

A Response to Rodrik's Geography Critique

Incomplete and subject to revision as of March 6, 2001

The idea of using instrumental variables from the gravity model to isolate the effect of openness on growth (Frankel and Romer, 1999) has generally been well received. Nevertheless, the approach has been criticized. In their wide-ranging critique of the empirical literature on trade and growth, Rodriguez and Rodrik (2000) argue that the geographically constructed instrumental variable in Frankel and Romer (1999) or Irwin and Tervio (2000) might be incorrectly appropriating the direct influences of geography on income, such as the harmful effect of tropical diseases. They argue that the results of Frankel and Romer change if the output equation controls for any one of three geographical variables: (1) distance from the equator (which Hall and Jones (1999) suggest belongs in the equation), (2) percentage of land area inside the tropics (proposed by Radelet, et al. 1997), and (3) dummy variables for the three historically poor continents. Clearly this critique must be taken seriously insofar as it affects our work just as seriously as that of Frankel and Romer.

We implement these suggestions in Table A2. Distance from the equator appears with a positive coefficient, as expected, though it is only significant when we do not include extra income controls. The tropical variable has a negative and significant coefficient, as expected. Dummy variables for Latin America, East Asia, and sub-Saharan Africa appear significantly in our equation without controls. Thus, in some sense, the intuition of Rodriguez and Rodrik is confirmed. Still, the key question concerns the implications of these controls for the openness variable. *In every case*, regardless whether the other controls are included or not, *the openness variable retains most of its magnitude and all of its statistical significance* in the presence of each of the three Rodriguez-Rodrik modifications. The t-statistics are 3 to 4.

Rodrik (2000), a comment on an earlier draft of this paper, takes up the trail of criticism. He controls for size, and finds our significant positive effect of openness on income. But he then proposes deleting Hong Kong and Singapore from the sample, and including an additional explanatory variable, "institutions". Again, he claims that these adjustments will cause the significant positive effect of openness to go away.

Excluding a few countries that are outliers in terms of openness does not have a firm rationale, but is nevertheless a useful check for robustness and one we pursued in our original paper. Below we follow Rodrik in excluding just Hong Kong and Singapore, as reported in Table A3. The coefficient on openness remains significant – and in fact turns out to be higher in estimated magnitude – when the city-states are included. This is true regardless of whether the equation is estimated by OLS or IV, and whether or not initial income and the other controls are included.

Rodrik's argument for including a measure of the quality of institutions is that these are independent determinants of productivity and that openness may be spuriously appropriating their effect. We implement his suggestion in Table A4 by including measures of corruption, law and order, and bureaucracy for 1990 taken from *International Country Risk Guide* (which Rodrik kindly gave us). The three different measures are scaled from 1 (worst) through 6 (best); we have also followed Rodrik in calculating a rescaled average of the measures. The measures are statistically significant when included in the income equation without initial income and the other controls, and are especially so when entered in the form of a rescaled combined single variable. None are significant when included along side initial income and the other factor accumulation variables. However, the key question is the implication for the openness coefficient, which remains positive with a t-statistic around 3, under each of these specifications.

Finally, Rodrik has suggested including at the same time: distance from equator, selected continental dummies; and institutional measures. We pursue this set of combinations in Table A5. While the openness coefficient remains positive, its size and statistical significance is diminished, especially when we exclude our auxiliary controls (though the equation is then by no means “bare bones”). This debate will undoubtedly continue. No doubt if one throws enough variables into the equation, at some point the openness coefficient will indeed be impacted severely enough to turn negative. But our sensitivity analysis currently indicates that it is reasonably insensitive.

Table A2: Sensitivity Analysis: The Role of Geography

Controls?	No	No	No	No	Yes	Yes	Yes	Yes
Openness	1.61 (.52)	1.28 (.27)	1.13 (.22)	1.23 (.33)	.43 (.10)	.43 (.10)	.45 (.10)	.36 (.12)
Log Distance from Equator		.58 (.09)				.01 (.04)		
Tropical Dummy			-1.62 (.15)				-.18 (.09)	
Latin Dummy				-.50 (.20)				-.15 (.10)
East Asian Dummy				-1.14 (.30)				.08 (.19)
Sub-Saharan Dummy				-1.60 (.19)				-.18 (.11)
Number of Observations	110	110	106	110	102	102	101	102
R²		.35	.55	.49	.94	.94	.94	.94
RMSE	1.08	.88	.75	.78	.28	.28	.28	.28

IV estimation.

Regressand is log of Real GDP/capita in 1990, PWT.

Intercepts not reported. Robust standard errors recorded in parentheses.

Table A3: Sensitivity Analysis: The Role of Outliers

		Drop S, HK		Drop S, HK		Drop S, HK		Drop S, HK
	OLS	OLS	IV	IV	OLS	OLS	IV	IV
Controls?	No	No	No	No	Yes	Yes	Yes	Yes
Openness	.79 (.18)	1.04 (.31)	1.61 (.52)	4.1 (1.1)	.33 (.07)	.34 (.11)	.43 (.10)	.53 (.28)
Number of Observations	115	113	110	108	106	104	102	100
R²	.11	.08			.94	.94	.94	.94
RMSE	1.02	1.02	1.08	1.30	.28	.28	.28	.30

Regressand is log of Real GDP/capita in 1990, PWT.

Intercepts not reported. Robust standard errors recorded in parentheses.

Sample is same as Table 2 but drops Singapore and Hong Kong in selected columns.

Table A4: Sensitivity Analysis: The Role of Institutions

Controls?	No	No	No	Yes	Yes	Yes
Openness	1.61 (.52)	.69 (.24)	.68 (.23)	.43 (.10)	.39 (.12)	.38 (.10)
Corruption (1/6)		.10 (.09)			-.06 (.04)	
Law And Order (1/6)		.18 (.07)			.02 (.04)	
Bureaucracy (1/6)		.23 (.08)			.07 (.03)	
Rescaled Combined Institutions (0/1)			3.11 (.23)			.22 (.23)
Number of Observations	110	91	91	102	89	89
R²		.56	.56	.94	.94	.94
RMSE	1.08	.72	.71	.28	.27	.28

IV estimation.

Regressand is log of Real GDP/capita in 1990, PWT.

Intercepts not reported. Robust standard errors recorded in parentheses.

Table A5: Sensitivity Analysis: Combinations

Controls?	No	No	Yes	Yes
Openness	1.61 (.52)	.27 (.17)	.43 (.11)	.15 (.08)
Rescaled Combined Institutions (0/1)		2.57 (.20)		.59 (.23)
Log Distance from Equator		-.02 (.09)		-.03 (.04)
Latin Dummy		-.17 (.17)		-.24 (.09)
East Asian Dummy		-.20 (.30)		.17 (.17)
Sub-Saharan Dummy		-1.37 (.16)		-.50 (.11)
Number of Observations	110	91	102	90
R²		.84	.94	.95
RMSE	1.08	.45	.28	.25

IV estimation.

Regressand is log of Real GDP/capita in 1990, PWT.

Intercepts not reported. Robust standard errors recorded in parentheses.

References

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

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, 83-116.

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

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

Rodrik, Dani (2000) "Comment on Frankel and Rose" unpublished.