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Economic Diversification in Resource Rich Countries: Uncovering the State of Knowledge[1]

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Abstract: Diversification is often presented as a desirable policy objective for petroleum rich nations. Yet very little is known about the causes and consequences of diversification in petroleum rich states. In this paper we review the recent literature on diversification in oil-exporting states. We identify gaps and shortcomings in this literature along with documenting some trends in non-oil exports and non-oil private sector employment in hydrocarbon rich countries. We conclude with an agenda for research addressing the potential gaps in the literature.

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1 Introduction

Oil and gas exporting countries are routinely advised to diversify their economies away from hydrocarbons and raw materials. Even though necessary due to the finite nature of hydrocarbon resources, diversification was not perceived as a priority by many in an environment of very high oil prices over the past two decades. However, the dynamic has changed since then with a spectacular drop in oil prices in July 2014 followed by a prolonged period of cheap oil. There is a renewed interest in the diversification agenda in oil and gas exporting countries. For example, in April 2016 the Saudi Crown Prince Mohammed bin Salman unveiled the 'National Transformation Plan' to diversify the Saudi economy and significantly increase the share of non-oil revenue of the government. Similar initiatives are also observed in Nigeria with the Nigerian Minister of Finance, Mrs. Kemi Adeosun, recently revealing the government's plan to jump start diversified growth.

Despite its popularity as a policy recommendation, surprisingly little is known about the merits of economic diversification in resource-rich countries (Wiig and Kolstad, 2012; Ahmadov, 2014). At least in theory diversification could deliver the following benefits. First, diversification could act as a buffer against commodity price volatility. Note that volatility is particularly disruptive for oil rich countries through its unanticipated impact on the sovereign balance sheet even in the presence of clearly defined fiscal rules. Furthermore, the risks from volatility gets magnified many fold in the absence of clearly defined fiscal rules. Second, diversification could also create new jobs in the non-resource sector of the economy. It could bring new skills and technology to the economy with long term benefits. Finally, diversification could also act as a buffer against a broader "resource curse." [3] However, it remains difficult to identify where and when petroleum rich states have successfully diversified and which policy interventions worked effectively. It is unclear how to measure

[3] See, for example, Auty (2001); Lipschitz (2011); Conceição et al. (2011); Lederman and Maloney (2003, 2012); and Collier and Page (2009).

diversification success or failure. In the absence of a more fine-grained analysis of reliable diversification measures, analysts commonly fall back on a handful of examples of countries that appear to have been successful. For example, Indonesia and Malaysia are often presented as success stories even though it is not obvious that they are useful examples for other countries.

In this paper we review recent studies of diversification in oil-exporting states.[4] We suggest that our understanding of this issue has been limited by three problems. First, the data used by some of the existing studies appear to be incomplete and inconsistent. For example, studies addressing the issue of diversification at different stages of development[5] tend to focus mainly on exports data from the World Trade Organization (WTO). The coverage of petroleum rich developing countries in these datasets is patchy. Some studies utilize employment data from the International Labor Organization (ILO) but these datasets typically have very weak coverage both in time series and cross-sectional dimensions. Note that we discuss data challenges in section 3 and present several illustrative plots. Furthermore, sectoral GDP data is very much restricted to OECD member countries significantly limiting the scope of analysis. In particular, important questions such as the impact of petroleum resources on the sectoral composition of GDP in developing countries remain largely beyond reach. Second, some studies such as Imbs and Wacziarg (2003) and Cadot et al. (2011) use export concentration measures. These measures are innovative but they are potentially noisy and uninformative for oil exporting developing countries due to weak data coverage. Either complete lack of coverage or missing observations appear to be the norm when it comes to disaggregated exports data from developing countries. Finally, causal identification remains a major challenge in this literature. The structure of the

[4] We do not attempt to summarize the broader literature on trade diversification, income, and development. On diversification and income, see Imbs and Wacziarg (2003), Koren and Tenreyro (2007), Cadot et al. (2011). On diversification and economic development, see Hirschman (1958), Hidalgo (2012) and Rodrik (2013). For a recent survey, see Cadot et al. (2013).

[5] See Cadot et al. (2013) for a survey of this literature.

economy could be driving the volume of oil exported by these countries. A diversified economy would generate greater domestic demand for oil leading to fewer volumes exported abroad. Therefore, causation could run from the structure of the economy to petroleum exports rather than in the other direction as is typically assumed.

To gain a clearer picture on the challenges faced by the oil-exporting countries we offer a description of the diversification pathways of the world's 35 oil exporters. We track 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 US dollars year 2000 constant prices. In addition, we also track 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. Consistent with recent efforts to explain sustained periods of economic performance (Hausmann et al. 2005, Freund and Pierola 2012), we look at diversification over 10 year periods and offer summary statistics of these diversification spells. The shares fail provide a holistic picture of the nature of diversification across the entire economy. Therefore, we also plot Gini coefficient based measures of diversification which takes account of the diversity across multiple sectors within the economy. Finally, as a step toward identifying policy successes and failures, we plot changes in the non-oil exports share with several macroeconomic policy and institutions variables. We also employ a simple regression model that correlates non-oil exports and employment with resource rent and geography and comment on the room for policy maneuvers.

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 remainder of the paper proceeds as follows. The next section reviews recent scholarship on the consequences of "oil dependence" – meaning a specialization in petroleum exports – as well as its causes. Section 3 describes how these studies have been limited by the problems of data, measurement, and causal identification. To this end we also present illustrative plots to highlight data challenges. Section 4 contains our analysis of diversification trends in the oil exporting states, and section 5 outlines a research agenda that could help scholars address some of the problems. Section 6 concludes.

2 Causes and Consequences of Oil Export Dependence: A Review

A large literature deals with commodity boom and their socioeconomic consequences. This

body of work is commonly known as the "resource curse literature."[6] Even though related, here we place most of that literature aside. Instead we focus on the narrower question of the causes and consequences of a specialization in oil exports.[7] Furthermore, in section 3 we also explain why it is challenging to causally identify relationships between oil dependence and other factors. But here we concentrate our attention on the existing studies that have attempted to address the question of oil specialization.

What are the effects of oil dependence?

Studies of the consequences of oil dependence can be divided into three categories: those that focus on volatility, those that focus on crowding out, and those that focus on broader effects on institutional quality, government accountability, and violent conflict. It is also noteworthy that the volatility, crowding out and institutions effects are often interlinked.

Perhaps the most carefully-studied result of oil dependence is macroeconomic volatility. The more concentrated the export sector, and the larger the export sector relative to the domestic economy (characterized by consumption, investment and government demand), the greater the economy's exposure to international price shocks.[8] Commodities in general and oil and gas in particular tend to have volatile prices. This is not only due to abrupt shifts in the forces of demand and supply in the physical market but also movements in the financial markets of futures and options. A large literature explores the determinants of commodity price volatility (Yang et al., 2005). Some argue that the introduction of hedging in the form of futures trading reduces volatility in the cash price of commodities (Kamara, 1982). Other more recent studies indicate that commodity price volatility is positively related

[6] For a review of the resource curse literature, see van der Ploeg (2011), Frankel (2012), and Venables (2016).

[7] We use the term "oil dependence" below to denote a specialization in the export of crude oil, refined oil products, and natural gas.

[8] Busch (2011) notes that estimates of the causal effects of export concentration on volatility may be biased by endogeneity. It develops an instrument for export concentration, based on country geographic characteristics, and finds instrumented export concentration is correlated with terms of trade volatility and export growth volatility but has no clear association with exchange rate volatility.

to the volume of futures trading (Adrangi and Chatrath, 1998). Note that the futures market in oil and gas is many times the size of the physical market. Yang et al. (2005) presents a review of this literature. Irrespective of the source of volatility, a specialization in oil and gas – if left unmitigated by policies or institutions – often leads to macroeconomic volatility.[9]

Several studies report that resource-based volatility tends to deter investment, which in turn may lead to reduced economic growth (Ramey and Ramey 1995, Blattman et al. 2007, Aghion et al. 2009)[10] and increased inequality (Bhattacharyya and Williamson, 2016). Poelhekke and van der Ploeg (2009) decompose natural resource dependence into a direct economic effect, which they report is positive, and an indirect economic effect through its effect on volatility, which they find is negative and much larger. Cavalcanti et al. (2015) looks at the relationship between commodity terms of trade volatility and growth and reports a similar finding. Lederman and Maloney (2012), however, find a strong correlation between extractive exports and terms-of-trade volatility but no robust link to growth volatility.[11]

Resource-based volatility may also have consequences for governance and public service provision. Oil, gas, and mineral wealth tend to generate significant government revenues, typically out of proportion to their share of GDP (Bhattacharyya and Hodler, 2010; Arezki et al., 2014). Price shocks in the resource sector hence tend to have large effects on government revenues and modernization of public services. How these affect governance depends, in part, on the government's ability to stabilize its revenue flows through other means, like the use of stabilization funds or hedging instruments such as access to international capital markets. At a minimum, revenue volatility places greater demands on the

[9] Jacks et al. (2011) show that commodity prices have been more volatile than the prices for services and manufactured goods since at least the 1700s. On contemporary oil prices and volatility, see Kilian (2008), Regnier (2007), and Hamilton (2009).

[10] See the review of earlier studies in Poelhekke and van der Ploeg (2009). For older versions of this argument, see Nurske (1958) and Levin (1960).

[11] On the relationship between export concentration and income in a broader set of countries – i.e., both resource dependent and non-resource dependent – see Imbs and Wacziarg (2003), Koren and Tenreyro (2007), and Cadot et al. (2011). All report a U-shaped relationship between export concentration and income, but make no strong claims about causality.

government's fiscal policies. More broadly, revenue instability may help explain why oil wealth has been linked in many studies to higher levels of corruption (Arezki and Bruckner 2011, Sala-i-Martin and Subramanian 2013, Caselli and Michaels 2013), particularly in autocracies (Bhattacharyya and Hodler 2010).

A second consequence of specialization in hydrocarbon exports is the potential crowding out of other tradable sectors of the economy through the "Dutch Disease" mechanism. The mechanism stipulates that a hydrocarbon export boom would lead to an appreciation of the real exchange rate damaging competitiveness of other tradable sectors of the economy such as manufacturing and agriculture (Corden and Neary 1982). A resource boom would also trigger structural change with rapid resource (capital and labor) reallocation away from manufacturing towards non-tradable services. Hence an expansion in extractive industries (or positive price shock) in a country with a diversified export portfolio should lead to resource dependence through both a direct channel (an increase in the value of resource exports) and an indirect channel (a decline in the value of non-resource exports). These crowding-out effects could be large. Harding and Venables (2016), for example, find that for each additional dollar of resource revenues, countries tend to see a decrease in non-resource exports of 75 cents.[12]

The crowding out of manufacturing may be undesirable for the long term health of an economy. Manufacturing could generates significant positive externalities, such as from learning-by-doing (Krugman, 1987). Learning-by-doing aids and abets human capital accumulation and long run economic growth. Rodrik (2013) reports that manufacturing industries tend to converge across countries in their labor productivity, which implies that having a large manufacturing sector will help low-income countries grow more rapidly. McMillan and Rodrik (2011) argue that trade openness leads resource-rich countries to

[12] It is unclear whether the Dutch Disease reduces economic growth; the meta-analysis by Magud and Sosa (2010) finds little convincing evidence of a growth-reducing effect. Matsen and Torvik (2005) argue there may be an optimal degree of Dutch Disease.

specialize in raw material exports, which in turn limits their incentives to diversify into exports of high valued products such as manufacturing. Furthermore, this also limits the country's ability to undergo structural change from raw materials to industry to services.

Export-oriented manufacturing may also have consequences for gender equity. Sectors differ in their propensity to absorb female labor. For example, in the United States textile manufacturing is the most female labor intensive sector (Do et al., 2016, Table 1). In many other countries, too, manufacturing has played an important role in drawing women into the workforce. For example, Morocco's textile industry accounted for three-quarters of the growth in female employment in the 1990s (Assaad, 2004). Ozler (2000) and Baslevent and Onaran (2004) find that export-oriented factories in Turkey are more likely to employ women than firms that produce similar goods for the domestic market.[13]

Ross (2008) argues that since oil wealth tends to crowd out export-oriented manufacturing, it could also crowd women out of the labor force under certain conditions. The most important condition could be the inability of women to work in the non-tradable sector. In other words, a resource boom would crowd women out of the labor force only if they are not able to move into the service sector, which tends to expand with resource booms. The paper also argues that oil windfalls can deter women from joining the labor force by boosting government transfers to families, which can reduce the opportunity cost of female non-participation in the labor force. The reduced presence of women in the labor force also impedes the development of their economic and political rights.[14] Similarly, Do et al. (2016) find that countries with a comparative advantage in goods that are intensive in female labor (like manufacturing) exhibit more rapid decline in fertility rates.

Finally, oil dependence has been statistically associated with a wide range of

[13] For the case of Tunisia, see White (2001); for the case of South Korea, see Park (1993), World Bank (2005). For the case of the US in the 19th century, see Smuts (1959).

[14] Social theorists have long suggested that joining the labor force has a transformative effect on women's lives; one early proponent was Engels [1884] 1978. Many recent studies support this claim; see, for example, Brewster and Rindfuss (2000).

undesirable political outcomes, including more durable authoritarian governments, higher corruption rates, and under certain conditions, the outbreak of separatist violence (Collier and Hoeffler, 2004, Miguel et al., 2004)[15]. While volatility and crowding out are specifically linked to a specialization in oil exports, we explain below that it is more difficult to draw strong causal links between policy, oil dependence *per se* and these outcomes.

What are the causes of oil export dependence?

Before we embark on examining the causal link between policy, oil dependence and outcomes, it is perhaps worthwhile spending some time exploring the following question. What are the causes of oil export dependence in the first place? To a first approximation, a specialization in oil exports is a simple result of factor endowments. For instance, in a classic Heckscher-Ohlin model, countries with a relative abundance of natural resources will specialize in their export. Once established, this specialization can become self-perpetuating for three reasons. The first is the Dutch Disease, through which oil windfalls can reduce competitiveness of other tradable goods. Hausmann and Rigobon (2002) suggest a second mechanism, showing how a country that specializes in resource exports will experience greater volatility, which can deter investment in other types of tradable goods and hence perpetuate the dependence on resource sector exports. Finally, oil might be uniquely hard to diversify from because there are few other products that require similar skills. Hence the learning-by-doing that occurs in the oil sector tends to generate little entrepreneurship, or employment, in other industries. Hidalgo et al. (2007) and Hausmann et al. (2014) suggests that countries diversify by moving from products they specialize in to others that require similar capabilities and hence occupy an adjacent "product space." To measure the location of products it develops a "complexity" index that captures both the export diversity of the countries that produce it, and the number of countries that export it. The complexity index is

[15] These cross-country findings are not corroborated by more recent studies using disaggregated geocoded data on resource discovery and conflict. See, for example, Cotet and Tsui (2013) and Arezki et al. (2015).

designed to indicate how easy or difficult it is for countries that specialize in a given export to diversify into other categories of exports. Crude oil has by far the lowest rating of all products, followed by tin ores and cotton (p. 25). Of all categories of products, they find oil production shares the fewest characteristics with other products and inhabits the most isolated sector of the "product space," making it the single most difficult category of goods to diversify from.[16]

Beyond this framework – that oil specialization is initially the result of factor endowments, and then becomes self-perpetuating – the degree of oil dependence may be affected by a large number of other factors, including policies and institutions. Oil dependence is typically measured as oil exports as a share of total exports. The value of oil exports will be affected by both global factors, such as price shocks, and domestic factors, such as policies and institutions that influence the investment climate.

Some country characteristics may have different effects on oil investments and non-oil investments. The former tend to be highly-specific and can operate in protected geographic enclaves whereas the latter tend to be more mobile and more susceptible to changing labor market conditions. For example, when countries experience political instability or violent conflict, investment in manufacturing may flee to other countries while investment in oil, gas, and mining may remain, leading to heightened dependence on oil exports. A recent study of foreign direct investment in the Middle East and North Africa between 2003 and 2012 found that political instability had little effect on investment flows into natural resource sectors, but significantly reduced investment flows into non-resource sectors (Burger et al., 2016).

Several studies have looked at whether selected variables are associated with export concentration in a regression model. Using a cross-section dataset of 65 resource rich

[16] This argument is consistent with the findings of both Ahmadov (2014) and Lederman and Maloney (2012) that among primary commodities, oil is most strongly correlated with export concentration.

developing countries, Ahmadov (2014) estimates the effects of a series of variables averaged over the period 1960-2000 on export concentration in the 2001-2010 period. The study instruments for two potentially endogenous variables, trade integration and institutional quality. It reports that diversification is inhibited by autocratic institutions, weak rule of law, landlocked or mountainous terrain, and a location in the Middle East or Africa. Oil wealth is also associated with less diversification, while an abundance of non-fuel minerals, coal, and forest resources is associated with greater export diversity.

Starosta de Waldemar (2010), using the Generalized Method of Moments (GMM) estimation approach and a sample of more than 130 countries between 1995 and 2007, reports that measures of both perceived corruption and autocratic institutions are also associated with less diversification at the product level, and the export of fewer products. They argue that rent-seeking discourages innovation by creating uncertainty about future returns, and leading to the misallocation of credit.

Freund and Pierola (2012) asks a closely related question: what explains surges in manufacturing exports, where surges are defined as significant increases that are sustained for at least seven years? They report that among developing countries, export surges are preceded by depreciations in the real exchange rate that are both large and leave the exchange rate significantly undervalued – a finding that underscores the challenges caused by the Dutch Disease.

Policies to mitigate oil dependence

The policy recommendations designed to mitigate oil/minerals dependence are not strongly based on evidence. This is perhaps partly explained by the lack of data and the challenges associated with quantifying economic policy differences across nations. The policy literature mainly focuses on the following three themes. First, they argue that it is important for hydrocarbon rich nations to get the economic fundamentals in order (Gelb, 1988; Sachs,

2006; Diop et al., 2012; McMillan and Rodrik, 2014; Cherif et al., 2016). The argument runs as follows. Petroleum 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 non-resource tradable sector often stunting structural change and economic development. Furthermore, lack of fiscal and monetary discipline coupled with an overvalued exchange rate could unleash 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. History teaches us that this gets easily reversed in the event of a negative price shock. In contrast, good policy would be for petroleum rich developing countries 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 would ensure long term price stability by squeezing inflation out of the system and steer the economy away from consumption and government expenditure dependency towards investments and exports.

Second, the policy literature also recommends investments in human capital and infrastructure (Sachs, 2006; Collier and Page, 2009; Lederman and Maloney, 2012). This is somewhat linked to the first prescription on maintaining a prudent macroeconomic policy. A prudent macroeconomic policy delivers effective demand management and long term price stability. However, price stability is also dependent on the supply side in the form of economic growth. Therefore there is a strong case for utilizing savings generated from god 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. Even though there is very little disagreement on the merits of good schooling and infrastructure, there is hardly any

consensus on how to actually achieve this goal. Some studies argue in favor of more active state involvement (Sachs, 2006) whereas others recommend innovative management models such as public private partnerships (Collier and Page, 2009).

Finally, the policy literature also notes that it is important for petroleum rich countries to provide incentives for non-resource industries to further improve the prospects of long term sustainable growth (Collier and Page, 2009; Cherif et al., 2016). Some of the key policy prescriptions are improving the business climate through tax reforms, promotion of e-governance by substantially reducing legal and administrative costs on small businesses, providing assistance with accounting through sophisticated use of the banking sector, and identifying fast growing export oriented firms in the non-resource sector and providing export subsidy for them (Sachs, 2006; Cherif et al., 2016).

Overall, it is worthwhile noting that there is little disagreement about the value of the first and second policy prescriptions, but considerable disagreement remains over how far governments should go on the third. For example, Warner (2015) observes that "Public capital accumulation is not the only possible antidote for forces pulling in the direction of a curse, but it may be the most often recommended." In contrast, Bhattacharyya and Collier (2014) documents that resource rich countries systematically underinvest in public capital and van de Ploeg and Venables (2011) refer to the need for capital accumulation as "the fundamental economic problem faced by resource rich economies." Furthermore, it also remains unclear how the state could pick winners efficiently in the non-resource sector and support them with export subsidy. To what extent these firms are independent of the resource sector is an open question and identifying them using an objective strategy could be extremely challenging.

3 Understanding Diversification: Limitations and Challenges

For all the importance of export diversification, why do we know so little about it? Scholars

working on this topic face three formidable challenges.

The first is missing or unreliable data. Majority of studies dealing with the issue of 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 export diversification whereas the other two sources provide data on overall employment, manufacturing value added, and manufacturing employment. All of these sources provide data of varying quality and some are obviously better than the others. However, what appears to be a common problem is their lack of coverage of petroleum rich developing countries. Both time series and spatial coverage of these locations are weak. Datasets are often riddled with missing values in addition to the problem of reliability.

Figures 1 and 2 demonstrates this problem by plotting the number of missing values per country against that countries log resource rent per capita. A positive pattern is apparent from the plot in both the oil sample and the full sample indicating that countries with high levels of resource rent are those with more missing values.

The second is that export diversification is often measured in ways that are noisy or uninformative for oil exporters. Export diversification is generally measured as export shares (e.g., Imbs and Wacziarg 2003, Cadot et al. 2011). Similarly, natural resource or petroleum dependence is measured as a fraction of total exports, or as a fraction of GDP (e.g., Ahmadov 2014). As is apparent in figure 3, countries dependent on a single commodity such as oil with volatile prices are likely to witness the oil share of their exports rise and fall with global prices as the quantity of oil production adjusts. This however reveals very little about the structure of production and exports in these economies.

Even the more sophisticated measure of "economic complexity" developed in Hausmann et al. (2014) and Hidalgo et al. (2007) seems to show price-driven fluctuations in the oil exporters. States that are highly oil-dependent, like Saudi Arabia, Venezuela, Oman,

and Libya, showed spectacular increases in their economic "complexity" between 1978 and 1988, a time when oil prices collapsed. During the next oil price boom, between 1998 and 2008, their complexity scores once again plummeted. This pattern albeit at a muted level is also observed for all OPEC countries in figure 4.

A third challenge in this literature is reverse causality in general and establishing causality in particular. We note above that oil dependence may be affected by a wide range of policies, institutions, and shocks, some of which may be difficult to model. These policies and institutions could change either simultaneously with the composition of exports or could also be influenced by the variety of exports. Therefore, establishing causality becomes extremely challenging. Scholars can partially address this problem by using potentially exogenous instruments, like giant or supergiant oil field discoveries (Arezki et al., 2014; Lei and Michaels, 2014; Alsharif and Bhattacharyya, 2016), favorable geology (Cotet and Tsui, 2013), or price shocks caused by out-of-area natural disasters (Ramsay, 2011). But instrumental variables may be of limited use here as the instruments could also be directly correlated with some of the outcome variables violating the exclusion restrictions.

4 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 petroleum price.

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 non-oil 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 appears 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 ISIC-revision 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.

$$Div_{it} = \alpha_i + \omega_t + \gamma_1 Oil\,\mathrm{Re}nt_{it} + \varepsilon_{it} \qquad (1)$$

where Div_{it+j} 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, α_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 γ_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 $Oil\,\mathrm{Re}nt_{it}$ 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.

5 Oil 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. Hydrocarbons and Gender Specific Diversification

Ross (2008) argues that oil production could lead to gender skewed labour market outcomes in many oil producing countries. The study postulates that oil production reduces the number of women in the labor force through multiple channels. First, a rise in oil production leads to a drop in tradable goods production through the Dutch Disease mechanism. This in turn reduces the demand for female workers which depresses female wages. Low wages acts as a disincentive towards female workforce participation. Second, a rise in oil production increases male wages and government transfers which acts as a further disincentive towards female workforce participation. Low workforce participation by women reduces their political power and influence. As a result, oil-producing states are more likely to be left with atypically strong patriarchal norms, laws, and political institutions.

This is indeed a strong thesis and the study finds support for it by correlating oil production with female employment and female political rights. A worthy exercise but a thesis of this significance merits further investigation. It could very well be that oil disproportionately affects female dominated professions and thereby making the female labor market more concentrated. Therefore a systematic analysis of the impact of oil on the employment diversification of women relative to men would be useful. Furthermore, we currently have very little knowledge of the impact of hydrocarbons on female labor productivity and female manufacturing employment. Female manufacturing employment is an indicator of how much stake women have in a shared and diversified economy as a vibrant manufacturing sector seems to be one of the preconditions for a diversified economy.

Therefore, analyzing the impact of oil on female manufacturing employment has broader significance.

2. 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 highlights 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.

3. 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.

4. 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 stock 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.

5. 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.

6. 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.

7. 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.

8. 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 from 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.

6 Concluding Remarks

Diversifications remains a key policy agenda for many petroleum 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 oil-exporting states. We map the data limitations and highlight the challenges facing the oil-exporting countries 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 3 of the paper. We do however take stock and lay out a detailed research plan in order to take this important literature forward.

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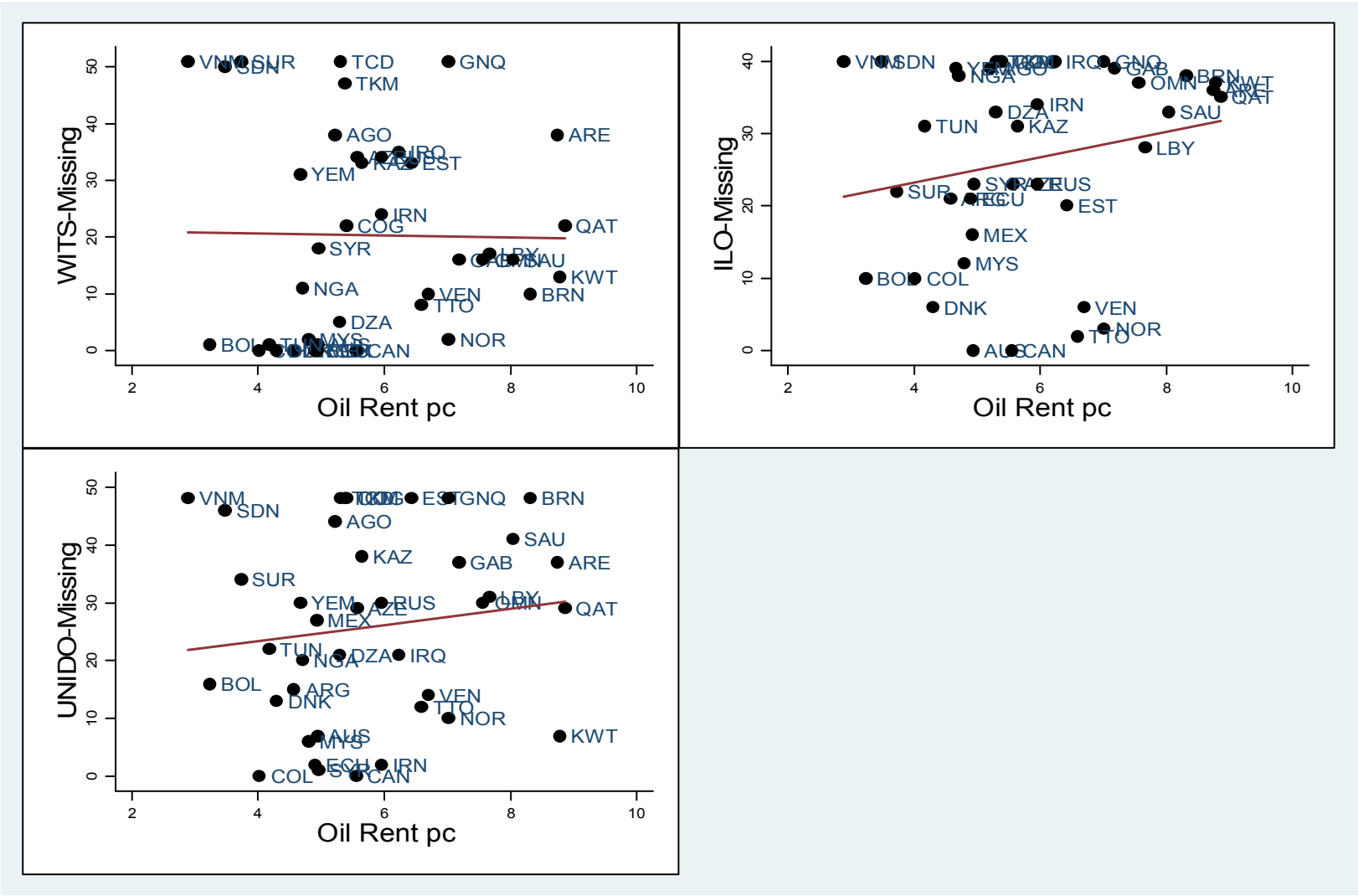
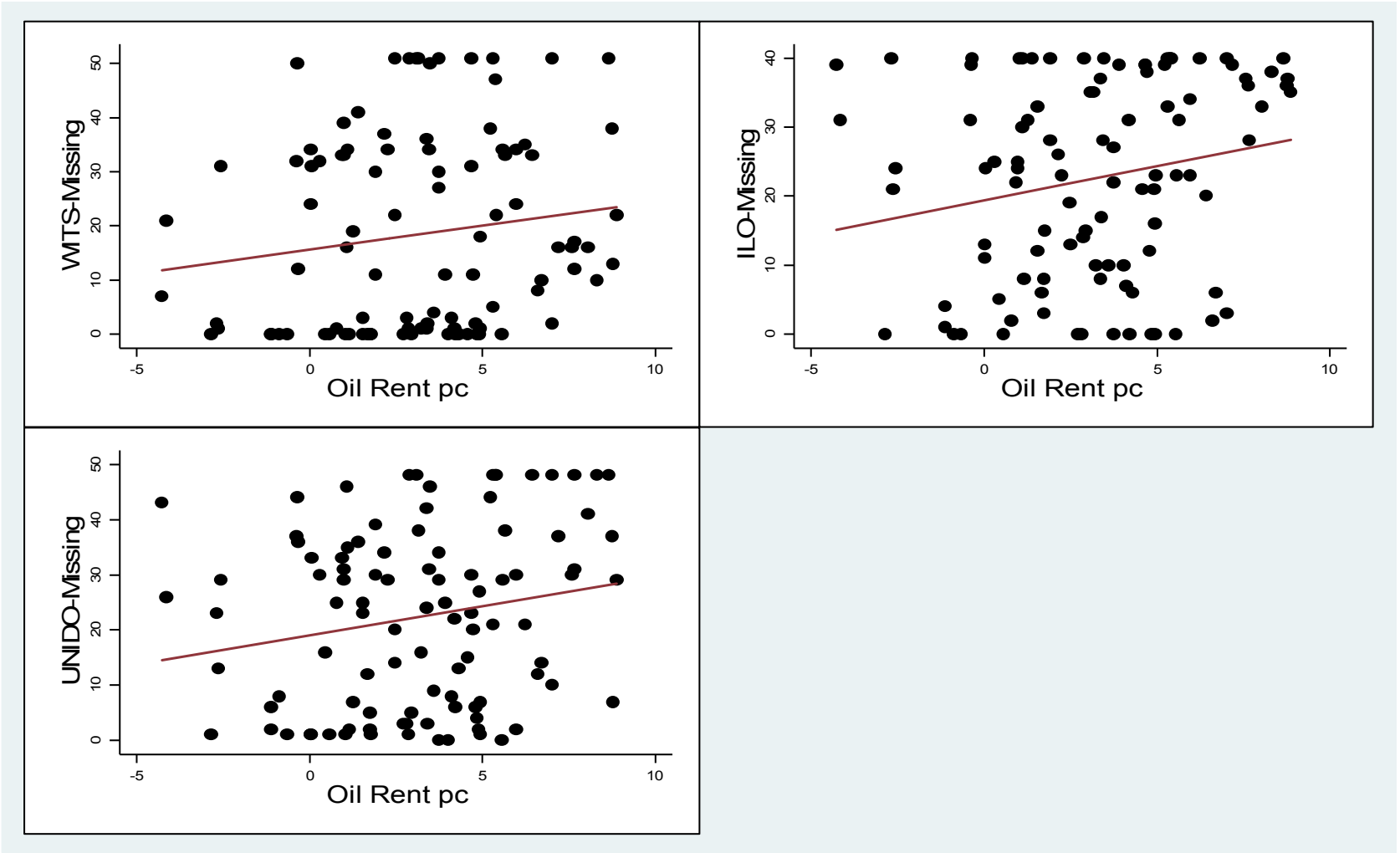
Figure 1: Missing Values in Oil Countries



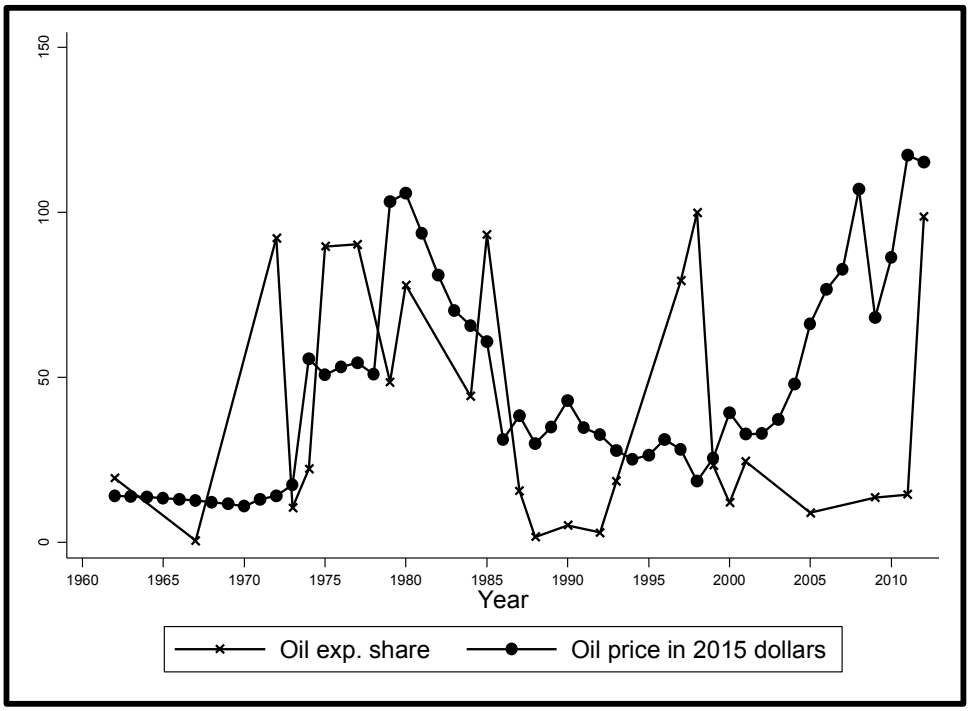
Note: The figure plots the number of missing values for oil countries against log oil rents per capita in the WITS, UNIDO and ILO datasets over the period 1962-2012. *Source:* WITS, UNIDO, and ILO.

Figure 2: Missing Values in All Countries



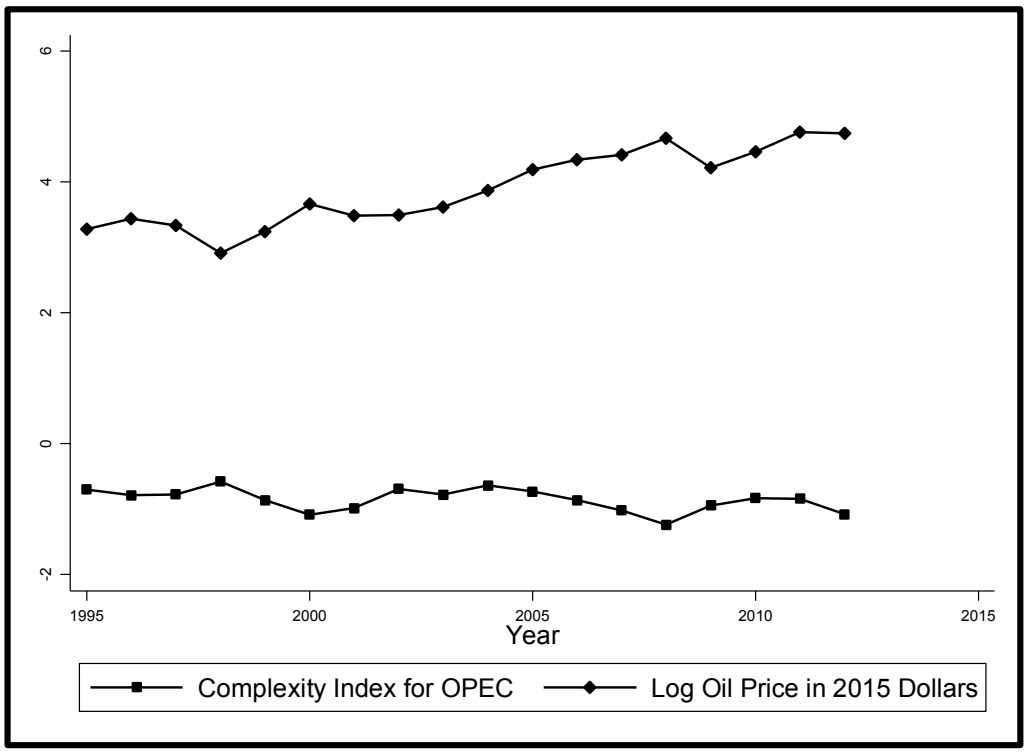
Note: The figure plots the number of missing values for all countries against log oil rents per capita in the WITS, UNIDO and ILO datasets over the period 1962-2012. *Source:* WITS, UNIDO, and ILO.

Figure 3: Oil Export Share and Oil Price



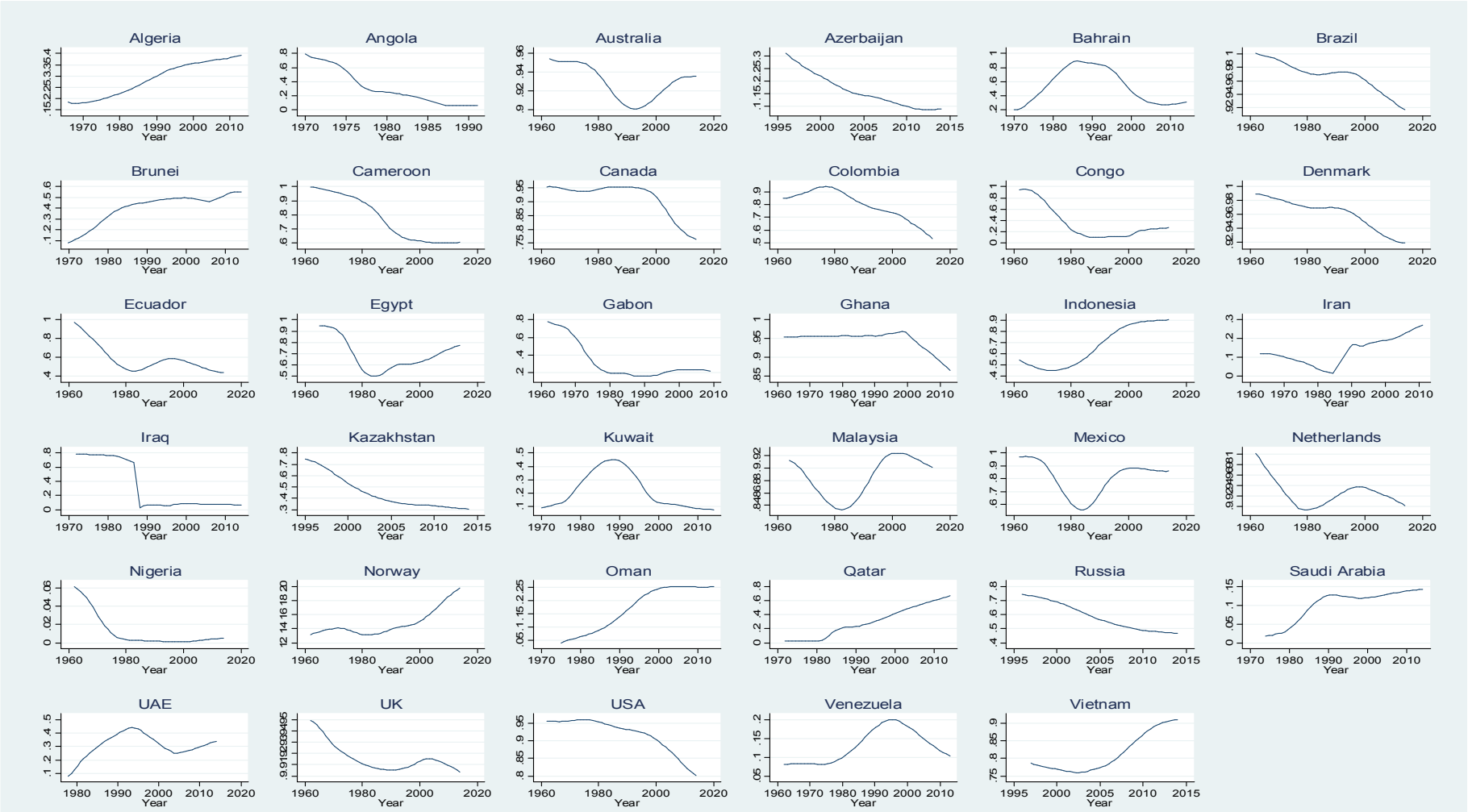
Note: The figure plots oil export share averaged over all oil exporting countries and oil price over the period 1962-2012. *Source:* WITS for oil export share and BP oil price dataset for oil price.

Figure 4: Complexity Index and Oil Price



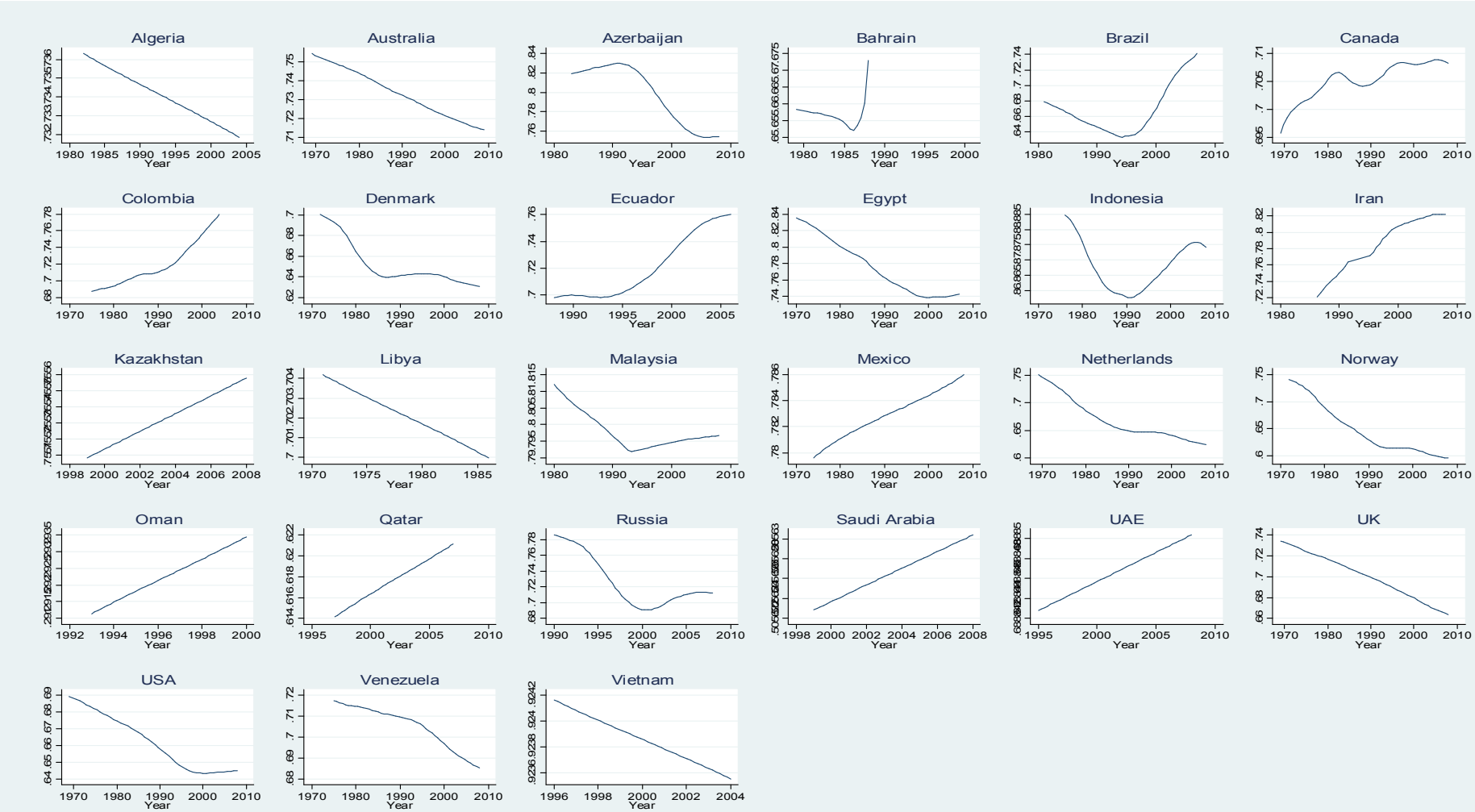
Note: The figure plots complexity index averaged over all OPEC countries and oil price over the period 1995-2012. *Source:* Complexity Index from Hausmann et al. (2014) and BP oil price dataset for oil price.

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



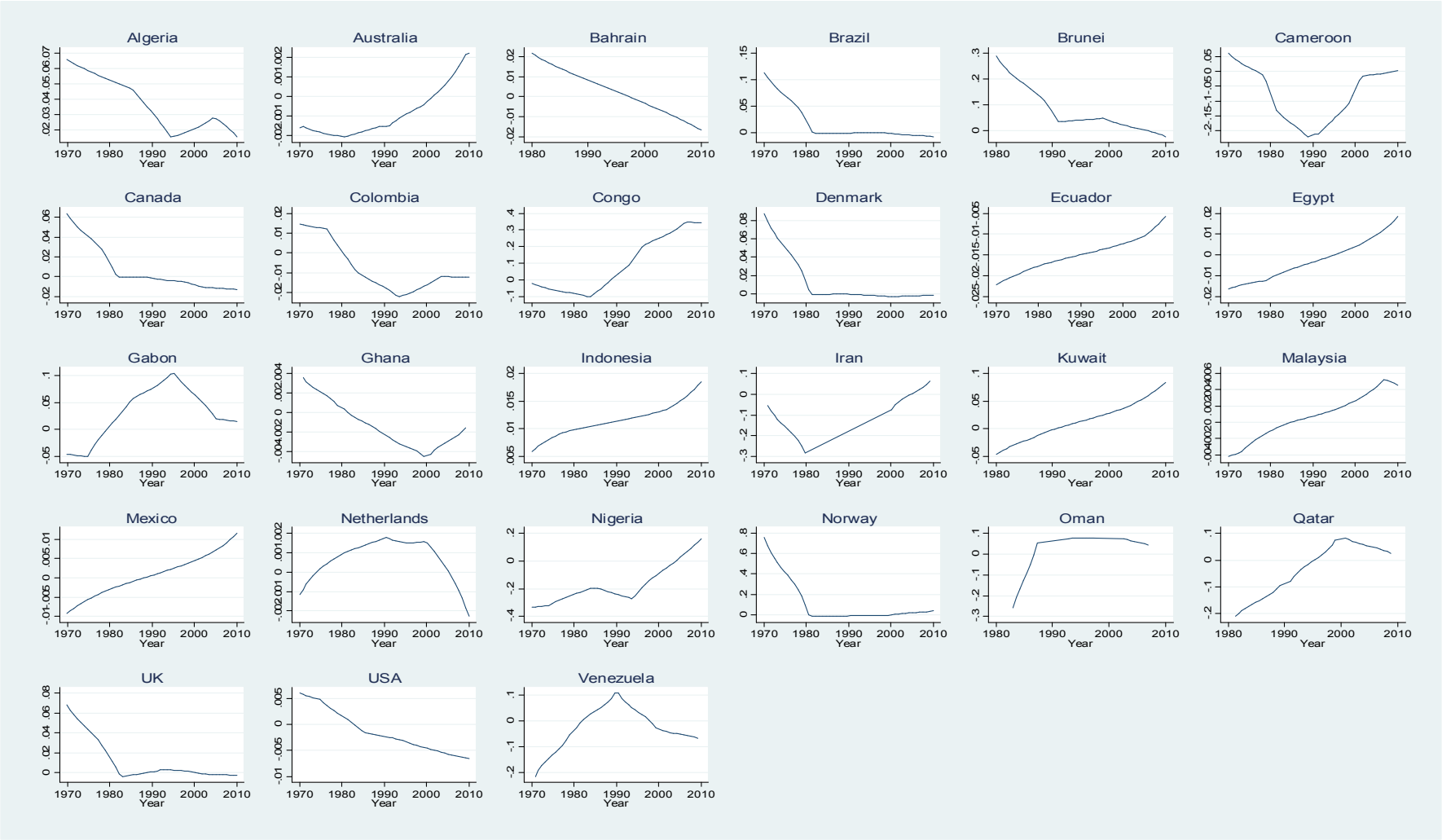
Note: Non-Oil exports as a share of total exports plotted over the period 1962-2012 subject to data availability for 35 oil exporting countries.
Source: The World Bank, World Integrated Trade Solutions (WITS) and UN Comtrade database, the United Nations.

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



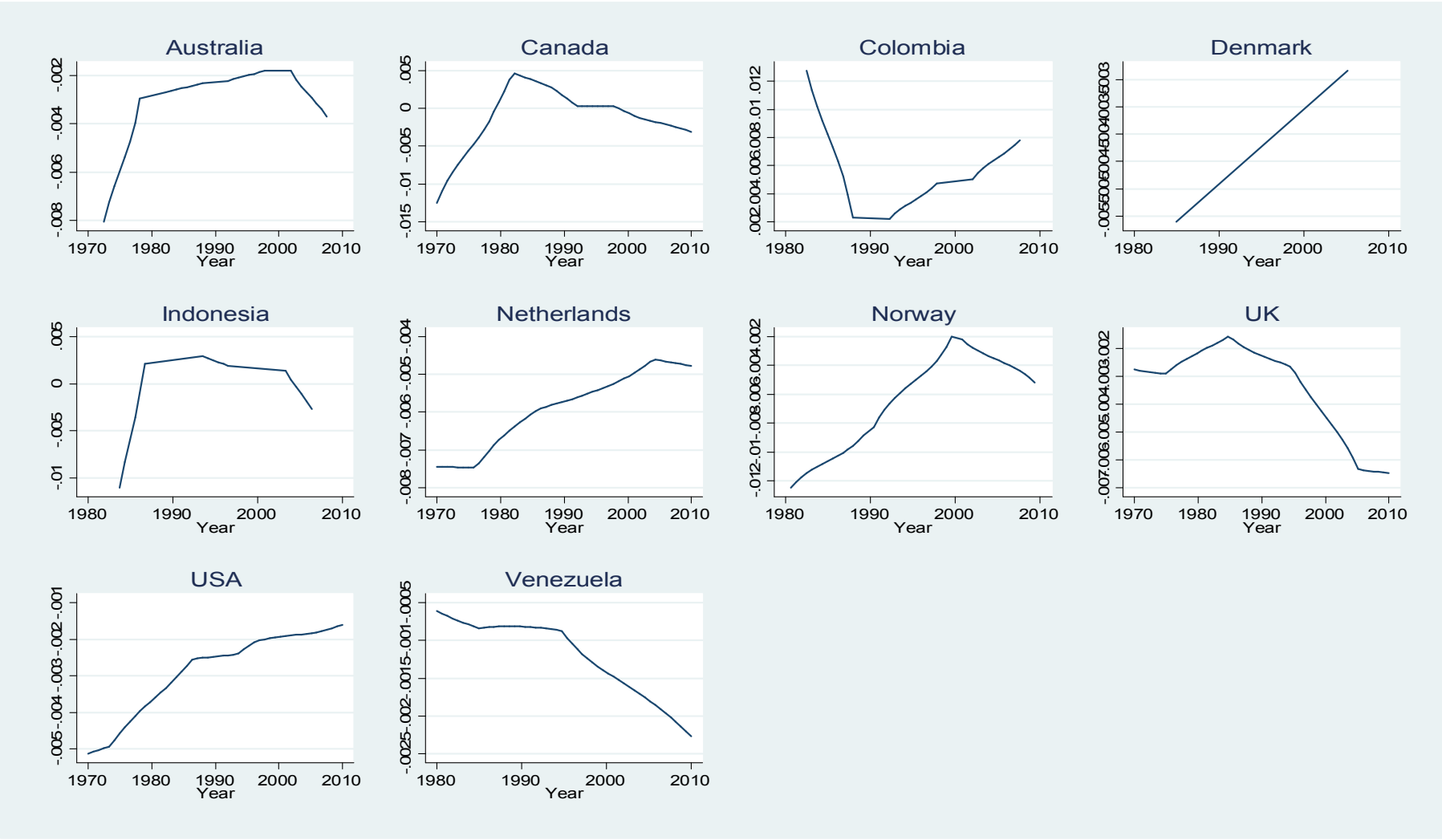
Note: Non-Oil private sector employment as a share of total employment plotted over the period 1969-2008 subject to data availability for 27 oil exporting countries. *Source:* International Labour Organization (ILO).

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

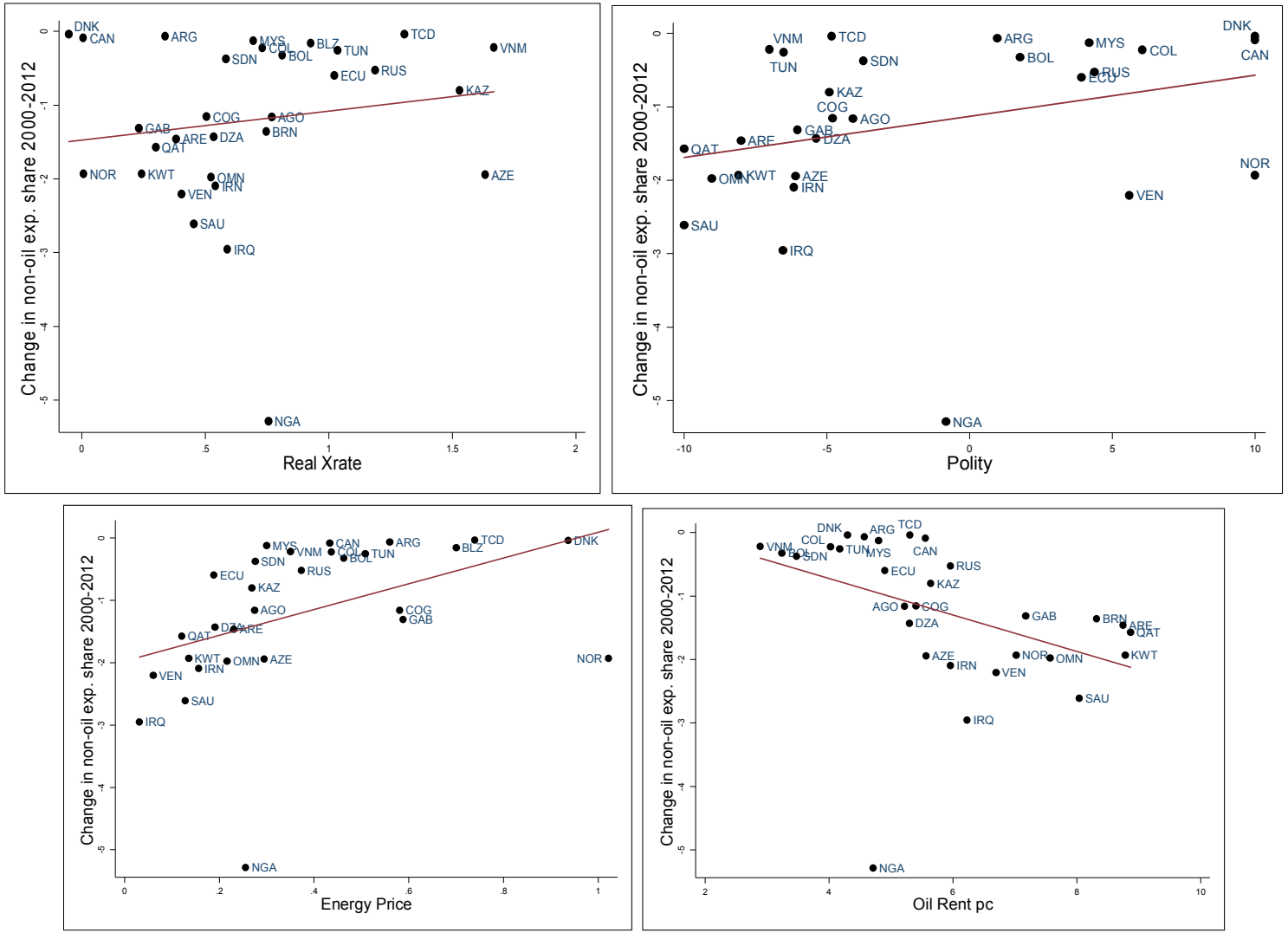


Table 1: different classifications between ISIC revisions 2 and 3

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***	-0.20***	-0.38***	-0.02***	-0.005**	-0.003
	(0.04)	(0.03)	(0.02)	(0.004)	(0.002)	(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.