

# **Energy and Economic Growth Applied Research Programme**

## Thematic Note: Role of Extractives in Energy Provision

Michael L. Ross

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EEG will commission rigorous research exploring the links between energy, economic growth and poverty reduction in low-income countries. This evidence will be specifically geared to meet the needs of decision makers and enable the development of large-scale energy systems that support sustainable, inclusive growth in low income countries in South Asia and Sub-Saharan Africa.

This Thematic Note was authored by Michael L. Ross (Professor of Political Science, University of California Los Angeles), and edited by Rachita Daga (Oxford Policy Management).

Email: [eeg@opml.co.uk](mailto:eeg@opml.co.uk)

Website: [www.opml.co.uk/projects/energy-economic-growth](http://www.opml.co.uk/projects/energy-economic-growth)

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## List of abbreviations

EEG	Applied Research Programme on Energy and Economic Growth
IMF	International Monetary Fund
LIC	Low Income Country
OECD	Organisation for Economic Co-operation and Development
US	United States of America

# 1 Introduction

This Thematic Note is one of six produced in the first year of the Applied Research Programme on Energy and Economic Growth (EEG). Each summarises a set of EEG State-of-Knowledge Papers that explore current understanding around one aspect of a theme related to large-scale energy infrastructure and economic development. This Thematic Note summarises the State of Knowledge Papers produced under EEG's Theme 5 – The Role of Extractives in Energy Provision. It highlights the key findings and research gaps that were identified by State of Knowledge Paper authors through their literature review and their engagement with policymakers and industry practitioners at the EEG Policy Workshops and Research & Matchmaking Conference.

In principle, fossil fuel discoveries might help LICs develop their energy sectors, diversify their economies, boost the competitiveness of non-fuel exports, and generate more sustainable, broad-based patterns of growth. Historically, resource booms in both the US and Canada led to investments in infrastructure and profitable value-added industries. In recent decades, however, few LICs have successfully leveraged their oil and natural gas wealth to build smart domestic energy sectors and diversify their economies.

Most studies of the challenges facing mineral-exporting countries come under the heading of the 'resource curse' and tend to focus on certain types of policy failures, including heightened corruption, procyclical fiscal policies, and poorly-run state-owned companies (Collier, 2010; van der Ploeg, 2011; Ross, 2015). While there are lessons to be learned from this literature – such as the critical role of institutions and accountability, particularly in LICs – Theme 5 projects seek to bring much-needed attention to two other, understudied types of policy failures: the use of suboptimal fuel price policies – including poorly-targeted subsidies and inflexible pricing regimes – and the failure to develop more diversified economies.

The two commissioned papers synthesize what is known about these problems and indicate how remaining knowledge gaps should be addressed. Each includes both reviews of past research and original data analyses that are designed to set the stage for subsequent research projects.

This Thematic Note is based on the following two State of Knowledge Papers:

1. Ross, M. & Mahdavi, P. (2016) The Political Economy of Hydrocarbon Wealth and Fuel Prices. Energy and Economic Growth Applied Research Programme.
2. Ross, M. (2016) What Do We Know about Economic Diversification in Resource Rich Countries? Energy and Economic Growth Applied Research Programme.

This theme's two papers are built around three questions:

- Is there any general relationship between the discovery and exploitation of hydrocarbon fuels and cheaper fuels and/or electricity in the local market? (Paper: Mahdavi and Ross)
- Where hydrocarbon endowments seem to allow cheaper fuel and/or electricity in the local market, how significant are the benefits? Do large hydrocarbon discoveries always cause

“Dutch Disease” and reduce the competitiveness of other industries or can cheaper energy stimulate competitiveness and growth? (Paper: Ross)

- Are there critical institutional differences which seem to help explain why some countries convert natural resource discoveries into economic diversity and competitiveness and some move in the opposite direction? Are initial institutional differences, large or small, and is there any institutional “taxonomy” which can be offered and evidenced? (Paper: Ross)

## 2 Key insights from the State of Knowledge Papers

### 2.1 Paper 1: The Political Economy of Hydrocarbon Wealth and Fuel Prices

This paper begins with a review of the extensive literature on fossil fuel price subsidies. It notes that studies tend to focus on three themes: estimating the harmful impacts of these subsidies – particularly consumer subsidies for gasoline and diesel; the role of politics in understanding the persistence of these subsidies; and strategies for reform. The suggested reforms generally emphasize gradual changes in subsidies via price-smoothing mechanisms, targeted compensation to poor consumers, and broad-based public relations campaigns to educate consumers about the costly effects of fuel subsidies.

Although these arguments are rarely disputed, the paper points out that claims about both political support for subsidies, and the effectiveness of specific reform strategies, are based on selected case studies and have not been tested in rigorous ways. More fundamentally, scholars lack a comprehensive description of net taxes, net subsidies, and subsidy and pricing reform: it is unclear, for example, how taxes and subsidies have changed over time, when and where countries are moving toward or away from market-based pricing mechanisms, how often we observe “successful,” reform, and how frequently these reforms are reversed. Without a more accurate and comprehensive description of the fuel pricing landscape it is difficult to develop a strong research agenda.

To begin developing a better foundation for the analysis of these issues the paper introduces an original dataset on implicit gasoline taxes, subsidies, and price flexibility at the monthly level in 157 countries from 2003 to 2015. For countries that are classified as “persistent subsidizers” of gasoline, the study extends the data to mid-2016 to capture important recent developments.

The data suggest that a dependence on oil exports is a necessary but not sufficient condition to explain gasoline subsidies: all 22 of the “persistent subsidizers” during the 2003-2015 period were oil dependent, but not all oil-dependent states were gasoline subsidizers. The paper also documents several other patterns: there have been heterogeneous responses within countries to new oil and gas discoveries; recent subsidy “reforms” have overwhelmingly been the result of falling prices, not changes to existing policies; and changes in price fixity – that is, movements from fixed to market-based, floating prices – are rare among oil-producing states, and in the two cases where such reforms occurred they were quickly reversed. The paper also documents many other important developments in fuel price and subsidy reform.

The study’s answers to question 5.1 can be summarized by breaking it into three parts:

5.1 (a): Is there any general relationship between the exploitation of hydrocarbon fuels and cheaper fuels?

During the period for which relatively complete data could be obtained (2003-2015), all countries that maintained subsidies for sustained periods were petroleum exporters, but not all petroleum exporters maintained subsidies. This suggests that the exploitation of hydrocarbon fuels was a

necessary but not sufficient condition to explain cheap (i.e., subsidized) gasoline. The new data will make it possible to develop, in future studies, a more complete explanation for variation in fuel prices among the oil and gas producers.

5.1 (b): Is there any general relationship between the discovery of hydrocarbon fuels and cheaper fuels?

These findings imply that new discoveries among countries without pre-existing hydrocarbon production will often lead to subsidies. Among countries that already produced petroleum and/or natural gas, further discoveries were sometimes followed by subsequent drops in gasoline prices but the pattern was not consistent. Additional research will be needed to explain these heterogeneous responses to new discoveries among existing producers.

The study also raises another possibility: that the relationship between hydrocarbon wealth and subsidies is at least partly a byproduct of the relationship between hydrocarbon wealth and price fixity. This is based on two observations: that there is a strong association between oil wealth and price fixity, and that subsidies can be understood as a byproduct of price fixity. Often governments fix prices at a non-subsidized level, and subsidies only emerge when international prices rise and create a wedge between the local price and the global price. The central role of price fixity has rarely been studied and merits closer scrutiny in future studies.

5.1 (c): Is there any general relationship between the discovery and exploitation of hydrocarbon fuels and cheaper electricity?

The study reports that data on electricity pricing in oil-exporting LICs is too scarce to adequately address this question, and suggests that obtaining these data should become a research priority.

## **2.2 Paper 2: What Do We Know about Economic Diversification in Resource Rich Countries?**

The heart of the problems facing fuel-rich LICs is whether they can use their natural assets to build more diversified, sustainable economies over the long run. Surprisingly little is known about this question. This paper begins by asking why we know so little. While there has been important research in the last fifteen years on the more general issue of economic diversification, it has tended to focus on the general patterns of diversification and concentration that affect countries without large minerals endowments. After reviewing the recent literature, this paper suggests two reasons to explain why such little information is available on the use of natural resources in building sustainable economies. The first is missing or unreliable data: economic data on oil-exporting states tend to be unusually scarce, and some of the existing data are inaccurate. The second problem is that export diversification is commonly measured in ways that are noisy or uninformative for oil exporters. For example, a country whose exports are dominated by a single product whose price is volatile will experience large swings in the value of this product, creating the appearance of large changes in export concentration even if there is no change in volume of goods exported, the number of exported products, or the number of trading partners.

The paper then uses an improved measure of export concentration from Papageorgiou and Spatafora – which uses harmonized data from both importers and exporters to mitigate the problem of missing



and misreported data – to document three empirical patterns over the last half-century: the divergence in export concentration between oil-producing states and non-oil states; the re-concentration of exports in most oil and mineral producing states since 1998, caused by the boom in commodity prices; and the heterogeneity of the oil producers, marked by greater diversification in Latin America and Southeast Asia, mixed performances in the Middle East, and greater concentration in Africa and the former Soviet Union. While change in the former Soviet Union was spurred by large new discoveries, the failure of all oil-producing states in both North and Sub-Saharan Africa to diversify is striking, and stands in contrast to the region's non-oil producers.

Explaining these heterogeneous diversification trajectories is a challenge that is largely left for follow-on research projects. The paper shows, however, that there is no preliminary evidence that this heterogeneity can be explained by some obvious factors, such as the size of their populations (since larger domestic markets might give rise to firms that can compete internationally), the effectiveness of their governments (since governments that provide better public goods might encourage private sector development), and the accountability of their governments (since democratic governments might be more willing to tolerate the diverse interests that arise from diversified economies).

It also analyses the available data on fuel subsidies and economic diversification, showing that in general higher subsidies were associated with less diversification, not more – although in some cases, much of the critical data are missing.

The weakness of the data, existing measures, and the familiar challenges of causal identification explain why there are not yet good answers to questions 5.2 and 5.3. To the extent they can be addressed, this paper offers the following insights:

5.2 (a): Where hydrocarbon endowments seem to allow cheaper fuel and/or electricity in the local market, how significant are the benefits?

The narrow question of the benefits (and costs) of fuel and electricity subsidies are addressed in the literature review in paper 5.1; studies overwhelmingly emphasize the economic, social and environmental costs of these subsidies with relatively narrow exceptions, e.g., targeted kerosene subsidies for low-income households.

5.2 (b) Do large hydrocarbon discoveries always cause “Dutch Disease” and reduce the competitiveness of other industries or can cheaper energy stimulate competitiveness and growth?

The literature review notes that many studies confirm the strong and consistent relationship between hydrocarbon discoveries and the Dutch Disease, although the magnitude of the effect depends on several factors, including the relationship between the size of the discovery and the size of the economy, and the government's management of oil and gas revenues. Past studies show that the resulting exchange rate appreciation tends to reduce the competitiveness of other tradable goods in global markets, although there are several ways to partially mitigate these effects: a commitment to a stable and competitive exchange rate, adherence to strict fiscal rules, allowing the immigration of skilled labour to ease constraints in the non-tradable sector, and through import restrictions that raise prices for local producers (and consumers). These effects may or may not extend to the

production of intermediate goods that are part of international supply chains, since these industries may enjoy offsetting benefits from the reduced cost of importing unfinished goods.

To summarize, our analysis of the diversification literature suggests questions 5.2 and 5.3 have not been well addressed, in part due to data constraints; hence improved measures of diversification are given priority for the next round of research. Many academic studies report that resource-rich countries with “low-quality institutions” have bad outcomes and those with “high-quality institutions” have good outcomes. There are many problems with these studies that make it difficult to know if the association between bad institutions and bad outcomes is meaningful. For example, they generally use perceptions-based indicators of “institutional quality,” which means that countries that are performing poorly (even when there is no obvious reason) will likely be coded as having poor institutions. It is also likely that countries with better institutions *ex ante* will attract more investment, and hence extract more oil. As a result, we cannot be confident that “bad institutions” are having a causal effect on economic outcomes like diversification and competitiveness. Once again, this question is difficult to address with existing data. But given its importance – especially in the current low-price environment – it is listed below as a research priority. The literature review also paid special attention to questions of gender and describes an interesting set of studies that imply female labor force participation may be linked to resource wealth, a connection that could have important implications for export diversification. This topic is also identified below as a promising area for follow-up research.

### 3 Priority Research Questions

The priority research areas listed below are derived from both the State-of-Knowledge Papers and feedback provided by policymakers and energy industry practitioners at the EEG Policy Workshops and R&M Conference below. They are listed in order of importance:

1. Improved measures and data on diversification

Even with the Papageorgiou-Spatafora data, it is difficult to measure and diagnose diversification success or failure when the data are relatively weak. Constructing more complete data for the oil-exporting states would give scholars and policymakers a more reliable picture of the diversification landscape and enable them to better estimate the factors associated with both success and failure. It could also attract new scholars to a topic whose real-world importance dwarfs the attention it receives from social scientists.

There would be special value in addressing four data gaps:

- a) Bringing missing oil-exporting countries into the data by mining alternative sources – particularly for data on domestic diversification, such as employment by sector, manufacturing and manufacturing value-added, and entrepreneurship.
- b) Correcting misclassified oil products. According to Bataille and Mishra (2015), several countries report improvements in their manufactured exports only because they misclassify processed petroleum products. Fixing these errors would allow us to better distinguish between true and untrue stories of successful diversification.
- c) The development of fuel price-corrected measures of diversification, to allow distinctions between nominal diversification (which may be driven by fluctuating oil prices) and the export of new product lines.
- d) Data on service sector performance, including the trade in services. As Bataille and Mishra (2015, 5) suggest, “a key question for (resource-rich economies) is how sustainable any service sector growth is, and how it links to other sectors of the economy, especially if it is driven largely by consumption of resource rents versus a more sustainable move to more modern sectors.” Conceivably the service sector could provide oil-exporting states with an alternative route to diversification; if service sector growth is driven largely by consumption of resource rents, however, the diversification would be illusory. These and other critical questions could be addressed by obtaining firm-level data, and building on newly-available service sector data (e.g., Eichengreen and Gupta 2013).

Improved measures would be especially valuable to deploy in studying the Sub-Saharan African countries whose diversification records are strikingly different from countries in other regions. Of special interest are Nigeria, Angola, and Congo-Brazzaville, all of which have export concentration levels significantly higher than might be expected from their per-capita oil endowments. While the policy challenges of these states have been studied extensively,

obtaining data that is comparable across a significant number of oil-producing states will facilitate a more rigorous comparative analysis.

It is difficult to know *ex ante* how much work this would entail. The number of new product lines should already be available in the Papageorgiou-Spatafora harmonized bilateral trade data, and a forensic examination of alleged misclassification – again using the bilateral data – would at least help us estimate the scale of the problem. Unless it is possible to address these data gaps in years 2-3 of the EEG project, this priority could be revisited.

## 2. The sources of changing taxes and subsidies

The Mahdavi and Ross paper documents the apparent correlation between fossil fuel exports and government pricing policies; a logical next step would be to causally identify some important causes of policy change. One avenue of research might entail a closer look at the effects of oil shocks – perhaps from new discoveries or global price shocks – on both tax and subsidy levels, and on price fixity. Other possible (and measurable) sources of policy change could include elections, changes in political leadership, changes in government accountability, fiscal or monetary crises, and IMF conditionality.

## 3. The microfoundations of subsidies and subsidy reform

Little attention has been devoted to the microfoundations of fossil fuel price policies – for example, on how people perceive gasoline taxes and subsidies, what they believe is a “fair” price, and how they respond politically to changes in prices. In fact, there is a behavioral economics literature on perceptions of price fairness (Kahneman et al. 1986a, 1986b, Bolton et al. 2003) and responses to price changes (Tversky and Kahneman 1991, Morewedge et al. 2009), that might ultimately provide clues about how citizens respond to changing prices.

There are also many empirical studies on the price elasticity of consumer fuel demand (e.g., Brons et al. 2008, Havranek et al. 2012, Levin et al. 2015), differences in consumer responses to price changes and tax increases (Dieler et al. 2014, Rivers and Schaufele 2015), and consumer expectations about future prices (Anderson et al. 2011). While most studies are based on data from OECD states, a recent study by Arzaghi and Squalli (2015), however, estimates price and income elasticities for gasoline demand in 32 fuel-subsidizing countries.

A richer understanding of the microfoundations of fuel prices and price reforms – particularly in the fuel-exporting countries that typically have low, fixed prices – could ultimately yield insights with important policy implications. To discover the specific mechanisms underlying consumer attitudes towards fuel prices and policy reforms, researchers could engage in behavioral experiments and randomized survey experiments. These studies would be particularly appropriate to undertake in countries considering the reform of subsidies or pricing policies.

## 4. Price policies for coal, natural gas, and non-gasoline fuels

The study of fuel pricing highlights the need for detailed, cross-national data on subsidies and taxes for fossil fuels beyond gasoline, such as coal, natural gas, and fuels such as diesel, propane, kerosene, and residual fuel oils. Global data on price policies for coal and natural gas would be a critical improvement of any study of subsidies in the electricity sector. Current research is largely limited to electricity subsidies in the OECD countries, along with China and India; future research can uncover the determinants and consequences of variation in price policies and policy reform in this important sector using new data with broader coverage, particularly in low-income states.

Still, it is unclear whether a comprehensive cross-national data base could feasibly be constructed for coal and natural gas. We therefore also advocate research can achieve more limited advances, including studies of fossil fuel taxes and subsidies over time in specific countries, which could facilitate a careful analysis of the causes and consequences of changing government policies.

## 5. Hydrocarbons and Gender Specific Diversification

Ross (2008) shows how oil production can crowd out female labor force participation through two channels, one that reduces the demand for female workers, and a second that reduces the supply of women choosing to enter the labor force. While it does not consider the implications for economic diversification, it may nonetheless have important consequences. Low income countries often develop their manufacturing sectors by relying on low wage female labor, and any mechanisms that reduce their supply may also inhibit the development of an export-oriented manufacturing sector. New data on sectoral employment by gender has become available, which could make a disaggregated look at oil, gender, and export diversification fruitful. Moreover, any findings on this topic could have significant policy implications: while some factors that inhibit export diversification (like the Dutch Disease) are difficult to change, policies that help bring women into the labor force are more tractable.