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Blocking the Pathway Out of the Resource Curse

What Hinders Diversification in Resource-Rich Developing Countries?

Anar Ahmadov

Blocking the Pathway Out of the Resource Curse: What Hinders Diversification in Resource-Rich Developing Countries?

Dr Anar K. Ahmadov[1]

Abstract

This essay assesses the impact of geographic factors, trade openness and political institutions on one of the key possible avenues for addressing the "resource curse": export diversification. It does so with refined data spanning 1960-2010 and in a single framework that uses instrumental variables approach to tackle endogeneity, omitted variable bias and measurement error issues that characterize many studies of the resource curse. The results show that natural resource-rich developing countries are less likely to achieve export diversity the more autocratic institutions they have, particularly weak executive constraints and low legislative effectiveness; the weaker the rule of law; if they are located in the Middle East or Africa; if they are landlocked or mountainous; and the richer they are in oil, but not in other resources. On the other hand, the quality of government and competitiveness of political participation do not predict export concentration. There is also little evidence to support the view that trade integration, trade policy and tariff rates matter for export concentration in this set of countries. While neither colonial experiences under British or French rule, nor having legal systems designed under English Common Law or French Commercial Code have significant effects, resource-rich developing countries with past socialist institutions are significantly more likely to have more concentrated exports. Population size, ethnic or religious fractionalization, and human capital do not seem to affect the diversity of exports. Finally, unlike oil wealth, abundance in non-fuel minerals, coal, and forest resources is associated with higher export diversity.

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[1] Assistant Professor of Comparative Political Economy at the University College The Hague, Leiden University. I would like to thank Bob Keohane, Ngaire Woods, Kris Ramsay, Duncan Snidal, Andreas Fuchs, Emily Jones, Faisal Z. Ahmed, and workshop participants at Princeton University and Oxford University for helpful advice and comments. Any omissions are of course mine.

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1 Introduction

Many scholars and practitioners working on the "resource curse" - the apparently negative association between natural resource abundance and a host of development outcomes - see a lack of diversity in exports as a key aspect of this problem (Collier and Venables, 2007; Gelb, 2010; Gelb and Grasmann, 2010). Strong empirical evidence suggests that diversifying exports entails sustainability in economic growth (Hausmann et al., 2007; Hesse, 2008; Lederman and Maloney, 2007). It can make natural resource-rich developing countries less vulnerable to fiscal shocks, reduce their dependence on a single or a few resources and boost their productivity and employment (Gelb and Grasmann, 2010). Therefore, diversification is one of the most frequently offered - and, in many cases, at least nominally adopted - long-term solutions to the "resource curse."[1] It is puzzling, however, that while some resource-rich developing countries are successful in their efforts to defy specialization in primary commodities, others fail in this. This essay aims to cast light on this puzzle.

Given the frequency with which diversification is mentioned in the "resource curse" scholarship (see, for example, Collier and Venables, 2007; Dunning, 2005a; Weinthal and Luong, 2006; Wiig and Kolstad, 2012; Auty, 1993; Birdsall and Subramanian, 2004; Humphreys et al., 2007b) and in the policy literature by major international organizations (see, for example, Gelb, 2010; Gill et al., 2014; Hasan and Toda, 2004; Hesse, 2008; Marotta and de Melo, 2012; Papageorgiou and Spatafora, 2012) as a key course of action that resource-rich governments should pursue, it is surprising how little empirical scrutiny this topic has received. While there seems to be a consensus that diversification is important, we have a limited understanding of conditions under which it is likely to materialize. To the best of our knowledge, there has been no systematic cross-national examination to locate such conditions. The only work to date that aims at this - an insightful study by Dunning (2005a) - offers a game-theoretic model with illustrative cases to map the effect of three structural variables on elite incentives to diversify. This study aims to fill this gap.

The broad literature on determinants of economic development, studies of economic diversification, and the work on the "resource curse" provide clues as to what factors might explain the variation in export diversity in the resource-rich developing world. Three main perspectives on what predicts economic development accord primary role to geography (Bloom et al., 1998; Diamond, 1997; Redding and Venables, 2004; Sachs, 2003), trade openness (Frankel and Romer, 1999; Sachs et al., 1995) or institutions (Acemoglu et al., 2001; Easterly and Levine, 2003; Rodrik et al., 2004; Sokoloff and Engerman, 2000). Similarly, while some studies of diversification provide evidence that market access and climate variability are important predictors (Malik and Temple, 2009), others find that export, international transport and market entry costs (Dennis and Shepherd, 2007) or such institutional variables as political regime and rent-seeking significantly affect diversification chances (Cuberes and Jerzmanowski, 2009; Starosta de Waldemar, 2010). Finally, while some studies of the potential sources of the "resource curse" attribute a critical role to trade policies (Arezki and Van der Ploeg, 2007), others find that resource abundance - a largely geographic variable[2] - per se is a key predictor (Brunnschweiler and Bulte,

2008) and many agree that political economy and institutions have an overarching impact on susceptibility to becoming resource-dependent and suffering from low growth in the long run (Arezki and Van der Ploeg, 2007; Jones Luong and Weinthal, 2006; Mehlum et al., 2006; Robinson et al., 2006; Torvik, 2009).

We draw on insights from this literature to identify key variables that affected export concentration in developing countries endowed with abundant natural resources between 1960 and 2010. Particularly, following Rodrik et al. (2004), we assess the potential causal impact of key geographic variables, trade openness[3] and institutions. We do this in a single framework that uses instrumental variables approach so as to tackle endogeneity, omitted variable bias and measurement error issues that have been unfortunate characteristics of many studies of the resource curse. We instrument for integration by Frankel-Romer constructed openness measure (Frankel and Romer, 1999). For institutions, we use three instrumental variables: the fraction of the country's population speaking English and the fraction of the population speaking other European languages (Hall and Jones, 1999) and the logarithm of settler mortality (Acemoglu et al., 2001). We estimate models with a battery of explanatory variables using limited information maximum likelihood (LIML) and subject key findings to robustness tests, including through Arellano-Bond estimation.

The results show that natural resource-rich developing countries are less likely to achieve export diversity the more autocratic institutions they have, particularly weak executive constraints and low legislative effectiveness; the weaker the rule of law; if they are located in the Middle East or Africa; if they are landlocked or mountainous; and the richer they are in oil. The quality of government and competitiveness of political participation do not predict export concentration. While neither colonial experiences under British or French rule, nor having legal systems designed under English Common Law or French Commercial Code have significant effects, resource-rich developing countries with past socialist institutions are significantly more likely to have more concentrated exports. We fail to find evidence to support the view that trade integration, trade policy and tariff rates matter for export concentration in this set of countries. Nor we find that population size, ethnic or religious fractionalization, and human capital significantly affect the diversity of their exports. Finally, unlike oil wealth, abundance in non-fuel minerals, coal and forest resources is associated with higher export diversity.

These findings speak directly to the academic and policy debates on the "resource curse." The distinct contribution of this study to this literature is threefold. First, to the best of our knowledge, it is the first systematic cross-national examination of conditions under which export diversification in natural resource-endowed developing countries is likely to succeed. Identifying these conditions is important in itself. Apart from its effect on economic growth (Hausmann et al., 2007), the structure and composition of exports can also serve as a critical indicator of the extent to which resource-endowed developing countries have escaped resource dependence or such particular resource effects as Dutch Disease (Brahmbhatt et al., 2010; Jacks et al., 2011). Therefore, this study complements other studies of the resource curse that use income, economic growth and human development as their dependent variables (for nuanced treatments of this topics, see Atkinson and Hamilton, 2003; Brunnschweiler and Bulte, 2008;

Bulte et al., 2005; Neumayer, 2004). Furthermore, it helps answer the larger question of why some natural resource-rich developing countries are able to avoid the "resource curse," while others are not. Finally, by focusing on a frequently-cited solution, we aim to contribute to advancing the debate towards concentrating on potential remedies to the "resource curse."

Second, this study responds to calls for conditional theories of the "resource curse," which argue that the effects of natural resources may differ depending on various intervening factors (Collier and Goderis, 2008; Dunning, 2005a; Ross, 2012). By limiting the analysis to developing countries endowed with natural resources and assessing the relationships between their various characteristics and their record on export diversification, we are able to cast light on whether natural resources' hypothesized negative effects are uniform across different contexts and to identify specific factors that are likely to make up these contexts. Understanding conditions under which such solutions as export diversification are likely to work is probably also more relevant for policy than establishing whether a solution works on average.

Finally, we aim to contribute to the "resource curse" literature by emphasizing the value of simulatenously assessing the impact of key explanatory variables from this literature within a single framework that tackles endogeneity, omitted variable bias and measurement error issues through an instrumental variables approach. While many studies advance cogent arguments, much fewer test these arguments by analytically juxtaposing all competing explanations and addressing reverse causality issues as well as using coherent data with wide coverage. As such, this study is one of few that uses instrumental variables approach in the "resource curse" scholarship (along with Arezki and Van der Ploeg, 2007; Brunnschweiler and Bulte, 2008) and the first to use it to study variation in export diversification in the resource-rich developing world.

We also aim to contribute to the other two strands of literature. Our findings may be helpful for the scholarship on diversification in that they help explain the variation in export diversity within a distinct type of countries that derive large part of their income from natural resources (on the relationship between income and sectoral concentration, see Imbs and Wacziarg, 2003). They also speak to the general literature on development by identifying factors that affect one of the channels through which economic development is hypothesized to occur in many countries.

Two caveats are in order. While we focus our analysis on "deep determinants" (Rodrik et al., 2004) or "fundamentals" (Hausmann et al., 2007), we do not imply that contingency and idiosyncratic scenarios cannot play a role in shaping export diversity outcomes. Rather, our task is to identify major patterns and propensities. Second, while the use of instruments can bring us closer to establishing causal relationships, we obviously do not contend to have arrived at a complete causal story - much more needs to be done for this in terms of both quantitative and qualitative work.

The next section provides a brief critical survey of the extant scholarship. Next, we introduce the data on key variables. An extensive analysis follows, in which we subject various hypotheses to empirical tests and report the results. We conclude with a summary of findings and a few thoughts on their implications.

2 What Do We Know About Diversification and the Resource Curse?

While the Ricardian economics argument on the efficiency benefits from specialization are still resonant, too much economic specialization, i.e. little diversification, can be risky (Brainard and Cooper, 1968; Kemp and Liviatan, 1973). This hypothesis has found extensive support through empirical tests of the last several decades. Hausmann, Hwang, and Rodrik show that the level of sophistication in developing country's exports predicts its growth (Hausmann et al., 2007). While export concentration hampers economic growth, export diversification leads to higher growth. Existing scholarship also finds a differential effect of export diversification on growth in developing countries and in the advanced industrialized world - while the former benefit from diversification, the latter are believed to benefit from specialization (Lederman and Maloney, 2007; Hesse, 2008). Imbs and Wacziarg (2003) establish a U-shaped pattern in the relationship between sectoral concentration and income: countries initially specialize, particularly as they exploit their natural resources, then, as they develop, they diversify their economies, and finally lean toward specialization.

One of the criticisms of many existing studies is the potential endogeneity involved. However, Ramcharan (2005) exploits the exogeneity and randomness of earthquakes in assessing the effect of economic specialization on the cost of shocks and finds that little diversification can enlarge the negative impact of earthquakes on consumption. He also finds that "the negative impact of specialization appears less pronounced in economies with greater financial depth, suggesting that the benefits of diversification are larger when insurance is unavailable" (Ramcharan, 2005, 15).

In the context of resource-abundant countries, particularly in the developing world, export diversification may help tackle a number of economic issues. First, it can help counteract the "Dutch Disease" effects of natural resources, such as a decline in preexisting domestic sectors of the economy. Second, some primary commodities, particularly minerals, are price-volatile and exporting these products may transmit volatility into public finance and national income if there is a dependence on these few primary commodities. Diversifying away from such dependence may help stabilize public finance. Finally, as some resource-rich countries face the depletion issue, economic diversification in general and export diversification in particular are strategies available to ensure economic sustainability (Auty, 1988, 1993; Humphreys et al., 2007a; Gelb, 2010). The question is: What conditions predispose resource-rich developing countries to achieve success in this strategy and what conditions, to underperform?

The existing literature offers three main perspectives on what might explain the considerable variation among developing countries in economic development in general and export diversification in particular - geographic, trade openness, and institutional perspectives. The first view holds that geographic factors - such as location, climate, natural resource endowment, transport costs, and disease burden - are key variables affecting productivity and growth in different sectors through such channels as productivity in agriculture and human capital (Diamond, 1997; Sachs, 2003). Lack of progress in developing manufacturing sectors in African countries, for example, is attributed to their adverse geography (Bloom et al., 1998; Redding

and Venables, 2004). Along with resource dependence, tropical location, landlocked position and malaria incidence can impede development (Sachs, 2003). Market access and climate variability can enable or impede achieving diversity in exported goods for developing countries (Malik and Temple, 2009).

A second view gives a causal role in development to world market integration (Frankel and Romer, 1999; Sachs and Warner, 1995). Some studies argue that trade facilitation significantly fosters export diversification in developing countries (Dennis and Shepherd, 2007). Specifically, countries with a low degree of trade openness can suffer from the resource curse considerably more than more open countries and, conversely, liberal trade policies can be associated with milder resource curse (Arezki and Van der Ploeg, 2007).

Finally, the third view emphasizes political-economic and institutional factors as key variables determining the course of economic development (Acemoglu et al., 2001; Easterly and Levine, 2003; Rodrik et al., 2004; Sokoloff and Engerman, 2000). While geographic factors may exert a direct effect on development, significant evidence suggests that their effect can be limited to their initial impact on institutions (Acemoglu et al., 2001; Easterly and Levine, 2003; Sokoloff and Engerman, 2000). Some studies find a positive association between rent-seeking and economic specialization (Murphy et al., 1993; Starosta de Waldemar, 2010). In terms of specific institutions, political regime type can be a strong predictor of industrial diversification (Cuberes and Jerzmanowski, 2009).

Scholars working on the “resource curse” have offered explicitly institutional and political-economic explanations of why some developing countries are affected by the “resource curse” while others manage to avoid it (Brunnschweiler and Bulte, 2008; Isham et al., 2005; Jones Luong and Weinthal, 2001; Karl, 1997; Mehlum et al., 2006; Robinson et al., 2006; Ross, 1999; Torvik, 2009). Recent work has formalized a set of related institutional explanations, which argue that political leaders in resource-rich developing countries pursue excessive spending because they discount the future by the probability of them remaining in power and create inefficiencies in the economy due to patronage; therefore the resource curse takes place where institutions are weak (Dunning, 2005a; Robinson et al., 2006; Mehlum et al., 2006; Humphreys and Sandbu, 2007). Available empirical evidence provides some support for this view (Humphreys and Sandbu, 2007).

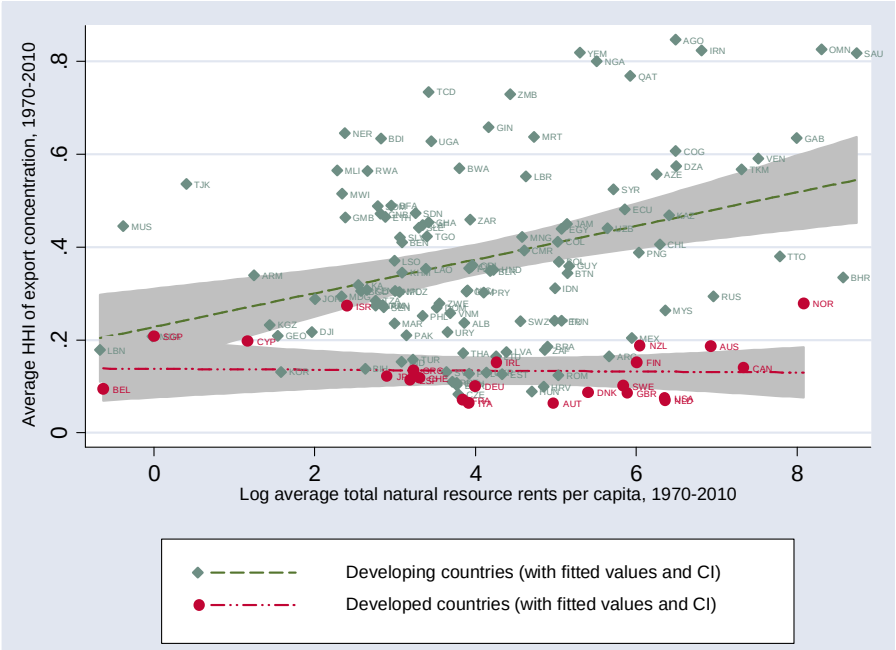
We draw on this literature to understand why some resource-endowed developing countries are able to successfully pursue diversification, while others ‘are not. Export concentration has received surprisingly little systematic emprical scrutiny in studies of the resource curse. This is puzzling given the overall consensus about its importance. The only study to date that, drawing on the literature on political losers as barriers to economic development (Acemoglu and Robinson, 2000), explicitly models the effect of political-economic and institutional factors on elite incentives for economic diversification in resource-rich developing world, suggests that the degree of domestic opposition to elites and the size of the non-resource private sector as well as the degree of volatility of their key commodity are key factors (Dunning, 2005a). Despite its insights, this study’s key limitation, as acknowledged by the author, lies in the fact that its three empirical cases do not constitute a test of its formal model’s predictions but are rather

used for illustratiting them. In addition, we may need to distinguish between elite incentives to diversity and the actual outcome of diversification efforts. While Dunning (2005a) deals with the former, the actual outcomes may only partly depend on ruling elite strategies.

3 Data

In the analysis are sixty-five developing countries that received natural resource rents of at least 100 US dollars (in constant 2010 USD) per capita per year at least three years in a row between 1970 and 2010. Testing the hypotheses at hand calls for restricting the analysis to these countries. This also helps to avoid the analysis to be driven by blanket differences between developing and developed countries and between resource-rich and resource-poor developing countries as in such cases large effects can be attributable to the variation between these different sets of countries rather than to the variation within the set of resource-rich developing nations. Figure 1 plots the average Herfindahl–Hirschman Index (HHI) of export concentration[4] between 1970 and 2010 and the log of yearly average total natural resource rents per capita for the same period for each country in the dataset that includes both developed and developing countries. The figure suggests that export diversity is associated with resource rents in developing, but not developed countries. It also shows significant variation among developing countries in terms of the relationship between resource wealth and export concentration.

Figure 1: Differences in average export concentration between developing and developed countries, 1970-2010



The pool of resource rich developing countries is identified from among hundred thirteen countries that are coded as 'emerging and developing countries' in the International Monetary Fund's (IMF) classification.[5] The measure of natural resource rents per capita is constructed

from a measure of total natural resource rents as a percentage of GDP from 2010 World Development Indicators. We use this variable to derive the per capita measure of rents using GDP value and population size for each country-year from Penn World Tables (PWT) (Heston et al., 2011). Sample composition is further corroborated using the U.S. Geological Survey's Minerals Yearbook (U.S. Geological Survey, 2010), BP historical statistical data from 1965-2011 and country profiles from the U.S. Energy Information Administration and the Petroleum Dataset (Lujala et al., 2007), particularly for the pre-1970 period.

Table 1: Descriptive statistics

Variable	*Obs*	*Mean*	*SD*
Mean HHI of export concentration over 2001-2010	65	0.44	0.25
Distance from Equator of capital city measured as abs(Latitude)/90	65	0.26	0.18
Integration: Mean of natural logarithm of nominal openness, 1960-2000	65	0.32	0.24
Mean Polity IV score, 1960-2000, normalized	65	0.38	0.29
Mean log yearly natural resource rents per capita (2010 US$), 1970-2000	64	5.66	1.53
Constructed openness: Natural logarithm of predicted trade shares	65	2.81	0.70
Fraction of the population speaking English	65	0.04	0.19
Fraction of the population speaking other European languages	65	0.21	0.37
Log settler mortality	33	4.68	0.96

Table 1 provides descriptions and summary statistics of key variables used in the analysis. We focus on export diversification rather than broader economic diversification as a dependent variable for three reasons. First, since the two are interlinked, particularly in developing countries, the former can be used as a proxy for the latter (Papageorgiou and Spatafora, 2012). Second, the structure and composition of exports is a particularly critical indicator for many resource-rich developing countries as many have lacked full-fledged domestic non-resource economies with sectorally-diverse production. Finally, economic diversification data suffer from uneven coverage and poor quality. For example, UNIDO output dataset covers only agriculture and manufacturing and ILO employment dataset covers only a fraction of workforce and is available for only a fraction of developing countries. The only detailed real-sector diversification dataset available from IMF covers 50 low- and middle-income countries, only a small fraction (12) of which have abundant natural resources.[6]

We measure diversity in exports mainly as a mean HHI of export concentration over 2001-2010. The less diversified (more concentrated) the exports are, the closer a country's score to 1, and vice versa. In extensions and robustness tests, we use export concentration scores for different periods and years. We use two sources of data on export concentration. For the period from 2001 to 2010, we use data from UNCTAD, which provides HHI data on export concentration for 162 countries for 1995-2010, constructed on the basis of data on commodity export values at 3-digit group level of Revision 3 of the Standard International Trade Classification (SITC).

For the period from 1962 to 2000, we constructed HHI of export concentration based on detailed bilateral trade flows from NBER-United Nations Trade Data, 1962-2000 (Feenstra et al.,

2005). This dataset reports bilateral trade by commodity organized by 4-digit group level of SITC Revision 2. This dataset is a revised, corrected and expanded version of original United Nations data (for details, see Feenstra et al., 2005). First, we extracted all world export value data for each commodity for each country, i.e. a country *i*'s exports to all other countries. Next, where several separate values are reported for each SITC product for any given country in any year (starting from 1984), we first summed such values. Then we calculated the number of exported commodities, the total value of exports, and the square of the ratio of the value of each commodity type in total value for exports for each country for each year. The resulting data are then used to calculate HHI for each country in each year from 1962 to 2000 using the following formula:

$$H_j = \frac{\sqrt{\sum_{i=1}^{n} \left(\frac{x_i}{X}\right)^2} - \sqrt{1/n}}{1 - \sqrt{1/n}} \quad (1)$$

where

H_j is the country index of export concentration in a given year,

x_i is the value of exports of commodity i,

X is the sum of all x_i, and

n is the number of commodities (SITC Revision 2 at 4-digit group level).

The resulting data and UNCTAD data for the period of overlap from 1995 to 2000 are highly correlated (r = 0.98). For this period we use constructed data, followed by UNCTAD data from 2001 onward.

Key explanatory variables in the analysis are primarily the ones advocated by their proponents. The main geographic variable we use is the distance from the Equator of a country's capital city measured as absolute latitude divided by 90 (La Porta et al., 1999). For the other explanatory variables we follow several major works (Easterly and Levine, 2003; Glaeser et al., 2004; Rodrik et al., 2004) and use the means of these variables for the period preceding observations on the dependent variable. Trade integration is measured as the mean of the natural logarithm of nominal openness over the 1960-2000 period. Nominal openness is constructed as the ratio of nominal imports and exports relative to GDP in current US Dollars based on PWT data (Heston et al., 2011).

Our key measure of political institutions is constructed from Polity IV database (Marshall et al., 2011). We derive the mean 1960-2000 score for each country in the analysis from the 11-point democracy scale and normalize it so that it runs from 0 (least democratic) to 1 (most democratic). The Polity measure is regarded a better measure of political regime than other existing measures, such as the Gastil index, on issues of conceptualization, measurement, and aggregation (Munck and Verkuilen, 2002),[7] and has a wider coverage. In subsequent analysis we use modifications of integration and Polity variables and a number of other geographic, integration, and institutional variables in order to both test the robustness of the core specification and identify other factors that affect export concentration.

The instrumental variable for integration is constructed openness, which is measured as the

natural logarithm of predicted trade shares calculated from a bilateral trade equation by Frankel and Romer.[8] This equation includes only "purely geographic" variables: a country's population and area, its trading partner's population and area, whether the two countries share a border, the distance between the countries, and whether the home country is landlocked. This variable has been shown to be a good instrument for integration (Frankel and Romer, 1999; Easterly and Levine, 2003; Rodrik et al., 2004) and is unlikely to be correlated with export concentration other than through its effect on integration.

The two instrumental variables for political institutions are the fraction of the country's population speaking English and the fraction of the population speaking other European languages (Easterly and Levine, 2003; Hall and Jones, 1999; Kaufmann et al., 1999; Rodrik et al., 2004).[9] As another instrument for political institutions, we use the natural logarithm of settler mortality for each country in the sample (Acemoglu et al., 2001). While this variable may be a stronger instrument for institutions than the two other instruments where income is the dependent variable (Rodrik et al., 2004) and is also plausibly unrelated to export concentration, it covers only 33 of the 65 country-observations in the dataset and, as discussed below, does not pass the test for weak instruments. Equally important, unlike settler mortality data, the two former instruments cover also countries that were not colonized.

4 Empirical Analysis

Figure 2 presents graphs of bivariate relationships between export concentration and its three potential determinants. The two top panels show that political institutions and distance from the Equator are indeed negatively related to export concentration. The farther from the Equator the country is, the less concentrated its exports tend to be. The association of export concentration with political institutions seems to be nonlinear - export concentration decreases with an increase in democracy, but then stabilizes around the Polity score of 0.7.

The lower left panel suggests a result that runs against the hypothesis that more trade openness is associated with less concentration in exports - it shows just the opposite. This result may not be surprising, however, in that it may reflect the fact that exports and imports of natural resource rich developing countries are larger relative to their GDP than those of non-rich developing countries. A box plot that substitutes the mean integration variable with another proxy for integration that may better reflect government policy - a dichotomous trade policy measure (Wacziarg and Welch, 2008) - suggests that open trade policies are indeed negatively related to export concentration in this sample of countries. In general, all three variables - integration, distance from the Equator, and political institutions - may help explain the variation in export concentration, and the signs of their coefficients can clarify the direction of the effect.

Figure 2: Correlations between export concentration and its three determinants

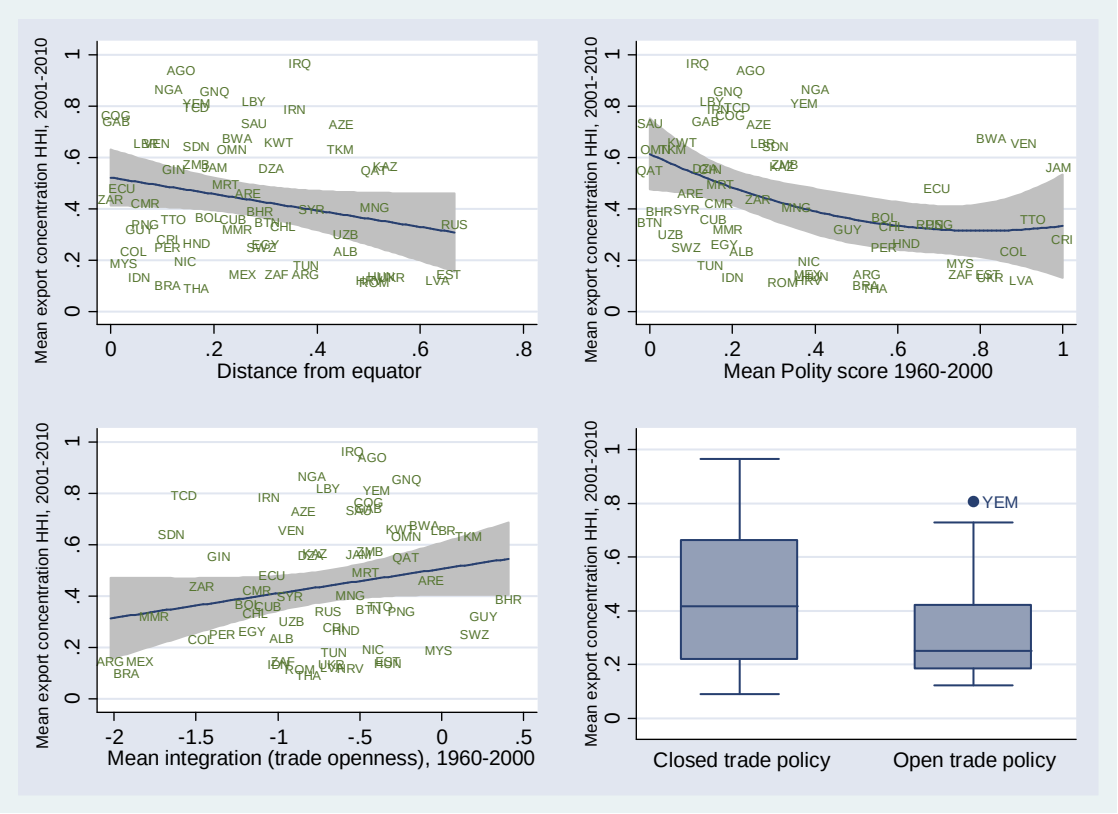


Table 2 reports the results of an ordinary least squares (OLS) regression of the mean export concentration in 2001-2010 on 1960-2000 mean of integration, distance from the Equator, and 1960-2000 mean of Polity score. Results in columns i-iii are based on the full sample, while the results in columns iv-vi are based on the sample of thirty three countries for which log settler mortality data is available. We estimate the following equation:

$$Export\,concentration_i = \mu + \alpha Integration_i + \beta Geography_i + \gamma Institutions_i + \varepsilon_i \qquad (2)$$

Table 2: OLS estimates: Export concentration on nominal openness, distance from the Equator, and mean Polity IV score

	Mean export concentration, 2001-2010					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Mean integration, 1960-2000	0.095*	0.106**	0.090*	0.077	0.048	0.068
	(0.050)	(0.052)	(0.050)	(0.072)	(0.076)	(0.072)
Distance from the Equator		-0.352**	-0.385***		-0.505*	-0.565*
		(0.157)	(0.133)		(0.288)	(0.286)
Mean Polity, 1960-2000			-0.309***			-0.274*
			(0.085)			(0.134)
Constant	0.506***	0.606***	0.719***	0.481***	0.531***	0.686***
	(0.049)	(0.072)	(0.069)	(0.085)	(0.094)	(0.120)
Number of observations	65	65	65	33	33	33
R^2	0.043	0.105	0.234	0.036	0.088	0.195

Notes: Robust standard errors in parentheses. OLS = ordinary least squares. *** p<0.01, ** p<0.05, * p<0.1

The results confirm the direction of effects for the three determinants suggested by Figure 2. However, while the statistical significance of the coefficient of distance from the Equator remains robust after controlling for political institutions, the coefficient of integration loses its statistical significance. Political institutions and distance from the Equator, on the other hand, have substantively large and statistically significant negative associations with export concentration - the more democratic the political institutions and the larger the distance from the Equator, the less concentrated the exports are. The results on the smaller sample restricted to countries with settler mortality data suggest that geography and political institutions are statistically significant predictors of export concentration at 10 percent level, while integration is not significant.

However, these results cannot be treated as testifying to causal and accurate relationships. First, while distance from the Equator is a purely exogenous variable for export concentration, the same may not be true for integration and political institutions - it may be that changes in export diversity induce changes in integration and political institutions, not the other way around. Second, changes in export concentration, integration, and political institutions may all be driven by variables incorrectly left out of the analysis. Third, an error in measurement remains a possibility.

To address these issues, we employ an instrumental variables approach and use the constructed openness measure and the fractions of the population speaking English and other European languages as credible sources of exogenous variation in integration and political institutions, respectively. The first-stage regressions estimate equations of the following form:

$$Integration_i = \lambda + \sigma Constructed\,openness_i + \delta Percent\,speaking\,English_i + \\ + \phi Percent\,speaking\,other\,European\,languages_i + \omega Geography_i + \varepsilon_{Integration_i} \quad (3)$$

$$Institutions_i = \theta + \eta Percent\ speaking\ English_i + \psi Percent\ speaking\ other\ European\ languages_i + \\ + \rho Constructed\ openness_i + \varphi Geography_i + \varepsilon_{Institutions_i} \quad (4)$$

Constructed openness, the fraction of the population speaking English and the fraction of the population speaking other European languages do not appear in equation 2. Equations 1-3 are our core specification.

As an estimation procedure, we use limited information maximum likelihood (LIML) rather than two-stage least squares (2SLS) to avoid a potential weak instrument problem since LIML has been shown to be less prone to bias and to result in more reliable standard errors (Stock and Watson, 2010). [10]

4.1 Baseline results

Table 3 reports the LIML estimates from specifications with two different instrumental variables for political institutions and their corresponding samples. Columns i-iii report results for the sample with fractions of the population speaking English and other European languages and Columns iv-vi are based on data with log settler mortality. The signs of the coefficients for all three determinants confirm the earlier OLS results - while distance to the Equator and mean polity have a negative effect on export concentration, integration has a positive sign. However, the coefficients for mean integration in both samples are not significant - that is, integration does not explain the variation in export concentration among natural resource rich developing countries once the distance from the Equator and political institutions are controlled for. The coefficients for the latter**,** on the other hand, are statistically significant in the full sample, confirming that larger distance from the Equator and more democratic political institutions are associated with less export concentration. In the smaller sample, only political institutions seem to exert a negative effect that is significant at 1 percent level.

Table 3: LIML estimates: Export concentration on nominal openness, distance from the Equator and mean Polity IV score

	Mean export concentration, 2001-2010					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Mean integration, 1960-2000	0.127	0.151*	0.079	0.176*	0.163	0.110
	-0.082	(0.080)	-0.085	(0.104)	-0.108	-0.140
Distance from the Equator		-0.365**	-0.395**		-0.328	-0.766
		(0.168)	(0.156)		-0.4	-0.542
Mean Polity, 1960-2000			-0.420**			-1.078***
			(0.191)			(0.400)
Constant	0.528***	0.642***	0.755***	0.576***	0.613***	1.13***
	(0.066)	(0.083)	(0.086)	(0.107)	(0.103)	(0.251)
Basmann's F statistic p-value			0.234			
Cragg-Donald Wald F Statistic	54.12	52.23	5.65	28.60	26.93	4.20

	First stage results							
	(i)	(ii)	(iii)	(iii)	(iv)	(v)	(vi)	(vi)
	Integration	Integration	Integration	Polity	Integration	Integration	Integration	Polity
Constructed openness	0.526***	0.526***	0.452***	-0.093*	0.64***	0.613***	0.624***	-0.011
	(0.072)	(0.073)	(0.078)	(0.048)	(0.120)	(0.118)	(0.119)	-0.076
Distance from the Equator		0.003	-0.064	0.212		-1.047	-1.246*	-0.721
		(0.289)	(0.296)	(0.181)		(0.658)	(0.687)	(0.438)
Population speaking English			0.604**	0.345*				
			(0.299)	(0.183)				
Population speaking other European languages			-0.324*	0.324***				
			(0.165)	(0.101)				
Log settler mortality							-0.079	-0.145***
							(0.079)	(0.050)
Constant	-2.2***	-2.201***	-1.933***	0.499***	-2.572***	-2.343***	-1.968***	1.283***
	(0.207)	(0.214)	(0.246)	(0.151)	(0.311)	(0.336)	(0.503)	(0.321)
Number of observations	65	65	65	65	33	33	33	33
Partial R^2	0.46	0.46	0.50	0.35	0.48	0.47	0.49	0.23
Shea's Partial R^2			0.37	0.28			0.50	0.23
F-statistic	54.12***	52.23***	20.17***	11.02***	28.60***	26.93***	13.97***	4.22**

Note: All models estimated through limited information maximum likelihood (LIML) using ivreg2 Stata module (Baum et al., 2010).
Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Estimates in Table 3 also help to assess the relevance and strength of the instrumental variables quantitatively. The first stage regression results for the full sample confirm that constructed openness and the fractions of the population speaking English and other European languages are statistically significant predictors of integration and political institutions, respectively.[11] The first stage regression results for models with log settler mortality too attest that this instrument has a statistically significant correlation with political institutions. The values of the standard (Bound et al., 1995) partial R^2 and Shea's partial R^2 are relatively large and, since the differences between them are not pronounced, we can conclude that the instruments are relevant in explaining all endogenous regressors (Baum et al., 2003). The test of overi-

dentifying restrictions in the full model with fractions of the population speaking English and other European languages renders a Basmann's F statistic p-value of 0.234, suggesting that the instruments can be considered valid.

However, statistical tests of the strength of instruments render different results for the two sets of instruments for political institutions. The first stage regression F-statistics for all models, except in Column vi with log settler mortality, are higher than the conventional threshold of 10. The Cragg-Donald Wald F statistics for the full model with fractions of the population speaking English and other European languages as instruments passes the Stock-Yogo critical value at 15% maximal LIML size (Column iii), while the same statistic for the model with log settler mortality as an instrument is smaller than this critical value (Column vi). Given its advantages, the former is my preferred specification.

4.2 Regional and colonial legacy effects

We first check the robustness of the baseline results to dropping influential observations from the analysis (Column i in Table 4). The coefficients and their statistical significance levels for all three variables remain the same.

Table 4: LIML estimates: Export concentration on regional effects and colonial heritage

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
Mean integration, 1960-2000	0.079	0.026	-0.210	0.003	0.065	0.006	0.051	0.004	-0.030
	(0.083)	(0.070)	(0.162)	(0.070)	(0.127)	(0.068)	(0.102)	(0.102)	(0.068)
Mean Polity, 1960-2000	-0.415**	0.137	-0.821*	0.080	0.302	0.072	0.172	0.068	0.277
	(0.185)	(0.273)	(0.494)	(0.274)	(0.545)	(0.277)	(0.380)	(0.289)	(0.328)
Distance from the Equator	-0.389**	-0.133	-0.568	-0.051	-0.084	-0.063	-0.113	-0.036	-0.597**
	(0.156)	(0.161)	(0.423)	(0.158)	(0.161)	(0.161)	(0.156)	(0.195)	(0.277)
MENA dummy		0.338***		0.210*	0.336	0.221*	0.234	0.200	0.402**
		(0.122)		(0.127)	(0.259)	(0.120)	(0.156)	(0.123)	(0.183)
Sub-Saharan Africa dummy		0.323***		0.337***	0.415**	0.353***	0.376***	0.335***	0.438***
		(0.093)		(0.093)	(0.169)	(0.088)	(0.121)	(0.096)	(0.119)
Mean log rents per capita, 1970-2000				0.055***	0.052**	0.053**	0.057***	0.055***	0.066***
				(0.021)	(0.022)	(0.021)	(0.021)	(0.021)	(0.022)
British colony dummy					-0.161				
					(0.161)				
French colony dummy						-0.048			
						(0.084)			
English Common Law dummy							-0.133		
							(0.102)		
French Commercial Code dummy								0.012	
								(0.085)	
Socialist laws dummy									0.323**
									(0.152)
Constant	0.751***	0.287*	0.770***	-0.018	-0.039	0.003	0.008	-0.021	-0.175
	(0.086)	(0.162)	(0.166)	(0.215)	(0.247)	(0.223)	(0.218)	(0.218)	(0.249)
Number of observations	61	65	30	64	64	64	64	64	64
Basmann's F statistic p-value	0.234	0.528	0.824	0.602	0.271	0.618	0.20	0.536	0.710
Omitted observations	Bhutan		non-MENA	Myanmar	Myanmar	Myanmar	Myanmar	Myanmar	Myanmar
	Botswana		non-SSAFR						
	South Africa								
	Turkmenistan								

Note: All models estimated through limited information maximum likelihood (LIML) using ivreg2 Stata module (Baum et al., 2010). The instrumental variable for integration is the natural logarithm of predicted trade shares calculated from a bilateral trade equation by Frankel and Romer (1999). The instrumental variables for Polity are the fraction of the country's population speaking English and the fraction of the population speaking other European languages (Hall and Jones, 1999). Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

It is possible that there are region-specific effects on export concentration picked up by distance from the Equator and Polity measures. Particularly, we can expect the Middle East and North Africa (MENA) and sub-Saharan Africa to have negative experiences with export concentration as these regions are documented to have worst economic development experiences. Column ii suggests that this concern is at least partly justified - both MENA and sub-Saharan Africa dummies have statistically significant coefficients while Polity and Distance from the Equator are no longer significant. While in the case of Distance from the Equator it may be true that its effect picks up those of MENA and sub-Saharan Africa, it may not necessarily be true in the case of Polity variable. If Distance from the Equator without reference to MENA and sub-Saharan Africa were a robust predictor of export concentration, it would remain a statistically significant predictor after controlling for MENA and sub-Saharan Africa since some other world regions, like Latin America and Southeast Asia have similar locations relative to the Equator. In the case of Polity, MENA and sub-Saharan regions have disproportionately large numbers of nondemocratic countries.[12] In short, since the variation in Polity scores roughly

coincides with different world regions, the negative effect of Polity in regressions without region dummies is likely showing a *cross-regional* phenomenon.

To test within-region effects of distance from the Equator and Polity, we estimate a model circumscribed to MENA and sub-Saharan Africa (Column iii). The results show that while distance from the Equator does not explain the variation in export concentration, less democracy is in fact associated with more concentrated exports even within these two regions.

The strong regional effects of MENA and sub-Saharan Africa may be driven by the amount of resource rents accruing to countries in these regions. To test the robustness of the regional effects, we estimate a model that includes the 1970-2000 mean of the natural logarithm of yearly total natural resource rents per capita in 2010 constant US Dollars . Including such measure is useful in two other ways. First, a resource rich country may have a high concentration index by construction, in which case an export concentration measure could be biased. While a measure of resource *dependence*, i.e. resource rents as a percentage of GDP is correlated with export concentration relatively strongly (r = 0.57), the correlation between resource rents per capita, i.e. the measure of *abundance*, and export concentration is not a cause for concern (r = 0.38). Still, including the measure of resource abundance in specifications helps to purge its effect on export concentration and ensure that the effects of other determinants are not driven by the variation in resource rents.

Second, including it into specifications allows estimating the direct effect of pre-2001 resource abundance on subsequent, post-2000 export concentration, thus testing the intuition that wealthier countries are not likely to diversify their exports.[13]

The results in Column iv confirm that resource abundance is a strong predictor of subsequent chances of export diversification among developing countries, controlling for other variables. An increase in log rents per capita in 1970-2000 period is associated with an increase in export concentration in 2001-2010. The inclusion of this variable also leads to MENA dummy losing in its significance, but not disappearing. The effect of MENA may be largely, but not wholly driven by the region's oil wealth. However, the statistical significance of the sub-Saharan Africa dummy coefficient remains almost unchanged, suggesting that there maybe other region-specific effects not accounted for by resource abundance. Since the resource abundance measure is a strong predictor of export concentration, we retain it in subsequent specifications. We return to the examination of the effect of resource rents in more detail below.

Different colonial experiences may have had different effects on economic structures of colonies (Dunning, 2005a; Sokoloff and Engerman, 2000), making exports of some more diversified than those of others. We estimate several models with colonial and legal origin dummies from La Porta and colleagues' work (1999). The results in Columns v-viii show that neither colonial experiences under British or French rule, nor having legal systems designed under English Common Law or French Commercial Code have significant effects on export concentration, controlling for other determinants. Natural resource-rich developing countries with the past of socialist laws, however, are significantly more likely to have more concentrated exports (Column ix). This may provide support to the hypotheses that the development of the private sector (particularly, in non-resource sector) has an effect on diversification (Dunning, 2005a) -

formerly socialist countries are likely to have less developed preexisting non-resource private sectors at independence that are likely to pose relatively fewer political challenges to the elites and lesser net economic benefits of investing in diversification.

4.3 Different measures of institutions and integration

We next use the model with regional and resource abundance controls to examine whether different components of Polity score, different measures of institutions, and different measures of integration affect export concentration. Table 5 reports estimates. Two components of Polity score can be expected to entail differences in export concentration: constraints on the executive and competitiveness of participation (Marshall et al., 2011). Like the composite Polity score, neither is a statistically significant predictor once the regional effects and resource rents are controlled for (Columns i and iii). However, estimates reported in Columns ii and iv show that while executive constrains explain some variation in export concentration within the MENA and sub-Saharan Africa regions, competitiveness of participation does not.

Table 5: LIML estimates: Export concentration on measures of institutions and integration

	Mean export concentration, 2001-2010										
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)	(xi)
Mean integration, 1960-2000	-0.000	-0.233	-0.002	-0.231	-0.001	-0.204	0.003	0.270			
	(0.067)	(0.144)	(0.068)	(0.254)	(0.065)	(0.132)	(0.070)	(0.690)			
Mean Polity, 1960-2000									0.092	-0.078	0.314
									(0.266)	(0.261)	(0.355)
Distance from the Equator	-0.060	-0.492	-0.064	-0.534	-0.113	-0.295	-0.048	2.399	-0.051	-0.108	-0.258
	(0.153)	(0.346)	(0.149)	(0.611)	(0.164)	(0.356)	(0.161)	(4.285)	(0.158)	(0.164)	(0.192)
MENA dummy	0.211*		0.187*		0.235**		0.174**		0.212*	0.168	0.372*
	(0.114)		(0.100)		(0.110)		(0.068)		(0.121)	(0.126)	(0.217)
Sub-Saharan Africa dummy	0.336***		0.323***		0.341***		0.294**		0.337***	0.270***	0.375***
	(0.084)		(0.088)		(0.085)		(0.115)		(0.092)	(0.104)	(0.140)
Mean rents per capita, 1970-2000	0.054**	0.044	0.055***	-0.014	0.047**	0.039	0.058**	0.160	0.054***	0.089***	0.030
	(0.022)	(0.030)	(0.021)	(0.086)	(0.022)	(0.029)	(0.023)	(0.172)	(0.021)	(0.025)	(0.026)
Mean executive constrains, 1960-2000	0.014	-0.083*									
	(0.040)	(0.049)									
Mean competitiveness of participation, 1960-2000			0.007	-0.510							
			(0.063)	(0.534)							
Mean legislative effectiveness, 1960-2000					0.036	-0.195*					
					(0.087)	(0.114)					
Mean rule of law, 1996-2000							-0.036	-0.979			
							(0.161)	(1.398)			
"Real" openness, 1960-2000									0.015		
									(0.073)		
Trade policy openness dummy, 1990-2000										-0.037	
										(0.097)	
Mean tariff rates, 1990-1999											-0.000
											(0.009)
Constant	-0.029	0.480*	0.006	1.459	0.010	0.489*	-0.000	-1.370	-0.081	-0.091	-0.009
	(0.222)	(0.274)	(0.231)	(1.279)	(0.208)	(0.264)	(0.185)	(2.488)	(0.357)	(0.254)	(0.293)
Observations	64	30	64	30	62	30	64	30	64	52	52
Basmann's F statistic p-value	0.631	0.941	0.561	0.850	0.707	0.588	0.578	0.859	0.628	0.761	0.965

Note: All models estimated through limited information maximum likelihood (LIML) using ivreg2 Stata module (Baum et al., 2010). The instrumental variable for integration is the natural logarithm of predicted trade shares calculated from a bilateral trade equation by Frankel and Romer (1999). The instrumental variables for Polity are the fraction of the country's population speaking English and the fraction of the population speaking other European languages (Hall and Jones, 1999). Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Next, we test whether other measures of political or other institutions are better predictors

of export concentration than Polity. We estimate similar models with a legislative effectiveness variable drawn from Banks (Banks, 2009) and averaged over the 1960-2000 period (Columns v-vi). The results remain similar: legislative effectiveness is not a good predictor in the full sample with regional controls, but is statistically significant within the MENA and sub-Saharan Africa sample. While executive constraints and legislative effectiveness measure similar things, they do not fully overlap (r = 0.86). However, similar estimations with a rule of law measure for the 5-year period preceding observations on export concentration constructed from Kaufmann et al. (2009) do not yield a statistically significant result for this measure in either sample (Columns vii-viii). We repeat estimations on the full sample with three other measures of institutions - mean quality of government in 1984-2000 constructed from the International Country Risk Guide (Political Risk Services, 2011) and mean measures of political rights and civil liberties for 1972-2000 constructed from Freedom in the World 2012 (Freedom House, 2012). Neither variable explains the variation in export concentration once regional controls and resource rents are taken into account (results not reported due to space considerations and are available on request).

Overall, different measures of institutions are likely to be correlated with one another resulting in estimates that are similar to the effect of Polity without regional and resource controls. Estimates from specifications with these variables without regional and resource controls show that legislative effectiveness, rule of law, political rights and civil liberties behave in the same way as Polity, whereas the coefficient of the quality of government measure has a hypothesized negative sign but is not statistically significant at any conventional level.[14]

Finally, we substitute the measure of integration - nominal openness - with three other measures. First, following Rodrik et al. (2004), we use the natural logarithm of "real" openness constructed from PWT based on a measure of GDP in purchasing-power parity US Dollars and averaged for the same period. The second is a trade policy openness dummy for the 1990-2000 period drawn from Wacziarg and Welch (2008). The third variable is mean tariff rates for 1990-1999 constructed from Milner and Kubota (2005). While the two latter variables enter with hypothesized negative signs, none of the three variables is statistically significant.

4.4 Which geographic factors matter?

Table 6 reports estimates that provide evidence for the causal role of some geographic variables while discarding the role of others. First, to test whether export concentration differences are explained by the proximity to major world markets we estimate a model with a log distance to Belgium, Japan or the US (constructed from Mayer and Zignago, 2011). The coefficient of this variable is not statistically significant and does not change the effects of the regional dummies and rents per capita (Column i). Landlocked location, however, increases export concentration, lending support to the hypothesis that such location inhibits development and growth (Sachs and Warner, 1995).

Table 6: LIML estimates: Export concentration on selected geographic variables

	Mean export concentration, 2001-2010						
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(viii)
Mean integration, 1960-2000	0.003	-0.010	0.045	0.016	-0.004	-0.011	0.173
	(0.072)	(0.067)	(0.080)	(0.069)	(0.068)	(0.081)	(0.133)
Mean Polity, 1960-2000	0.041	0.212	0.238	0.079	-0.013	0.288	0.268
	(0.244)	(0.300)	(0.332)	(0.271)	(0.319)	(0.301)	(0.337)
Distance from the Equator	-0.056	-0.161	0.008	0.034	-0.161	0.207	-0.059
	(0.156)	(0.153)	(0.168)	(0.174)	(0.261)	(0.250)	(0.171)
MENA dummy	0.194*	0.309**	0.316*	0.200	0.210*	0.230*	0.288*
	(0.116)	(0.148)	(0.161)	(0.124)	(0.125)	(0.134)	(0.152)
Sub-Saharan Africa dummy	0.320***	0.350***	0.435***	0.322***	0.333***	0.342***	0.349***
	(0.086)	(0.093)	(0.124)	(0.091)	(0.093)	(0.097)	(0.103)
Mean rents per capita, 1970-2000	0.054**	0.058***	0.051**	0.046**	0.050**	0.071***	0.039
	(0.021)	(0.021)	(0.021)	(0.021)	(0.023)	(0.025)	(0.025)
Distance to major markets	0.008						
	(0.028)						
Landlocked dummy		0.185**					
		(0.086)					
Percent mountainous			0.003*				
			(0.002)				
Percent arable land				-0.003			
				(0.002)			
Population at risk of malaria in 1975					-0.062		
					(0.116)		
Population at risk of malaria in 1995						0.145	
						(0.111)	
Log land area							0.039
							(0.024)
Constant	-0.051	-0.125	-0.138	0.059	0.103	-0.335	-0.387
	(0.302)	(0.232)	(0.244)	(0.208)	(0.321)	(0.303)	(0.344)
Observations	64	64	64	64	64	63	64
Basmann's F statistic p-value	0.552	0.763	0.405	0.576	0.563	0.760	0.530

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

We then estimate a model with a percent of mountainous terrain variable (drawn from Humphreys, 2005) and find similar evidence - more mountainous countries are likely to have more export concentration. Arable land endowment, however, while having a hypothesized sign, does not have a statistically significant effect on how diversified exports are, controlling for the other determinants. There is also no evidence that resource rich developing countries with large land area have higher or lower export concentration than countries with smaller land area (Column viii).

Finally, Sachs argues that malaria incidence is an exogenous variable that affects develop-

ment (Sachs, 2003). We estimate two models with measures of the percentage of population at risk of malaria in 1975 and 1995 drawn from Conley et al. (2007) and fail to find evidence to support this view (Columns v-vii).

4.5 Differential impact of different types of resources

Different types of resources may affect export concentration directly or through their effect on institutions. Point-source resources, such as oil and some minerals, have been found to undermine institutional quality and thereby growth (Bulte et al., 2005; Sala-i Martin and Subramanian, 2003). Isham et al. supplement this list with some agricultural resources, such as plantation crops and coffee and cocoa (Isham et al., 2005). Mehlum et al. distinguish "lootable" resources from others, arguing that the former is harmful for development (Mehlum et al., 2006). Differences in international price volatility of their countries' key export commodities can pose different incentives to ruling elites, inducing diversification in less volatile settings, while discouraging it in settings with more fiscal and economic volatility (Dunning, 2005a).

Table 7: LIML estimates: Export concentration on resource rents, types of resources and oil reserves

	Mean export concentration 2001-2010						
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
Mean integration, 1960-2000	0.084	0.051	-0.025	-0.049	0.014	0.095	0.032
	(0.085)	(0.078)	(0.070)	(0.070)	(0.070)	(0.080)	(0.087)
Mean Polity integration, 1960-2000	0.312	0.218	0.235	0.028	0.219	0.241	-0.015
	(0.342)	(0.319)	(0.294)	(0.285)	(0.303)	(0.282)	(0.384)
Distance from the Equator	-0.069	-0.124	-0.240	0.038	-0.181	-0.039	0.100
	(0.176)	(0.167)	(0.164)	(0.177)	(0.159)	(0.166)	(0.252)
MENA dummy	0.340***	0.352***	0.333***	0.238*	0.310**	0.273**	0.262*
	(0.132)	(0.133)	(0.129)	(0.126)	(0.127)	(0.109)	(0.152)
Sub-Saharan Africa dummy	0.400***	0.372***	0.342***	0.301***	0.362***	0.355***	0.342**
	(0.119)	(0.120)	(0.098)	(0.096)	(0.104)	(0.094)	(0.172)
Mean oil rents per capita, 1970-2000	0.008*						
	(0.005)						
Mean gas rents per capita, 1970-2000		0.004					
		(0.004)					
Mean mineral rents per capita, 1970-2000			-0.011***				
			(0.004)				
Mean coal rents per capita, 1970-2000				-0.011***			
				(0.004)			
Mean forest rents per capita, 1970-2000					-0.014*		
					(0.008)		
Oil producer dummy						0.173**	
						(0.074)	
Percent change in oil reserves, 1981 to 1999							0.001*
							(0.000)
Constant	0.219	0.263	0.207	0.177	0.268	0.173	0.316
	(0.188)	(0.177)	(0.174)	(0.186)	(0.173)	(0.177)	(0.239)
Observations	64	64	64	64	61	65	42
Basmann's F statistic p-value	0.880	0.682	0.584	0.288	0.635	0.968	0.394

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7 reports estimates that provide evidence on the differential effects of different natural resources on export concentration.[15] Columns i-v draw on measures of different resources per capita constructed from World Development Indicators data in the same way as the measure of total natural resource rents per capita. Column i shows that an increase in log mean oil rents per capita for the 1970-2000 period is associated with an increase in export concentration. Gas rents per capita do not have a statistically significant coefficient (Column ii). On the other hand, minerals, coal and forest resources have statistically significant negative effect on export concentration - the larger the rents from these resources, the less concentrated the exports.

To further test the effect of oil resources, we use two other measures. The first is an oil-

producer dummy constructed from bp Statistical Review historical data. We find that oil producers are significantly more likely to have concentrated exports than non-oil developing countries (Column vi). The other variable is a percent change (increase or decrease) in oil reserves per capita between 1981 and 1999 (constructed from the data from Humphreys, 2005). The intuition behind including this variable is that economic benefits of diversification may depend not only on the degree of resource abundance, but also on the expected depletion time for resources, which will likely be a function of the dynamic of oil discovery. The greater is the percent increase in oil reserves, the weaker are the elite incentives to diversify and the less is the likelihood of export diversification. Estimates in Column vii that draw on a subsample limited to oil producers provide some evidence to support this hypothesis.

Finally, we estimate several models where means of export concentration for three different periods are regressed on percent change (positive/negative) in total natural resource rents per capita between different periods, controlling for other determinants (results available on request). We find no evidence that percent change in total rents affects export concentration in different periods.

4.6 Demographic variables and human capital

The size of its population may affect a country's chances of diversifying its exports. Some scholars have also argued that ethnic diversity affects a variety of political and economic outcomes (Habyarimana et al., 2007; Alesina et al., 2003; Fearon, 2003; Posner, 2004). Elites in countries with more ethnically or religiously fragmented societies may be more likely to face explicit or implicit opposition, and therefore be less likely to embark on economic diversification (as it entails public goods provision) since their opponents can benefit from economic diversification and pose political challenges to the elites in the future.[16] In addition, some studies argue that different religious-cultural traditions have different effects on economic development. Finally, following the logic of Glaeser et al. who argue that human capital is a critical factor in economic growth, the level of human capital may be important for whether a country will be able to achieve diversity in its exported products (Glaeser et al., 2004).

Table 8: LIML estimates: Export concentration on demographic variables and human capital

	Mean export concentration, 2001-2010						
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
Mean integration, 1960-2000	-0.008	0.009	0.018	0.010	-0.012	0.019	0.071
	(0.110)	(0.072)	(0.085)	(0.069)	(0.075)	(0.097)	(0.091)
Mean Polity, 1960-2000	0.085	0.092	0.170	0.190	0.093	0.120	
	(0.290)	(0.275)	(0.347)	(0.306)	(0.268)	(0.434)	
Distance from the Equator	-0.042	-0.023	-0.029	-0.055	-0.081	-0.034	-0.117
	(0.163)	(0.169)	(0.168)	(0.155)	(0.165)	(0.172)	(0.177)
MENA dummy	0.212	0.220*	0.220	0.106	0.195	0.199	0.178**
	(0.132)	(0.129)	(0.135)	(0.106)	(0.125)	(0.150)	(0.156)
Sub-Saharan Africa dummy	0.336***	0.326***	0.371***	0.341***	0.331***	0.375**	0.315***
	(0.098)	(0.093)	(0.127)	(0.092)	(0.091)	(0.158)	(0.107)
Mean rents per capita, 1970-2000	0.055***	0.053**	0.058***	0.052**	0.058***	0.055***	0.055***
	(0.021)	(0.022)	(0.022)	(0.021)	(0.022)	(0.021)	(0.023)
Log population at entry, 1960 onward	-0.005						
	(0.025)						
Ethnic Fractionalization		0.069					
		(0.134)					
Religious Fractionalization			-0.130				
			(0.159)				
Percent Muslim in 1980				0.002*			
				(0.001)			
Percent Catholic in 1980					-0.000		
					(0.001)		
Percent Protestant in 1980						-0.003	
						(0.004)	
Primary school enrollment at entry							-0.000
							(0.000)
Constant	0.054	-0.048	-0.028	-0.081	-0.025	-0.008	0.039
	(0.408)	(0.223)	(0.221)	(0.225)	(0.212)	(0.232)	(0.237)
Observations	64	64	63	64	64	64	64
Basmann's F statistic p-value	0.428	0.700	0.377	0.807	0.801	0.326	0.556

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8 reports estimates from several models that include demographic and human capital measures as potential explanatory variables. Log population at entry is constructed from Penn World Tables (Heston et al., 2011).[17] We use data on ethnic and religious fractionalization and percentage of Muslim, Catholic and Protestant populations in each country in 1980 from La Porta et al. (1999). Primary school enrollment at entry, a measure of initial human capital, is from Banks (2009). Since Glaeser et al. argue that human capital affects development through its impact on institutions (Glaeser et al., 2004), we substitute it for the institutions measure.

The results provide some support only to one of these factors - percent Muslim - suggesting

that the larger is the percentage of Muslim population, the more concentrated the country's exports tend to be, controlling for location in MENA and size of rents. While a deeper examination of this topic is beyond the scope of this paper, this finding may be corroborating the hypotheses about the negative long-term effect on economic development of certain Islamic institutions, such as the law of inheritance that hinders capital accumulation, individualistic laws that hamper the development of corporations and specific institutions of trust (*waqf*) that tended to become inefficient over long term (Kuran, 2003, 2004).

4.7 Robustness checks

Finally, we subject the main findings to several robustness tests (see Table 9). First, we estimate two models where the dependent variable is not mean export concentration during 2001-2010, but a 10-year mean of export concentration 10 years after resource boom in each country. The resource boom commencement is operationalized as the year from which resource rents per capita pass the threshold of 100 USD (in 2010 constant dollars) and stay at that level for the next three years. The intuition here is that within the first ten years of resource production - with its likely boom and bust episodes - the elites in the resource-producing country are likely to understand (or prodded to do so by international financial institutions) the risks of depending on a single commodity or few commodities. As a result, they are more likely to consider diversifying their exports. Results in Column i show that the main results do change somewhat, but political institutions still retain statistical significance, while integration does not explain variation in export concentration. These results also give a larger causal role to the distance from the Equator. Column ii confirm this result as well as strong regional effects in MENA and sub-Saharan Africa.

Table 9: Robustness checks: LIML with different periods

	Export concentration			
	10-year mean 10 years after boom		mean, 1995-2010	
	(i)	(ii)	(iii)	(iv)
Distance from the Equator	-0.489***	-0.290**	-0.362**	-0.090
	(0.172)	(0.147)	(0.143)	(0.148)
Integration at entry	0.026	-0.098		
	(0.084)	(0.066)		
Polity at entry	-0.025*	0.005		
	(0.013)	(0.012)		
MENA dummy		0.339***		0.227*
		(0.101)		(0.117)
Sub-Saharan Africa dummy		0.278***		0.315***
		(0.066)		(0.093)
Mean rents per capita, 1970-2000	0.046*	0.064***	0.030	0.050**
	(0.027)	(0.022)	(0.020)	(0.020)
Mean integration, 1970-2000			0.056	0.012
			(0.090)	(0.069)
Mean Polity, 1970-2000			-0.021**	0.003
			(0.009)	(0.013)
Constant	0.318	-0.005	0.334**	0.061
	(0.199)	(0.178)	(0.163)	(0.154)
Number of observations:	64	64	64	64
Number of countries:	64	64	64	64
Basmann's F statistic p-value:	0.07	0.76	0.25	0.62

Notes: Columns i-iv report LIML estimates. Standard errors in parentheses.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Next, we estimate two models where the dependent variable is the mean of export concentration in a longer period, between 1995 and 2010, and the variables for integration, political institutions, and rents per capita are for the period from 1970 to 2010. Again, the results are relatively similar to previous findings.

Finally, we run two-step system GMM of Arellano and Bond (1991) on a larger dataset with observations every five years from 1960 to 2010 (Table 10). The AR(2) test and the Hansen J test show that the overidentiyfing restrictions are not rejected. The estimates are in line with previous results, and while integration is statistically significant in the first specification, it

loses significance once regional controls are included. Polity, on the other hand, remains a statistically significant determinant throughout different specifications.

Table 10: Robustness checks: Arellano-Bond estimates

	Yearly export concentration			
	(i)	(ii)	(iii)	(iv)
Distance from the Equator	-0.000**	-0.000**	-0.000***	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Export concentration$_{t-1}$	0.701***	0.614***	0.659***	0.627***
	(0.042)	(0.050)	(0.021)	(0.046)
Integration$_{t-1}$	0.031**	0.021	0.018*	0.011
	(0.015)	(0.014)	(0.010)	(0.013)
Polity$_{t-1}$	-0.007***	-0.004*	-0.004***	-0.005**
	(0.002)	(0.002)	(0.001)	(0.002)
MENA dummy		0.106**	0.065***	0.075*
		(0.041)	(0.015)	(0.041)
Sub-Saharan Africa dummy		0.088***	0.061***	0.072***
		(0.026)	(0.014)	(0.024)
Rents per capita$_{t-1}$				0.000
				(0.000)
Constant	0.174***	0.154***	0.157**	0.156***
	(0.028)	(0.025)	(0.074)	(0.025)
Number of observations:	440	440	436	435
Number of countries:	65	65	64	64
Hansen J test:	0.34	0.35	0.46	0.36
Number of instruments:	48	50	64	51
AR(2) test:	0.95	0.82	0.36	0.91

Notes: Estimates from two-step system GMM of Arellano and Bond (1991). The base sample for GMM is an unbalanced panel, with observations every five years from 1960 to 2010. The start date for the dependent variable is 1965, so t = 1965 and t-1 = 1960. Year dummies are included, but not reported. Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

5 Conclusion

This article assessed the causal impact of geography, trade integration and institutions on export concentration in natural resource-rich developing countries. It did so in a single framework that used instrumental variables approach to tackle endogeneity, omitted variable bias and measurement error issues. We extended the analysis in previous studies of resource curse to include all other factors that are hypothesised to be correlated with export concentration and to develop a nuanced framework for understanding why some natural resource rich developing countries have more diversity in their exports than others. Derived through using multiple measures and different specifications, the evidence in this paper suggests causal influence of institutions, in particular political institutions, and certain geographic factors on export concentration. We failed to find evidence to support the view that trade integration matters in this regard.

Political-institutional factors that affect export concentration seem to do more with checks and balances on the executive and with rule of law, rather than competitiveness of participation and quality of government. While the analysis detected strong regional effects with location in the Middle East and North Africa and sub-Saharan Africa having a consistently positive effect on export concentration, it also found that less democracy seems to be associated with more concentrated exports even within these two regions. Resource-rich developing countries with the past of socialist institutions are likely to have more concentrated exports than countries without such experience. If we take socialist past as a proxy for the level of development of the private sector - post-socialist countries are likely to have underdeveloped preexisting private sectors at independence - their lower export diversity may be seen as emerging from the private sector's relative lack of leverage on the elites and the relatively fewer net economic benefits for elites of investing in diversification, given large sunk costs. If we conceive political institutions as indicators of the distribution of power (Moe, 2005; Przeworski, 2004; Acemoglu and Robinson, 2006), collectively the evidence of the causal primacy of these factors can be taken as lending credence to the argument, according to which powerful groups block innovation to guard their economic rents thereby hampering economic development in general (Kuznets, 1968; Krusell and Rios-Rull, 1996; Acemoglu and Robinson, 2000) and economic diversification in resource-rich countries in particular (Dunning, 2005a).

Finally, the evidence in this study helps cast light on which geographic factors matter for export diversification. First, among variables other than the size of resource endowment, we find that only landlocked position and extensive mountainous terrain inhibit export diversity. In addition, resource abundance itself is a strong predictor of subsequent chances of export diversification. However, the evidence strongly suggests the hypotheses on differential effects of different types of resources, in this case in the context of determinants of diversity in exports. This finding provides some support for the view that the international market structure of their key commodity affects chances of diversification (Dunning, 2005a) and re-emphasizes the need to distinguish among, rather than lump together, different natural resources when dealing with their political, economic and social effects (Ross, 2001; Bulte et al., 2005; Dunning, 2005b).

The findings of this paper are necessarily somewhat general in that it provides a bird's-eye perspective on the puzzle of export diversification differences among natural resource-rich developing countries. However, it can contribute to informing policy debates on solving or alleviating the economic resource curse by providing comprehensive "snapshots of the terrain" in the context of which policy interventions would need to maneuver to succeed or else risk failure. Both our practical efforts and theoretical understanding of the resource curse would benefit if future studies identify interactions among factors that constrain or enable export diversification and causal mechanisms by which the structure of exports is linked to its key determinants. Multiplicative interaction models and nuanced treatment of the interaction between context and causal mechanisms could be especially useful in this regard.

Notes

[1]A more precise term to use would be “economic resource curse” - to distinguish it from political and social effects of natural resources. From here on, we refer to the “economic resource curse” - that is, the economic effects of natural resources - as simply the resource curse. On the “political resource curse”' see Ross 2001; Ramsay 2011; Haber and Menaldo 2011; Ahmadov 2013.

[2]See Dunning (2007) on endogenous resource rents.

[3]Following the literature, we use the terms “trade openness” and “world market integration” (or simply “integration”) interchangeably.

[4]See Equation 1 and detailed description below.

[5]IMF classification is preferred because it is more conservative in defining development. The World Bank (WB) classification relies on income level, which can be a function of high level of external rents, not of wider and sustainable economic development. For example, Saudi Arabia and Bahrain are coded as high-income and therefore are treated as developed countries despite the fact that their incomes are derived mostly from natural resources. A membership in the Organization for Economic Co-operation and Development (OECD) is arguably a better measure. Nielsen (2011) provides an empirically-driven methodology for classifying countries.

[6]See Papageorgiou and Spatafora, 2012. We thank Chris Papageorgiou for generously sharing their dataset.

[7]For a skeptical view on Polity scale's precision, see Treier and Jackman 2008.

[8]The values for Azerbaijan, Estonia, Croatia, Kazakhstan, Latvia, Turkmenistan, Ukraine, Uzbekistan are computed following the equation in Frankel and Romer 1999.

[9]Their use in this study may be questioned by the possibility of them influencing export concentration directly, based on reasoning that the larger is the fraction of the population speaking English or European languages in a developing country, the richer the bundle of goods imported by global North from such country. To test this empirically, I estimate limited information maximum likelihood (LIML) models regressing export concentration on these two variables controlling for geography, integration (instrumented by constructed openness), regional effects and political institutions. Neither variable is significant at any conventional level in models with and without political institutions.

[10]Since the sample is relatively small, generalized method of moments (GMM) is not a recommended strategy; see Baum et al. 2003.

[11]The coefficient of the fraction of the population speaking English is statistically significant at 1 percent level in a model without the fraction of the population speaking other European languages. I include both variables in first stage regressions to be able to further test the relevance of the instruments through overidentification tests.

[12]Two-group mean-comparison tests (two-sample t tests with unequal variances) for distance from the Equator and mean Polity where countries are grouped into MENA and sub-Saharan Africa, on one side, and Southeast Asia and Latin America, on the other, confirm this intuition. The means of two groups are not significantly different in distance from the Equator, but are very different in mean Polity scores.

[13]While resource rents per capita may be an endogenous measure to political institutions (Norman 2009), in this context this is not a concern given that the dependent variable is export concentration.

[14]Results available on request.

[15]Such as that hypothesized by Dunning (2005a) in the case of economic diversification.

[16]Posner (2004) points out that some measures of ethnic fragmentation may not be valid as they do not necessarily differentiate politically salient fragmentation from politically inessential. However, such measures are not yet available for all countries.

[17]The entry year is 1960 for countries that were independent by then; for the rest of the countries it is the year of actual independence. Missing values imputed from WDI.

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