ISSN 1756-7904

DEV ODG

Working Paper Series

Ethnic Diversity, Property Rights and Natural Resources

Jacopo A. Baggio and
Elissaios Papyrakis

2009

University of East Anglia

Working Paper 15

The School of International Development, University of East Anglia
Norwich, NR4 7TJ, United Kingdom

DEV Working Paper 15

Ethnic Diversity, Property Rights and Natural Resources

Jacopo A. Baggio and Elissaios Papyrakis

First published by the School of International Development in April 2009.

This publication may be reproduced by any method without fee for teaching or nonprofit purposes, but not for resale. The papers should be cited with due acknowledgment.

This publication may be cited as:
Baggio, J.A., Papyrakis, E., 2009, Ethnic Diversity, Property Rights and Natural Resources, Working Paper 15, DEV Working Paper Series, The School of International Development, University of East Anglia, UK.

About the Authors

Jacopo Baggio, is a Postgraduate Research Student in the School of International Development at the University of East Anglia, Norwich, UK.

Elissaios Papyrakis is a Lecturer in Economics at the School of International Development at the University of East Anglia, Norwich, UK.

Contact:
J.Baggio@uea.ac.uk
School of International Development
University of East Anglia
Norwich, NR4 7TJ
United Kingdom
Tel: +44(0)1603 592338
Fax: +44(0)1603451999

ISSN 1756-7904

About the DEV Working Paper Series

The Working Paper Series profiles research and policy work conducted by the School of International Development and Overseas Development Group. Launched in 2007, it provides an opportunity for staff, associated researchers and fellows to disseminate original research and policy advice on a wide range of subjects. All papers are peer reviewed within the School. Recent past work, provided it meets the standards required and has contemporary significance is also welcome.

About the DEV/ODG Reports and Policy Papers

These are reports and policy papers that reproduce consultancy, applied research findings and policy work conducted by the School of International Development or Overseas Development Group. Launched in 2007, the reports provide an opportunity for staff, associated researchers and fellows to disseminate studies and findings on a wide range of subjects. Recent past work, provided it meets the standards required and has contemporary significance is also welcome.

About the School of Development Studies

The School of International Development (DEV) applies economic, social and natural sciences to the study of international development, with special emphasis on social and environmental change and poverty alleviation. DEV has a strong commitment to an interdisciplinary research and teaching approach to Development Studies and the study of poverty. This has been developed over a forty year period, bringing together researchers and students from different disciplines (economists, social scientists, natural resource scientists) into research areas and teaching teams.

The Overseas Development Group (ODG)

Founded in 1967, the ODG is a charitable company wholly owned by the University of East Anglia, which handles the consultancy, research, and training undertaken by the faculty members in DEV and approximately 200 external consultants. Since its foundation ODG has provided training for professionals from more than 70 countries and completed more over 1,000 consultancy and research assignments. ODG provides DEV staff with opportunities to participate in on-going development work - real-world experience which adds a unique and valuable element to the School's teaching programmes.

For further information on DEV and ODG, please contact:

School of International Development
University of East Anglia, Norwich NR4 7TJ, United Kingdom
Tel: +44 (0)1603 592329
Fax: +44 (0)1603 451999
Email: dev.general@uea.ac.uk
Webpage: www.uea.ac.uk/dev

Abstract

Countries rich in natural resources constitute both development failures and successes depending on their underlying socioeconomic fundamentals. Recent empirical evidence and theoretical work provide support to a resource curse hypothesis based on ethnic fractionalization; rivaling ethnic groups engaging in resource rent-seeking weaken property rights and erode institutional quality reducing hence long-term growth. On another front, there is increasing empirical evidence suggesting that ethnic heterogeneity based on polarization rather than fractionalization is a stronger deterrent of economic growth. In this paper, we explore the interlinkages between natural resource abundance and both measures of ethnic heterogeneity. In a two-simultaneous equation system, we assess the effects of fractionalization and polarization on institutions, and thereof on growth, both directly as well as interacted with our resource abundance proxy. We find that while ethnic fractionalization has a direct negative impact on the effectiveness of property rights, polarization affects institutions only in a resource-rich context. We find that resource wealth lowers income in ethnically polarized rather than fractionalized countries, a result robust to different specifications adopted, as well as when controlling for the direct impacts of fractionalization and polarization on growth.

Keywords: Natural Resources, Growth, Fractionalization, Polarization.
JEL *classification*: C31, O11, O13

Introduction

Numerous empirical and theoretical studies have recently linked resource abundance to poor economic development (Bulte et al. 2005; Sachs and Warner 1997, 2001). The negative correlation between economic growth and resource-abundance, albeit a solid fact, still is a conceptual puzzle. Early development economists accentuated the role of natural resource wealth in economic development (Nurkse 1953; Rostow 1960; Watkins 1963). The industrial revolution in Great Britain and Germany was, for instance, largely supported by their vast domestic deposits of ore and coal, in an era of high transportation costs (Matsuyama 1992; Sachs and Warner 1995). Over the last four decades, natural resource abundance has been a development curse for most resource-dependent economies. This is by no means an iron law, and as Auty (2001) suggests, the long-term impact of resource wealth on economic performance depends on country-specific socioeconomic fundamentals.

Sachs and Warner (2001) suggest that natural resources do not inhibit economic growth *per se*, but rather, they crowd-out growth-promoting activities. Several transmission channels have been identified through which resource rents lower economic growth rates. A first stream of work focuses on Dutch Disease explanations of the curse, linking resource booms with overvalued domestic currencies and reduced exports. Positive income shocks from natural resource exploitation trigger inflationary pressure in the

economy, hurting hence the competitiveness of commodities outside the primary sector. Manufacturing and other sectors conducive to growth are likely hence to contract, as exports decrease and production factors shift towards primary production (Corden and Neary 1982; Sachs and Warner, 2001; Torvik 2002).

A second branch of the resource curse literature focuses on the impact of natural resources on institutional quality, particularly via rent-seeking and corruption (Bulte et al. 2005; Dalmazzo and De Blasio 2003; Sachs and Warner 1999, 2001; Torvik 2002; Wick and Bulte 2006). Political theories of institutional quality, as in La Porta et al. (1999) and Robinson and Torvik (2005), suggest that institutions are often endogenously shaped by public officials to help prolong their stay in power. In the same tune, Ross (1999) claims that governments in resource-rich countries make use of resource revenues to relieve social pressure (i.e. via increased spending on patronage or reduced taxation) that would otherwise lead to greater demand for accountability. La Porta et al. (1999) claim that institutions are often not shaped by consideration of social welfare, but rather become determined by the ability of various economic agents (ethnic groups, political parties, industrial organizations) to extract rents and self-finance their dominant positions. Natural resources, such as oil and precious metals, are geographically concentrated and easily embezzled, creating hence a large incentive for individuals and government officials in resource-rich countries to adopt rent-seeking behaviour and corrupt practices respectively. Rent-seeking activity consecutively diverts entrepreneurial talent away from productive activities, decreasing hence total income and welfare (Lian and Oneal 1997; Torvik 2002; Wick and Bulte 2006)[1]. Such rent-seeking competition is likely to be intensified across ethnically heterogeneous groups making cooperative solutions difficult to achieve and favouring short-term opportunism over long-term planning (Alesina et al. 2003). In this context, public goods are likely to be underprovided, especially when the preferences of individual groups for public investment diverge (Easterly and Levine 1997).

In a recent paper, Hodler (2006) claims that ethnic fractionalization interacted with natural resource abundance explains why "the impact of natural resources may differ in different resource-rich countries" (Hodler 2006, p. 1382). Hodler finds a significant negative correlation between the level of income levels and the interaction term between ethnic fractionalization and the share of natural capital in total capital. In his empirical analysis, accounting for ethnic fractionalization cancels out any negative direct impact of resource wealth on income, as suggested in the resource curse literature. In parallel, Montalvo and Reynal-Querol (2005a; 2005b) have recently suggested that ethnic heterogeneity based on polarization rather than fractionalization is likely to be a stronger deterrent of long-term growth. While fractionalization measures the probability of two randomly chosen individuals from a

[1] Secure property rights on the other hand constrain elites in forming and imposing successful predatory strategies (Acemoglu and Robinson 2006).

given country belonging to ethnically distinct groups, polarization indices also focus on the relative size of rivalling groups. In this context, the fractionalization index approaches unity as the number of rivalling groups increases, while the polarization index reaches one in the case of bipolar distribution of two ethnic groups of equal size[2]. According to Montalvo and Reynal-Querol (2005a; 2005b), polarized societies with large rivalling groups of comparable size are more prone to growth-retarding rent-seeking behaviour and conflict. The polarization index captures to a larger extent hence the potential conflictual relationships between groups compared to the fractionalization measure, which is simply based on their number. In this paper, we bring the two streams of literature together by exploring the interlinkages between natural resource abundance and both measures of ethnic heterogeneity. We explore whether natural resource abundance is more prone to be a development curse when the country is highly polarized than fractionalized, since in this case polarized rivalling groups need to intensify their rent-seeking behaviour by competing with groups of similar size. The absence of clearly dominant groups in polarized societies is likely to intensify frictions between contestants and erode pro-growth institutions based on cooperation and property right protection. While the same argument linking institutions and ethnic heterogeneity holds for fractionalization as well (Alesina et al. 2003; Collier 2001; Easterly and Levine 1997; Hodler 2006; La Porta et al. 1999), we contribute to the resource curse literature by studying the differentiated impact of natural resource rent-seeking on institutional quality (and thereof on growth) between ethnically polarized and fractionalized contexts. To our knowledge this is the first empirical study that attempts to differentiate between the role of ethnic fractionalization and polarization to explain the resource curse paradox.

The next section is devoted to the empirical evidence on the interlinkages between resource-abundance and ethnic structure (fractionalization, polarization), as well as their direct and indirect (via institutional quality) effects on economic growth, We find that while ethnic fractionalization has a direct negative impact on the effectiveness of property rights, polarization affects institutions only in a resource-rich context. Contrary to earlier empirical results in the literature, we find that resource wealth lowers income in ethnically polarized rather than fractionalized countries, a result robust to different specifications adopted. In Section 3 we extend our analysis by focusing on income levels rather than economic growth as a

[2] There is generally a non-linear relationship between indices of ethnic fractionalization and polarization. The general formulas for ethnic fractionalisation and polarization are $frac = 1 - \sum_{i=1}^{N} \pi_i^2$ and $pol = 1 - \sum_{i=1}^{N} \left(\frac{0.5 - \pi_i}{0.5} \right)^2 \pi_i$ respectively, where π is the proportion of people that belongs to the *i-th* ethnic group. For an in-depth discussion on the construction of the indices, see Montalvo and Reynal-Querol (2005a).

dependent variable and we verify that our main propositions hold. Section 4 summarizes our main results and offers concluding remarks.

Direct and Indirect Impacts of Ethnic Structure and Resource Abundance

In this section we explore the type of ethnic heterogeneity (polarization, fractionalization) that relates to pro-growth institutions in a resource-rich context. We investigate whether powerful rivalling groups of similar size, as captured by polarization indices, are more important in enhancing rent-seeking conflictual behaviour, eroding institutions and property rights and reducing long-term growth. To identify the dependence of growth and institutions on natural resource abundance and ethnic heterogeneity, we estimate a two-simultaneous equation system, where natural resources interacted with ethnic structure (polarization, fractionalisation) affect the extent of institutional quality, with the latter being a strong determinant of economic growth.

Our two-equation simultaneous system is summarized by equations 1 and 2. To identify the dependence of growth on institutions (equation 1) we estimate cross-country growth regressions in the tradition of Kormendi and Meguire (1985), Grier and Tullock (1989), Barro (1991), and Sachs and Warner (1995; 1997). We include initial income per capita in our regressions to check for the conditional convergence hypothesis that predicts higher growth in response to lower starting income per capita keeping the other explanatory variables constant. Thus, per capita economic growth from period t_0=1980 to t_T=2004, denoted by $growth=(1/T)\ln(Y_T/Y_0)$, depends on initial per capita income Y_0, on institutions (*inst*) and a vector of other explanatory variables common in the growth literature, captured by X[3]. Equation 2 assesses the impact of ethnic structure alone (Z; being either fractionalization or polarization), as well as interacted with resource richness (*nr*) upon institutional quality.

$$growth = a_1 Y_0 + a_2 inst + a_3 X \quad [1]$$
$$inst = b_1 Z + b_2 nr*Z \quad [2]$$

We estimate the system making use of the Seemingly Unrelated Regression (SUR) technique, as in Easterly and Levine (1997) and Montalvo and Reynal-Querol (2005a). SUR estimations allow for random correlation of the error term, increasing the efficiency of estimated coefficients (Zellner 1962) (and are virtually identical to the ordinary least squares estimations in case of no or near zero correlation). Since

[3] Appendix I lists all variables and data sources. Descriptive statistics are presented in Appendix II. The whole dataset is available upon request to the authors.

institutions appear both as a dependent and independent variable, the set of equations needs to be estimated simultaneously[4]. All variables linked to economic growth (i.e. investment, primary exports, institutional quality) are taken at the beginning of the period to minimize any endogeneity bias (Aron 2000). As in Hodler (2006) and Montalvo and Reynal-Querol (2005a), we avoid entering the fractionalization and polarization proxies jointly into the estimated specifications to avoid multicollinearity.

The estimations of our two-equation system are presented in Table 1. For all growth specifications (equation [1]), we include as independent variables the level of initial income (Y_0), the ratio of real gross domestic investment to real GDP averaged in 1980 (*inv*), the Sachs and Warner measure of resource abundance referring to the share of primary exports in total production in 1970, an index of openness, measured by the value of exports plus imports divided by the level of GDP in 1980 (*open*) a measure of institutions based on the quality of the judicial system and the extent of property rights protection (*inst*) and a geography index measuring the malaria disease environment and proximity to the tropics (*geo*). We expect countries characterized by higher investment rates, trade openness, lower initial income per capita, a disease-free environment and better-quality institutions to experience faster economic growth (see, for instance, Sachs and Warner 1995). Data on income levels, institutions and the disease environment are provided by the World Bank Development Indicators (WDI, 2006), and Kiszewski et al. (2004) respectively. Data on trade openness and investment are provided by the Penn World Tables (Heston et al. 2006). In column entry (1) we additionally include fractionalization (*frac*) as an independent variable, and interact it with our resource abundance proxy as a determinant of institutions (*frac*nr*). In column entry (2) we substitute fractionalization with polarization (*pol*) as the ethnic heterogeneity proxy and similarly interact it with natural resources (*pol*nr*). The interaction terms aim to capture how the impact of ethnic diversity on property rights protection may differ between resource rich and resource scarce economies. Data on ethnic fractionalization and polarization are provided by Alesina et al. (2003) and Montalvo and Reynal-Querol (2005a; 2005b) respectively.

Our results reveal that institutional quality has a strongly significant and positive effect on economic growth, as suggested in the literature (Acemoglu et al. 2003; Rodrik et al. 2004). Ethnical polarization and fractionalization both appear to affect growth negatively, as in Holder (2006). For the rest of the independent variables in the growth regression, the signs of coefficients accord with intuition[5]. The estimation

[4] Montalvo and Reynold (2005a) suggest that the SUR procedure is less sensitive to specification errors.

[5] It is worth noticing that once we account for differences in institutions and ethnic diversity, the direct effect of natural resource abundance on growth generally becomes insignificant (as in Mehlum et al. 2006).

of the institutions channel (equation [2]) in columns (1) and (2) reveals that while ethnic fractionalization has a direct negative impact on the effectiveness of property rights, polarization affects institutions only in a resource-rich context[6].

This suggests that while fractionalized countries suffer from weak institutions (and hence lower growth) irrespective of the availability of natural resources, polarized countries experience enhanced rent-seeking and weak property rights only in the presence of an extensive resource base. In this case, natural resources do not contribute to a resource curse directly, but indirectly via eroding pro-development institutions. We find that resource wealth lowers income in ethnically polarized rather than rights, polarization affects institutions only in a resource-rich context[7]. This suggests that while fractionalized countries suffer from weak institutions (and hence lower growth) irrespective of the availability of natural resources, polarized countries experience enhanced rent-seeking and weak property rights only in the presence of an extensive resource base. In this case, natural resources do not contribute to a resource curse directly, but indirectly via eroding pro-development institutions. We find that resource wealth lowers income in ethnically polarized rather than fractionalized countries, a result that remains robust when controlling for the direct impacts of fractionalization and polarization on growth. The effect is of significant magnitude, suggesting that the impact of polarization on institutions between a generally homogenous country (such as Denmark) and a fully polarized nation (such as Guatemala) has no impact on institutions when countries are resource scarce, but reduces drastically the institutional proxy (1-10 scale property rights index) by approximately 0.5 points for every 10% increment of the share of primary exports in production (see, regression (2). This confirms that resource rent seeking behaviour becomes more pronounced in ethnically polarized societies, where "winner takes all" successful strategies require considerably larger effort (Montalvo and Reynal-Querol (2005a, 2005b). Consecutively, the negative impact of natural resources on institutions for ethnically polarized nations will extend to economic growth, as suggested by the strong beneficial impact of property rights protection on income growth (Table 1).

[6] The coefficients of ethnic polarization, as well as fractionalization interacted with natural resources, are statistically insignificant, although of the expected sign.

[7] The coefficients of ethnic polarization, as well as fractionalization interacted with natural resources, are statistically insignificant, although of the expected sign.

Table 1. Growth and institutions: SUR estimations

Dependent Variable	Independent Variable	(1)	(2)	(3)	(4)	(5)
growth	Y_0	-0.166 (0.055)***	-0.148 (0.055)***	-0.166 (0.055)***	-0.147 (0.055)***	-0.163 (0.056)***
	inst	0.135 (0.038)***	0.127 (0.039)***	0.132 (0.038)***	0.133 (0.039)***	0.129 (0.039)***
	geo	-0.018 (0.011)*	-0.027 (0.010)***	-0.018 (0.011)*	-0.027 (0.010)***	-0.020 (0.011)*
	open	0.322 (0.163)**	0.346 (0.164)**	0.322 (0.163)**	0.346 (0.164)**	0.332 (0.164)**
	nr	-0.639 (0.516)	-0.841 (0.503)*	-0.649 (0.516)	-0.821 (0.503)*	-0.670 (0.520)
	inv	1.490 (0.768)*	1.369 (0.769)*	1.490 (0.767)*	1.370 (0.769)*	1.474 (0.771)*
	frac	-0.602 (0.263)**		-0.609 (0.263)**		-0.462 (0.368)
	pol		-0.480 (0.237)**		-0.468 (0.237)**	-0.191 (0.328)
	N	82	82	82	82	82
	R^2	0.41	0.40	0.41	0.40	0.41
inst	frac	-1.802 (0.898)**		-1.905 (0.802)**	-1.910 (0.802)**	-1.904 (0.802)**
	pol		-1.364 (0.952)			
	frac*nr	-3.890 (2.674)				
	pol*nr		-4.643 (2.290)**	-4.285 (2.127)**	-4.261 (2.127)**	-4.294 (2.127)**
	N	82	82	82	82	82
	R^2	0.15	0.13	0.16	0.16	0.16

Note: robust standard errors for coefficients in parentheses; superscripts *, ** and * correspond to a 1, 5, and 10% level of significance.**

In columns (3)-(5) we keep institutions dependent on the variables found to be significant in columns (1) and (2); namely fractionalization and polarization interacted with natural resource abundance (*frac, pol*nr*). In column (3) and (4) we alternate between fractionalization and polarization as our ethnic diversity proxy in the growth regression. When we let the two proxies enter jointly the growth specification in column (5), they both become insignificant as suggested in Hodler (2006) and Montalvo and Reynal-Querol (2005a). Similar to columns (1) and (2) we find that ethnic fractionalization has a direct negative impact on the effectiveness of property rights, while polarization affects institutions only in a resource-rich context.

Table 2. SUR estimation of the system: introducing the interaction term

Dependent Variable	Independent Variable	(6)	(7)	(8)	(9)	(10)
growth	Y_0	-0.168 (0.056)***	-0.163 (0.053)***	-0.175 (0.055)***	-0.179 (0.056)***	-0.162 (0.056)***
	inst	0.136 (0.039)***	0.144 (0.038)***	0.145 (0.039)***	0.143 (0.039)***	0.150 (0.040)***
	geo	-0.019 (0.011)*	-0.028 (0.010)***	-0.016 (0.011)	-0.017 (0.011)	-0.027 (0.010)***
	open	0.338 (0.165)**	0.414 (0.161)**	0.342 (0.162)**	0.273 (0.160)*	0.282 (0.163)*
	nr	-1.550 (1.522)	-3.937 (1.321)***	-2.187 (1.141)*		
	inv	1.442 (0.774)*	1.289 (1.730)*	1.458 (0.761)*	1.617 (0.770)**	1.516 (0.778)*
	frac	-0.756 (0.361)**		-0.755 (0.280)***	-0.649 (0.280)**	
	pol		-0.966 (0.301)***			-0.458 (0.263)*
	frac*nr	1.501 (2.353)				
	pol*nr		4.505 (1.777)**	2.245 (1.476)	-0.285 (0.674)	-0.384 (0.687)
	N	82	82	82	82	82
	R^2	0.41	0.45	0.43	0.40	0.38
inst	frac	-1.802 (0.898)**		-1.908 (0.802)**	-1.908 (0.802)**	-1.927 (0.802)**
	pol		-1.372 (0.952)			
	frac*nr	-3.888 (2.674)				
	pol*nr		-4.604 (2.291)**	-4.266 (2.127)**	-4.266 (2.127)**	-4.247 (2.127)**
	N	82	82	82	82	82
	R^2	0.14	0.13	0.16	0.16	0.16

Note: robust standard errors for coefficients in parentheses; superscripts *, ** and * correspond to a 1, 5, and 10% level of significance.**

In Table 2, we introduce the interaction terms between natural resources and ethnic heterogeneity (*frac*nr, pol*nr*) both in the growth and institutions specifications, in order to control for possible direct effect of ethnic heterogeneity interacted with natural resources and economic growth. These specification changes also allow us to assess the robustness of our estimates and main results in Table 1. In columns (6) and (7) we incorporate natural resources interacted with fractionalization and polarization in the growth specification respectively. The signs and statistical significance of coefficients for the rest of the variables remain consistent with

previous results presented in Table (1). The interaction term between natural resources and polarization in the growth regression is statistically significant and positive in column (7), but the result is not robust when fractionalization rather than polarization enters directly the growth specification as in column (8). More importantly, any positive coefficients of the interaction terms in the growth specification (as in columns (7) and (8)) are most likely to be the result of multicollinearity between the natural resource proxy and the interaction terms; for this reason we drop in columns (9) and (10) the natural resource abundance variable from the growth specification, and we verify indeed a change in sign of the interaction term. With respect to the institutional channel (equation [2]), the coefficient of the interaction term between natural resources and polarization is consistent with our findings in Table 1 for all specifications, and we hence confirm that polarized countries experience enhanced rent-seeking and weak property rights in the presence of an extensive resource base.

Additional Evidence: Ethnic Heterogeneity, Institutions and Income

In this section we further examine the robustness of our results by replacing economic growth as the development dependent variable with the level of GDP per capita in 2004 (Y_T). Such estimations potentially provide a longer term analysis of economic development by focusing on the current world income distribution as the outcome of economic processes spanning beyond a period of a few decades (Acemoglu et al. 2001, 2002). Columns 11 and 12 of Table 3 replicate the specifications of column entries (1) and (2) of Table 1, with income levels now as the dependent variable.

Our main results from the previous estimations of the institutional channel still hold, suggesting that ethnic fractionalization has a direct negative impact on the effectiveness of property rights, while polarization affects institutions only in a resource-rich context. For that reason, in columns (13) and (14) we keep institutions dependent on fractionalization and polarization interacted with natural resource abundance (*frac, pol*nr*), while alternating between fractionalization and polarization as the ethnic diversity proxy in the long-term income regression. We still find that polarized countries experience enhanced rent-seeking and weak property rights in the presence of an extensive resource base, although polarization now does not appear to have a direct statistically significant impact on long-term income (column entries (12) and (14)).

Table 3. SUR estimation of the system: level of GDP

Dependent Variable	Independent Variable	(11)	(12)	(13)	(14)	(15)
Y_T	inst	0.402 (0.075)***	0.414 (0.070)***	0.395 (0.067)***	0.437 (0.070)***	0.400 (0.068)***
	geo	-0.083 (0.020)***	-0.109 (0.017)***	-0.083 (0.020)***	-0.109 (0.017)***	-0.077 (0.022)***
	open	0.361 (0.327)	0.398 (0.339)	0.361 (0.327)	0.396 (0.339)	0.339 (0.330)
	nr	1.891 (0.986)*	1.417 (0.998)	1.871 (0.986)*	1.496 (0.997)	1.898 (0.991)*
	inv	3.860 (1.495)**	3.677 (1.542)**	3.860 (1.495)**	3.684 (1.542)**	3.873 (1.502)**
	frac	-1.376 (0.515)***		-1.390 (0.515)***		-1.680 (0.721)**
	pol		-0.689 (0.486)		-0.648 (0.486)	0.385 (0.659)
	N	82	82	82	82	82
	R^2	0.71	0.69	0.71	0.69	0.71
inst	frac	-1.802 (0.898)**		-1.905 (0.802)**	-1.942 (0.802)**	-1.906 (0.802)**
	pol		-1.368 (0.952)			
	frac*nr	-3.889 (2.674)				
	pol*nr		-4.624 (2.290)**	-4.284 (2.127)**	-4.205 (2.126)**	-4.276 (2.127)**
	N	82	82	82	82	82
	R^2	0.14	0.13	0.16	0.16	0.16

Note: robust standard errors for coefficients in parentheses; superscripts *, ** and * correspond to a 1, 5, and 10% level of significance.**

The results of Table 3 suggest that the negative institutional impact of polarization in resource dependent nations is likely to reflect a much longer-term resource-curse effect than that captured by most growth empirics spanning a period of three or four decades. While most resource curse empirical analyses (Gylfason 2001; Papyrakis and Gerlagh 2004, 2007; Sachs and Warner 2001)) present the curse as a phenomenon of the last three to four decades, our results imply that even if there was a positive impact of natural resources on institutions and income in the past (as suggested by Matsuyama (1992) and Wright (1990)), this has been largely outweighed by the more recent effect of resource affluence on property rights and growth, as suggested by our preceding growth analysis.

Conclusions

Resource-rich countries constitute both development failures and successes depending on their underlying socioeconomic fundamentals. Recent empirical evidence and theoretical work provide support to a resource curse hypothesis based on ethnic fractionalization; competing ethnic groups engaging in resource rent-seeking weaken property rights and erode institutional quality, reducing hence long-term growth. At the same time a separate branch of development economics distinguishes between the impact of ethnic fractionalization and polarization on institutions and economic outcomes, suggesting that polarization is a stronger deterrent of long-term growth. In this paper we bring the two streams of literature together and examine the interlinkages between natural resources and both measures of ethnic heterogeneity. We estimate simultaneously a two-equation system where economic growth depends on institutions (property rights protection) (equation [1]) and institutions depends on ethnic diversity and on the interaction between ethnic diversity and natural resource abundance (equation [2]). We find that natural resources appear to be a curse in ethnically polarized rather than fractionalized communities, suggesting that rivalry amongst groups of similar size is likely to intensify rent-seeking and conflictual behavior.

This is an important finding for two reasons. First, it demonstrates that weak institutions are more likely to persist in resource-rich states with ethnically polarized rather than fractionalized populations. This has significant policy implications for the new Extractive Industry Transparency Initiative, an international scheme with the support of the World Bank and several donor countries that currently aims at reducing the extent of corruption and rent-seeking in developing mineral-dependent economies. The initiative is likely to have a greater impact in countries dominated by few ethnic groups of similar size rather than in ethnically homogenous or fractionalized states. Secondly, our analysis reveals that resource abundance in ethnically polarized countries has had both a medium term negative impact on economic growth (Section 2), as well as a longer term effect on the current income distribution (Section 3). This suggests that the combination of ethnic polarization and natural resources is likely to have been a long-lasting poverty trap for several resource-rich countries.

Future research could shed further light into the relationship between natural resources, economic growth and ethnic structure. We propose several extensions of our current analysis. First, we should try to distinguish between ethnic, linguistic and religious measures of polarization (and fractionalization) and test whether the results of our analysis hold for different classifications of ethnic heterogeneity. Furthermore, we need to acknowledge that the current polarization and fractionalization indices are still far from perfect, as they focus exclusively on

population structures, ignoring hence the relative financial and military power of groups, or potential long term alliances amongst them. Developing fractionalization and polarization indices with such qualitative attributes will certainly improve the accuracy of our estimations. Last, institutional quality is more likely to be negatively correlated with resource wealth created by mining rather than farming. The distinction of the resource rents source and its pointness (i.e., geographic concentration, as is often the case for mineral resources) might hence provide valuable information to the causes of the resource curse.

1 Appendix I: Variable Description

Variable Name	Variable Label	Source:
growth	Growth rate of GDP per capita, 1980-2004 (constant 2000 US$)	(WDI 2006)
Y_0	Log of GDP per capita 1980 (constant 2000 US$)	(WDI 2006)
Y_T	Log of GDP per capita 2004 (constant 2000 US$)	(WDI 2006)
frac	Ethnic Fractionalization Index	(Alesina et al. 2003)
pol	Ethnic Polarization Index	(Montalvo and Reynal-Querol 2005a)
inst	Legal System and Property Rights Index (1-10 scale) in 1980	(Gwartney and Lawson 2006)
nr	Primary Exports/GNP in 1970	(Sachs and Warner 2001)
inv	Investment share of GDP in 1980	(Heston et al. 2006)
open	Openess to trade in 1980 (Import plus Exports / GDP in 2000 constant prices)	(Heston et al. 2006)
geo	Malaria Ecology, pop-weighted, v. sep 2003	(Kiszewski et al. 2004)
pol*nr	Intearction btw Ethnic Polarization and Primary exports/GNP	
frac*nr	Intearction btw Ethnic Fractionalization and Primary exports/GNP	

2 Appendix II: Descriptive Statistics

Variable	N	mean	Stand. Dev.	median	min	max
Y_0	82	7.738	1.576	7.548	4.909	10.722
Y_T	82	7.975	1.723	7.782	4.479	10.571
growth	82	0.377	0.593	0.273	-0.649	2.962
inst	82	4.916	1.932	4.666	1.759	8.347
inv	82	0.182	0.090	0.184	0.042	0.488
geo	82	3.786	7.024	0.163	0.000	30.095
open	82	0.584	0.385	0.476	0.093	2.298
nr	82	0.130	0.126	0.100	0.006	0.728
pol	82	0.524	0.243	0.577	0.020	0.982
frac	82	0.441	0.268	0.484	0.002	0.875
pol*nr	82	0.076	0.101	0.052	0.000	0.713
frac*nr	82	0.067	0.090	0.050	0.000	0.481

References

Acemoglu, D., Johnson, S., Robinson, J. A. (2001) The Colonial Origins of Comparative Development: An Empirical Investigation. *The American Economic Review, 91*(5), 1369-1401

Acemoglu, D., Johnson, S., Robinson, J. A. (2002) Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution. *The Quarterly Journal of Economics, 117* (4), 1231-1294

Acemoglu, D., Johnson, S., Robinson, J. A. (2003) Understanding Prosperity and Poverty: Geography, Institutions, and the Reversal of Fortune. *NBER Working Paper*

Acemoglu, D., Robinson, J. A. (2006) *Economic Origins of Dictatorship and Democracy*: Cambridge University Press

Alesina, A., Devleeschauwer, A., Easterly, W., Kurlat, S., Wacziarg, R. (2003) Fractionalization. *Journal of Economic Growth, 8*(2), 155-194

Aron, J. (2000) Growth and Institutions: A Review of the Evidence. *The World Bank Research Observer, 15*(1), 99-135

Auty, R. M. (2001) *Resource abundance and economic development*. Oxford: Oxford University Press

Barro, R. (1991) Economic Growth in a Cross Section of Countries. *Quarterly Journal of Economics, 106*(2), 407-444

Bulte, E. H., Damania, R., Deacon, R. T. (2005) Resource intensity, institutions, and development. *World Development, 33*(7), 1029-1044

Collier, P. (2001) Ethnic Diversity: an Economic Analysis. *Economic Policy, 16*(32), 127-166

Corden, W. M., Neary, J. P. (1982) Booming Sector and De-Industrialisation in a Small Open Economy. *The Economic Journal, 92*(368), 825-848

Dalmazzo, A., De Blasio, G. (2003) Resources and Incentives to Reform. *IMF Staff Papers, 50*(2), 250-273

Easterly, W., Levine, R. (1997) Africa's Growth Tragedy: Policies and Ethnic Divisions. *The Quarterly Journal of Economics, 112*(4), 1203-1250

Grier, K. B., Tullock, G. (1989) An empirical analysis of cross-national economic growth, 1951–1980. *Journal of Monetary Economics, 24*(2), 259-276

Gwartney, J., Lawson, R. (2006) Economic Freedom of the World: 2006 Annual Report (Publication. Retrieved June 2007, from The Fraser Institute: www.freetheworld.com)

Gylfason, T. (2001) Nature, Power and Growth. *Scottish Journal of Political Economy, 48*(5), 558-588

Heston, A., Summers, R., Aten, B. (2006) *Penn World Table Version 6.2* Center for International Comparisons of Production, Income and Prices, University of Pennsylvania

Hodler, R. (2006) The curse of natural resources in fractionalized countries. *European Economic Review, 50*(6), 1367-1386

Kiszewski, A., Mellinger, A., Spielman, A., Malaney, P., Sachs, S., Sachs, J. D. (2004) A Global Index Representing the Stability of Malaria Transmission. *The American Journal of Tropical Medicine and Hygiene, 70*(5), 486-498

Kormendi, R. C., Meguire, P. G. (1985) Macroeconomic determinants of growth: Cross-country evidence. *Journal of Monetary Economics, 16*(2), 141-163

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R. (1999) The quality of government. *Journal of Law, Economics, and Organization, 15*(1), 222-279

Lian, B., Oneal, J. R. (1997) Cultural Diversity and Economic Development: A Cross-National Study of 98 Countries, 1960-1985. *Economic Development and Cultural Change, 46*(1), 61-77

Matsuyama, K. (1992) Agricultural productivity, comparative advantage, and economic growth. *Journal of Economic Theory, 58*(2), 317-334

Melhum, H., Moene, K., Torvik, R. (2006) Insitutions and the Resource Curse. *The Economic Journal, 116(508)*, 1-20

Montalvo, J. G., Reynal-Querol, M. (2005a) Ethnic diversity and economic development. *Journal of Development Economics, 76*(2), 293-323

Montalvo, J. G., Reynal-Querol, M. (2005b) Ethnic Polarization, Potential Conflict, and Civil Wars. *The American Economic Review, 95*(3), 796-816

Nurkse, R. (1953) *Problems of capital formation in Underdeveloped Countries*. Oxford: Basil Blackwell

Papyrakis, E., Gerlagh, R. (2004) The resource curse hypothesis and its transmission channels. *Journal of Comparative Economics, 32*(1), 181-193

Papyrakis, E., Gerlagh, R. (2007) Resource abundance and economic growth in the United States. *European Economic Review, 51*(4), 1011-1039

Robinson, J. A., Torvik, R. (2005) White elephants. *Journal of Public Economics, 89*(2-3), 197-210

Rodrik, D., Subramanian, A., Trebbi, F. (2004) Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development *Journal of Economic Growth, 9*(2), 131-165

Ross, M. L. (1999) The Political Economy of the Resource Curse. *World Politics, 51*(2), 297-322

Rostow, W. W. (1960) *The stages of economic growth: A non-communist manifesto*. Cambridge: Cambridge University Press

Sachs, J. D., Warner, A. M. (1995) Natural Resource Abundance and Economic Growth. *NBER Working Paper, W5398*

Sachs, J. D., Warner, A. M. (1997) Fundamental Sources of Long-Run Growth. *The American Economic Review, 87*(2), 184-188

Sachs, J. D., Warner, A. M. (1999) The big push, natural resource booms and growth *Journal of Development Economics, 59*(1), 43-76

Sachs, J. D., Warner, A. M. (2001) The curse of natural resources. *European Economic Review, 45*(4), 827-838

Torvik, R. (2002) Natural resources, rent seeking and welfare. *Journal of Development Economics, 67*(2), 455-470

Watkins, M. H. (1963) A Staple Theory of Economic Growth. *The Canadian Journal of Economics and Political Science, 29*(2), 141-158

WDI. (2006) *World Development Indicators 2006*: The World Bank

Wick, K., Bulte, E. H. (2006) Contesting resources – rent seeking, conflict and the natural resource curse *Public Choice, 128*(3-4), 457-476

Wright, G. (1990) The Origins of American Industrial Success, 1879-1940. *The American Economic Review, 80*(4), 651-668

Zellner, A. (1962) An efficient method of estimating Seemingly Unrelated Regressions and Test for Aggregation bias. *Journal of the American Statistical Association, 57*(298), 348-368