Southern Economic Journal 2010, 77(2), 385–405

Institutions, Capital, and Growth

Joshua C. Hall,* Russell S. Sobel,† and George R. Crowley‡

The international development community has encouraged investment in physical and human capital as a precursor to economic progress. Recent evidence shows, however, that increases in capital do not always lead to increases in output. We develop a growth model where the allocation and productivity of capital depends on a country's institutions. We find that increases in physical and human capital lead to output growth only in countries with good institutions. In countries with bad institutions, increases in capital lead to negative growth rates because additions to the capital stock tend to be employed in rent-seeking and other socially unproductive activities.

JEL Classification: B53, O10, I2

1. Introduction

The causes of economic development have been studied before Adam Smith made his inquiry into the causes of the wealth of nations. As a field of study, however, economic development did not really exist until after World War II (Arndt 1997). The first development economists focused primarily on the accumulation of physical capital as the driving force in economic growth.[1] For example, Paul Rosenstein-Rodan, Sir Arthur Lewis, and Walt Rostow all argued that developing countries suffered from a ''poverty trap,'' where they could not afford to save enough to accumulate the necessary amounts of physical capital to grow (Easterly 2006a). This focus on the accumulation of physical capital provided the intellectual impetus for the large sums of foreign aid provided to developing countries by international aid agencies post–World War II because aid was seen as being crucial to giving poor nations the physical capital they needed to break out of the ''poverty trap.'' The notion that developing countries are in a poverty trap that prevents them from accumulating physical capital is still alive today, both in the actions of the

* Department of Economics and Management, Beloit College, 700 College Street, Beloit, WI 53511, USA; E-mail halljc@beloit.edu; corresponding author.

† Department of Economics, West Virginia University, P.O. Box 6025, Morgantown, WV 26506-6025, USA; E-mail russell.sobel@mail.wvu.edu.

‡ Department of Economics, West Virginia University, P.O. Box 6025, Morgantown, WV 26506-6025, USA; E-mail george.crowley@mail.wvu.edu.

The authors would like to thank Peter Boettke, Chris Coyne, Stratford Douglas, Peter Leeson, Santiago Pinto, Frank Stephenson, two anonymous referees, and participants at the 77th Annual Meeting of the Southern Economic Association in Charleston, South Carolina, for helpful comments and suggestions. Hall gratefully acknowledges the support of the Visiting Scholar program at the Social Philosophy and Policy Center at Bowling Green State University. We also thank Gerald Dwyer for generously providing data.

Received April 2008; accepted November 2009.

[1] One notable exception is Peter Bauer (1948, 1954, 1957) who viewed the accumulation of capital as an outcome of successful economic performance, not an input.

World Bank and International Monetary Fund (IMF) as well as in the research of economists such as Jeffrey Sachs.[2]

In the 1960s and 1970s, the pioneering work of Schultz (1961) and Becker (1964) on human capital caused development economists to augment their standard economic growth models to allow for human capital investment to play a role. Early research into the effects of formal education on economic growth found that education seemed to explain a significant portion of economic growth (Hall 2000). These findings led development economists to focus on human capital as a primary factor of production throughout the 1980s and 1990s (Coyne and Boettke 2006). International development organizations such as the World Bank encouraged high levels of government investment in schooling in an attempt to increase human capital levels.[3] As a result of these efforts, there was a tremendous expansion of schooling in nearly all developing countries (Easterly 2001). According to Pritchett (2001), since 1960 primary enrollments in developing countries increased from 66 to 100% and secondary enrollments rose from 14 to 40%.

There is little evidence to suggest that efforts to increase either physical or human capital levels in developing countries, especially in Africa, have been successful in generating growth. Good historical data on public investment in capital is available for 22 African countries since 1970. From 1970–1994, those countries received $187 billion in aid and spent $342 billion on public investment, only to achieve zero per capita growth (Easterly 2006b). The same can be said of the increases in formal schooling stimulated, in part, by foreign aid. Easterly (2001) details how sub-Saharan African countries had larger increases in schooling than any other region since 1960. Yet these countries remained mired in poverty while Asian "tigers" like South Korea and Taiwan had smaller increases in education levels but flourished economically. In cross-country growth regressions, Pritchett (2001) finds no relationship between increases in education and increases in output per worker. Similarly, Gwartney, Holcombe, and Lawson (2004) find that the growth of human capital per worker is not related to per capita gross domestic product growth.[4]

The macroeconomic evidence is somewhat paradoxical because it is contrary to the microeconomic evidence that increases in physical and human capital increase individual productivity and remuneration. After all, it would seem that summing all individual positives within a country should aggregate to a social positive. Yet in many countries this is clearly not the case. In an important paper trying to figure out "where all the education has gone," Pritchett (2001) provides a possible solution to this paradox. He argues that in some countries

---

[2] For example, in his book *The End of Poverty*, Sachs (2005, pp. 56–7) says, "This is the main reason why the poorest of the poor are most prone to becoming trapped with low or negative economic growth rates. They are too poor to save for the future and thereby accumulate the capital that could pull them out of their current misery." For more on the revival of the "Big Push" and "poverty trap" theories of development, see Easterly (2006b).

[3] For example, according to Leeson (2007) education in Somalia was completely financed through foreign aid prior to the collapse of the Somalia central government in 1991. While this may have led to higher school enrollments and literacy rates, it is not clear that it led to better economic well-being or living standards in Somalia (Leeson 2007; Powell, Ford, and Nowrasteh 2008).

[4] There is a large body of empirical literature showing that initial education levels matter for economic growth (Barro 1991; Barro and Sala-i-Martin 1995). Pritchett (2001, p. 381) argues that these papers are misspecified because growth rates are stationary and the education stock is nonstationary and globally increasing. A stable relationship is thus not possible between education and growth when formulated in that manner. In addition, such a formulation cannot explain negative growth rates or the fact that the initial level of education has been rising for over 40 years in sub-Saharan Africa but growth has stagnated or declined.

the institutional environment could be so perverse that increasing education actually leads to lower growth.[5]

More generally, societal payoffs to improvements in the levels of both physical and human capital are likely dependent on the institutional context in which those investments occur. In countries with good institutions—where the social, political, and legal rules provide for secure property rights, unbiased contract enforcement, and reliance on market prices and profits and losses to guide economic activity—investments in capital are both privately beneficial to individuals and also create a positive return for society as a whole. In countries with poor institutions, however, the higher returns to investments in rent-seeking activities that plunder the wealth of others, through lobbying and lawsuit abuse, for example—draw significant resources into these privately beneficial, but socially unproductive activities. Investments in education produce more lobbyists, politicians, and lawyers, rather than engineers and scientists.[6]

Building on Pritchett's (2001) insight, this article examines the relationship between institutional quality and the impact of human capital accumulation on economic growth.[7] We also extend this analysis to physical capital. We begin by integrating this hypothesis into the augmented Solow (1956) growth model of Mankiw, Romer, and Weil (1992). In this respect, our theoretical approach is a clear extension of the work of Dawson (1998) who was the first to incorporate institutions into the standard growth models. We then empirically test this hypothesis by interacting institutional quality with both physical and human capital in cross-country growth regressions. In this respect, our article is closely connected to the valuable work of Stroup (2007, 2008) who uses a similar approach to separate out the influence of political and economic institutions on different human welfare indicators.

We use data on "risk of expropriation" from the *International Country Risk Guide* (PRS 2007) as our primary measure of institutional quality. The PRS Group annually grades each country using a 0-to-10 scale with a score of 0 being consistent with a high risk of confiscation or forced nationalization of property and a score of 10 indicating an extremely low risk of expropriation. We find that the relationship between increases in human capital and economic growth is indeed negative for countries with perverse institutional environments. We calculate that for countries with risk of expropriation scores below 7.33 (e.g., South Africa, Costa Rica), additions to the stock of human capital have a *negative* effect on growth of output per worker. The relationship between growth of physical capital per worker and output per worker also is negative in countries with poor institutions, albeit at a much lower level. We find that the

---

[5] While brought into the contemporary debate by Pritchett (2001), the idea that additional education, in some instances, might actually yield low or negative social returns is not new. In *Free to Choose: A Personal Statement*, Milton and Rose Friedman (1980, p. 34) suggested that higher education might lead to the disruption of the social order and political institutions. Griliches (1997) suggests in a footnote that the effect of education on productivity might be muted in countries where most educated individuals end up working within governments not known for productivity.

[6] There is a clear parallel between our argument and that of Murphy, Shleifer, and Vishny (1991) who take the proportion of students enrolled in law as representative of the societal payoffs to rent-seeking. They find that countries with a higher proportion of law students grow slower than those with a smaller share of students studying law.

[7] There is a rich and interesting literature examining why some countries have better institutional quality than others. One strand explores how a country's legal origins matter, and a good review and summary of this literature can be found in La Porta, Lopez-de-Silanes, and Shleifer (2008). Another strand of literature, commonly referred to as the 'resource curse,' examines how the presence of natural resources affects institutional quality. See Acemoglu, Johnson, and Robinson (2001b), Robinson, Torvik, and Verdier (2006), Mehlum, Moene, and Torvik (2006), and Easterly and Levine (2003).

Figure 1. Marginal Effect of Capital on Output per Worker: The Conventional View

relationship between increases in physical capital per worker and output per worker turns positive at around a risk of expropriation score of 4.90 (roughly equivalent to Uganda).

2. Institutions, Capital, and Growth of Output per Worker

The conventional perspective on the marginal effect of increases in physical and human capital on economic growth is that they have the same marginal effect regardless of the level of institutional quality. Figure 1 illustrates this view. The figure shows the marginal effect of a change in capital per worker on the change in output per worker conditional on the level of institutional quality. From this perspective, an additional unit of capital has the same impact on economic growth whether the country is in a good institutional environment or a poor one. To put it in the context of human capital, an additional year of education in the Democratic Republic of the Congo would have the same effect on the growth of output per worker as a year in Australia.

This view is incorrect because it ignores the impact of institutional quality on the productivity and allocation of labor. An additional year of education in the Democratic Republic of the Congo is not the same as an additional year of education in Australia because of the opportunities provided by the overall institutional environment.[8] The best opportunities for more educated individuals in countries with low-quality institutions are more likely to be zero-or-negative sum, such as working in the government bureaucracy. When the institutional environment is "bad," increases in education levels will be less socially productive than in

[8] The years of education are also different in that they might come at different levels (primary vs. secondary) and that the quality of the education surely differs. As described later, the first problem is dealt with in how measures of education growth are constructed. Correction of the second problem is hampered by the lack of systematic test score data for a large number of countries.

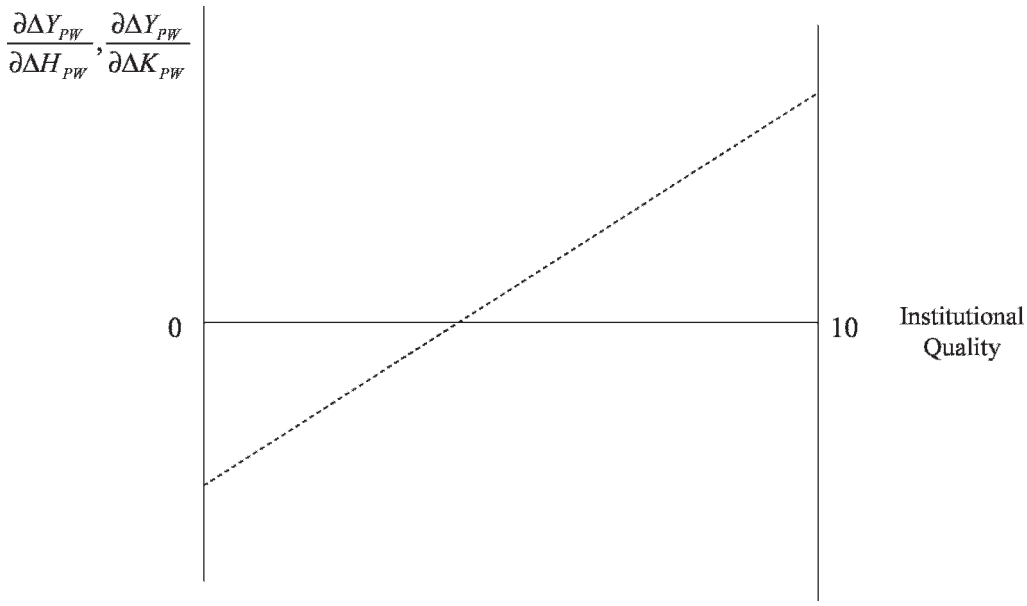

Figure 2. Marginal Effect of Capital on Output per Worker: Our View

countries with a "good" institutional environment. While individuals will always choose the occupation that gives them the highest personal return, good institutions create a correspondence between positive personal and positive social returns.

In the long run, the higher payoffs to public sector activity distort the choices individuals make in the types of education to acquire. Thus in a society where the payoffs to the private sector are low because of poor institutions but payoffs to the public sector are high (also because of poor institutions), individuals will tend to invest in human capital more valued by the public sector. For example, Nobel Laureate Sir Arthur Lewis discusses in his Nobel Prize lecture how he wanted to be an engineer but could not find employment in St. Lucie as an engineer because of discrimination, thus he went into business studies with the goal of working in the civil service or private sector (Lewis 1992). While both the public and private sector employ engineers, the issue is that in countries with poor institutional environments, the payoffs to being a private sector engineer will be lower; thus we will get fewer engineers, and the ones we do have will be less alert to positive-sum entrepreneurial opportunities.

Countries with bad institutions have more zero- or negative-sum opportunities, and thus the marginal effect of more education could be negative if enough of the additional education goes into negative-sum activities. Not only are resources being removed from production to increase education levels (in terms of expenditures on education but also opportunity costs), but if educated individuals move into rent seeking, the societal payoffs from their education will be negative. At some level of institutional quality, however, the rewards to positive-sum activities begin to outweigh the rewards to zero- and negative-sum activities and the marginal effect of human capital increases on growth becomes positive.

Figure 2 illustrates this proposed relationship. The marginal effect of an increase in capital is negative when institutional quality is "zero." While all societies have some level of formal or informal institutions, countries like present-day Somalia, Rwanda, or Venezuela would be examples of countries that have extremely low levels of institutional quality according to most

measures. At some break-even level of institutional quality, the allocation of resources between sectors of the economy is balanced so that net additions to capital neither add to nor diminish output per worker. As institutional quality rises beyond that break-even point, the additions to capital flow to the productive sectors of the economy and have a positive contribution to output per worker. This view of the role of institutions in channeling increases in capital toward socially productive areas of the economy helps to explain why public investment in human and physical capital have not uniformly led to increases in output per worker in the developing world.

3. Theoretical Model

In this section we follow Dawson (1998) in augmenting the standard macroeconomic growth model of Mankiw, Romer, and Weil (1992) to formally include the quality of a country's institutions. Consider a standard aggregate production function given by

$$Y_t = A_t K_t^{\alpha_1} H_t^{\alpha_2} L_t^{\alpha_3}, \tag{1}$$

where Y is output, A is the level of technology that augments physical capital K, human capital H, and labor L. The production function exhibits the standard assumption of constant returns to scale ($\alpha_1 + \alpha_2 + \alpha_3 = 1$). Dividing through by L puts Equation 1 in per worker terms:

$$y_t = A_t h_t^{\alpha_1} k_t^{\alpha_2}. \tag{2}$$

This traditional model implicitly assumes an underlying set of good institutions. In our model, the quality of institutions affects output through the effect that institutions have on the productivity of human and physical capital. Thus we specify the technology parameter as

$$A_t = A_0 h_t^{\beta_1(I-I^*)} k_t^{\beta_2(I-I^*)}, \tag{3}$$

where A_0 represents the basic level of technology, I^* represents the ideal institutions implicitly assumed in the traditional growth model, and I is the country's current level of institutional quality. Thus, $I - I^*$ measures the degree to which the country's institutions fall short of ideal conditions. When $I = I^*$, the model reduces to its standard form in the previous literature.

Substituting Equation 3 into Equation 2 yields

$$y_t = A_0 h_t^{\beta_1(I-I^*)} k_t^{\beta_2(I-I^*)} h_t^{\alpha_1} k_t^{\alpha_2}. \tag{4}$$

Rearranging

$$y_t = A_0 h_t^{\alpha_1+\beta_1(I-I^*)} k_t^{\alpha_2+\beta_2(I-I^*)}. \tag{5}$$

Taking logs

$$\ln y_t = \ln A_0 + [\alpha_1 + \beta_1(I-I^*)] \ln h_t + [\alpha_2 + \beta_2(I-I^*)] \ln k_t. \tag{6}$$

Here we follow Pritchett (2001) in focusing on explaining the growth of output per worker using the growth of physical and human capital per worker. We do this by taking differences, which gives the growth rate of output as

$$\hat{y}_t = \hat{A}_0 + [\alpha_1 + \beta_1(I-I^*)]\hat{h}_t + [\alpha_2 + \beta_2(I-I^*)]\hat{k}_t, \tag{7}$$

where ˆ denotes a growth rate. Simplifying

$$\hat{y}_t = \hat{A}_0 + (\alpha_1 - \beta_1 I^*)\hat{h}_t + \beta_1 I\hat{h}_t + (\alpha_2 - \beta_2 I^*)\hat{k}_t + \beta_2 I\hat{k}_t. \quad (8)$$

Defining $\delta_i = (\alpha_i - \beta_i I^*)$ and $\alpha_0 = \hat{A}_t$, and adding an error term, ε_t, yields our equation to be estimated as

$$\hat{y}_t = \alpha_0 + \delta_1 \hat{h}_t + \beta_1 I\hat{h}_t + \delta_2 \hat{k}_t + \beta_2 I\hat{k}_t + \varepsilon_t. \quad (9)$$

Equation 9 is the primary equation we use to test the impact of institutions on the productivity of physical and human capital. Of interest are the coefficient estimates for δ_1, δ_2, β_1, and β_2. δ_1 and δ_2 measure the return to human and physical capital investments in a country with the worst possible institutional quality (the left *y*-axis intercept value in Figure 2), while β_1 and β_2 are the slopes of the respective lines in the figures, showing an increasing social return to these capital investments as the country's institutional quality improves to the ideal level for a well-functioning market economy.

4. Data and Empirical Approach

Our initial analysis covers a cross section of 96 countries for the years 1980–2000. We obtain data on real output per worker from Baier, Dwyer, and Tamura (2006a) and calculate the cumulative growth of output per worker from 1980 to 2000. The included countries are a comprehensive mixture of developed and developing nations from all regions, mitigating any concerns over sample selection bias that can be an issue in cross-country growth studies (De Long 1988). A full list of the countries is included in Appendix A. The average country in our sample had a 16.4% increase in output per worker increase over the period, with Cyprus having the top growth rate of 276% and the Republic of Congo seeing output per worker fall by 79%.

We measure institutional quality using an index of the "risk of expropriation" within a country. Produced by the PRS Group (2007) and published in the *International Country Risk Guide*, these data were first used as a measure of institutional quality by Knack and Keefer (1995) and more recently by Acemoglu, Johnson, and Robinson (2001a, b) and Glaeser et al. (2004). The PRS Group annually grades each country on the risk of confiscation or forced nationalization of property, using a 0-to-10 scale. A score of 0 is consistent with a high risk of property expropriation, and a country with a score of 10 would represent an extremely low risk of expropriation. We feel this measure of institutions is most consistent with Acemoglu and Johnson's (2005) finding that property-right institutions are what matter for long-run growth. Baier, Dwyer, and Tamura (2006b) also show protection of property rights to be the most important measure of institutions when looking at factor productivity. While concerns have been raised over "outcome" measures of institutions (Glaeser et al. 2004), written rules ostensibly designed to protect citizens from government are useless unless the politically powerful are willing to commit to obeying the rules (Boettke 2001, pp. 191–265).

We follow convention and use the average risk of expropriation within a country over the period in question.[9] The average country in the sample had a score of 7.3. The country with the

[9] Specifically, the variable is the average from 1982–1997, obtained from Glaeser et al. (2004).

lowest risk of expropriation was Switzerland with an average risk of expropriation of 9.98, while the country with the greatest average risk of expropriation was the Democratic Republic of the Congo with a score of 3.71. The Democratic Republic of the Congo having the highest risk of expropriation is illustrative of the problem that exists in trying to use input measures of institutions such as constitutions instead of output measures because the recent switch from dictatorship to constitutional democracy has not seemed to reduce expropriation of private property (Boettke and Leeson 2009).

Our measure of education is average years of schooling per worker, and it is obtained from Baier, Dwyer, and Tamura (2006a). They calculate the average number of years of schooling per worker from primary, secondary, and higher education enrollment figures using the perpetual inventory method. The perpetual inventory method uses census-survey figures on attainment by age as a measure of the stock of schooling and then updates the stock using lagged enrollment figures. We use their estimates of average schooling per worker in 1980 and 2000 to calculate the change in schooling per worker by country from 1980–2000. Our measure of the change in physical capital per worker from 1980 to 2000 is also obtained from Baier, Dwyer, and Tamura (2006a). They use the perpetual inventory method to calculate the physical capital stock per worker using annual investment data from the Summers and Heston (2000) data set and assuming 7% annual depreciation.

These data on a cross section of 96 countries allow us to begin addressing the relationship between institutions and the productivity of human and physical capital. Our equation to be estimated using ordinary least squares is obtained from the equation derived in section 3.

$$\hat{y}_t = \alpha_0 + \delta_1 \hat{h}_t + \beta_1 I\hat{h}_t + \delta_2 \hat{k}_t + \beta_2 I\hat{k}_t + \varepsilon_t, \tag{9}$$

where $\hat{y}_t$ is the cumulative growth rate from 1980 to 2000, α_0 is a constant term, $\hat{h}_t$ is the change in schooling over that period, and $\hat{k}_t$ is the change in physical capital. The interaction terms, $I\hat{h}_t$ and $I\hat{k}_t$ measures how economic growth in different countries might respond differently to changes in human and physical capital depending upon the level of institutions, measured here by the average level of expropriation risk during the period. Our use of interaction terms to isolate the effect of institutional quality on the return to increases in human capital follows from the estimating equation but is also inspired by the empirical work of Stroup (2007, 2008) on institutions, democracy, and different measures of well-being.

In addition to this basic model, we provide several robustness checks that consider additional explanatory variables. For example, a prominent strain of the development literature, most notably associated with Sachs (2003), argues that geographic factors play an extremely important role in the economic development of nations. From Gallup, Sachs, and Mellinger (1999), we obtain three geographic variables that might influence the rate of economic growth. The first geographic variable is the minimum air distance a country is from the core markets of Rotterdam, New York, or Tokyo. The hypothesis is that the farther a country is from one of these core markets, the more costly it is for the country to engage in international trade. Reduced trade will, in turn, reduce gains from the division of labor, economies of scale, and specialization. The second geographic variable, the percentage of a country's population living within 100 km of an ocean, also attempts to measures the degree to which it is costly for the citizens of a country to engage in international trade. A high percentage of a country's population with access to an ocean coastline should exert a positive impact on economic growth.

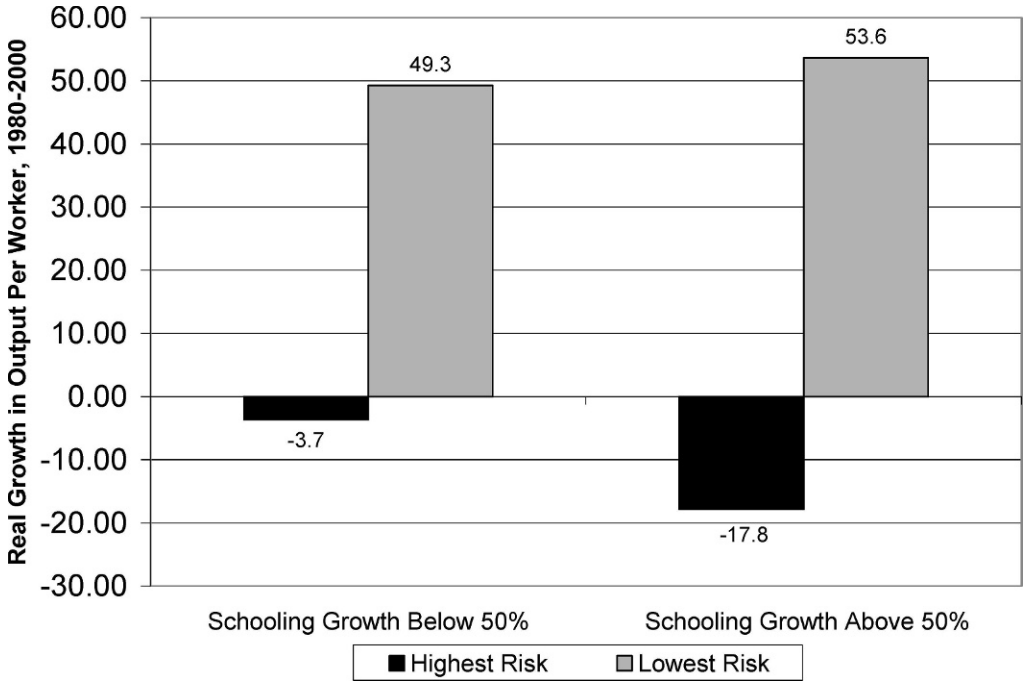

Figure 3. The Stratification of the Returns to Schooling by Risk of Expropriation

Finally, a country located in a tropical climate might have low rates of economic growth because a hot and humid climate reduces the productivity of labor. This can occur directly through work effort or indirectly through health. The prevalence of malaria in tropical climates provides one channel through which tropical climate can affect health and, indirectly, the productivity of labor. To capture the effect of tropical climate on growth, we employ a third geographic variable measuring the proportion of a country located in the tropics as an explanatory variable, with the tropics defined as the area located between the Tropic of Cancer (latitude 23.5° north) and Tropic of Capricorn (latitude 23.5° south). These geographic variables are employed both in the baseline empirical analysis in section 6 as well as the sensitivity analysis in section 7.

5. A First Look

Before proceeding to the regression analysis, we provide some evidence for the proposition that the effect of investment in capital depends on the institutional environment using the raw data. To get an idea of how the returns to schooling differ by institutional quality, we broke down countries into two groups: those with the lowest risk of expropriation and those with the highest risk. We split the sample of 96 countries into two groups based on their average risk of expropriation score, with countries below the median score of 7.06 being defined as "high risk" and those above defined as "low risk." Figure 3 shows the relationship between changes in schooling per worker and growth in output per worker for these different groups.

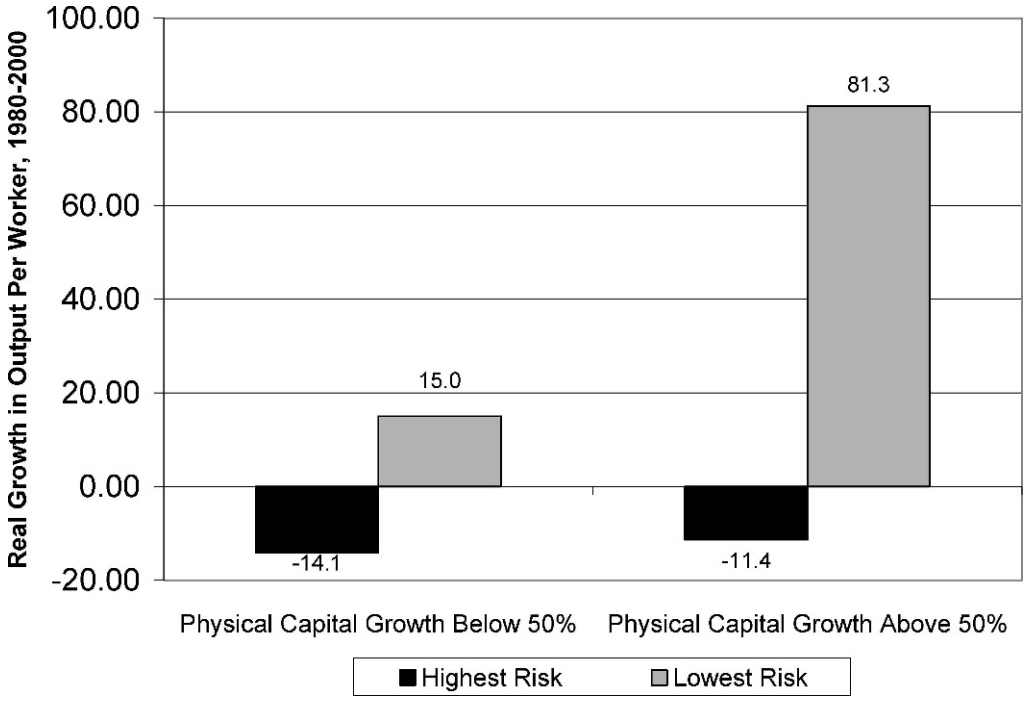

Figure 4. The Stratification of the Returns to Physical Capital by Risk of Expropriation

Among countries with the lowest risk of expropriation, countries with schooling growth above 50% from 1980–2000 grew slightly faster than countries where schooling growth was below 50%. For countries with the highest risk of expropriation, however, the exact opposite was the case. While all countries with poor protection of property rights saw negative real growth during this period, those countries with schooling growth below 50% had an average growth of output per worker of negative 3.7% compared with negative 17.8% for countries with schooling growth above 50%. Clearly, countries with bad institutions did poorly over this period; however, those countries with the largest increases in education did the worst.

Figure 4 shows the relationship between changes in physical capital per worker and growth in output, again split by risk of expropriation. Among countries with low risk of expropriation, those with physical capital growth above 50% grew much faster. As before, countries with the highest risk of expropriation experienced negative real growth; though countries with capital growth above 50% performed slightly better. These results suggest that the level of institutional quality at which the productivity of physical capital turns positive is lower than for human capital. Our estimation methods will allow us to examine this more directly.

Additional insight comes from examining the relationship between institutional quality and total factor productivity. Total factor productivity (or alternatively, the "Solow residual") is traditionally used to explain changes in output not directly attributable to changes in physical or human capital. In previous literature, these exogenous factors were assumed to include changes in technology and institutions (Baier, Dwyer, and Tamura 2006a). Because our study extends traditional growth models by accounting for institutional variation, a comparison

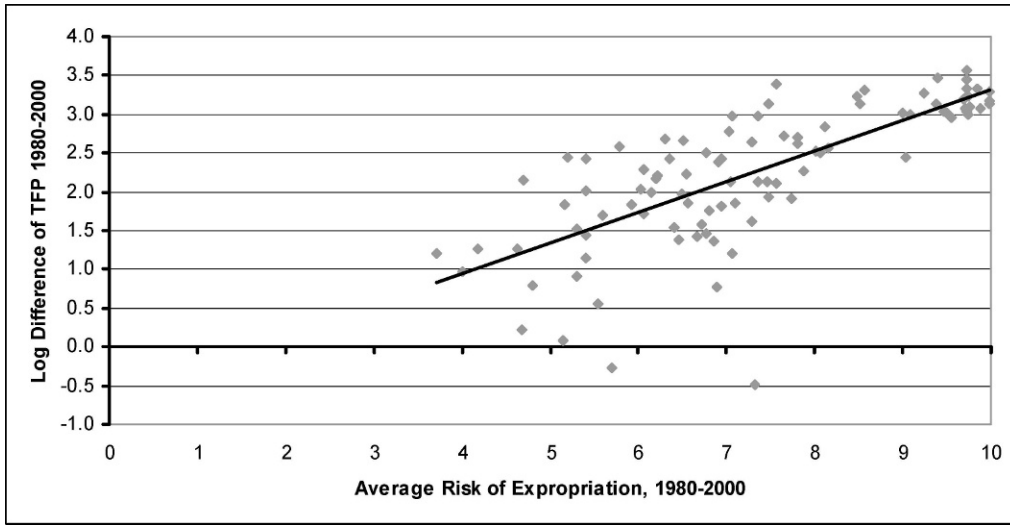

Figure 5. The Relationship between Institutional Quality and Total Factor Productivity

between the conventional view of total factor productivity and our measure of institutions is necessary and insightful.

We follow Baier, Dwyer, and Tamura (2006a) in calculating total factor productivity (TFP) for the 96 countries mentioned earlier. Specifically, we assume physical capital's share of income to be 0.33. The natural log of TFP is calculated by taking the natural log of output per worker and subtracting the natural logs of physical and human capital, weighted by their respective shares. TFP growth over 1980–2000 is the log difference between TFP in those two periods. Figure 5 illustrates the relationship between changes in TFP and institutional quality. The relationship is clearly positive with those countries characterized by the worst institutions also exhibiting the lowest growth in TFP. The correlation coefficient between the average risk of expropriation and the log difference of TFP is 0.74, and the R^2 of the trend line is 0.55. This result confirms that previous empirical papers, by omitting institutional quality, forced the impact of it into TFP, potentially leading to biases in their estimates. It also suggests that previous estimates of the Solow residual are largely explained by institutional quality differences rather than other factors.

6. Empirical Results

Table 1 presents our regression results that examine the effect of institutions on the impact of human and physical capital growth on a country's rate of economic growth. Column 1 is the baseline regression consistent with Equation 9 derived in section 3. The model fits the data well, explaining 56% of the variation in the change in output per worker between 1980 and 2000. The coefficients on both interaction terms are positive and statistically significant, while the coefficients on the change in physical capital and the change in human capital are negative and significant. These results are consistent with our hypothesis that changes in physical and human capital only have a positive effect on the rate of economic growth where strong property-rights

Table 1. The Determinants of Economic Growth

Dependent Variable: Growth of Output per Worker, 1980–2000				
Independent Variables	1	2	3	4
Constant	−1.17 (0.28)	0.96 (0.11)	6.17 (0.81)	9.91 (1.54)
Growth of schooling per worker (Baier et al.), 1980–2000	−0.719*** (3.59)	−0.734*** (3.64)	−0.637*** (3.13)	−0.362* (1.67)
Growth of physical capital per worker, 1980–2000	−0.789*** (8.05)	−0.793*** (8.10)	−0.735*** (6.56)	−0.762*** (7.62)
Growth of schooling per worker × risk of expropriation	0.098*** (3.60)	0.100*** (3.64)	0.087*** (3.14)	0.050* (1.68)
Growth of physical capital per worker × risk of expropriation	0.161*** (10.83)	0.162*** (10.73)	0.153*** (9.63)	0.158*** (11.65)
Percentage of population within 100 km of coast		−0.042 (0.34)		
Air distance from major trading centers			−0.0018 (1.15)	
Percentage of land area located in tropics				−0.243** (2.54)
Number of observations	96	96	96	96
Adj. R^2	0.56	0.56	0.56	0.59

Absolute value of heteroskedasticity-corrected *t*-statistics in parentheses.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

institutions are in place. In countries with strong institutions, increases in human and physical capital have a larger effect on economic growth rates than in countries with bad institutions.

In columns 2, 3, and 4 of Table 1, we included additional geographic variables thought to affect economic growth. Importantly, the inclusion of these variables does not qualitatively change the results of our basic regression. In all three additional columns, the signs and coefficients on each of the variables are very similar to those in column 1. One notable exception is in column 4, where the coefficients on human and physical capital per worker variables were reduced in magnitude. Note, however, that the coefficients on each of the interaction terms are very similar to the coefficients in the previous regressions, suggesting that good institutions still channel physical and human capital to productive ends in tropical environments.

The only geographic variable to add any explanatory power to the model is the percentage of the land area in the tropics. A country entirely located in the tropics is expected to have a cumulative growth rate 24.3 percentage points lower from 1980–2000 than a country with none of its area in the tropics. The other two geographic variables are not statistically or economically meaningful, with the percentage of the population within 100 km even having the opposite sign of what is expected.

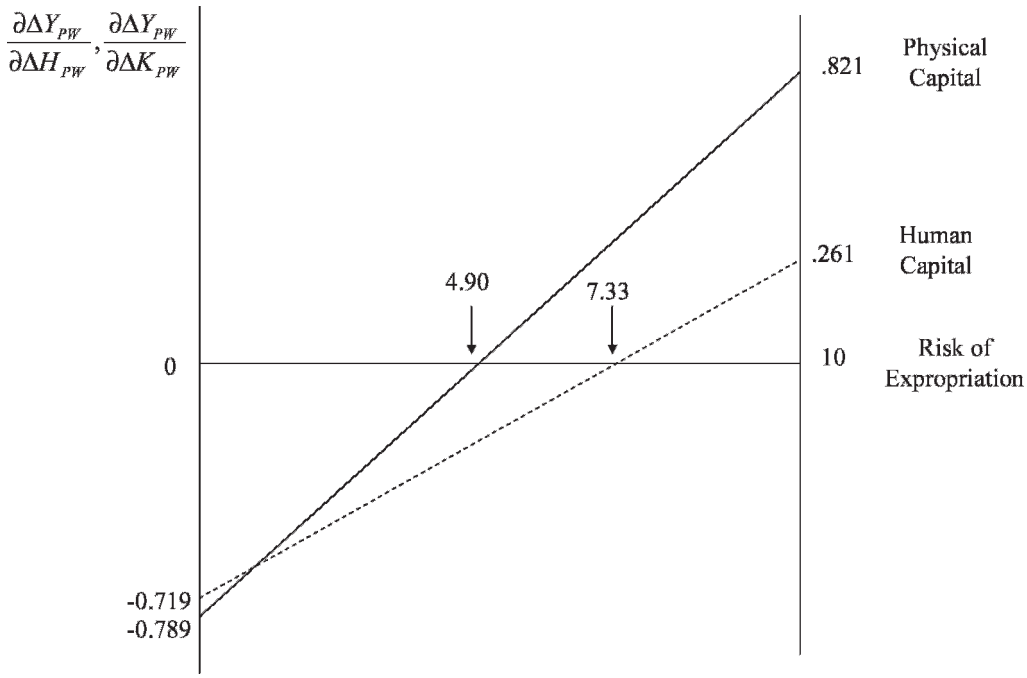

Figure 6. The Marginal Effect of Capital on Growth: An Estimate

In Figure 6 we take the coefficients from column 1 of Table 1 and put them in the context of the framework put forth in Figure 2. The negative left *y*-axis intercept values of −0.719 and −0.789 for human and physical capital, respectively, show the socially negative returns to investments in these areas in countries scoring the worst possible value on the risk of expropriation measure (remember this index increases with property rights protection). The intercept values along the right *y*-axis show the return in a country with ideal institutional quality. We find that the "break-even" point is a risk of expropriation score of 7.33 for human capital investment and 4.90 for physical capital investment.[10] In countries with a high risk of expropriation (a score below 4.90), the social returns to both types of capital investment are negative. Increases in either type of capital have a positive effect on output per worker in countries with a risk of expropriation score greater than 7.33. The level of institutional quality required to generate a positive return to education is higher than the level necessary to produce a positive return to physical capital investment.[11] This implies that in countries with midrange scores (between 4.90 and 7.33), focusing on investments in physical capital is likely to promote economic development to a much greater extent than additional investments in human capital. The greater slope coefficient for physical capital implies that the productivity of physical capital investment is more sensitive to institutional quality than the productivity of human capital investment.

[10] A risk of expropriation score of 7.33 is consistent with the institutions of a country such as South Africa, while Guinea-Bissau is a country just below 4.90.

[11] A possible explanation for this result is that protection of large-scale physical capital investment can likely be purchased either through the use of private protection or bribery of public officials. Conversely, it is likely more difficult to protect incremental investments in human capital absent good institutional quality. We thank an anonymous referee for providing this insight.

Our estimates explain why some countries that have had large increases in formal schooling from 1980 to 2000 have also seen real output decline over that period. A country that falls in this category is Haiti, which had an average risk of expropriation over this period of 4.17. Education levels in Haiti increased by over 120% from 1980 to 2000. At the same time, however, real output per worker declined by 26%. Guineau-Bissau, Iran, Madagascar, Niger, the Republic of the Congo, and Uganda are all countries with high (below 5.6) risk of expropriation scores that had increases in education levels over 80% and real output per worker declines of greater than 20%.

7. Sensitivity Analysis

A potential concern about the basic results presented in section 6 is that they might be sensitive to how institutional quality or changes in schooling are measured. For example, much of the cross-country economic growth literature uses educational levels from Barro and Lee (2000). While we employ the Baier, Dwyer, and Tamura (2006a) data in our initial analysis because we believe they are more up-to-date and expansive than the Barro–Lee calculations, we obtained the Barro–Lee data for the available countries in our data set to test the robustness of our results to an alternative measure of schooling increase. From the Barro and Lee (2000) data set, we obtained the years of education for individuals 15 and older in 1980 and 2000 and then calculated the change in education from 1980 to 2000.[12] Twelve countries in our sample were not in the data set, thus the sample contains only 84 countries.[13] The correlation between the two measures of schooling is 0.56.

Table 2 presents the results using the Barro and Lee measure of schooling rather than the Baier, Dwyer, and Tamura measure. In the table we consider each of the specifications from Table 1. The basic specification is in column 1, and the results are similar in significance to our previous results. In the other specifications, the results are consistent with those in Table 1 with the exception of the growth of physical capital per worker. While the sign on that variable is still negative, it is not statistically significant in columns 2–4. However, the coefficient on the interaction of physical capital growth and risk of expropriation remains positive and significant in all specifications, consistent with our hypothesis. Two other items of note are that air distance from major trading centers is statistically significant and the coefficient on the percentage of population within 100 km of the coast now has the correct sign.

In following Pritchett (2001), the model we developed in section 3 differs from the original empirical specification of Mankiw, Romer, and Weil (1992) because it does not include labor force growth or a measure of initial output. For robustness, we reestimate all of the specifications from Table 1, including these additional variables. Initial output is measured by output per worker in 1980, and the growth of the labor force from 1980–2000 is calculated from the Baier, Dwyer, and Tamura (2006a) data.

---

[12] Note that here education is not measured in per worker terms but in per capita (15 and older) terms. The Barro and Lee (2000) data set does not provide enough detail for conversion to per worker terms.

[13] The regressions presented in Table 1 were run using only the 84 countries available in Table 2, and the results were qualitatively and quantitatively similar.

Table 2. The Determinants of Economic Growth, Alternative Measure of Education

Dependent Variable: Growth of Output per Worker, 1980–2000				
Independent Variables	1	2	3	4
Constant	2.20 (0.39)	1.21 (0.17)	10.74 (1.53)	12.74*** (2.67)
Growth of schooling per worker (Barro), 1980–2000	−0.800*** (3.10)	−0.788*** (2.92)	−0.779*** (2.81)	−0.628** (2.37)
Growth of physical capital per worker, 1980–2000	−0.593* (1.85)	−0.592* (1.83)	−0.478 (1.50)	−0.470 (1.43)
Growth of schooling per worker × risk of expropriation	0.106*** (2.69)	0.104** (2.52)	0.106** (2.54)	0.087** (2.28)
Growth of physical capital per worker × risk of expropriation	0.134*** (3.47)	0.133*** (3.43)	0.117*** (3.05)	0.117*** (2.98)
Percentage of population within 100 km of coast		0.017 (0.18)		
Air distance from major trading centers			−0.0023* (1.69)	
Percentage of land area located in tropics				−0.243*** (3.21)
Number of observations	84	84	84	84
Adj. R^2	0.67	0.63	0.64	0.68

Absolute value of heteroskedasticity-corrected *t*-statistics in parentheses.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

The results in Table 3 are analogous to those in Table 1 but include the additional variables described previously. Importantly, all coefficients retain their significance as well as similar magnitudes, indicating that our results are robust to the inclusion of these variables. Labor force growth is negative and significant in all specifications, consistent with the findings of Mankiw, Romer, and Weil (1992). Similarly, the coefficient on initial output per worker is negative (indicating convergence), though it only obtains significance in the specification controlling for tropical location.

To this point, our measure of institutional quality has been the ''risk of expropriation'' of private property. The other measure of institutions frequently employed in the literature is the Economic Freedom of the World (EFW) index by Gwartney and Lawson (2003). The EFW index measures the degree to which a country's economy is consistent with ''economic freedom,'' e.g., personal choice, voluntary exchange, and security of private property. The index measures the quality of a country's policies and institutions in five areas: (i) size of government, (ii) legal structure and security of property rights, (iii) access to sound money, (iv) freedom to trade internationally, and (v) regulation of capital, labor, and business. Data from third-party international sources such as the World Bank and

Table 3. The Determinants of Economic Growth, Alternative Specification

Dependent Variable: Growth of Output per Worker, 1980–2000				
Independent Variables	1	2	3	4
Constant	31.01** (2.20)	29.82* (1.93)	36.23** (2.20)	43.84*** (2.65)
Growth of schooling per worker (Baier et al.), 1980–2000	−0.632*** (2.78)	−0.630*** (2.70)	−0.617*** (2.67)	−0.479** (2.31)
Growth of physical capital per worker, 1980–2000	−0.752*** (8.32)	−0.748*** (8.18)	−0.719*** (7.03)	−0.754*** (8.68)
Growth of schooling per worker × risk of expropriation	0.087*** (2.79)	0.086*** (2.71)	0.085*** (2.68)	0.066** (2.32)
Growth of physical capital per worker × risk of expropriation	0.149*** (10.32)	0.147*** (9.91)	0.144*** (9.07)	0.147*** (11.03)
Output per worker, 1980	−0.0004 (1.33)	−0.0004 (1.65)	−0.0005 (1.43)	−0.0008** (2.14)
Growth of labor force, 1980–2000	−37.13*** (2.79)	−37.89*** (2.98)	−35.34*** (2.71)	−28.25** (2.18)
Percentage of population within 100 km of coast		5.110 (0.52)		
Air distance from major trading centers			−0.0013 (0.82)	
Percentage of land area located in tropics				−25.870** (2.43)
Number of observations	96	96	96	96
Adj. R^2	0.64	0.64	0.64	0.66

Absolute value of heteroskedasticity-corrected *t*-statistics in parentheses.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

IMF are used to derive each country's ratings in each of the five areas. The area rankings are then averaged to create a summary ranking for each country included in the index.[14] The ranking theoretically varies from 0 (no economic freedom) to 10 (complete economic freedom).

As an additional measure of institutions, the EFW index has two advantages. First, like the risk of expropriation data, the index has been used in a number of studies on institutions and growth (Dawson 1998; Sturm and De Haan 2001; Adkins, Moomaw, and Savvides 2002; Cole 2003; Gwartney, Holcombe, and Lawson 2006). Second, because the EFW index is

[14] The most recent version of the EFW index (Gwartney and Lawson 2006), which measures economic freedom for 2004, rates 130 countries. The decision to include or exclude from the index depends solely on the quality of the available data, with data being unavailable mainly for autocratic or small countries.

Table 4. The Determinants of Economic Growth, Alternative Measure of Institutions

Dependent Variable: Growth of Output per Worker, 1980–2000				
Independent Variables	1	2	3	4
Constant	9.27* (1.68)	12.96 (1.21)	26.05*** (2.94)	24.49*** (3.44)
Growth of schooling per worker (Baier et al.), 1980–2000	−0.732*** (3.03)	−0.782*** (2.78)	−0.529** (2.18)	−0.297 (0.96)
Growth of physical capital per worker, 1980–2000	−0.220 (0.50)	−0.234 (0.53)	−0.192 (0.50)	−0.431 (1.25)
Growth of schooling per worker × avg. EFW 1980–2000	0.109*** (3.03)	0.116*** (2.78)	0.079** (2.19)	0.044 (0.97)
Growth of physical capital per worker × avg. EFW 1980–2000	0.097 (1.46)	0.100 (1.52)	0.091 (1.55)	0.129** (2.47)
Percentage of population within 100 km of coast		−0.06 (0.47)		
Air distance from major trading centers			−0.005** (2.48)	
Percentage of land area located in tropics				−0.376*** (3.70)
Number of observations	103	103	103	103
Adj. R^2	0.35	0.35	0.39	0.44

Absolute value of heteroskedasticity-corrected *t*-statistics in parentheses.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

calculated using policy variables such as tax rates, use of the index provides clearer guidance to policymakers, unlike indirect measures of institutions such as surveys or instrumental variables (Gwartney, Holcombe, and Lawson 2006). For our period of 1980–2000, the EFW index is available at 5-year intervals starting with 1980. The average country in our data set had a mean economic freedom score of 5.67, equal to Guatemala's mean summary ranking for the period. Hong Kong has the highest average economic freedom over the period with a score of 8.6 and the Democratic Republic of the Congo has the lowest score at 3.61.

Table 4 shows the results for the regressions run in Table 1 with the average EFW score inserted used instead of the risk of expropriation. The results are less robust using the EFW index, with growth of physical capital per worker and its interaction with the index being statistically insignificant in all but the last specification. The growth of schooling per worker and its interaction with economic freedom have the correct signs, however, and are strongly significant except in the final specification that includes the tropical location variable. In all cases, however, a joint *F*-test shows that each pair of variables is jointly significant. These results seem to confirm the general hypothesized relationship found earlier.

Table 5. The Determinants of Economic Growth, Alternative Functional Forms

Dependent Variable: Growth of Output per Worker, 1980–2000			
Independent Variables	Quadratic	Lowest Risk	Highest Risk
Constant	−12.52* (1.74)	−1.08 (0.27)	28.15 (1.67)
Growth of schooling per worker (Baier et al.), 1980–2000	−0.689*** (3.62)	0.464*** (4.96)	−0.613*** (2.85)
Growth of physical capital per worker, 1980–2000	−0.801*** (8.72)	0.822*** (11.95)	−0.047*** (3.21)
Growth of schooling per worker × risk of expropriation	0.117*** (3.41)		
Growth of physical capital per worker × risk of expropriation	0.191*** (8.84)		
Growth of schooling per worker × risk of expropriation, squared	−0.000000205 (1.41)		
Growth of physical capital per worker × risk of expropriation, squared	−0.000018* (1.87)		
Number of observations	96	8	10
Adj. R^2	0.57	0.97	0.51

Absolute value of heteroskedasticity-corrected *t*-statistics in parentheses.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

As a final check for robustness, we explore alternative functional forms. To this point we have assumed returns to capital are linear in institutional quality, though conceivably this may not be the case. Specifically, the role of institutions may diminish as they become better—that is, for countries with a high risk of expropriation, increases in institutional quality may have a greater impact on returns to capital than they would in low-risk countries. Further, because our results suggest certain break-even points of institutional quality for each type of capital, we divide our sample and examine returns to capital for those countries with the best and worst institutions in an attempt to explore a possible stepwise linear relationship.

Results from these additional specifications are presented in Table 5. The first column shows estimates for a specification, including squared interaction terms. These additional terms help identify the second-order relationship of institutional quality on returns to human and physical capital. Once again, estimates for returns to each type of capital are negative and statistically significant. The interaction between capital growth and risk of expropriation remains positive and significant for both types of capital as well. Both squared interaction terms are negative, though only the physical capital term is statistically significant. The positive interaction terms and negative squared interaction terms can be interpreted as institutional quality, increasing the returns to capital at a decreasing rate.

The final two columns in Table 5 present estimates for the truncated samples. We define "Lowest Risk" as those countries with a risk of expropriation score in the 90th percentile. Similarly, "Highest Risk" countries have scores in the 10th percentile. Our results show positive and statistically significant returns to both types of capital for the lowest risk countries and negative and statistically significant returns to both types of capital for those countries with the highest risk. This lends further credence to our claim that returns to capital "switch" from negative to positive as institutional quality increases.

8. Conclusion

Since World War II, the development-policymaking community has stressed the importance of capital accumulation. Large amounts of aid from developed countries and international aid organizations such as the IMF and World Bank have flowed to developing countries to encourage the capital investment thought necessary for poor countries to "take-off" on the path to development. Cross-country studies show, however, that the macroeconomic relationship between capital accumulation and growth is not as robust as the microeconomic relationship would suggest.

In this article we model and empirically test Pritchett's (2001) hypothesis that the quality of a country's institutions plays an important role in ensuring that increases in human capital lead to increases in economic growth. We empirically test this hypothesis using data on a large cross-section of countries and find that the effect of changes in both human and physical capital varies considerably along the institutional quality continuum, as measured by *International County Risk Guide* (IRG) data on the risk of expropriation within a country. We calculate that for countries with risk of expropriation scores below 4.90, additions to both the stock of physical and human capital have a *negative* effect on growth of output per worker. For countries between 4.90 and 7.33, increases in physical capital per worker have a positive impact but increases in schooling are still negative. Above 7.33, all increases in capital per worker increase output per worker.

The finding that capital increases only have a positive impact on growth once a break-even level of institutional quality has been reached is a strong argument against naïve proposals to double the capital stock in developing countries to double their income.[15] If aid flows are

Appendix A. List of Countries

Algeria	Denmark	Jamaica	Panama	Trinidad & Tobago
Argentina	Dominican Rep.	Japan	Papau New Guinea	Tunisia
Australia	Ecuador	Jordan	Paraguay	Turkey
Austria	Egypt	Kenya	Peru	Uganda
Bangladesh	El Salvador	Kuwait	Philippines	United Arab Emirates[b]
Belgium	Finland	Madagascar[b]	Poland	United Kingdom
Benin[a]	France	Malawi	Portugal	United States
Bolivia	Gabon[b]	Malaysia	Romania[b]	Uruguay
Botswana	Germany	Mali	Rwanda[a]	Venezuela
Brazil	Ghana	Mauritius[a]	Senegal	Zambia
Bulgaria[b]	Greece	Mexico	Sierra Leone	Zimbabwe
Burundi[a]	Guatemala	Morocco[b]	Singapore	
Cameroon	Guinea-Bissau[b]	Myanmar	South Africa	
Canada	Haiti	Namibia[b]	South Korea	
Central African Republic[a]	Honduras	Nepal[a]	Spain	
Chad[a]	Hong Kong	Netherlands	Sri Lanka	
Chile	Hungary	New Zealand	Sweden	
China	India	Nicaragua	Switzerland	
Colombia	Indonesia	Niger	Syria	
Congo, Democratic Republic	Iran	Nigeria[b]	Taiwan	
Congo, Republic of the	Ireland	Norway	Tanzania[b]	
Costa Rica	Israel	Oman[b]	Thailand	
Cote d'Ivoire[b]	Italy	Pakistan	Togo	

[a] Countries without risk of expropriation data and thus excluded from Tables 1, 3, and 5 regressions.
[b] Countries without Barro schooling data and thus excluded from Table 2 regressions.

[15] For example, Sachs (2005, p. 250) has said that "The likelihood is that doubling the human and physical capital stock will actually more than double the income level, at least at very low levels of capital per person."

inevitable, however, our findings suggest that spending should be focused on investment in physical capital if the country has a risk of expropriation score between 4.90 and 7.33. More important, however, these results focus attention toward institutional reform as the key to economic progress so that future increases in physical and human capital will generate positive social returns as well as private ones.

References

Acemoglu, Daron, and Simon Johnson. 2005. Unbundling institutions. *Journal of Political Economy* 113:949–95.

Acemoglu, Daron, Simon Johnson, and James A. Robinson. 2001a. Reversal of fortune: Geography and institutions in the making of the modern world income distribution. *Quarterly Journal of Economics* 117:1231–94.

Acemoglu, Daron, Simon Johnson, and James A. Robinson. 2001b. The colonial origins of comparative development: An empirical investigation. *American Economic Review* 91:1369–401.

Adkins, Lee C., Ronald L. Moomaw, and Andreas Savvides. 2002. Institutions, freedom, and technical efficiency. *Southern Economic Journal* 69:92–108.

Arndt, H. W. 1997. *Economic development: The history of an idea*. Chicago, IL: University of Chicago Press.

Baier, Scott L., Gerald P. Dwyer, and Robert Tamura. 2006a. How important are capital and total factor productivity for economic growth? *Economic Inquiry* 44:23–49.

Baier, Scott L., Gerald P. Dwyer, and Robert Tamura. 2006b. Factor returns, institutions, and geography: A view from trade. IIIS Discussion Paper No. 166.

Barro, Robert J. 1991. Economic growth in a cross-section of countries. *Quarterly Journal of Economics* 106:407–33.

Barro, Robert J., and Jong-Wha Lee. 2000. International data on educational attainment: Updates and implications. CID Working Paper No. 42.

Barro, Robert J., and Xavier Sala-i-Martin. 1995. *Economic growth*. New York: McGraw-Hill.

Bauer, Peter T. 1948. *The rubber industry: A study in competition and monopoly*. London: Longmans, Green & Company.

Bauer, Peter T. 1954. *West African trade: A study of competition, oligopoly and monopoly in a changing economy*. Cambridge, UK: Cambridge University Press.

Bauer, Peter T. 1957. *Economic analysis and policy in underdeveloped countries*. Durham, NC: Duke University Press.

Becker, Gary S. 1964 [1975]. *Human capital*. New York: National Bureau of Economic Research.

Boettke, Peter. 2001. *Calculation and coordination: Essays on socialism and transitional political economy*. London: Routledge.

Boettke, Peter J., and Peter T. Leeson. 2009. Two-tiered entrepreneurship and economic development. *International Review of Law and Economics* 29:252–259.

Cole, Julio H. 2003. The contribution of economic freedom to world economic growth: 1980–99. *Cato Journal* 23:189–98.

Coyne, Christopher J., and Peter J. Boettke. 2006. The role of the economist in economic development. *The Quarterly Journal of Austrian Economics* 19:47–68.

Dawson, John W. 1998. Institutions, investment, and growth: New cross-country and panel data evidence. *Economic Inquiry* 36:603–19.

De Long, J. Bradford. 1988. Productivity growth, convergence, and welfare: Comment. *American Economic Review* 78:1138–54.

Easterly, William. 2001. *The elusive quest for growth*. Cambridge, MA: MIT Press.

Easterly, William. 2006a. Planners vs. searchers in foreign aid. *Asian Development Review* 23:1–35.

Easterly, William. 2006b. Reliving the 50s: The big push, poverty traps, and takeoffs in economic development. *Journal of Economic Growth* 11:289–318.

Easterly, William, and Ross Levine. 2003. Tropics, germs, and crops: The role of endowments in economic development. *Journal of Monetary Economics* 50:3–39.

Friedman, Milton, and Rose Friedman. 1980. *Free to chose: A personal statement*. New York, NY: Harcourt, Brace and Jovanovich.

Gallup, John L., Jeffrey D. Sachs, and Andrew Mellinger. 1999. Geography and economic development. CID Working Paper No. 1.

Glaeser, Edward L., Raphael La Porta, Florencio Lopez-De-Silanes, and Andrei Shleifer. 2004. Do institutions cause growth? *Journal of Economic Growth* 9:271–303.

Griliches, Zvi. 1997. Education, human capital and growth: A personal perspective. *Journal of Labor Economics* 15:S330–44.

Gwartney, James D., Randall G. Holcombe, and Robert A. Lawson. 2004. Economic freedom, institutional quality, and cross-country differences in income and growth. *Cato Journal* 24:205–33.

Gwartney, James D., Randall G. Holcombe, and Robert A. Lawson. 2006. Institutions and the impact of investment on growth. *Kyklos* 59:255–73.

Gwartney, James D., and Robert A. Lawson. 2003. *Economic freedom of the world: 2003 annual report*. Vancouver, BC: Frasier Institute.

Gwartney, James D., and Robert A. Lawson. 2006. *Economic freedom of the world: 2006 annual report*. Vancouver, BC: Frasier Institute.

Hall, Joshua C. 2000. *Investment in education: Public and private returns*. Washington, DC: Joint Economic Committee.

Knack, Steven, and Philip Keefer. 1995. Institutions and economic performance: Cross-country tests using alternative institutional measures. *Economics and Politics* 7:207–27.

La Porta, Rafael, Florencio Lopez-de-Silanes, and Andrei Shleifer. 2008. The economic consequences of legal origins. *Journal of Economic Literature* 46:285–332.

Leeson, Peter. 2007. Better off stateless: Somalia before and after government collapse. *Journal of Comparative Economics* 35:689–710.

Lewis, Sir Arthur. 1992. Autobiography. In *Nobel lectures, economic sciences 1969–1980*, edited by Assar Lindbeck. Singapore: World Scientific Publishing, pp. 394–98.

Mankiw, N. Gregory, David Romer, and David N. Weil. 1992. A contribution to the empirics of economic growth. *Quarterly Journal of Economics* 107:407–37.

Mehlum, Halvor, Karl Moene, and Ragnar Torvik. 2006. Institutions and the resource curse. *The Economic Journal* 116:1–20.

Murphy, Kevin M., Andrei Shleifer, and Robert W. Vishny. 1991. The allocation of talent: Implications for growth. *Quarterly Journal of Economics* 106:503–30.

PRS (Political Risk Services Group). 2007. *International country risk guide* [electronic file]. East Syracuse, NY: PRS Group.

Powell, Benjamin, Ryan Ford, and Alex Nowrasteh. 2008. Somalia after state collapse: Chaos or improvement? *Journal of Economic Behavior and Organization* 67:657–70.

Pritchett, Lant. 2001. Where has all the education gone? *The World Bank Economic Review* 15:367–91.

Robinson, James A., Ragnar Torvik, and Thierry Verdier. 2006. Political foundations of the resource curse. *Journal of Development Economics* 79:447–68.

Sachs, Jeffrey D. 2003. Institutions don't rule: Direct effects of geography on per capita income. NBER Working Paper No. 9490.

Sachs, Jeffrey D. 2005. *The end of poverty: Economic possibilities for our time*. New York: The Penguin Press.

Shultz, Theodore W. 1961. Investment in human capital. *American Economic Review* 51:1–17.

Solow, Robert M. 1956. A contribution to the theory of economic growth. *Quarterly Journal of Economics* 70:65–94.

Stroup, Michael D. 2007. Economic freedom, democracy, and the quality of life. *World Development* 35:52–66.

Stroup, Michael D. 2008. Separating the influence of capitalism and democracy on women's well-being. *Journal of Economic Behavior and Organization* 67:560–72.

Sturm, Jan Egbert, and Jakob De Haan. 2001. How robust is the relationship between economic freedom and economic growth? *Applied Economics* 33:839–44.

Summers, Robert, and Alan Heston. 2000. *Penn world tables 5.6* [electronic file]. Philadelphia: Center for International Comparisons.