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Economic Diversification in Resource Rich Countries: History, State of Knowledge and Research Agenda¹

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Abstract: Is economic diversification desirable for a resource rich country? Our knowledge on this issue is at best partial. This paper revisits the literature on diversification in resource rich states. It maps the history of diversification, identifies gaps in the literature and documents some trends in the data. In particular, it exposes limitations in the data and catalogues trends in non-oil exports and non-oil private sector employment. It concludes with an agenda for research.

JEL classification: D72, O11

Key words: Resource Wealth; Economic Diversification

1 Introduction

Diversification is perceived as a priority by many resource rich countries. Yet our knowledge of its merit remains at best partial mainly due to the lack of data and challenges associated with causal interpretation (Wiig and Kolstad, 2012; Ahmadov, 2014). The scarcity of data is very much apparent in figures 1 and 2 which plot the number of missing values per country in datasets frequently used by studies of diversification against that countries log resource rent per capita.³ A positive pattern is apparent from the plots in both the oil sample and the full sample indicating that countries with high levels of resource rent are those with more missing values.

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³ Majority of studies on economic diversification use data from the WTO or the ILO or the United Nations Industrial Development Organization (UNIDO). Data from the WTO is used to compute measures of

Very close association of diversification measures with commodity price also confounds causal interpretation in econometric studies. For example, figure 3 demonstrates that oil export shares in petroleum rich countries move with international price of oil. This pattern is hardly reversed when measures of economic complexity developed by Hausmann et al. (2014) and Hidalgo et al. (2007) are considered in figure 4. Resource rich states typically witness an increase in complexity during price collapse but the opposite follows during boom time.

In this paper we revisit the topic of diversification in resource rich countries. We engage with the literature and present several case studies documenting diversification history in commodity exporters during three distinct epochs. We also review diversification challenges and opportunities in the Gulf Cooperation Council (GCC).⁴ Our data analysis opens by mapping diversification trends of 35 petroleum exporting countries. We map changes in their non-oil export shares over the period 1962 to 2012 sourced from the World Integrated Trade Solutions (WITS) of the World Bank and UN Comtrade database of the United Nations. Fluctuations in the non-oil export price relative to the price of all other exports could contaminate the time series variation of these shares. Therefore, in order to remove the effects of oil price fluctuations we express both non-oil and total exports in year 2000 constant prices US dollars. In addition, we also map changes in non-oil private sector employment as a share of total employment. The latter is sourced from the International Labor Organization (ILO) and covers the period 1969 to 2008. Diversification could be associated with sustained epochs of economic progress (Hausmann et al. 2005, Freund and Pierola 2012). Therefore, we analyze diversification spells over a decade. The shares fail to provide a holistic picture of the nature of diversification across the entire economy. Therefore, Gini coefficient based measures of

export diversification whereas the other two sources provide data on overall employment, manufacturing value added, and manufacturing employment.

⁴ The GCC countries are Saudi Arabia, Kuwait, Bahrain, United Arab Emirates (UAE), Oman, and Qatar.

diversification which takes account of the diversity across multiple sectors within the economy could be relevant here (Cadot et al., 2011; Alsharif and Bhattacharyya, 2016). Finally, we correlate non-oil exports share with several macroeconomic policy and institutions variables using bivariate plots. We present regression results linking non-oil exports and employment with resource rent and geography.

We find diverse patterns in the data when it comes to diversification. The Middle East and North African (MENA) countries register a steady increase in the share of non-oil exports post globalization whereas former USSR countries witness a decline in industrial capacity. The post globalization experience of the majority of the oil exporting high income countries does not appear to be positive in terms of non-oil exports share. Same applies to Sub-Saharan Africa. However, the trend in East Asia and Central America appears to be positive. According to our data on the relative size of non-oil employment in the private sector, larger countries exhibit more internally diversified (in terms of employment) structure than their export share data show. Finally, we find strong negative correlation between change in non-oil export share and oil rent per capita but weak correlation between the former and variables such as real exchange rate and political institutions over the period 2000 to 2012. In a regression model, we also find strong negative correlation between oil rent and diversification after controlling for country specific unobserved heterogeneity such as geography, country specific trends such as culture and demographic factors, time varying global shocks, and cross-sectional dependence.

The rest of the paper is organized as follows. The next section revisits the three epochs of economic diversification in resource rich countries. It also introduces the literature on diversification in the GCC. Section 3 presents diversification trends in petroleum rich countries, and section 4 sets up a research agenda for the future. Section 5 concludes.

2 Three Epochs of Economic Diversification: A Review

Nation states diversified their economies under different paradigms of global trade and commerce. These paradigms were underpinned by sophisticated networks of markets and

source of raw materials. In this section, we revisit this literature to explore any lessons from history that today's resource rich aspiring nations could learn.

Diversification Before 1870

Needless to say that before 1870 we do not have reliable sectoral data on employment and exports. However, we do have data on terms of trade and share of exports which allows us to draw indirect inference on their diversification performance (Blattman et al., 2007). Blattman et al. (2007) and Jacks et al. (2011) document that countries in the industrial core (Britain, France, and Germany) specialized in the export of manufactured goods. They were supported by a network of raw materials exporters from the periphery. Bulmer-Thomas (1994) notes that by 1870 and certainly by the end of the 19th century, raw materials exporting peripheral countries increasingly focused on the export of just a few commodities. The highly specialized nature of the periphery is demonstrated by the fact that the top two exports made up 70 percent of their all exports in 1913 (Bulmer-Thomas, 1994). In contrast, the industrial core remained much more diversified with the same figure recorded to be 12 percent (Blattman *et al.* 2007).

Volatility was also a common feature in raw material exporting peripheral countries than the industrial core (Jacks et al., 2011). This affected their economic performance with a decline local manufacturing and further specialization. This in turn created a feedback loop of more specialization, more vulnerability to volatility, and economic decline. All this took place under an imperial free trade regime whereby the industrial core had a disproportionate advantage over the raw material exporting peripheries in terms of setting up of the rules of trade, military power, and political power.

There were some degree of variation in volatility across the periphery. Blattman et al. (2007) finds that between 1820 and 1870, the highest volatility experiencing regions were the European Periphery (Italy and Russia), the Middle East (Egypt and the Levant), and East Asia (China). Needless to say that this had an impact on diversification and long run economic

progress of these regions. In comparison, the volatility experienced by Latin America and Southeast Asia were lower but still more than twice that of Britain. Volatility in South Asia was equal to the average for the entire periphery which is more than three times that of Britain. It is also noteworthy that terms of trade volatility witnessed a secular increase under the imperial free trade regime between 1820 and 1870 (Hadass and Williamson, 2003).

Diversification between 1865 and 1940

The macroeconomic scenario for the raw materials exporting periphery during the period 1865 to 1940 was not dissimilar to the earlier pre-1870 period (Blattman et al., 2007). Terms of trade volatility for the periphery during this period was even more severe than what the experienced during the previous period. This invariably had a negative impact on their economic performance. In the absence of a well-developed financial market to facilitate investment and consumption smoothing, high levels of volatility forced individuals and governments to cut investments and consumption. In addition, high volatility forced individuals and governments to diversify towards low-risk income generating alternatives with lower average returns (Dercon, 2004; Fafchamps, 2004), as well as to lower levels of investment (Rosenweig and Wolpin, 1993). Furthermore, severe cuts to health and education expenditure by the households and the state in raw material exporting countries invariably followed negative terms of trade shocks which disproportionately affected long term human capital accumulation (Jensen 2000; Jacoby and Skoufias 1997). However, there were some notable exceptions such as Australia where a well-developed financial market acted as a buffer against shocks and contributed towards the process of economic diversification (Bhattacharyya and Williamson, 2011).

In summary, the high volatility experienced by the raw material exporters during this period led to low investments, weak growth performance and more specialization. Some raw material exporters with a relatively well-developed capital market were able to hedge against

these risks by successfully smoothing their consumption and investment decisions did much better than the average.

Diversification after 1940

A large literature dealing with post 1950 data documents that resource rich countries tend to grow slower. This is commonly known as the resource curse literature.⁵ This literature also documents the negative consequences of raw materials exports on investments (Ramey and Ramey, 1995) and inequality (Bhattacharyya and Williamson, 2016). One of the key channels through which commodities affect growth, investments and income distribution is volatility. Theory predicts that households in resource rich countries find it difficult to smooth their expenditures in the face of shocks because of credit rationing and absence of insurance (Dercon, 2004). Therefore, they lower investment in human capital and take fewer risks. Similarly firms struggle to smooth net returns on their predominantly natural assets in the face of terms of trade volatility which also forces them to lower investment in physical capital and take fewer risks. The same also applies to governments who struggle to smooth public investments in the event of highly volatile customs revenue which typically follows an adverse terms of trade shock. All of this contributes towards the resource curse effect and deindustrialization.

A more recent literature finds that the negative effect of commodities on growth performance is conditional on institutional quality (Mehlum et al., 2006; Bhattacharyya and Hodler, 2010; Arezki and Bruckner, 2011; Sala-i-Martin and Subramanian, 2013; Arezki et al., 2015), financial markets (Poelhekke and van der Ploeg 2009), and ethnic fractionalization (Hodler, 2006).

The policy response to resource curse and deindustrialization has been mainly based on structural adjustment whereby raw materials exporters are advised to strengthen macroeconomic fundamentals (Gelb, 1988; Sachs, 2006; Diop et al., 2012; McMillan and

⁵ See van der Ploeg (2011), Frankel (2012), and Venables (2016) for a review of this literature.

Rodrik, 2014; Cherif et al., 2016). In other words, they are advised to shy away from a consumption, government expenditure and import driven economy to an investment and export driven one. The theoretical argument runs as follows. Resource rich countries run the risk of an overvalued exchange rates which places large costs on firms in terms of hiring and firing of workers. Overvalued exchange rate also undermines the competitiveness of the nonresource tradable sector often stunting structural change and economic development. Furthermore, lack of fiscal and monetary discipline coupled with an overvalued exchange rate unleashes huge inflationary pressure undermining price stability and the prospect of long term investments in manufacturing. Therefore, the net outcome often is an economy over reliant on cheap credit funded consumption and government expenditure during boom time as opposed to investments and exports. We learn from history that this easily gets reversed in the event of an adverse terms of trade shock. Therefore, good policy for resource rich developing countries is to exercise fiscal discipline and tight monetary policy. Tight monetary policy characterized by positive real interest rate (approximately around 2-3 percent) and fiscal discipline ensures long term price stability by squeezing inflation out of the system and thus creating the environment for long term investments.

Sound macro management needs to be backed by improvements in the business climate, tax reforms, investments in human capital and infrastructure (Sachs, 2006; Collier and Page, 2009; Lederman and Maloney, 2012). Prudent macroeconomic policy delivers effective demand management and long term price stability. However, price stability is also dependent from the supply side in the form of productivity growth (Rodrik, 2013). Therefore there is a strong case for utilizing savings generated from good macroeconomic policy into investments in factors of production that exhibit increasing returns to scale. Investments in human capital and infrastructure are obviously strong candidates to create incentives for long term growth.

Public investments in infrastructure without doubt is a contentious topic. Bhattacharyya and Collier (2014) recommends such steps for resource rich developing countries while Warner (2015) opposes it. In the same vein as Bhattacharyya and Collier (2014), van de Ploeg and Venables (2011) identifies capital scarcity as the main challenge faced by resource rich developing countries.

Diversification in the GCC:

So far we have discussed diversification trends over three epochs and corresponding policy recommendations. In this section we introduce a case study of the GCC. The GCC is heavily dependent on raw materials exports and in particular petroleum. Half of the world's petroleum production comes from the MENA region and particularly from the GCC.

Therefore, to understand diversification patterns in resource rich countries it is perhaps useful to map diversification trends in the GCC. There is a literature that pays special attention to the GCC. In this section, we revisit this literature.

Scholarly studies document that the GCC economies are highly concentrated despite efforts to diversify (Gelb, 2011). Our data shows that the share of resource rents to GDP in the GCC has ranged between 70% and almost 100% between 1975 and 2012. Fossil fuel and mainly oil is the main export commodity of the GCC. In spite of very heavy reliance on oil there is some variation in diversification patterns within the GCC. For example, the UAE underwent relatively successful diversification programs over the last three decades (Flamos et al., 2013). It managed to lower the resource rent to GDP share from 66% in 1979 to less than 31% in 2007. This occurred mainly due to the successful expansion of non-oil services in Dubai. In particular, tourism, finance, and transport services played a major part in this transformation.

The success of Dubai is also noted by Gelb (2011) as one of the very few examples of developing countries diversifying successfully from initial conditions of strong concentration in minerals. Gelb (2011) observes that Dubai's strategy was to attract investments in

infrastructure, real estate and a range of other services while establishing a free trade zone. It had to rely on expatriate labor and skills, but it managed to attract foreign direct investments from major multinational corporations. The factors that contributed towards incentivizing FDI are an efficient bureaucracy, establishment of a tax haven, no capital control, and near zero tariff. E-governance and a liberal visa regime for businesses and tourists also contributed towards the development of the service sector.

In spite of the Dubai's success, the data for the GCC reveals very high levels of concentration in exports and employment. Whatever little diversification is observed in the ILO employment data stems from government jobs and therefore are indirectly reliant on petroleum rents. Sectors that produce local consumables such as food and beverages and apparel show some degree of diversification in the UNIDO data.

3 Oil and Diversification: Documenting Stylized Facts

So far we have documented that the literature on diversification is often plagued by data limitations. In particular, both exports and employment data used to compute diversification measures lack both spatial and time series coverage. Furthermore, some of the diversification measures are contaminated by price movements reflecting pseudo diversification rather than genuine change in the structure of the economy. In this section, we make an attempt to document some patterns in the data after accounting for challenges such as rapid movements in commodity price. We choose to focus on petroleum here given its global importance as a commodity.

First we begin by plotting non-oil exports as a share of total exports in 35 oil exporting countries over the period 1962 to 2012 subject to data availability in figure 5. The rationale here is that a bigger non-oil exports relative to all exports including oil would imply a much more diversified and petroleum independent export structure.

We draw exports data from the World Integrated Trade Solution (WITS) database, which is a collaboration between the World Bank and the UNCOMTRADE database of the United Nations Conference of Trade and Development (UNCTAD). The export data covers 133 countries in total however here we focus on 35 oil exporting countries. We select data at the 1-digit level of aggregation from the SITC Revision 1 which contains the main 10 trade sectors. These 10 trade sectors are food and live animals; beverages and tobacco; crude materials, inedible except fuel; mineral fuels, lubricants and related materials; animal and vegetable oils and fats; chemicals; manufactured goods classified chiefly by material; machinery and transport equipment; miscellaneous manufactured articles; and commodities and transactions not classified. To compute non-oil exports, we deduct the value of mineral fuels, lubricants and related materials exports from the aggregate. Values in the WITS dataset are reported in constant 1000 USD with base year 2000. In other words, export volume is evaluated at 2000 constant price. Therefore, any changes in the value of trade reflects a real change and not nominal fluctuations associated with short term price movements. Moreover, as we compute non-oil exports as shares of total exports, we effectively evaluate the quantity share at the year 2000 relative price. The WITS data values are consistent over the years and did not need any adjustment.

We notice that there is quite a diversity of patterns when it comes to the share of nonoil exports to total exports. We observe steady improvements in non-oil exports share in the MENA countries especially during the post 1980 period of the new era of globalization. These countries include Algeria, Egypt, Iran, Oman, Qatar, Saudi Arabia, and UAE. Iraq and Kuwait appear to be exceptions in this region with both countries experiencing a significant drop in non-oil export share post 1990. The case of Iraq is perhaps partly explained by adverse international relations shock in the form of UN Security Council approved sanctions, subsequent foreign invasion and military conflict.

In contrast, oil producing countries from the former USSR (Azerbaijan, Kazakhstan, and Russia) exhibit steady decline in the share of non-oil exports in the 1990s. However, this decline appears to have slowed down 2005 onwards in all three countries. The initial rapid decline in the 1990s post disintegration of USSR could partly be explained by the loss of industrial capacity during this period. Industrial production in the USSR was heavily reliant on the value chain network of raw materials, parts and components, and assembly spread over multiple constituent republics based on cost advantages and economies of scale. Disintegration of USSR severed these networks and also caused significant loss of market for these firms. As a result these countries witnessed a decline in high value goods production relative to the production of raw materials.

To our surprise, the pattern in high income countries appear to be somewhat similar to the countries from the former USSR. Canada, Denmark, the Netherlands, UK, and USA all exhibit a steady decline in non-oil exports share post 1980. This is perhaps reflective of the deindustrialization experienced by these countries during the age of globalization. Norway and Australia appear to be exceptions perhaps reflecting their strength as exporters of food and agro processed products.

The trend in Sub-Saharan Africa is of export concentration and deindustrialization. Angola, Cameroon, Congo, Gabon, and Nigeria all experience rapid fall in non-oil exports relative to total exports in the decades of 1960s and 1970s. These are lost decades for Africa when initial attempts towards industrialization through big push were reversed. The Ghanaian case however is somewhat different from the others as she witnesses a decline post 2000. This is consistent with the fact that Ghana became a major oil producer only in the last decade.

Finally, the experiences of oil exporting countries in South East Asia and Latin America appears to be mixed. Oil export dependency increases in Brazil, Colombia, Ecuador, and Venezuela whereas the opposite takes place in Indonesia, Malaysia, Mexico, and Vietnam. The

diversification success of the latter could be explained by these countries ability to enter global production networks through trade deals and favorable geography. Indonesia, Malaysia, and Vietnam perhaps benefitted and continue to benefit from their proximity to a China led production network in spite of negative Dutch Disease effects from petroleum exports. The Mexican success story is perhaps partly explained by the effects of the North American Free Trade Agreement (NAFTA).

It is entirely possible that large countries do not export much to the outside world due to relatively bigger size of their internal market. Therefore, solely focusing on exports may not present us with a complete picture of the state of diversification. Ideally one would also need to examine the internal structure of the economy.

In figure 6 we focus on the state of the labor market. We plot non-oil private sector employment as a share of total employment in 27 oil exporting countries covering the period 1969 to 2008. We focus on non-oil private sector employment as opposed to all non-oil employment because a significant proportion of non-oil public sector employment are likely to dependent on the oil revenue. Therefore, including non-oil public sector employment might create a pseudo impression of diversification which could easily be reversed in the event of an adverse oil price shock.

We draw sectoral employment data are from the International Labor Organization (ILO). ILO data covers 127 countries and includes all economic activities at the 1-digit level between 1969 and 2008. Here, we only exploit data from 27 oil exporting countries. The ILO dataset reports employment under different classifications. Some countries use the ISICrevision 2, others moved to ISIC-revisions 3 and 4 in recent years, and some are using their own national classification. We harmonize more disaggregated employment data from ISICrev3 and ISICrev4 to ISICrev2 by following Imbs and Wacziarg (2003), Timmer and de Vries (2008) and McMillan and Rodrik (2011). If a country reports two revisions, we use the earlier revision.

Official estimates are preferred over labor surveys and data not complying with ISIC conventions are dropped. Table 1 shows the concordance between ISICrev3 and ISICrev2.

As we have mentioned earlier, employment data from the ILO suffers from several shortcomings. Lack of developing country coverage and missing values often bring in serious challenges. Furthermore, ILO employment data sometimes have sudden big fluctuations in the numbers reported under certain sectors. This could be due to countries sometimes changing their calculation method even under the same classification/revision. We take this into consideration by dropping such observations from the sample by making the data more comparable. However, we do compromise data coverage by using this strategy. Nevertheless, we try to make the best of what we have in figure 6.

We observe that the non-oil private sector employment shares in some of the MENA countries such as Algeria, Egypt and Libya declined. However an upward trend is observed in Bahrain, Iran, Oman, Qatar, Saudi Arabia, and UAE. These trends offer some direction but one would need to be careful in interpreting these trends as employment data from MENA countries are not of highest quality.

Among the former Soviet bloc countries, Azerbaijan exhibits greater oil dependency in the labor market whereas there is evidence of growth in non-oil private sector employment in both Kazakhstan and Russia. This is consistent with the fact that both of these countries experienced expansion in industrial output post 2000.

Oil exporting high income countries such as Australia, Denmark, the Netherlands, Norway, UK, and USA experienced a relative decline in non-oil private sector employment. This is perhaps partly explained by the expansion in public sector employment in these countries (particularly Australia, the Netherlands, UK, and USA) over the last two decades coupled with rapid expansion of the financial services industries. Even though the share of the financial services industries have increased rapidly over this period their employment

contribution remained fairly modest. In contrast, credit fueled property boom in these countries contributed to the expansion of employment in local government. Canada appears to be an exception to this common trend where the share of non-oil private sector employment remained steady during 1980 to 2008.

Labor market trends in Latin America and East Asia appears to be mixed with some countries making significant gains (Brazil, Colombia, Indonesia, Malaysia, Mexico) while others losing out (Venezuela, Vietnam).

In summary the employment trends appear to be mixed. The employment trends are perhaps better indicators of diversification for large countries with bigger internal markets and who tend to engage less in international trade. For small and medium sized countries, export based measures are better indicators as they are more likely to be outward oriented due to the relatively small size of their internal market. The caveat however is that the data used is of reasonable quality.

Hausmann et al. (2005) and Freund and Pierola (2012) argue that observing sustained periods of economic performance is more meaningful than short term fluctuations in economic data. There is merit in their argument and hence we look at diversification over 10 year periods and plot summary statistics of these diversification spells. In particular, in figure 7 we plot the decadal growth rates of the share of non-oil exports. A rising trend over a decade would indicate diversification whereas a declining trend would signify concentration. The high income oil exporters such as Canada, Denmark, the Netherlands, Norway, UK, and USA experience concentration. However, drawing a conclusion that this is solely due to oil exports is problematic. Imbs and Wacziarg (2003) document that high income countries specialize beyond a certain threshold level of income. What we observe in figure 7 is perfectly compatible with their observation.

In figure 8 we are only able to plot decadal growth rates of non-oil employment share for 10 countries due to data constraints. Note that the decadal growth rates in Australia, Canada, Denmark, the Netherlands, Norway, UK, and USA are negative indicating a gradual concentration in the labor market but at a slower pace.

In figure 9 we plot the change in non-oil export share over the period 2000 to 2012 against several macroeconomic policy and institutional variables. We find that real exchange rate overvaluation do not seem to hinder non-oil exports relative to other exports during the last decade. The positive association between non-oil exports and institutional quality is quite strong implying countries with growing non-oil export sectors are likely to have better quality institutions. Oil dependent countries are also likely to be heavy subsidizers of the local fuel market. Hence, we plot local gasoline prices against the change in non-oil exports. We find that less reliance on oil exports is also correlated with less fuel subsidy and higher energy price. Finally, we also plot oil rent per capita against the change in non-oil exports share and as expected find a negative association.

In summary, we observe statistical association between macroeconomic policy or institutions variables and non-oil exports. However, the direction of causality remains an open question.

The real exchange rate, energy price, and oil rent per capita data are sourced from the World Bank whereas the Polity 2 data is sourced from the Polity IV dataset. Note that the energy price data is the log of the pump price of gasoline and diesel fuel measured in US dollars per litre. The World Bank sources this data from the German Agency for International Cooperation.

Finally, we correlate the diversification measures with measures of oil dependence in a regression model. The idea here is that the oil dependence variable would capture Dutch Disease leaving the effect of policy and other factors hidden in the residuals. We use a panel

dataset covering up to 35 countries observed over the period 1962 to 2012 for the exports based indicator and up to 27 countries observed over the period 1969 to 2008 for the employment based indicator. To correlate oil dependence with diversification we estimate the following model.

$$Div_{it} = \alpha_0 + \alpha_1 \Omega_i + \alpha_2 \Omega_t + \alpha_3 OilRent_{it} + \epsilon_{it} \quad (1)$$

where Div_{it} is the outcome variable (natural log of the share of non-oil exports or natural log of the share of non-oil private sector employment) in country i and year t , Ω_i is a country dummy variable accounting for country fixed effects, Ω_t is a year dummy variable controlling for time varying common shocks. In order to further constrain the specification we replace Ω_t by country specific trends which is a stronger control.

We expect the coefficient α_1 to be negative and statistically significant implying higher oil dependency associated with smaller share of non-oil exports and non-oil private sector employment. The estimated coefficient could be interpreted as elasticity as both the dependent and independent variables are measured in logs.

The oil rent variable $Oil\ Rent_{it}$ is the natural log of rent per capita from oil and gas and expressed in 2010 constant US dollars. The data is derived from the World Bank's adjusted net savings database. Rent from petroleum is defined as the difference between its world price and the average extraction cost. World price of petroleum is global and it only varies over time. The extraction cost however is variable over time and across countries. We calculate total rents accruing from oil by multiplying the rent per unit of output by the total volume extracted.

In table 2 column 1 we find strong negative correlation between oil rent and the share of non-oil exports to total exports. In column 2 we add stronger controls in the form of country and year fixed effects. The country fixed effects control for country specific time invariant

factors such as geography and the year dummies control for common international shocks. We observe that the size of the elasticity declines to 20 percent. However, this drop appears to be reversed in column 3 when we replace the year dummy by a stronger control in the form of country specific trends.

The R^2 in the full model is approximately 80 percent suggesting that the majority of the variation in export diversification in oil exporting countries are explained by Dutch Disease, geography, and global shocks.

In columns 4-6 we perform the same experiment with the share of non-oil private sector employment as the dependent variable. The results are similar except that the magnitude of the elasticity declines in column 6 and loses statistical significance. The negative sign however survives. We also notice that non-oil exports are far more sensitive to oil rent than non-oil private sector employment as is revealed by the magnitude of the estimated elasticities.

In our regressions, countries such as Angola, Brunei, Iraq, Kuwait, Nigeria, Oman, Qatar, Saudi Arabia, and UAE typically have large residuals when non-oil exports were used as a dependent variable. This perhaps signals significant room for policy. Among the high income oil exporters, Denmark, Norway and United Kingdom have higher residuals highlighting policy space in these countries to improve their export diversification levels.

The non-oil employment residual plot exposes similar patterns as the non-oil exports residual plot. The MENA countries identified above also shows patterns of large residuals with the employment data along with Malaysia and Algeria but to a much lesser extent.

4 Commodities and Diversification: A Research Agenda

So far we have discussed the literature on diversification and presented a descriptive summary of the data. In this section we identify some gaps in the literature and map out a research agenda for the future. We propose the following eight areas that could help address the gaps and move the literature forward.

1. Petroleum, Infrastructure Investments and Economic Diversification

The policy literature often highlights the importance of infrastructure and especially energy infrastructure in attaining economic progress and a diversified economy. However, we have very little knowledge of the role that infrastructure and especially energy infrastructure plays in energy rich states. Therefore, it is of utmost importance to highlight the strength, weakness, bottlenecks, and constraints associated with infrastructure in energy rich states.

There are several potentially important specific questions/issues that remain unaddressed. We list them as follows. First, the literature needs to dig deep into the types of infrastructure investment that could potentially be beneficial for energy rich countries. In many energy rich developing countries, the energy infrastructure is geared towards exports rather than local consumption and electricity generation. For example, a country rich in natural gas could make substantial investments in setting up LNG terminals for exports. Alternatively, it could also invest in power plants to bolster natural gas fired electricity generation for local consumption. There is hardly any analysis of the merits and limitations of such policy choice in the context of diversification. Second, it is also important to map out the potential country specific costs and infrastructure bottlenecks associated with diversification. Generating internationally comparable new data could be very useful here. Furthermore, one needs to ask the question how useful is it to invest in electricity infrastructure during oil booms and what are the long term effects of such investments? Do electricity prices play a role in influencing the long term effects? How important is the interconnection between hydrocarbons, electricity prices and diversification in the long run? Can we analyze the location specific effects of energy infrastructure investments and electricity provision on economic activity and diversification using project level geocoded datasets? Addressing these questions could go a long way in understanding the infrastructure investment challenges faced by oil rich developing countries.

2. Hydrocarbon, Trade Networks and the Road to Economic Diversification

Yeats (1998) and Yi (2003) document that the trade in parts and components (otherwise known as global production sharing) has grown at a much faster rate than total world trade in merchandise over the last three decades. The current growth success stories of South East Asia in underpinned by the successful exploitation of these trade networks by these countries. Therefore, any viable diversification strategy for an energy rich state based on industrialization and sustainable development should include effective participation in the global production sharing network.

Being energy rich could potentially be a strength or a weakness in terms of breaking into the global production sharing network. For example, energy riches could be exploited to generate cheap electricity and attract foreign investment in key energy intensive tasks and components at different stages of production. This could potentially kick start the process of skill renewal, learning by doing, and diversified economic progress. In contrast, energy riches could also trigger extreme specialization relegating the energy rich country to a mere supplier of raw materials. In spite of the importance of global production sharing in economic development and diversification we know very little of it in the context of oil rich countries. There is very little research on the risks and possibilities for an energy rich economy in participating in the global production sharing network. To make progress on the policy front this obviously ought to change.

3. Oil, Outward Oriented Employment and Economic Diversification

Modern oil extraction is extremely capital intensive. Therefore, it generates little direct employment. Therefore, any viable diversification strategy for oil rich nations ultimately boils down to developing a sustainable non-oil private sector able to generate large volumes of employment; a point that we have made earlier in the paper. For an oil rich developing country however, this challenge is somewhat more complex. Given that the internal market for these countries are likely to be small, therefore it is unlikely that such a small sized market would be

able to generate the big push required for the development of the non-oil private sector. Hence, outward orientation of the economy is extremely important.

Given the significance of outward orientation and globalization, it is important to keep track of the size of outward oriented employment in oil producing countries. How export oriented employment get affected in the event of price, production, and discovery shocks in the oil industry? Is this form of employment less volatile than other forms of employment (for example, public sector employment) in the event of an adverse shock? We recognize building such disaggregated employment data would be a challenge. However, there is some progress made on that front in the form of labor content of exports database (LACEX) from the World Bank which could be improved upon.

4. Hydrocarbons, Investment Quality and Diversification

Investments in oil rich developing countries are often characterized by poor quality. This is particularly true for infrastructure investments but is also relevant for other forms of investments. The profession and the policy community is well aware of these challenges and often point to corruption, bad governance, lack of skilled workforce as contributing factors.

In spite of the widespread awareness of these issues, there is very little objective analysis of the challenges faced by these countries. In particular, there is very little data on the quality of investments. An innovative research program would make a serious attempt towards quantifying investment quality across countries. A way forward would be to utilize geocoded data of private investment to evaluate its location characteristics, rental value, and gestation period. Development of a composite index based on these and other parameters would go a long way in objectively analyzing investment quality and its effects on diversification in hydrocarbon rich countries.

In addition to analyzing private investment quality, there is also a need to assess the quality of public investments. The Public Investments Management Index (PIMI) is a step in

the right direction but there is an urgent need to extend this metric to the project level so that researcher could have access to more disaggregated information on investment quality in oil rich countries.

5. Hydrocarbons and the Role of Institutions in Diversification

Institutions are identified as a key determinant of economic progress. The literature on long term economic progress and other areas of social science emphasize the importance of institutions in numerous publications. Yet very little is known on the impact of institutions on industrialization and diversification. Beyond the economic mechanism of Dutch Disease there is a good reason to believe that politics and political institutions alter the incentives for the ruling elite to adopt policies to diversify the economy. This is of particular significance for an oil rich country (or for that matter any other society) since resource endowment often guides the nature of the tax system, political system and public policy in general. Many studies have identified that these incentives for the incumbent elite in an oil rich country are markedly different from an oil poor country. Furthermore, surprisingly little is known about the role of individuals in these societies. For example, Mahathir in Malaysia or Lee Kwan Yu in Singapore or General Park in South Korea are often portrayed as reformers and modernizers who significantly influenced the process of industrialization in their countries as leaders. Suharto's role in Indonesia could be viewed as similar to the others but his share of Indonesian history remains controversial.

A research program on diversification in energy rich countries should include a systematic study of the impact of institutions on diversification outcomes. Needless to say that the role of the leader merits special attention and so is the role of political institutions.

6. Oil and Policy towards Diversification

As we have documented in section 2, there is a large policy literature on diversification. We recognize the importance of this research and the value of having country case studies alongside

empirically focused comparative studies. However, this literature is somewhat disorganized and haphazard. Therefore, there is demand for research outlining the policy space to achieve diversification. In section 2 we highlighted the importance of prudent macroeconomic policy. We also highlighted the importance of a moderately tight monetary policy and fiscal policy coupled with improving the business climate could go a long way in ensuring price stability and promoting savings, investments, and exports led sustainable growth as opposed to growth led by unsustainable consumption demand. However, beyond our knowledge of macroeconomic policy, the policy space is not very specific on concrete practical measures that petroleum rich countries could undertake to achieve diversification. For instance, what could oil rich countries do to penetrate global production networks? What are the merits of having a coherent electricity policy in the event a country is energy rich but infrastructure poor?

Mapping the policy space and creating a consolidated database could be useful. Furthermore, visualization of diversification oriented policy data could be of value to both practitioners and researchers.

7. Improving Data Quality and Coverage

In section 3 we made the argument that limitations associated with data quality and coverage severely handicaps research on diversification. Therefore improving the data quality and coverage is of utmost priority when it comes to research on diversification. The data from the World Bank and WITS primarily used to compute measures of export diversification are of reasonable quality and both coverage and quality have improved over the years. However there is still more room for improvement on that front as it only covers 122 countries. For many countries the number of data points offered are extremely limited.

The quality of employment data predominantly derived from the ILO database remains significantly poor. There is scope for improving both the quality and coverage of disaggregated labor market data across countries. Disaggregated labor productivity data could be computed

from UNIDO sources which has far better coverage than ILO. However the data is only restricted to manufacturing.

There is also demand for sectoral GDP data across countries. The University of Groningen project does a good job in compiling a database for predominantly OECD countries. McMillan and Rodrik (2014) extends this dataset to 10 African countries which is an advancement. However, significant improvements could be made in utilizing administrative data from many other countries to extend this database even further. This could be achieved provided such research programs are properly resourced.

5 Concluding Remarks

Diversifications remains a key policy agenda for many resource rich countries. Yet surprisingly little is known about the merits of diversification in these locations. In this paper we review recent studies of diversification in raw material exporting states. We map the data limitations and highlight the challenges facing the raw material exporting countries and especially oil exporters by mapping the diversification pathways of the world's 35 oil exporters. We track their non-oil export shares over the period 1962 to 2012. We also track the non-oil private sector employment share over the period 1969 to 2008. To track sustained period of diversification or the lack of we look at diversification over 10 year periods and offer summary statistics of these diversification spells. Finally, we also employ plots and a simple regression model that correlates non-oil exports and employment with resource rent and geography. The intention here is to identify any room for policy maneuvers.

We find diverse patterns in the data when it comes to diversification. Therefore, the challenges for different countries and regions are likely to be different. We find strong negative correlation between oil dependency and diversification even after controlling for country specific unobserved heterogeneity such as geography, country specific trends such as culture and demographic factors, time varying global shocks, and cross-sectional dependence. A closer

look at the residuals indicate that MENA and Sub-Saharan African countries have more room for policy maneuvers when it comes to diversification.

We do not claim that our empirical approach presented here is superior to the approaches taken by others in the literature. Nor do we argue that the indicators of diversification used by us here is free from limitations that we documented in section 1 of the paper. We do however take stock and lay out a detailed research plan in order to take this important literature forward.

References

- Ahmadov, A. (2014). Blocking the Pathway Out of the Resource Curse: What Hinders Diversification in Resource Rich Developing Countries? *Global Economic Governance (GEG) Working Paper No. 2014/98*, University of Oxford.
- Alsharif, N., and S. Bhattacharyya (2016). Oil Discovery, Political Institutions and Economic Diversification. *Centre for the Study of African Economies (CSAE) Working Paper No. 2016-19*, University of Oxford.
- Arezki, R., and M. Bruckner (2011). Oil Rents, Corruption, and State Stability: Evidence from Panel Data Regressions. *European Economic Review*, 55(7):955-963.
- Arezki, R., S. Bhattacharyya and N. Mamo (2015). Resource Discovery and Conflict in Africa: What Do the Data Show? *Centre for the Study of African Economies (CSAE) Working Paper No. 2015-14*, University of Oxford.
- Bhattacharyya, S. and P. Collier (2014), Public Capital in Resource Rich Economies: Is there a Curse? *Oxford Economic Papers*, 66 (1), 1-24.
- Bhattacharyya, S., and R. Hodler (2010). Natural Resources, Democracy and Corruption, *European Economic Review*, 54, 608-621.
- Bhattacharyya, S. and J. G. Williamson (2011), Commodity Price Shocks and the Australian Economy since Federation, *Australian Economic History Review*, 51(2), 150-177.

- Bhattacharyya, S., and J. G. Williamson (2016). Distributional Consequences of Commodity Price Shocks: Australia over a Century, *Review of Income and Wealth*, 62(2), 223-244.
- Blattman, C., J. Hwang, and J. G. Williamson (2007), The Impact of the Terms of Trade on Economic Development in the Periphery, 1870-1939: Volatility and Secular Change, *Journal of Development Economics*, 82 (January), 156-179.
- Bulmer-Thomas, V. (1994). *The Economic History of Latin America since Independence*. Cambridge: Cambridge University Press.
- Cadot, O., Carrère, C., & Strauss-Kahn, V. (2011). Export diversification: What's behind the hump? *Review of Economics and Statistics*, 93(2), 590-605.
- Cherif, R., F. Hasanov, and M. Zhu. (2016). *Breaking the Oil Spell: The Gulf Falcons Path to Diversification*. Washington DC: International Monetary Fund.
- Collier, P., and J. Page. (2009). Breaking in and Moving Up: New Industrial Challenges for the Bottom Billion and the Middle-Income Countries. Industrial Development Report, UNIDO.
- Dercon, S. (2004). *Insurance Against Poverty*. Oxford: Oxford University Press.
- Diop, N., D. Marotta, and J. de Melo. (2012). *Natural Resource Abundance, Growth and Diversification in the Middle East and North Africa*. Washington DC. The World Bank. September.
- Fafchamps, M. (2004). *Rural Poverty, Risk and Development*. Cheltenham: Edward Elgar.
- Flamos, A., Roupas, C. V., & Psarras, J. (2013). GCC Economies Diversification: Still a Myth? *Energy Sources, Part B: Economics, Planning, and Policy*, 8(4), 360-368.
- Frankel, J. (2012). The Natural Resource Curse: A Survey of Diagnoses and Some Prescriptions, *Working Paper Series rwp12-014*, John F. Kennedy School of Government, Harvard University.

- Freund, C., and M. Pierola. (2012). Export Surges. *Journal of Development Economics*, 97, 387-395.
- Gelb, A. (1988). *Oil Windfalls: Blessing or Curse?* New York: Oxford University Press.
- Gelb, A. (2011). Economic diversification in resource rich countries. *Beyond the Curse: Policies to Harness the Power of Natural Resources*, 55-80.
- Hadass, Y. and J. G. Williamson (2003), Terms-of-Trade Shocks and Economic Performance, 1870-1940: Prebisch and Singer Revisited, *Economic Development and Cultural Change*, 51 (April), 629-56.
- Hausmann, R., C. Hidalgo, S. Bustos, M. Coscia, S. Chung, J. Jimenes, A. Simoes and M. Yildirim (2014). The Atlas of Economic Complexity: Mapping Paths to Prosperity. Centre for International Development, Harvard University.
- Hausmann, R., L. Pritchett, and D. Rodrik (2005). Growth Accelerations. *Journal of Economic Growth*, 10: 303-329.
- Hidalgo, C., B. Klinger, A-L. Barabasi and R. Hausmann (2007). The Product Space Conditions the Development of Nations. *Science*, 317: 482-487.
- Hodler, R. (2006), The curse of natural resources in fractionalized countries, *European Economic Review*, 50, 1367-86.
- Imbs, J., and R. Wacziarg (2003). Stages of diversification. *American Economic Review*, 93(1): 63-86.
- Jacks, D., K. O'Rourke, and J. G. Williamson (2011), Commodity Price Volatility and World Market Integration since 1700, *Review of Economics and Statistics*, 93 (3), 800-813.
- Jacoby, H. G. and E. Skoufias (1997), Risk, Financial Markets, and Human Capital in a Developing Country, *Review of Economic Studies* 64 (July): 311-35.
- Jensen, R. (2000), Agricultural Volatility and Investments in Children, *American Economic Review* 90 (May): 399-404.

- Lederman, D., and W. Maloney. (2012). *Does What You Export Matter? In Search of Empirical Guidance for Industrial Policy*. The World Bank, Washington D.C.
- McMillan, M. S., and D. Rodrik. (2011). Globalization, structural change and productivity growth: National Bureau of Economic Research.
- McMillan, M. S., and D. Rodrik. (2014). Globalization, Structural Change and Productivity Growth, with an Update on Africa. *World Development*, 63: 11-32.
- Mehlum, H., K. Moene, and R. Torvik (2006). Institutions and the Resource Curse, *Economic Journal*, 116, 1-20.
- Poelhekke S, and F. van der Ploeg (2009). Volatility and the Natural Resource Curse. *Oxford Economic Papers*, 61(4), 727-60.
- Ramey, G. and V. Ramey (1995), Cross-country Evidence on the Link Between Volatility and Growth, *American Economic Review* 85(5): 1138-51.
- Rodrik, D. (2013). Unconditional Convergence in Manufacturing. *Quarterly Journal of Economics*, 128(1):165-204.
- Rosenweig, M. R. and K. I. Wolpin (1993), Credit Market Constraints, Consumption Smoothing, and the Accumulation of Durable Production Assets in Low Income Countries: Investments in Bullocks in India, *Journal of Political Economy* 101(2): 223-44.
- Sachs, J. (2006). *The End of Poverty: Economic Possibilities for Our Time*. Penguin Books, New York, NY.
- Sala-i-Martin, X. and A. Subramanian (2013), Addressing the Natural Resource Curse: An Illustration from Nigeria, *Journal of African Economies*, 22(4): 570-615.
- Timmer, M. P., and de Vries, G. J. (2008). Structural change and growth accelerations in Asia and Latin America: a new sectoral data set. *Cliometrica*, 3(2), 165-190.

- van der Ploeg, F. (2011), Natural Resources: Curse or Blessings? *Journal of Economic Literature*, 49, 366-420.
- van der Ploeg, F., and A.J. Venables (2011). "Harnessing windfall revenues; optimal policies for developing economies", *The Economic Journal*, 121: 1-30.
- Venables, A. (2016), Using natural Resources for Development: Why Has It Proven So Difficult? *Journal of Economic Perspectives*, 30(1): 161-184.
- Warner, A. (2015). Natural Resource Booms in the Modern Era: Is the curse still alive? IMF Working Paper No. WP/15/237. International Monetary Fund. Washington DC.
- Wiig, A., and I. Kolstad (2012). "If Diversification is Good, Why Don t Countries Diversify More? The Political Economy of Diversification in Resource-Rich Countries, *Energy Policy*, 40: 196-203.
- Yeats, A. (1998). Just How Big is Global Production Sharing? World Bank Policy Research Working Paper.
- Yi, K. M. (2003), Can Vertical Specialization Explain the Growth of World Trade? *Journal of Political Economy*, 111: 52-102.

Figure 1: Missing Values in Oil Countries

Note: The figure plots the number of missing values for oil countries against log oil rents per capita in the WITS, UNIDO and ILO datasets over the period 1962-2012. *Source:* WITS, UNIDO, and ILO.

Figure 2: Missing Values in All Countries

Note: The figure plots the number of missing values for all countries against log oil rents per capita in the WITS, UNIDO and ILO datasets over the period 1962-2012. *Source:* WITS, UNIDO, and ILO.

Figure 3: Oil Export Share and Oil Price

Note: The figure plots oil export share averaged over all oil exporting countries and oil price over the period 1962-2012. *Source:* WITS for oil export share and BP oil price dataset for oil price.

Figure 4: Complexity Index and Oil Price

Note: The figure plots complexity index averaged over all OPEC countries and oil price over the period 1995-2012. *Source:* Complexity Index from Hausmann et al. (2014) and BP oil price dataset for oil price.

Figure 5: Non-Oil Exports as a Share of Total Exports in Oil Countries

Note: Non-Oil exports as a share of total exports plotted over the period 1962-2012 subject to data availability for 35 oil exporting countries.
Source: The World Bank, World Integrated Trade Solutions (WITS) and UN Comtrade database, the United Nations.

Figure 6: Non-Oil Private Sector Employment as a Share of Total Employment in Oil Countries

Note: Non-Oil private sector employment as a share of total employment plotted over the period 1969-2008 subject to data availability for 27 oil exporting countries. *Source:* International Labour Organization (ILO).

Figure 7: Decadal Growth in Non-Oil Exports Share in Oil Countries

Note: Decadal growth rate of the Non-Oil exports share of total exports plotted over the period 1970-2010 subject to data availability for 27 oil exporting countries. *Source:* The World Bank, World Integrated Trade Solutions (WITS) and UN Comtrade database, the United Nations.

Figure 8: Decadal Growth in Non-Oil Private Sector Employment Share in Oil Countries

Note: Decadal growth in Non-Oil private sector employment share plotted over the period 1970-2010 subject to data availability for 10 oil exporting countries. *Source:* International Labour Organization (ILO).

Figure 9: Macroeconomic Policy and Change in Non-Oil Export Share

Table 1: different classifications between ISIC revisions 2 and 3

ISIC-Revision 2	ISIC-Revision 3 Equivalent
1. Agriculture, Hunting, Forestry and Fishing	A. Agriculture, Hunting and Forestry B. Fishing
6. Wholesale and Retail Trade and Restaurants and Hotels	G. Wholesale and Retail Trade; Repair of Motor Vehicles, Motorcycles and Personal and Household Goods H. Hotels and Restaurants
8. Financing, Insurance, Real Estate and Business Services	J. Financial Intermediation K. Real Estate, Renting and Business Activities
9. Community, Social and Personal Services	L. Public Administration and Defense; Compulsory Social Security M. Education N. Health and Social Work O. Other Community, Social and Personal Service Activities P. Households with Employed Persons

Note: McMillan and Rodrik (2011) and Timmer and de Vries (2008) follows this harmonization procedure

TABLE 2.
OIL RENT AND ECONOMIC DIVERSIFICATION

VARIABLES	Non-Oil Exports (1)	Non-Oil Exports (2)	Non-Oil Exports (3)	Non-Oil Pvt.Emp. (4)	Non-Oil Pvt.Emp. (5)	Non-Oil Pvt.Emp. (6)
Oil Rent	-0.34*** (0.04)	-0.20*** (0.03)	-0.38*** (0.02)	-0.02*** (0.004)	-0.005** (0.002)	-0.003 (0.002)
Controls						
Country Fixed Effects	NO	YES	NO	NO	YES	NO
Year Fixed Effects,	NO	YES	YES	NO	YES	YES
Country Specific Trends	NO	NO	YES	NO	NO	YES
R ²	0.26	0.85	0.83	0.06	0.90	0.88
Observations	1007	1007	1007	599	599	599
Countries	35	35	35	27	27	27
Year	1962-2012	1962-2012	1962-2012	1969-2008	1969-2008	1969-2008

Note: Figures in parentheses give Driscoll-Kraay standard errors. The Driscoll-Kraay standard errors are robust to arbitrary heteroscedasticity, arbitrary intra-group correlation and cross-sectional dependence. *Non-Oil Exports*: natural log of non-oil exports as a share of total exports. *Non-Oil Pvt.Emp*: natural log of non-oil private sector employment as a share of total employment. *Oil Rent*: natural log of oil rent per capita. ***, **, and * indicate significance level at 1%, 5%, and 10% respectively against a two sided alternative.