Working Paper Series*
Department of Economics
Alfred Lerner College of Business & Economics
University of Delaware

Working Paper No. 2007-04

Minerals, Openness, Institutions and Growth: An Empirical Analysis†

James L. Butkiewicz and Halit Yanikkaya

2007

*http://lerner.udel.edu/economics/workingpaper.htm

Minerals, Openness, Institutions and Growth: An Empirical Analysis

James L. Butkiewicz*
University of Delaware

Halit Yanikkaya**
Celal Bayar University

January 2007

*University of Delaware
Lerner College of Business and Economics
Department of Economics
Newark, DE 19716
butkiewj@lerner.udel.edu
Tel: 302 831 1891
Fax: 302 831 6968

**Celal Bayar University
College of Economics and Administrative Sciences
Department of Economics
Manisa, Turkey 45030
halit.yanikkaya@bayar.edu.tr
Tel: 90 236 233 0657
Fax: 90 236 233 2729

Abstract

Empirical evidence from a panel-data analysis indicates that a mineral resource curse exists for certain developing countries, but not for developed countries. Countries with weak institutions are cursed, while developing countries with strong institution are able to avoid the curse. These results are consistent the hypothesis that owners of mineral resources use weak institutions and openness to trade to stifle the development of human capital, to the detriment of growth of other sectors of the economy. Imports of manufactured goods substitute for the development of domestic manufacturing, so openness to trade correlates with lower growth in mineral dependent economies.

JEL classification: Q32, O11, O50

Key Words: Mineral Resources, Institutional Quality, Economic Growth

1. Introduction

Are countries that suffer from the "original sin" of abundant natural resources cursed to lower rates of economic growth? Recent work by Auty (1994, 1997, 2001) and Sachs and Warner (1997, 1999, 2001) provide evidence of a "natural resource curse."[1] However, other studies provide various evidence against the existence of a resource curse (Davis, 1995; Ding and Field, 2005; Lederman and Maloney, 2003; Stijns, 2006; and Wright and Czelusta, 2004).

If a resource curse exists, are all natural resources equally cursed, and if so, why? While Auty and Sachs and Warner argue that all resources are cursed, others (Atkinson and Hamilton, 2003; Bulte, Damania and Decon, 2005; Mehlum, Moene and Torvik, 2006; and Sala-i-Martin and Subramanian, 2003) find that the curse is attached to specific resources, generally mineral resources.

Explanations of the resource curse fall into several categories; the "Dutch disease", poor institutions that are susceptible to rent-seeking and corruption, debt overhang, and low investment in human capital. The "Dutch disease" explanation is that resource exports cause real exchange rate appreciation that crowds out other exports, usually manufacturing. For this effect to lower growth, the declining sector (manufacturing) must have increasing returns or externalities that would result in more rapid growth than expansion of the resource sector.

Rent seeking lowers growth by diverting resources away from productive activities. The potential rewards from development of natural resources, especially mineral resources, provide incentives for corruption of existing political institutions. Alternatively, if existing institutions are strong, development of natural resources may promote growth, while weak institutions foster corruption and lower rates of growth.

[1] Lederman and Maloney (2003) cite a passage from Adam Smith stating that mining is detrimental to growth. However, the cited passage (1937, pp. 529-30) refers to the mining of precious metals (gold and silver). Elsewhere Smith argues that other types of mining are more profitable than precious metal mining (pp. 167-9). Smith believed that agriculture was the greatest source of wealth (p. 392). Smith viewed open ports and British institutions as conducive to higher rates of growth (pp. 537-9).

The debt-overhang problem results from heavy borrowing followed by a resource price decline. Resource-abundant countries benefited from rising resource prices in the 1970s, and some borrowed heavily based on anticipated future revenue. A price decline in the 1980s resulted in debt-crises and revenue-shortfalls that retarded growth in the heavily-indebted countries.

Finally, resource-abundant economies may invest less in the development of other resources, particularly human capital. Lower levels of human capital hinder development of the non-resource sectors of the economy, thereby reducing the overall growth rate of these economies.

These explanations are not mutually exclusive. For example, Falkinger and Grossmann (2005) argue that resource owners may wield their political power to minimize mass education in order to maintain a low cost labor force, particularly if their country is open to trade, providing access to foreign manufactures. Thus, resource abundance, weak institutions and openness to trade combine to reduce the growth of these economies.

This paper reports the results of a new, expanded study of the "resource curse." The study examines data for a larger number of countries and for a longer time span than most previous studies. While many studies examine averages for a cross section of countries, the data here are a panel for three decades. The cross-section studies generally report evidence of a resource curse, but Mangano and Rigobon (2001) report that evidence of a curse disappears in panel estimates.

The first important result is that there is a mineral curse for developing countries only. This curse appears to result from poor institutions that are susceptible to rent-seeking behavior by the owners of mineral resources. Rent seeking is likely more lucrative when resource ownership is concentrated, as is typical with minerals, than when ownership is diffused, as is

often the case in agriculture. Importantly, support is found for Falkinger and Grossmann's (2005) contention that openness to trade reduces growth in mineral dependent economies.

The remainder of this paper is written as follows. Section 2 discusses the literature on the resource curse. Section 3 discusses the econometric approach and data. Results are presented and discussed in section 4. Section 5 concludes the paper.

2. Literature Review

Both Auty (1994, 1997, 2001) and Sachs and Warner (1997, 1999, 2001) find evidence of a natural resource curse. Both sets of studies attribute the curse to all resources. While Sachs and Warner attribute the curse primarily to Dutch disease effects, and to a lesser extent rent seeking, Auty also cites less openness to trade and slower development of physical and human capital in resource-abundant economies.

Sala-i-Martin and Subramanian (2003) find that a resource curse exists for mineral resources, but the curse is due to negative effects on institutional quality. Controlling for the indirect effect of resources on institutional quality, they find no evidence of an independent effect of resources on growth. Isham, et al., (2005) show that export concentration in minerals, fuels and plantation crops is strongly associated with weak public institutions which are, in turn, strongly associated with slower growth. They find that the main channel through which export structure affects growth is via institutions.

Easterly and Levine (2002) similarly find that the effect of resource endowments on development works through institutions. Bulte, Damania and Deacon (2005) find that high levels of "point resources", resources extracted from a narrow base such as oil and minerals, result in lower levels of various human development indicators. They also find the link is indirect, through institution quality, rather than directly from resources to human development.

Robinson, Torvik and Verdier (2006) develop a theoretical model of the impact of resources on institutions. In their model good institutions avoid rent seeking while weak institutions succumb to rent-seeking behavior. Sandbu (2006) proposes a solution to rent seeking by making society aware of the costs of rent seeking. He recommends that governments should distribute all resource rents and tax back what they need to spend as a method of limiting wasteful government consumption.

Rather than assuming that institutional quality responds endogenously to resources, Lane and Tornell (1996) and Mehlum, Moene and Torvik (2006a, 2006b) argue that existing institutional quality determines whether resources are a blessing or a curse. Mehlum, Moene and Torvik present evidence (2006a) that the effect of resources varies from a curse to a blessing as institutional quality improves. Focusing on government behavior, Atkinson and Hamilton (2003) find that the curse varies with an appropriately computed measure of saving adjusted for resource (energy, minerals and timber) depletion. When governments consume resource rents, a curse exists, but disappears if governments invest (save) resource rents.

Birdsall, Pinckney and Sabot (2001) find that resource-abundant countries invest less in human capital, with negative implications for growth. Bravo-Ortega and Gregorio (2005) find that natural resources are damaging for economic growth in countries with low levels of human capital. Hence, the negative impact of natural resources could be offset through the accumulation of human capital. Manzano and Rigobon (2001) argue that resource-abundant countries borrowed heavily based on future revenue. Falling resource prices in the 1980s created a debt-overhang problem that slowed growth. Hausmann and Rigobon (2002) suggest that the curse results from financial market imperfections. Papyrakis and Gerlagh (2004) report that the most important negative effect of natural resource abundance on growth is that resource abundance lowers (the need for) physical investment.

Birdsall and Hamoudi (2002) argue that Dollar and Kraay's (2001) finding that openness promotes growth is due, at least in part, to commodity-dependent countries. The collapse of commodity prices in the 1980s forced many commodity exporters to limit imports to reduce trade deficits. Thus, openness measures of trade to GDP declined. They find that controlling for commodity-dependent countries reduces the effect of openness on growth by at least half.

Other studies present evidence against the existence of a resource curse. Davis (1995) finds that 22 mineral economies compare favorably to nonmineral economies in terms of GDP/capita and a variety of human development indicators. Stijns (2006) presents similar results that there is a positive correlation between mineral wealth and human capital indicators.

Resource dependence is typically measured by resource exports as a percent of GDP or of merchandise exports. Wright and Czelusta (2004) and Ding and Field (2005) distinguish between exports and endowments. Wright and Czelusta discuss various cases demonstrating that mineral extraction is knowledge based and high tech, arguing that there is no curse. Ding and Field find a curse for dependence but not for endowments. Estimating a recursive model they find that the negative effects of dependence (exports) and endowments disappear. They find a negative relationship between human capital and resource dependence, that is, increases in human capital reduce resource dependence and increase growth. Thus, the curse may be due to a high level of resource dependence that is due to poor development of human capital.

Lederman and Maloney (2003) find that resource abundance positively affects growth, but export concentration in resources hurts growth. They find that the negative effect is due to reduced accumulation of physical and human capital and deterioration of the terms of trade.

Most of the studies discussed above investigate measures of economic development at a point in time or use the average growth rate over some period of time for a cross-section of

countries. Mangano and Rigobon (2001) find that the cross-section evidence of a resource curse disappears in panel estimates. Only Birdsall and Hamoudi (2002) who find evidence of a commodity cur se, and Lederman and Maloney (2003) who find that resources are positively related to growth, use panel data in their estimates. Their contradictory findings leave in doubt the existence of a resource curse.

Thus the existence of a resource curse, the resources that are "cursed" and the mechanism through which the curse reduces growth are all subject to dispute. This paper presents additional evidence on the existence of a resource curse, using an expanded data set and econometric specifications that improve upon previous studies. New variables that are included in the study provide new insights into policies that can foster economic development.

3. Model and Data

An empirical growth model is used to analyze the effect of resources on growth. The model has the form:

$$g_{yt} = F(y_t, X_t, Z_t) \qquad (1)$$

where γ_{yt} is a country's per capita growth rate in period t, y_t is initial GDP per capita, X_t is a vector of conditioning variables that have found to be key determinants of growth, and the variable Z_t represents a vector of variables related to the resource curse.

The conditioning variables in the vector X_t are those commonly used in the literature. The lagged logarithm of life expectancy is used as a measure of human capital, and current gross capital formation as a percentage of GDP is the measure of physical capital. Since the population growth rate reduces growth in the neoclassical growth model, current population growth enters as an independent variable. Institutional quality is measured by the Kaufmann, Kraay and Mastruzzi (2003) index of the rule of law. Dummy variables are included for

landlocked countries and for three geographic regions: Sub-Saharan Africa, Latin America and East Asia (coefficients not reported).[2]

The measures of resource dependence in Z_t are real resource exports as a percentage of real GDP and real resource exports as a percentage of real merchandise exports. Following the recommendations of Dollar and Kraay (2001) and Birdsall and Hamoudi (2002), the trade/GDP measures are deflated by their respective price indices to obtain ratios of real magnitudes. This is especially important if resource prices are more volatile than prices in general.[3]

Other variables in Z_t include four categories of resource exports: agricultural products, food, fuel and mineral; the ratio of central government debt to GDP; volatility of the terms of trade; the growth of the terms of trade; and growth of real effective exchange rate index. Contemporaneous and five-year lags of import and of export duties are used in some specifications. Another trade measure used is the ratio of real trade to real GDP, each deflated by the appropriate price index. Other measures of openness include the Sachs and Warner index of openness, the share of trade in GDP from Penn World Tables 6.1 (which is a ratio of nominal values), the constant dollar values of imports and exports to GDP, the external balance as a percent of GDP, and trade shares with OECD and non-OECD nations.[4]

Decade averages growth rates are computed for the periods 1970-1979, 1980-1989 and 1990-1999 to form a panel of data that is the basis of analysis. The use of a panel is important because Manzano and Rigobon (2001) reported that the evidence of a curse found in a simple cross-section regression disappeared in panel estimates.

[2] Of the regional dummies, only East Asia has a significant (positive) coefficient.
[3] Separate price indices do not exist for export components, so nominal ratios are used for commodity exports/merchandise exports.
[4] Unless otherwise noted, all variables are taken from World Development Indicators, 2004; trade shares with OECD and non-OECD nations and landlocked dummy are from Easterly and Sewadeh (2000); and initial GDP per capita is from PWT 6.1.

Lederman and Maloney (2003) point out that Sachs and Warner changed the measure used for resource exports for two countries and that this adjustment was crucial to their results. No such adjustments are made to the data used here.

The data set includes over 100 developed and developing nations.[5] The model is estimated using the Seemingly-Unrelated Regression (SUR) technique. While the constant term for each decade is allowed to vary, coefficients for other variables are constrained to have the same value for all decades.

4. Results

Estimates of the base model are reported in Table 1. The estimated coefficients for initial GDP indicate rates of convergence typically obtained in empirical studies. The measures of human and physical capital are both significant with the correct sign. Being landlocked reduces growth, although the effect is significant only for developing nations when the sample is split into developing and developed nations.

Population growth rates have a positive and significant effect on growth in developing countries. While this result is inconsistent with the basic neoclassical growth model, in models of knowledge accumulation and research and development population growth can have a positive effect on growth (Strulik, 2005).

Having high quality institutions as measured by the rule-of-law index significantly enhances growth. Again, the effect is important only for developing nations when the sample is split.[6]

Even controlling for two possible channels through which the resource curse hinders growth, poor institutional quality and low human capital,[7] the results suggest a resource curse

[5] A list of countries is available from the authors upon request.
[6] The standard deviation for the rule of law index over the entire sample is 0.44 for developed nations and 0.67 for developing nations, an increase of 50%. The insignificance of the rule of law measure for developed nations may be due to a lack of variation in the data.
[7] Using educational variables instead of life expectancy does not affect the significance of the natural resource exports and also most of the educational variables are statistically insignificant.

exists for either measure of resources. However, when the sample is divided between developing and developed countries, the resource curse exists only for developing countries. For developing countries, while a 10% increase in resource exports (percentage of GDP) is estimated to reduce growth by approximately 0.3% annually, a 10% increase in resource exports (percentage of merchandise exports) reduces growth by 0.1% annually.

To further understand the resource curse, exports are separated into the component categories. Table 2 reports the results for each type of resource exports. The results indicate the curse applies to mineral exports for developing nations and agricultural exports for developed nations. Since the resource curse exists for mineral exports, the fifteen most mineral dependent countries are excluded from the sample and the model is re-estimated.[8] The results reported in the second panel of Table 2 indicate that the mineral resource curse is not exclusive to the most important mineral-dependent exporters.

The next set of results examines the debt-overhang argument of Manzano and Rigobon (2001), that the curse is the result of extensive borrowing and declining terms of trade in the 1980s.[9] The estimates in Table 3 are for developing countries only. Columns 1 and 2 report results indicating that a resource curse exists for either measure of resource dependence. Controlling for the level of central government debt to GDP (columns 3 and 4), the results indicate that the resource curse still exists. Countries with a high debt ratio do experience lower growth, but including the debt ratio does not render either resource measure insignificant.

The next four columns of Table 3 examine whether the resource curse results from declining terms of trade. One limitation is that neither resource measure is significant in the

[8] The ten most mineral-dependent developing and five most mineral-dependent developed countries are excluded. The developing countries are Bolivia, Chile, Guyana, Malaysia, Mauritania, Morocco, Papa New Guinea, Sierra Leone, Togo, and Zambia. Their share of mineral exports (% of GDP) exceeds 10 percent. The developed countries are Australia, Canada, Iceland, Norway, and Sweden. These are the only developed countries appearing in the upper one-third when countries sorted by their shares of mineral exports in the 1970-75.

[9] Note that the sample used here includes the 1990s and well as the 1970s and 1980s.

smaller sample for which terms of trade data are available.[10] While the terms of trade volatility measure is insignificant, the growth of the terms of trade variable is marginally significant in both specifications. Thus, declining terms of trade do reduce growth. However, due to the limited sample size, it cannot be concluded that declining terms of trade explain the resource curse.

The last two columns of Table 3 examine whether the mineral curse results from currency revaluation. Both mineral exports measures and real effective exchange rate index are highly significant and negative but the sample size is extremely small. Note that there are no changes in the magnitudes of the coefficients of the mineral exports variables. It seems that for the mineral curse, rent seeking activities and export concentration are the problem, not the Dutch disease.

Table 4 reports the results when the developing countries are divided into good and bad institution cohorts using the Kaufmann, Kraay and Mastruzzi (2003) measure of institutional quality.[11] Countries with a rule-of-law score greater than zero are assigned to the good institutions group. Consistent with previous findings, a mineral-resource curse exists when institutions are bad, but not when they are good. The results for non-mineral resources indicate that these other types of resources neither enhance nor deter growth.

Since these estimates are for the full sample of developing nations, they provide strong evidence that the mineral-resource curse exists when institutions are weak, but not when they are strong. Since many cross-section studies also found that weak institutions caused the resource curse, the findings reported here, estimated for panel data over a longer time span than any previous study, corroborate these previous findings.

[10] That is, excluding the terms of trade measures and re-estimating the model for the same sample, both resource measures are insignificant (results not reported).
[11] Dividing countries into two groups according to the quality of their institutions based on other measures such as Gastil indices or Regime Durability Dummy taken Polity IV data set does not change the pattern of results. The mineral resource curse exists only for countries having poor institutions.

The sample of developing countries is divided into the two groups of most and least commodity dependent, using Birdsall and Hamoudi's (2002) criteria. The reported results in Table 5 indicate that developing countries that are not commodity dependent benefit from tariffs, while commodity dependent countries benefit from export duties.[12] Generally trade taxes are expected to have negative effects on trade-driven development, but Yanikkaya (2003) previously found that tariffs increase the growth rates of developing nations. Developing nations that are not commodity dependent are developing export sectors that may benefit from tariff protection. Export duties may increase export diversification in commodity dependent countries, and diversification may enhance growth. For example, export taxes have been effective instruments for promoting domestic processing activities for cashew nuts in Mozambique, and for agro-processing in Thailand; and have facilitated diversifying exports beyond coffee in Colombia (UNCTAD, 1997).

The results reported in Table 6 indicate that trade shares are negatively associated with growth in both least- and most-commodity dependent developing countries.[13] However, these results by no means imply that the overall effects of trade volumes on growth are negative. When investment shares are excluded from the regressions, trade shares have no negative impact on the growth rates of either least- or most-commodity dependent developing countries.[14] Excluding investment shares from the growth regressions can be justified by both the potential existence of reverse causality between growth and investment, and because investment is the most likely channel through which trade affects growth. These results imply that trade affects growth mainly through higher capital accumulation. These results are consistent with Levine and Renelt (1992) who suggest that the linkage between trade and output growth may occur through investment, rather through better resource allocation.

[12] Using the five-year lagged values of import and export duty variables obtain identical results.
[13] The estimated effect is larger (in absolute value) for the most-commodity dependent countries.
[14] The estimation results without gross capital formation (not reported) are available from authors.

A recent model developed by Falkinger and Grossmann (2005) demonstrates how owners of concentrated resources use weak institutions and openness to trade to limit development of human capital with negative consequences for growth. The results in Table 7 provide evidence in support of their model. The sample is divided into two groups of the least and most mineral dependent countries. Results for import and exports duties in the first two rows are generally consistent with the results reported in Table 5.

The coefficients for the real trade share variable in row 3 indicate that openness to trade in mineral dependent countries reduces growth, consistent with the Falkinger-Grossmann prediction. When the openness measure is divided into exports and imports, the negative effect is due to imports, again consistent with Falkinger and Grossman. The results obtained using the PWT trade share data in row 6 are also consistent with this hypothesis. The negative effect of trade with OECD countries while trade with non-OECD countries has no significant effect supports their contention that powerful groups will limit development of domestic manufacturing if manufactured goods are readily imported.[15] It is in this sense that openness to trade hinders growth.

The results using the Sachs and Warner openness index indicate a positive effect on growth. However, this index is (negatively) determined in part by black market exchange rate premium data. If the black market premium measure is substituted for the openness index, a significant negative effect is obtained. Thus, a higher black market premium, or market/price distortion, deters growth.

The significant, positive coefficient for the external balance variable indicates that mineral dependent countries with a trade surplus grow faster. However, the negative and significant coefficient for the external balance measure for the least-mineral dependent countries seems consistent with the result that exports lower growth in these countries.

[15] Imports from developed nations are more likely finished products such as manufactures.

5. Conclusion

Previous studies have provided contradictory evidence regarding the existence of a resource curse that slows economic growth. Also, the evidence has been shown to be sensitive to the statistical method employed; cross-section evidence of a resource curse disappears in panel estimates.

This paper reports new evidence about the natural resource curse. A sample of developed and developing countries is studied in a thirty-year panel data set. The time span is longer than previous studies, including the commodity price boom of the 1970s, the decline of the 1980s, and the 1990s as a comparison to both.

The results indicate that a mineral-resource curse exists for developing countries only. Other types of resources are not similarly cursed. Investigation of various possible causes of the resource curse finds the strongest evidence supporting the weak institution-rent seeking explanation. A mineral-resource curse exists for developing nations with weak institutions, but not for those with strong institutions.

Further examination of the data finds evidence supporting the explanation of Falkinger and Grossmann. Powerful groups who control resources also control weak institutions and use their power to limit education for the general population, especially of openness to trade provides access to manufactured imports. Openness to trade in this case can also increase the returns to the owners of the resources, and a poorly educated labor force with limited alternatives is a source of cheap labor for development of domestic resources. The evidence indicates that increased imports do reduce growth in mineral-dependent economies.

The policy implications are clear. Mineral-dependent economies need to develop stronger institutions that encourage the development of human capital and diversified growth. The methods by which this can be done are, unfortunately, equally unclear.

REFERENCES

Atkinson, G., & Hamilton, K. (2003). Savings, growth and the resource curse hypothesis. *World Development*, 31, 1793-1807.

Auty, R. M. (1994). Industrial policy reform in six large newly industrializing countries: The resource curse thesis. *World Development*, 22, 11-26.

Auty, R. M. (1997). Natural resource endowment, the state and development strategy. *Journal of International Development*, 9, 651-63.

Auty, R. M. (2001). The political economy of resource-driven growth. *European Economic Review*, 45, 839-846.

Bravo-Ortega, C., & de Gregorio, J. (2005). "The relative richness of the poor? Natural resources, human capital, and economic growth", The World Bank, Policy Research Working Paper Series 3484.

Birdsall, N., Pinckney, T., & Sabot, R. (2001). Natural resources, human capital and growth. In R. M. Auty (Ed.), *Resource abundance and economic development* (pp. 57-75). Oxford: Oxford University Press.

Birdsall, N., & Hamoudi, A. (2002). Commodity dependence, trade, and growth: When "openness" is not enough. Center for Global Development Working Paper 7.

Bulte, E. H., Damania, R., & Deacon, R. T. (2005). Resource intensity, institutions, and development. *World Development*, 33, 1029-1044.

Davis, G. (1995). Learning to love the Dutch disease: Evidence from the mineral economies. *World development*, 23, 1765-1779.

Ding, N., & Field, B. C. (2005). Natural resource abundance and economic growth. *Land Economics*, 81, 496-502.

Dollar, D., & Kraay, A. (2001). Trade, growth, and poverty. World Bank Working Paper.

Easterly, W., & Levine, R. (2002). Tropics, germs, and crops: How endowments influence economic development. NBER Working Paper 9106.

Easterly, W., & Sewadeh, M. (2002) Global development network growth database" The World Bank: http://www.worldbank.org/research/growth/

Falkinger, J., & Grossmann, V. (2005). Institutions and development: The interaction between trade regimes and political system. *Journal of Economic Growth*, 10, 231-272.

Hausmann, R., & Rigobon, R. (2002). An alternative interpretation of the "resource curse": Theory and policy implications. NBER Working Paper 9424.

Isham, J., Woolcock, M., Pritchett, L. & Busby, G. (2005). The varieties of resource experience: Natural resource export structures and the political economy of economic growth. *World Bank Economic Review*, 19 (2), 141-74.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2003). Governance matters III – Governance indicators for 1996-2002. WBER, Volume:12, No:12.

Lane, P. R., & Tornell, A. (1996). Power, growth, and the voracity effect. *Journal of Economic Growth*, 1, 213-241.

Lederman, D., & Maloney, W. F. (2003). Trade Structure and Growth. World Bank Policy Research Paper 3025.

Levine, R. & Renelt, D. (1992). A sensitivity analysis of cross-country growth regressions. *American Economic Review*, 82, 942-963.

Manzano, O., & Rigobon, R. (2001). Resource curse or debt overhang? NBER Working Paper 8390.

Mehlum, H., Moene, K., & Torvik, R. (2006a). Institutions and the resource curse. *The Economic Journal*, 116, 1-20.

Mehlum, H., Moene, K., & Torvik, R. (2006b). Cursed by resources or institutions? *World Economy*, 8, 1117-1131.

Papyrakis, E. & Gerlagh, R. (2004). The resource curse hypothesis and its transmission channels. *Journal of Comparative Economics*, 32, 181-193.

Penn-World Table: http://pwt.econ.upenn.edu/php_site/pwt_index.php

Robinson, J. A., Torvik, R., & Verdier, T. (2006). Political Foundations of the resource curse. *Journal of Development Economics*, 79, 447-68.

Sachs, J. D., & Warner, A. M. (1997). Sources of slow growth in African economies. *Journal of African Economies*, 6, 335-76.

Sachs, J. D., & Warner, A. M. (1999). The big push, natural resource booms and growth. *Journal of Development Economics*. 59, 43-76.

Sachs, J. D., & Warner, A. M. (2001). The curse of natural resources. *European Economic Review*, 45, 827-838.

Sala-i-Martin, X., & Subramanian, A. (2003). Addressing the natural resource curse: An illustration from Nigeria. NBER Working Paper 9804.

Sandbu, M. E. (2006). Natural wealth accounts: A proposal for alleviating the natural resource curse. *World Development*, 34, 1153-1170.

Smith, A. (1937). *The wealth of nations*. New York: The Modern Library.

Stijns, J.-P. (2006). Natural resource abundance and human capital accumulation. *World Development*, 34, 1060-1083.

Strulik, H. (2005). The role of human capital and population growth in R&D-based models of economic growth. *Review of International Economics*, 13, 129-45.

UNCTAD (1997). Diversification in commodity dependent countries: the role of governments, enterprises and institutions. UNCTAD secretariat report: http://www.unctad.org/en/docs/c1d12.en.pdf.

World Bank. (2004). *World Development Indicators.*

Wright, G., & Czelusta, J. (2004). The myth of the resource curse. *Challenge*, 47, #2, 6-38.

Yanikkaya, H. (2003). Trade openness and economic growth: A cross-country empirical investigation. *Journal of Development Economics*, 72, 57-89.

Table 1

Basic Growth Model and Resource Curse

Independent variable	GDP per capita growth rates					
Variable	All Countries	Developing Countries	Developed Countries	All Countries	Developing Countries	Developed Countries
Log (Initial GDP per capita)	-3.63***	-3.69***	-4.79**	-3.26***	-3.37***	-3.26*
	(6.67)	(5.84)	(2.15)	(6.14)	(5.45)	(1.72)
Log (Life Expactancy, lagged)	9.00***	10.87***	-51.05***	7.11**	9.01***	-59.17***
	(2.62)	(2.90)	(2.76)	(2.15)	(2.46)	(3.68)
Population Growth Rates	0.20	0.30*	0.10	0.20	0.38**	-0.03
	(1.29)	(1.63)	(0.38)	(1.31)	(2.02)	(0.11)
Gross Capital Formation	0.15***	0.15***	0.12**	0.12***	0.12***	0.12**
	(7.18)	(6.12)	(2.17)	(6.07)	(5.13)	(2.47)
Rule of Law	1.30***	1.21***	0.36	1.22***	1.22***	0.19
	(5.91)	(4.40)	(0.58)	(5.64)	(4.55)	(0.41)
Landlocked Dummy	-0.77**	-0.69*	0.13	-0.81**	-0.66*	-0.13
	(2.22)	(1.73)	(0.19)	(2.34)	(1.68)	(0.19)
Natural Resource Exports (% of GDP)	-0.031***	-0.031***	0.049			
	(3.03)	(2.82)	(1.29)			
Natural Resource Exports (% of Merchandise Exports)				-0.012**	-0.012*	0.007
				(2.33)	(1.78)	(1.05)
For each equation, R^2	.24, .64	.32, .60	.48, .45	.30, .59	.33, .51	.47, .49
(N)	.31, (297)	.34, (220)	.42, (77)	.26, (321)	.30, (237)	.43, (84)

Each system of equations is estimated by SUR method. The systems have 3 equations, where the dependent variables are the per capita growth rate over each decade. Each equation has a different constant term (not reported here). Other coefficients are restricted to be the same for all periods. t-statistics are in parentheses. *** Significant at the 1 percent-level. ** Significant at the 5 percent-level. * Significant at the 10 percent-level. In all regressions, three regional dummies (Sub-saharan Africa, Latin America, and East Asia) are also included.

Table 2

Effects of Resource Types on Growth

Variable	All Countries	Developing Countries	Developed Countries	All Countries	Developing Countries	Developed Countries
	% of GDP in constant prices			% of Merchandise Exports		
Natural Resource Exports	-0.031***	-0.031***	0.049	-0.012**	-0.012*	0.007
	(3.03)	(2.82)	(1.29)	(2.33)	(1.78)	(1.05)
Agricultural Exports	-0.13**	-0.11*	-0.50***	-0.013	-0.005	-0.12***
	(2.29)	(1.91)	(2.57)	(1.18)	(0.45)	(3.30)
Food Exports	0.006	-0.010	0.056	0.003	0.005	0.0005
	(0.37)	(0.52)	(1.27)	(0.59)	(0.96)	(0.04)
Fuel Exports	-0.011	-0.0009	0.069	0.0003	0.002	0.024**
	(0.66)	(0.05)	(0.93)	(0.06)	(0.32)	(2.24)
Mineral Exports	-0.084***	-0.085***	0.19	-0.024***	-0.027***	0.069
	(3.90)	(4.12)	(0.74)	(3.20)	(3.50)	(1.50)
	Without 15-most-mineral dependent countries					
Natural Resource Exports	-0.026**	-0.021	0.052	-0.010*	-0.009	0.04
	(1.97)	(1.47)	(0.88)	(1.69)	(1.22)	(0.43)
Agricultural Exports	-0.18***	-0.16**	-0.65**	-0.017	-0.011	-0.13***
	(2.60)	(2.13)	(2.56)	(1.43)	(0.85)	(3.00)
Food Exports	-0.004	-0.006	0.16**	0.0006	0.002	-0.005
	(0.18)	(0.29)	(2.04)	(0.10)	(0.26)	(0.27)
Fuel Exports	-0.015	-0.005	0.031	-0.0007	0.0008	0.024
	(0.88)	(0.28)	(0.15	(0.12)	(0.11)	(1.65)
Mineral Exports	-0.15***	-0.15***	0.07	-0.02*	-0.024**	0.28***
	(2.58)	(2.52)	(0.14)	(1.71)	(2.00)	(2.93)

Notes: See, Table 1.

Table 3

Alternative Explanations of Resource Curse

Independent variable	GDP per capita growth rates: Developing Countries only									
Variable	1	2	3	4	5	6	7	8	9	10
Log (Initial GDP per capita)	-3.69***	-3.14***	-4.30***	-3.98***	-2.63***	-2.40***	-2.71***	-2.77***	-5.22***	-5.02***
	(5.95)	(5.14)	(4.63)	(4.58)	(3.63)	(3.32)	(3.76)	(3.86)	(6.11)	(5.99)
Log (Life Expactancy, lagged)	8.92***	6.57*	4.82	4.29	7.25*	7.44*	7.19*	9.56**	4.97	3.55
	(2.41)	(1.76)	(0.90)	(0.81)	(1.75)	(1.73)	(1.73)	(2.24)	(0.77)	(0.53)
Population Growth Rates	0.24	0.29*	0.19	0.38*	0.57**	-0.70***	-0.49*	-0.58**	0.40	0.51**
	(1.29)	(1.64)	(0.76)	(1.67)	(2.25)	(2.81)	(1.92)	(2.33)	(1.53)	(1.96)
Gross Capital Formation	0.15***	0.12***	0.16***	0.15***	0.15***	0.13***	0.14***	0.13***	0.12***	0.11***
	(6.19)	(5.32)	(4.06)	(4.12)	(4.54)	(4.09)	(4.52)	(4.28)	(3.66)	(3.33)
Rule of Law	1.31***	1.32***	1.58***	1.64***	0.89***	0.67**	1.017***	0.83***	2.12***	2.26***
	(4.85)	(4.97)	(4.54)	(5.18)	(2.82)	(2.13)	(3.27)	(2.74)	(5.78)	(6.06)
Landlocked Dummy	-0.38	-0.43	-0.87	-0.84	-0.47	-0.69	-0.47	-0.60	-0.36	-0.22
	(0.97)	(1.11)	(1.523	(1.63)	(1.12)	(1.58)	(1.12)	(1.40)	(0.68)	(0.42)
Mineral Exports (% of GDP)	-0.085***		-0.077***		-0.017		-0.012		-0.091***	
	(4.12)		(3.12)		(0.45)		(0.34)		(2.65)	
Mineral Exports (% of Merchandise Exports)		-0.026***		-0.030***		0.001		0.05		-0.028**
		(3.50)		(2.87)		(0.13)		(0.54)		(2.23)
Central Gov't Debt (% of GDP)			-0.009*	-0.010**						
			(2.03)	(2.27)						
Terms of trade volatility					-0.014	-0.012				
					(1.37)	(1.20)				
Growth of terms of trade							0.069*	0.079*		
							(1.65)	(1.93)		
Growth of real effective exchange rate index									-0.047***	-0.047***
									(2.99)	(2.85)
For each equation, R2	.41, .59	.43, .50	.58, .48	.64, .44	.54, .49	.51, .44	.56, .48	.59, .43	.65, .63	.60, .65
(N)	.35, (220)	.31, (234)	.45, (126)	.46, (135)	(133)	(138)	(133)	(137)	(83)	(85)

Notes: See Table 1.

Table 4

Developing Nation Institutional Quality and the Resource Curse

GDP per capita growth rates: Developing Countries only

Variable	% of GDP in constant prices				% of Merchandise Exports			
	Good-institutions		Poor-institutions		Good-institutions		Poor-institutions	
Natural Resource Exports	-0.004	.58, .47	-0.034***	.30, .55	-0.004	.59, .47	-0.018*	.26, .47
	(0.15)	.31, (67)	(2.65)	.22, (153)	(0.39)	.33, (73)	(1.86)	.17, (164)
Agricultural Exports	-0.15*	.34, .51	-0.071	.28, .46	-0.036	.48, .51	-0.0008	.27, .39
	(1.90)	.43, (67)	(0.85)	.23, (153)	(1.44)	.38, (73)	(0.06)	.18, (163)
Food Exports	0.048	.58, .55	-0.020	.28, .49	0.003	.60, .48	0.003	.28, .38
	(1.14)	.28, (67)	(0.93)	.22, (153)	(0.25)	.31, (73)	(0.38)	.19, (164)
Fuel Exports	0.013	.61, .47	-0.010	.27, .46	0.010	.64, .46	0.003	.32, .40
	(0.38)	.30, (67)	(0.51)	.23, (153)	(0.95)	.31, (71)	(0.03)	.20, (156)
Mineral Exports	-0.11	.58, .39	-0.068***	.38, .51	-0.020	.62, .40	-0.022***	.37, .44
	(1.57)	.40, (67)	(2.92)	.21, (153)	(1.42)	.38, (73)	(2.51)	.17, (164)

Notes: See, Table 1.

Table 5

Trade Taxes, Resources and Growth

Independent variable						
Variable	All Developing Countries	Least Commodity Dependent Countries	Most Commodity Dependent Countries	All Developing Countries	Least Commodity Dependent Countries	Most Commodity Dependent Countries
Log (Initial GDP per capita)	-3.56***	-2.42***	-1.39	-3.30***	-2.52***	-0.74
	(5.37)	(2.46)	(0.86)	(4.92)	(2.54)	(0.61)
Log(Life Expactancy, lagged)	10.34***	9.88*	4.10	8.13**	6.32	0.15
	(2.74)	(1.86)	(0.69)	(2.16)	(1.21)	(0.03)
Population Growth Rates	0.38**	0.22	-0.57	0.44**	0.24	0.049
	(1.98)	(0.91)	(0.82)	(2.34)	(1.02)	(0.08)
Gross Capital Formation	0.13***	0.14***	0.16***	0.13***	0.13***	0.20***
	(5.66)	(4.28)	(2.78)	(5.63)	(3.84)	(4.23)
Rule of Law	1.48***	0.75*	1.22*	1.62***	0.99***	0.70
	(5.11)	(1.81)	(1.78)	(5.65)	(2.52)	(1.34)
Landlocked Dummy	-0.11	-0.19	-0.21	-0.18	-0.51	-0.40
	(0.27)	(0.27)	(0.30)	(0.46)	(0.76)	(0.77)
Import Duties	0.042*	0.058**	-0.0025			
	(1.91)	(2.04)	(0.06)			
Export Duties				0.033	-0.003	0.11***
				(1.11)	(0.06)	(3.75)
For each equation, R^2	.42, .42	.55, .41	-.38, .36	.39, .39	.52, .39	-.20, .54
(N)	.39, (222)	.25, (131)	.29, (53)	.41, (219)	.25, (129)	.34, (52)

Notes: See Table 1.

Table 6

Effects of Trade Taxes and Openness on Growth

Variable	All Developing Countries	Least Commodity Dependent Countries	Most Commodity Dependent Countries
Import Duties	0.042*	0.058**	-0.0025
	(1.91)	(2.04)	(0.06)
Export Duties	0.033	-0.003	0.11***
	(1.11)	(0.06)	(3.75)
Trade (% of GDP in constant prices)	-0.005	-0.010**	-0.019*
	(1.03)	(2.03)	(1.84)
Exports(% of GDP in constant prices)	-0.012	-0.022**	-0.044*
	(1.16)	(2.08)	(1.81)
Imports(% of GDP in constant prices)	-0.006	-0.015*	-0.029*
	(0.82)	(1.80)	(1.75)

Note: See Table 1.

Table 7

Effects of Trade Taxes and Openness on Growth by Resource Dependency

Variable	All Developing Countries	Based on Mineral Exports (% of Merchandise Exports)		Based on Mineral Exports (% of GDP)	
		Least Commodity Dependent Countries	Most Commodity Dependent Countries	Least Commodity Dependent Countries	Most Commodity Dependent Countries
Import Duties	0.042*	0.031	0.01	0.056**	0.016
	(1.91)	(1.15)	(0.18)	(2.13)	(0.26)
Export Duties	0.034	-0.034	0.24**	0.011	0.21*
	(1.11)	(0.54)	(2.31)	(0.17)	(1.74)
Trade (% of GDP)	-0.005	-0.002	-0.017**	-0.007	-0.015**
(in constant prices)	(1.03)	(0.26)	(2.41)	(0.81)	(2.50)
Exports (% of GDP)	-0.012	-0.024*	-0.017	-0.032*	-0.017
(in constant prices)	(1.16)	(1.65)	(1.00)	(1.86)	(1.25)
Imports (% of GDP)	-0.006	0.08	-0.039***	-0.0007	-0.034***
(in constant prices)	(0.82)	(0.76)	(3.42)	(0.05)	(3.39)
Trade PWT	-0.006	-0.012	-0.015	-0.020***	-0.013*
(% of GDP)	(1.06)	(1.58)	(1.67)	(2.43)	(1.76)
Trade shares with	-0.009	-0.016	-0.024*	-0.028**	-0.028**
OECD Nations	(0.96)	(1.36)	(1.72)	(2.09)	(2.44)
Trade shares with	-0.029*	-0.005	-0.028	-0.029	-0.027
non-OECD Nations	(1.75)	(0.22)	(1.20)	(1.21)	(1.16)
Sachs and Warner	0.99***	0.45	2.07***	0.42	3.20***
Openness Index	(2.44)	(0.88)	(2.69)	(0.71)	(5.35)
External balance	-0.008	-0.047**	0.034	-0.06	0.10**
(% of GDP)	(0.55)	(2.18)	(0.79)	(0.21)	(2.31)

Note: Least mineral-commodity dependent countries and most mineral-commodity dependent countries are classified as in Birdsall and Hamoudi (2002) but using average mineral export shares for 1970-74. See also Table 1.