

INSTITUTE OF ECONOMIC STUDIES

WORKING PAPER SERIES

W01:06

August 2001

Lessons from the Dutch Disease: Causes, Treatment, and Cures

Thorvaldur Gylfason

Address: Thorvaldur Gylfason
Department of Economics
University of Iceland
Oddi at Sturlugata, 101 Reykjavik
Iceland
Email: gylfason@hi.is

Lessons from the Dutch Disease: Causes, Treatment, and Cures

by Thorvaldur Gylfason *

Abstract

This paper begins with a few remarks on the origins and symptoms of the Dutch disease. Thereafter it describes the way economists in recent years have come to think about the relationship between natural resource abundance and economic growth. This is followed by a brief interlude on the experience of the OPEC countries. An attempt is then made to provide a glimpse of some of the results that have emerged in the last few years from empirical studies of the cross-country relationships between natural resource abundance and economic growth and various key determinants of growth across the world. The paper concludes with a brief discussion of the special case of Norway and its unusual position among the resource-rich countries.

Key words: Dutch disease, natural resources, economic growth.

JEL: Q32.

* Thorvaldur Gylfason is Research Professor of Economics, University of Iceland; Research Fellow, CEPR and CESifo; and Research Associate, SNS – Center for Business and Policy Studies, Stockholm. The paper was prepared for a conference on *The Paradox of Plenty* organized by Statoil and ECON and held in Oslo, Norway, 7-8 March 2001. Author's address: Faculty of Economics and Business Administration, University of Iceland, 101 Reykjavik, Iceland. Tel: 354-525-4533 or 4500. Fax: 354-552-6806. E-mail: gylfason@hi.is

This paper is intended to discuss some of the economic lessons that can be drawn from the experience of natural-resource-rich countries around the world since the 1960s. The discussion is divided into five parts. It begins with a few remarks on the origins and symptoms of the Dutch disease. Thereafter I describe the way economists in recent years have come to think about the relationship between natural resource abundance and economic growth. This is followed by a brief interlude on the experience of the OPEC countries. I then try to provide a glimpse of some of the results that have emerged in the last few years from empirical studies of the cross-country relationships between natural resource abundance and economic growth and various key determinants of growth across the world. The paper concludes with a brief discussion of the special case of Norway and its unusual position among the resource-rich countries.

I. “Neither Dutch nor a Disease”

In the original, narrow sense of the term, the ‘Dutch disease’ refers to the fears of de-industrialization that gripped the Netherlands as a result of the appreciation of the Dutch guilder that followed the discovery of natural gas deposits within the country’s jurisdiction in the North Sea in the late 1950s and early 1960s. This stood to reason: the appreciation of the currency that followed the gas export boom reduced the profitability of manufacturing and service exports.¹ As Figure 1 shows, total exports decreased markedly relative to Gross Domestic Product (GDP) during the 1960s. This means that the expansion of petroleum exports in the 1960s not only crowded out other exports: it actually reduced other exports disproportionately, with the result that total exports declined markedly relative to GDP. Hence the fears of dire consequences for Dutch manufacturing. However, as Figure 1 shows, the problem proved short-lived. From the late 1960s onwards, exports of goods and services have increased from less than 40 per cent of GDP to nearly 60 per cent, a high ratio by international standards for a country with 16 million inhabitants. The fears of de-industrialization did not materialize, far from it. But the name stuck. It is sometimes said that, being neither Dutch nor a disease, the Dutch disease is a double misnomer. But when, as in this case, a disease bears the name of the first patient diagnosed with it, it would seem

¹ See W. Max Corden, “Booming Sector and Dutch Disease Economics: Survey and Consolidation,” *Oxford Economic Papers* 36, 1984, pp. 359-380.

a bit harsh to require the patient to remain sick for the name to stick. The fact that the Dutch recovered fairly quickly from the disease that bears their name, while some other countries have suffered much longer and continue to do so, does not by itself call for a name change.

But is it a disease? Those who do not think so seem to view it as matter of one sector benefiting partly at the expense of others, without seeing any macroeconomic or social damage being done, on the contrary. By contrast, those who, like myself, view the Dutch disease as an ailment, are concerned about the potentially harmful consequences of the induced reallocation of resources between sectors – from high-tech service industries to low-tech primary production, for example – for economic growth and diversification.

I happen to think that Adam Smith would have concurred. In his *Wealth of Nations* (1776), he describes how government bounties to one favored industry hurt other industries as well as the national economy as a whole. Listen to him:

But the great encouragement, which a bounty of thirty shillings the ton gives to the buss fishery, is necessarily a discouragement to the boat fishery; which, having no such bounty, cannot bring its cured fish to market upon the same terms as the buss fishery. The boat-fishery, accordingly, which before the establishment of the buss bounty, was very considerable, and is said to have employed a number of seamen, not inferior to what the buss fishery employs at present, is now gone almost entirely to decay. ... (t)he herring buss bounty serves no ... good purpose. It has ruined the boat fishery, which is, by far, the best adapted for the supply of the home market.²

Let Smith continue:

When the undertakers of fisheries, after such liberal bounties have been bestowed upon them, continue to sell their commodity at the same, or even at a higher price than they were accustomed to do before, it might be expected that their profits should be very great; and it is not improbable that those of some individuals may have been so. In general, however, I have every reason to believe, they have been quite otherwise. The usual effect of such bounties is to encourage rash undertakers to adventure in a business, which they do not understand, and what they lose by their own negligence and ignorance, more than compensates all that they can gain by the utmost liberality of government.³

And Smith adds:

... there must surely be something more than ordinary absurdity, in continuing such profusion in times of general difficulty and distress.⁴

² Adam Smith, *An Inquiry Into the Nature and Causes of the Wealth of Nations*, R. H. Campbell and A. S. Skinner, eds., Oxford University Press, Oxford, 1976, Vol. I, p. 521.

³ Ibid., p. 522.

⁴ Ibid., p. 523.

True, Smith speaks of subsidies, but the discovery of a natural resource is the economic equivalent of a subsidy as far as the beneficiary is concerned – which, by the way, is probably why unrequited foreign aid may in many cases turn out to be, at best, a mixed blessing, no less than a natural resource discovery. As the above quotes should make clear, Smith was not talking about the harmful effects of the taxation necessary to finance the subsidies. Anyhow, according to this view of the reallocative consequences of the Dutch disease, the empirical evidence of an inverse relationship between natural resource abundance and economic growth over long periods that has emerged in the last few years, and which we will explore in Section IV, can be viewed as a sign of the Dutch disease. Because the disease *is* the symptoms associated with it, by definition, the issue of misdiagnosis – of mistaking symptoms for the disease – does not arise.

An overvalued currency was the first symptom associated with the Dutch disease, but subsequently several other symptoms came to light. Natural resource abundance 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. Fish stocks, for example, are notoriously volatile. Oil wells go dry, mines are depleted, and so forth. 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 tends to hurt 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 industries, thus making it difficult for the latter to remain competitive. This problem can become particularly acute in countries with centralized wage bargaining (or with oligopolistic banking systems, for that matter) where the natural-resource industries set the tone in nationwide wage negotiations and dictate wage settlements that other industries can ill afford. The Faeroe Islands and Greenland, both of which use the Danish krone, are a case in point.⁵ Their fishing industry dominates their national economies to the virtual exclusion of other manufacturing.

In one or all of these ways, the Dutch disease tends to reduce the level of total

⁵ See Martin Paldam, “Dutch Disease and Rent Seeking: The Greenland Model,” *European Journal of Political Economy* 13, No. 1, 1997, pp. 591-614.

exports or skew the composition of exports away from those kinds of manufacturing and service exports that may be particularly conducive to economic growth over time. Exports of capital – i.e., inward foreign direct investment – may also suffer in the same way.

Against this background, Figures 1-3 present relevant empirical evidence for Norway and the Netherlands. Figure 1 shows that the Netherlands recovered quickly from the Dutch disease, as mentioned before, and have seen a persistent upward trend in their total exports relative to GDP since the mid-1960s. Meanwhile, Norway's total exports have been stagnant relative to GDP at a level well below that of the Netherlands, even if the Dutch economy is almost three times as large as that of Norway. Figure 2 tells a similar story about foreign direct investment, which has increased relative to GDP in both countries since 1975, but less rapidly in Norway than in the Netherlands. Figure 3 shows that the share of manufacturing exports in total exports in the Netherlands increased from 50 percent in 1980 to 70 percent in 1998, while the same ratio has hovered around 30 percent in Norway without showing any tendency to rise over time. These things matter because exports and foreign investment are good for growth.⁶ Openness to trade and investment stimulates imports of goods and services, capital, technology, ideas, and know-how. Further, too much primary-export dependence and too little manufacturing may hurt economic growth over the long haul. The upshot of this discussion is that the Dutch disease is a matter of concern mainly because of its potentially deleterious consequences for economic growth.

II. Thinking about Natural Resources and Growth⁷

The structure of recent models of the relationship between natural resource abundance and economic growth is nearly always the same. An abundance of natural resource riches is taken to influence some variable or mechanism “X” which impedes growth. The challenge for economic growth theorists and empirical workers in the field is to identify and map these intermediate variables and mechanisms.

To date, five possible channels of transmission from natural resource abundance to sluggish economic growth have been suggested in the literature. At the top of the

⁶ See, for example, Jeffrey A. Frankel and David Romer, “Does Trade Cause Growth?,” *American Economic Review* 89, June 1999, pp. 379-399.

⁷ This section draws on my paper with Gylfi Zoega, “Natural Resources and Economic Growth: The Role of Investment,” CEPR Discussion Paper No. 2743, March 2001.

list is the Dutch disease, as discussed in the preceding section: to repeat, the idea is that a natural resource boom and the associated surge in raw-material exports tend to drive up the value of the domestic currency in real terms, and perhaps also increase exchange rate volatility and wages, with the result that exports may stagnate or even fall relative to GDP, or may become biased away from manufacturing and services.

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.⁸ The combination of abundant natural resources, missing markets, and lax legal structures 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 placate their political supporters and thus secure their hold on power, with stunted or weakened democracy and slow growth as a result.⁹ 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. Military expenditures tend to inhibit growth through their adverse effects on capital formation and resource allocation.¹⁰

Rent seeking can also take 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

⁸ See Richard M. Auty, “The Political Economy of Resource-Driven Growth,” *European Economic Review*, May 2001, and Alan Gelb, *Windfall Gains: Blessing or Curse?*, 1988, Oxford University Press, Oxford and New York.

⁹ See Terry Lynn Karl, “The Perils of the Petro-State: Reflections on the Paradox of Plenty,” *Journal of International Affairs* 53, Fall 1997, pp. 31-48.

¹⁰ See Malcolm Knight, Norman Loayza, and Delano Villaneuva, “The Peace Dividend: Military Spending and Economic Growth,” *IMF Staff Papers* 43, No. 1, 1996, pp. 1-37.

economic efficiency and social equity. Empirical evidence and economic theory suggest that import protection, cronyism, and corruption all tend to impede economic efficiency and growth.¹¹

Third, natural resource abundance 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. However, 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. Empirical evidence shows that, across countries, school enrolment at all levels is inversely related to natural resource abundance, as measured by the share of the labor force engaged in primary production.¹² There is also, as we shall see, evidence that, across countries, public expenditures on education relative to national income, expected years of schooling, and secondary-school enrolment are all inversely related to natural resource abundance.¹³ This matters because more and better education stimulates growth.¹⁴

Fourth, and this point is closely related to the preceding one, 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.¹⁵ Put differently, abundant natural capital may crowd out social capital in the same way as it seems to crowd out human capital.¹⁶ 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.

¹¹ See Pranab Bardhan, “Corruption and Development: A Review of the Issues,” *Journal of Economic Literature* 35, September 1997, pp. 1320-1346, and Paolo Mauro, “Corruption and Growth,” *Quarterly Journal of Economics* 90, 1995, pp. 681-712.

¹² See Thorvaldur Gylfason, Tryggvi Thor Herbertsson, and Gylfi Zoega, “A Mixed Blessing: Natural Resources and Economic Growth,” *Macroeconomic Dynamics* 3, June 1999, pp. 204-225.

¹³ See Thorvaldur Gylfason, “Natural Resources, Education, and Economic Development,” *European Economic Review*, May 2001. See also Jonathan Temple, “A Positive Effect of Human Capital on Growth,” *Economics Letters* 65, 1999, pp. 131-134.

¹⁴ For a survey of the recent literature on education and growth in industrial countries, see Jonathan Temple, “Growth Effects of Education and Social Capital in the OECD,” ECO Working Papers No. 263, October 2000.

¹⁵ See Jeffrey D. Sachs and Andrew M. Warner, “Natural Resource Intensity and Economic Growth,” Ch. 2 in Jörg Mayer, Brian Chambers, and Ayisha Farooq (eds.), *Development Policies in Natural Resource Economies*, Edward Elgar, Cheltenham, UK, and Northampton, Massachusetts, 1999.

¹⁶ See Michael Woolcock, “Social Capital and Economic Development: Toward a Theoretical Synthesis and Policy Framework,” *Theory and Society* 27, 1998, pp. 151-208. See also Martin Paldam and Gert Tinggaard Svendsen, “An Essay on Social Capital: Looking at the Fire behind the Smoke,” *European Journal of Political Economy* 16, No. 2, 2000, pp. 339-366.

This phenomenon may have something to do with the difference between other people's money and your own, for there is a tendency for people to treat other people's money with less respect than their own. For example, unrequited foreign aid seems more likely to be squandered on worthless investments than foreign loans that have to be serviced on commercial terms. Likewise, lottery winnings seem more likely to be wasted than an equivalent inheritance from hard-working parents (but if the parents were drug dealers, then perhaps not). The list of examples can be extended and they seem to fit a pattern: a person's respect for a given bundle of money, and the care that the person takes in disposing of the money, is inversely proportional to the person's distance from the effort expended to make the money. (This is not – repeat not – a rehash of the labor theory of value.) How am I doing as a sociologist?

Fifth, natural resource abundance may blunt private and public incentives to save and invest and thereby reduce 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.¹⁷ 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 impede saving, investment, and economic growth through that channel as well.

In sum, then, an abundance of natural capital may erode or reduce the quality of social, human, and physical capital, and thus stand in the way of rapid economic growth. It is a matter of taste and classification whether the mechanisms reviewed above are regarded as additional symptoms of the Dutch disease or as separate channels of transmission from resource abundance to slow growth.

III. A Quick Look at OPEC

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. 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

¹⁷ See Thorvaldur Gylfason and Gylfi Zoega, "Natural Resources and Economic Growth: The Role of Investment," CEPR Discussion Paper No. 2743, March 2001.

and Kuwait, and -6 percent in Qatar (1970-1995), to mention six other OPEC countries.¹⁸ 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 described 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.

Is OPEC an exception? No. The above examples from the OPEC member states seem to reflect a consistent pattern. Of 65 countries that can be classified as natural-resource rich, only four managed to attain both (a) long-term investment exceeding 25 percent of GDP on average from 1970 to 1998, equal to that of various successful industrial countries lacking raw materials, and (b) per capita GNP growth exceeding 4 percent per year on average over the same period. These four countries are Botswana, Indonesia, Malaysia, and Thailand. The three Asian countries achieved this success by diversifying their economies and by industrializing; Botswana, rich in diamonds, without doing so. Of the four, only Indonesia has oil. In East Asia, the countries with few raw materials (Hong Kong, Singapore, South Korea, and Taiwan) have done even better than the resource-rich ones (Indonesia, Malaysia, and Thailand).

But let us not jump to conclusions. For the problem is not the existence of natural wealth as such, but rather the failure to avert the dangers that accompany the gifts of nature. It is not inevitable that existing natural resources prevent the emergence of a dynamic economy or that the discovery of such resources acts to 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 second largest oil exporter (after Saudi-Arabia), Norway shows as yet no clear symptoms of the Dutch disease – other, perhaps, than a stagnant ratio of exports to GDP since before the oil discoveries, indicating that Norway's oil exports have crowded out non-oil exports krone for krone relative to income (recall Figure 1). Nor does Norway 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

¹⁸ Source: World Bank, *World Development Indicators 2000*, World Bank, Washington, D.C., 2000.

government-owned oil fund, which is invested in foreign securities. There are no 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.

One of the factors that separates Norway's experience from that of OPEC is timing. Norway was already a developed country at the time of the oil discoveries in the 1970s. Most importantly, Norway's social institutions were mature and the financial system relatively developed, although by no means fully liberalized. 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.

I shall return to Norway in Section V.

IV. Natural Capital and Growth: The Evidence

I now turn to the empirical evidence that has emerged in the last few years from econometric studies of the cross-country relationships between natural resource abundance and economic growth around the world. Even if the evidence reviewed below is exclusively cross-sectional, it reflects a pattern that accords with a number of historical case studies of individual resource-rich countries.¹⁹ In what follows, I will stress linkages between natural resource abundance and various key determinants of economic growth as well as growth itself.

Figure 4 shows a scatterplot of economic growth per capita from 1965 to 1998 and natural resource abundance as 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 capital).²⁰ The figure covers 85 countries. 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 as a residual from a regression of growth during

¹⁹ For a number of such case studies, see Richard M. Auty (ed.), *Resource Abundance and Economic Development*, Oxford University Press, Oxford and New York, 2001.

²⁰ Source: World Bank, "Expanding the Measure of Wealth: Indicators of Environmentally Sustainable Development," *Environmentally Sustainable Development Studies and Monographs Series* No. 17, World Bank, Washington, D.C., 1997. 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 in the period under review, 1965-1998. There are exceptions, true, such as Malaysia, Mauritius, and Mexico, where the share of primary exports in merchandise exports decreased dramatically from 1965 to 1998 as a result of economic diversification away from primary production. Even so, all the empirical results reported in this paper can be reproduced without significant deviations by using the average primary export share 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.

1965-1998 on initial GNP per capita (i.e., in 1965) as well as natural capital. The 85 countries in the sample are represented by one observation each for each variable under study, an average for the entire sample period, 1965-1998.

The regression line through the scatterplot in Figure 4 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.²¹ 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.²² Shaving one percentage point of any country's annual growth rate 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.

Let us now look at the evidence for the various possible explanations for the pattern observed in Figure 4. We start with the Dutch disease. Is there a discernible cross-sectional relationship between openness to trade and natural capital? Figure 5 shows a scatterplot of natural capital as defined above and openness, defined as the difference between the actual average ratio of exports to GDP over the same period as before, 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. This indicator of openness is above zero for countries that are more open to trade than their size predicts, and below zero for countries that are less open to trade than their size predicts. Norway lies a few percentage points above zero, indicating that the country is relatively open to trade

²¹ There is admittedly an element of statistical bias in Figure 4 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 4 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.

²² See Jeffrey D. Sachs and Andrew M. Warner, "Natural Resource Abundance and Economic Growth," NBER Working Paper 5398, Cambridge, Massachusetts, 1995 (revised 1997, 1999); Thorvaldur Gylfason, and Tryggvi Thor Herbertsson, "Does Inflation Matter for Growth?," *Japan and the World Economy* (forthcoming); and Thorvaldur Gylfason, Tryggvi Thor Herbertsson, and Gylfi Zoega, "A Mixed Blessing: Natural Resources and Economic Growth," *Macroeconomic Dynamics* 3, June 1999, pp. 204-225.

given its size. The sample now contains 91 countries. The regression line through the scatterplot in Figure 5 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 statistically significant (Spearman's rank correlation is -0.33). Given existing empirical evidence that foreign trade is good for growth, Figure 5 suggests that natural resource abundance may hurt growth by harming trade.

It needs to be understood that no conclusions are being drawn here as to cause and effect. Figure 5 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,²³ and where the 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.

Now consider corruption, to take but one aspect of social capital corrosion into account. 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 is the evidence?

In Figure 6, which covers 60 countries, natural capital is plotted along the horizontal axis as before and the corruption perceptions index for the year 2000 along the vertical axis.²⁴ How can corruption be measured? It is measured by, for instance, systematically collecting information from domestic and foreign 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. Indices of corruption compiled from many different sources enable the ranking of countries according to estimated corruption. Corruption indices compiled from varying sources correspond fairly well, which would indicate that these indices are reasonably credible. Here I use the corruption perceptions index from Transparency International, Berlin. The index

²³ See Thorvaldur Gylfason, "Exports, Inflation, and Growth," *World Development* 27, June 1999, pp. 1031-1057.

²⁴ Corruption rankings for earlier years give similar results.

extends from 0, in countries where corruption is greatest, to 10, where corruption is practically none (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 raw material production. When the share of natural capital in national wealth goes up by 15 percentage points, the corruption perceptions index drops (i.e., corruption increases) by two points. The rank correlation is -0.52. When the corruption index is purged of that part which is caused by initial income, the results remain unchanged.

Econometric evidence indicates that a decrease in the corruption perceptions index by two points (i.e., increased corruption) from one country to the next is associated with a reduction in per capita growth of one-half a percentage point per year on the average.²⁵ Figure 6 thus suggests that an increase of 30 percentage points in the natural capital share from one place to another tends to reduce per capita growth by one percentage point per year on the average, merely by encouraging corruption, if nothing else changes. This is no small effect – if it is an effect, that is, as opposed to a mere correlation. This is yet another possible reason why natural resource abundance appears to reduce economic growth across countries.

Next, consider human capital. Figure 7 shows a scatterplot of public expenditure on education from 1980 to 1997 and natural resource abundance measured as in Figures 4-6. Public expenditure on education varies a great deal from country to country. In the 1990s, some countries spent as little as 1 percent of their GNP on education (Haiti, Indonesia, Myanmar, Nigeria, and Sudan). Others have spent between 8 percent and 10 percent of their GNP on education, including St. Lucia, Namibia, Botswana, and Jordan (which, by the way, has no oil). Public expenditure is admittedly an imperfect measure of a nation's commitment to education, not least because some nations spend more on private education than others. Moreover, public expenditure on education may 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-led and thus, perhaps, likely to be of a higher quality. Even so, this yardstick should reflect at least to some extent the government's commitment to education. The regression line through the 90 observations suggests that an increase of 18 percentage points in the natural capital share from one country

²⁵ See Paolo Mauro, "Corruption and Growth," *Quarterly Journal of Economics* 110, August 1995, pp. 681-712.

to the next is associated with a decrease in public expenditure on education by one percent of GNP. The relationship is statistically significant: the rank correlation is -0.32.

Figure 8 shows a scatterplot of secondary-school enrolment for both genders from 1980 to 1997 and natural resource abundance. The regression line through the 91 observations, one per country, suggests that an increase in the natural capital share by five percentage points goes along with a decrease by ten percentage points in the secondary-school enrolment rate from one country to another. The regression is statistically significant: the rank correlation is -0.66. Secondary-school enrolment is probably the most commonly used indicator of education in empirical growth research. Of the two indicators used here, it is the one that is most closely correlated with economic growth.

How about growth? Figure 9 shows that a 30 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. The number of observations is 87. The relationship is statistically significant (the rank correlation is 0.69) and, moreover, significantly nonlinear (not shown), indicating decreasing returns to education. Like the other two indicators, school enrolment reflects, at best, the quantity of education provided rather than the quality of education received. Public expenditure on education (as in Figure 7) is also positively correlated with economic growth across countries in our sample (not shown), but the correlation is not significant in a statistical sense.

To summarize this part of my story, we have seen that, across countries, (a) economic growth varies inversely with natural resource abundance, (b) two different measures of education intended to reflect education inputs and participation are both inversely related to natural resource abundance, and (c) economic growth varies directly with education. Therefore, natural resource abundance seems likely to deter economic growth 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, and possibly displace, the effect of education on growth.

Let us now turn to physical capital. Figure 10 shows a scatterplot of the average ratio of gross domestic investment to GDP in 1965-1998 and natural resource

abundance measured as before. The regression line through the 87 observations, one per country, suggests that an increase of about ten percentage points in the natural capital share from one country to the next is associated with a decrease in investment by two percent of GDP. The relationship is statistically significant: the rank correlation -0.37.

To finish the story, Figure 11 shows a scatterplot of economic growth as measured in Figure 4 and the average ratio of gross domestic investment to GDP over the same period, 1965-1998. The regression line through the 85 observations suggests that an increase in the investment ratio by about five 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.²⁶

In sum, then, an increase in the natural capital share by 25 percentage points goes along with a decrease in the investment ratio by five percentage points by Figure 10, which in turn goes along with a decrease in economic growth by one percentage point by Figure 11.

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.²⁷ Moreover, workers released from primary industries, such as agriculture, fisheries, forestry, or mining, generally 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:

²⁶ See Ross Levine and David Renelt, "A Sensitivity Analysis of Cross-Country Growth Regressions," *American Economic Review* 82, September 1992, pp. 942-963.

²⁷ See Adrian J. B. Wood, "Natural Resources, Human Resources and Export Composition: a Cross-country Perspective", Ch. 3 in Jörg Mayer, Brian Chambers, and Ayisha Farooq (eds.), *Development Policies in Natural Resource Economies*, Edward Elgar, Cheltenham, UK, and Northampton, Massachusetts, 1999.

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.

V. The Special Case of Norway

Norway has charted a long-run-oriented, tax-based, and reasonably market-friendly approach to the management of its vast oil resources. Exactly how vast they are depends on oil prices, which are quite volatile: estimates of the oil wealth range from 50% to 250% of GNP.²⁸ According to Section 1-1 of the Petroleum Act of 1996, the title to petroleum deposits on the Norwegian continental shelf is vested in the State. This means that, 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 in accordance with the Petroleum Taxation Act of 1975.

Exploration and production licenses are awarded for a small fee to domestic and foreign oil companies alike. Why small? Because the Norwegian government has decided to expropriate 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.²⁹ 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, roughly 40 percent of the total. 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. 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. Thus, in 1997, revenues from petroleum activities accounted for more than a fifth of total government revenues and were equivalent to 9-10 percent of Norway's mainland GNP, or 8-9 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 5 percent by 2020. The oil revenue is deposited in the Norwegian Petroleum Fund, which is being built up and invested mostly in foreign securities for the benefit of the

²⁸ See Øysten Thøgersen, "Economic Policy, Macroeconomic Performance and the Norwegian Petroleum Wealth: A Survey", Stiftelsen for Samfunns- og Næringslivsforskning, Norges Handelshøyskole, Bergen, manuscript, 1994.

²⁹ See *OECD Economic Surveys: Norway*, 1999, OECD, Paris, Ch. 3.

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.

At the same time, however, a variable proportion of each year's net oil-tax revenue is transferred from the Government Petroleum Fund to the fiscal budget, essentially to cover the non-oil budget deficit. The proportion of net tax revenues from petroleum thus transferred to the government budget was about one-fourth in 1997 and almost 40 percent in 1998, but is envisaged to drop to less than 10 percent in the years ahead. Even so, the Norwegians have not been tempted to expand their central government beyond reasonable limits as a result of the oil boom. Even 20 years after discovering their oil, the Norwegians continue to content themselves with smaller central government than Denmark, Finland, and especially Sweden. On the other hand, local governments (municipalities and counties), which employ over three quarters of all public-sector workers and almost one fourth of the entire labor force,³⁰ a doubling since 1970, have not managed to exercise similar restraint, but they do not have oil-tax revenue to fall back on except perhaps indirectly through income transfers from the central government. Since 1980, public employment in Norway has increased by almost 60 percent, compared with a 20 percent increase in Denmark over the same period and no increase at all in Sweden. However, the social cost of local government expansion is probably smaller than that of central government expansion, krone for krone, other things being the same. The reason is that local governments, especially in sparsely populated countries such as Norway, are typically more efficient providers of public services like education and health care than the central government because of their closer proximity to their clients.

As indicated in Section II, 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 26 percent in 1980 to 62 percent in 1997. It is not certain, however, whether the average quality of

³⁰ See *OECD Economic Surveys: Norway*, 1998, OECD, Paris, Chapter 2.

college education in Norway has changed in tandem with – or perhaps, as some fear, in inverse proportion to – the huge increase in enrolment since 1980.

Even so, Norway faces challenges. Some (weak) signs of the an outbreak of the Dutch disease can be detected, as was indicated in Section I, notably stagnant exports, the absence of a large, vibrant high-tech manufacturing industry (as in Sweden and Finland next door), and sluggish foreign direct investment. 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 ways to immunize the fund from political interference, just as other key institutions – the courts, media, and now even central banks – have been depoliticized over the years. Such 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. 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.

In conclusion, natural resources bring risks. One is that too many people 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 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 as well as for good education and good investments. In other words, 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 human, physical, and even social capital. Indeed, resource-rich nations can live well of their natural resources over extended periods, even with poor economic policies and a weak commitment to education. Awash in easy cash, they may find that education does 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.

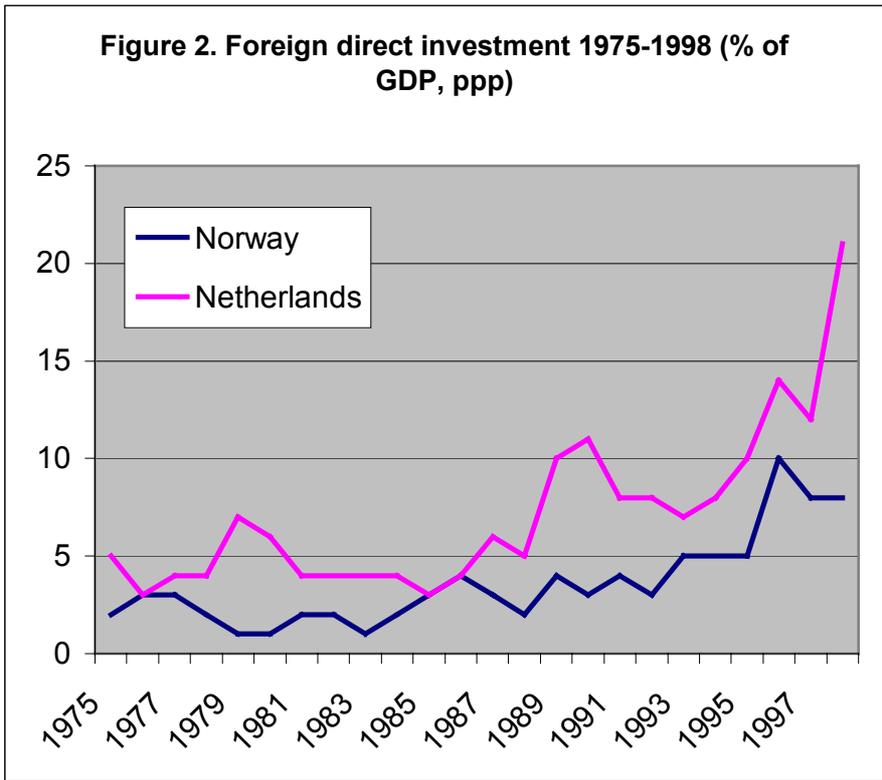
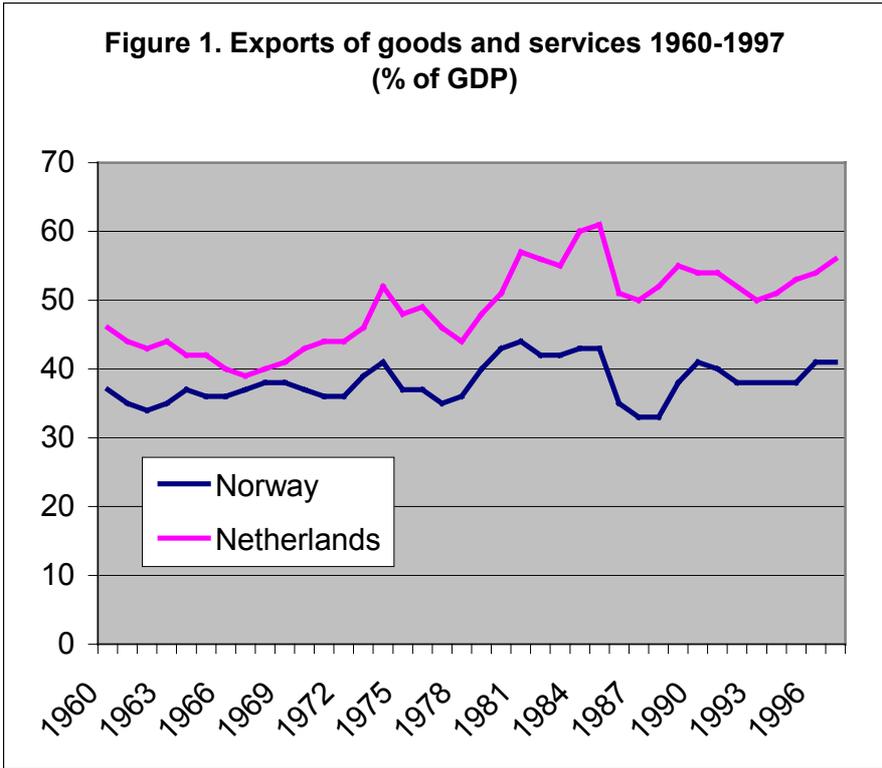


Figure 3. Manufacturing exports 1980-1998 (% of total exports)

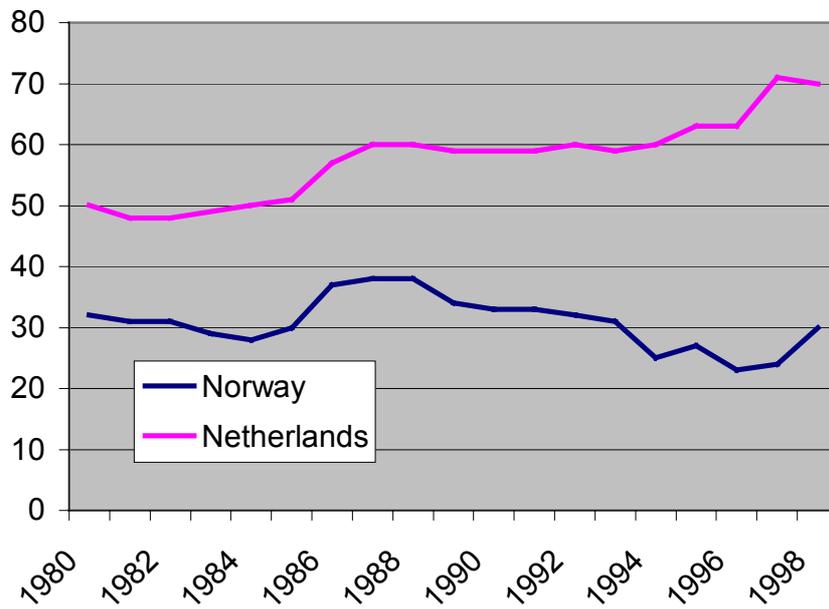
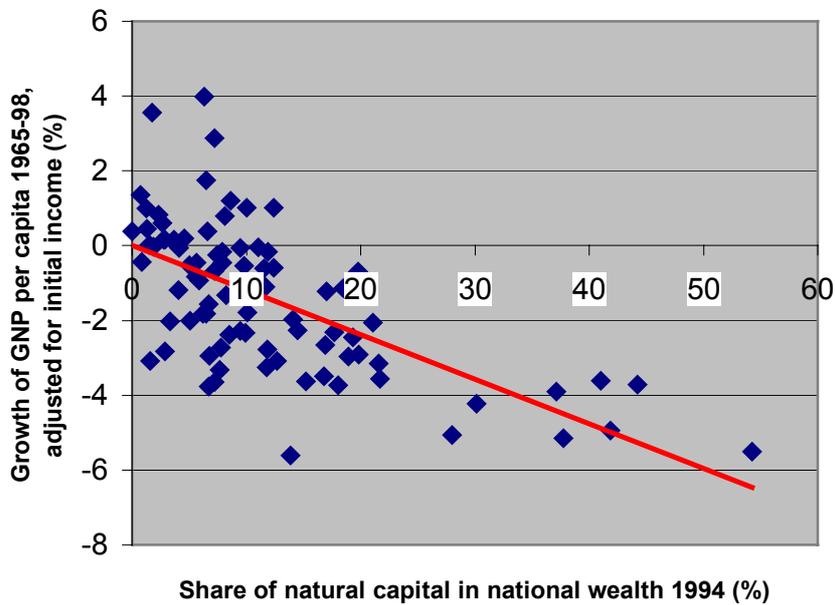


Figure 4. Natural capital and economic growth 1965-1998



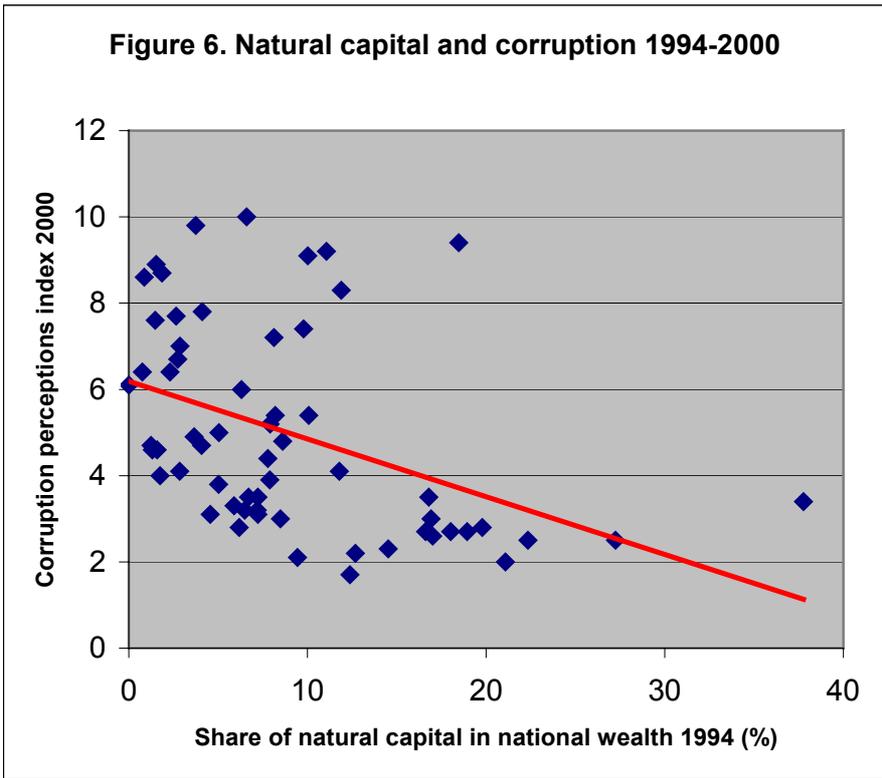
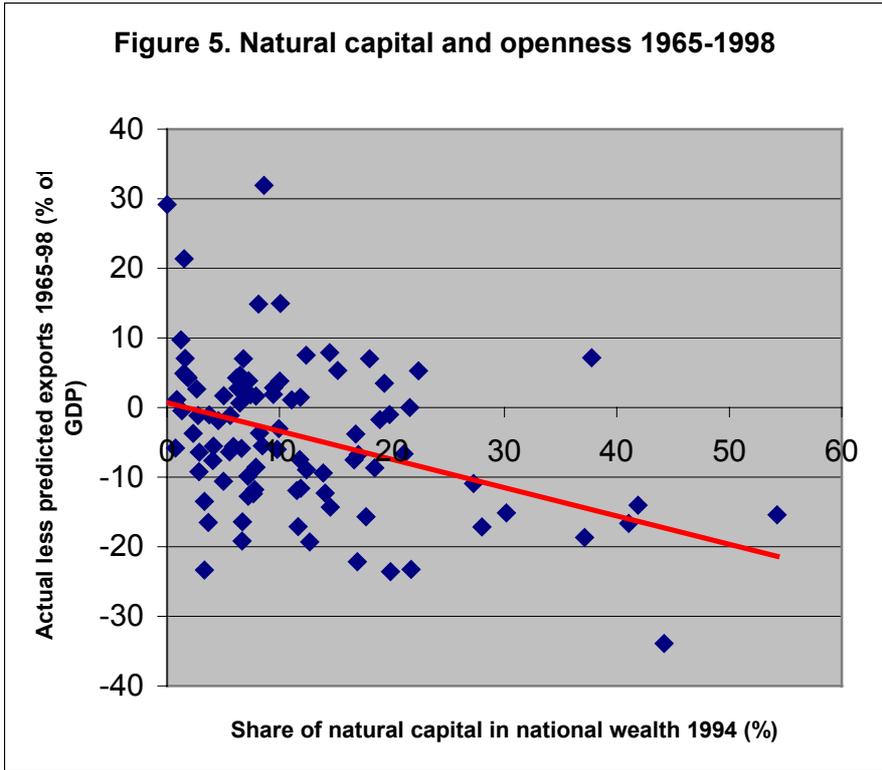


Figure 7. Natural capital and expenditure on education 1980-1997

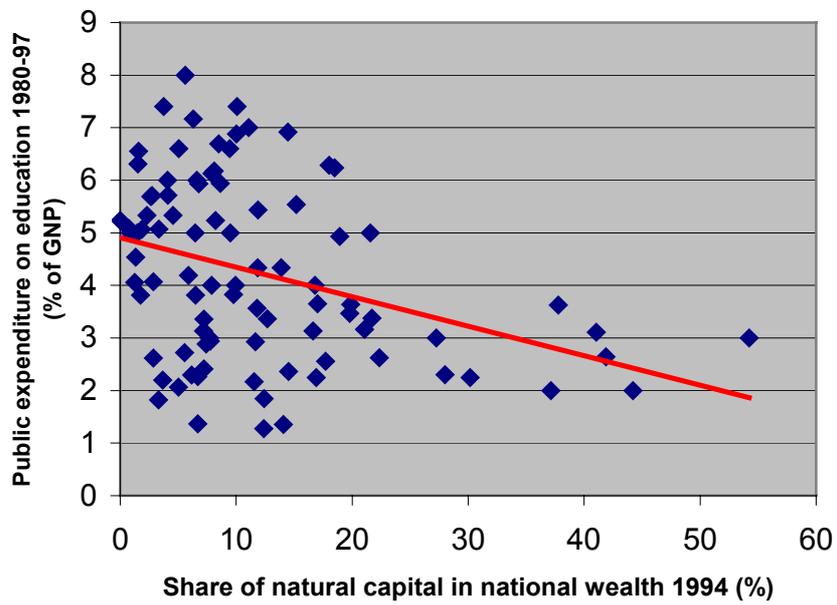


Figure 8. Natural capital and school enrolment 1980-1997

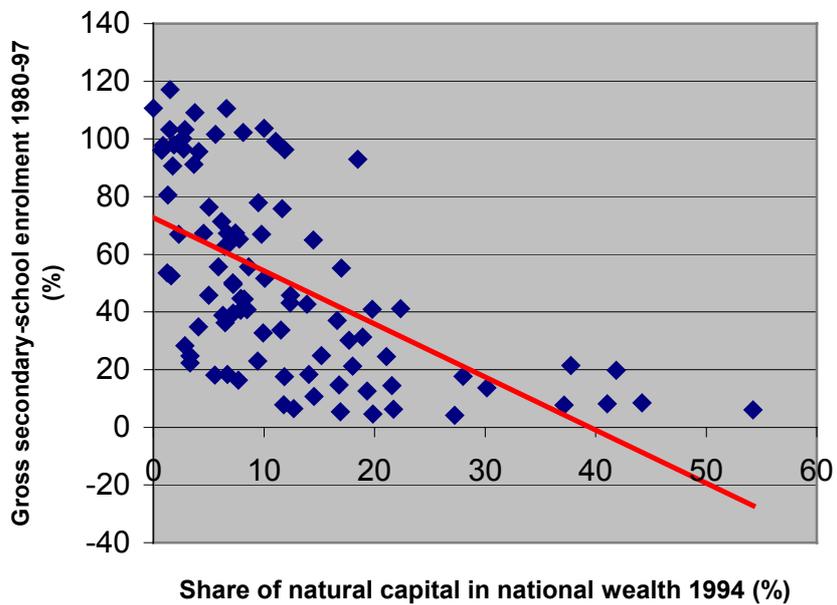


Figure 9. Education and economic growth 1965-1998

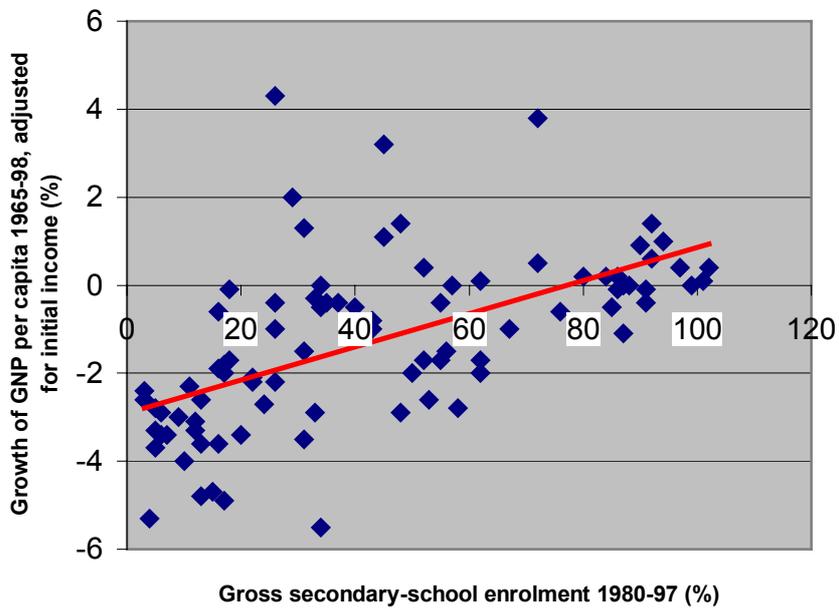


Figure 10. Natural capital and investment

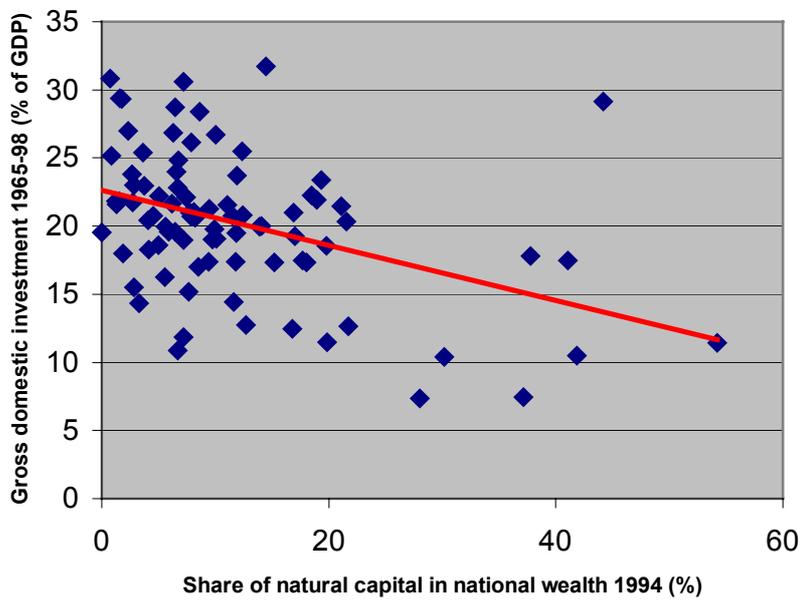
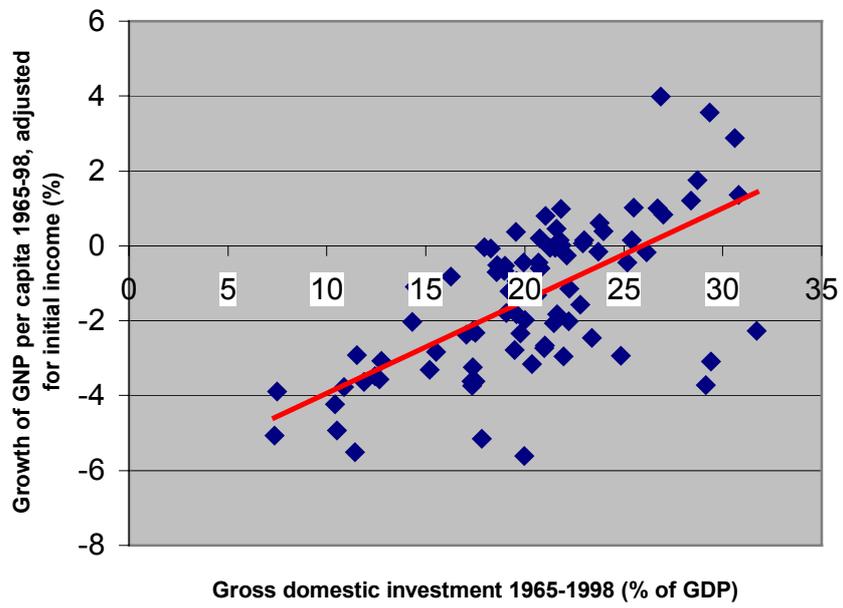


Figure 11. Investment and economic growth 1965-1998



INSTITUTE OF ECONOMIC STUDIES WORKING PAPERS 1987-2001

Formerly Iceland Economic Papers Series

Editor Tryggvi Thor Herbertsson

A complete list of IoES Working Papers and Reprints can be accessed on our World Wide Web site at <http://www.ioes.hi.is>

- W98:12 J. Michael Orszag and Dennis Snower: From Unemployment Benefits to Unemployment Support Accounts
- W98:13 Sveinn Agnarsson, Axel Hall, Tryggvi Thor Herbertsson, Sigurdur Ingolfsson, Gylfi Magnusson, and Gylfi Zoega: EMU and the Icelandic Labor Market
- W98:14 Thorvaldur Gylfason: Exports, Inflation, and Growth
- W99:01 Alison L. Booth, Yu -Fu Chen, and Gylfi Zoega: Hiring and Firing: A Tale of Two Thresholds
- W99:02 Martin Paldam and Gert Tinggaard Svendsen: Is Social Capital an Effective Smoke Condenser?
- W99:03 J. Michael Orszag and Dennis J. Snower: Anatomy of Policy Complementarities
- W99:04 Thorvaldur Gylfason and Tryggvi Thor Herbertsson: Does Inflation Matter for Growth?
- W99:05 Marco Biamchi, Bjorn R. Gudmundsson, and Gylfi Zoega: Iceland's Natural Experiment in Supply-side Economics
- W99:06 Haukur C. Benediktsson, Tryggvi Thor Herbertsson, Gylfi Magnússon, and Marta G. Skúladóttir: Generational Accounts for Iceland
- W99:07 Axel Hall and Jon Thor Sturluson: Testing a CGE Model: The Tax Free Year in Iceland as a Natural Experiment
- W99:08 Edmund S. Phelps: Equilibrium and Disequilibrium in 20th Century 'Macro': With Attention to the Share Price Boom of the 1990s
- W99:09 Kenneth F. Wallis: Macroeconometric Modelling
- W99:10 Tryggvi Thor Herbertsson, Marta G. Skúladóttir, and Gylfi Zoega: Three Symptoms and a Cure: A Contribution to the Economics of the Dutch Disease
- W99:11 Tryggvi Thor Herbertsson and J. Michael Orszag: Issues in European Pension Reforms: Supplementary Pensions
- W99:12 Tryggvi Thor Herbertsson, J. Michael Orszag and Peter R. Orszag: Population Dynamics and Convergence in Fertility Rates
- W99:13 Ragnar Arnason: Costs of Fisheries Management: Theoretical and Practical Implications
- W99:14 Ragnar Arnason: Economic Instruments to Achieve Ecosystem Objectives in Fisheries Management
- W99:15 Ragnar Arnason: Property Rights as a Means of Economic Organization
- W00:01 Jerry Coakley, Ana-Maria Fuertes and Gylfi Zoega: Testing the Persistence and Structuralist Theories of Unemployment

- W00:02 Thrainn Eggertsson: Norms in Economics – With Special Reference to Economic Development
- W00:03 Thorvaldur Gylfason: Growing Apart
- W00:04 Jon Danielsson: The Emperor has no Clothes: Limits to Risk Modelling
- W00:05 Thorolfur Matthiasson: The Icelandic Debate on the Case for a Fishing Fee: A Non-Technical Introduction
- W00:06 Willem H. Buiter: Is Iceland an Optimal Currency Area?
- W00:07 Alison L. Booth and Gylfi Zoega: Why do Firms Invest in General Training? ‘Good’ Firms and ‘Bad’ Firms as a Source of Monopsony Power
- W00:08 Eduard Hochreiter: “Exchange rate regimes and capital mobility: Issues and some lessons from central and eastern European applicant countries”
- W00:09 Thorvaldur Gylfason: Fix or Flex? Alternative Exchange Rate Regimes in an Era of Global Capital Mobility
- W00:10 Thorvaldur Gylfason: Natural Resources, Education and Economic Development
- W00:11 Helgi Tomasson: Signal-noise Decomposition in Financial Markets: An Empirical Stochastic Process Analysis for Infrequent Trading
- W00:12 Thorolfur Matthiasson: Changing Rules for Regulation of Icelandic Fisheries
- W00:13 E. Tumusiime-Mutebile: Economic Reforms and their Impact in Uganda
- W00:14 Sveinn Agnarsson: Productivity in Icelandic Fish Processing Industry 1985 – 1995: A Comparison of Methods
- W00:15 Sveinn Agnarsson: Development of Efficiency in Icelandic Fish Processing Firms: A DEA Approach
- W00:16 Jon Danielsson, Bjorn N. Jorgensen and Casper G. de Vries: Risk Management and Regulation in Incomplete Markets
- W00:17 Ragnar Arnason, Gylfi Magnusson and Sveinn Agnarsson: The Norwegian Spring Spawning Herring Fishery: A Stylised Game Model
- W00:18 Helgi Tomasson: Estimation of Correlations in Financial Markets when Trading is Infrequent
- W00:19 Helgi Tomasson: Computations of Bayesian Estimators in ARMA Models
- W00:20 Helgi Tomasson: Monitoring the trading intensity of a stock market under infrequent trading
- W01:01 Tryggvi Thor Herbertsson: The Economics of Early Retirement
- W01:02 Tryggvi Thor Herbertsson and J. Michael Orszag: The Costs of Early Retirement in the OECD
- W01:03 Asta Herdis Hall and Solveig Frida Johannsdóttir: Generational Equality in Iceland
- W01:04 Gylfi Zoega and Yu -Fu Chen: Exchange Rate Volatility as Employment Protection
- W01:05 Tryggvi Thor Herbertsson and Gylfi Zoega: The Modigliani “Puzzle”
- W01:06 Thorvaldur Gylfason: Lessons from the Dutch Disease: Causes, Treatment and Cures