



No.166/June 2006

Factor Returns, Institutions, and Geography:
A View From Trade

Scott L. Baier

Clemson University and Federal Reserve Bank of Atlanta

Gerald P. Dwyer

Federal Reserve Bank of Atlanta

Robert Tamura

Clemson University and Federal Reserve Bank of Atlanta



IIS Discussion Paper No. 166

**Factor Returns, Institutions, and Geography:
A View From Trade**

Scott L. Baier, Gerald P. Dwyer and Robert Tamura

Disclaimer

Any opinions expressed here are those of the author(s) and not those of the IIS.
All works posted here are owned and copyrighted by the author(s).
Papers may only be downloaded for personal use only.

Factor Returns, Institutions, and Geography: A View From Trade

Scott L. Baier

Clemson University and Federal Reserve Bank of Atlanta

Gerald P. Dwyer

Federal Reserve Bank of Atlanta

Robert Tamura

Clemson University and Federal Reserve Bank of Atlanta

May 2006

Abstract

We show that estimated productivities of labor and capital which rationalize trade flows across countries are related to total factor productivities which rationalize output differences across countries. We present evidence that these productivities from trade flows are related to the institutions and geography across countries. Protection of property rights is the dominant influence on both labor and capital productivity and has similar effects on workers with only primary education as on those with more education. Geography is only important in terms of distance to a large market. Evidence concerning democracy is not compelling.

Acknowledgement 1 *We thank Daron Acemoglu, William Dougan, Stanley Engerman, Patrick Honohan, Colm Kearney, Casey Mulligan, Rowena Pecchenino, Dani Rodrik, Thomas R. Saving, Robert Tollison, Daniel Trefter and Karl Whelan for comments on earlier drafts of this paper. Linda Mundy and Budina Naydenova provided editorial assistance. An earlier version of this paper was presented at the Villa Mondragone International Economic Seminar. Members of the staff at the Central Bank of Ireland provided very helpful comments. Baier appreciates financial support from the BB&T Bank and the Center for International Trade at Clemson University. Dwyer thanks the Institute for International Integration Studies at Trinity College, Dublin for support while a visitor there; a seminar there was extraordinarily helpful in revising the paper. The views expressed here are the authors' and not necessarily those of the Federal Reserve Bank of Atlanta or the Federal Reserve System. Any remaining errors are the authors' responsibility.*

INTRODUCTION

Factor prices differ widely across countries. For example, the typical manufacturing worker in the United States is paid roughly ten times more than the average manufacturing worker in the Philippines. No doubt the quality and quantity of other inputs as well as workers' skills affect workers' pay. Still, a few simple calculations show that such differences cannot possibly account for the differences in pay. The typical U.S. worker has about three and a half more years of schooling than the typical Filipino worker in 2000. Suppose a relatively high return of 10 percent to years of schooling and that manufacturing production in the U.S. and in the Philippines are characterized by a Cobb-Douglas production function in capital and labor with labor's share equal to 0.6. Given these assumptions, the U.S. capital stock per worker would have to be 333 times larger to explain the tenfold difference in wages. Three hundred and

thirty-three times larger is very far from the actual five times larger capital per worker in the U.S.

Large disparities in relative wages are not particular to this example of the U.S. and the Philippines. For a set of 80 countries, the average manufacturing wage in the top five percent of countries is ten times greater than the median country's wage and 58 times greater than the average for the bottom five percent (World Bank 2003). For the small sample of countries where there are reliable capital estimates of capital's returns, capital returns also differ widely across countries. These differences in factor returns cannot even remotely be explained by other factors of production.

Over the past decade, many economists have tried to quantify cross-country differences in income per person. In all studies, differences other than physical and human capital loom large. Hall and Jones (1999) find that stocks of physical and human capital account for only 35 percent of the differences between the richest and poorest countries; the remaining 65 percent is due to the residual, total factor productivity. Klenow and Rodriguez-Clare (1997) find that up to 80 percent of the cross-country variation in the level of output per worker is due to total factor productivity. Over longer horizons, Baier, Dwyer and Tamura (2006) find that variation in the growth of total factor productivity explains from 30 to over 80 percent of the cross-country differences in the growth of output per worker. This evidence indicates that cross-country income differences are associated with productivity differences. Unfortunately, as Abramovitz (1956) puts it, total factor productivity is a measure of ignorance because little was known about it other than that total factor productivity makes income differences consistent with smaller factor endowment differences.

Over the last ten years, a substantial amount of research also has been devoted to understanding how income and total factor productivity are affected by institutions and geography. This research includes, among others, Knack and Keefer (1995), Sachs and Warner (1995), Barro (1996), Gallup and Sachs with Mellinger (1999),

Hall and Jones (1999), Easterly and Levine (2003), Acemoglu, Johnson and Robinson (2004), and Rodrik, Subramanian and Trebbi (2004). The evidence clearly indicates that protection of private property rights is important, provides some support for the importance of democratic institutions, and the evidence concerning geography is mixed.

While evidence concerning income and total factor productivity is important, institutions and geography are quite likely to have different effects on the returns and productivity of labor and capital. Knowing how institutions influence factors' returns and productivity is important partly because the effects on factor returns are likely to be helpful for understanding the development of institutions themselves. While these points are not new and are mentioned, for example, by Engerman and Sokoloff (2003) and Acemoglu, Johnson and Robinson (2004), the only statistical evidence of which we are aware is Rodrik's (1999) finding that more democratic institutions are associated with higher wages.

In this paper, we estimate the productivity of capital and labor and then examine the relative importance of institutions and geography for those productivities. We use the relative factor content of trade to estimate the productivities of capital and labor across countries.

We start with a standard model of international trade: the Heckscher-Ohlin-Vanek (HOV) model. In this model of an integrated world, trade in goods is a substitute for direct trade in factor services or migration of factors and a country is a net exporter of its relatively abundant good. There have been many empirical tests of the HOV model which examine the relationship between the observed pattern of trade and endowments, including among others Maskus (1985) Bowen, Leamer, and Sveikauskus (1987), Trefler (1993, 1995) and Davis and Weinstein (2001). These studies invariably find that the HOV model explains little of trade patterns.

Over half a century ago, Leontief (1953) suggested a possible explanation for the

HOV model's poor performance – some countries may use their endowments more efficiently than others. Bowen, Leamer and Sveikauskas (1987) and Treffer (1993, 1995) follow Leontief's suggestion and allow for productivity differences in the HOV model. Treffer (1993) shows that factor-augmenting technology can exactly equate actual trade in factor services and the theoretically implied trade in factor services. In addition, factor-augmenting technological differences imply that factor prices can be equalized relative to productivity. Treffer presents evidence that there is a high correlation between factor payments and his estimates of factor productivity.

Allowing for differences in factor-augmenting technology may seem appealing, but these measures of productivity based on trade become a measure of ignorance. As Feenstra (2004, p. 61) notes,

Even if we accept that the HOV equation can fit perfectly by allowing sufficient differences in technologies across countries, this begs the question, *where do the differences come from?* Such differences can hardly be accepted as exogenous, however, and must be explicable based on underlying causes. [Emphasis in original.]

This is precisely the same complaint made about total factor productivity.

We show that the measures of factor-augmenting technology obtained from trade theory, which also can be called measures of factor productivity, are related to total factor productivity. Theoretically, factor productivity implied by trade is related to total factor productivity. For example, if the factor productivities from trade theory indicate that both labor and capital are twice as productive in the U.S. as in the Philippines, then total factor productivity in the U.S. will be twice as high as total factor productivity in the Philippines. Despite this theoretical relationship, factor productivity from the HOV model and the level of total factor productivity are based on two independent sets of data and the relationship between the two measures is

an empirical question. Our empirical results indicate that an aggregated measure of factor-augmented productivity is highly correlated with total factor productivity from development accounting.

In this paper, we explore the determinants of differences in factor productivities across countries. We examine the relationship of factor productivities to institutions and geography. For most of our results, we measure the extent to which institutions and geography influence productivity using two factors of production: physical capital and effective labor (or human capital). Because a differential effect on those with relatively less education is an important and interesting issue, we also examine the differential effects of institutions and geography on unskilled and skilled labor based on education.

Our measures of institutions include measures of countries' protection of property rights and levels of democracy. With respect to geography, we consider two ways that geography influences factor productivity. First, certain geographic characteristics reduce productivity because they are associated with an unhealthy climate that is not conducive to production. Second, geography can limit the extent of the market.

The government's protection of property rights is highly correlated with factor productivity. Democracy generally is positively correlated with both labor and capital productivity, but this univariate relationship disappears once property rights are included in regressions. Geographic variables can account for some of the cross-country differences in productivity, but the only geography variable that is robustly correlated with productivity is minimum distance to a large market. These results continue to hold when we correct for potential endogeneity of the measures of property rights and democracy. We also find that the effect of property rights protection on the productivity of skilled and unskilled workers is similar.

This paper is organized as follows: Section two presents our construction of factor productivities and related analysis. We summarize HOV theory with and without

differences in productivity, discuss the data used in this paper and compare the measures of capital and labor productivity to each other and to total factor productivity. In section three, the relationships of capital and labor productivities with institutions and geography are examined. We also examine the sensitivity of the results to institutions' possible endogeneity and present preliminary evidence on whether there are differential effects of institutions and geography on skilled and unskilled labor. Section four concludes.

HOV THEORY AND PRODUCTIVITY DIFFERENCES

In this section, we summarize how HOV theory generates measures of productivity based on Vanek's transformation of trade in goods into trades in factor services. Let $i = 1, \dots, H$ index countries, $m = 1, \dots, M$ index factors of production and $n = 1, \dots, N$ index industries with $M < N$. We define Y_i as the $N \times 1$ vector of industry outputs produced by country i . We assume that countries have identical constant returns to scale production functions, markets are perfectly competitive, and the world is free from barriers that distort trade. Each country has an $M \times 1$ vector of endowments V_i . We assume that world endowments are distributed in such a manner that the distribution is consistent with an integrated world equilibrium in which all countries produce all goods, which is sufficient to rule out corner solutions.¹ We also assume that the input requirements for producing various industries' outputs are common across countries.

In the baseline HOV model, there are no differences in how efficiently factors are used across countries, and the technology is given by a $M \times N$ matrix of common direct and indirect technology D , where the typical element $d_{m,n}$ is the amount of

¹At the level of aggregation used for industries in this paper, there are no countries with zero production in any industry. This suggests that the conditions for factor price equalization with productivity differences are not wildly unrealistic.

factor m required to produce one unit of good n . Full employment of resources implies that the vector of factor endowments for country i , $V_i = [v_{1,i}, \dots, v_{M,i}]'$, is related to output by $V_i = DY_i$. We define C_i as an $N \times 1$ vector of domestic expenditure on final goods and services. If people in all countries have identical and homothetic preferences, country i 's expenditure is proportional to its share of world expenditure, i.e., $C_i = s_i C_w$ where C_w is the world expenditure vector and s_i is country i 's share of world expenditure. Multiplying country i 's expenditure vector by the direct and indirect input requirement matrix yields $DC_i = s_i DC_w = s_i V_w$ where V_w is the $M \times 1$ vector of world endowments. The predicted factor content of trade is factor use in domestic production, V_i , minus factor use in domestic expenditure on the goods, $s_i V_w$. The measured factor content of trade, $F_i = [f_{1,i}, \dots, f_{M,i}]'$, is the $M \times 1$ vector of implied trade flows of factors, which equals exports minus imports multiplied by the direct and indirect factor requirements matrix, i.e., $F_i = DNX_i$ where NX_i is the $N \times 1$ vector of country i 's net exports.

The correlation between the measured factor content of trade and the predicted factor content of trade typically is very low. The sign test, one simple test used to assess the predictions of the HOV model, is the percentage of times that the measured content of factor m in trade, $f_{m,i} = \sum_{n=1}^N d_{m,n} nx_{n,i}$, has the same sign as the predicted content of factor m in trade, $\hat{f}_{m,i} = v_{m,i} - s_i v_{m,w}$. There are $H - 1$ independent observations, the H th being implied by the other $H - 1$ countries because the shares of expenditure add up to one. The percentage of sign matches typically is around 50 percent, indicating that the HOV prediction is no better than a flip of a coin.²

Trefler (1993) allows for international differences in factor productivity. He defines $\pi_{m,i}$ as the factor augmenting technology for factor m in country i , which also can

²Maskus (1985) termed the consistently poor performance of the of the HOV model the "Leontief commonplace" as opposed to the "Leontief paradox".

be called the productivity of factor m in country i . The predicted factor content of trade for factor m by country i adjusted for differences in productivity is $\hat{f}_{m,i} = \pi_{m,i}v_{m,i} - s_i \sum_{i'=1}^H \pi_{m,i'}v_{m,i'}$ in which the $\pi_{m,i}$'s are unknowns. Given the singularity due to the expenditure shares summing to one, the U.S. productivity for each factor can be normalized to one. If the predicted and actual factor contents of trade are equated, i.e. $f_{m,i} = \hat{f}_{m,i}$, there are $H - 1$ unknowns $\pi_{m,i}$ and $H - 1$ linear equations for each factor m , $f_{m,i} = \pi_{m,i}v_{m,i} - s_i \sum_{i'=1}^H \pi_{m,i'}v_{m,i'}$, where $\pi_{m,US} = 1$. It is possible to solve exactly for these unknown factor productivities $\pi_{m,i}$ that exactly “predict” or “explain” the factor content of trade. As Treﬂer shows, the estimates of productivity for a factor are independent of mismeasurement of the quantities of other factors and their productivities.

Data

As in other HOV studies, the data used in this study are drawn from a variety of sources. Unless otherwise noted, all data are for 84 countries in 1997 based on 32 industries of traded goods. Appendix Tables 1 and 2 list the countries and industries.³ The data on trade ﬂows are from Feenstra (2000.)

Our primary estimates use data on two factors of production: the capital stock and the labor force measured in effective labor units. The capital stock measures are constructed using the perpetual inventory method with an annual depreciation rate of 13.3 percent (Leamer 1984) using real investment data from Baier, Dwyer, and Tamura (2006). Aggregate labor force data are converted into effective labor force units by multiplying the labor force by $\exp(\varphi(\text{educ}_i, \text{exper}_i))$ where educ_i is the number of years of schooling for the average worker in country i , exper_i is the average

³Data are available to estimate trade productivities for 91 countries, but the institutional information used in the later regressions is not available for seven of them, which leaves the 84 countries listed in Appendix Table 1.

level of experience in country i and $\exp(\varphi(\text{educ}_i, \text{exper}_i))$ reflects returns to education and experience.⁴ Data on the labor force are from the World Bank (2002) and data on education are from Baier, Dwyer, and Tamura (2006).

For some of our analysis, labor is divided into skill categories based on education. Data on education are multiplied by the labor force in each country to arrive at the number of workers with some primary education – called “unskilled workers” and those with at least some education beyond the primary level – called “skilled workers”. Because we do not know the average education of workers who attended only primary school, calculating these measures of labor based on education comes at the expense of not being able to measure labor in effective labor.

Construction of the direct and indirect input requirement matrix is standard (Bowen, Leamer and Sveikauskas 1987). Input requirements are based on the 1997 input-output tables for the United States. The stocks of capital by industry in the U.S. are from the U.S. series “fixed reproducible tangible wealth.” To equate the total of these capital stocks and our computed U.S. perpetual-inventory aggregate capital stock, the capital stock in each industry is multiplied by the ratio of the U.S. perpetual-inventory aggregate capital stock to the total of the U.S. capital stocks from fixed reproducible tangible wealth. This results in a sum of the capital stocks by industry in the U.S. equal to our estimate of the aggregate U.S. capital stock. Data for the U.S. labor force employed in each sector are from the National Income and Product Accounts of the United States and the Bartelsman and Gray (2002) productivity database for 1997. The total labor force is adjusted to equal the World

⁴The derivatives of $\varphi(\text{educ}_i, \text{exper}_i)$ are the returns to an additional year of schooling or experience that can be estimated from Mincerian wage regressions. As in Hall and Jones (1999), Debaere and Demiroglu (2003) and Baier, Dwyer and Tamura (2006), we assume that the return to education for the first four years of schooling is 13.4 percent, 10.1 percent for the second four years and 6.8 percent for all years of education above the 8th year. As in Bils and Klenow (2000), we assume the return to experience is quadratic.

Bank’s estimate of the U.S. labor force (World Bank 2002). Data on workers’ average education by industry for the U.S. are from the 1990 Census (Ruggles, Sobek *et al.* 2003). Income per capita and population are from the World Bank (2002). Each country’s share of world consumption is its share of absorption of goods and services in all countries.

HOV Estimates

Baseline HOV Results for Trade.—

The assumptions in the baseline HOV model in which technology is assumed to be the same across countries are

Assumption 1. In each country, factors are mobile across sectors and factor markets clear.

Assumption 2. Tastes can be represented by homothetic preferences that are the same across countries, which implies that each country’s consumption of each good is proportional to its share of world consumption; that is, $C_i = s_i C_w$.

Assumption 3. Each country has access to the same technology.

Assumption 4. The distribution of the endowment of factors is such that world trade is consistent with an integrated world equilibrium in which each final good is produced by every country.

We focus on one implication of the model, namely

Proposition 1. The predicted factor content of trade is $\hat{f}_{m,i} = v_{m,i} - s_i v_{m,w}$ and the actual factor content of trade is $f_{m,i} = D_m N X_i$.

If factor markets are perfectly competitive, it also follows that

Proposition 2. Factor price equalization holds, i.e., $w_{m,i} = w_{m,i'}$ where $w_{m,i}$ is the return to factor m in country i .

A weak implication of the HOV hypothesis is that country i should export the services of its relatively abundant factor and import the services of its relatively scarce factor, which implies that $\hat{f}_{m,i} \gtrless 0$ as $f_{m,i} \gtrless 0$, an implication that can be examined by a sign test. The sign test tabulates the percentage of times that the signs of $\hat{f}_{m,i}$ and $f_{m,i}$ are the same. The percentage of observations for which the actual and predicted effective labor and capital content of trade have the same sign is 47.8 percent. The HOV model performs worse than a flip of a coin!⁵ If we attach more weight to observations with a larger factor content of trade as in Trefler (1995), this weighted statistic is 63.5 percent – an improvement but still a far cry from one hundred percent.⁶ Allowing for cross-country differences in productivity weakens the model’s assumptions.

HOV Estimates of Productivities.—

As does Trefler (1993), we allow productivity to differ by country and by factor. Assumptions 1, 2 and 4 of the baseline model are the same. However, Assumption 3 becomes

Assumption 3’. Technology can differ by country and by factor.

This assumption and Assumptions 1, 2 and 4 imply

Proposition 1’: The actual factor content of trade $f_{m,i}$ is identically equal to the predicted factor content of trade $\hat{f}_{m,i} = \pi_{m,i}v_{m,i} - s_i \sum_{i=1}^H \pi_{m,i}v_{m,i}$ with $\pi_{m,US} = 1$.

If factor markets are perfectly competitive,

⁵Bowen, Leamer, and Sveikauskus (1987), Trefler (1993, 1995) and Davis and Weinstein (2001) report similar results.

⁶The results are similar if labor is measured in terms of the number of workers rather than in terms of effective labor. The percent with the correct sign is 47.8 percent using the number of workers. The percentage correct increases to 64.2 percent if the observations are weighted by their factor content of trade.

Proposition 2': Factor price equalization holds in terms of effective labor, i.e., $w_{m,i} = \pi_{m,i}w_{m,US}$.

Trefler (1993) examined the plausibility of the model by comparing relative factor returns, $w_{m,i}/w_{m,US}$, to the relative productivities, $\pi_{m,i}$. He found a good fit between these relative factor returns and the relative productivities.⁷ Gabaix (1997) calculates the productivity by factor types assuming zero trade and shows little difference between these productivities and the productivities when trade is included in the calculation. Algebra similar to Gabaix's with U.S. productivity normalized to unity implies that the productivity of factor m in country i relative to U.S. productivity can be written as a function of factor m 's average product and trade by

$$\pi_{m,i} = \frac{TC_i/v_{m,i}}{TC_{US}/v_{m,US}} + \frac{f_{m,i}}{v_{m,i}} - \frac{TC_i}{TC_{US}} \left(\frac{f_{m,US}}{v_{m,US}} \right) \quad (1)$$

where TC_i is total domestic expenditure on final goods and services in country i . If total domestic expenditure is approximately equal to Gross Domestic Product, then the first term on the right-hand side indicates that relative productivities are related to the relative average product. Because of diminishing returns, it would be hard to imagine a world in which factor returns are orthogonal to average products. Trade can weaken this relationship, but average products are likely to be of first-order importance in determining productivities. Holding constant average product, a country's relative productivity is higher if the country is an exporter of that factor's services.⁸ The larger the factor content of trade relative to the endowment, the higher is measured relative productivity. It is also easy to see why the factor content of

⁷Using a different methodology, Repetto and Ventura (1997) find that, while factor prices do reflect differences in factor-augmenting productivity, disparities exist in relative factor prices even after taking into account differences in productivity. Because of the data requirements for their tests, they have a relatively small sample size and their estimates are imprecise.

⁸In our data, the average estimates of the productivities are ten percent different with trade than without trade, indicating that the trade data are adding information to the information in the technology matrix.

trade is scaled by the endowment. If a country is a net exporter of a factor's service and its endowment of that factor is small, that factor must be relatively productive. The third term enters with a minus sign because, everything else the same, a country's relative productivity compared to the US is lower if the US is a net exporter of that factor's service. For the same reason that the factor content of trade is measured relative to a country's endowment, If the U.S. is a net exporter of a factor's service and its endowment of that factor is relatively small, that factor must be relatively productive in the U.S. The third term also is scaled by country i 's size relative to the U.S.

Figure 1 shows estimates of aggregate labor and capital productivities by country. The vertical axis is the country's capital productivity and the horizontal axis is the country's labor productivity. The line in the figure is the line indicating equality of capital and labor productivity. The figure shows that countries with high measured labor productivity tend to have high measured capital productivity, but the relationship between these two measures is far from perfect. The correlation between the two measures is 0.58. We find that the mean level of capital productivity is higher than the mean level of labor productivity, and there is less dispersion of capital productivity than labor productivity. This is not too surprising to us. If capital is more mobile than labor, then returns to capital will be more similar across countries. There are a few countries that have high capital productivities relative to their labor productivity and to their GDP, for example Angola. This high capital productivity may be due to the endowments of natural resources – e.g., diamonds and oil in Angola.

HOV Productivity and Total Factor Productivity

What is the correlation of these measures of factor productivity based on trade with other measures of aggregate productivity? We compare the factor-augmenting productivity from Trefler's approach to the estimate of productivity from development

accounting.

In the growth literature, factor endowments account for little of the cross-country differences in income per worker. Klenow and Rodriguez-Claire (1997) and Hall and Jones (1999) are two recent papers that emphasize this, finding that much of cross-country differences in output per worker are due to differences in total factor productivity. They calculate total factor productivity from an aggregate production function. Let y_i be output per worker in country i . With Cobb-Douglas production, output per worker, y_i , is

$$y_i = A_i k_i^\alpha h_i^{1-\alpha} \quad (2)$$

where A_i , k_i , and h_i , are total factor productivity, capital per worker and human capital per worker in country i . Total factor productivity in country i relative to total factor productivity in the U.S. is

$$\frac{A_i}{A_{US}} = \frac{y_i/k_i^\alpha h_i^{1-\alpha}}{y_{US}/k_{US}^\alpha h_{US}^{1-\alpha}} \quad (3)$$

This relative total factor productivity can be compared to productivity estimated from the factor content of trade. A simple way to aggregate the capital and labor productivities from trade theory is to take a geometric average of the capital and labor productivities, $\pi_i = \pi_{k,i}^\eta \pi_{\ell,i}^{1-\eta}$, with the weight on capital's productivity equal to its share of income. We set capital's share of income η to 0.33, a value consistent with Gollin's (2002) careful cross-country study of income shares. Figure 2 shows that there is a substantial positive relationship between the geometric average of the trade productivities and relative total factor productivity. Total factor productivity and the weighted average of trade productivities do not lie along the line in the figure showing equality, but the correlation between the measure of relative productivity from the factor content of trade and relative total factor productivity is 0.876. This indicates that the two measures of productivity derived from largely independent data

are quite similar.⁹

PRODUCTIVITY, GEOGRAPHY, AND INSTITUTIONS

What country-specific factors are related to these measures of relative productivity? We focus on the correlations of factors' productivities with geography, property rights protection and democratic government. We separate the potential influence of geography on productivity into "productive geography," which affects productivity through geographic characteristics, and "market geography," which affects productivity through access to large markets and the ability to specialize and exploit economies of scale. Then we describe the measures of property rights and democracy.

Initially, we report the R^2 from separate regressions of the productivity measures on productive geography, market geography, property rights protection, and democracy. These are followed by regressions that include different subsets of these four possible influences on productivity. Causality and correlation, of course, are not the same thing. It is likely, though, that a country's geographic characteristics are exogenous relative to factor productivity in the country. Property rights and democracy, on the other hand, could be as much a result as a cause of factor productivity. In the last part of this section, we present some instrumental-variables estimates of the relationship of productivity with property rights and democracy.

The data on geography are from Gallup and Sachs with Mellinger (1999). The measure of protection of property rights is from Hall and Jones (1998, 1999). The data on democracy are based on the Polity IV data (Marshall and Jaggers 2004) that

⁹If productivity differences are assumed to be only labor augmenting as in Hall and Jones (1999), the correlation of relative total factor productivity and the total relative trade productivity is 0.89.

We also performed a grid search allowing capital's share to vary between 0.01 and 0.99. The highest correlation between the aggregated trade productivities and total factor productivity is 0.876 to three digits, which is the value with capital's share ranging from 0.31 to 0.40.

update the Polity III data (Jagers and Gurr 1995). The data on legal origin are from La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998).

Geography

Geography can affect productivity directly by limiting the productivity of resources due to characteristics associated with its geographic location or indirectly by limiting the extent of the market and the ability of factors to specialize and achieve economies of scale.

The tropics seem like paradise with an abundance of sun, vegetation and food, but the reality can be quite different. Diet often has limited variety and the seemingly desirable characteristics of the tropics can foster diseases that can reduce the production of goods and services (Gallup and Sachs with Mellinger 1999). With abundant rainfall and no frost, the tropics are breeding grounds for diseases and the diseases' carriers.¹⁰ To lessen illness and death, resources can be allocated to prevent and treat diseases, but this implies that smaller quantities of other goods and services are produced. Such use of resources acts effectively as a tax on non-disease-preventing production in the area. We use latitude and the fraction of the population with malaria to measure these adverse effects of tropical diseases.

More obviously than the tropics, deserts are inhospitable environments that can be associated with lower output. Deserts have little precipitation, high winds, poor soil and extreme temperatures. All of these characteristics make capital and labor less productive by making the production of many goods more costly. To estimate the effect of desert climate on productivity, we use desert area in tropical latitudes relative to total land in each country and desert area in temperate latitudes relative

¹⁰The most notable pests are the Anopheles mosquito which spreads malaria and the tsetse fly which spreads sleeping sickness (African trypanosomiasis).

to total land in each country, as do Gallup and Sachs with Mellinger (1999).¹¹ In sum, the productive geography hypothesis suggests that countries located in less temperate zones (lower latitudes) with a higher prevalence of malaria and countries with a higher fraction of land covered by desert have less productive capital and labor.

Figure 3 shows the relationships between productive geography and labor and capital productivity. The “productive geography” shown in the panels of the figure are the fitted values of labor and capital productivity from the productive geographic factors: latitude, desert, and fraction of the population with malaria. By itself, productive geography explains 42 percent of the variation in labor productivity and six percent of the variation in capital productivity. For labor productivity, latitude and the fraction of the population afflicted by malaria are statistically significant at the five percent level but neither desert variable is statistically significant.¹² For capital productivity, only the fraction of land that is tropical desert is statistically significant at the five percent level.

A country’s location can affect the size of the economic market and the economy’s ability to specialize and achieve economies of scale. Countries that have small local markets, are far away from large markets, and do not have access to water transport may not be able to specialize and exploit economies of scale as much as others. We test this market geography hypothesis by four variables: 1. the logarithm of land area; 2. the proximity to large markets by the logarithm of the minimum great-circle

¹¹Extremely cold environments also have undesirable characteristics, but few people live in such areas, e.g. above the Arctic Circle. Perhaps this explains why there are no estimated effects of very cold climates in the published literature.

¹²Because malaria can be a result as well as a cause of low income or low productivity, we use the incidence of malaria in 1966 to lessen any endogeneity of the incidence of malaria relative to the 1997 estimates of productivity.

We also examined whether absolute distance from the equator affects growth and found empirical results qualitatively similar to those presented.

distance to Tokyo, Rotterdam, or New York; 3. the cost of moving goods into and out of a country by a dummy variable equal to one if the country is landlocked; and 4. the fraction of land that is within 100 kilometers of the coast.

Figure 4 shows the relationships between market geography and labor and capital productivity. By itself, market geography explains 43 percent of the variation in labor productivity and eleven percent of the variation in capital productivity. Distance from large markets is the only variable that is statistically significant at the five percent level, with the productivity of both labor and capital falling as the distance to a large market increases.

Property Rights and Democracy

In addition to geographic factors, the productivity of factors of production is likely to be affected by the institutions in a country. The two institutions that we investigate in this paper are protection of private property rights and the democratic selection of government officials.

Why would protection of property rights affect labor and capital productivity? In the absence of protection of property rights, individuals face two types of risks. First, if individuals fear government expropriation, they will try to hide their assets to decrease the probability of government expropriation, which can decrease the efficiency of production. For example, the possibility of expropriation can be reduced by building smaller-than-optimal production facilities that are not as readily obvious or fixed in place (de Soto 2000). Second, as suggested by Tullock (1967) and elaborated by Murphy, Shleifer, and Vishny (1991), Acemoglu (1995), and Grossman and Kim (1995), some individuals may choose to attempt to steal from those who produce goods and services, and those who produce goods will use resources to protect themselves from the predators. Effective protection of private property rights that decreases theft will result in resources being allocated to more productive uses.

We quantify the government's protection of property rights by the same measure used by Knack and Keefer (1995) and Hall and Jones (1999), which is based on five components from the International Country Risk Guide and available from Hall and Jones (1998). The first two components measure the role of government in protecting against predatory private behavior through the rule of law and bureaucratic quality. The other three components measure the government as a possible diverter of resources by measures of government corruption, risk of expropriation, and the government's repudiation of contracts. We use a somewhat arbitrary equally weighted average of these five measures. The relationships between these measures of the protection of property rights and labor and capital productivity are shown in Figure 5. The government's protection of property rights explains 69 percent of the cross-country variation in labor productivity and 22 percent of the cross-country variation in capital productivity.

The effect of democratic government on productivity is not obvious. More democratic societies can winnow out bad laws and inefficient leaders, effects which would tend to raise productivity. In this case, political and economic freedom are mutually reinforcing, a point emphasized by Friedman (1962, Ch. 1). On the other hand, people may vote for income redistribution and make the economy less efficient, with the relationship between redistribution and the wealth distribution not necessarily obvious (Peltzman 1980).

To measure democracy, we follow a procedure similar to Rodrik (1999), classifying Jagers and Gurr's (1995) updated Polity IV measures (Marshall and Jagers 2004) into two equally weighted groups, Categories A and B, and then using an equally weighted average of these groups.

Category A is an equally weighted average of six measures of institutionalized democracy, four of which reflect the selection and the accountability of the executive and two of which reflect the expression of political opinions. Category A's measures

of institutional democracy include 1. the existence of institutionalized procedures for the transfer of executive power; 2. the extent to which subordinates have equal opportunity to become superordinates; 3. the choice of the executive by election, a dual process in which one office is elected and the other is hereditary, or by hereditary alone; 4. the extent to which decisions made by the executive are accountable to other authorities; 5. whether, when and how policy preferences can be expressed; and 6. whether alternative preferences for policy leadership can be expressed. Category A is an equally weighted ten-year average in which all components are normalized from zero to one, with higher values indicating more democracy.

Category B measures the extent to which the political process is open to the general population. The two components contained in Category B are 1. the extent to which political expression is suppressed or curtailed and 2. the extent to which citizens can express political preferences, civil liberties are guaranteed, and people can participate in the political process. Both scores are normalized from zero to one with a higher score indicating a more democratic regime. Category B is a ten-year equally weighted average of these components.

The overall measure of democracy is an equally weighted average of the Category A and Category B measures of democracy. Different weighting schemes yield quantitatively similar results for the measure of democracy.

There is a positive and statistically significant relationship of both labor and capital productivity with this measure of democracy, which explains 39 percent of the cross-country variation in labor productivity and nine percent of the cross-country variation in capital productivity. Figure 6 shows the relationship of this measure of democracy with labor and capital productivities.

Productivity, Geography and Institutions – OLS Estimates

In this section, we allow the measures of geography and institutions to enter into a regression specification simultaneously to identify which variables appear to be robustly correlated with productivity.¹³

Table 1 shows the estimated coefficients in OLS regressions for labor and capital productivity.¹⁴ Property rights are statistically significant and highly correlated with labor productivity in all specifications in Table 1. On the other hand, democracy is not statistically significant in any regressions that include property rights. The only geographic variable that is robustly related to labor productivity is the logarithm of the minimum distance to a large market.¹⁵

The regression results are very similar for capital productivity. Property rights are significantly related to capital productivity. Democracy, on the other hand, is not statistically significant at the ten percent level in any of the six regressions that include property rights as a right-hand side variable. There is some evidence that the logarithm of the minimum distance to a major market is related to capital productivity.

The apparent insignificance of democracy could be due to using a rather arbitrarily equally weighted index of aspects of democracy, some of which are important and some of which are not. To examine this issue, we test whether the equally weighted index is consistent with the data. The Category B components are so collinear that

¹³The results are similar for log-linear estimates and fractional logit (Papke and Wooldridge 1996) specifications. Since it is not obvious which is the correct functional form, a simple functional form test of the log-linear specification compared to the levels specification revealed that the levels specification explains a higher fraction of the variation for capital, labor, and skilled and unskilled productivities.

¹⁴The reported standard errors are White heteroskedasticity-consistent standard errors.

¹⁵Latitude is statistically significant only if the logarithm of the minimum distance to a major market is not included in the regressions.

separate estimation is not feasible, and we examine only the Category A components separately. In the specification including all variables, an F-test for equating the six coefficients of the Category A components has a p-value of 93 percent and the R^2 increases only from 0.75 to 0.77. For the same regression for capital productivity, however, the R^2 increases from 0.33 to 0.40 when the components are entered separately and the p-value is 4 percent. The restriction imposed on the coefficients is marginally statistically significant but none of the individual estimated coefficients is statistically significant, quite possibly indicative of multicollinearity. Somewhat surprisingly, these tests suggest that the individual components of democracy are unimportant for labor productivity but are important for capital productivity. They also indicate that teasing any such possible relations from the data is likely to be complicated by correlations among the components. We do not pursue this line of research in this paper but discuss its implications in the conclusion.

Even though not statistically significant, the point estimates still could indicate that geography is economically important compared to institutions. We estimate the economic importance of geography and institutions by calculating whether a country would have higher productivity with the United Kingdom's geographic position or with its institutions.¹⁶ The United Kingdom has attractive geographic features: direct access to the ocean, relatively short distances to large markets, low incidence of malaria, almost no desert, and a location in a relatively temperate zone. The United Kingdom also has relatively high scores on property rights and democracy. The property rights index is 0.933 compared to a mean of 0.624 and a median of 0.571 and the democracy index is 0.902 compared to a mean of 0.614 and a median of

¹⁶Here, we are assuming the costs of switching geographic positions and institutions are zero and that institutions are independent of geography. Obviously, the costs of changing geography and institutions are far from zero. Institutions may well depend partly on geography (Acemoglu, Johnson and Robinson, 2001; Engerman and Sokoloff 2003).

0.657.¹⁷ We compare the Philippines to the United Kingdom using the regressions for labor and capital productivity in Table 1 that include all variables. If the Philippines kept its institutions but had the United Kingdom's geography, the Philippines' labor productivity would increase from seven percent to 28 percent of the U.S.'s and capital productivity would increase from 25 percent to 26 percent of the U.S.'s. On the other hand, if the Philippines were to keep its physical position and adopted the same institutions as the United Kingdom, labor productivity would increase from seven percent to 75 percent and capital productivity would increase from 25 percent to 58 percent. In short, the Philippines' geography which, practically speaking is almost entirely exogenous to the Philippines, has far less effect on the Philippines' labor and capital productivities than does its protection of property rights and governance. The Philippines is hardly unique.

Consider Ethiopia, a country at roughly the same latitude as the Philippines but with other geographic characteristics that are worse than those of the Philippines – a much higher incidence of malaria, no port, and a location farther from large markets. A move to the United Kingdom's geographic position would increase Ethiopia's labor productivity from two percent to 33 percent and capital productivity from 25 percent to 35 percent. If Ethiopia adopted the United Kingdom's institutions, labor productivity would increase from two percent to 74 percent and capital productivity would increase from 25 percent to 61 percent.

Table 2 presents the results of this analysis by quintiles based on the countries' labor and capital productivities, with the numbers in the table being the mean of the values in each quintile. This table shows that adopting the United Kingdom's institutions uniformly has a bigger impact on productivity than does its geography. If all countries could move to the United Kingdom's geographic position, average labor

¹⁷For comparison, the property rights index for the United States is 0.947 and the democracy index is 0.902.

productivity in the middle quintile would increase from 17 percent of the U.S.'s level to 36 percent. On the other hand, if the world were to adopt the United Kingdom's institutions, labor productivity in the middle quintile would increase to 66 percent of the U.S.'s level. The U.K.'s geography would increase the middle quintile's capital productivity by a trivial amount, but the U.K.'s institutions would increase it by 25 percentage points to 73 percent.

While better geography would help people in the Philippines, Ethiopia and in much of the rest of the world, better institutions would help them quite a bit more. These results are similar to those in Rodrik, Subramanian and Trebbi (2004).¹⁸ Our results also indicate that protection of property rights is more important than democracy.¹⁹ Institutions clearly can increase the relative well being of both workers and owners of physical capital, even given a disadvantageous location. Our estimates indicate that

¹⁸This conclusion is not sensitive to the specification of the regressions. An ad hoc specification search is not particularly informative, although it can provide an indication of the sensitivity of results to specification. To this end, we ran all possible regressions of labor and capital productivity on any five of the ten variables. Property rights were statistically significant at the five percent level in all 126 regressions for labor productivity including property rights and in 56 of the 126 regressions for capital productivity including property rights. With property rights included, democracy was not statistically significant in any of the 56 regressions for each productivity. With property rights included, the only geography variables that are statistically significant in more than four regressions for either labor or capital productivity are distance to a major market for labor productivity and latitude for capital productivity; distance to a major market is statistically significant in 32 of the 56 regressions for labor productivity that include property rights and distance, and latitude is statistically significant in 18 of the 56 regressions for capital productivity that include property rights and latitude.

¹⁹As another measure of government efficiency, there are 2002 data on government regulation from the World Bank (2004). If the cross-sectional variation of this variable has changed little with time, these variable for 2002 are additional measures of government efficiency and may be related to 1997 productivity differences. As with democracy, these variables have little or no explanatory power once property rights are included in the regressions.

the Philippines and Ethiopia still would not be as wealthy as the United Kingdom or the United States if they had better protection of property rights, but better protection of property rights would make their wealth dramatically higher than it is. The policy implications of these observations are far from immediate (Rodrik, Subramanian and Trebbi 2004, pp. 157-58), but they indicate a direction for further analysis.

Robustness to Endogeneity and Measurement Error

There are several reasons why the coefficients on the above estimates might be biased or inconsistent and, therefore, inaccurately reflect how institutions affect productivity and factor returns. The results may be sensitive to the specification of individual regressions. Causality may run from productivity to institutions; if more productive countries choose better institutions, the importance of institutions may be overstated. On the other hand, the index measures are noisy measures of institutions and these coefficients may suffer from the classic errors in variables bias toward zero.

To examine the importance of reverse causality and measurement error, we use instrumental variables for the institutional variables. The instruments are 1. the legal origin of a country, a set of dummy variables divided into alternatives of English, French, German and Scandinavian, Spanish and Socialist, 2. a dummy variable equal to one if a country ever had a Communist government, 3. a measure of ethnolinguistic fractionalization that measures the likelihood that two randomly matched people in a country speak the same language, and 4. the productive and market geography variables.

Table 3 reports the results from the instrumental variables (IV) estimation. Property rights remain robustly related to labor productivity and the coefficient estimates are higher than in OLS regressions. The evidence for the importance of property rights for capital productivity is weaker than in the OLS regressions. Even so, the

measure of property rights is statistically significant at the ten percent level in all but one of the IV specifications, and the democracy index never is statistically significant. As before, the distance to a large market is the only geographic variable that is robustly related to labor productivity. There also is some evidence that distance to a large market is related to capital productivity.

Productivity of Skilled and Unskilled Workers

The evidence above indicates that protection of property rights benefits both workers and owners of capital, but the evidence could be consistent with unskilled workers losing out. We measure labor in terms of effective labor units and examine how institutions affect a worker with the average years of schooling and experience in that country. How do geography and institutions affect the productivity of workers with different skill levels?

To provide an initial answer to this question, we divide the labor force into workers with at most primary education and those who have completed some secondary or higher education. A practical problem arises because the Baier, Dwyer and Tamura (2006) data include no information on the years of schooling completed by workers who only completed primary school. As a result, these measures of productivity for unskilled and skilled workers are not for effective labor based on average education. Instead, they are the productivity of workers who have completed at most primary school and the productivity of workers who have completed more schooling.

Table 4 presents the regressions for the workers with no more than primary education and those with more education. This table shows that property rights are more closely related to the productivity of both sets of workers than is geography. As before, the only geographic variable consistently associated with productivity is the logarithm of the minimum distance to a major market. The coefficient estimates suggest that better protection of property rights raises the productivity of skilled

workers more than the productivity of workers with less education. At least without controlling for endogeneity, it seems to be the case that more property rights protection benefits skilled workers more than unskilled workers.

The differential effect for skilled and unskilled workers disappears when instrumental variables are used for property rights protection and for democracy. Table 5 shows the estimated equations using instrumental variables. The coefficient on property rights is statistically different for skilled workers compared to unskilled workers only in the first equation with property rights and the market geography variables.

The apparent difference between the OLS and IV estimates may be explicable, perhaps being consistent with an exogenous effect of property rights and endogenous feedback that increases workers' education. Suppose that an exogenous increase in property rights protection occurs. By hypothesis, this will lead to an increase in the returns to both skilled and unskilled labor. This increases the accumulation of human capital, because returns to it have increased. Consequently, average education increases and there is an increase in the actual education of those who have completed more than primary school. While the average education of those with primary education also would increase, the low upper bound for primary education is consistent with a smaller effect on their average education. As a result, OLS using the number of workers with at most primary education and those with more indicates a greater effect of property rights on skilled workers' productivity because the OLS estimate includes this endogenous increase in years of schooling completed.

We conclude that these results provide no support for concerns that protecting property rights favors one class of workers over another class of workers. In fact, the correlation between low skill productivity and income per worker is positive, 0.80.²⁰

²⁰Caselli and Coleman (2004) find a negative relationship between the productivity of unskilled workers and output per worker. In their framework, countries choose "appropriate technology"; that is, they can adopt and employ technologies that make one type of workers more productive, but

CONCLUSION

In the trade literature, there has been little work done to explain cross-country differences in productivities from Treffer's modification of the HOV model. We show that the measures of productivity based on the HOV model are highly correlated with productivity estimated by development accounting. Hence, our research ties the productivities based on trade into the literature on total factor productivity, which has substantial evidence on the effects of institutions and geography on economic growth.

We find little evidence that geography is reliably associated with productivity, especially in terms of climate and related factors. We do find that distance from a large market has a consistent effect on productivity, but this effect is of secondary importance compared to institutions.

We find that more protection of private property rights is correlated with higher productivity of capital and labor and that the higher productivity of labor reflects higher productivity of both skilled and unskilled workers. Once property rights are included in the estimated equations, the overall democracy index plays little direct role in influencing factor productivity. This conclusion is the same as that reached by many others, as the summary by Gerring, Bond and Barndt (2004) indicates. On the other hand, we find that the restriction of the democracy index to an equally weighted average is inconsistent with the data for capital productivity. If all of the coefficients on the individual components were zero, an equally weighted average of unimportant factors would be as good as any other weighted average of the components. For capital productivity, the restriction to an equally weighted average has a p-value of 4 percent, statistically significant and therefore marginally inconsistent

this comes at the expense of making the other type less productive. In our framework, there is no trade-off between the productivity of worker types and the correlation can be positive or negative.

with no effect of any component. Unfortunately, there is substantial correlation of the various components. Sorting out whether the statistical significance is happenstance or indicative of an interesting relationship is not trivial. Gerring, Bond and Barndt (2004) and Acemoglu and Johnson (2005) present interesting evidence on possible links of political organization and economic growth. We currently are pursuing this issue with more data over a longer period. In the meantime, it can be said that private property rights are important, and it is uncertain whether democratic institutions affect productivity independently of property rights.

Beyond this important issue, there are numerous directions that can be pursued to clarify the effect of institutions on productivity. Important questions are how quickly institutional change translates into changes in measured productivity and quantifying whether institutions have an effect on factor returns independent of the effect on productivity, as Rodrik (1999) suggests. Embedding trade into a model in which there is corruption as in Anderson and Marcouiller (2002) or Anderson and Bandiera (2003) or where countries face a trade-off among different levels of efficiency as in Caselli and Coleman (2004) would go a long way in aiding our understanding of how institutions influence productivity and efficiency.

We leave many other unanswered questions. Most glaringly, why do some countries fail to protect property rights given that both owners of physical and human capital gain from better institutions? We do not doubt that the answer is that some people in these countries would lose if property rights were protected. While it may seem plausible to say “The ruling elite would lose and therefore prevents change”, it is an uninformative truism. This merely puts a name on the answer without providing any way of identifying these people or how they would be affected.

REFERENCES

- Abramovitz, Moses. 1956. "Resource and Output Trends in the United States since 1870." *American Economic Review, Papers and Proceedings* 46 (May), pp. 5-23.
- Acemoglu, Daron. 1995. "Reward Structures and the Allocation of Talent." *European Economic Review* 39 (January), pp. 17-33.
- Acemoglu, Daron and Simon Johnson. 2005. "Unbundling Institutions." *Journal of Political Economy* 113 (October), pp. 949-95.
- Acemoglu, Daron, Simon Johnson and James A. Robinson. 2004. "Institutions as the Fundamental Cause of Long-run Growth." *Handbook of Economic Growth*, forthcoming.
- Anderson, James A., and Oriana Bandiera. 2003. "Traders, Cops, and Robbers." National Bureau of Economic Research Working Paper 9572.
- Anderson, James A., and Douglas Marcouiller. 2002. "Insecurity and the Pattern of Trade: An Empirical Investigation." *Review of Economics and Statistics* 84 (May), pp. 342-52.
- Baier, Scott L., Gerald P. Dwyer, Jr. and Robert Tamura. 2006. "How Important Are Capital and Total Factor Productivity for Economic Growth?" *Economic Inquiry* 44 (January), 23-49.
- Barro, Robert J. 1996. "Democracy and Growth." *Journal of Economic Growth* 1 (March), pp.1-27.
- Bartelsman, Eric J., Randy A. Becker and Wayne B. Gray. 2002. "The Manufacturing Industry Productivity Database." National Bureau of Economic Research Technical Working Paper 205.

- Bils, Mark, and Peter J. Klenow. 2000. "Does Schooling Cause Growth?" *American Economic Review* 90 (December), pp. 1160-83.
- Bowen, Harry P., Edward E. Leamer and Leo Sveikauskas. 1987. "Multicountry, Multifactor Tests of the Factor Abundance Theory. *American Economic Review* 77 (December), pp. 791-809.
- Caselli, Francesco, and John Wilbur Coleman II. 2004. "The World Technology Frontier." Unpublished paper, Harvard University.
- Davis, Donald R. and David E. Weinstein. 2001. "An Account of Global Factor Trade." *American Economic Review*. 91 (December), pp. 1423-53.
- Debaere, Peter and Ukuf Demiroglu. 2003. "On the Similarity of Country Endowments." *Journal of International Economics*. 59 (January), pp.101-36.
- de Soto, Hernando. 2000. *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else*. New York: Basic Books.
- Easterly, William and Ross Levine. 2003. "Tropics, Germs, and Crops: How Endowments Influence Economic Development." *Journal of Monetary Economics*. 50 (January), pp. 3-40.
- Engerman, Stanley L. and Kenneth L. Sokoloff. 2003. "Institutional and Non-Institutional Explanations of Economic Differences." National Bureau of Economic Research Working Paper 9989.
- Feenstra, Robert. 2000. "World Trade Flows: 1980-1997." University of California at Davis, manuscript and CD.
- Feenstra, Robert C. 2004. *Advanced International Trade: Theory and Evidence*. Princeton University Press.

- Friedman, Milton. 1962. *Capitalism and Freedom*. Chicago: The University of Chicago Press.
- Gabaix, Xavier. 1997. "The Factor-Content of Trade: A Rejection of the Heckscher-Ohlin-Vanek-Leontief Hypothesis." Harvard University, unpublished paper.
- Gallup, John Luke, Jeffrey D. Sachs with Andrew D. Mellinger. 1999. "Geography and Economic Development." Harvard Center for International Development Working Paper 1.
- Gerring, John, Phillip Bond and William T. Barndt. 2004. "Democracy and Economic Growth: A Historical Perspective." Unpublished paper, Boston University.
- Gollin, Douglas. 2002. "Getting Income Shares Right." *Journal of Political Economy*. 110 (April), pp. 458-74.
- Grossman, Herschel I., and Minesong Kim. 1995. "Swords or Plowshares? A Theory of Security of Claims to Property." *Journal of Political Economy*. 103 (December), pp.1275-88.
- Hall, Robert E., and Charles I. Jones. 1999. "Why Do Some Countries Produce So Much More Output Per Worker Than Others?" *The Quarterly Journal of Economics*. 114 (February), pp. 83-116.
- Hall, Robert E., and Charles I. Jones. 1998. "Data Appendix for Robert E. Hall and Charles I. Jones, 'Why Do Some Countries Produce So Much More Output per Worker than Others?'" Unpublished paper at <http://emlab.berkeley.edu/users/chad/HallJones400>.
- Jagers, Keith and Ted Robert Gurr. 1995. "Tracking Democracy's Third Wave with the Polity III Data," *Journal of Peace Research* 32 (November), pp. 469-82.

- Klenow, Peter J., and Andres Rodriguez-Clare. 1997. "The Neoclassical Revival: Has it Gone Too Far?" *NBER Macroeconomics Annual*, edited by Ben Bernanke and Julio Rotemberg, pp.73-102.
- Knack, Stephen, and Phillip Keefer. 1995. "Institutions and Economic Performance: Cross-Country Tests Using Alternative Institutional Measures." *Economics and Politics* 7 (November), pp. 207-27.
- La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer and Robert W. Vishny. 1998. "Law and Finance." *Journal of Political Economy* 106 (December), pp.1113-55.
- Leamer, Edward E. 1984. *Sources of International Comparative Advantage: Theory and Evidence*. Cambridge, Massachusetts: MIT Press.
- Leontief, Wassily W. 1953. "Domestic Production and Foreign Trade: The American Capital Position Reexamined." *Proceedings of the American Philosophical Society*. 97 (4), pp. 332-49.
- Marshall, Monty G., and Keith Jagers. 2004. "Political Regime Characteristics and Transitions, 1800-2002." Website <http://www.cidcm.umd.edu/inscr/polity/>.
- Maskus, Keith E. 1985. "A Test of the Heckscher-Ohlin-Vanek Theorem: The Leontief Commonplace." *Journal of International Economics* 19 (November), pp. 201-12.
- Murphy, Kevin M., Andrei Shleifer and Robert W. Vishny. 1991. "The Allocation of Talent: Implications for Growth." *The Quarterly Journal of Economics* 106 (May), pp. 503-30.
- Papke, Leslie E., and Jeffrey M. Wooldridge. 1996. "Econometric Methods for Fractional Response Variables with an Application to 401(k) Plan Participation

- Rates.” *Journal of Applied Econometrics* 11 (Nov-Dec), pp. 619-32.
- Peltzman, Sam. 1980. “The Growth of Government.” *Journal of Law and Economics* 23 (October), pp. 209-87.
- Repetto, Andrea and Jaume Ventura. 1997. “The Leontief-Trefler Hypothesis and Factor Price Insensitivity.” Unpublished paper, Massachusetts Institute of Technology.
- Rodrik, Dani. 1999. “Democracies Pay Higher Wages.” *The Quarterly Journal of Economics* 114 (August), pp. 707-38.
- Rodrik, Dani, Arvind Subramanian and Francesco Trebbi. 2004. “Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development.” *Journal of Economic Growth* 9 (June), pp. 131-65.
- Ruggles, Stephen, Matthew Sobek *et al.* 2003. Integrated Public Use Microdata Set Series Version 3. Minneapolis: Historical Census Project, University of Minnesota.
- Sachs, Jeffrey D., and Andrew M. Warner. 1995. “Economic Reform and the Process of Global Integration.” *Brookings Papers on Economic Activity*. (1), pp. 1-95.
- Trefler, Daniel. 1995. “The Case of Missing Trade and Other Mysteries.” *American Economic Review* 85 (December), pp. 1029-46.
- Trefler, Daniel. 1993. “International Factor Price Differences: Leontief was Right!” *Journal of Political Economy* 101 (December), pp. 961-87.
- Tullock, Gordon. 1967. “The Welfare Costs of Tariffs, Monopolies, and Theft.” *Western Economic Journal* 5 (June), pp. 224-32.

World Bank. 2004. *Doing Business in 2004: Understanding Regulation*. Washington, D.C.: World Bank.

World Bank. 2003. *World Development Indicators 2003*. Washington, D.C.: The World Bank.

World Bank. 2002. *World Development Indicators 2002*. Washington, D.C.: The World Bank.

Table 1
Relationship of Factor Productivities with Institutions and Geography
OLS Estimates
(Labor Productivity)

<u>Right-hand-side Variable</u>	<u>Regressions</u>								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Property Rights	1.414 ^a (0.180)		1.304 ^a (0.233)	1.434 ^a (0.178)		1.406 ^a (0.210)	1.292 ^a (0.200)		1.263 ^a (0.223)
Democracy		0.664 ^a (0.140)	0.152 (0.138)		0.610 ^b (0.249)	0.069 (0.189)		0.502 ^b (0.238)	0.074 (0.179)
Proximity to Large Markets	-0.062 ^c (0.033)	-0.180 ^a (0.033)	-0.060 ^c (0.033)				-0.124 ^a (0.043)	-0.247 ^a (0.050)	-0.124 ^a (0.044)
Fraction of Land Near Coast	0.124 (0.096)	0.008 (0.140)	0.089 (0.102)				0.034 (0.109)	-0.070 (0.147)	0.026 (0.109)
Landlocked Dummy Variable	0.080 (0.081)	0.072 (0.095)	0.078 (0.079)				0.041 (0.082)	0.031 (0.108)	0.043 (0.084)
Logarithm of Land Area	-0.008 (0.027)	-0.016 (0.044)	-0.011 (0.028)				-0.026 (0.029)	-0.037 (0.046)	-0.027 (0.029)
Latitude				0.000 (0.001)	0.004 ^b (0.002)	0.000 (0.001)	-0.003 ^c (0.002)	-0.004 (0.003)	-0.003 (0.002)
Fraction of Land in Tropical Desert				-0.107 (0.081)	-0.144 (0.156)	-0.085 (0.103)	0.008 (0.101)	0.037 (0.150)	0.031 (0.113)
Fraction of Land in Temperate Desert				-0.058 (0.424)	0.318 (0.544)	-0.030 (0.446)	0.092 (0.421)	0.261 (0.464)	0.128 (0.427)
Fraction of Population with Malaria				-0.144 ^b (0.060)	-0.206 (0.151)	-0.121 (0.095)	-0.097 (0.065)	-0.137 (0.134)	-0.074 (0.092)
Constant	0.027 (0.412)	1.586 ^b (0.667)	0.042 (0.406)	-0.472 ^a (0.118)	0.006 (0.225)	-0.507 ^a (0.149)	0.939 (0.632)	2.615 ^a (0.988)	0.920 (0.647)
R-squared	0.73	0.55	0.73	0.71	0.48	0.71	0.75	0.58	0.75

Heteroskedasticity-consistent standard errors in parentheses

Statistically significant at 1 percent is denoted by “a”, 5 percent by “b”, 10 percent by “c”.

Table 1 (Cont'd)
 Relationship of Factor Productivities with Institutions and Geography
 OLS Estimates
 (Capital Productivity)

<u>Right-hand-side Variable</u>	<u>Regressions</u>								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Property Rights	0.571 ^a (-0.124)		0.599 ^a (-0.147)	0.772 ^a (-0.145)		0.743 ^a (-0.155)	0.639 ^a (-0.165)		0.623 ^a (-0.175)
Democracy		0.196 (0.119)	-0.039 (0.132)		0.355 ^b (0.167)	0.069 (0.149)		0.253 (0.175)	0.042 (0.162)
Proximity to Large Markets	-0.004 (0.027)	-0.059 ^b (0.026)	-0.005 (0.028)				-0.113 ^b (0.048)	-0.173 ^a (0.047)	-0.112 ^b (0.048)
Fraction of Land Near Coast	-0.029 (0.108)	-0.057 (0.118)	-0.020 (0.110)				-0.069 (0.120)	-0.121 (0.127)	-0.074 (0.121)
Landlocked Dummy Variable	-0.073 (0.077)	-0.076 (0.077)	-0.073 (0.077)				-0.128 (0.081)	-0.133 ^c (0.079)	-0.126 (0.082)
Logarithm of Land Area	-0.015 (0.017)	-0.016 (0.019)	-0.014 (0.017)				-0.028 (0.018)	-0.033 (0.021)	-0.028 (0.019)
Latitude				-0.001 (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.005 ^b (0.002)	-0.005 ^b (0.002)	-0.005 ^b (0.002)
Fraction of Land in Tropical Desert				-0.097 (0.067)	-0.107 (0.107)	-0.076 (0.086)	-0.018 (0.082)	-0.002 (0.121)	-0.004 (0.103)
Fraction of Land in Temperate Desert				-0.201 (0.365)	0.011 (0.372)	-0.173 (0.367)	-0.238 (0.332)	-0.152 (0.326)	-0.217 (0.350)
Fraction of Population with Malaria				0.098 (0.085)	0.077 (0.111)	0.122 (0.096)	0.126 (0.085)	0.108 (0.113)	0.139 (0.102)
Constant	0.428 (0.364)	1.133 ^a (0.369)	0.425 (0.367)	0.062 (0.111)	0.298 ^b (0.144)	0.027 (0.135)	1.476 ^b (0.622)	2.301 ^a (0.578)	1.465 ^b (0.626)
R-squared	0.23	0.14	0.23	0.27	0.11	0.27	0.33	0.23	0.33

Heteroskedasticity-consistent standard errors in parentheses

Statistically significant at 1 percent is denoted by “a”, 5 percent by “b”, 10 percent by “c”.

Table 2
 Effect of the United Kingdom's Geography and Institutions on Productivities
 Estimates by Quintile Based on OLS Estimates

	Bottom Quintile (Percent)	Fourth Quintile (Percent)	Middle Quintile (Percent)	Second Quintile (Percent)	Top Quintile (Percent)
Labor Productivity					
Productivity with UK's Institutions	69.37	71.37	79.54	78.76	91.70
Productivity with UK's Geography	33.77	34.17	49.58	67.12	95.96
Actual Labor Productivity	2.98	6.44	17.35	47.84	108.00
Capital Productivity					
Productivity with UK's Institutions	71.85	71.75	76.19	76.00	78.77
Productivity with UK's Geography	46.38	52.71	51.67	63.14	65.84
Actual Capital Productivity	22.79	35.37	47.78	67.56	95.13

Table 3
 Relationship of Factor Productivities with Institutions and Geography
 IV Estimates
 (Labor Productivity)

<u>Right-hand-side Variable</u>	<u>Regressions</u>								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Property Rights	1.834 ^a (0.361)		1.319 ^c (0.725)	2.143 ^a (0.375)		1.781 ^a (0.475)	1.915 ^a (0.382)		1.529 ^a (0.504)
Democracy		2.397 ^b (1.033)	0.871 (1.014)		1.985 ^a (0.671)	0.725 (0.565)		2.013 ^a (0.755)	0.751 (0.638)
Proximity to Large Markets	-0.006 (0.054)	0.002 (0.120)	0.017 (0.067)				-0.053 (0.066)	-0.173 ^b (0.086)	-0.06 (0.067)
Fraction of Land Near Coast	0.107 (0.108)	-0.442 (0.347)	-0.099 (0.269)				0.062 (0.120)	-0.210 (0.198)	-0.025 (0.141)
Landlocked Dummy Variable	0.080 (0.087)	0.047 (0.179)	0.068 (0.100)				0.055 (0.094)	0.086 (0.148)	0.074 (0.095)
Logarithm of Land Area	-0.011 (0.020)	-0.057 (0.048)	-0.028 (0.031)				-0.025 (0.023)	-0.067 ^c (0.039)	-0.041 (0.027)
Latitude				-0.002 (0.002)	0.003 ^c (0.002)	-0.001 (0.002)	-0.003 (0.002)	-0.002 (0.003)	-0.002 (0.002)
Fraction of Land in Tropical Desert				0.028 (0.152)	0.389 (0.329)	0.240 (0.226)	0.081 (0.142)	0.582 ^c (0.345)	0.307 (0.239)
Fraction of Land in Temperate Desert				-0.136 (0.582)	0.808 (0.904)	0.162 (0.636)	0.136 (0.567)	1.044 (0.968)	0.498 (0.647)
Fraction of Population with Malaria				0.014 (0.112)	0.379 (0.306)	0.241 (0.211)	0.015 (0.103)	0.439 (0.312)	0.232 (0.211)
Constant	-0.643 (0.680)	-0.233 (1.311)	-0.735 (0.774)	-0.945 ^a (0.256)	-1.077 ^b (0.534)	-1.274 ^a (0.365)	-0.089 (0.871)	1.245 (1.163)	-0.133 (0.874)
R-squared	0.70			0.64	0.19		0.70	0.27	

Heteroskedasticity-consistent standard errors in parentheses

Statistically significant at 1 percent is denoted by “a”, 5 percent by “b”, 10 percent by “c”.

Table 3 (Cont'd)
Relationship of Factor Productivities with Institutions and Geography
IV Estimates
(Capital Productivity)

<u>Right-hand-side Variable</u>	<u>Regressions</u>								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Property Rights	0.847 ^b (0.381)		1.163 ^c (0.693)	1.053 ^a (0.352)		1.022 ^b (0.421)	0.921 ^b (0.374)		1.045 ^b (0.472)
Democracy		0.811 -0.626	-0.534 -0.970		0.786 ^c -0.470	0.063 -0.501		0.621 -0.513	-0.241 -0.598
Proximity to Large Markets	0.032 (0.057)	0.005 (0.073)	0.018 (0.064)				-0.080 (0.065)	-0.155 ^a (0.058)	-0.078 (0.062)
Fraction of Land Near Coast	-0.041 (0.114)	-0.217 (0.210)	0.085 (0.257)				-0.056 (0.118)	-0.155 (0.134)	-0.029 (0.132)
Landlocked Dummy Variable	-0.074 (0.092)	-0.084 (0.109)	-0.066 (0.095)				-0.121 (0.092)	-0.119 (0.101)	-0.127 (0.089)
Logarithm of Land Area	-0.016 (0.021)	-0.030 (0.029)	-0.005 (0.029)				-0.027 (0.023)	-0.041 (0.027)	-0.023 (0.025)
Latitude				-0.002 (0.002)	0.000 (0.001)	-0.002 (0.002)	-0.005 (0.002)**	-0.005 ^b (0.002)	-0.005 ^b (0.002)
Fraction of Land in Tropical Desert				-0.044 (0.143)	0.060 (0.231)	-0.025 (0.201)	0.016 (0.139)	0.132 (0.234)	-0.057 (0.224)
Fraction of Land in Temperate Desert				-0.233 (0.546)	0.164 (0.634)	-0.206 (0.565)	-0.218 (0.557)	0.039 (0.657)	-0.334 (0.606)
Fraction of Population with Malaria				0.161 (0.105)	0.260 (0.215)	0.181 (0.187)	0.177 (0.101)*	0.248 (0.212)	0.107 (0.198)
Constant	-0.012 (0.716)	0.487 (0.795)	0.044 (0.740)	-0.126 (0.240)	-0.041 (0.374)	-0.154 (0.324)	1.011 (0.855)	1.967 ^b (0.790)	1.025 (0.819)

Heteroskedasticity-consistent standard errors in parentheses

Statistically significant at 1 percent is denoted by "a", 5 percent by "b", 10 percent by "c".

Table 4
Relationship of Skilled and Unskilled Workers' Productivity with Institutions and Geography
OLS Estimates
(Primary Education)

<u>Right-hand-side Variable</u>	<u>Regressions</u>								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Property Rights	0.643 ^a (0.164)		0.638 ^a (0.153)	0.841 ^a (0.132)		0.807 ^a (0.126)	0.657 ^a (0.180)		0.648 ^a (0.174)
Democracy		0.257 ^b (0.104)	0.006 (0.061)		0.392 ^a (0.139)	0.082 (0.087)		0.241 ^c (0.136)	0.021 (0.083)
Proximity to Large Markets	-0.096 ^a (0.032)	-0.154 ^a (0.028)	-0.096 ^a (0.032)				-0.118 (0.084)	-0.181 ^b (0.074)	-0.118 (0.085)
Fraction of Land Near Coast	0.1 (0.083)	0.059 (0.106)	0.098 (0.091)				0.093 (0.067)	0.042 (0.084)	0.091 (0.069)
Landlocked Dummy Variable	0.038 (0.053)	0.035 (0.058)	0.038 (0.053)				0.026 (0.042)	0.02 (0.047)	0.027 (0.042)
Logarithm of Land Area	0.023 ^c (0.014)	0.021 (0.018)	0.023 (0.014)				0.022 ^c (0.012)	0.017 (0.017)	0.022 ^c (0.012)
Latitude				0.002 ^b (0.001)	0.004 ^a (0.001)	0.002 ^b (0.001)	-0.001 (0.003)	-0.001 (0.003)	-0.001 (0.003)
Fraction of Land in Tropical Desert				-0.087 ^b (0.042)	-0.095 (0.082)	-0.062 (0.049)	-0.048 (0.078)	-0.038 (0.094)	-0.041 (0.076)
Fraction of Land in Temperate Desert				0.176 (0.280)	0.408 (0.358)	0.209 (0.273)	-0.016 (0.221)	0.063 (0.252)	-0.006 (0.227)
Fraction of Population with Malaria				0.004 (0.034)	-0.017 (0.070)	0.032 (0.050)	0.035 (0.035)	0.009 (0.061)	0.041 (0.044)
Constant	0.176 (0.226)	0.932 ^a (0.293)	0.176 (0.226)	-0.401 ^a (0.082)	-0.148 (0.108)	-0.443 ^a (0.104)	0.371 (0.838)	1.235 (0.745)	0.365 (0.851)
R-squared	0.63	0.53	0.63	0.57	0.39	0.57	0.64	0.54	0.64

Heteroskedasticity-consistent standard errors in parentheses

Statistically significant at 1 percent is denoted by "a", 5 percent by "b", 10 percent by "c".

Table 4 (Cont'd)
 Relationship of Skilled and Unskilled Workers' Productivity with Institutions and Geography
 OLS Estimates
 (Secondary Education)

<u>Right-hand-side Variable</u>	<u>Regressions</u>								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Property Rights	1.311 ^a (0.164)		1.182 ^a (0.213)	1.331 ^a (0.169)		1.299 ^a (0.196)	1.177 ^a (0.182)		1.139 ^a (0.201)
Democracy		0.643 ^a -0.131	0.179 -0.100		0.578 ^b -0.223	0.078 -0.200		0.481 ^b -0.216	0.095 -0.200
Proximity to Large Markets	-0.053 ^c (0.029)	-0.160 ^a (0.030)	-0.051 ^c (0.029)				-0.129 ^a (0.036)	-0.240 ^a (0.044)	-0.129 ^a (0.036)
Fraction of Land Near Coast	0.110 (0.093)	-0.004 (0.134)	0.068 (0.099)				0.007 (0.107)	-0.091 (0.141)	-0.004 (0.107)
Landlocked Dummy Variable	0.094 (0.080)	0.086 (0.094)	0.091 (0.078)				0.046 (0.080)	0.038 (0.103)	0.049 (0.082)
Logarithm of Land Area	-0.005 (0.026)	-0.013 (0.041)	-0.009 (0.027)				-0.025 (0.027)	-0.035 (0.043)	-0.027 (0.028)
Latitude				0.000 (0.001)	0.003 ^b (0.002)	0.000 (0.001)	-0.004 ^b (0.002)	-0.004 ^c (0.002)	-0.004 ^b (0.002)
Fraction of Land in Tropical Desert				-0.116 (0.073)	-0.146 (0.138)	-0.092 (0.092)	-0.008 (0.089)	0.027 (0.134)	0.022 (0.103)
Fraction of Land in Temperate Desert				-0.040 (0.410)	0.313 (0.518)	-0.008 (0.423)	0.078 (0.409)	0.244 (0.442)	0.124 (0.407)
Fraction of Population with Malaria				-0.139 ^b (0.059)	-0.191 (0.135)	-0.113 (0.086)	-0.101 (0.062)	-0.128 (0.121)	-0.071 (0.085)
Constant	-0.029 (0.385)	1.387 ^b (0.630)	-0.012 (0.376)	-0.417 ^a (0.114)	0.017 (0.202)	-0.457 ^a (0.137)	1.048 ^c (0.568)	2.553 ^a (0.899)	1.024 ^c (0.581)
R-squared	0.71	0.55	0.72	0.70	0.46	0.70	0.74	0.58	0.74

Heteroskedasticity-consistent standard errors in parentheses

Statistically significant at 1 percent is denoted by "a", 5 percent by "b", 10 percent by "c".

Table 5
 Relationship of Skilled and Unskilled Workers' Productivity with Institutions and Geography
 IV Estimates
 (Primary Education)

<u>Right-hand-side Variable</u>	<u>Regressions</u>								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Property Rights	1.446 ^a (0.455)		1.441 ^b (0.574)	1.560 (0.397)		1.457 ^a (0.382)	1.475 ^a (0.437)		1.459 ^a (0.419)
Democracy		1.675 ^b (0.803)	0.008 (0.803)		1.237 ^a (0.310)	0.206 (0.455)		1.234 ^a (0.461)	0.030 (0.531)
Proximity to Large Markets	0.011 (0.059)	-0.006 (0.081)	0.011 (0.053)				-0.024 (0.094)	-0.132 (0.085)	-0.024 (0.055)
Fraction of Land Near Coast	0.067 (0.111)	-0.310 (0.274)	0.065 (0.213)				0.130 (0.097)	-0.050 (0.160)	0.127 (0.117)
Landlocked Dummy Variable	0.038 (0.068)	0.015 (0.137)	0.038 (0.079)				0.044 (0.064)	0.056 (0.083)	0.045 (0.079)
Logarithm of Land Area	0.019 (0.019)	-0.012 (0.041)	0.019 (0.024)				0.023 (0.016)	-0.003 (0.037)	0.022 (0.022)
Latitude				0.000 (0.001)	0.004 ^a (0.001)	0.000 (0.001)	0.000 (0.003)	0.000 (0.003)	0.000 (0.002)
Fraction of Land in Tropical Desert				0.050 (0.083)	0.232 ^c (0.121)	0.110 (0.182)	0.049 (0.086)	0.321 ^b (0.157)	0.058 (0.199)
Fraction of Land in Temperate Desert				0.096 (0.308)	0.709 ^c (0.391)	0.181 (0.512)	0.042 (0.314)	0.578 (0.458)	0.056 (0.538)
Fraction of Population with Malaria				0.165 ^c (0.095)	0.342 ^b (0.144)	0.230 (0.169)	0.181 ^b (0.091)	0.387 ^b (0.167)	0.190 (0.176)
Constant	-1.105 (0.728)	-0.558 (0.876)	-1.106 ^c (0.612)	-0.881 ^a (0.261)	-0.813 ^a (0.239)	-0.974 ^a (0.294)	-0.979 (1.067)	0.334 (0.998)	-0.980 (0.727)

Heteroskedasticity-consistent standard errors in parentheses

Statistically significant at 1 percent is denoted by "a", 5 percent by "b", 10 percent by "c".

Table 5 (Cont'd)
Relationship of Skilled and Unskilled Workers' Productivity with Institutions and Geography
IV Estimates
(Secondary Education)

<u>Right-hand-side Variable</u>	<u>Regressions</u>								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Property Rights	1.505 ^a (-0.329)		0.942 -0.689	1.843 ^a (-0.363)		1.426 ^a (-0.446)	1.603 ^a (-0.362)		1.102 ^b (-0.491)
Democracy		2.041 ^a (0.759)	0.951 (0.964)		1.845 ^a (0.399)	0.836 (0.531)		1.885 ^a (0.553)	0.976 (0.622)
Proximity to Large Markets	-0.027 (0.044)	-0.013 (0.082)	-0.002 (0.063)				-0.080 (0.050)	-0.171 ^a (0.053)	-0.090 (0.065)
Fraction of Land Near Coast	0.102 (0.096)	-0.368 (0.273)	-0.123 (0.255)				0.026 (0.109)	-0.220 (0.239)	-0.087 (0.137)
Landlocked Dummy Variable	0.094 (0.080)	0.066 (0.155)	0.081 (0.095)				0.056 (0.081)	0.089 (0.142)	0.080 (0.093)
Logarithm of Land Area	-0.007 -0.024	-0.046 -0.057	-0.026 -0.029				-0.025 -0.024	-0.064 -0.071	-0.045 ^c (-0.026)
Latitude				-0.002 -0.002	0.003 -0.002	-0.001 -0.002	-0.003 ^b (-0.002)	-0.003 -0.003	-0.003 -0.002
Fraction of Land in Tropical Desert				-0.018 (0.102)	0.345 ^b (0.172)	0.226 (0.213)	0.042 (0.097)	0.534 ^b (0.249)	0.336 (0.233)
Fraction of Land in Temperate Desert				-0.096 (0.420)	0.765 (0.523)	0.247 (0.598)	0.108 (0.420)	0.972 (0.612)	0.579 (0.630)
Fraction of Population with Malaria				-0.025 (0.098)	0.347 ^c (0.184)	0.237 (0.198)	-0.024 (0.090)	0.407 ^c (0.231)	0.258 (0.206)
Constant	-0.338 (0.605)	-0.080 (1.008)	-0.439 (0.735)	-0.759 ^a (0.242)	-0.980 ^a (0.293)	-1.138 ^a (0.343)	0.345 (0.745)	1.279 (1.105)	0.287 (0.852)

Heteroskedasticity-consistent standard errors in parentheses

Statistically significant at 1 percent is denoted by "a", 5 percent by "b", 10 percent by "c".

Figure 1: Labor and Capital Productivity

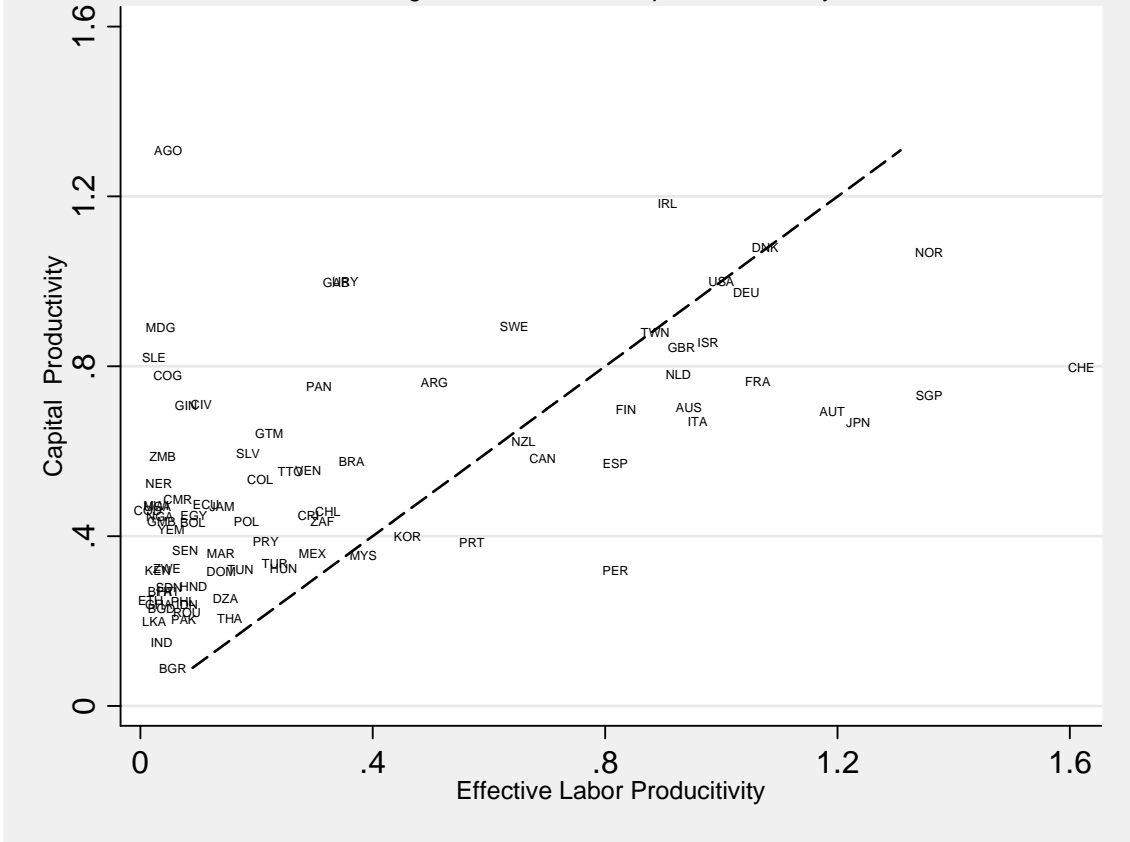


Figure 2: Total Factor Productivity and Trade Productivity

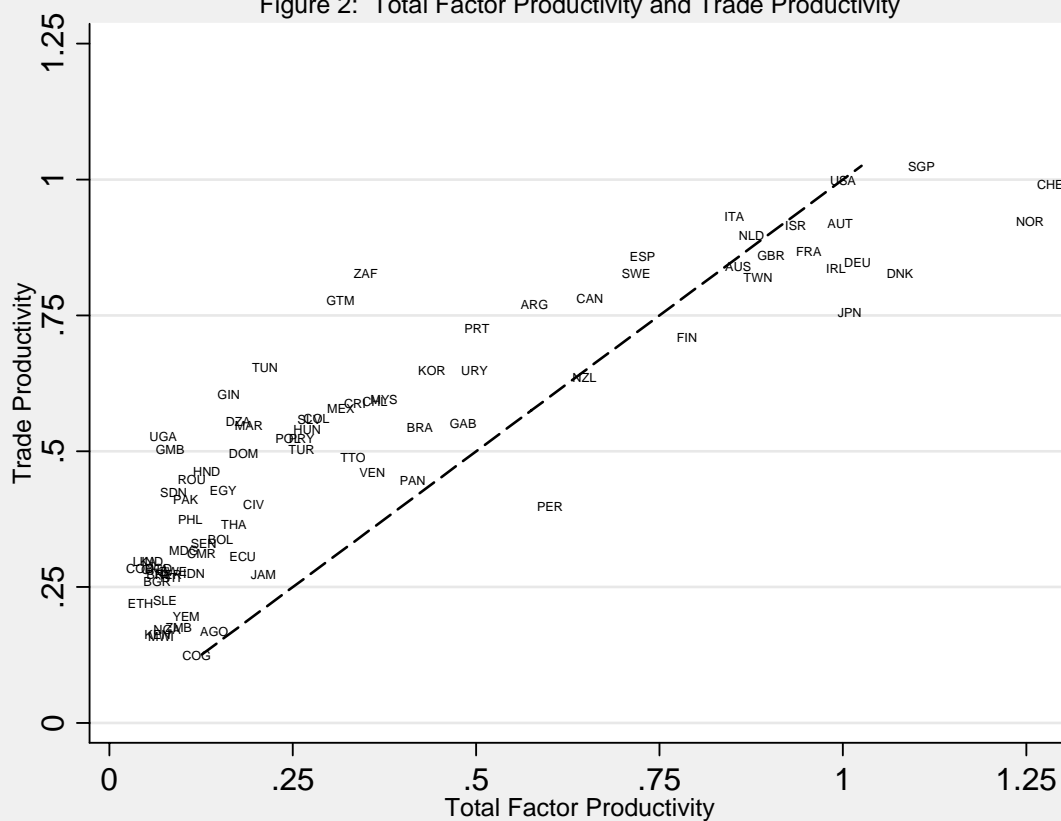


Figure 3: Productive Geography, Labor, and Capital Productivity

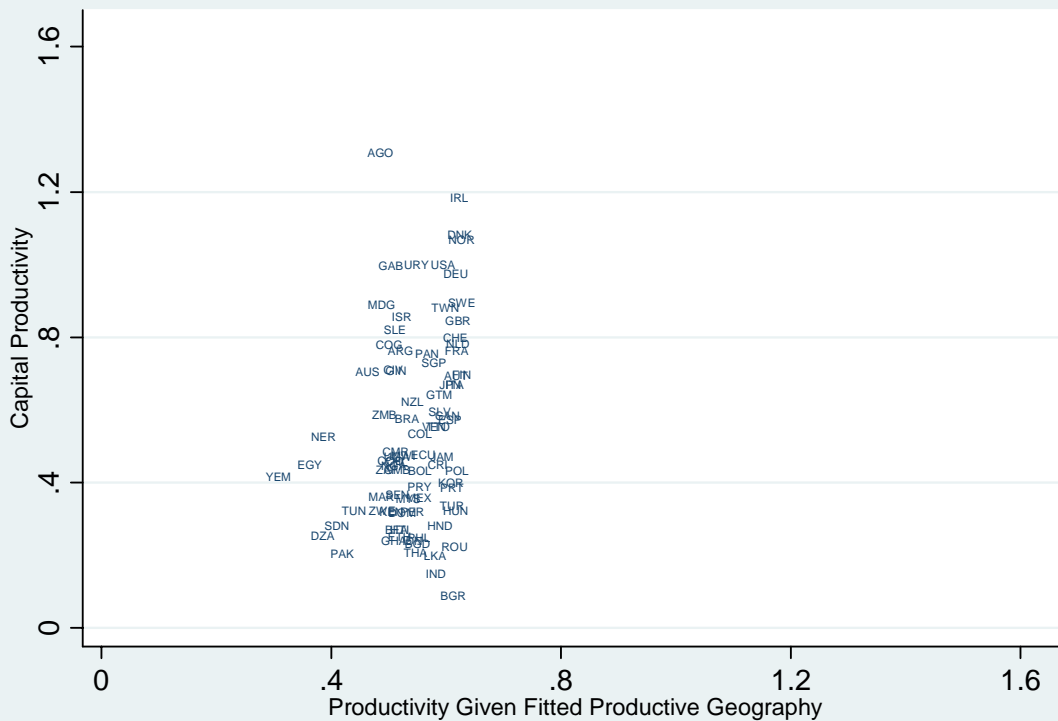
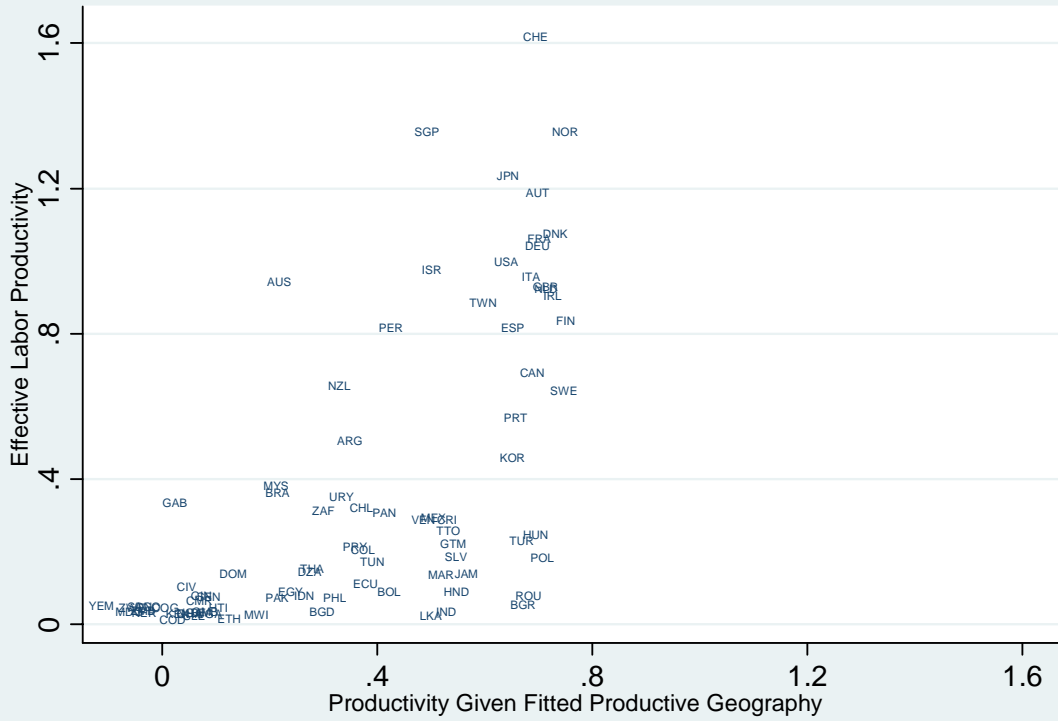


Figure 4: Market Geography, Labor, and Capital Productivity

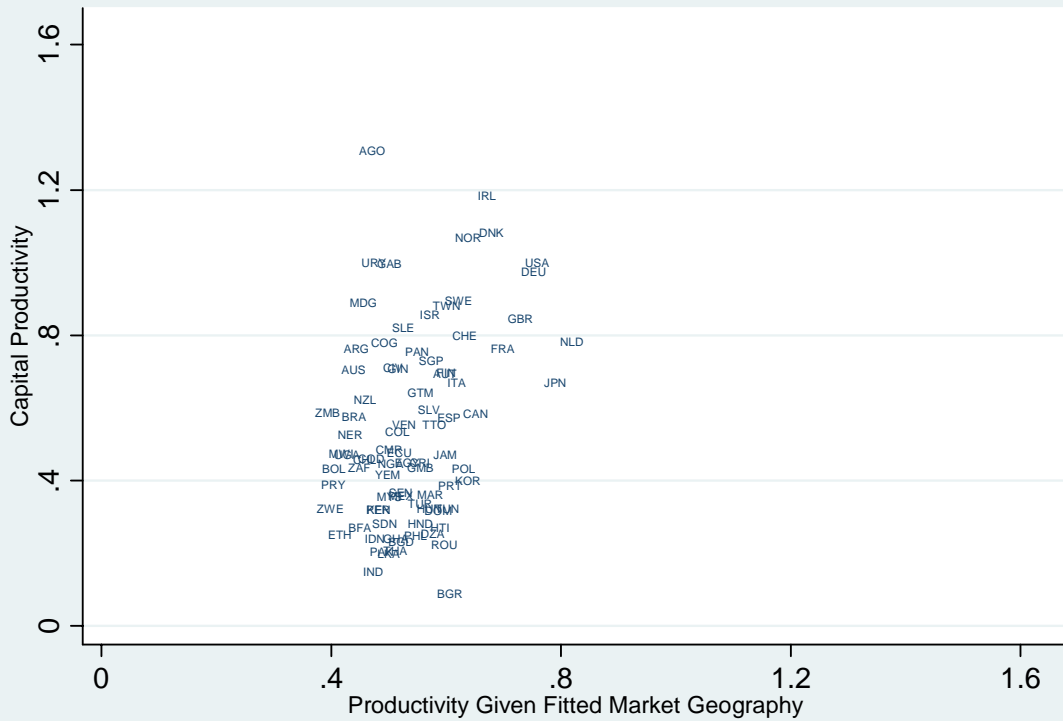
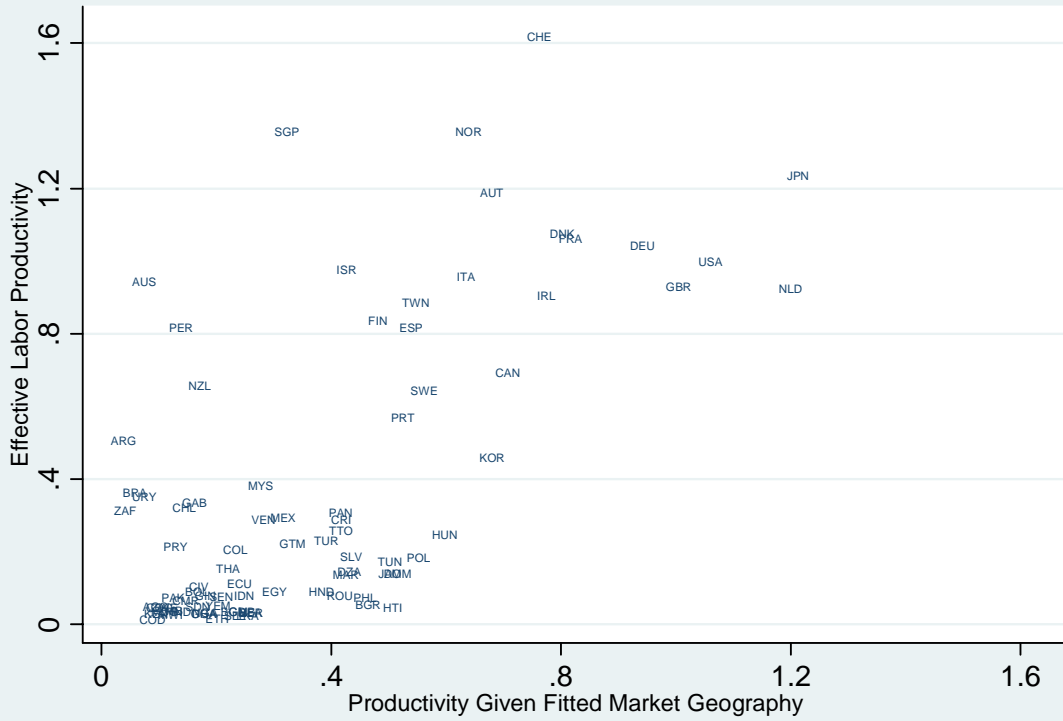
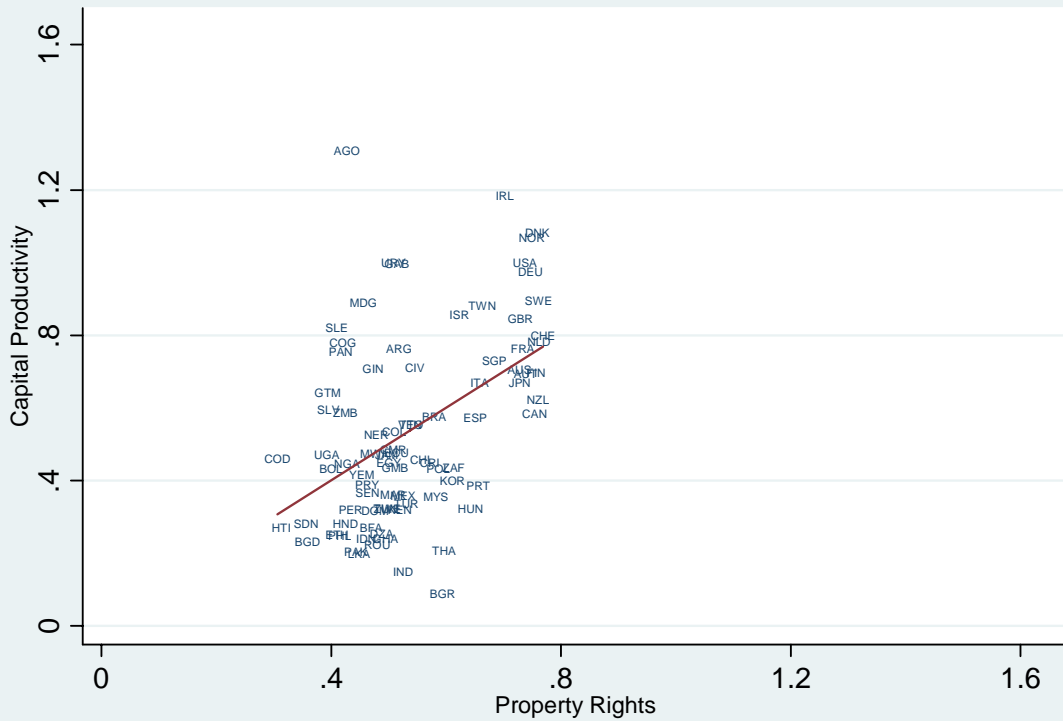
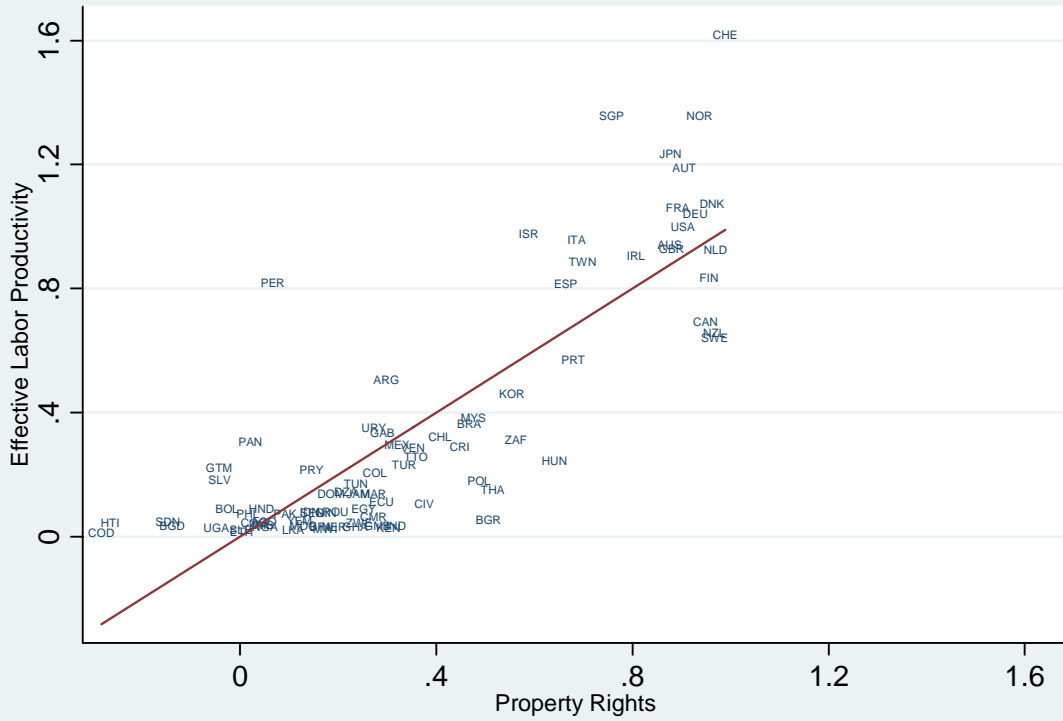


Figure 5: Property Rights, Labor, and Capital Productivity



Appendix Table 1
Countries (84) Included in Empirical Analysis

Algeria	Haiti	Senegal
Angola	Honduras	Sierra Leone
Argentina	Hungary	Singapore
Australia	India	South Africa
Austria	Indonesia	Spain
Bangladesh	Ireland	Sri Lanka
Bolivia	Israel	Sudan
Brazil	Italy	Sweden
Bulgaria	Ivory Coast	Switzerland
Burkina Faso	Jamaica	Tawain
Cameroon	Japan	Thailand
Canada	Kenya	Trinidad and Tobago
Chile	Korea, Rep.	Tunisia
Colombia	Madagascar	Turkey
Congo	Malawi	Uganda
Congo, Democratic Republic	Malaysia	United Kingdom
Costa Rica	Mexico	United States
Denmark	Morocco	Uruguay
Dominican Republic	Netherlands	Venezuela, RB
Ecuador	New Zealand	Yemen, Rep.
Egypt, Arab Rep.	Niger	Zambia
El Salvador	Nigeria	Zimbabwe
Ethiopia	Norway	
Finland	Pakistan	
France	Panama	
Gabon	Paraguay	
Gambia	Peru	
Germany	Philippines	
Ghana	Poland	
Guatemala	Portugal	
Guinea	Romania	

Appendix Table 2
Industries (32) Included in Empirical Analysis

Industry	BEA Code
Food and Kindred Products	14
Tobacco	15
Apparel	16, 17 18, 19
Pulp, Paper and Allied Products	24, 25
Printing and Publishing	26A, 26B
Drugs	29A
Soaps, Cleaners and Toilet Goods	29B
Agricultural Chemicals	27B
Industrial Chemicals and Synthetics	27A
Rubber and Plastic Products	32
Primary Metals	37
Non-Ferrous Metals	38
Fabricated Metals	38, 40,41,42
Farm Machines	44,45
Construction, Mining Equipment	46
Computers	51
Other Non-Electrical Equipment	43, 47,48,49,50,52
Household Appliances	54
Household Video	56
Electrical Components	57
Other Electrical	53,55,58
Motor Vehicle	59A, 59b
Other Transport	60, 61
Lumber, Wood, Furniture	20, 21, 22, 23
Stone and Clay	36
Glass	35
Instruments	62, 63
Other Manufactures	64
Agriculture	01, 02, 03, 04
Mining	05, 06, 07, 09, 10
Gas/Oil	08
Construction	11, 12



Institute for International Integration Studies

The Sutherland Centre, Trinity College Dublin, Dublin 2, Ireland

