The Dog that Didn't Bark

The Missed Opportunity of Africa's Resource Boom

James Cust Alexis Rivera Ballesteros Albert Zeufack



Africa Region Office of the Chief Economist July 2022

Abstract

The commodity price boom from 2004–2014 was a huge economic opportunity for African countries abundant in oil, gas and minerals. During this period their government revenues from resources grew by an average of 1.1 billion US\$ per year, and economic growth in those same resource-rich countries surged. GDP growth in resource-rich countries accelerated from 4.6% to 5.4% as countries entered a decade long period of sustained high commodity prices. Nonetheless, the paper traces a significant missed opportunity for resource-rich countries in Africa, with little to show for it in the post-boom period, which saw growth collapse far below pre-boom levels, to 2.7% per annum. This paper considers the record of performance during the boom (2004–2014) and subsequent bust from 2015 onwards. The paper describes four main outcomes of the boom: 1) measures of resource dependency rose in Sub-Saharan Africa during the boom, 2) the growth record was strong during

the boom but collapsed once commodity prices fell, 3) poverty and inequality rose during the boom despite strong GDP growth, 4) resource-rich countries failed to diversify both their exports and their asset base, leaving them poorly prepared for the end of the boom and a period of lower commodity prices and subsequent COVID-19 pandemic. The conclusions are stark. During this golden decade of sustained high commodity prices and booming revenues, there was limited re-investment of those revenues into building sustainable assets for the future. In other words, countries consumed the boom, rather than successfully transformed their economies. The conclusion is that many resource-rich countries in the region squandered their "once in a generation" opportunity for economic transformation, offering policy lessons that may prove valuable as we enter a new period of elevated commodity prices.

The Policy Research Working Paper Series disseminates the findings of work in progress to encourage the exchange of ideas about development issues. An objective of the series is to get the findings out quickly, even if the presentations are less than fully polished. The papers carry the names of the authors and should be cited accordingly. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent.

This paper is a product of the Office of the Chief Economist, Africa Region. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://www.worldbank.org/prwp. The authors may be contacted at jcust@worldbank.org.

The Dog that Didn't Bark: The Missed Opportunity of Africa's Resource Boom

James Cust¹, Alexis Rivera Ballesteros¹ and Albert Zeufack²

Keywords: Africa, natural resources, growth, resource curse, commodities, poverty, growth.

JEL: 04, 013, Q3

¹ World Bank. Office of the Chief Economist Africa Region. jcust@worldbank.org and alexis.rivera.b@gmail.com

² Chief Economist, World Bank Africa Regions. azeufack@worldbank.org

Introduction

In this paper we examine the effects of the commodity price boom, running from around 2004 to 2014, and what it meant for the economies of Sub-Saharan Africa. We consider how this period marked a change from the pre-boom years, and also the legacy of the boom once commodity prices fell post-2015. We examine the record of resource-rich (RR) countries in harnessing this opportunity and consider how their economic performance compares to their non-resource-rich (non-RR) neighbors in the region. We investigate how these groups fared in terms of rising resource dependence, overall record of economic growth, the impacts on poverty and inequality and diversification of economic activity.

Our work follows the recent economic literature in considering the overall performance economic of resource-rich countries compares to non-resource-rich counterparts. Here the hypothesis taken by studies in this area is to consider whether resource abundance undermines economic performance or enhances it and treats non-resource rich countries as a useful benchmark or control group to consider possible economic counter-factual experiences.

Resources generate export revenue, government revenues and can secure access to foreign currency. As such developing countries often celebrate major resource discoveries as the first step on a path to middle income status and sustainable prosperity. However, there is no guarantee resources will deliver on this promise, and instead economic performance in resource-rich countries has often been much worse than their neighbors.

Previous studies have discussed the potentially positive effects of price booms in developing resource-rich countries while balancing this against the historical record of weaker economic performance in resource rich developing countries. For example, Warner (2015) traces more recent economic performance in resource rich countries around the world and considers how poorly the non-resource economy fared during resource booms. Venables (2016) finds that it has proven challenging in recent decades for resource-rich developing countries to translate their relative abundance of subsoil assets into above-ground prosperity and asset accumulation.

The historical record of resource-rich countries globally is mixed, with many countries that have struggled to harness booms and that have recorded lower average growth rates than their non-resource-rich counterparts. This phenomenon has become known as the 'resource curse', for which there exists an extensive empirical literature, summarized in surveys such as by (Van der Ploeg 2011) and (Ross 2015). Earlier work analyzed the relationship between resource dependence and economic growth starting with the seminal studies by Sachs and Warner (1997) to compare growth between economies with and without substantial natural resources over the 1970-1990 period. More recent work such as van der Ploeg and Poelhekke (2009) explore the effect of resource dependence on growth during the last decades of the 20th century and find similarly disappointing growth

results in resource rich countries. They point to the challenges associated with volatility as a chief culprit.

Resource booms and busts provide us with an interesting time period over which to analyze the economic performance of resource rich countries as they face both the blessing of increased revenues and investments, while also riding the tiger of commodity price volatility. By contrasting their experience over such periods with resource-poor neighbors, we can build a picture of comparative performance, benchmarked using peers who are similar in many other respects. This paper builds on other comparative studies that came before. For example, Bravo-Ortega and Gregorio (2005) considers the comparative experiences within Scandinavia and Latin America. Olter (2007) and Bates et al. (2008) review the experiences of various African countries. More recent works like the IMF (2012) policy paper examines the growth in developing resource-rich countries during the rising commodity prices period of the 2000s, and Ross (2012) discusses the growth performance of oil-rich economies during a similar period.

Indeed, Warner (2015) finds little evidence to suggest that the resource boom led to sustained increases in non-resource GDP. Looking beyond Africa, he notes that some Gulf states were able to finance migration-facilitated economic expansion, however African countries fared worse. Warner examines 18 boom countries, including five from Sub-Saharan Africa: Chad, Equatorial Guinea, Mauritania, Mozambique and Zambia. In all cases, he finds no statistically significant difference in growth during the boom period compared to each country's counter-factual non-boom time period.

This study contributes to this literature with a comparative analysis of resource-rich Sub-Saharan Africa compared to less resource endowed countries in the region to investigate the comparative economic performance and draw lessons for policymakers as they enter a new period of rising commodity prices.

Our conclusions are stark. While economic performance among resource-rich countries was strong during the commodity price boom period – as one might expect – growth rates and other economic indicators sharply declined once resource prices fell. Furthermore, during this decade of booming revenue we find limited evidence of re-investment of those revenues into building sustainable assets for the future. In other words, countries consumed the boom, rather than used it to transform their economies. This supports our conclusion that many resource-rich countries in the region squandered their "once in a generation" opportunity for economic transformation. Our results are consistent with other studies of the same commodity price boom and the economic performance of resource-rich countries in Africa and beyond (Venables 2016; Warner 2015).

We offer some reflections and policy insights based on these findings. Consistent with earlier work we conclude that resource-richness doesn't not condemn countries to a fate of weak economic performance. Instead, we find that policy choices matter. As such the experiences of resource-rich countries can serve as useful guides to the policy missteps and successes made by those who came before. We build on previous work such as by van der Ploeg and Venables (2011) who discuss the earlier challenges resource abundance and resource booms may present for developing countries, and what, if anything, macroeconomic management can do to overcome them.

We find that the "missed opportunity" was not universal. In fact, several resource-rich countries have been able to sustain relatively higher economic growth beyond the resource boom. Those who performed best were also those who saw relatively higher savings and investments rates out of resource revenues – for example those with higher levels of Adjusted Net Savings. While resource extraction implies a process of asset depletion, the high performing countries were typically those who accumulated assets in other categories of national wealth, including physical capital, human capital and even other forms of natural capital, such as forests, fisheries and natural ecosystems.

Key Findings

Sub-Saharan Africa has seen rising degrees of resource dependence since 2004. First, the number of resource-rich countries rose considerably during the boom years, from 18 to 26 according to the IMF (2012) definition using 20% of exports or 20% of government revenues.³ Overall natural resource exports increased their share of total merchandise exports; rising from an average of 23 percent between 1998 and 2003 to 28 percent on average during the boom years of 2004-2014.

The boom period also saw a sharp increase in the levels of resource revenues flowing to the government. During this period resource-rich African countries' resource government revenues grew by an average of 1.1 billion US\$ each year, from an average of 8.5 percent of GDP during the pre-boom years to 8.6 percent of GDP. This represents about 61% of total government revenues. At the same time, average resource revenues share in GDP in resource-rich countries were almost four times greater than in non-resource-rich Sub-Saharan Africa countries (2.1%) but around 7 percentage points lower than other non-resource-rich countries elsewhere in the world, standing at around 15.5% (Figure 1). Some countries stand out in particular. Natural resource revenues flows were considerably higher in Angola, the Republic of Congo, and Equatorial Guinea, where the measures of resource dependency in resource revenue terms rose to more than 25 percent of GDP (Figure 2).

³ For the remainder of this paper, this group of 26 resource-rich countries who exceed this 'resource-richness' threshold will be compared to the other 22 counties in the region who do not throughout this analysis. Second, when viewing aggregates for the entire region we see a rise in resource dependency for the region as a whole.



Figure 1. Average annual resource revenues share in GDP

Notes: Natural resource revenues share of GDP and in constant 2015 US\$, 2004-2014 annual average. Sub-Saharan Africa RR includes 21 countries listed in IMF (2012) as resource rich and Sub-Saharan Africa non-RR includes 9 countries non listed in IMF (2012) with non-missing data. Source: authors' calculations with data from UNU-WIDER Government Revenue Dataset 2021.



Figure 2: Average annual natural resource revenues, by country, between 2004-2014

Notes: Natural resource revenues share of GDP (blue bars) and in constant 2015 US\$ (red bars) for 2004-2014 annual average by resource-rich Sub-Saharan African country with natural resource revenues greater than zero. The following six countries from the resource-rich group are not included due to missing data: Central African Republic, Madagascar, Mozambique, Tanzania, and Togo. Source: authors' calculations with data from UNU-WIDER Government Revenue Dataset 2021. Headline economic performance during the boom was strong but proved unsustainable. Resource-rich countries saw economic growth rise during the boom years driven by resource exports and increased government revenues. However, economic growth once we subtract the expanding resource sector, was not significantly higher than the rest of Africa. This reflects the overall dominance of the resource sector as a driver of growth, but also implies a failure to translate the boom into broader based economic prosperity. The starkest evidence for an unsustainable and narrow economic boom was seen in the slump in growth rates following the fall in commodity prices. In the post-boom period, annual GDP per capita growth in resource-rich countries was on average 2.5 percentage points lower than during the boom, and 1.5 percentage points lower than non-resource rich countries in the region.

Overall, resource-rich countries suffered a 'missed opportunity' to translate significant revenues and growth acceleration into sustainable and broad-based prosperity. Even during the boom years, the lack of inclusive growth was seen in other economic measures such as the rising poverty headcount and growing inequality – both of which deteriorated in resource-rich African countries during this period on average.

The legacy of the boom was characterized by countries being poorly prepared for the drop in commodity prices. Many had failed to save and invest a sufficient proportion of resource revenues to grow national wealth via the accumulation offsetting assets during the boom. As a consequence, the 'bust' period undermined the economic gains made during the boom. One extreme of this saw several resource-rich countries enter debt crises post-2014. This post-boom (or 'bust) period (2015-2018) has also seen a more general pattern of resourcerich countries experiencing slumps in GDP growth and non-resource sector GDP growth, with rates of both falling below those of the rest of Africa.

The legacy of the boom is therefore one of missed opportunity, overhanging macroeconomic vulnerability, and increasing concentrations of the world's poor in resource-rich Sub-Saharan Africa.

Most alarmingly we find that by 2030, on current projections even after adjusting all countries for the impacts of COVID-19, 80 percent of the world's poor will reside in Sub-Saharan Africa, while 75 percent of the world's poor will be found in resource-rich countries. Taken together, 62 percent of the extreme poor could be concentrated in resource-rich Sub-Saharan Africa. This is up from only 13 percent in 2000.

The findings of this study are in line with those documented in the literature on the resource curse. Recent surveys such as Van der Ploeg (2011) and Ross (2015) point towards the challenges resource-rich developing countries have faced translating price booms into sustained prosperity. While the cross-country empirical evidence does not support the hypothesis that this is a problem restricted to African countries, studies do suggest that weaker political and economic institutions may exacerbate the challenges countries face harnessing resource wealth for economic development (Mehlum, Moene, and Torvik 2006).

The rest of the study is organized as follows. The next section 2 examines the four main outcomes of the boom relating to i) resource dependency, ii) economic growth iii) poverty

and inequality, and iv) economic transformation. In section 3 we consider the legacy of the boom and prospects for the future. Section 4 concludes.

Section 1: The commodity price boom

The boom period 2004-2014 marked a critical decade in Africa's post-independence economic history.⁴ This decade spawned much optimism, centered on the 'Africa Rising' narrative⁵; associated with increased rates of economic growth, higher levels of inward investment, and large, sustained revenues from natural resource exports and taxation. This period also constituted the longest sustained period of high commodity prices on record.

Overall, this gave governments large increases in their fiscal space, derived in part from the receipts from resource taxation alongside debt relief for some countries post-2000. For example, at least 8 Sub-Saharan African countries obtained revenues from natural resources representing on average more than 10% of their GDP during the boom – a significant fraction by both regional and global standards (see Figure [fig:resrev_countries]). Many chose to use this time to undertake significant expansions of public service provision, such as educational enrollment, as well as increased infrastructure investment. For example, according to IMF's Investment and Capital Stock Dataset, public investment in physical assets, including economic infrastructure – like roads, and airports – and social infrastructure – such as hospitals and schools – rose from roughly an average of US\$200 per capita during the pre-boom period (1998-2003), to an average of over US\$435 per capita during the boom, and US\$270 after the boom period in resource-rich countries in Africa. Similarly annual spending on health services rose from 4.6% of GDP to 4.9% on average, and expenditure on education rose from an average of 2.8% of GDP before the boom, to 3.5% of GDP after the boom.

Policymakers sought to capitalize on the boom to translate investment and revenues into broader economic transformation. This included the opportunity to boost growth of manufacturing exports and other non-resource sectors of the economy. This economic diversification, emphasizing export diversification, was a popular economic objective during this period. Despite this, there was little change in the overall sectoral composition of exports of resource-rich economies beyond a boost in the resource sector and a squeezing of agricultural exports (see Figure 3).

⁴ Previous booms had occurred between 1949 and 1952, 1972 and 1975, and 1992 and 1995 (Varangis, Takamasa, and Mitchell 1996; Radetzki 2006) However, as noted by Deaton (1999) (p. 28), while price cyclicality was present, there was little evidence of a long run increase in commodity prices.

⁵ Africa Rising, The Economist, December 2011, 3rd edition, https://www.economist.com/printedition/2011-12-03



Figure 3. Share of Sub-Saharan African exports by sector

Notes: Average exports share of total merchandise exports value by sector in Sub-Saharan African RR countries, pre-boom (1998-2003), boom (2004-2014) and post-boom (2015-2018) years averages. Source: authors calculations using World Bank staff estimates through the WITS platform from the Comtrade database maintained by the United Nations Statistics Division.

The boom created a set of major public policy challenges. First, high prices meant significant revenues would accrue to government, which in turn implied 'big government' in some form was hard to avoid. Government, as the constitutionally designated resource owners had to attempt to capture the full value of resources on behalf of citizens, while also efficiently managing state-owned resource companies and production shares. Second, they had to maximize these revenues from the sector in a way that was also consistent with inward investment into the sector, for example to take advantage of the geological potential and new discoveries being made. Third, they had to ensure those revenues were put to good use – fulfilling urgent development needs and longer-term investment goals for sustaining prosperity. Finally, they needed to ensure the economy was protected from the harmful effects of resource dependence – ranging across hazards such as Dutch disease (Corden and Neary, 1982), price and revenue volatility, corruption, conflict, and profligacy.⁶

⁶ These various challenges faced by government are described in documents such as the Natural Resource Charter, which highlights the various public policy choices that must be made along the decision chain, from exploration for resources, through to how to invest revenues from resources for sustainable and diversified development (Cust and Manley 2014).

The economic outcomes of the boom



Figure 4. Evolution of global fossil fuel and metals and minerals indices.

Notes: Monthly indices based on nominal US dollars, 2010=100. Fossil fuels include oil, natural gas and coal. Metals and minerals index includes aluminum, copper, lead, nickel, tin, and zinc. Source: authors' elaboration using World Bank staff estimates.

As illustrated in Figure 4, the boom saw prices for hydrocarbons, minerals and metals hit record levels and these high prices were sustained for over a decade. Even the financial crises of 2007-08 saw only a temporary dip in the cycle, with a rapid recovery of oil prices in 2009-10. To estimate the impacts of the boom compared to the counterfactual this study takes three time periods for analysis – the 'pre-boom' period of 1998-2003, the boom of 2004-2014, and the post-boom 2015 to 2018. We then compare resource-rich countries to non-resource-rich counterparts.

We trace four major macroeconomic outcomes of the commodity price boom. We conclude from these stylized facts that in aggregate the commodity boom was a huge opportunity that did not deliver on its promise: a dog that didn't bark in the nighttime.⁷

First, outcome 1, we find that Sub-Saharan Africa became a more resource-dependent region during the boom, and compared to the period prior to 2004. This rising resource dependency can be traced in terms of the number of countries – a majority of countries

⁷ The title of the paper is drawn from Sherlock Holmes' The Adventure of Silver Blaze, Arthur Conan Doyle, 1892 and the curious incident of the dog in the nighttime.

during the boom were defined as resource-rich – 26 of 48, up from 18 before 2004. It can also be found in rising resource exports as a share of total merchandise exports for the entire region, 28% on average during the boom, up from 23% before 2004.⁸

Second, outcome 2, we find a mixed growth impact of natural resources in Sub-Saharan Africa, with resource-rich countries barely outperforming their non-resource-rich counterparts during the boom. We find average growth rates during the boom of 5.6% for resource-rich countries and 4.2% for non-resource-rich countries. In the post-boom period, we find the growth slumped to an average of 2.8% in the resource-rich countries, but remained at a healthier 3.5% for the non-resource-rich countries.

Third, outcome 3, we trace a record of rising poverty headcounts and inequality deterioration in resource-rich Africa. The increased economic growth, in both GDP and non-resource GDP, failed to be pro-poor on average and drove worsening Gini coefficients across the region. Overall, the poverty headcount in resource-rich African countries rose from about 280 to 294 million people from 2004 to 2014.

Finally, outcome 4, we document a widespread failure to diversify the economy, and a failure overall to transform natural resource revenues into productive forms of above ground capital. We measure lower adjusted net savings in resource-rich Africa, and rising export concentration in these same countries. The post-boom crash in some countries underscored the failure to diversify away from resource sector dependence and vulnerability to shocks.

Outcome 1: Measures of resource-dependency increased across Sub-Saharan Africa during the boom

During the resource boom there was a marked increase in the number of resource-rich countries, the levels of resource dependence in these countries, and the overall degree of resource dependence across the region.

First, we consider the number of resource-rich countries. Here there is a simple threshold criterion defined by the IMF as a country being resource rich if it derives either 20% of exports from resources or 20% of government revenues from resources.

By this definition, we found that the number of resource-rich countries rose from 18 out of 48 before the boom, to 26 out of 48 countries listed by the IMF (2012) as resource-rich using the same criteria and averages of first five years of the boom. This constituted a majority of the Africa region's countries.⁹ This trend was caused by a combination of new discoveries, new production, and rising resources prices pushing up levels of resource

⁸ While the number of countries reaching the classification threshold for 'resource-richness' rose compared to before the boom, throughout this study we refer to the 26 resource-rich countries as our sample of resource-rich countries for other comparisons.

⁹ In this paper we focus on the WB Africa region, which is predominantly Sub-Saharan Africa, comprising 48 countries in total (see appendix 1): https://data.worldbank.org/region/sub-saharan-africa. We refer to this group of countries as Africa throughout. We follow the IMF definition of resource-richness to distinguish our groups of countries for analysis (IMF 2012) and to chart changing patterns of resource dependency. The IMF considers a country resource-rich primarily if resource share of exports or government revenues exceeds 20%.

dependence and pulling more countries into this grouping. The IMF list in 2012 included five newly resource-rich countries and several prospectively resource-rich due to major discoveries (see Map 1).



Map 1. Sub-Saharan African resource-rich countries.

Notes: Panel a) Resource-rich countries for the pre-boom period using the IMF criteria, where resource-rich countries had at least 20% of resource revenues or exports in total government revenues and in total merchandise exports, respectively between 1998 and 2003. Panel b) Resource-rich countries listed by IMF (2012) using 2006-2010 averages and with the following criteria: being a low-income country (LIC), a lower-middle income country (LMIC) or an upper-middle income country (UMIC), and had either natural resource revenue or exports at least 20% of total fiscal revenue and exports, respectively, over 2006–10 (average), including countries with identified reserves where production has not begun or reached significant levels (Sierra Leone, Madagascar, Mozambique, Central African Republic, Uganda, Tanzania, Togo, Sao Tome and Principe and Ghana). South Sudan is excluded as it gained its independence until 2011. Source: authors' calculations using data from IMF, UNU-WIDER, WTO and WB.

By the end of the boom (2015-2018), the number of resource-rich countries using the IMF (2012) criteria has fallen slightly to 22, where some Western African countries like Cote d'Ivoire lost their resource-richness classification derived from the drop in oil prices. Meanwhile, other countries – such as Namibia – gained the resource-rich status due to its growing mining industry (see Map 2).





Note: Resource-rich countries for the post-boom period using the IMF criteria, where resource-rich countries had at least 20% of resource revenues or exports in total government revenues and in total merchandise exports, respectively between 2015 and 2018. Source: authors' calculations using data from IMF, UNU-WIDER, WTO and WB.

An alternative measure of resource dependence is the fraction of resource rents generated in a country relative to GDP. This measures the overall economic importance, and as an indication of potential revenues available for taxation, for a given resource rich country. As shown in Figure 5, when measured in terms of rents as percent of GDP, African countries constitute a large fraction of the most resource rich countries in the world – with a large concentration among oil and gas producing countries. But also, resource rents highlight countries that are rich in mineral resources, including some in Sub-Saharan Africa. For example, according to IMF (2012), Mauritania was the resource-rich country with the lowest share of natural resource exports and revenues of the 26 Sub-Saharan African countries in its list. However, resource rents share in GDP of this west African country stood as the sixth highest during the boom.



Figure 5. Receipts from natural resources by country using 2004-2014 averages (% of GDP).

Notes: The figure shows countries where natural resource rents exceed 10 percent in GDP. Fossil fuel-rich Sub-Sahara African countries (in blue) are those defined as resource-rich by IMF (2012) and oil is their main type of nonrenewable natural resource. Mauritania and Zambia (in green) are resource-rich Sub-Saharan African countries where minerals were the main type of nonrenewable natural resource in this figure. There is a total of 20 countries that saw average resource rents exceeding 20% of GDP in the world. Timor-Leste is not shown but the share of natural resource rents exceeded 100 percent its GDP. Source: authors' calculations using World Bank data and Changing Wealth of Nations 2021 data.

We can examine the degree of resource-dependence observed in the Africa region compared to other regions. By using the same threshold criteria, we applied at the country level (20% of exports or 20% government revenues from resources), Figure 6 shows that three regions of the world can be considered resource rich using either threshold.

The Middle East & North Africa notably dominates this category, with almost 70% of total export value derived from natural resources – mostly petroleum and over 50% of government revenues. The Africa region also exceeds the 20% threshold for resource richness during this period with a larger mineral component, exceeding 50% of export value and almost 30% of government revenues. Furthermore, in these regions, there were individual countries where natural resource revenues surpassed 80% of total government revenues during the boom years.

Figure 6. Average nonrenewable resources exports share of total merchandise exports and average resource revenues share of total government revenues by region.



Notes: Upper panel: 2004-2014 average of fossil fuels, metals and minerals exports share of region's total merchandise exports by region. Lower panel: 2004-2014 average of natural resource revenues share of total government revenues. This share is calculated as the 2004-2014 average of the sum of natural resource revenues of all countries with non-missing data of each region, divided by the region's sum of total government revenues (resource plus non-resource revenues). The red line denotes the IMF criteria for resource-richness (natural resource revenue or exports at least 20% of total fiscal revenue and exports, respectively) applied to the boom period. Source: author's calculations based on World Bank staff estimates and the UNU-WIDER Government Revenue Dataset.

The once-in-a-generation opportunity

During the boom, countries extracted huge amounts of natural wealth from their reserves of oil, gas and minerals. The cumulative production value derived from primary subsoil resources exceeded \$200bn over this period for each of Nigeria, Angola, and South Africa – the three biggest economies in Africa accounting for over 60% of total GDP in the region. Figure 7 shows both the extent and the diversity of commodities driving these revenues. In terms of GDP, primary subsoil resource production value accounted for an average of 13% and 30% in Nigeria and Angola respectively during this same period, mainly from fossil fuels.



Figure 7. Cumulative production value of oil, gas, and mining, 2004-2014.

Notes: Sum of production value (price x quantity) across oil, gas and select mineral commodities between 2004-2014 by country in constant 2010 billion US dollars. Coal production value not shown but South Africa is the main coal producer in the region and one of the main coal producers in the world. Sources: World Bank staff calculations based on S&P Capital IQ, EIA International Statistics and World Bank data.

While these numbers are striking for their size, this did not always translate into similarly large government revenues. For example, cumulative resource revenues between 2004 and 2014 totaled 478 billion US dollars in Nigeria, about a half of the production value of oil and gas during the same years. Likewise, cumulative resource revenues in Angola and Equatorial Guinea only reached 292 and 38 billion US dollars, respectively (see Figure 8), which is far less than the value of their production of these nonrenewable natural resources.



Figure 8. Cumulative government resource revenues for selected resource-rich African countries, 2004-2014

Note: sum of government revenues from resources of selected resource-rich countries ordered by cumulative production value of oil, gas and minerals (Figure 7) with available resource revenue data. Source: authors' calculations based on UNU-WIDER (2021).

There exists a widespread perception that governments have systematically failed to capture their fair share of revenues– thus allowing companies to make larger than necessary profits (Laporte and Quatrebarbes 2015; Mansour 2014). An economic shorthand for this fair share is the rents. Conceptually, rents are the fraction of the resource value that is left as excess and therefore should accrue to the resource owners – invariably government – once reasonable costs of extraction and a reasonable rate of return on capital have been deducted.

Figure 9 presents a comparison between government revenues per capita according to our best measures, against the World Bank's calculation of rents per person for each country during this same period. In most cases, the value of natural resource rents exceeds the value of revenues, except in Botswana, Nigeria, Sudan, and Uganda. This implies that there

may have been some amount of untapped revenues for government during the boom, proxied by gap between these estimated rents values and collected revenues.¹⁰



Figure 9. Cumulative natural resource rents and revenues per capita

Notes: Sum of natural resource rents (orange bars) and natural resource revenues (blue bars) per person between 2004 and 2014 by country in thousand US dollars. Natural resource rents include rents from oil, natural gas, coal, and principal mineral commodities (bauxite, copper, gold, iron ore, lead, nickel, phosphate, silver, tin, and zinc), but exclude rents from other important commodities – such as diamonds and other valuable minerals – which could underestimate the real value of total natural resource rents. No resource rents data for Sao Tome and Principe. Source: World Bank staff estimates based on UNU-WIDER (2021) and The Changing Wealth of Nations 2021.

¹⁰ Two important caveats are necessary to interpret this finding. First, the measure of rents is likely subject to sizeable uncertainty and measurement error. It relies on measures of both total revenues – which typically uses on world prices rather than the actual price paid for a unit of the commodity – and an estimated measure of costs – which are held confidentially by the industry, and vary significant by project, by country, by geology, and even by the level of prices for the commodity (Toews and Naumov 2015). Second, the relationship between what the government 'ought' to collect, i.e. the rents value once a reasonable cost and return on capital is deducted, and what it actually collects is complicated by numerous factors. Taxes and contracts might be poorly configured or badly negotiated, either due to bad luck, significant information asymmetries, lack of relevant expertise, or deliberate (and potentially corrupt) actions by decision makers. Alternatively, government may be unable to recover more of the rents without deterring investors due to additional risk to capital, like political risks, associated with operating in particular context. This is also very hard to evaluate on a general basis.

As you see in Figure 9, there was wide variation in the extent of resource revenues when expressed in terms of a country's population. The highly resource-rich but populous Cameroon saw only a modest \$677 per person cumulative revenues over the boom decade, meanwhile the tiny oil rich countries of Equatorial Guinea recorded cumulative per capita revenues of roughly \$43,000 cumulative over the decade. In the middle of the range, the large oil-rich state of Nigeria recorded \$3,000 per head over the same period (an average of \$300 per person per year). Zambia, meanwhile, despite its \$3.5 billion in cumulative government natural resource revenues, had only around \$200 per head to allocate (an average of \$20/person/year).

These revenues created unprecedented levels of fiscal space for many governments, while also reflecting the scale of the boom in the resource sector. A critical question to consider is how much of this boom translated into economic growth. Furthermore, while the boom drove expansion in GDP in many countries, once we subtract the resource sector the picture may not be as rosy. We consider the extent to which non-resource sector GDP grew as well. This allows us to subtract the portion of growth that arises directly from the booming sector itself (a largely price driven effect).

Outcome 2: Mixed growth impact of natural resources

During the boom years resource-rich economies saw impressive GDP growth. Countries such as Angola and Ghana saw average growth rates increase respectively from 5.1% and 4.4% in the pre-boom period to an average rate of 8.2% and 7% during the boom. Such jumps were driven by a combination of factors including a boost in the value of hydrocarbon exports, new oil discoveries in Ghana and a boom in the price of gold. However, both countries saw growth slump following the sharp decline in oil prices in 2014 - where we mark the end of the boom - to -1% and 5% respectively.

For the region, average growth rates pre-boom were 4.6% for resource-rich Sub-Saharan Africa and 2.9% for non-resource-rich Africa. During the boom this jumped in both cases, to 5.4% and 4.2% respectively (Figure 10). While resource-rich countries saw higher growth rates during the boom on average, the increase from the pre-boom period was modest, and less of a jump compared to non-resource-rich countries. This is particularly disappointing given the scale of commodity price increases during this period.



Figure 10. Average annual GDP growth by country group

Note: RR= Sub-Saharan African resource-rich countries listed in IMF (2012), nonRR= rest of Sub-Saharan African countries, RR RoW= rest of the world resource-rich countries listed in IMF (2012). Source: author's calculations based on World Bank data.

Following the boom, the group averages fell to 2.7% and 3.8%, respectively. Here the drop was biggest in the resource-rich group, and fell to below the pre-boom average growth rates. This indicates the average effects saw a bigger boom for non-resource-rich Africa, as compared to the resource exporting countries in the region. While the average effects mark a bigger bust for the resource exporters. However, if we account for population growth in these countries, GDP growth rates look less favorable. After the boom, resource-rich Africa's GDP growth did not keep up with population growth and resulted in negative GDP growth per capita (Figure 11).



Figure 11. Average annual GDP growth per capita by country group

Note: RR= Sub-Saharan African resource-rich countries listed in IMF (2012), nonRR= rest of Sub-Saharan African countries, RR RoW= rest of the world resource-rich countries listed in IMF (2012) Source: author's calculations based on World Bank data.

This result is striking. While the boom period represented a prosperous period of growth for resource-rich Africa, the subsequent slump in growth rates underscore how resource-dependent this was and how little economic transformation had occurred, to develop other sources of growth during the boom. The same period saw a slowing of growth across the entire region, reflecting the overall higher level of regional resource-dependency compared to before the boom.

What about the rest of the economy?

It is important to consider not just total GDP growth performance but also how nonresource GDP has fared. This is because the resource sector is such a large driver of growth in most of the region, and particularly during the boom, that a focus on GDP growth numbers is largely reflecting the price-driven increase in resource sector activity in this period. To appreciate the broader growth experience, and particularly the sustainability of economic growth we need to look beyond the resource sector.

Figure 12 separates the average GDP growth rate (left panel) and compares it to the nonresource GDP boom – using sectoral GDP data that subtracts GDP attributable to resource extraction. It shows that resource-rich Africa saw a boom in both GDP and non-resource GDP during the period of higher prices - lying above the non-resource-rich countries for much of this period. During the boom, by the end of 2003 and until 2014, 13.3% of the median increase in resource-rich Sub-Saharan African countries' output came from the resource sector. This is equivalent to 1.3 percentage points annually of additional growth, or a cumulative total of \$17 billion US dollars in additional output in resource-rich Sub-Saharan Africa. By contrast 6.9% of resource-rich Sub-Saharan Africa's increase in output came from the non-resource sectors. This is equivalent to 0.7 percentage points annually of growth, or a cumulative total of \$7 billion US dollars in the region. Since the boom, the resource sector has contributed about 1.8 billion US dollars to non-resource-rich Sub-Saharan Africa, but has decreased about 3.1 billion US dollars in the resource-rich Africa.

The post-boom period is notable. Both average GDP growth rates and non-resource GDP growth rates in resource-rich Africa fell below the non-resource-rich countries. This can be most clearly seen by the smoothed line in blue (RR Africa) crossing below the red (non-RR Africa) by 2015. The drop in non-resource GDP growth was most stark for resource-rich Africa following the boom period, reflecting the high level of interdependence between the resource sector and the rest of the economy.



Figure 12. Average growth rate in resource-rich and non-resource-rich Sub-Saharan Africa.

Notes: panel a shows average GDP growth rate of resource-rich (blue) and non-resource-rich (red) Sub-Saharan African countries between 1998 and 2018. Panel b shows the average non-resource GDP growth rate of the same groups and years. Non-resource GDP growth rates are calculated with the average of mining and quarrying GDP from the Statistics Division of the United Nations according to the International Standard Industrial Classification (ISIC). Source: authors' calculations based on data from the National Accounts Main Aggregates Database, Statistics Division, United Nations.

While resource-rich countries outstripped their non-resource counterparts in terms of average growth per capita, they compare less favorably to resource-rich countries in the rest of the world. This group saw impressive GDP per capita growth, but were able to translate this into even more impressive non-resource GDP per capita growth rates – exceeding 3% per annum during the boom – see Figure 13.

Meanwhile the end of the boom saw a weak GDP growth per capita in the resource-rich African group, while non resource rich African countries were able to sustain modestly positive growth from 2015 to 2018.

Despite strong growth during the boom, as noted in a recent study by Warner (2015), GDP growth during a resource boom is neither evidence for productivity gains in the economy, nor evidence that any such economic expansion can be sustained beyond the period of depletion. To put it differently, during a boom, resource sector GDP booms by definition. However, the important question is whether such a boom can shift the non-resource economy to a higher growth path, outliving the boom period. Figure 13 suggests the performance has not been strong in this regard.

Indeed, Warner (2015) find little evidence to suggest that the resource boom led to sustained increases in non-resource GDP. Looking beyond Africa, he notes that some Gulf states were able to finance migration-facilitated economic expansion, however African countries fared worse. Warner examines 18 boom countries, including five from Sub-Saharan Africa: Chad, Equatorial Guinea, Mauritania, Mozambique, and Zambia. In all cases, he finds no statistically significant difference in growth during the boom period compared to each country's counter-factual non-boom period.

Figure 13. GDP and non-resource GDP per capita growth in Sub-Saharan Africa, period averages.



Notes: Average GDP growth (left panel) and average non-resource GDP growth (right panel) in the pre-boom, boom and post-boom periods comparing Sub-Sahara African resource-rich, Sub-Sahara African non-resource-rich and non-Sub-Sahara African resource-rich countries. Resource GDP corresponds to the GDP coming from mining activities including mining of metals and minerals, and extraction of crude petroleum and gas. Source: authors' calculations using UN Statistics Division data.

We examine average growth rates for 26 resource-rich and 22 non-resource-rich Sub-Saharan African countries. We examine both GDP growth rates and non-resource GDP growth rates. We find evidence that GDP and non-resource GDP growth rates were somewhat higher for resource-rich Africa compared to the rest of the region before and during the boom, but slumped to lower levels following the boom – see Table 1.

		GDP growth rate					Non-resource GDP growth rate				
Country/ group	Res.	Pre boom (A)	Boom (B)	Post boom (C)	B-A	C-B	Pre boom (A)	Boom (B)	Post boom (C)	B-A	C-B
SSA RR		4.6	5.4	2.7	0.8	-2.7	4.5	5.8	2.5	1.3	-3.3
SSA non- RR		2.9	4.2	3.8	1.3	-0.4	3.2	3.5	3.2	0.3	-0.3
Angola	Oil	5.1	8.2	-0.9	3.1	-9.1	3.8	8.8	0.1	5	-8.7
Botswana	Diam.	3.8	5.2	2.5	1.4	-2.7	2.7	8.2	4.4	5.5	-3.8
Cameroon	Oil	4.2	4.2	4.5	0	0.3	6.1	4.5	4.6	-1.6	0.1
Ghana	Gold, Oil	4.4	7.1	5	2.7	-2.1	4.7	6.3	4.1	1.6	-2.2
Nigeria	Oil	6.1	6.7	0.9	0.6	-5.8	6.6	8.3	1.4	1.7	-6.9
Tanzania	Gold	5.5	6.5	6.3	1	-0.2	5.4	6.5	7.1	1.1	0.6

Table 1. GDP and non-resource GDP growth of resource-rich, non-resource-rich, and selected Sub-Saharan African countries.

Notes: Comparison of average growth rates pre and during the boom, SSA, RR countries only. Source: World Bank national accounts data, and OECD National Accounts data files

(https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG) and UN Statistics Division, National Accounts Main Aggregates Database (https://unstats.un.org/UNSD/snaama/formulas.asp)

Outcome 3: Rising poverty and inequality in resource-rich countries, putting Africa on a perilous trajectory

The commodity price boom saw large inflows to African economies via resource companies exports and government revenues from production shares, royalties, and other resource sector taxes. However, despite the economic boom, the impact on poverty alleviation and inequality was disappointing.

The overall trend in resource-rich African countries was an increasing poverty headcount during the boom – indicated by the solid red line in Figure 14 – from about 280 million in 2003 to more than 310 million living in extreme poverty by 2019.¹¹ Meanwhile non-resource-rich Africa saw more modest increases – from 110 million to over 113 million over the same period. In part this was driven by a higher average (mean) poverty rate in resource-rich Sub-Saharan African countries that failed to converge with the poverty rates

¹¹ Poverty projection estimates included in this paper are based on the poverty projection methodology designed and published by Lakner et al (2021) that incorporate the impact of COVID-19 on global poverty. These projections are based on the growth forecasts from the June 2021 version of Global Economic Prospects (GEP) and take the Sustainable Development Goals (SDGs) definition of extreme poverty which groups people living below the poverty line of \$1.90 a day, measured in 2011 Purchasing Power Parity prices.

in non-resource-rich Sub-Saharan African countries. It was also driven by high population growth in these countries – for example, according to data from the United Nations Population Division, the fertility rate during the boom in Nigeria was on average 5.9, and in DRC was 6.5. The onset of the COVID-19 public health and economic crisis is expected to worsen poverty forecasts for many countries.



Figure 14. Total poverty headcount, resource-rich and non-resource-rich Sub-Saharan African countries.

Notes: Number of people living below \$1.90 a day in Sub-Sahara African resource-rich and non-resource-rich countries from 1995 to 2030. Projected data starts after 2020 and missing historical poverty data was filled using linear interpolation with the available data. Source: authors' calculations using World Bank's PovcalNet, Lakner et al (2021) and World Bank staff estimates.

Given sharply weakened economic performance as countries exited the commodity price boom, the projected poverty headcount and global shares of those living in extreme poverty present an even starker picture. For resource-rich Africa, by 2030 the headcount could rise even further – to around 379 million– while the count in non-resource-rich Africa is set to fall to below 120 million. Taking this as a share of world poverty, resourcerich Sub-Saharan African countries could constitute as much as 62% by 2030, while nonresource-rich African countries around 20% of the global total (Figure 15). Meanwhile Sub-Saharan Africa as a whole – including non-resource-rich countries - could total almost 80% of global extreme poverty by 2030. This compares to Africa constituting only 16% of total world poverty in 2000. 12



Figure 15. World's poverty share, resource-rich and non-resource rich Sub-Saharan African countries

Notes: World's share of poor people living below \$1.90 a day in Sub-Sahara African resource-rich and non resource-rich countries from 1995 to 2030. Projected data starts after 2020 and missing historical poverty data was filled using linear interpolation with the available data. Source: authors' calculations using World Bank's PovcalNet, Lakner et al (2021) and World Bank staff estimates.

Figure 16 shows the comparison of the poverty headcount before and after the boom. Left of the 45-degree line indicates increased poverty headcount by the end of the boom compared to the period preceding the boom. Half of Africa's resource-rich countries with poverty data available saw the poverty headcount increase (12 of 24) – including Nigeria, Mozambique and Côte d'Ivoire. Several resource-rich countries did manage to reduce poverty during the same period, such as Tanzania, Uganda and Ghana.

¹² To see how this trend has transformed in recent years, for resource-rich countries the share of global poverty was only 23% in 2000 compared to 74% in 2030, and for resource-rich Sub-Saharan African countries the share was 12% the same year, compared to 64% in 2030.



Figure 16. Poverty headcount in Sub-Saharan African countries, 2003 vs 2014

Similarly, by the end of the boom, many countries had seen a worsening in overall inequality – as measured by the Gini coefficient. Most non-resource-rich countries for which Gini data is available for two years within the boom period (9 of 16) including Namibia, Burkina Faso and several smaller non-resource-rich countries saw an improvement in their Gini coefficient by 2014 compared to the pre-boom period. However, many resource-rich countries did not improve their Gini coefficient, including Mozambique, Cameroon, Chad, Ghana, Cote d'Ivoire, Zambia, and Tanzania. Figure 17 shows the comparison between the pre-boom and end of boom, with countries lying left of the 45-degree line having worsened their Gini coefficient during the boom. Figure 18 shows that from the 34 African countries with reported Gini index, 21 reduced income inequality, while the other 13 had no improvement or ended up with more unequal population. The boom helped to reduce inequality in some resource-rich countries. Among the 19 resource-rich countries with reported Gini index data, 12 had improved during the boom years, and the majority of them were mineral-rich.

Notes: Poverty headcount by country in Sub-Saharan Africa comparing poverty headcount in the year before the boom and at the end of the boom. Countries where poverty increased appear above the 45-degree line. Source: authors' calculations using World Bank's PovcalNet.



Figure 17. Inequality in Sub-Saharan Africa. Gini coefficient comparison between the preboom and end of the boom periods.

Notes: Gini coefficient by country in Sub-Saharan Africa in 2003 and in 2014. If the value for these years were not available, it is shown the earlier closest value for each country. Source: authors' calculations using World Bank PovcalNet data.



Figure 18. Gini index change between 2004-2014, resource rich and non-resource-rich Sub-Saharan African countries.

Notes: Gini index of 2014 or the closest year of reported value minus the Gini index in 2004 or closest year with reported value. Blue bars correspond to fossil fuel-rich countries and orange bars correspond to mineral-rich countries according to IMF (2012). A decrease in the Gini coefficient indicates an improvement in the income equality of a country's population. Source: authors' calculations using World Bank PovcalNet data.

Outcome 4: Failure to transform and diversify

Resource-rich countries in Africa recorded lower adjusted net savings rates and increased export concentration compared to before the boom

The transformation of resource endowments into sustained prosperity is a multi-stage economic and political problem (Venables 2016). It requires governments to navigate a series of decisions - counties must secure investment, typically from abroad to explore for and develop resources. They must secure a fair deal that maximizes value for the country without deterring investors, even in conditions of weaker governance. Then they must

capture those revenues, manage them prudently, and ultimately invest them judiciously to promote sustained long-term prosperity for the country.

This chain of decision is made all the harder for impediments at each stage - investors may be deterred by weak governance and business climate (Cust and Harding 2013), or from time-inconsistency challenges leading to hold-up. The negotiating of fair deals is hampered by severe informational asymmetries and uncertainty regarding the future value of resources and cost of extraction. Capturing revenues requires effective tax administrations who must carefully monitor complex operations in the face of sophisticated tax minimization techniques by multinational corporations. The management of revenues is challenged by price volatility, lumpiness and difficult distributions considerations. Finally, long term sustainable development can be elusive where countries struggle to diversify, where Dutch disease crowds out other sectors and where governments and citizens alike become addicted to the additional consumption short-term resource windfalls can sustain.

To judge how successfully resource-rich Africa diversified its economic activity away from resource dependence we consider three key criteria: 1. Economic concentration: measured in resource-sector GDP versus non-resource sector GDP; 2. Concentration of exports: measured using indexes of product and value diversification in export categories; 3. Concentration of assets: measured using Hartwick's Rule, adjusted net savings and the diversity of asset classes across natural capital, human capital and productive assets.

Economic concentration

We examine the impact of the boom on the economic concentration in resource-related GDP between the pre-boom and post-boom periods. Figure 19 shows how each country fared – those lying to the left of the 45-degree line saw a higher resource to non-resource GDP ratio after the boom, meaning economic concentration in resources increased by the end of the boom.

Figure 19 shows that 11 of 23 countries of resource-rich Africa with sectoral GDP data saw increasing concentration. Countries such as Chad, Zambia, and DRC saw a higher resource to non-resource GDP ratio by the end of the boom. In contrast Nigeria, Botswana and 10 other resource-rich countries managed to reduce economic concentration.

Figure 19. Resource GDP to non-resource GDP ratio in Sub-Saharan African countries, 1998-2003 vs 2014-2018 averages.



Notes: Average resource GDP to non-resource GDP ratio in 1998-2003 compared to the average in 2014-2018. Resource GDP corresponds to the GDP coming from mining activities including mining of metals and minerals, and extraction of crude petroleum and gas. Countries above the 45-degree line increased more their resource GDP over their non-resource GDP after the boom. Chad, Gabon, and Equatorial Guinea not shown, but their ratios in 1998-2003 were -0.1, 3.3, and 1.1, respectively. Their ratios in 2014-2018 were 0.2, 0.6, and 0.4. Source: authors' calculations using UN Statistics Division data.

Export concentration: The boom drove increased export concentration (little progress on diversification, reversal in some cases)

A key tenet of best practice advice to resource-rich countries is to use the opportunity created by a boom to promote a more diversified economy. This can reduce exposure to price volatility and price risk, while also moving the economy up the value chain to higher value added and shift the economy into labor-intensive export manufacturing and other non-resource sectors. Diversification is a protection against depletion of the resource base, while in the case of hydrocarbons, it may be insurance against a future global shift from fossil-fuel consumption driven by alternative energy technologies and taxation of carbon emissions (Cust, Manley, and Cecchinato 2017).

While many countries have actively pursued diversification strategies during their respective resource booms, the record of success is rather poor. For many oil-rich countries the boom was associated with increases in export concentration, including in Africa. However, some regions saw some success - notably Latin American and Southeast

Asian countries, according to Ross (2017). Where oil-rich economies have successfully diversified during periods of high oil prices, Ross finds evidence that for 4 of the 8 successful cases this has been associated with countries reaching resource depletion, or economic sanctions being placed from outside.

The picture of diversification during the recent boom is rather bleak, particularly for oil rich economies. It suggests that such a process is challenging in the face of high prices and strong resource exports.

Figure 20 illustrates the performance of African economies in terms of export diversification. Those lying to the right of the 45-degree line increased their measure of export diversification late into the boom (2006-2010) compared to the pre-boom (1998-2003). We find that the majority of resource-rich Africa reporting export diversification index saw increased export concentration (14 of 24, left to the 45-degree line) including Sudan and Chad. By contrast, 10 of these countries could diversify their exports during this period, including Uganda and Tanzania.

Figure 20. Export diversification index of Sub-Saharan African countries, 1998-2003 vs 2006-2010 averages.



Notes: Average export diversification index during 1998-2003 and 2006-2010 in Sub-Sahara African countries. A lower index value means higher diversification and 2010 is the most recent year with data available. Source: authors' calculations using IMF data.

This rising export concentration in the resource sector is not unique to Africa. First modeled by Corden and Neary (1982) this has become popularized as the Dutch disease. Harding and Venables (2013) find that for each additional dollar of resource revenues countries tend to see a decrease in non-resource exports of 75 cents.

Asset concentration: What happened to the wealth of nations?

The process of resource extraction has a first-order effect of reducing a countries overall wealth, by depleting the stock of natural capital given subsoil assets' finite non-renewable nature. However, countries may use the proceeds from this depletion to accumulate other forms of capital – such as building physical infrastructure, or investing in human capital, via improvements in education and healthcare of citizens. Meanwhile, the stock of natural capital can also increase due to rising prices applied to remaining resource base, or new discoveries – some occurring as part of the discovery-by-extracting process.

Although the boom offered a unique opportunity for resource-rich African countries to increase of their wealth, its total wealth per capita still grew at a similar average annual rate than its non-resource-rich counterparts and around two thirds what other resource-rich elsewhere in the world achieved. The lack of investment in other assets different from the resource sector during the boom, left resource-rich African countries even less prepared for the end of the commodity boom, when their total wealth, mainly deposited in nonrenewable natural resources, resulted in negative growth numbers (see Figure 21).





Note: RR= Sub-Saharan African resource-rich countries listed in IMF (2012), nonRR= rest of Sub-Saharan African countries, RR RoW= rest of the world resource-rich countries listed in IMF (2012). Source: Changing Wealth of Nations 2021.

This poor growth of per capita wealth in resource-rich Africa has widened the divide the amount of wealth between them, the rest of Africa and other resource-rich countries in the world. Other lower income resource-rich countries listed in IMF (2012) – such as – Mongolia managed to increase their total per capita wealth to almost double their value before the boom (Figure 22).



Figure 22. Average annual total wealth per capita by period

Note: RR= Sub-Saharan African resource-rich countries listed in IMF (2012), nonRR= rest of Sub-Saharan African countries, RR RoW= rest of the world resource-rich countries listed in IMF (2012). Values expressed in thousand constant 2018 US\$. Source: Changing Wealth of Nations 2021.

We find that during the boom decade the total wealth stocks in resource-rich countries in Africa generally increased. This means, including price effects, the total value of a nations stock of human wealth, productive capital, and natural assets, rose. Figure 23 plots this effect for African countries expressed in per capita terms. Countries like Namibia and Botswana added over \$20,000 per person to their total national wealth during this period.



Figure 23. Total wealth per capita change of Sub-Saharan African countries, 2004-2014

Notes: Total per capita wealth in 2014 minus total per capita wealth in 2005 for Sub-Saharan African countries. Source: authors' calculations using the Changing Wealth of Nations 2021 data.

The total wealth stocks during this period rose by an average of \$4,000 per person for Sub-Saharan Africa. Outliers in this process included countries such as Gabon, which, due to a combination of high oil depletion and high population growth (over 3% annually) saw per capita wealth fall during this period from 2005 to 2014.

One of the key textbook principles of prudent natural resource management is the accumulation of assets to replace a depleting asset. Known as Hartwick's rule (Hartwick 1977), this principle states that economic sustainability rests of replacing a non-renewable natural asset with an alternative productive asset to offset depletion. This can take the form of physical capital, financial capital, or human capital.

As useful metric to evaluate how well a country is accumulating these offsetting assets is the rate of adjusted net savings (ANS), calculated and published by the World Bank.

Most of resource-rich countries with non-missing data have a zero or positive rate of adjusted net savings during the commodity boom since the implied rate of capital accumulation rises with the rate and value of the depleting asset. Unfortunately, during the boom the relationship between resource wealth, measured as natural resource rents percent of GDP, has been negatively associated with countries rate of adjusted net savings. This is shown in Figure 24.



Figure 24. Resource rents vs adjusted net savings, 2004-2014 average

Notes: Average adjusted net savings as percent of GNI and average natural resource rents as percent of GDP over the boom period in Sub-Sahara African countries. Source: authors' calculations using the Changing Wealth of Nations 2021 and World Bank data.

In Africa many fossil fuel-rich countries with the most depletion (proxied by rents) – such as Angola and Republic of Congo – have seen low and negative rates of net saving, meaning they are running down the overall stock of assets in the country, and instead consuming a large share of this value. Such a pattern means countries are bringing forwards consumption as the expense of future GDP, effectively reducing the available assets for future generations. Venables (2016) documents this phenomenon. Meanwhile, the ANS of some mineral-rich countries have been less impacted reaching 10% of GNI – such as Zambia and Mauritania.

According to the Changing Wealth of Nations 2021 report, in 2004, 10 countries in Sub-Saharan Africa had the most of their wealth held in natural assets, versus human or productive assets or net foreign assets. Surprisingly, by 2014, this same number of countries still had natural capital as the most abundant asset. Only Ghana reduced its natural capital share of total wealth below its human capital share, while this share increased in Niger. A large part of this was due to countries replacing their depleting reserves with new discoveries, plus if prices rise enough the value of those depleting reserves also rises even as their stock might decrease, reflected in increased natural capital wealth. The boom did not translate in a significant improvement of the asset portfolio in resource-rich Africa. Despite resource-rich countries benefited from additional income from their abundant natural capital, they did not translate into significant higher investment in produced or human capital compared to non-resource-rich African countries. Therefore, the concentration of wealth in resource-rich Africa remain as twice as much as in non-resource-rich African countries (Figure 25).



Figure 25. Sub-Saharan Africa wealth composition, 2004 vs 2014.

Note: the left panel shows the average composition of wealth per capita of resource-rich and non-resource rich Sub-Saharan Africa in thousand US dollars. The right panel shows the component of wealth share of total wealth, excluding net foreign assets. Source: World Bank staff estimates based on the Changing Wealth of Nations 2021.

When we limit this to just nonrenewable natural assets, seven countries had the largest share (more than 50%) of total wealth in assets including oil, natural gas, coal or metals and minerals. By 2014, five of these countries still had most of its total wealth concentrated in nonrenewable natural resources. These countries were: Central African Republic, Democratic Republic of Congo, Gabon, Guinea, Liberia, Mali and Chad.

According to the Growth Commission: "Strong enduring growth requires high rates of investment. If the sustained, high-growth cases are any guide, it appears overall investment rates of 25 percent GDP or above are needed, counting both public and private investment.

We can examine this in terms of investment in physical capital (gross fixed capital formation), human capital (such as educational expenditures). First, we examine the investment rate over the period, defining investment as the sum of physical capital investment (the traditional definition of the investment rate) and the investments made into human capital (i.e. health and education spending).

From the 22 resource-rich countries with non-missing data, only 10 exceeded 25% during the boom. However, this measure excludes health and education as it does in national accounts. The Growth Commission report notes than health and education spending should

constitute at least an extra 7-8 percent GDP, taking the total target to around 33 percent. From these 22, only 9 exceeded this target during the boom (Figure 26).



Figure 26. Average annual investment rates, percent of GDP between 2004-2014

Notes: Average annual investment rates calculated as the gross fixed capital formation, investment on education and health share of GDP over the 2004-2014 period in resource-rich Sub-Saharan African countries. Missing expenditure on education data for Nigeria and Equatorial Guinea, and missing gross fixed capital formation for Sao Tome and Principe and Liberia, therefore these were not included in the figure. Source: authors' calculations using IMF data for the public-sector gross fixed capital formation, World Bank data for investment on health and UNESCO for investment on education.

Despite the limited number of countries exceeding the Growth Commission target, the gains from the boom boosted the resource-rich Africa group's average annual investment rates to surpass the rates of the non-resource rich Africa group (Figure 27). This growth has been supported by an increased investment in gross fixed capital, but at the expense of a more limited growth of investment in education and health.



Figure 27. Average annual investment rates, percent in GDP between 2004-2014

Note: Average annual investment rates calculated as the group average of gross fixed capital formation, investment on education and health share in GDP over the 2004-2014 period. RR = resource-rich Africa, nonRR = non-resource rich Africa, RR RoW = resource-rich excluding Africa. Source: authors' calculations using IMF data for the public-sector gross fixed capital formation, World Bank data for investment on health and UNESCO for investment on education.

African countries abundant in fossil fuels were the largest contributors to resource-rich Africa's gross fixed capital formation. In Equatorial Guinea, Gabon, Angola, Republic of Congo and in the mineral-rich Botswana, cumulative public and private investment per capita exceeded 10 thousand US dollars between 2004 and 2014, while the remaining resource-rich African countries accumulated less than 5 thousand US dollars per person (Figure 28). In the non-resource-rich group, excluding the smaller insular countries, only South Africa, Namibia, had comparable accumulation of public and private fixed capital derived from their abundant mineral production.



Figure 28. Cumulative public and private investment per capita, 2004-2014

Notes: Government and private cumulative gross fixed capital formation during the boom divided by population in constant million 2015 US\$. Source: authors' calculations using World Bank national accounts.

Similarly, oil-rich countries show a higher accumulation of capital stock, including economic infrastructure, such as roads and airports, and social infrastructure, as in hospitals and schools. Oil-rich Equatorial Guinea and Gabon lead the list while the rest of resource-rich countries, mainly mineral-rich, - such as Guinea and the DRC - had just a small fraction of capital stock per person, as in most non-resource-rich African countries (Figure 29).



Figure 29. Cumulative government and private capital stock (2004-2014)

Note: Sum of annual general government capital stock per capita and private capital stock in constant 2017 international dollars, between 2004 and 2014. Countries to the left correspond to resource-rich countries and countries to the right correspond to non-resource-rich countries. Source: authors' calculations using IMF's Investment and Capital Stock Dataset, 2021.

The legacy of the boom

The legacy of the boom for Africa's resource-rich exporters has proven very mixed. As commodity prices fell in 2014 onwards a challenging period was entered where revenues and exports slumped. Some have weathered the end of the boom well, including managing to sustain impressive rates of growth. Tanzania is an example of this – recording 6.5% during the boom, and 6.3% after the boom. By contrast, a group of countries, and especially those rich in oil and gas, have faced growth slumps induced by the price crash and weak price recovery. Here examples include Ghana, Nigeria and Angola, with boom and postboom growth measured as 7.1% to 5.0%, 6.7% to 1.0%, and 8.2% to -1.0% respectively.

Overall, the growth rates in Sub-Saharan Africa fell following the 2014 price falls. For the region, average growth rates during the boom were around 5.7% and 3.4% for resource-rich and non-resource-rich Sub-Saharan Africa respectively. Following the boom however, the group averages fell to 2.8% and 3.1%. Here the drop was biggest in the resource-rich group, and fell to below the pre-boom average growth rates.

While improved growth rates were notable during this period, they do not appear to be significantly higher than other non-resource-rich Africa counterparts. Further, resource-rich countries had on average lower net savings rates and only modestly higher growth on average than the non-resource-rich countries in the region. Non-resource sector growth was not measurably higher than for non-resource-rich countries. Furthermore, we see estimates for non-resource GDP growth plummet from an average in resource-rich countries during the boom in the years since the boom. The poverty headcount rose for 12 of 24 resource-rich countries with poverty data and inequality rose - measured by the Gini coefficient - in 7 of 19 resource-rich countries.

Debt

If we analyze total external debt owed to nonresidents repayable in currency, goods, or services including the sum of public, publicly guaranteed, and private non-guaranteed long-term debt, use of IMF credit, and short-term debt (all debt having an original maturity of one year or less and interest in arrears on long-term debt), we find that during the boom debt in many resource-rich African countries decreased. However, right after the boom ended, debts in countries like Zambia, Mozambique and Uganda grew considerably.

The increase of debt service in the region led to an increase of the number of countries in high risk of debt distress from 8 to 18 between 2013 and 2018 (Calderon and Zeufack 2020). The average public debt for Sub-Saharan African countries went from 38 percent in 2013 to 59 percent of GDP in 2018. However, this increase was more noticeable in oil rich countries (excluding Nigeria) which on average saw their public debt grow 42 percent points from 31 percent in 2013 to 73 percent of GDP in 2018 (Figure 30). This increase is relatively high compared to resource poor Sub-Saharan African countries which had an increase of 17 percent points between 2013 and 2018 (Calderon and Zeufack 2020).



Figure 30. Public debt by type of resource

Notes: Public debt in Sub-Saharan Africa, by resource abundance (% of GDP) reporting GDP-weighted averages by region. Source: Calderon and Zeufack (2020) based on IMF World Economic Outlook Database 2018 data.

After the global financial crisis, low- and lower-middle-income Sub-Saharan African countries started to increasingly issue Eurobonds as an alternative source to finance their development, being Kenya, Côte d'Ivoire, Gabon and Tanzania some of the countries with the largest issuances (Calderon and Zeufack 2020).

Some governments and state-owned companies have preferred to use resource-backed loans to finance themselves. However, Mihalyi, Adam, and Hwang (2020) suggest that most of the times these instruments are opaque and pose a major public finance risk because they can dramatically increase debt in commodity dependent countries after commodity prices shocks and the contract terms could put countries in disadvantage. During and after the boom, several Sub-Saharan African governments and oil companies have contracted these resource-backed loans representing an important part of the countries' GDP (Mihalyi, Adam, and Hwang 2020), compromising countries economic future. Figure 31 shows how many of these resource-backed loans represent an important part of Sub-Saharan African countries' GDP, especially in the case of Guinea in 2017, when the loan reached almost two times the country's GDP.

To overcome this situation, countries can choose to share these contracts publicly available, they could build trust of the public and lenders, while this can provide more information for policy makers about the country's repayment capacity. Additionally, Sub-Saharan Africa should improve the efficiency of spending and prioritizing high-quality investment projects, such as investing in infrastructure since it is one of the region's challenges that can help to boost development.



Figure 31. Resource-backed loans as percent of GDP, by country and lender.

Source: Mihalyi, Adam, and Hwang (2020).

On average, Sub-Saharan African oil and gas rich countries enjoyed a surplus of their fiscal balances (excluding grants) compared to the rest of Sub-Saharan African countries during the boom. However, with the boom years coming to an end, the average overall fiscal balance of these oil and gas rich countries reached the deficit levels of their mineral-rich and non-resource-rich counterparts (see Figure 32).



Figure 32. Average overall fiscal balance (% of GDP) during and after the boom period.

Notes: Oil and gas rich countries considered as oil and gas rich are Chad, Nigeria, Cameroon, Equatorial Guinea, Gabon, Republic of Congo and Angola; while mineral-rich countries are the remaining resource-rich countries, as defined by Lundgren, Thomas, and York (2013). Source: authors' calculations using World Bank and IMF Government Finance Statistics Yearbook data.

Governance and corruption

Improvements in governance can reduce collusion of some stakeholders and prevent capture by interest groups leading to the leakage of resource rents that should otherwise accrue to governments and citizens. Restuccia and Rogerson (2008) and Hsieh and Klenow (2009) describe how transparency can improve resource allocation and Stiglitz (1999), Bellver and Kaufmann (2005) argue that transparency makes governments more accountable, weakening the power of special interests leading to better policies and institutions (Kubota and Zeufack 2020). Sub-Saharan Africa has much to do in this area, since the region has the lowest scores of transparency in the world according to the World Bank Statistical Capacity Index and the IMF's Special Data Dissemination Standards (Kubota and Zeufack 2020). Figure 33 shows that while Sub-Saharan African countries transparency indices on average have improved over time and are significantly higher than those indices during the pre-boom and boom periods, they still remain as the lowest of the world.



Figure 33. Data transparency by selected region.

Source: Kubota and Zeufack (2020)

Kubota and Zeufack (2020) found that increasing data transparency leads to a reduction of the costs of external borrowing. They provide evidence that data transparency has a positive impact on sovereign bond spreads conditional on the level of external public debt. Their estimates (Figure 34) show that on average, 10 percent improvement in data transparency is associated with a decline in sovereign spreads for the regional average. They find that the decline is stronger than the regional average in some countries including oil rich countries like Nigeria, Angola and Gabon.

Figure 34. Impact of a 10% change in data transparency on sovereign bond spreads conditional on the level of external public debt by country.



Source: Kubota and Zeufack (2020) using World Bank, Bloomberg and PRS Group data.

In oil rich countries, lack of transparency and accountability in oil revenue management could affect countries development pace in the long run as Gauthier and Zeufack (2012) suggest. They argue that what helped countries like Malaysia escape from the Dutch disease is that they publicly release information on the breakdown and time series of federal government revenues from the oil sector. This has helped this Asian country to consider oil revenue management part of the medium- to long- term development planning of the country.

Many oil rich countries have been making progress improving the transparency of their oil revenues, especially those that have joined the Extractive Industries Transparency Institute (EITI) guidelines. However, there are others that show important gaps between the real oil revenues and the official numbers reported in their budgets. For example, Gauthier and Zeufack (2009) propose a strategy to estimate these gaps by comparing production data from state-owned oil companies with World Bank's Adjusted Saving Project (WBASP) data. They found a persistent gap through the 1980s and 1990s that started to rapidly increase when the commodity boom started (see Figure 35).

Figure 35. Oil revenue gap between World Bank's adjusted savings project and Cameroon's National Hydrocarbon Corporation (SNH) in millions of current USD.



Source: Gauthier and Zeufack (2009) using World Bank and Cameroon's National Hydrocarbon Corporation data.

On the other hand, we could not find evidence that on average, increases of adjusted net savings in resource-rich countries were associated with increases of their polity score. Figure 36 shows countries like Angola that increased its adjusted net savings during the boom period but did not improve its polity score. However, other non-resource-rich

countries like Kenya, slightly increased its adjusted net savings during the boom but its polity score increased more than 6 points.



Figure 36. Adjusted net savings share in GNI vs democracy score in Sub-Saharan African countries, 2004-2014 average.

Notes: Average adjusted net savings % of GNI vs Polity IV score in Sub-Saharan Africa change during the boom. It excludes Eswatini, Burundi and Liberia considered as outliers. Eswatini scored an average of -9 in polity IV, and Burundi and Liberia reached ANS of -32 % and -61 % of GNI, respectively. Source: authors' calculations using World Bank data and the Center for Systemic Peace (CSP), Polity IV dataset version 2015.

During the boom, we see that higher adjusted net savings are related to higher Country Policy and Institutional Assessment (CPIA) ratings for non-resource-rich countries and for fossil fuel-rich countries significant at 95% confidence level. However, this relationship does not hold for mineral rich countries as shown in Figure 37. Although, while several mineral-rich countries that improved their control of corruption during the boom period, saw an increase of their adjusted net savings share in GDP, many oil and gas rich countries actually worsened their control of corruption with an increase of their adjusted net savings, as shown in Figure 38. Figure 37. Adjusted net savings share in GNI and transparency score in Sub-Saharan African countries, 2004-2014 average.



Notes: Adjusted net savings as % of GNI vs Country Policy and Institutional Assessment (CPIA) transparency, accountability, and corruption in the public sector rating 2004-2014 average. The CPIA rating captures the level of performance of a country in a given year rated on a scale of 1 (low) to 6 (high). Oil and gas rich countries (in blue) are Chad, Nigeria, Cameroon, Equatorial Guinea, Gabon, Republic of Congo and Angola; while mineral-rich countries as defined by Lundgren, Thomas, and York (2013) are identified with color red. It excludes Burundi and Liberia which have ANS of -32 % and -61 % of GNI, respectively. Source: authors' calculations using World Bank data and the CPIA database.

Figure 38. Adjusted net savings share in GNI vs control of corruption score in Sub-Saharan African countries, 2004-2014 average



Notes: Adjusted net savings as % of GNI vs control of corruption estimates measured as units of standard normal distribution changes between 2004 and 2014. The control of corruption variable captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, or influence of the elites and private interests. According to this, Liberia is the country that has better improved the perception of control of corruption. Oil and gas rich countries are Chad, Nigeria, Cameroon, Equatorial Guinea, Gabon, Republic of Congo and Angola; while mineral-rich countries are the remaining resource-rich countries, as defined by Lundgren, Thomas, and York (2013). It excludes Burundi and Liberia which have ANS of -32 % and -61 % of GNI, respectively. Source: authors' calculation using World Bank data and the Worldwide Governance Indicators database.

Investment efficiency

Finally, we examine the effects of the end of the super-cycle and prospects for resource-rich countries- including the vulnerability to the price crash, the future threat of depletion and the prospect that prices may not hit similar highs again. While resource-rich countries saw strong economic performance during the boom, the vulnerability and lack of fiscal buffers became apparent after prices fell, particularly in petroleum rich countries following 2014. Low rates of adjusted savings and poor public investment management during the boom in resource-rich African countries contributed to this vulnerability. For example, although resource-rich countries like the Republic of Congo and Mauritania were some of the largest recipients of natural resource rents during the boom, their adjusted savings rates and public investment management index are poorer than other non-resource-rich Africa countries, such as Ethiopia or Benin, which did not enjoy the same windfall from commodities (Figure 39).



Figure 39. Adjusted net savings % of GDP vs public investment management index, SSA countries (2004-2014 average)

Adjusted net savings as % of GNI vs the Public Investment Management Index. The Public Investment Management Index captures the institutional environment underpinning public investment management in 72 countries. It covers four different stages: project appraisal, selection, implementation, and evaluation. In Sub-Saharan Africa, the highest score is 3.53 for South Africa with a better public investment management than the Republic of Congo with a score of 0.5. The red line indicates the line of best fit for resource-rich countries and blue line for non-resource-rich countries. Source: authors' calculations using World Bank and Dabla-Norris et al. (2012).

The legacy of the boom is one of macroeconomic weaknesses and increasing concentrations of the world's poor in resource-rich Sub-Saharan Africa. We find that by 2030, 89% of the world's poor may reside in Sub-Saharan Africa, while 82% of the world's poor will be found in resource-rich countries. Taken together, 67% of the extreme poverty will be concentrated in resource-rich Sub-Saharan Africa (Figure 40).

The World Bank goal of eliminating poverty by 2030 will therefore be overwhelmingly a challenge of helping resource-rich African countries translate this subsoil wealth into prosperity for their citizens.



Figure 40. Projected share of world's poor by country groups, 2020-2030

Note: share of world's poor living below 1.90 US dollars per day. Projections start in 2020 and reflect COVID-19 impact based on growth forecasts from the June 2021 version of the World Bank's Global Economic Prospects Source: authors' calculations based on Lakner et al (2021) data.

Conclusion

We examine the effects of the recent commodity price boom, running from around 2004 to 2014, for the economies of Sub-Saharan Africa. We find a mixed record of economic performance across the region and evidence that resource-rich countries squandered their "once in a generation" opportunity for economic transformation. Our results are consistent with other studies of the recent commodity price boom and the economic performance of resource-rich countries in Africa and beyond.

The commodity boom has left resource-rich Africa with important lessons for the future. First, the resource boom increased countries' dependence on resource exports and revenues, which could put at risk economic growth once the boom comes to an end. Second, increased resource dependence does not necessarily translate into a more rapid economic growth if countries do not pursue an economic diversification that helps them transition away from this dependence. Third, increased economic growth during the boom, in both GDP and non-resource GDP, failed to reduce the number of poor or to reduce inequality. Rising poverty and inequality in resource-rich Africa will increase world's poverty concentration in them. Fourth, the resource boom did not equip resource-rich African countries with enough savings to sustain economic growth after the boom ended and failed to help them transform natural resource revenues into productive forms of above ground capital. The disappointing economic outcomes from the resource boom left resource-rich Africa more exposed to the COVID-19 crisis and global economic slowdown. The need has never been greater for policy choices that learn the lessons of the past and of peers to harness resource wealth effectively and to diversify away from resource dependency.

Bibliography

Bates, R., B. Ndulu, S.A. O' Connel, and P. Collier. 2008. *The Political Economy of Economic Growth in Africa, 1960–2000.* Cambridge University Press.

Bellver, A., and D. Kaufmann. 2005. "Transparenting Transparency." *MPRA Paper*, no. 818. University Library of Munich, Germany: 1403–48.

Bhattacharyya, S., and P. Collier. 2014. "Public Capital in Resource Rich Economies: Is There a Curse?" *Oxford Economic Papers* 1 (66): 1–24.

Bravo-Ortega, C., and J. de Gregorio. 2005. "The Relative Richness of the Poor? Natural Resources, Human Capital, and Economic Growth." *World Bank Policy Research Working Paper*, no. 3484.

Calderon, Cesar, and Albert Zeufack. 2020. "Borrow with Sorrow? The Changing Risk Profile of Sub-Saharan Africa's Debt." *Policy Research Working Paper, Office of the Chief Economist, Africa Region, World Bank Group* 9137: 1–35.

Corden, W Max, and J Peter Neary. 1982. "Booming Sector and de-Industrialisation in a Small Open Economy." *The Economic Journal*. JSTOR, 825–48.

Crespo-Cuaresma, J. 2017. "Income Projections for Climate Change Research: A Framework Based on Human Capital Dynamics." *Global Environmental Change* 42: 226–36.

Crespo-Cuaresma, J., W. Fengler, H. Kharas, K. Bekhtiar, M. Brottrager, and M. Hofer. 2018. "Will the Sustainable Development Goals Be Fulfilled? Assessing Present and Future Global Poverty." *Palgrave Communications* 4 (29).

Cust, James, and Torfinn Harding. 2013. "Institutions and the Location of Oil Exploration." OxCarre Research Paper. *OxCarre Research Paper* 127 (December). University of Oxford, Department of Economics. https://ideas.repec.org/p/oxf/wpaper/oxcarre-research-paper-127.html.

Cust, J, and D Manley. 2014. "Natural Resource Charter." NRGI. Available at: Https://Resourcegovernance. Org/Analysis-Tools/Publications/Natural-Resource-Charter-2nd-Ed.

Cust, J., D. Manley, and G. Cecchinato. 2017. "Unburnable Wealth of Nations." *Finance and Development* 54 (1).

Dabla-Norris, Era, Jim Brumby, Annette Kyobe, Zac Mills, and Chris Papageorgiou. 2012. "Investing in public investment: an index of public investment efficiency." *Journal of Economic Growth* 17: 235–66. https://link.springer.com/article/10.1007\%2Fs10887-012-9078-5\#citeas.

Datt, G. 1998. "Computational Tools for Poverty Measurement and Analysis." *International Food Policy Research Institute*.

Deaton, A. 1999. "Commodity Price Stabilization and Growth in Africa." *Journal of Economic Perspectives* 13 (3): 23–40.

Dellink, R., J. Chateau, E. Lanzi, and B. Magne. 2017. "Long-Term Economic Growth Projections in the Shared Socioeconomic Pathways." *Global Environmental Change* 42: 200–2014.

Gauthier, Bernard, and Albert Zeufack. 2009. "Governance and Oil Revenues in Cameroon." *Oxcarre Research Paper* 38: 1–58.

———. 2012. "Cameroon's Oil Wealth: Transparency Matters in *Oil Wealth in Central America*." *International Monetary Fund*, 155–70.

Harding, Torfinn, and Anthony J Venables. 2013. "The Implications of Natural Resource Exports for Non-Resource Trade." OxCarre Working Papers 103. Oxford Centre for the Analysis of Resource Rich Economies, University of Oxford. http://ideas.repec.org/p/oxf/oxcrwp/103.html.

Hartwick, John M. 1977. "International Equity and the Investing of Rents from Exhaustible Resources." *The American Economic Review* 67 (5). JSTOR: 972–74.

Hsieh, C.T., and P.J. Klenow. 2009. "Misallocation and Manufacturing Tfp in China and India." *The Quarterly Journal of Economics* 124 (4): 1403–48.

IMF. 2012. "Macroeconomic Policy Frameworks for Resource Rich Developing Countries." https://www.imf.org/en/Publications/Policy-Papers/Issues/2016/12/31/Macroeconomic-Policy-Frameworks-for-Resource-Rich-Developing-Countries-PP4698.

———. 2019. "The World Economic Outlook (Weo)." https://www.imf.org/external/pubs/ft/weo/2019/01/weodata/index.aspx.

Kubota, Megumi, and Albert Zeufack. 2020. "Assessing the Returns on Investment in Data Openness and Transparency." *Policy Research Working Paper, Office of the Chief Economist, Africa Region, World Bank Group* 9139: 1–32.

Lange, Glenn-Marie, Quentin Wodon, and Kevin Carey. 2018. "The Changing Wealth of Nations 2018." The World Bank.

https://openknowledge.worldbank.org/bitstream/handle/10986/29001/978146481046 6.pdf?sequence=4&isAllowed=y.

Laporte, Bertrand, and Celine de Quatrebarbes. 2015. "What do we know about the sharing of mineral resource rent in Africa?" *Resource Policy* 46: 239–49.

Lundgren, Charlotte, Alun Thomas, and Robert York. 2013. "Boom, bust, or prosperity?: managing Sub-Saharan Africa's natural resource wealth." *International Monetary Fund, African Department*. https://www.imf.org/external/pubs/ft/dp/2013/dp1302.pdf.

Lutz, W., and S. K.C. 2017. "The Human Core of the Shared Socioeconomic Pathways: Population Scenarios by Age, Sex and Level of Education for All Countries to 2100." *Global Environmental Change* 42: 181–92.

Mansour, Mario. 2014. "Une base de donnees sur les recettes fiscales en Afrique subsaharienne, 1980-2010." *Revue d'Economie Du Developpement* 22: 99–128.

Mehlum, Halvor, Karl Moene, and Ragnar Torvik. 2006. "Institutions and the Resource Curse." *The Economic Journal* 116 (508). Wiley Online Library: 1–20.

Mihalyi, David, Aisha Adam, and Jyhjong Hwang. 2020. "Resource-Backed Loans: Pitfalls and Potential." Natural Resource Governance Institute.

Olter, J.P. 2007. "Old Curses, New Approaches? Fiscal Benchmarks for Oil-Producing Countries in Sub-Saharan Africa." *IMF Working Paper*, no. WP/07/107.

O'Neill, B.C., E. Kriegler, K.L. Ebi, E. Kemp-Benedict, K. Riahi, D.S. Rothman, B.J. van Ruijven, D.P. van Vuuren, J. Birkmann, and K. Kok. 2017. "The Roads Ahead: Narratives for Shared Socioeconomic Pathways Describing World Futures in the 21st Century." *Global Environmental Change* 42: 169–80.

O'Neill, B.C., E. Kriegler, K. Riahi, K.L. Ebi, S. Hallegatte, T.R. Carter, R. Mathur, and D.P. van Vuuren. 2013. "A New Scenario Framework for Climate Change Research: The Concept of Shared Socioeconomic Pathways." *Climatic Change* 122 (3): 181–92.

Ploeg, F. van der, and S. Poelhekke. 2009. "Volatility and the Natural Resource Curse." *Oxford Economic Papers* 4 (6): 727–60.

Ploeg, F. van der, and A. J. Venables. 2011. "Harnessing Windfall Revenues: Optimal Policies for Resource-Rich Developing Economies." *The Economic Journal*, no. 121: 1–30.

Radetzki, Marian. 2006. "The anatomy of three commodity booms." *Resources Policy* 3 (1): 56–64. https://ideas.repec.org/p/oxf/wpaper/oxcarre-research-paper-127.html.

Ravallion, M. 2013. "How Long Will It Take to Lift One Billion People Out of Poverty." *World Bank Policy Research Working Paper*.

https://openknowledge.worldbank.org/bitstream/handle/10986/12166/wps6325.pdf?se quence=1&isAllowed=y

———. 2017. "Why Don't We See Poverty Convergence?" *American Economic Association* 42: 504–23.

Restuccia, D., and R. Rogerson. 2008. "Policy Distortions and Aggregate Productivity with Heterogeneous Establishments." *Review of Economic Dynamics* 11: 707–20.

Ross, Michael L. 2015. "What Have We Learned About the Resource Curse?" *Annual Review of Political Science* 18. Annual Reviews: 239–59.

Ross, M.L. 2012. *The Oil Curse: How Petroleum Wealth Shapes the Development of Nations.* Princeton University Press.

Ross, M. L. 2017. "What Do We Know About Economic Diversification in Oil Producing Countries?" *Social Science Research Network*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3048585.

Sachs, J.D., and A.M. Warner. 1997. "Sources of Slow Growth in African Economies." *Journal of African Economies* 3 (6): 335–76.

Stiglitz, Joseph. 1999. "On Liberty, Their Right to Know, and Public Discourse: The Role of Transparency in Public Life." Oxford Amnesty Lecture.

Toews, Gerhard, and Alexander Naumov. 2015. "The Relationship Between Oil Price and Costs in the Oil Industry." *The Energy Journal* 36 (Adelman Special Issue). International Association for Energy Economics.

United Nations University World Institute for Development. 2017. "World income inequality database." https://www.wider.unu.edu/project/wiid-world-income-inequality-database.

Van der Ploeg, Frederick. 2011. "Natural Resources: Curse or Blessing?" *Journal of Economic Literature* 49 (2): 366–420.

Van Ruijven, B.J., M.A. Levy, A. Agrawal, F. Biermann, J. Birkmann, T.R. Carter, K.L. Ebi, M. Garschagen, B. Jones, and R. Jones. 2014. "Enhancing the Relevance of Shared Socioeconomic Pathways for Climate Change Impacts, Adaptation and Vulnerability Research." *Climate Change* 122 (3): 481–94.

Varangis, Panos, Akiyama Takamasa, and Donald Mitchell. 1996. *Managing Commodity Booms and Busts.*

Venables, A. J. 2016. "Using Natural Resources for Development: Why Has It Proven so Difficult?" *Journal of Economic Perspectives* 30 (1): 161–84.

Warner, A. 2015. "Natural Resource Booms in the Modern Era." *IMF Working Paper*. https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Natural-Resource-Boomsin-the-Modern-Era-Is-the-curse-still-alive-43393.

World Bank. 2019a. "Commodity Prices."

https://www.worldbank.org/en/research/commodity-markets.

———. 2019b. "PovcalNet."

http://iresearch.worldbank.org/PovcalNet/povOnDemand.aspx.