Economic Freedom, Institutional Quality, and Cross-Country Differences in Income and Growth

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In the past few decades, the issues in the literature on economic growth have broadened from the development of general theories of growth, largely based on Solow (1956), toward an examination of why there are differences in growth rates across countries, and why some countries continue to grow while others stagnate at low levels of income. This study takes an institutional approach and uses a recently developed measure of institutional quality, the Economic Freedom of the World (EFW) index (Gwartney and Lawson 2003) to examine the issue of cross-country differences in income levels and growth rates. The emphasis on the importance of institutions to economic prosperity goes back at least to Adam Smith (1776), and has been found in the more recent work of Olson (1982), Scully (1988), North (1990), Barro (1996), Barro and Sala-i-Martin (1995), Landes (1998), Hall and Jones (1999), and Acemoglu, Johnson, and Robinson (2001). Despite this interest in institutions, much work on economic growth treats institutions peripherally if at all.

One challenge to the institutional approach is to find a way to quantify the quality of institutions. The EFW index used here is a measure of institutional quality and, to the extent that higher EFW ratings lead to more rapid growth and higher income levels, it provides insight into the characteristics of an environment conducive to prosperity. The results show that better institutions lead to higher

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income, and that institutional improvements result in higher rates of economic growth.

Three Explanations of Cross-Country Differences in Economic Performance

Over the past decade, the economics literature has offered three different types of explanations for the differences in income levels and growth rates across countries. The most well-established explanation in the literature takes a production function approach based on the work of Solow (1956). The second approach explains differences in income and growth across countries as a function of institutions, and is represented by the work of North (1990) and Landes (1998). A third type of explanation, promoted by Sachs (2003), points to the effects of geography and location as determinants of growth and income.

The production function approach views output (Q) as a function of capital (K) and labor (L), such that Q = f(K,L). Within this framework, output is increased by increasing the amount of inputs (K and L), and by technological improvements that alter the production function so that more output can be produced with the same amount of inputs. This approach focuses on increasing human and physical capital, and on technological progress through, for example, research and development. This explanation suggests that higher growth rates can be generated by increasing inputs into the production function, and by discovering ways to employ those inputs more productively.

The institutional approach to growth is based on the idea that both the availability and productivity of resources will be influenced by the institutional and policy environment. While there is some debate about the exact characteristics of the institutions that are most appropriate for economic growth and prosperity, there is considerable agreement that secure property rights are crucial, and that the impediments to exchange must be minimal. Institutions and policies are reflective of government actions. To promote economic growth, governments must not only follow actions that are supportive of secure property rights and freedom of exchange, they must also make a convincing and credible commitment that the policies will be maintained in the future. Public policy must be designed to implement what Mancur Olson (2000) has referred to as "market-augmenting government."[1]

A third approach to identifying factors that lead to prosperity looks at geographical factors. During the last several years, Jeffrey Sachs has promoted the idea that geography and location are major deter-

[1]Olson's ideas are further developed in Azfar and Cadwell (2003) and Knack (2003).

minants of cross-country differences in income levels and growth. Sachs has stressed the importance of three major geographic-locational factors: a tropical climate, access to an ocean port, and distance of country from the world's major trading centers (Rotterdam, New York, and Tokyo). According to this view, a tropical climate inhibits economic growth because of the increased threat posed by diseases such as malaria, and because of the negative impact of a hot and humid climate on the energy level and productivity of labor. The lack of access to an ocean port will mean higher transactions costs and less trade with a sizable portion of the world's population. A distant location from the major markets of the world will also retard trade. In turn, less trade will reduce the gains from division of labor, specialization, and economies of scale. Furthermore, each of these geographic-locational factors will reduce the attractiveness of a country as a base for production, and thereby retard its ability to attract investment.

These three alternative theories of cross-country differences in income levels and growth are not necessarily inconsistent with each other, and may even be mutually reinforcing. For example, if the institutional and geographic-locational factors influence capital formation and the productivity of capital and other inputs, this has implications for the production function approach to growth. However, the policy implications of the three models have substantial differences. The production function approach naturally focuses on policies that will increase the quantity and improve the productivity of capital and labor. The institutional approach focuses on economic, legal, and political institutions, reasoning that if appropriate institutions are in place, the market system provides an incentive for market participants to invest in human and physical capital, and to improve their methods of production through innovation. The geographic-locational approach suggests that greater attention should be paid to the control of tropical diseases and an analysis of how technology can be applied to affect the productivity of resources in tropical regions.

Measurement of Cross-Country Differences in Institutional Quality

Institutional quality will be measured using the Economic Freedom of the World index published in Gwartney and Lawson (2003).[2]

[2]Strictly speaking, the EFW index measures both longer term institutional variables such as the quality of the legal system and shorter term public policies such as marginal tax rates. Throughout this study we used the term "institutional quality" to refer to both.

The EFW index has been used in a number of previous studies, and a review of both the index and other studies in which it has been used is found in Berggren (2003). The EFW index measures institutional quality in five major areas: (1) size of government, (2) legal structure and security of property rights, (3) access to sound money, (4) exchange with foreigners, and (5) regulation of capital, labor, and business. The index provides current ratings for 123 countries, but data are available for only about 100 countries continuously (at five-year intervals) throughout 1980–2000. These countries make up the data set for the empirical analysis that follows.

The EFW index reflects the key elements of the new institutional economics. For many years, Douglass C. North (1990), Friedrich Hayek (1945, 1960), Peter Bauer (1957, 1972), Hernando de Soto (1989), Gerald Scully (1988, 1992), and Scully and Slottje 1991) have stressed the importance of institutions and related policy variables. Following this same path, the new growth theory argues that sound institutions and policies are the keys to economic progress (e.g., see Torstensson 1994; Knack and Keefer 1995; Barro 1995, 1996; Olson 2000; Knack 2003; and Azfar and Cadwell 2003). The EFW index is also closely related to what Hall and Jones (1999) call "social infrastructure." Using the language of Hall and Jones, a quality infrastructure is present when the institutions and government policies of a country encourage productive behavior (e.g., accumulation of skills or the development of new goods and production techniques) and discourage predatory activities (e.g., rent seeking, corruption, and theft.)

The EFW measure is available for a large number of countries over a lengthy period of time. This is a major advantage because it allows the study of how changes in institutional quality affect economic growth.[3] While there are advantages to using proxies for institutional quality, such as is done by Hall and Jones (1999) and Acemoglu, Johnson, and Robinson (2001), that approach precludes looking at the effect of decade-by-decade changes in institutional quality. In contrast, the approach employed here makes it possible to investigate directly the impact of changes in institutional quality on economic performance.

[3]Hanson (2003) criticizes the empirical literature using various economic freedom indexes, arguing that different indexes measure different things even though they come up with similar results. Because this study uses only the EFW index, Hanson's criticisms of the broader literature are only peripherally related to the work undertaken here.

Measurement of Geographic and Locational Factors

Jeffery Sachs has popularized the view that a country's level of economic activity will be adversely affected by a tropical climate and a location that is distant from the world's major market centers while access to an ocean coastline will exert a favorable impact. We measure these factors in the same manner as Sachs and his fellow researchers. The proportion of a country's geographic area located in a tropical region (Tropics) will be used to measure the tropical location variable.[4] The distance from core markets (Air Distance) variable is the minimum air distance (in kilometers) of a country from any one of the world's major trading centers (Rotterdam, New York, or Tokyo). Finally, the coastal variable is a percentage of a country's population living within 100 kilometers of an ocean coastline.[5]

Measurement of Physical and Human Capital

The data for physical capital per worker (Kpw) and human capital per worker (Hpw) are from Baier, Dwyer, and Tamura (2003). The physical capital stock was derived from annual investment data in the usual manner. A 7 percent depreciation rate was used to convert the annual investment data into capital stock estimates. The human capital estimates reflect cross-country differences in both years of schooling and demographic (age) factors that can be expected to influence the years of work experience. The years of schooling were also adjusted for differences in returns across schooling categories (elementary, secondary, and higher education). We believe that these data are the most comprehensive cross-country human capital estimates currently available. The physical and human capital data are available for 91 of the 99 countries in our core data set. All of the eight omitted countries have a population of less than one million.

Cross-Country Differences in Income Levels and Growth Rates: Empirical Results

Because the economic performance of an economy will generally reflect the quality of its institutional arrangements and policies over a substantial time period, empirical analysis should also employ a measure that reflects institutional quality over a substantial time period. The core database for this study comprises 99 countries for which

[4]Tropical regions are defined as areas located between 23.5 degrees of latitude North (Tropic of Cancer) and 23.5 degrees of latitude South (Tropic of Capricorn).

[5]See Gallup, Sachs, and Mellinger (1999) for additional details on these data.

the *Economic Freedom of the World* data are available in 1980, 1985, 1990, 1995, and 2000.[6] The EFW rating used throughout this paper is the mean summary rating for these five years during the 1980–2000 period, which reflects the quality of a nation's institutions and policies over a period of two decades.

The Determinants of Cross-Country Differences in per Capita GDP

Earlier, the study identified three different explanations in the recent economics literature for cross-country differences in economic performance. Table 1 looks at each of these explanations separately to see how much of the cross-country differences in per capita GDP in the year 2000 each can explain. Because the level of income is the dependent variable, this analysis will reflect the cumulative long-run income-enhancing effects of the independent variables. The first regression takes the EFW index as the sole measure of institutional quality, and using that variable alone finds that differences in institutions explain 63.2 percent of the cross-country variation in per capita GDP. The square of EFW rather than the linear form is used here because it gives a slightly better fit. This reflects the fact that a one-unit increase in EFW has a larger impact on per capita GDP for countries with higher EFW ratings than for those with lower ratings.[7] The three key variables suggested by Sachs are incorporated into the geographic-locational model of Equation 2. This model explains slightly more than half of the variation in per capita income. The production function approach, using measures of human and physical capital in the third regression, explains 92.8 percent of the cross-country variation in income.

Clearly, each of the three explanations of cross-country differences in per capita GDP has considerable explanatory power. The t-statistics on the coefficients show that all of the independent variables in all three regressions are statistically significant as well, providing empirical support for all three explanations. The R-squares indicate

[6]These data were available for 103 countries. Because their per capita GDP figures and growth rates were dominated by conditions in the world market for crude oil, four of the countries (Bahrain, Kuwait, Oman, and the United Arab Emirates) were omitted from the core database.

[7]The $651 coefficient for the square of EFW in Equation 1 indicates, for example, that a typical country with a long-term EFW rating of 6.0 had an income level in 2000 that was $7,161 ($651 times 11, the difference between the square of 6 and the square of 5) higher than one with a long-term EFW rating of 5.0.

TABLE 1

THE DETERMINANTS OF CROSS-COUNTRY DIFFERENCES IN GDP PER CAPITA: THREE ALTERNATIVE MODELS

Dependent Variable: GDP Per Capita, 2000 (t-ratio in parentheses)			
Independent Variables	I-P Model (1)	G-L Model (2)	P-F Model (3)
EFW Rating^2, 1980–2000	651.00 (13.00)		
Tropics		–10,590.00 (9.33)	
Coastal		4,554.00 (2.20)	
Air Distance (1,000s km.)		–1.22 (3.51)	
Kpw, 1999			0.25 (15.93)
Hpw, 1999			954.00 (4.27)
Intercept	–11,183.00	18,831.00	–3,900.00
R^2 (adjusted)	63.20	50.80	92.80
Number of Countries	99	99	91

that the production function approach explains the greatest percentage of the variation in incomes across countries, but while this shows the importance of human and physical capital to the generation of income, it does not explain why the stock of human and physical capital varies across countries.

The regressions in Table 2 examine the impact of institutions and geography on the 1999 levels of physical and human capital. The first three regressions use the stock of physical capital as the dependent variable while the stock of human capital is the dependent variable in the last three equations. Because both of the dependent variables are "stock" measures, the coefficients for the independent variables will reflect their estimated cumulative effects over lengthy time periods. Regressions 1 and 4 show that the 1980–2000 mean EFW rating by itself explains a substantial amount of the variation across countries in the levels of both physical and human capital. Regression 1 shows that a one-unit increase in the square of the EFW rating is

TABLE 2

Economic Freedom, Geography, and the Stock of Physical and Human Capital Per Worker

	Dependent Variable: Kpw, 1999 (t-ratio in parentheses)			Dependent Variable: Hpw, 1999 (t-ratio in parentheses)		
Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
EFW Rating^2, 1980–2000	1,897.00	1,610.00	1,527.00	0.11	0.09	0.07
	(13.41)	(12.52)	(11.11)	(8.75)	(7.38)	(6.00)
Tropics		−21,502.00	−22,203.00		−1.90	−2.02
		(6.06)	(6.27)		(5.82)	(6.47)
Coastal			7,275.00			1.27
			(1.62)			(3.20)
Intercept	−32,704.00	−11,543.00	−12,243.00	2.66	4.52	4.40
R^2 (adjusted)	66.50	76.10	76.50	45.70	60.30	64.10
Number of Countries	91	91	91	91	91	91

Note: When Air Distance was added to Equations (3) and (6), it exerted an insignificant impact on the dependent variable.

associated with an increase of $1,897 in the 1999 stock of physical capital per worker, and regression 4 shows that a one-unit increase in the EFW rating increases the stock of human capital per worker by 0.112 years.[8]

Equations 2 and 3 add the tropical location and share of population near a coastline variables to the physical capital model, while Equations 5 and 6 add them to the human capital model. The addition of these variables reduces the size of the EFW coefficient somewhat, but it remains sizable and statistically significant. The tropical location variable is negative and significant, and it adds substantially to the explanatory power. This is consistent with the view articulated by Sachs that a tropical location adversely affects capital formation. The coastal variable is positive and significant in the human capital equation, but insignificant in the physical capital equation. The size of the t-ratio for the coastal variable and its additional contribution to R^2 indicate that it is substantially less potent than the institutional environment (EFW) and tropical location as a determinant of both physical and human capital. The distance from the major markets variable was omitted from Table 2 because it was insignificant in both the physical and human capital stock regressions. The findings of Table 2 indicate that the institutional (EFW) and tropical variables are important determinants of cross-country differences in the stock of both physical and human capital. The impact of the coastal variable is smaller, particularly as a determinant of the physical capital stock.

The impact of institutional factors on the levels of physical and human capital across countries shows that the production function approach to economic growth leaves out an important factor if it does not account for institutional differences across countries. Levels of physical and human capital do have a substantial impact on a country's income, but a country's institutional quality has a major effect on a country's level of human and physical capital. Better institutions provide a greater incentive for individuals to invest in their human and physical resources. The regressions show that the tropical and coastal locational variables also have an impact on the levels of physical and human capital.

[8]These coefficients indicate that, measured in 1995 U.S. dollars, the capital stock per worker of countries with long-time EFW ratings of 6.0, for example, were more than $20,000 greater in 1999 than those with long-time EFW ratings of 5.0. Correspondingly, the EFW coefficient in the human capital equation indicates that countries with long-term ratings of 6.0 had approximately 1.2 additional years of human capital than those with long-term ratings of 5.0. Basically, the human capital variable is a country's mean years of schooling adjusted for its age composition and the diminishing returns associated with additional schooling.

Table 3 looks at the impact of institutional and geographical factors along with levels of human and physical capital as determinants of per capita GDP. The first regression shows that institutional differences along with location in the tropics explain 75 percent of the cross-country differences in the 2000 per capita GDP. Equation 2 illustrates that once the effects of EFW and tropical location are taken into account, the coastal variable is insignificant and fails to add to the explanatory power of the model. Equation 3 adds the levels of both physical and human capital per worker (Kpw and Hpw) to the model. The four independent variables of Equation 3 together explain about 94 percent of the cross-country variation in per capita GDP.

Because the EFW rating and the tropics variable exert a major impact on the levels of both human and physical capital, as shown in Table 2, those variables have both a direct and an indirect impact on per capita GDP. The direct effect reflects their impact on per capita GDP via the productivity of human and physical capital. The indirect effect reflects their impact through the level of capital formation—the fact that the levels of human and physical capital per worker are a function of the EFW rating and tropical location.

Because the levels of physical and human capital are included in regression 3, the indirect effect of those variables on per capita GDP is concealed. In order to measure the indirect effects—through capital formation—as well as the direct effects of EFW and tropical location on per capita GDP, only the portion of the human and physical capital variables that is independent of EFW and tropics should be included in these measures. The residuals from Equations 2 and 4 of Table 2 provide this information. The residuals measure the amount of physical and human capital that are not explained by EFW and Tropics. When these residuals are substituted for the physical and human capital variables, the coefficients for the EFW and tropical variables will register both their direct and indirect effects. Equation 4 of Table 3 presents these results.

Note how the inclusion of the indirect effects through Kpw and Hpw substantially increase the coefficients and t-ratios of both the institutional quality and tropical variables. Once the indirect effects are included, a one-unit increase in the square of EFW enhances per capita GDP by slightly more than $500. This implies, for example, that an increase in the mean 1980–2000 EFW rating from 5.0 (approximately the levels of Argentina and Columbia) to 6.0 (approximately the level of South Korea) enhances 2000 per capita GDP by about $5,500. Similarly, an EFW increase from 6.0 to 7.0 enhances 2000 per capita GDP by approximately $6,500 ($500 multiplied by the square of 7 minus the square of 6). Equation 4 of Table 3 also

TABLE 3

ECONOMIC FREEDOM, GEOGRAPHY, AND PHYSICAL AND HUMAN CAPITAL AS DETERMINANTS OF GDP PER CAPITA

Dependent Variable: GDP Per Capita, 2000 (t-ratio in parentheses)						
Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
EFW Rating^2, 1980–2000	529.42	516.73	107.55	508.94	109.41	485.86
	(11.91)	(10.91)	(2.99)	(23.75)	(3.03)	(20.96)
Tropics	–8,472.00	–8,566.00	–2,061.00	–7,982.00	–1,927.00	–8,176.00
	(7.03)	(7.06)	(2.81)	(13.50)	(2.52)	(13.68)
Coastal		1,170.00			–516.90	2,021.00
		(0.79)			(0.64)	(2.66)
Kpw, 1999			0.21		0.21	
			(10.31)		(10.28)	
Hpw, 1999			762.90		804.50	
			(3.47)		(3.50)	
Kpw, 1999 (residuals)				0.21		0.21
				(10.31)		(10.28)
Hpw, 1999 (residuals)				762.90		804.50
				(3.47)		(3.50)
Intercept	–2,575.00	–2,733.00	–3,758.00	–2,709.00	–3,893.00	–2,904.00
R^2 (adjusted)	75.10	75.30	93.70	93.70	93.60	93.60
Number of Countries	99	99	91	91	91	91

NOTE: The values for Kpw (residuals) and Hpw (residuals) of Equation 4 were derived from Table 2, Equations 2 and 5, respectively. The Kpw (residuals) and Hpw (residuals) of Equation 6 were derived from Table 2, Equations 3 and 6, respectively.

highlights the importance of tropical location. The coefficient for this variable indicates that, other things constant, a tropical location adversely impacted 2000 per capita GDP by almost $8,000 once the indirect as well as the direct effects were taken into account.

Equation 5 of Table 3 adds the coastal variable to the model of Equation 3. When only the direct effects are taken into account, the coastal variable is insignificant. Equation 6 of Table 3 incorporates the methodology of Equation 4; the residuals from regressions 3 and 6 in Table 2 are substituted for the Kpw and Hpw variables, respectively. Thus, Equation 6 will capture the indirect, as well as the direct, effects of the institutional and geographic-locational variables. When the indirect effects are taken into consideration, the coastal variable exerts a positive and significant impact on 2000 per capita GDP. The coefficients and t-statistics on the EFW and tropical variables are approximately the same size in Equation 6 as in Equation 4.

Tables 1 through 3 show that institutional differences across countries, as measured by differences in their EFW ratings, have a major impact on cross-country differences in income levels. This is especially true when one considers the impact that institutional differences have on the levels of physical and human capital across countries.

The Determinants of Cross-Country Differences in the Growth of GDP

Higher income levels are the result of higher past rates of growth. If there is a causal relationship between institutional quality (or any other independent variable) and per capita GDP, differences in growth rates should also reflect this relationship. This section will examine the importance of cross-country differences in the quality of institutions, as measured by countries' EFW ratings, and other variables as determinants of differences in long-term growth rates among countries. In order to measure long-term growth more accurately and minimize the impact of business cycles and other factors that will temporarily influence growth rates, the analysis will focus on differential growth rates over the entire 1980 to 2000 time period.

Table 4 analyzes the separate contributions of institutions, geography, and physical and human capital as determinants of growth in per capita GDP during 1980–2000. The first regression shows that cross-country differences in the EFW rating explain 23.6 percent of the variation in the annual rates of growth during the two decades, and the coefficient on EFW has a t-statistic of 5.59. A one-unit change in

TABLE 4

The Determinants of Cross-Country Differences in Growth of GDP Per Capita: Three Alternative Models

Dependent Variable: Average Annual Growth Rate of GDP Per Capita, 1980–2000 (t-ratio in parentheses)			
Independent Variables	I-P Model (1)	G-L Model (2)	P-F Model (3)
EFW Rating, 1980–2000	0.94 (5.59)		
Tropics		–1.78 (3.97)	
Coastal		1.48 (2.91)	
Air Distance (1000s km.)		0.02 (0.19)	
Growth of Kpw, 1980–1999			0.49 (7.85)
Growth of Hpw, 1980–1999			0.34 (1.42)
Intercept	–3.99	1.40	–0.15
R^2 (adjusted)	23.60	21.90	42.20
Number of Countries	99	99	91

the EFW rating is associated with an increase in long-term annual growth of a little more than nine-tenths of a percent. The mean growth rate of per capita GDP for the 99 countries of our basic database was only 1.3 percent during 1980–2000, so a 0.9 percentage point increase in growth is a substantial impact.

Equations 2 and 3 of Table 4 examine the impact of the geographic-locational and production function models as sources of growth. As Equation 2 shows, the three variables of the geographic model explain approximately 22 percent of the cross-country variation in per capita growth. The tropical location and coastal population variables of the geographic model are statistically significant, but the distance from major markets does not appear to have a significant impact on a country's growth rate. The growth rate of physical and human capital taken together explain slightly more than 42 percent of the cross-country variation in the growth of per capita real GDP, with the growth rate of physical capital significant and the growth rate of human capital insignificant at generally accepted confidence levels.

As with the regressions in Table 1 that looked at determinants of the levels of income across countries, there is statistical evidence supportive of each of the three major explanations for differences in economic growth across countries. Once again, the production function explanation using physical and human capital as explanatory variables produces the highest R^2, but all three of the models have some explanatory power.

As illustrated in Table 2, institutions and geography have an effect on the stock of both human and physical capital. They also exert an impact on the rate of capital formation. Using several alternative measures of capital formation, Table 5 addresses this issue. In Equation 1 of Table 5, real annual investment per worker (measured in 1995 U.S. dollars) during 1980–2000 is the dependent variable. As the equation indicates, EFW exerted a strong impact of $1,281 on average annual rate of investment per worker during the two decades. This was true even after the effects of the initial (1980) per capita income level and the tropical and coastal variables were taken into account. In contrast, neither the tropical nor coastal variables exerted a significant impact on cross-country differences in real investment per worker.

The investment per worker figures of Equation 1 include both private-sector and public-sector investment. Foreign direct investment (FDI) per worker provides an alternative measure that will be almost entirely reflective of private investment flows. Furthermore, the FDI figures will reflect the attractiveness of a country's investment climate to those residing outside of the country. As Equation 2 illustrates, the EFW measure of institutional quality also exerted a strong impact on FDI per worker during 1980–2000. The impact of the other variables in Equation 2 was similar to that of Equation 1. A higher initial income level was associated with more foreign investment per worker, but neither tropical location nor coastal population share exerted a significant impact on FDI.

In Equation 3 of Table 5, investment as a share of GDP (I/GDP) is the dependent variable. Once again, the EFW rating is positive and statistically significant, indicating that the quality of a country's institutions exert a strong impact on the rate of investment. Even though countries with a lower initial GDP invested a smaller dollar amount per worker (Equations 1 and 2), the negative sign on the 1980 per capita GDP variable in Equation 3 indicates these countries actually invested a larger share of their GDP during the two subsequent decades. A tropical location exerts a negative and significant impact on investment as a share of GDP, while a larger coastal population enhances the I/GDP ratio. Thus, Equation 3 indicates that both

TABLE 5

ECONOMIC FREEDOM, GEOGRAPHY, AND LOCATION AS DETERMINANTS OF INVESTMENT

	Dependent Variable (t-ratio in parentheses)				
Independent Variables	Investment Per Worker (US$), 1980–2000 (1)	FDI Per Worker (US$), 1980–2000 (2)	I/GDP, 1980–2000 (3)	Growth of Kpw, 1980–1999 (4)	Growth of Hpw, 1980–1999 (5)
EFW Rating, 1980–2000	1,281.20	545.70	2.16	1.24	–0.08
	(4.12)	(4.00)	(3.09)	(3.76)	(0.75)
GDP Per Capita, 1980	837.59	121.80	–0.60	–0.51	–0.00
(in 1,000s US$)	(8.46)	(2.92)	(2.70)	(4.76)	(0.09)
Tropics	–562.80	–15.70	–3.76	–2.36	–0.14
	(0.92)	(0.06)	(2.74)	(3.69)	(0.73)
Coastal	–535.40	–42.50	3.00	0.53	0.16
	(0.83)	(0.16)	(2.06)	(0.77)	(0.75)
Intercept	–6,457.00	–2,883.00	12.28	–2.04	2.03
R^2 (adjusted)	79.20	51.20	18.50	22.00	0.00
Number of Countries	99	97	99	91	91

NOTE: Hong Kong and Taiwan were omitted from Equation 2 because the FDI data were unavailable.

institutional and geographical factors have an impact on investment as a share of GDP.

The last two regressions of Table 5 focus on the growth of physical and human capital per worker. The fourth regression shows that better institutions enhance the growth rate of physical capital per worker. Again, the level of GDP in 1980 has a negative impact on the growth rate of physical capital, so countries that are poorer initially tend to have higher investment growth. The growth of physical capital for countries in the tropics tends to be slower, but the coastal variable fails to exert a statistically significant impact on the growth of Kpw. In the final regression with the growth rate of human capital as the dependent variable, none of the independent variables are statistically significant.

Taken as a group, the regressions in Table 5, like those of Table 3, indicate that a country's institutional environment exerts a strong impact on capital formation. Investment tends to flow toward countries with institutions and policies that are more consistent with economic freedom. While the results are mixed for the geographic and locational variables, there is some evidence that a tropical location adversely affects the investment rate of physical capital.

As Tables 2 and 5 have shown, institutional quality affects both the stock of capital and rate of investment. Institutional factors may also influence the productivity of investment. Table 6 analyzes this issue. The dependent variable in Table 6 is the annual growth rate of per capita GDP from 1980 to 2000. The first regression uses investment as a fraction of GDP for 1980–2000 as the independent variable, measured as the average of each year's ratio of investment to GDP, and shows that the level of investment explains a substantial share (43.5 percent) of the variation in GDP growth across countries. Equation 2 of Table 6 partitions the 99 countries in the database into three groups based on their EFW ratings. The first independent variable multiplies I/GDP by one if a nation's EFW rating is 7 or above, and zero otherwise. The second independent variable does the same for nations with an EFW rating between 5 and 6.99, and the third independent variable separates out countries with an EFW rating below 5. All of the independent variables are significant, and together explain nearly half of the variation in GDP growth across countries.

The key feature of this regression is the magnitude of the coefficients. For countries with EFW ratings of 7 or above, the coefficient is .275, which is greater than the .236 coefficient for the countries with ratings from 5 to 6.99, which in turn is greater than the .197 coefficient for the countries with ratings below 5. Equation 3 of Table 6 adds the tropical and coastal variables to the model. The tropics

TABLE 6

Economic Freedom and the Productivity of Investment

Dependent Variable: Average Annual Growth Rate of GDP Per Capita, 1980–2000 (t-ratio in parentheses)					
Independent Variables	(1)	(2)	(3)	(4)	(5)
I/GDP, 1980–2000	0.244				
	(8.74)				
I/GDP, 1980–2000 × EFW > 7.0		0.275	0.242		
		(9.40)	(7.81)		
I/GDP, 1980–2000 × 5.0 < EFW < 7.0		0.236	0.212		
		(8.76)	(7.56)		
I/GDP, 1980–2000 × EFW < 5.0		0.197	0.183		
		(6.52)	(6.21)		
I/GDP, 1980–2000 × EFW (top half)				0.245	0.217
				(9.11)	(7.72)
I/GDP, 1980–2000 × EFW (bottom half)				0.203	0.190
				(6.72)	(6.47)
Tropics			−0.937		−1.003
			(2.93)		(3.08)
Coastal			0.344		0.347
			(0.83)		(0.81)
Intercept	−3.96	−3.72	−2.91	−3.54	−2.75
R^2 (adjusted)	43.50	49.70	53.10	47.90	51.70
Number of Countries	99	99	99	99	99

variable is negative and statistically significant, but the coastal variable is insignificant. The magnitudes of the coefficients for the I/GDP variables all fall by a small amount, but changes in investment still exert a larger positive impact on the growth of GDP in those countries with higher EFW ratings.

This shows that for any given level of investment, investment is more productive in countries with a better institutional environment, as measured by the mean 1980–2000 EFW. Holding the tropical and coastal variables constant, a given amount of investment results in a higher rate of economic growth in countries with higher long-term EFW ratings. The coefficient of .242 on the group with the highest EFW rating is 13.6 percent higher than the coefficient of .212 on the middle group of countries. Thus, holding the tropical and coastal conditions constant, a unit increase in investment as a share of GDP enhances the long-term growth of per capita GDP by 13.6 percent more in the group with the higher EFW ratings. Similarly, investment in the highest-rated group of countries is 31.7 percent more productive than in the lowest-rated group of countries.

The fourth regression divides the 99 countries into two groups: those that have EFW ratings in the top half of all countries and those that have ratings in the bottom half, and the fifth regression adds the tropics and coastal variables to the model of Equation 4. As Equation 5 shows, the coefficient of .217 on the top half is 14.2 percent larger than the coefficient of .190 on the bottom half, again showing that the productivity of investment is higher in countries with higher long-term EFW ratings.[9]

A higher EFW rating was associated with a higher level of investment, as Table 5 showed, and Table 6 shows that given the level of investment, investment is more productive in countries with a higher EFW rating. Thus, higher institutional quality, as measured by the EFW rating, has two reinforcing effects on the relationship between investment and GDP growth: better institutions both increase the level of investment, and enhance its productivity.

Table 7 incorporates the key institutional, geographic-locational, and capital formation variables into combined models and uses them to analyze the growth of per capita GDP during 1980–2000. It also incorporates a methodology capable of capturing both the direct

[9]F-tests on the joint equality of the three EFW coefficients in regressions 2 and 3 yield values of 7.06 and 3.71, with associated p values of .001 and .03, indicating that the coefficients are statistically different. F-tests on the joint equality of the two EFW coefficients in regressions 4 and 5 produce values of 4.57 and 3.91 and p values of .035 and .051 again indicating that the coefficients are statistically different.

TABLE 7

Economic Freedom, Investment, Geography, and Location as Determinants of Economic Growth

Dependent Variable: Average Annual Growth Rate of GDP Per Capita, 1980–2000 (t-ratios in parentheses)				
Independent Variables	(1)	(2)	(3)	(4)
EFW Rating, 1980–2000	0.66	0.48	0.81	1.24
	(5.04)	(3.23)	(4.00)	(6.67)
Growth of Kpw, 1980–1999	0.43	0.41	0.35	
	(7.65)	(7.43)	(5.70)	
Growth of Kpw, 1980–1999 (residuals)				0.35
				(5.70)
Growth of Hpw, 1980–1999	0.44	0.39	0.42	0.42
	(2.07)	(1.90)	(2.08)	(2.08)
Tropics		–0.76	–1.30	–2.12
		(2.41)	(3.37)	(5.90)
Coastal		0.48	0.49	0.68
		(1.18)	(1.25)	(1.73)
GDP Per Capita, 1980 (in 1,000s US$)			–0.16	–0.33
			(2.33)	(5.58)
Intercept	–3.94	–2.66	–3.51	–4.21
R^2 (adjusted)	54.80	57.00	59.10	59.10
Number of Countries	91	91	91	91

Note: The residuals for Growth of Kpw in Equation 4 are from Table 6, Equation 4.

(through improvements in efficiency and productivity) and indirect (through capital formation) effects of institutional quality on the long-term growth of per capita GDP.

As Equation 1 of Table 7 shows, the mean EFW rating (1980–2000) along with the change in physical capital per worker and human capital per worker during the two decades explain 54.8 percent of the cross-country differences in the growth of per capita GDP over this time period. All three of the independent variables are positive and statistically significant. Equation 2 adds the geographic-locational variables.[10] While the tropical variable has the expected negative sign and is statistically significant, the coastal variable is insignificant. The

[10]When the growth of per capita GDP is the dependent variable, the distance from major markets variable was always insignificant. Thus, it has been omitted from the growth tables.

addition of these two variables increases the R^2 to 57.0. Equation 3 adds per capita GDP in 1980 as an independent variable to incorporate the idea that countries with higher initial income levels may grow less rapidly. Indeed, the sign of the initial per capita income variable is negative and statistically significant. The explanatory power of the model represented by Equation 3 is almost 60 percent.

In the specification of Equation 3, the EFW variable will reflect the impact of a one-unit change in institutional quality after the effects of the other variables, including Kpw, have been registered. Thus, the EFW coefficient of Equation 3 reflects only its direct impact on growth as a result of its impact on the efficiency of resource use. But this is only part of its impact on growth. As was illustrated in Table 5, EFW also influences investment and the growth of the capital stock (Kpw). The EFW coefficient in Equation 3 of Table 7 will not reflect this indirect impact.

In order to capture both the direct effect and indirect effect of EFW through capital formation, the methodology used in Table 3 is again employed. The residuals from Equation 4 of Table 5 measure the cross-country variation in Kpw that is unrelated to EFW and the other independent variables of Equation 3 in Table 7. When these residuals are substituted for the change in Kpw variable, the coefficients for EFW and the other variables in the model will reflect both their direct impact and their indirect impact, through changes in Kpw, on the growth of per capita GDP. Equation 4 of Table 7 presents these results. Note that the coefficients and t-ratios for both the institutional and geographic-locational variables are higher in Equation 4 than Equation 3. This is because their coefficients in Equation 4 now incorporate their indirect effects through changes in Kpw.

Once both the direct and indirect effects are taken into account, a one-unit change in EFW increases long-term growth by an estimated 1.24 percentage points. Because this is a change in a growth rate, it will have a large cumulative effect. Over a 30-year period, for example, a one-unit increase in a country's EFW index would increase the country's per capita GDP by approximately 43 percent.

Changes in Institutional Quality and Growth

The results reported above have focused on how variations in the *level* of economic freedom influence per capita GDP and its growth rate. If institutional quality as measured by the EFW index is a important factor underlying economic growth, *changes* in EFW should

also exert an observable impact on the growth of per capita GDP. However, the immediate effects of an institutional change may be relatively small and the response to the change may continue to evolve over a lengthy time period. Initially, there may be uncertainty with regard to whether the change is temporary or permanent. If a country has a history of institutions that inhibit economic activity, people may be suspicious that improvements in institutions may be reversed, either because political leaders support the old institutions or because institutional improvements prove difficult to enforce. Furthermore, it will take time for decisionmakers to identify new opportunities and for markets to adjust fully to the new environment. All of this makes it more difficult to measure the effects of institutional change and highlights the importance of analyzing the impact of such changes over a fairly long time period.

Table 8 analyzes the impact of changes in the EFW rating during both the 1980s and the 1990s on the growth of per capita GDP during 1980–2000. In addition to the mean EFW rating (1980–2000), the changes in EFW during each of the two decades are introduced as independent variables. In Equation 1, the three economic freedom variables are considered along with the changes in Kpw and Hpw during the two decades. All of the variables have the expected sign and, except for the change in EFW during the 1990s, all are significant at the 95 percent confidence level. A one-unit increase in EFW during the 1980s was associated with a 0.71 percentage point increase in growth during the two decades. The Equation 1 model explains 58.5 percent of the cross-country variation in growth during 1980–2000. The insignificance of the change in the EFW variable during the 1990s is not surprising given the expected time lag accompanying an institutional change and the fact that a change during the 1990s would potentially impact growth for only a fraction of the two decades.

Equations 2 and 3 add two additional variables, tropical location and initial income level, that prior analysis suggests exert a significant impact on the growth of per capita GDP. The addition of these two variables increases the explanatory power of the model to 62.4 percent. Both the tropical and initial income variables are significant and have the expected sign, but they exert little impact on either the pattern or the significance of the other variables in the model. The change in EFW during the 1980s is significant in both Equations 2 and 3 and its estimated impact on the growth rate of per capita GDP remains near seven-tenths of a percentage point. The change in EFW during the 1990s continues to be positive, but it falls just short of significance at the 90 percent confidence level.

TABLE 8

CHANGES IN ECONOMIC FREEDOM AND ECONOMIC GROWTH

Dependent Variable: Average Annual Growth Rate of GDP Per Capita, 1980–2000 (t-ratio in parentheses)				
Independent Variables	(1)	(2)	(3)	(4)
EFW Rating, 1980–2000	0.59	0.50	0.89	1.33
	(4.17)	(3.38)	(4.35)	(7.09)
Change in EFW Rating, 1980–1990	0.71	0.65	0.68	0.68
	(3.09)	(2.84)	(3.08)	(3.08)
Change in EFW Rating, 1990–2000	0.23	0.19	0.27	0.27
	(1.34)	(1.13)	(1.62)	(1.62)
Growth of Kpw, 1980–1999	0.42	0.41	0.33	
	(7.67)	(7.54)	(5.69)	
Growth of Kpw, 1980–1999 (residuals)				0.33
				(5.69)
Growth of Hpw, 1980–1999	0.47	0.45	0.49	0.49
	(2.33)	(2.23)	(2.51)	(2.51)
Tropics		–0.57	–1.15	–1.92
		(1.86)	(3.12)	(5.56)
GDP Per Capita, 1980 (in 1,000s US$)			–0.17	–0.35
			(2.66)	(5.93)
Intercept	–4.15	–3.19	–4.40	–5.14
R^2 (adjusted)	58.50	59.70	62.40	62.40
Number of Countries	91	91	91	91

NOTE: The residuals for Growth of Kpw in Equation 4 are from the following equation:

Change in Kpw = –2.23 + 1.32 EFW Rating –0.51 GDP Per Capita –2.31 Tropics.

All variables were significant and the adjusted R^2 was 22.4.

As we have previously discussed, the model of Equation 3 will fail to register the effects of EFW that are transmitted through its impact on the growth of capital formation. In order to better measure the total impact of EFW, once again we estimate the impact of the independent variables of Equation 3 on Kpw and then insert the residuals from this equation into the model instead of Kpw. Equation 4 of Table 8 presents these results. Except for the change in EFW during the 1990s, all of the variables in this model have the expected sign and are statistically significant. A one-unit increase in the level of EFW enhances long-term growth by an estimated 1.33 percentage

points and the t-ratio for this variable is very high (7.09). Further, a one-unit increase in EFW during the first of the two decades increases overall growth during the period by an additional 0.68 of a percentage point. In this specification, location in the tropics reduces long-term growth by an estimated 1.92 percentage points.

The pattern of these results sheds light on the impact of institutional change. The size and robustness of the change in EFW during the 1980s suggests that changes in institutional factors make a difference and that they will continue to exert an impact on economic growth over a long period of time. Correspondingly, the size and insignificance of the change in EFW during the 1990s indicates that the full impact of an institutional change will take time and that the immediate effects may be relatively small.

Table 9 divides the data set into two decades in order to facilitate a more detailed examination of the timing issue. The dependent variable in Table 9 is the growth rate of per capita income during the decade of either the 1980s or the 1990s, so each country has two observations. The model of Equation 1 comprises the EFW rating at the beginning of the decade (either 1980 or 1990), the change in EFW during the first half of the decade, the change during the last half of the decade, and a dummy variable (1 if 1990s). Equation 2 adds the change in Kpw and Hpw and the tropical location variable to the model. The results of the first two regressions show that changes in the EFW rating in the first five years of the decade have strong effects on GDP growth. A one-unit increase in EFW during the first five years of the decade is estimated to increase growth during the 10-year period by more than 1 percentage point. In contrast, changes in the last five years of a decade were statistically insignificant in both equations. Again, this pattern suggests that institutional changes affect growth, but their immediate effects are often small.

Equations 3 and 4 integrate the change in EFW during the five years before each of the decades into the model. Thus, the economic freedom variables are the EFW rating five years before the beginning of the decade (1975 for the decade of the 1980s and 1985 for the decade of the 1990s) and the changes in the EFW rating for the five years before the decade, the first five years of the decade, and the last five years of the decade. Equation 3 includes only the economic freedom variables and the decade dummy variable. Equation 4 adds the input (change in Kpw and Hpw) and tropical location control variables to the model.

Both Equations 3 and 4 indicate that a change in EFW during the first half of a decade exerts a strong (more than one percentage point)

TABLE 9

Changes in Economic Freedom and Economic Growth in the 1980s and 1990s

Dependent Variable: Average Annual Growth Rate of GDP Per Capita during the 1980s and 1990s (t-ratio in parentheses)				
Independent Variables	(1)	(2)	(3)	(4)
EFW Rating, beginning of decade	0.85	0.56		
	(7.02)	(4.64)		
EFW Rating, 5 years before decade			0.77	0.52
			(5.85)	(4.10)
Change in EFW Rating, 5 years before decade			1.26	0.91
			(4.93)	(3.72)
Change in EFW Rating, first 5 years of decade	1.45	1.11	1.41	1.04
	(6.37)	(5.21)	(5.90)	(4.74)
Change in EFW Rating, second 5 years of decade	0.24	–0.07	0.19	–0.11
	(0.85)	(0.27)	(0.65)	(0.39)
Growth of Kpw, during decade		0.21		0.20
		(5.51)		(5.23)
Growth of Hpw, during decade		0.24		0.26
		(1.51)		(1.48)
Tropics		–0.69		–0.52
		(2.41)		(1.79)

Dummy for Decade (1 if 1990s)	–0.74	–0.52	–0.92	–0.63
	(2.47)	(1.49)	(2.97)	(2.08)
Intercept	–3.63	–2.35	–3.19	–2.25
R^2 (adjusted)	26.50	40.10	29.80	41.20
Number of Countries	198	180	169	156

NOTES: The number of observations in Equation 3 is reduced because the EFW Rating was available for only 70 countries in 1975; the number of observations in Equations 2 and 4 were lower than 1 and 3 because the Kpw and Hpw data were unavailable for some countries; when the equations here were run separately by decade, the pattern of results was the same. A Chow test confirmed the validity of combining the two decades into a single regression.

and statistically significant (t-statistics of 5.90 and 4.74) positive impact on growth of per capita GDP during the decade. The impact of the change in EFW during the five years before the decade is positive and only slightly smaller (0.91 compared with 1.04 for the first five years of the decade) in Equation 4. This indicates that (a) institutional changes continue to influence economic growth long after they are initiated and (b) a time lag of 5 to 10 years will often occur before the full effects of an institutional change are observed. Once again, the change in EFW during the last half of a decade failed to exert a significant impact on growth during the decade. This illustrates that it takes time for institutional changes to work and implies that their immediate effects are often small.

Taken together, Tables 8 and 9 show that *changes* in the level of institutional quality exert an impact on economic growth.[11] However, the immediate effects of institutional changes are often weak. For this reason, empirical work trying to identify the impact of institutions must look at longer time periods to identify the effects. This also indicates that from a policy perspective, credibility is important, and countries making institutional changes with the hope of increasing economic growth must be prepared to keep them in place long enough for their effects to appear.

Conclusion

The results presented here indicate that cross-country differences in institutional quality, as measured by the EFW index, exert a major impact on both income differences and long-term growth rates. Countries with institutions and policies more consistent with eco-

[11]There is the possibility that the strong relationship between EFW and growth reflects, at least partially, a cause and effect relationship that runs in the opposite direction: from growth to institutional improvements (higher EFW ratings). In order to examine this possibility, we considered the following models:
(1) change in per capita GDP in t_2 = f(change in EFW in t_1),
(2) change in EFW in t_2 = f(change in per capita GDP in t_1).
The subscripts t_1 and t_2 indicate successive time periods. The two models were run for time periods of both 5 and 10 years. Various control variables including initial per capita GDP and initial EFW ratings were also incorporated into the models. In every case, the change in EFW exerted a positive and significant impact on the growth of per capita GDP during the subsequent period. In contrast, the change in per capita GDP during t_1 never exerted a significant positive impact on EFW during t_2. In a few cases the relationship between the change in per capita GDP in t_1 and the change in EFW in t_2 was negative and significant, suggesting that poor economic performance might actually enhance the likelihood of constructive economic reform. Clearly, there was no evidence of a causal relationship running from higher growth rates to subsequent increases in EFW.

nomic freedom both grow more rapidly and achieve higher income levels. Our findings go beyond the existing literature in that they show that institutional quality influences economic growth by affecting the rate of investment as well as through the productivity of resource use. Furthermore, we show that changes in institutional quality influence the future growth of per capita GDP.

Our estimates indicate that a one-unit increase in the long-term EFW rating is associated with a 2.16 percentage point increase in investment as a share of GDP and a 1.24 percentage point increase in the annual growth of capital per worker (Table 5, Equations 3 and 4). Not only do better institutions increase the amount of investment, they also increase its productivity. Measured by its impact on GDP growth, the productivity of investment in countries with EFW ratings of 7.0 or more was 13.6 percent higher than for countries with EFW ratings between 5.0 and 6.99 and 31.7 percent higher than for countries with EFW ratings of less than 5.0 (Table 6, Equation 3).

Holding constant geographic factors and changes in human and physical capital, a one-unit increase in a country's EFW rating increases the growth of per capita GDP by about 1.24 percentage points (Table 7, Equation 4). This suggests that if countries like Egypt, India, or Pakistan with mean EFW ratings of approximately 5 during 1980–2000, increased and maintained their long-term EFW rating by one unit, they could increase their long-run annual growth rate of per capita GDP by more than one percentage point. The average annual growth of per capita GDP during 1980–2000 for the 99 countries of this study was only 1.32 percent, so a 1.24 percentage point increase in long-term growth would be substantial.[12]

The increases would not come overnight, however. Analysis of the lag between institutional changes and changes in income suggests that a time period of 5 to 10 years is necessary for the effects of an improvement in the quality of a country's institutions to be registered fully (Tables 7, 8, and 9). Initially, the observable positive effects on growth may be minimal. Given the short time horizon of many political decisionmakers, these time lags may well create conflict between short-run political expediency and sound economics.

Historically, the growth literature has placed much emphasis on the importance of inputs into the production process. However, both

[12]Looking at the underlying data, countries in the bottom half ranked by EFW index had an average per capita GDP growth rate of 0.446 percent while those in the top half averaged a 2.218 percent rate of growth, so without controlling for other factors, the GDP growth rate in the top half of countries by EFW rating was nearly five times higher than for countries in the bottom half.

the quantity and productivity of inputs will be influenced by the institutional environment. Future analysis of the growth process must take this point into consideration.

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