.

Now let us analyze how a correlation between the instrument and the error term in the income equation will affect the quality of the IV estimator. Recall that the income equation is given by equation (8) and that the instrument is $\hat{T}$. In matrix notation, equation (8) is:

$$Z = X\beta + u \tag{13}$$

where

$$Z = \ln Y, \quad X = \begin{bmatrix} \mathbb{1} & T & \ln N & \ln A \end{bmatrix}, \quad \beta = (a, b, c_1, c_2)'$$

$\mathbb{1}$ is a vector of ones, X has dimension 150×4 for the 150-country sample and 98×4 for the 98-country sample. Z has dimensions 150×1 and 98×1. β is a 4×1 vector. Using equation (13), the OLS and IV estimators are

$$\widehat{\beta}_{OLS} = \beta + \frac{\widehat{\sigma}_{Xu}}{\widehat{\sigma}_X^2}, \quad \widehat{\beta}_{IV} = \beta + \frac{\widehat{\sigma}_{\hat{T}u}}{\widehat{\sigma}_{\hat{T}X}},$$

where $\widehat{\sigma}_{Xu}$, $\widehat{\sigma}_{\hat{T}u}$, and $\widehat{\sigma}_{\hat{T}X}$ are the estimated covariances of X and u, $\hat{T}$ and u, and $\hat{T}$ and

X, respectively; and $\widehat{\sigma}_X^2$ is the variance of X. The OLS estimator is consistent if:

$$\text{plim}_{N\to\infty}\,\widehat{\sigma}_{Xu} = \sigma_{Xu} = 0 \text{ and } \text{plim}_{N\to\infty}\,\widehat{\sigma}_X^2 = \sigma_X^2 \neq 0$$

Similarly, the IV estimator is consistent if:

$$\text{plim}_{N\to\infty}\,\widehat{\sigma}_{\hat{T}u} = \sigma_{\hat{T}u} = 0 \text{ and } \text{plim}_{N\to\infty}\,\widehat{\sigma}_{\hat{T}X} = \sigma_{\hat{T}X} \neq 0$$

Let us now examine the consistency of IV relative to OLS. We can write:

$$\text{plim}_{N\to\infty}\left[\frac{\widehat{\beta}_{IV}-\beta}{\widehat{\beta}_{OLS}-\beta}\right] = \frac{\sigma_{\hat{T}u}/\sigma_{\hat{T}X}}{\sigma_{Xu}/\sigma_X^2} = \frac{\rho(\hat{T},u)\sigma_{\hat{T}}\sigma_u}{\rho(\hat{T},X)\sigma_{\hat{T}}\sigma_X}\frac{\sigma_X^2}{\rho(X,u)\sigma_X\sigma_u} = \frac{\rho(\hat{T},u)}{\rho(\hat{T},X)\rho(X,u)}$$

where $\rho(\cdot,\cdot)$ is the correlation function.

Therefore, conditional on the size controls ($\ln N$ and $\ln A$) being uncorrelated with other determinants of income than international trade (the error term), if there is some correlation between the instrument and the error term, then the IV estimator of trade's effect on income becomes inconsistent relative to the OLS estimator. In addition, the smaller the correlation between $\hat{T}$ and T (after controlling for $\ln N$ and $\ln A$), the larger the inconsistency becomes. The correlation between actual trade share and constructed trade share is 0.62. But after controlling for the size measures, the partial correlation between those two variables is 0.29, which is very low. So clearly, the inconsistency of the IV estimate will be exacerbated if there is some correlation between $\hat{T}$ and u, which is very likely.

It is also noteworthy that the instrument proves to be weak for the 98-country sample. The F statistic associated with the IV regression is 8.45, which is lower than 10. So for that sample, there is enough evidence to suggest that in addition to the potential inconsistency of the IV estimates, a finite sample bias problem also occurs.

Conclusion

This paper conducts a pure replication of Frankel and Romer's 1999 paper "Does Trade Cause Growth". Using the same data and identification strategy, I reproduce most of the authors' results on the effects of international trade on income. Conditional on their key identifying assumptions being valid, the results are the same: international trade has a large but moderately significant positive effect on income. I further comment on the quality of the instrument, which I find to be the biggest threat to validity. Indeed, there is evidence to suggest the presence of large sample bias in the 150-country sample, and both large and finite sample bias in the 98-country sample used to estimate the effect of trade on income. In addition, one cannot confidently attest to the robustness of the estimation results.

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Appendix: Table A1: Basic Data

Country	Actual trade share	Constructed trade trade share	Area (square miles)	Population (millions)	Income per worker
ALGERIA	49.66	13.97	919595	4859	13434
ANGOLA	69.10	11.51	481354	3512	1742
BENIN	76.99	42.20	43483	1874	2391
BOTSWANA	121.3	24.03	231800	369.9	6792
BURKINA FASO	52.42	14.10	105870	4150	940
BURUNDI	30.82	24.86	10747	2539	986
CAMEROON	57.67	15.79	183569	3831	3869
CAPE VERDE IS.	118.0	45.11	1557	120.5	2829
CENTRAL AFR.R.	65.23	15.13	241313	1309	1266
CHAD	61.43	12.00	495755	1791	1146
COMOROS	67.06	46.77	863	181.4	1400
CONGO	112.8	25.77	132046	759.9	6878
DJIBOUTI	117.1	70.97	8958	105.2	4647
EGYPT	51.97	11.75	386900	12719	7142
ETHIOPIA	34.13	8.443	472432	18385	705
GABON	100.2	30.65	103346	419.7	9672
GAMBIA	89.14	52.20	4093	357.5	1609

Country	Actual trade share	Constructed trade trade share	Area (square miles)	Population (millions)	Income per worker
GHANA	21.29	18.87	92100	4468	2237
GUINEA	71.80	23.95	94926	2243	1583
GUINEA-BISS	62.74	42.24	13948	425.3	1354
IVORY COAST	78.19	16.58	124502	4030	3740
KENYA	51.69	12.48	224960	7980	2014
LESOTHO	152.4	20.66	11720	742.8	2028
LIBERIA	79.63	29.81	43000	811.3	2312
MADAGASCAR	30.99	9.897	226660	4498	1707
MALAWI	54.09	12.67	45747	3180	1171
MALI	73.60	12.80	482077	2332	1686
MAURITANIA	141.6	23.44	397953	532.8	2674
MAURITIUS	109.1	31.11	787	576.7	7474
MOROCCO	58.50	12.71	172413	6714	6427
MOZAMBIQUE	18.38	11.11	308642	7290	1417
NAMIBIA	119.8	21.31	317818	379.9	8465
NIGER	51.27	12.37	489206	3341	1098
NIGERIA	28.53	8.678	356700	30743	2874
REUNION	53.14	39.92	969	216.5	7858

Country	Actual trade share	Constructed trade trade share	Area (square miles)	Population (millions)	Income per worker
RWANDA	30.65	26.20	10169	3005	1539
SENEGAL	70.63	19.87	75954	2758	2688
SEYCHELLES	112.0	84.98	175	29.31	7058
SIERRA LEONE	19.15	27.81	27700	1372	2411
SOMALIA	25.64	14.89	246199	2774	1574
SOUTH AFRICA	55.43	8.896	471440	11240	9930
SUDAN	21.34	10.97	967491	7121	2436
SWAZILAND	118.7	56.87	6704	277.2	5225
TANZANIA	21.03	10.97	364900	10266	975
TOGO	105.5	41.47	21925	1277	1516
TUNISIA	71.33	23.83	63379	2280	8783
UGANDA	22.54	12.97	91343	6236	1224
ZAIRE	53.15	8.966	905365	12321	1136
ZAMBIA	76.96	13.81	290586	2274	2399
ZIMBABWE	56.40	11.27	150699	3135	3261
BAHAMAS	124.1	38.03	5382	96.52	29815
BARBADOS	130.3	56.10	166	127.0	12212
BELIZE	183.3	87.48	8866	49.47	8487

Country	Actual trade share	Constructed trade trade share	Area (square miles)	Population (millions)	Income per worker
CANADA	54.48	4.971	3.852e+06	12595	31147
COSTA RICA	63.19	23.37	19652	919.6	9148
DOMINICA	103.1	75.08	305	30.77	6163
DOMINICAN REP.	64.24	22.37	18704	1912	7082
EL SALVADOR	52.21	28.91	8260	1564	5547
GRENADA	120.6	81.25	133	39.11	4502
GUATEMALA	24.94	22.04	42042	2262	7358
HAITI	38.44	20.44	10714	2514	2125
HONDURAS	54.15	27.58	43277	1307	4652
JAMAICA	131.9	22.19	4411	1059	4726
MEXICO	25.74	4.523	761600	24669	17036
NICARAGUA	36.60	23.46	50180	979.6	5900
PANAMA	70.96	23.56	29761	759.8	10039
PUERTO RICO	136.7	22.75	3515	1101	21842
ST.LUCIA	165.8	68.83	238	56.97	5317
ST.VINCENT& GRE	152.2	79.41	150	42.43	5796
TRINIDAD & TOBAGO	61.90	30.33	1980	440.8	25529
U.S.A.	18.01	2.564	3.541e+06	117362	33783

Country	Actual trade share	Constructed trade trade share	Area (square miles)	Population (millions)	Income per worker
ARGENTINA	17.10	5.596	1.072e+06	10798	14955
BOLIVIA	30.27	8.061	424162	1978	5623
BRAZIL	19.34	3.026	3.286e+06	49609	10977
CHILE	53.85	7.250	292132	4303	9768
COLOMBIA	26.33	7.535	439735	9433	9276
ECUADOR	47.63	11.42	109484	2820	9615
GUYANA	110.0	25.92	83000	279.7	3573
PARAGUAY	49.58	10.43	157047	1226	6241
PERU	39.42	7.027	496222	6107	8141
SURINAME	82.99	30.95	63251	124.2	10883
URUGUAY	47.86	17.07	68040	1169	10216
VENEZUELA	40.76	8.940	352143	5789	18362
BAHRAIN	188.7	71.82	240	177.6	22840
BANGLADESH	25.78	10.31	55598	27684	4265
BHUTAN	62.54	37.74	17954	574.6	1504
CHINA	19.44	2.295	3.690e+06	612363	2166
HONG KONG	209.5	35.88	398	3516	16447
INDIA	15.04	3.286	1.230e+06	295478	2719

Country	Actual trade share	Constructed trade trade share	Area (square miles)	Population (millions)	Income per worker
INDONESIA	42.66	4.471	735268	62136	4332
IRAN	15.20	10.06	636293	13540	13847
IRAQ	49.22	19.14	169235	4105	15855
ISRAEL	85.80	54.17	8020	1602	21953
JAPAN	25.54	5.471	143574	75526	18820
JORDAN	113.5	68.18	37297	601.4	15655
KOREA, REP.	67.86	14.36	38031	16608	10361
KUWAIT	96.45	42.55	6880	640.3	35065
LAOS	13.80	27.32	91429	1758	2739
MALAYSIA	104.7	16.82	128328	6217	10458
MONGOLIA	82.72	13.52	604829	894.3	3966
MYANMAR	13.16	10.74	261220	16613	1332
NEPAL	31.29	13.26	54463	6958	2244
OMAN	87.06	34.19	82030	367.6	31609
PAKISTAN	34	8.039	310400	28567	4249
PHILIPPINES	45.84	8.845	115830	19945	4229
QATAR	80.94	69.56	4412	165.9	36646
SAUDI ARABIA	79.97	14.98	865000	3652	28180

Country	Actual trade share	Constructed trade trade share	Area (square miles)	Population (millions)	Income per worker
SINGAPORE	318.1	48.90	220	1189	17986
SRI LANKA	62.93	13.94	25332	5786	5597
SYRIA	37.23	37.44	71498	2556	17166
TAIWAN	94.62	17.92	13895	8262	12701
THAILAND	51.20	9.450	198455	26793	4751
UNITED ARAB E.	89.66	33.42	32000	694.0	38190
YEMEN	49.34	16.83	128560	2369	6425
AUSTRIA	81.27	36.64	32375	3528	23837
BELGIUM	151.3	52.46	11781	4071	27325
BULGARIA	85.99	31.12	42823	4417	9662
CYPRUS	107.6	54.39	3572	310.4	13918
CZECHOSLOVAKIA	69.45	21.07	49383	8137	7467
DENMARK	72.99	30.89	16631	2780	23861
FINLAND	57.50	21.64	130119	2493	23700
FRANCE	47.17	15.26	211208	24882	27064
GERMANY, WEST	61.52	18.47	96010	28085	27252
GREECE	53.97	27.01	50961	3800	16270
HUNGARY	82.32	26.92	35920	5195	10827

Country	Actual trade share	Constructed trade trade share	Area (square miles)	Population (millions)	Income per worker
ICELAND	81.83	33.08	39709	126.5	23256
IRELAND	118.8	33.85	26600	1342	19197
ITALY	46.06	13.97	116500	22714	27189
LUXEMBOURG	211.9	281.3	999	157.1	30782
MALTA	160.9	98.14	122	119.0	15380
NETHERLANDS	118.8	35.84	16041	5855	28563
NORWAY	86	23.54	125049	2043	28749
POLAND	35.07	13.84	120728	19235	8079
PORTUGAL	77.95	18.78	35550	4540	11343
ROMANIA	41.62	18.80	91699	11275	4021
SPAIN	43.51	12.38	194885	13732	21169
SWEDEN	69.02	18.22	173800	4238	26504
SWITZERLAND	77.69	32.57	15941	3222	29848
TURKEY	44.40	11.26	300947	21829	7091
U.K.	56.87	13.47	94247	27684	22981
U.S.S.R.	18.28	3.683	8.600e+06	142801	13700
YUGOSLAVIA	57.88	25.82	39449	10475	11417
AUSTRALIA	35.28	4.074	2.966e+06	7391	28960

Country	Actual trade share	Constructed trade share	Area (square miles)	Population (millions)	Income per worker
FIJI	89.13	18.56	7078	232.4	9840
NEW ZEALAND	65.25	8.190	103884	1438	26039
PAPUA N.GUINEA	94.52	10.17	178704	1660	3374
SOLOMON IS.	123.6	25.12	10954	87.85	5109
TONGA	102.3	43.40	288	30.43	6022
VANUATU	123.3	30.86	4707	41.98	5707
WESTERN SAMOA	92.17	32.77	1093	50.29	5388