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NATURAL RESOURCES AND ECONOMIC GROWTH: FROM DEPENDENCE TO DIVERSIFICATION

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ABSTRACT

Natural Resources and Economic Growth: From Dependence to Diversification*

This Paper reviews the relationship between natural resource dependence and economic growth, and stresses how natural capital intensity tends to crowd out foreign capital, social capital, human capital, physical capital, and financial capital, thereby impeding economic growth across countries. Specifically, the Paper presents empirical cross-country evidence to the effect that nations that depend heavily on their natural resources tend to have (a) less trade and foreign investment, (b) more corruption, (c) less equality, (d) less political liberty, (e) less education, (f) less domestic investment, and (g) less financial depth than other nations that are less well endowed with, or less dependent on, natural resources. This matters for long-run growth because empirical evidence also suggests that trade, honesty, equality, liberty, education, investment, and financial maturity are all positively and significantly related to economic growth across countries. Before concluding, the Paper briefly compares and contrasts the experience of the OPEC countries with that of Norway, a singularly successful oil producer.

JEL Classification: O11
Keywords: economic growth and natural resources

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Submitted 01 December 2004

I. Introduction

This paper reviews some aspects of the experience of natural-resource-rich countries around the world since the 1960s. The discussion will emphasize five main channels through which natural resource intensity appears to have inhibited economic growth across countries. By natural resource intensity is meant the extent to which a country depends on its natural resources. Resource abundance *per se* need not do any harm: many countries have abundant natural resources and have managed to outgrow their dependence on them by diversifying their economic activity. An important challenge to policy makers in many developing countries with abundant natural resources is to find ways to reduce their dependence on these resources, through successful diversification of economic activity. The paper offers some suggestions along these lines. As we proceed, an attempt will be made to provide a glimpse of some of the empirical results that have emerged in recent years from studies of the cross-country relationships between natural resource dependence and economic growth and various key determinants of growth across the world. Even if the evidence reviewed below is exclusively cross-sectional, it reflects a general pattern that accords well with a number of historical case studies of individual resource-rich countries.[1] This broad review is followed by a brief discussion of the disappointing economic growth record of the OPEC countries, and then by a brief discussion also of the lessons that may be drawn from Norway's singularly successful management of its oil wealth.

II. Five Channels: Theory and Evidence

The structure of recent models of the relationship between natural resource intensity and economic growth is nearly always the same. An abundance of or heavy dependence on natural resources is taken to influence some variable or mechanism "X" which impedes growth. An important challenge for economic growth theorists and empirical workers in the field is to identify and map these intermediate variables and mechanisms. This paper is an attempt in this direction.

To date, five main channels of transmission from natural resource abundance to slow economic growth have been suggested in the literature.[2] As we shall see, these channels can be described in terms of crowding out: a heavy dependence on natural

[1] For a number of such case studies, see Auty (2001).
[2] This discussion draws on and extends Gylfason and Zoega (2001).

capital, it will be argued, tends to crowd out other types of capital and thereby inhibit economic growth. Let us now consider the five channels one by one.

Channel 1: The Dutch disease and foreign capital

An overvalued currency was the first symptom associated with the Dutch disease following the discovery of natural gas deposits within the jurisdiction of the Netherlands in the North Sea in the late 1950s and early 1960s, but subsequently several other symptoms came to light. Natural resource dependence is, as a rule, accompanied by booms and busts: the prices of raw materials fluctuate a great deal in world markets, and so do supplies. The resulting fluctuations in export earnings trigger exchange rate volatility, perhaps no less so under fixed exchange rates than under floating rates. Unstable exchange rates create uncertainty that can be harmful to exports and other trade, including foreign investment. Further, the Dutch disease can strike even in countries that do not have their own national currency. In this case, the natural-resource-based industry is able to pay higher wages and also higher interest rates than other export and import-competing industries, thus making it difficult for the latter to remain competitive at world market prices. This problem can become particularly acute in countries with centralized wage bargaining (or with oligopolistic banking systems, for that matter) where the natural-resource-based industries set the tone in nation-wide wage negotiations and dictate wage settlements and banking arrangements that other industries can ill afford.[3]

In one or all of these ways, the Dutch disease tends to reduce the level of total exports or bias the composition of exports away from those kinds of high-tech or high-value-added manufacturing and service exports that may be particularly good for growth over time. Exports of capital – i.e., inward foreign direct investment (FDI) – may also suffer in the same way. The mechanism is essentially the same. In other words, natural capital tends to crowd out foreign capital, broadly speaking.

These linkages seem to accord well with the experience of the Arab world, a natural place to start an empirical overview of the macroeconomic consequences of abundant natural resources. Figure 1 presents relevant empirical evidence for two groups of Arab countries, a group of six countries that do not belong to the Organization of Petroleum Exporting Countries, OPEC (Egypt, Jordan, Morocco,

[3] Greenland, which uses the Danish krone, is a case in point (Paldam, 1997). Greenland's fishing industry dominates the national economy to the virtual exclusion of other manufacturing.

Sudan, Syria, and Tunisia) and a group of six OPEC countries (Algeria, Iran, Kuwait, Libya, Saudi Arabia, and United Arab Emirates).[4] Figure 1a shows that the nonoil-producing countries have achieved, on average, a significant increase in their total exports relative to GDP since 1960. Meanwhile, the total exports of the oil-producing countries have declined as a proportion of GDP. Hence, oil exports appear to have crowded out nonoil exports.

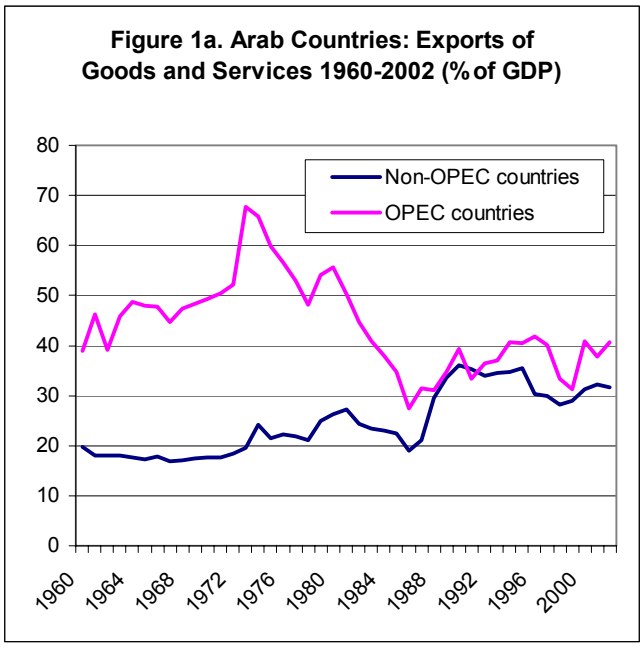
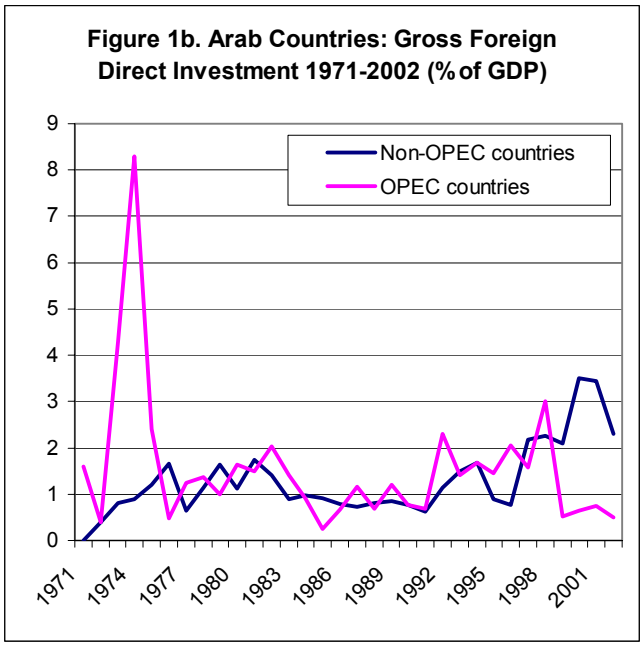
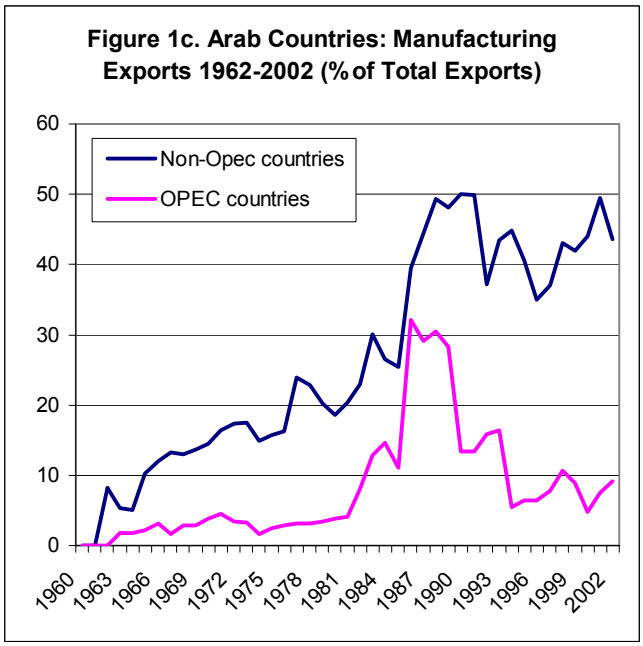


Figure 1b tells a similar story about FDI, but here the pattern is less clear. In the nonoil-producing Arab countries, gross FDI hovered around one percent of GDP until the late 1990s, and then increased to two to three percent of GDP. In the oil-producing countries, foreign investment relative to GDP exhibited a similar pattern until the late 1990s (except for the boom in FDI in Saudi Arabia following the first oil price hike in 1973-1974), and then fell below one percent of GDP.

Figure 1c shows that the share of manufacturing exports in total merchandise exports in the nonoil-producing Arab countries increased from about ten percent in the 1960s to 40-50 percent in the 1990s, while the same ratio has hovered around ten percent in the oil-producing Arab countries without showing a strong tendency to rise over time.

[4] Some of the countries in the first group, especially Egypt and Tunisia, produce and export oil, but they do so on a smaller scale than OPEC countries in the second group.





These things matter because exports and foreign investment are good for growth (Frankel and Romer, 1999). Openness to trade and investment stimulates imports of goods and services, capital, technology, ideas, and know-how. Furthermore, too much primary-export dependence and too little manufacturing may hurt economic growth over the long haul. The upshot of this is that the Dutch disease is a matter of concern mainly because of its potentially deleterious consequences for economic growth.

What is the empirical evidence from other parts of the world? Figure 2a shows a scatterplot of natural resource intensity and openness to external trade around the

world. The figure covers 85 countries. Natural resource intensity, which is measured along the horizontal axis, is measured by the share of natural capital in national wealth in 1994 – i.e., the share of natural capital in total capital, which comprises physical, human, and natural capital (but not social or financial capital; see World Bank, 1997). The natural capital share used here is close to the source: it is intended to come closer to a direct measurement of the intensity of natural resources across countries than the various proxies that have been used in earlier studies, mainly the share of primary (i.e., nonmanufacturing) exports in total exports or in gross domestic product (GDP) and the share of the primary sector in employment or the labor force.[5] The latter proxies may be prone to bias due to product and labor market distortions.

Openness on the vertical axis of Figure 2a is defined as the difference between the actual average ratio of exports to GDP over the period under review, 1965-1998, and the export ratio predicted by a linear regression of the average export ratio on the logarithm of the average population (in thousands) across countries to adjust for country size. This adjustment is made to reflect the fact that large countries are less dependent on foreign trade than smaller ones that need to extend their home markets beyond their national borders to make up for their small size. This indicator of openness is larger than zero for countries that are more open to trade than their size predicts, and smaller than zero for countries that are less open to trade than their size predicts. The 85 countries in the sample are represented by one observation each for each variable under study.

The regression line through the scatterplot in Figure 2a suggests that an increase of ten percentage points in the natural capital share from one country to another is associated with a decrease in the openness indicator by about four percent of GDP on average. The relationship is economically as well as statistically significant; Spearman's rank correlation is -0.31.[6] Given existing evidence that foreign trade is good for growth, Figure 2a suggests that natural resource intensity may hurt growth

[5] The year 1994 is the only year for which the World Bank has as yet produced data on natural capital, for 92 countries. In most cases, however, natural capital in 1994 is probably a pretty good proxy for natural resource abundance or intensity in the period under review, 1965-1998. There are some exceptions, true, but even so all the empirical results reported in this paper can be reproduced without significant deviations by using the average share of primary exports in total exports or GDP or the average share of the primary sector in total employment during 1965-1998 rather than natural capital in 1994 as a proxy for natural resource abundance, and also by measuring growth in terms of GNP per worker rather than GNP per capita.

[6] Because it is based on ranks rather than on actual values, the Spearman correlation is less sensitive to outliers than is the more commonly used Pearson correlation.

by harming trade.

Figure 2a. Natural Resource Intensity and Openness to Foreign Trade 1965-1998

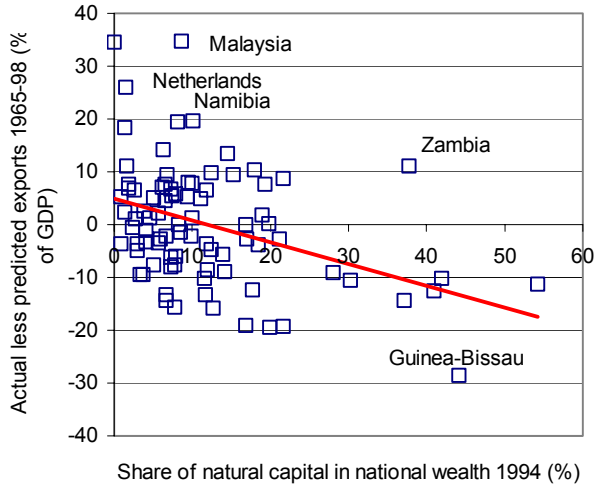
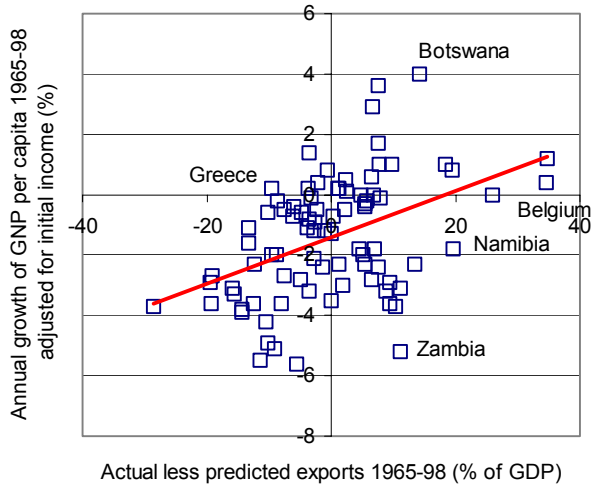


Figure 2b. Openness to Foreign Trade and Economic Growth 1965-1998



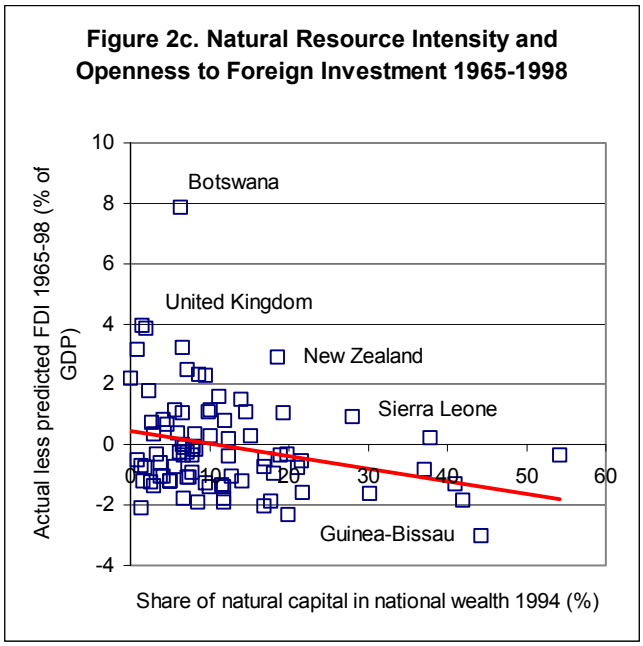
It needs to be emphasized that no conclusions are being drawn here as to cause and effect. Figure 2a is only intended to display the data in a way that accords with the results of multivariate regression analyses that can help account for more potential determinants of exports and openness to trade (Gylfason, 1999), and where an attempt was made to distinguish cause from effect. The same disclaimer applies to all the figures that follow. Even so, the study of bivariate cross-sectional relationships has

many shortcomings. For one thing, such studies bypass the diversity of individual country experiences. For another, they do not account for economic developments over time, as panel studies are designed to do.

Figure 2b shows a scatterplot of openness as defined above and economic growth per capita from 1965 to 1998. The figure covers the same 85 countries as before. The growth rate has been adjusted for initial income: the variable on the vertical axis is that part of economic growth that is not explained by the country's initial stage of development, obtained from a regression of growth during 1965-1998 on the logarithm of initial GNP per capita (i.e., in 1965) as well as natural capital. The regression line through the scatterplot in Figure 2b suggests that an increase of 14 percentage points in the openness indicator from one country to another is associated with an increase in per capita growth by one percentage point per year on average. The relationship is thus economically as well as statistically significant; Spearman's rank correlation is 0.40. The data thus seem to support the time-honored view that openness to foreign trade is good for growth.

Taking Figures 2a and 2b together, we see that an increase in the natural capital share by ten percentage points goes along with a four point decrease in the index of openness to foreign trade which, in turn, goes hand in hand with a decrease in annual per capita growth by about 0.3 percentage points.

How about openness to foreign direct investment? Figure 2c suggests that the natural capital share varies inversely with openness to gross FDI across the same 85 countries as before. The indicator of openness to FDI is defined in the same way as the corresponding indicator of openness to foreign trade, i.e., as the as the difference between the actual average ratio of gross FDI to GDP over the period under review, 1965-1998, and the FDI ratio predicted by a linear regression of the average FDI ratio on the logarithm of the average population (in thousands) across countries to adjust for country size. The relationship between natural resource intensity and openness to FDI is not very strong, true, but it is nonetheless economically as well as statistically significant. Notice that no country with a natural capital share above 20 percent has an FDI index above one percent of GDP. The slope of the regression line through the scatterplot suggests that an increase in the natural capital share by ten percentage points goes along with a decrease in the FDI index by 0.4 percent of GDP; the rank correlation is -0.24.



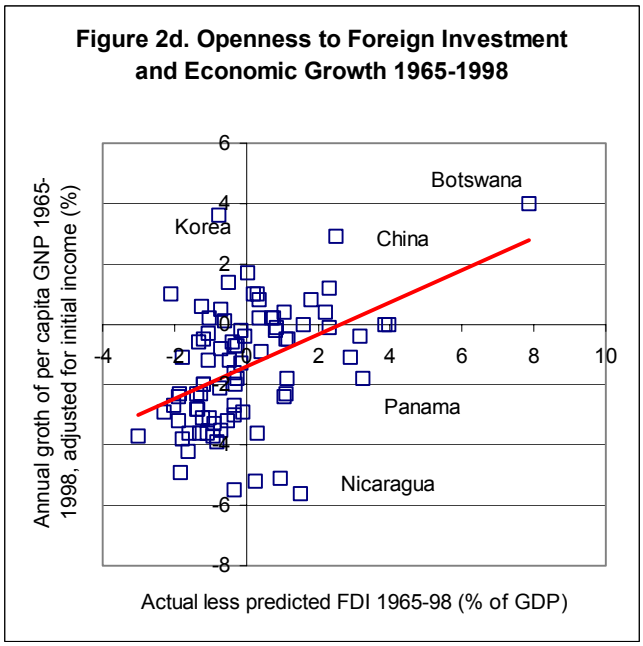


Figure 2d shows the relationship between openness to FDI and per capita growth from 1965 to 1998. Specifically, an increase in gross FDI by two percent of GDP goes along with an increase in per capita growth by one percentage point. The rank correlation is 0.44. Adding Figures 2c and 2d together, we see that an increase in the natural capital share by ten percentage points goes along with a decrease in the FDI index by 0.4 percent of GDP which, in turn, entails a decrease in annual per capita growth by about 0.2 percentage points.

In sum, then, since openness to foreign trade and investment is good for growth by

Figures 2b and 2d, Figures 2a and 2c suggests that natural resource dependence may hurt growth by harming foreign trade and investment.

Channel 2: Rent seeking and social capital

In second place, huge natural resource rents, especially in conjunction with ill-defined property rights, imperfect or missing markets, and lax legal structures in many developing countries and emerging market economies, may lead to rampant rent-seeking behavior on the part of producers, thus diverting resources away from more socially fruitful economic activity (Auty, 2001; Gelb, 1988). The combination of abundant natural resources, missing markets, and weak institutions may have quite destructive consequences. In extreme cases, civil wars break out – such as Africa's diamond wars – which not only divert factors of production from socially productive uses but also destroy societal institutions and the rule of law. In other, less extreme cases, the struggle for huge resource rents may lead to a concentration of economic and political power in the hands of elites that, once in power, use the rent to skew the distribution of income and wealth in their favor as well as to placate their political supporters and thus secure their hold on power, with inequality, stunted or weakened democracy, and slow growth as a result (Karl, 1997). Moreover, an abundance of natural resources may tempt foreign governments to invade with destructive consequences and the possibility of such an event may prompt the domestic authorities to spend vast resources on national defense. Large military expenditures tend to inhibit growth through their adverse effects on capital formation and resource allocation (Knight, Loayza, and Villaneuva, 1996).

Rent seeking can also take other, more subtle forms. For example, governments may be tempted to thwart markets by granting favored enterprises or individuals privileged access to common-property natural resources, as, for example, in Russia, or they may offer tariff protection or other favors to producers at public expense, creating competition for such favors among the rent seekers. Extensive rent seeking – i.e., seeking to make money from market distortions – can breed corruption in business and government, thus distorting the allocation of resources and reducing both economic efficiency and social equity. Empirical evidence and economic theory suggest that import protection (which is often extended to foreign capital as well as goods and services), cronyism, and corruption all tend to impede economic efficiency and growth (Bardhan, 1997; Mauro, 1995).

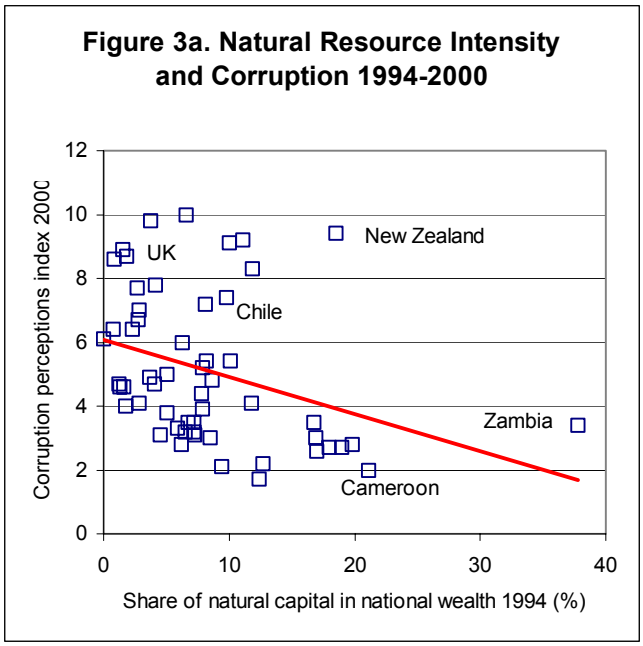
Furthermore, abundant natural resources may imbue people with a false sense of security and lead governments to lose sight of the need for good and growth-friendly economic management, including free trade, bureaucratic efficiency, and institutional quality (Sachs and Warner, 1999). Put differently, abundant natural capital may crowd out social capital, by which is meant the infrastructure and institutions of a society in a broad sense: its culture, cohesion, law, system of justice, rules and customs and so on, including trust (Woolcock, 1998; Paldam and Svendsen, 2000). Incentives to create wealth through good policies and institutions may wane because of the relatively effortless ability to extract wealth from the soil or the sea. Manna from heaven can be a mixed blessing. The argument can be extended to unconditional foreign aid. There are indications that natural-resource-rich countries are more dependent than others on foreign aid, which may actually exacerbate their economic predicament.

Let us now consider three different aspects of the corrosion of social capital that can follow from rent seeking, starting with corruption. Insofar as natural resource abundance involves public allocation of access to scarce common-property resources to private parties without payment, thereby essentially leaving the resource rent up for grabs, it is only to be expected that resource-rich countries may be more susceptible to corruption than others. What do the data say?

In Figure 3a, the share of natural capital in national wealth is plotted along the horizontal axis as before and the corruption perceptions index for the year 2000 along the vertical axis.[7] The figure covers 55 countries, all the countries from our original sample of 85 for which both data series are available. The corruption perceptions index (from Transparency International, Berlin) is constructed from information obtained from businessmen who are willing to report how often and how forcefully bribes and the like are demanded of them in various countries, and how high these are. The index extends from zero, in countries where corruption is greatest, to ten, where corruption is practically nonexistent (as, for example, in Finland and Denmark). The picture shows a clear and statistically significant relationship: corruption, as measured by this index, increases from one country to the next in accordance with the increase in natural resource intensity. When the share of natural capital in national wealth goes up by nine percentage points from one place to

[7] Corruption rankings for earlier years (1995-1999) give similar results.

another, the corruption perceptions index drops (i.e., corruption increases) by one point per year on the average, for given initial income. This is not a small effect – if it is an effect, that is, as opposed to a mere correlation. The pattern is quite significant; the rank correlation is -0.42.[8]



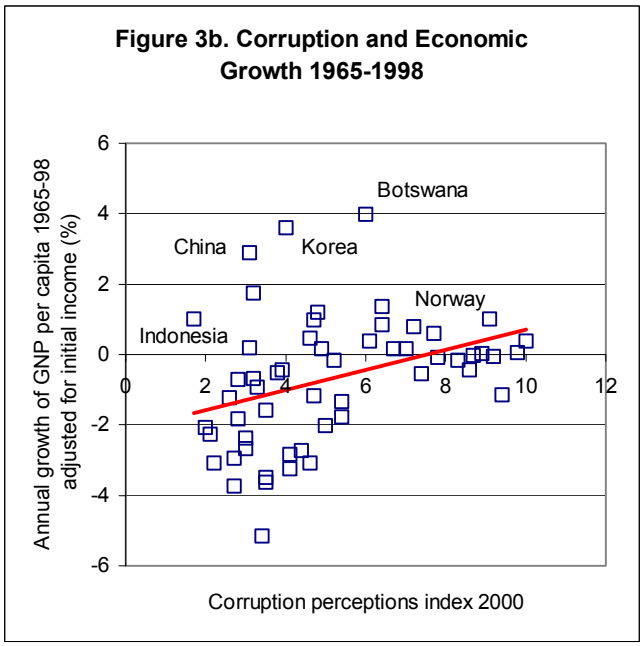


Figure 3b shows the pattern of corruption and economic growth across the same 55

[8] When the corruption perceptions index is purged of that part which is caused by initial income, the results remain unchanged.

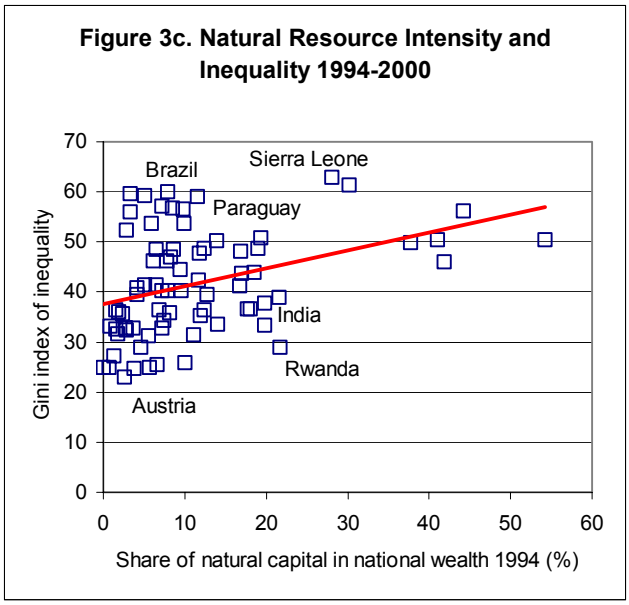
countries as in Figure 3a. We now measure corruption – or rather, honesty – along the horizontal axis and per capita growth along the vertical axis. There is a discernible tendency for honesty to go along with economic growth. The rank correlation is 0.42. A decrease in the corruption perceptions index by four points (i.e., increased corruption), corresponding to the corruption differential between the United States (7.8) and Turkey (3.8), is associated with a decrease in per capita growth by one percentage point. This result is the same as that reported by Mauro (1995) whose econometric evidence also suggests that a decrease in the corruption index by four points from one country to the next is associated with a reduction in per capita growth of one percentage point per year on the average. Corruption does not pay, at least not in a macroeconomic perspective.

Taking Figures 3a and 3b together, we see that an increase in the natural capital share by 36 percentage points goes hand in hand with a decrease in the corruption perceptions index by four points (Figure 3a), which in turn goes along with a decrease in per capita growth by one percentage point per year on the average, for given initial income (Figure 3b). Here we have another possible reason why natural resource intensity appears to inhibit economic growth across countries.

Next, consider income inequality. There are two schools of thought about the relationship between inequality and economic growth. Some claim that inequality is good for growth because too much equality weakens incentives to work, save, and acquire an education. Others think that inequality is bad for growth because too much inequality reduces social cohesion and creates conflict. What do the data say?

Figure 3c shows that the share of natural capital in national wealth is positively correlated with income inequality as measured by the Gini coefficient; the rank correlation is 0.41. The Gini index measures the extent to which income (or, in some cases, consumption) among individuals or households within an economy deviates from a perfectly equal distribution. A Gini index of zero represents perfect equality while a Gini index of 100 means perfect inequality.[9] Notice that no country with a natural capital share above 25 percent has a Gini coefficient below 45.

[9] While Gini coefficients based on net (i.e., after-tax) incomes are preferable in principle as measures of income inequality, the Gini coefficients published by the World Bank are more often than not based on gross (i.e., before-tax) incomes. Hence, the equalizing effects of taxes and transfer schemes on the distribution of income are not fully reflected in the Gini coefficients used here. The data come from nationally representative household surveys and refer to different years between 1983-85 and 1998-99. See World Bank (2000), Table 2.8.



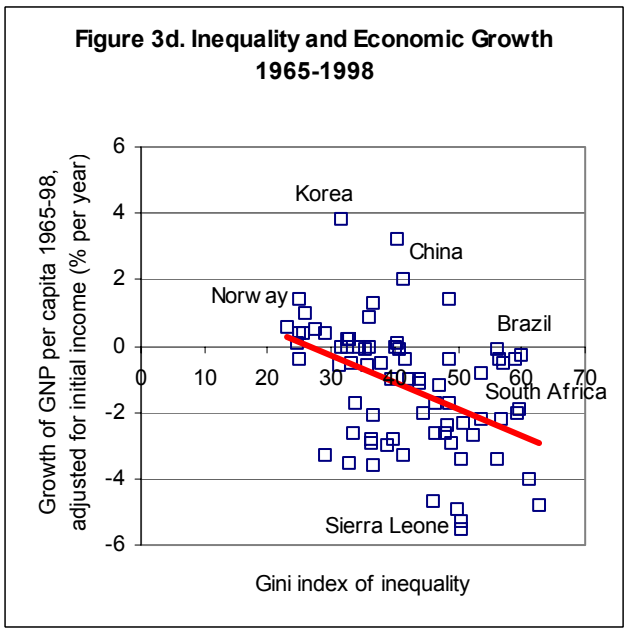


Figure 3d shows a scatterplot of per capita growth as measured before and the inequality of income or consumption as measured by the Gini coefficient (World Bank, 2000, Table 2.8).[10] The figure covers 75 countries, all from our original sample for whom the requisite data are available. Each country is represented by one observation as before. The regression line through the scatterplot suggests that an increase of about 12 points on the Gini scale from one country to another – corresponding to the difference in income distribution between India (Gini = 38) and

[10] Our sample does not include any transition economies because, for them, there is no information available on natural capital, which is one of the key determinants of growth in our framework. See Gylfason and Zoega (2001).

Zambia (Gini = 50), for example – is associated with a decrease in per capita growth by one percentage point per year on average. The relationship is statistically significant; the rank correlation is -0.50.[11] A reduction in a country's annual per capita growth rate by one percentage point is a serious matter because the (weighted) average rate of per capita growth in the world economy since 1965 has been about 1½ percent per year.

We now turn to political liberties, another essential ingredient of social capital. The political liberties index used here is an average for the period 1972-1990 and is taken from Przeworski *et al*. (2000). The index ranges from one (full political liberties) to seven (negligible political liberties). *A priori*, it is not obvious what to expect from the empirical evidence. One might speculate that natural resource riches seem likely to stifle political liberties by increasing the costs to the powers that be of being removed from power through the political process because their loss of political power would entail also their loss of control over the natural resource rents. If so, abundant resources may tend to go hand in hand with political oppression. After all, none of the oil-rich countries in the Middle East is a full-fledged democracy. On the other hand, it could be argued that natural resource wealth, if well managed, could be used to create conditions for political as well as economic and social progress by fostering political liberalization. Along similar lines, some observers have argued that political liberties are good for growth because they facilitate the peaceful replacement of bad governments by better ones through popular elections. Others have argued that there can be too much of a good thing, i.e., that too much liberty may be misused in the political arena to derail good governance through pressure group activity and such.[12] What do the data say?

Figure 3e shows a tendency for natural resource intensity measured as before to be inversely related to political liberties across countries, all 84 countries for which both series are available (data on political liberties in Namibia are missing). The pattern observed is significant in a statistical sense: the rank correlation is 0.50. An increase in the natural capital share by 11 percentage points goes along with a one point

[11] See Gylfason and Zoega (2003) for similar cross-country correlations between economic growth and both land inequality (-0.37) and gender inequality (-0.32). In our data, the distribution of income and land is highly correlated (0.57).

[12] Barro (1997, p.2) puts it as follows: "Another adverse feature of representative democracy is the strong political power of interest groups, such as agriculture, environmental lobbies, defense contractors, and the handicapped."

increase in the political liberties index, which means a decrease in liberty corresponding to the difference between India (2.0) and the United Kingdom (1.0), for example. All the countries with a natural capital share above 20 percent or so have limited political liberties. The removal of this cluster of eight countries from the sample does not materially reduce the statistical significance of the correlation shown in Figure 3e.

Figure 3e. Natural Resource Intensity and Political Liberties 1972-1990

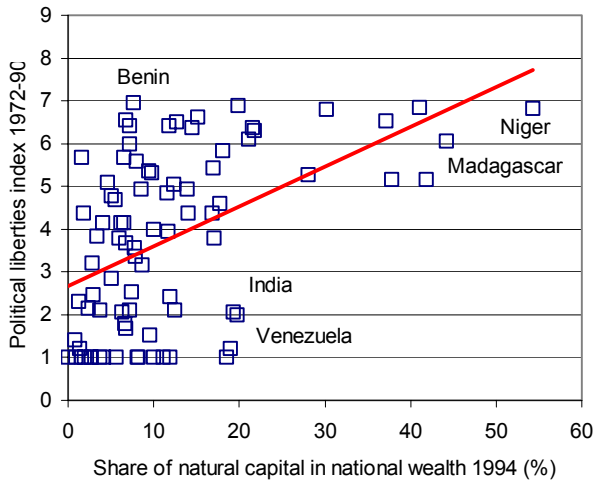
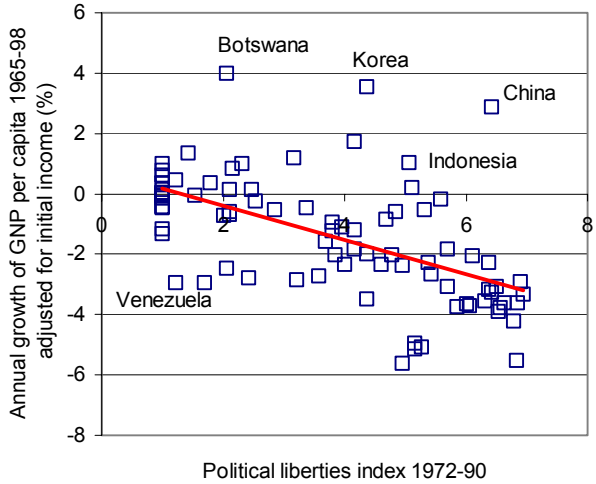


Figure 3f. Political Liberties and Economic Growth 1965-1998



In Figure 3f, we see the pattern of per capita growth and political liberties: an increase

in freedom of two points, corresponding roughly to the difference between Thailand (4.2) and Botswana (2.1), is associated with an increase in per capita growth of more than one percentage point per year. The pattern in the figure suggests that political liberties are good for growth, and vice versa. The rank correlation is -0.63.

Channel 3: Education and human capital

Natural resource abundance or intensity may reduce private and public incentives to accumulate human capital due to a high level of non-wage income – e.g., dividends, social spending, low taxes. Awash in cash, natural-resource-rich nations may be tempted to underestimate the long-run value of education. Of course, the rent stream from abundant natural resources may enable nations to give a high priority to education – as in Botswana, for instance, where government expenditure on education relative to national income is among the highest in the world. Even so, empirical evidence shows that, across countries, school enrolment at all levels is inversely related to natural resource abundance or intensity, as measured by the share of the labor force engaged in primary production (Gylfason, Herbertsson, and Zoega, 1999). There is also evidence that, across countries, public expenditures on education relative to national income, expected years of schooling, and school enrolment are all inversely related to natural resource abundance (Gylfason, 2001a; see also Temple, 1999). Once again, abundant natural capital appears to crowd out human capital. This matters because more and better education is good for growth.[13]

As far as economic growth is concerned, however, the supply of education may matter less than demand (Birdsall, 1996). This is relevant here because public expenditure on education tends to be supply-led and of mediocre quality, and may thus fail to foster efficiency, equality, and growth, in contrast to private expenditure on education, which is generally demand-determined and thus, perhaps, likely to be of a higher quality and more conducive to growth. For this reason, we use school enrolment rates rather than public expenditures on education as a measure of education in the empirical analysis to follow.

Figure 4a shows a scatterplot of secondary-school enrolment as a percentage of each cohort from 1980 to 1997 on the vertical axis and, on the horizontal axis, the natural capital share measured as before. Imperfect though it is, secondary-school

[13] For a survey of education and growth in OECD countries, see Temple (2000).

enrolment is the most commonly used yardstick for education in the empirical growth literature. Even so, other measures of education such as primary-enrolment rates, tertiary-enrolment rates, public expenditures on education, and years of schooling for girls or boys yield similar results (Gylfason, 2001a). The regression line through the 85 observations suggests that an increase of ten percentage points in the natural capital share from one country to the next is associated with a decrease in secondary-school enrolment by 15 percentage points. The Spearman rank correlation is -0.65.

Figure 4a. Natural Resource Intensity and Secondary Education 1980-1997

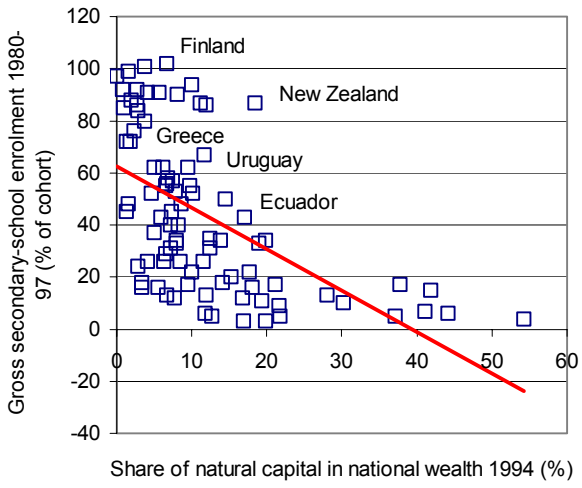


Figure 4b. Secondary Education and Economic Growth 1965-1998

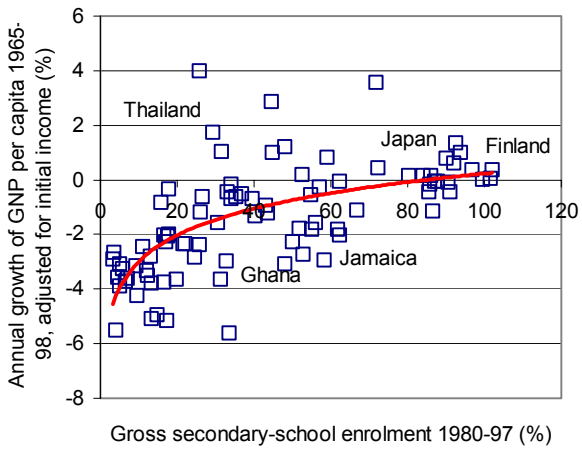


Figure 4b shows a scatterplot of secondary-school enrolment for both genders from

1980 to 1997 and economic growth. If we fit a straight line through the scatter (not shown), the figure shows that a 25 percentage point increase in secondary-school enrolment goes along with a one percentage point rise in the annual rate of growth of GNP per capita. In fact, the relationship is significantly nonlinear, indicating decreasing returns to education, and it is, moreover, statistically significant (the rank correlation is 0.72). The number of observations is once again 85. It needs to be emphasized that school enrolment reflects, at best, the quantity of education provided rather than the quality of education received. Public expenditure on education is also positively correlated with economic growth across countries in our sample (not shown), but the correlation is not significant in a statistical sense.

Taking Figures 4a and 4b together, we see that, across countries, secondary-school enrolment is inversely related to natural resource abundance and directly related to economic growth. Specifically, an increase in the natural capital share by 17 percentage points goes along with a decrease in secondary-school enrolment by 25 percentage points according to Figure 4a, which, in turn, goes along with a decrease in economic growth by one percentage point by Figure 4b. Therefore, high natural resource intensity seems capable of reducing economic growth significantly, not only through the Dutch disease, rent seeking, and overconfidence that tends to reduce the quality of economic policy and structure, but also by weakening public and private incentives to accumulate human capital. If so, the adverse effects of natural resource abundance on economic growth since the 1960s that have been reported in the literature may in part reflect the effect of education on growth.

How can we interpret these results? Natural-resource-based industries as a rule are less high-skill labor intensive and perhaps also less high-quality capital intensive than other industries, and thus confer relatively few external benefits on other industries (Wood, 1999). Moreover, workers released from primary industries, such as agriculture, fisheries, forestry, or mining, often have relatively limited general, labor-market relevant education to offer new employers in other industries. There are exceptions, though, such as in modern agriculture and, indeed, in high-tech oil-drilling operations. But insofar as high-skill labor and high-quality capital are less common in primary production than elsewhere, this may help explain why natural resource abundance and the associated preponderance of primary production and primary exports tend to impede learning by doing, technological advance, and economic growth. This linkage reinforces the case for investment in education and

training as an engine of growth: more and better education tends to shift comparative advantage away from primary production towards manufacturing and services, and thus to accelerate learning by doing and growth.

Channel 4: Saving, investment, and physical capital

Natural resource abundance may blunt private and public incentives to save and invest and thereby impede economic growth. Specifically, when the share of output that accrues to the owners of natural resources rises, the demand for capital falls, and this leads to lower real interest rates and less rapid growth (Gylfason and Zoega, 2001). Moreover, if mature institutions are conducive to an efficient use of resources, including natural resources, and if poorly developed institutions are not, then natural resource abundance may also retard the development of financial institutions in particular and hence discourage saving, investment, and economic growth through that channel as well. As in the case of education, it is not solely the volume of investment that counts because quality – i.e., efficiency – is also of great importance. Unproductive investments – white elephants! – may seem unproblematic to governments or individuals who are flush with cash thanks to nature's bounty.

Figure 5a shows a scatterplot of the average ratio of gross domestic investment to GDP in 1965-1998 and natural resource abundance or intensity measured as before. The regression line through the 85 observations suggests that an increase of about ten percentage points in the natural capital share from country to country is associated with a decrease in investment by two percent of GDP. The relationship is statistically significant: the rank correlation -0.38.

Figure 5b shows a scatterplot of economic growth as measured before and the average investment ratio over the same period, 1965-1998. The regression line through the 85 observations suggests that an increase in the investment ratio by about four percentage points is associated with an increase in annual economic growth by one percentage point. The relationship is highly significant: the rank correlation is 0.65. The slope of the regression line is consistent with the regression coefficients on investment in cross-country growth equations reported in recent literature (Levine and Renelt, 1992).

In sum, an increase in the natural capital share by 20 percentage points goes along with a decrease in the investment ratio by four percentage points by Figure 5a, which in turn goes along with a decrease in economic growth by one percentage point by

Figure 5b. Thus, the empirical evidence seems consistent with the idea that an abundance of or heavy dependence on natural resources may erode or reduce the quality of physical capital as well as foreign, social, and human capital, and thus stand in the way of rapid economic growth on a significant scale. It is a matter of taste and classification whether the some or even all the mechanisms reviewed above are regarded as additional symptoms of the Dutch disease or as separate channels of transmission from resource dependence to slow growth. But we are not done yet.

Figure 5a. Natural Resource Intensity and Investment 1965-1998

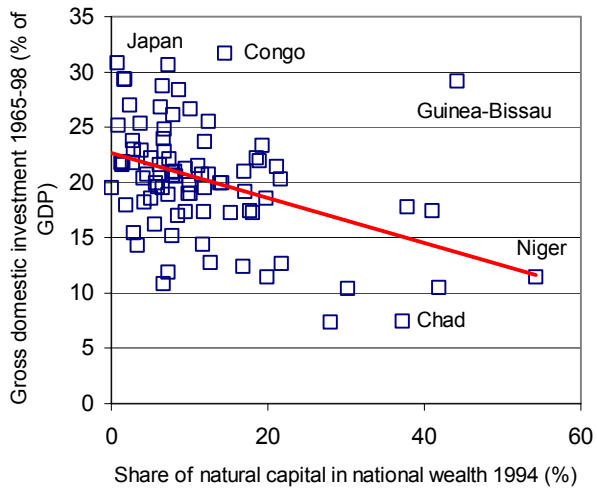
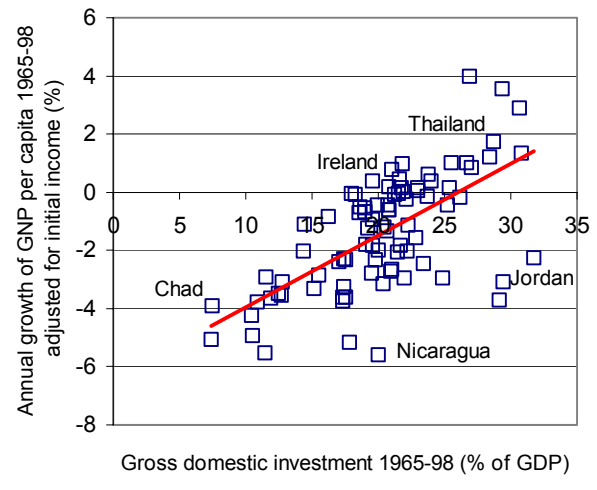


Figure 5b. Investment and Economic Growth 1965-1998



Channel 5: Money, inflation, and financial capital

Figure 6a shows a cross-sectional scatterplot of financial development, for which we use the average ratio of broad money (M_2) and GDP in 1965-1998 as a proxy, like King and Levine (1993), and natural resource dependence as measured before. The figure covers the same 85 countries as before. Figure 6a shows a clear negative correlation between natural resource dependence and financial depth (the rank correlation is -0.68).[14] Natural capital seems to crowd out financial capital. Figure 6b relates our measure of financial development to average economic growth per capita over the same period. The relationship is positive and the rank correlation is 0.66. But the question of causality remains. It is possible that heavy dependence on natural resources actually hinders the development of the financial sector and also growth, as appears plausible, but other possibilities also exist; in particular, some unspecified third factor may inhibit both financial development and economic growth. Naturally, the same reservation applies to all the other correlations presented in this paper.

Financial depth depends not only on natural resources but also, importantly, on inflation. This is because inflation reflects the opportunity cost of holding cash and other forms of financial capital that grease the wheels of production and exchange. Figure 6c shows the cross-sectional relationship between financial depth as measured above and inflation – specifically, the inflation distortion or the implicit rate of inflation tax, measured by the rate of inflation divided by one plus the rate of inflation – in the same 85 countries over the same 33-year period as before. This nonlinear transformation of the inflation rate is intended to reflect the phenomenon that a given decrease in inflation has a stronger proportional effect on liquidity at low rates of inflation than at high rates. In Figure 6c we can see a clear inverse association between financial depth and inflation. The Spearman rank correlation is -0.45 and significant.

Adding Figures 6b and 6c conveys a clear impression of an inverse cross-country relationship between inflation and economic growth, *via* financial depth or maturity. Inflation hurts growth by depriving the economic system of necessary lubrication. There is, however, no clear evidence of a two-dimensional correlation between inflation and growth around the world. The reason is that the relationship between inflation and growth is a complicated one, and involves several factors other than

[14] The exponential regression curve becomes steeper if the regression is confined to the 77 countries where the natural capital share is below 0.25, but the correlation remains highly significant (-0.61).

financial maturity, as mentioned before – among them, real interest rates and saving, real exchange rates and trade, and probably also political governance and stability. The relationship between inflation and growth is too complicated to be discernible to the naked eye as a two-dimensional cross-country correlation summarizing the impressions conveyed by Figures 6b and 6c. Even so, the relationship exists as can be ascertained by multiple regression analysis (for a recent survey, see Temple 2000).

Figure 6a. Natural Resource Intensity and Financial Depth 1965-1998

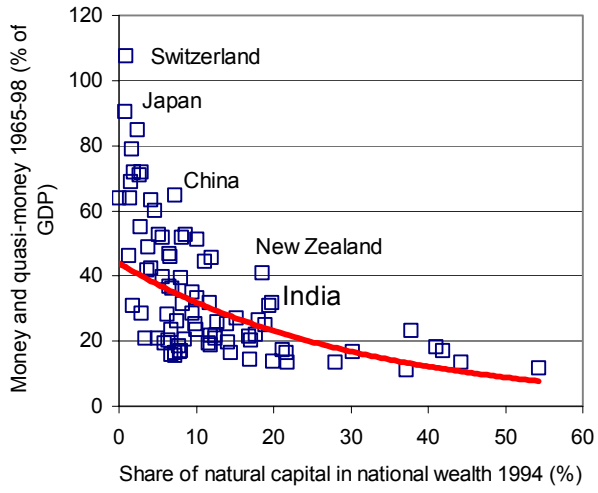
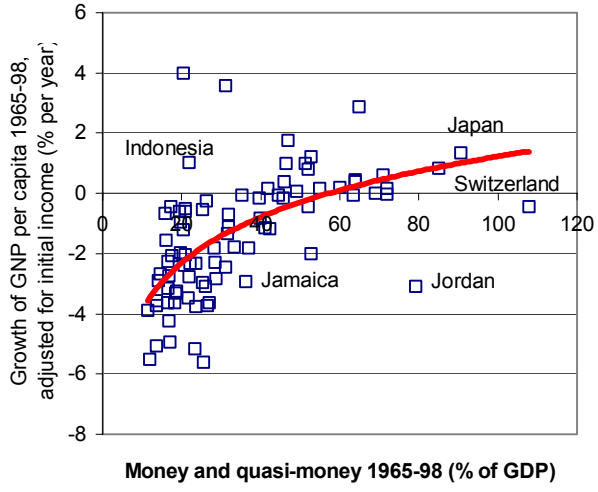
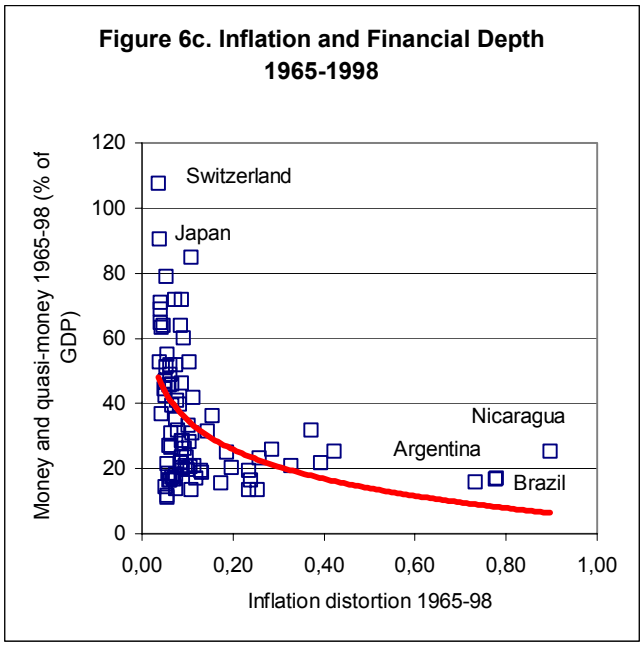


Figure 6b. Financial Depth and Economic Growth 1965-1998

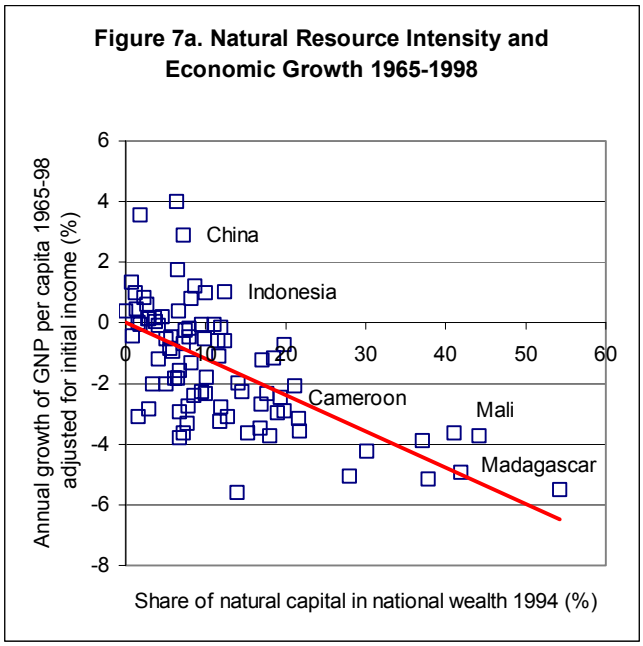


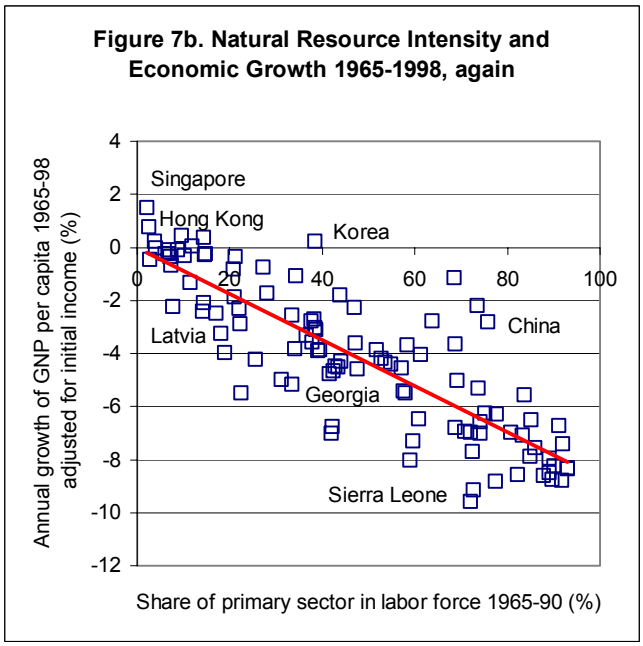


Natural capital and economic growth

To conclude the story, Figure 7a shows a scatterplot of economic growth per capita from 1965 to 1998 and natural resource intensity as we have measured it here. Once more, the figure covers the same 85 countries as before. The growth rate has been adjusted for initial income as before. The regression line through the scatterplot in Figure 7a suggests that an increase of about ten percentage points in the natural capital share from one country to another is associated with a decrease in per capita growth by one percentage point per year on average.[15] The relationship is also significant in a statistical sense (Spearman's rank correlation is -0.64), and conforms to the partial correlations that have been reported in multiple regression analyses where other relevant determinants of growth (investment, education, etc., as well as initial income to account for catch-up and convergence) are taken into account. A relationship of this kind has been reported in a number of recent studies (Sachs and Warner, 1995, 1999; Gylfason and Herbertsson, 2001; Gylfason, Herbertsson, and Zoega, 1999).

[15] There is admittedly an element of statistical bias in Figure 7a in that increased education and investment increase human and physical capital, thereby reducing the share of natural capital in national wealth *and* increasing economic growth. This bias, however, is probably not serious because Figure 7a can be reproduced by using different measures of natural resource abundance, such as the share of the primary sector in the labor force or the share of primary exports in total exports or GDP.





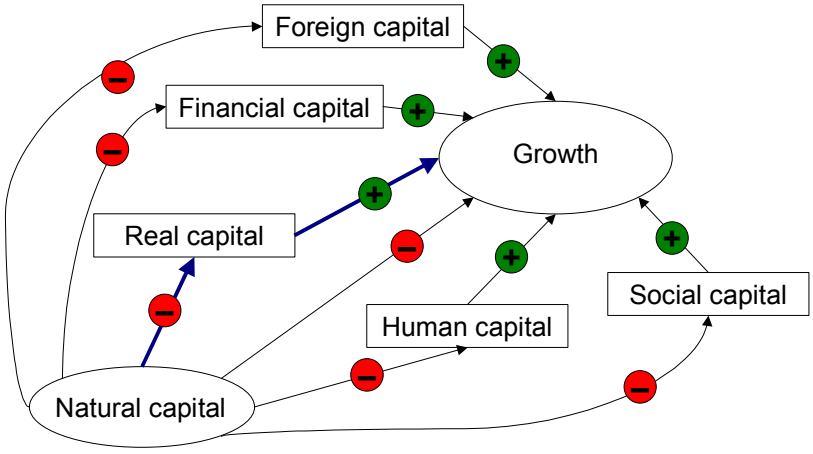
At last, therefore, Figure 7b shows the relationship between economic growth and natural resource intensity when the latter is measured by the share of the primary sector in total employment.[16] There are now 105 countries in the sample because the primary labor share is available for many more countries than the natural capital share. The relationship is negative, and highly significant. The Spearman correlation

[16] Notice that the growth measures are slightly different than before. The reason is that the adjustment for initial income is based on different measures of natural resource abundance, and the primary labor share in Figure 7b and the natural capital share everywhere else. This difference has no material effect on the patterns displayed in the figures.

is -0.85. The adjustment for initial income entails a speed of convergence of about 2 percent a year (not shown), a common result in empirical growth research. An increase of 11 or 12 percentage points in the primary labor share from one country to the next goes along with a decrease in per capita growth by one percentage point per year on average, for given initial income.

The punch line of the foregoing argument is summarized in Figure 8, which shows how natural capital affects economic growth directly as well as indirectly by crowding out other types of capital through the five channels of transmission outlined above. Let us now leave the cross-sectional evidence to one side and consider the experience of individual countries.

Figure 8. Determinants of Growth



III. The Experience of the OPEC Countries and Norway

In most countries that are rich in oil, minerals, and other natural resources, economic growth over the long haul tends to be slower than in other countries that are less well endowed. For example, in Nigeria, with all its oil wealth, gross national product (GNP) per capita today is no higher than it was at independence in 1960. Nedadi Usman, Nigeria's economy minister, has said in a newspaper interview: "Oil has made us lazy." And Nigeria is not alone. From 1965 to 1998, the rate of growth of GNP per capita in Iran and Venezuela was on average -1 percent per year, -2 percent

in Libya, -3 percent in Iraq and Kuwait, and -6 percent in Qatar (1970-1995), to mention six other OPEC countries (World Bank, 2000). For OPEC as a whole, GNP per capita actually *decreased* by 1.3 percent on average during 1965-1998 compared with 2.2 percent average per capita growth in all lower- and middle-income countries. King Faisal of Saudi Arabia (1964-1975) would hardly have been surprised, for he sized up the situation as follows (quoted from a newspaper interview with his oil minister, Shaikh Yamani):

> In one generation we went from riding camels to riding Cadillacs. The way we are wasting money, I fear the next generation will be riding camels again.

Lee Kwan Yew, founding father of Singapore (1959-1991), would not have been surprised either (quoted from the first volume of his autobiography):

> I thought then that wealth depended mainly on the possession of territory and natural resources, whether fertile land ..., or valuable minerals, or oil and gas. It was only after I had been in office for some years that I recognized ... that the decisive factors were the people, their natural abilities, education and training.

The above examples from the OPEC countries seem to reflect a consistent pattern as we saw in Section II. But the problem there and elsewhere is not the existence of natural wealth as such, but rather the failure to avert the dangers that accompany the gifts of nature. Abundant natural resources do not necessarily prevent the emergence of a dynamic economy. The discovery of natural resources does not necessarily dampen an already developed economy. Natural resources can be a blessing as well as a curse. Norway, indeed, is a case in point.

The world's third largest oil exporter (after Saudi-Arabia and Russia), Norway shows as yet no clear symptoms of the Dutch disease – other, perhaps, than a stagnant ratio of exports to GDP, albeit at a rather high level. Norway and Iceland, historically dependent on its fisheries, are the only industrial countries whose exports of goods and services have grown no more rapidly than their GDP since 1960 (in Iceland's case, the stagnation of exports relative to GDP reaches as far back as the data, to 1870). In Norway, manufacturing exports have fallen sharply in proportion to GDP and total merchandise exports since the mid-1970s: the share of manufacturing in total

exports declined from 60 percent in 1974 to 22 percent in 2002. Moreover, Norway has attracted a relatively limited, yet gradually increasing inflow of gross FDI, equivalent to five percent of GDP in 2002, far below the figures for Sweden and Finland next door (13 percent and 15 percent). The lack of interest among a majority of the Norwegians in joining the European Union – a proposition they have rejected in two referenda, in 1972 and 1994 – may well reflect similar forces as Norway's failure to fully open up to foreign trade and investment: many Norwegians consider their country so rich, thanks to their oil wealth, that they have no need for EU membership.

Norway does not show any signs yet of socially damaging rent-seeking behavior even if increasingly loud calls are being voiced for using more of the oil revenue to address domestic social needs rather than continue to build up the government-owned oil fund, which is invested in foreign securities. There are no clear signs either of a false sense of security or of an inadequate commitment to education, on the contrary. Growth has thus far remained stubbornly high. Even so, some observers of the Norwegian scene have recently expressed concerns that some deep-seated structural problems in the country's education and health care sectors (government monopoly, insufficient competition, low efficiency, etc.) may be misdiagnosed as financial problems because the money available from the oil fund may blunt the willingness of politicians to undertake difficult structural reforms.

One of the factors that separate Norway's experience from that of OPEC is timing. Norway was already a developed country and a democracy at the time of the oil discoveries in the 1970s. Most importantly, Norway's social institutions were mature and the financial system relatively well developed, although by no means fully liberalized. All of this facilitated judicious and far-sighted management of Norway's oil wealth, at least compared with most other oil producers (Hannesson, 2001). In contrast, full-fledged capitalist development did not take place in most OPEC countries prior to the discovery of their oil resources, or since for that matter (Karl, 1997). While Norway has built up substantial assets abroad, Saudi-Arabia has accumulated debts.

Norway has charted a long-run-oriented, tax-based, and reasonably market-friendly approach to the management of its vast oil resources, estimated at 50-250 percent of GNP depending on oil prices (Thøgersen, 1994). By law, the oil wealth belongs to the State. In principle, all the rent from oil and gas should accrue to the Norwegian people through their government. The State's title to these resources

constitutes the legal basis for government regulation of the petroleum sector as well as for its taxation. Exploration and production licenses are awarded for a small fee to domestic and foreign oil companies alike. The Norwegian government expropriates the oil and gas rent through taxes and fees as well as direct involvement in the development of the resources rather than through sales or auctioning of exploration and production rights (OECD, 1999). The State has a direct interest in most offshore oil and gas fields and, like other licensees, receives a corresponding proportion of production and other revenues. Through its direct partnership with other licensees as well as through various taxes and fees, it is estimated that the Norwegian State has managed to absorb about 80 percent of the resource rent since 1980.[17] In 1997, revenues from petroleum activities accounted for more than a fifth of total government revenues and amounted to eight to nine percent of total GNP, including oil. In 2000, the oil sector's contribution rose to more than 25 percent of GNP, but it is envisaged to drop to five percent by 2020. The oil revenue is deposited in the Petroleum Fund, which was established in 1990 and is being built up and invested mostly in foreign securities for the benefit of the current generation of Norwegians when they reach old age as well as for future generations, and also in order to shield the domestic economy from overheating and possible waste – a shrewd strategy, efficient and fair. In 1999, the management of the Petroleum Fund was transferred from the Ministry of Finance to the Bank of Norway in order to distance the fund further from political considerations in view of the central bank's increased freedom from political interference in keeping with recent developments in central banking practices and legislation.

Even so, a variable proportion of each year's net oil-tax revenue is transferred from the Petroleum Fund to the fiscal budget, essentially to cover the nonoil budget deficit. The proportion of net tax revenues from petroleum thus transferred to the government budget is envisaged to drop to less than ten percent in the years ahead. The Norwegians have not chosen to expand their central government beyond reasonable limits, or at least not to extravagant levels, as a result of the oil boom. Decades after discovering their oil, the Norwegians continue to live with smaller central government than Denmark, Finland, and especially Sweden, even if local government has expanded in terms of expenditure and manpower.

[17] The main revenue items are corporate tax (28 percent) and a special resource surtax (50 percent), but also royalty (8-16 percent), area fee, and carbon-dioxide tax.

Norway's long tradition of democracy and market economy since long before the advent of oil has probably helped immunize the Norwegian people from the ailments that inflict most other oil-rich nations. Large-scale rent seeking has been averted in Norway, investment performance has been adequate, and the country's education record is excellent. For example, the proportion of each cohort attending colleges and universities in Norway rose from 16 percent in 1970 to 70 percent in 2000. It is not certain, however, whether the average quality of college education in Norway has changed in tandem with – or perhaps, as some fear, in inverse proportion to – the huge increase in enrolment since 1970.

Even so, Norway faces challenges. Some (weak) signs of the an outbreak of the Dutch disease can be detected, as was indicated above, notably stagnant exports, the absence of a large, vibrant high-tech manufacturing industry (as in Sweden and Finland next door), and sluggish FDI. But perhaps the main challenge is to make sure that the oil fund does not instill a false sense of security, a feeling that anything goes and that difficult decisions can be deferred or avoided. To this end, it may be necessary to find new ways to immunize the fund from political interference, just as other key institutions – the courts, media, central banks – have been depoliticized over the years. The transfer of the fund to the Bank of Norway a few years ago was a step in this direction. Further immunization may require privatization, by, for example, turning the oil fund over to the people in the form of pension savings. It is not certain, however, that such a solution would be perfect, for the private sector is not infallible either. Another, intermediate solution might be to invest the authority to dispose of the oil revenues in a special independent, yet democratically accountable and fully transparent authority in accordance with the spirit of modern central banking legislation in countries that have granted their central banks and financial inspection agencies substantial independence from political interference. This would severe the link between the allocation of oil revenues and monetary policy considerations. Perhaps it would be most advisable to adopt a mixed strategy, with shared public and private responsibility for the disposal of the oil wealth, in order to spread the risks and reconcile different points of view.

IV. Concluding Remarks

Natural resources bring risks. This paper has reviewed the cross-country evidence of the various ways in which a heavy dependence on natural resources may adversely affect economic growth performance. Natural-resource-based activity sometimes drives the real value of the domestic currency up to levels that other export industries and import-competing industries find difficult to cope with, thus reducing the economy's openness to foreign trade and investment. Further, too many people tend to become locked in low-skill intensive natural-resource-based industries, including agriculture, and thus fail through no fault of their own to advance their own or their children's education and earning power. Another related risk is that the authorities and other inhabitants of resource-rich countries become overconfident and therefore tend to underrate or overlook the need for good economic policies and institutions as well as for good education and good investments. Excessive dependence on natural resources can thus weaken various societal institutional arrangements that need to be strong for the economy to grow briskly. The empirical evidence presented in this paper suggests that a heavy dependence on nature's bounty tends to be directly associated with corruption, inequality, and political oppression, all of which tend to impede economic progress and growth. Moreover, the evidence suggests that high natural resource intensity is inversely associated with financial depth – i.e., with the development of monetary and financial institutions and policies that keep inflation low and the economic system well lubricated, thereby advancing economic growth.

In short, nations that believe that natural capital is their most important asset may develop a false sense of security and become negligent about the accumulation of foreign, social, human, physical, and financial capital. Indeed, resource-rich nations can live well of their natural resources over extended periods, even with poor economic policies and institutions and a weak commitment to education, trade, and investment. Awash in easy cash, they may find that difficult reforms do not pay. Nations without natural resources have a smaller margin for error, and are less likely to make this mistake. In resource-rich countries, awareness of these risks, as well as a conscious effort and ability to contain them, is perhaps the best insurance policy against them. The experience of Norway shows, however, that efficient and far-sighted management of abundant oil wealth is clearly possible.

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