

# The Extractives Dependence Index (EDI)

By

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## 1. Introduction

This paper is about measuring the dependence of countries on non-renewable resources such as oil, gas and minerals for development. Understanding how much countries are dependent on natural resources and where the dependence emanates from is helpful to craft the right policies. For instance, one of the negative outcomes of dependence on oil, gas and minerals is loss of foreign exchange and fiscal revenues when commodity prices collapse. Higher degrees of export concentration in commodities are also correlated with greater volatility in economic growth rates. Specifically, additional sources of foreign exchange (other than oil, gas and minerals), such as manufactured exports, need to be nurtured. Creating a dependable revenue base is also an important determinant of a sustainable fiscal position. Alternative sources of revenue can come from non-resource related taxes such as incomes, profits and capital gains. Lower levels of dependence on oil, gas and minerals also require diversification of economic activity within GDP.

Following the seminal work of Sachs and Warner (1995), the ‘share of oil, gas and minerals in total exports (or in GDP)’ has become perhaps the most common proxy for resource dependence.<sup>2</sup> Another common variation of this proxy is ‘net resource exports per worker’ as used by Lederman and Maloney (2008) and ‘mineral exports in total merchandise exports’ as used by Davis (1995).

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<sup>2</sup> See Stijns (2001), Ding and Fields (2005) Brunnschweiler and Bulte (2008a) on the difference between resource abundance (i.e., stocks of natural resource wealth) and resource dependence as (i.e., natural resource exports as a percentage of GDP)

Alexeev and Conrad (2009) use ‘per capita hydrocarbon/mineral deposits and the value of oil/mineral produced’ to measure resource dependence. They argue that using resource exports to GDP: 1) is not independent of economic policies and institutions; therefore the ratio can suffer from endogeneity problems; and 2) does not address the possible bias that can result from high domestic consumption of oil, gas and minerals.

Ding and Field (2005) measure resource dependence as the ‘proportion of total capital that is accounted for by natural resource capital’. While Wizarat (2014), Brunnschweiler (2008), Nunn (2008) and Davis (1995) use the ‘value of resource production ratios (per capita or percent of GDP)’. In addition to production, Stijns (2005) uses ‘fuel and non-fuel mineral reserves per 1,000 inhabitants’. Sala-i-Martin *et al.* (2004) use ‘share of mining in GDP’.

The International Monetary Fund classifies resource dependent countries as those with oil, gas and mineral revenues or exports of at least 20% of total fiscal and total export revenues, respectively (Baunggaard *et al.*, 2012).<sup>3</sup> The Oxford Policy Management has used a similar threshold where a country is defined as resource dependent if resources account for 25% or more of total exports.

Noting that not all resource rich countries are also resource driven, the McKinsey Global Institute, in 2014, classified resource driven countries as those that met any one of the following three criteria: a) resource exports greater than 20% of total exports in 2011; b) resource revenues more than 20% of government revenue on average from 2006 to 2010; and c) resource rents<sup>4</sup> greater than 10% of GDP in 2011.<sup>5</sup>

The International Council of Mining and Metals (ICMM) developed the Mining Contribution Index (MCI) to assess the contribution of mining in national economies and consequently an economy’s dependence on the mining sector. The MCI is based on three variables: 1) mineral export contribution in 2010; 2) increase/decrease in mineral export

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<sup>3</sup> The IMF identified twenty-nine low income or lower middle-income countries as resource rich. The list includes Gabon and Equatorial Guinea because they are members of CEMAC. Liberia, Niger, Cote I’voire and Uzbekistan are also included despite incomplete data. Myanmar is not included “as the artificially low official exchange rate that was in place in the period before April 2012 hampers analysis.” In addition, twenty-two upper middle income and high-income countries were classified as resource rich.

<sup>4</sup> Used as a proxy for value added

<sup>5</sup> Eighty-seven countries are identified as resource driven by MGI, including Afghanistan, Guatemala, Madagascar, Sao Tome and Principe, Togo and Uganda who are expected to be resource driven in the future.

contribution over 2005-2010; and 3) mineral production value (%GDP) in 2010.<sup>6</sup> The MCI is constructed by first ranking countries in descending order for each of the three variables, then the three variables are weighted equally at 1/3, summed up and multiplied by 100.<sup>7</sup>

In this paper we propose a composite index.<sup>8</sup> We call it the 'Extractives Dependence Index (EDI)'. The three indicators that make up our index are: a) the share of export earnings from extractives in total export earnings; b) the share of revenue from extractives in total fiscal revenue; and c) extractives industry value added in GDP.

Our approach, however, goes beyond a simple creation of an index from the above three indicators. We weigh each of the indicators to capture the productive environment under which the extractive sector exists. First, we adjust export earnings from oil, gas and minerals by the share of high-skill and technology intensive manufactures. This is because, even if two countries have equal shares of export earnings from extractives, the country with a higher degree of skill and technology intensity is likely to have higher productive capabilities and greater probability of spillover of skills to other export oriented industries.

Second, the revenue generated by the extractive sector is adjusted to take account of tax revenue collected from other sources. Countries that generate a significant percentage of their fiscal revenue from oil, gas and minerals are vulnerable to commodity price volatilities. Such vulnerability is best tackled if countries generate revenue from other sources, including, for instance, personal income tax, corporate income tax and capital gains tax.

Third, the capacity to domestically process oil, gas and minerals into intermediate and final goods is an important indicator of the difference among countries in terms of their dependence on the extractive sector. In a country where domestic value addition is higher, there are also technological and skill transfers to other sectors. In other words, a higher

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<sup>6</sup> The latest ICMM MCI report covers 2014; however to be able to compare with EDI data (which goes up to 2011), we use results from ICMM's first MCI release (which covers 2010)

<sup>7</sup> See <http://www.icmm.com/document/4440> on MCI rankings, methodology and how missing data is dealt with.

<sup>8</sup> We focus on resource dependence, as opposed to resource abundance, as the role of natural resources in an economy cannot be expected to materialize until resources are extracted.

capacity in value addition is likely to be associated with a higher level of diversification within GDP.<sup>9</sup>

The rest of the paper is organized as follows. Section 2 presents the conceptual approach for the evolution of resource dependence. Section 3 constructs the model for the Extractives Dependence Index (EDI). Section 4 presents the results of the EDI calculations and shows the ranking of the countries in our sample. Concluding remarks are provided in Section 5.

## **2. The conceptual framework**

We hypothesize; following the patterns of development as put forth by the staples thesis, that as an economy's dependence on the extractive sector first increases and then decreases. The explanation for such progression comes from the fact that many countries have embarked on their economic development based on extraction of commodities. But these countries have subsequently reduced their dependence on oil, gas and minerals by reducing the share of foreign exchange and tax revenue they generate from these commodities.

Australia's extractive sector illustrates our hypothesis. After a series of discoveries that began in the 1940s, Australia's mining sector grew rapidly leading to a change in the composition of exports. Minerals, mainly coal, bauxite, iron ore, nickel, manganese, titanium and zirconium became the country's major exports. Exports of coal in particular increased expeditiously with the oil price shocks of the 1970s. By 1985, coal exports reached 88Mt and represented 16% of Australia's merchandise exports (Australian Bureau of Statistics, 2001).

The mining sector accounted for 60% of total export revenues, compared to 8.8% in the 1920s and its contribution to GDP increased to 6.5% from 1.7% in 1962 (Robertson, 2008 and The Commonwealth Treasury, 2006). As Table 1 shows, the value of minerals produced has continued to increase from AU\$342.6 million in 1969 to AU\$113,800 million in 2013. Similarly, mining sector royalties increased from AU\$1.3 million in 1969 to AU\$5,100 million in 2013.

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<sup>9</sup> See Hausmann and Hidalgo (2011) for the process of accumulating capabilities that drive product diversity

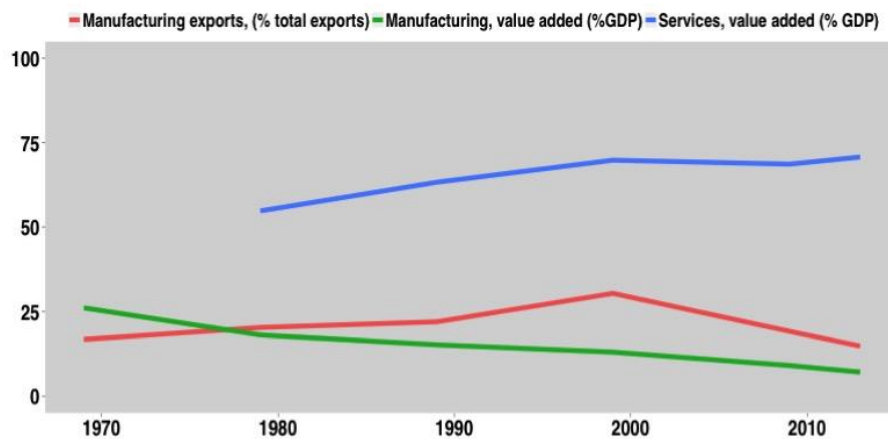
**Table 1: Australia’s extractive sector output and royalties**

	1969	1979	1989	1999	2009	2013
Value of minerals produced (AUD million)	342.6	2134	10,438	16,700	61,000	113,800
Royalties (AUD million)	1.3	58	139.49	692.9	3,700	5,100

Source: Department of Mines and Petroleum, Government of Australia

To avoid a staples trap Australia’s policy-makers implemented major economic reforms. From mid-1980s until 2000, manufacturing production volumes and manufacturing exports grew at an annual rate of 2% and 11%, respectively (Lowe, 2012). Subsequently, manufacturing exports has declined as Australia transitioned to a more service-based economy similar to those of high-income countries (Figure 1).

**Figure 1: Manufacturing and service sectors**



Source: Australian Bureau of Statistics and World Bank Development Indicators

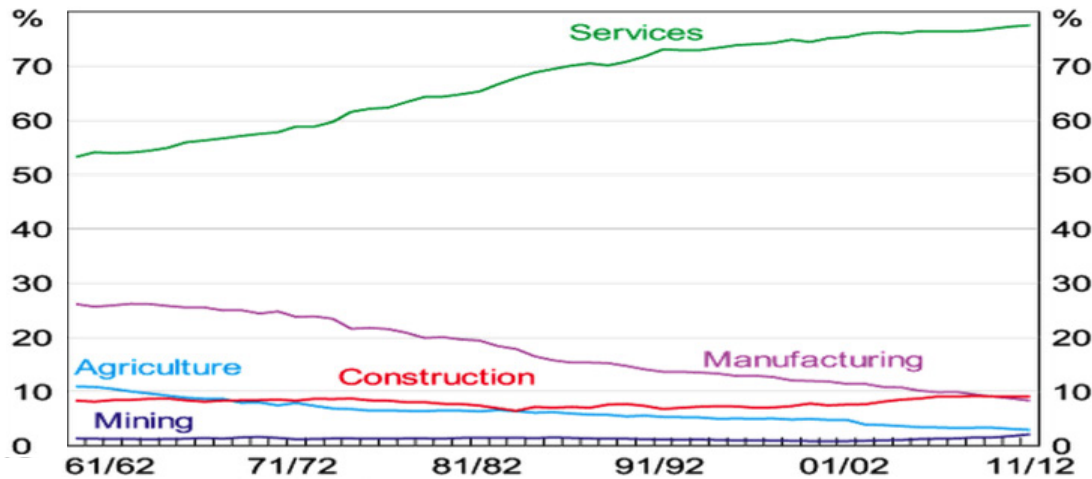
As Figure 2 shows, employment in services sector grew from approximately 52% from 1961/62 to over 75% in 2011/12. Conversely, manufacturing and agriculture share of employment declined, indicating structural change. The decline in manufacturing share in GDP however hides the trend of increasing productivity within the sector towards more advanced manufacturing and knowledge intensive goods, including specialized machinery and scientific instruments.

The mining sector also became more mechanized and grew in sophistication. By 1999, over US\$1.2 billion of mining related intellectual property was exported and 60% of the world’s

mines used software created by Australian companies (Australian Bureau of Statistics, 2001). The sector also saw increases in vertical and horizontal integration where with one new mining job; an estimated two additional jobs are created in sectors such as construction, telecommunications and the sciences (Clements et al., 1996).

Australia continues to retain a strong mineral sector and export of minerals remain high, averaging 63% since 2005. The country achieved significant diversification in economic activity. This has reduced the country’s dependence on the extractive sector (Downes and Stoeckel 2006).<sup>10</sup> Today, Australia’s extractive sector accounts for 5% of total government revenues and the sector’s contribution to GDP has averaged around 8%. Exports of high skilled products have averaged 8% (of total exports). Finland, Norway, the Netherlands, New Zealand and the United States have also developed their secondary sectors based on the resource sector.

**Figure 2: Employment by Industry (shares in total employment)**



Source: Lowe, Phillip. “The Changing Structure of the Australian Economy and Monetary Policy.” Reserve Bank of Australia.

Therefore, one possible representation of a country’s resource dependence trajectory over time is to look at it as an inverted-U. Initially, a larger share of foreign exchange and tax revenue is derived from non-renewable resources. Hence, any measure of resource

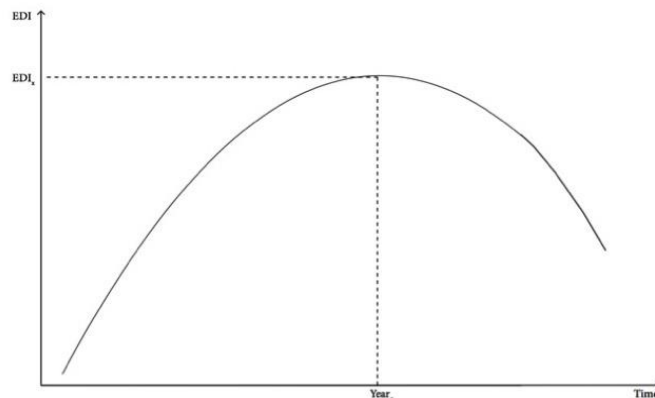
<sup>10</sup> The authors also report that although income from mining has increased, it is yet to register increases in constant price output shares. However, mining sector’s output share is expected to increase rapidly as current and prospective investment projects come on stream

dependence has to first increase. As the economy diversifies and other source of foreign exchange and revenues emerge, the measure of dependence begins to decline.

This relationship is depicted in Figure 3 below. The EDI in our case is expected to rise and reach a point of high dependence on resource extraction and then decline as alternate sources of finance emerge. Therefore, having a high EDI does not necessary imply a dependence on resources that has to be avoided. Rather it is an indication of the need to adopt strategies for future diversification of economic activity within GDP. What policy makers need to worry about is persistent dependence on resources and not transient ones.

We take a closer look at the extractive sector dependence of Mongolia, Nigeria and Botswana to further illustrate the different stages of the EDI curve.

**Figure 3: The EDI Curve**



Mongolia's mining sector has been active since the 1970s, but the country's extractive sector is relatively nascent. It was not until the 1990s that Mongolia experienced a significant expansion in mineral exploration and mining. With the discovery of the Oyu copper and gold deposits in early 2000s and commencement of large scale mines, the mining sector has become the largest financial contributor making up 49% of total government revenues in 2011.<sup>11</sup> As Figure 4 shows, Mongolia is in the first stage of the EDI curve and its dependence has followed an upward rise since 2000.

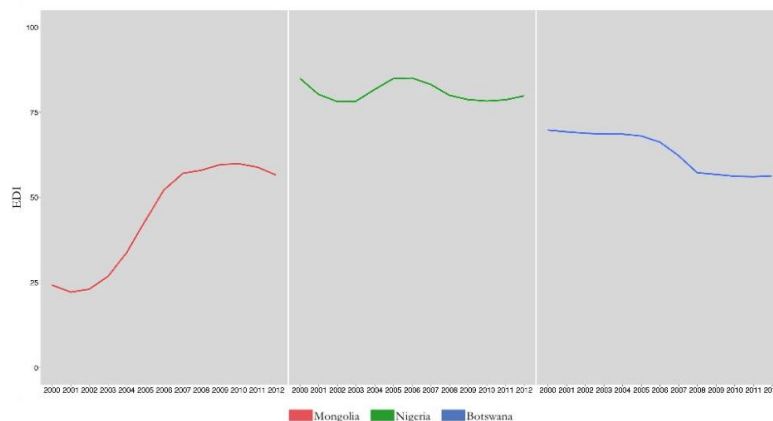
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<sup>11</sup> EITI Mongolia Report 2011

Oil and gas operations began in Nigeria in 1908 and the country started commercial production of oil in 1958 at a rate of 5,100 barrels of crude oil per day. By 1973, production rose to over 2.0 million barrels per day and today Nigeria is Africa’s largest and the world’s 13<sup>th</sup> largest oil producer (BP Statistical Review of World Energy, 2015).<sup>12</sup> After 80 years of production, however, the economy continues to be dominated by the hydrocarbon sector. For the past decade, oil has provided over 90% of foreign exchange earnings and financed 77% of total government revenues. As Figure 4 shows, from 2000 to 2011, Nigeria remained in the second stage of the EDI curve and has not undergone the structural transformation required to decrease the dependence on the extractive sector.

Since the 1980s, Botswana has experienced an average economic growth rate of 7.8%, of which the mining sector is responsible for 40% (Iimi 2006). The government’s efforts to promote downstream value addition; to develop non-resource sectors including agriculture and tourism; and mainly to de-link expenditure from resource revenues have enabled the country to slowly transition to the third stage of the EDI curve. As Figure 4 shows, although Botswana remains dependent on the extractive sector, for instance, diamonds, nickel, copper, gold and other resources continue to bring in an average of 85% of total export earnings, its dependence has slowly declined since 2000. However, diversification to non-resource sectors still remains a work in progress.

**Figure 4: The EDI Curve: Botswana, Mongolia, and Nigeria**



<sup>12</sup> In addition to oil, Nigeria is rich in natural gas, tin, iron ore, coal, lead, and zinc.



### 3. The EDI Formula

The equation from which the EDI is derived is given below:

$$EDI_{ct} = \sqrt[3]{[EIX_{ct} \times (1 - HTM_{ct})] * [Rev_{ct} \times (1 - NIPC_{ct})] * [EVA_{ct} \times (1 - MVA_{ct})]}$$

**EDI** is Extractives Dependence Index for country **c** in time **t**;

**EIX** is export revenue from oil, gas, and minerals as a share of total export revenue;

**HTM** is export revenue from high-skill and technology intensive manufactures as a share of total HTM exported in year **t**;<sup>13</sup>

**Rev** is revenue generated by the extractive industry as a share of total fiscal revenue;

**NIPC** is the total tax revenue collected from non-resource income, profits and capital gains as a share of GDP;

**EVA** is extractives industries value added as a share of GDP; and

**MVA** is the per capita manufacturing value added used as a proxy for domestic industrial capability

In the next sections, we discuss each of the three components of the above Equation.

#### 3.1 Share of extractive exports in total exports

Higher degrees of export concentration around extractive commodities are correlated with greater volatility in export earnings and economic growth rates. Lessening the dependence on the extractive sector, therefore, requires additional sources of foreign exchange (other than oil, gas and minerals), particularly from high skill and technology intensive manufactured exports.<sup>14</sup>

Hence, the first term in Equation 1,  $[EIX_{ct} \times (1 - HTM_{ct})]$ , shows the adjustment of the export earning variable (**EIX**) by the strength of the earnings from high-skill and technology intensive manufactured goods (**HTM**). This takes into consideration a country's

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<sup>13</sup> We use global HTM exports as the denominator to capture competitiveness in the country's manufacturing sector's external competitiveness

<sup>14</sup> The manufacturing sector contains greater learning effects and skills transfers that would lead an economy into a steeper productivity curve.

competitiveness in global trade. Higher shares of skill and technology intensive products imply well-developed capabilities to compete in the global market. The same capabilities can be used to diversify into a range of export products, hence lessening the dependence on the extractive sector.

We use Norway and Zambia as examples to illustrate the intuition behind the variables chosen, and the resulting calculation of the EDI. In 2011, the share of export earnings from the extractive sector for Norway and Zambia were 73.5% and 75.6%, respectively. While the extractive industry export share of the two countries is similar, their levels of economic development, human capital and technological progress are very different. Hence the degree of dependence on the extractive sector must also be different.<sup>15</sup>

In 2008, with a different share of high skill and technology exports, the first component of the *EDI* in Equation 1 results in more than a 10-point difference in the degree of dependence in export earnings between the two countries. Norway is less dependent with a first term value of 58.15 and the more dependent Zambia has a value of 69.30. Using just the export share of extractive commodities to measure dependence on the industry would have placed the two countries, with very different productive capabilities, in the same category. See the calculations below<sup>16</sup>:

Norway	Zambia
$[EIX_{2008} * (1 - HTM_{2008})]$	$[EIX_{2008} * (1 - HTM_{2008})]$
$= 73.54 * [1 - 0.21]$	$= 75.56 * [1 - 0.08]$
$= 58.10$	$= 69.52$

### 3.2 Share of extractive revenues

Commodity price volatility has implications for governments' fiscal position by subjecting them to boom-bust cycles. In the upswing, while some governments save a large proportion of increased revenues, others use the windfall to finance government spending. In the

<sup>15</sup> In 2008, *GNI* per capita in Norway was USD 85,580 and the country was ranked at the top of the Human Development Index (*HDI*). On the other hand, *GNI* per capita in Zambia was USD 970 and the country was ranked 141 out of 187 countries in the *HDI* rankings. Similarly, about 60% of Zambians live below the national poverty line while in Norway the figure is 4.3%.

<sup>16</sup> Calculations are shown using data rounded off to two decimal points

downswing, inability to finance expenditure commitments built-up during boom years can result in a fiscal crisis. Establishing a reliable revenue base is therefore an important determinant of a sustainable fiscal position, particularly for resource rich countries.

The second term in Equation 1,  $Rev_t$ , partly captures the extent of dependence on the extractive sector for government revenue. It is the ratio between government revenue from the extractive sector and total fiscal revenue. To take into account alternative sources of revenue, we adjust the  $Rev$  term by  $NIPC$ , which is total non-resource tax from incomes, profits and capital gains as a share of GDP. A higher ratio between non-resource tax from incomes, profits and capital gains and GDP reflects an economy with a larger non-resource revenue base. Moreover, because collection of taxes from this category is more complex than other categories such as property taxes or taxes on imports/exports, it requires greater tax collection capacity.<sup>17</sup>

Therefore, our second term in the EDI equation above will be:  $Rev_{ct} \times (1 - NIPC_{ct})$ . If there are two countries with the same  $Rev$  but different  $NIPC$  values, the country with a higher  $NIPC$  score will have lower extractives-related revenue dependence [i.e.:  $Rev_{ct} \times (1 - NIPC_{ct})$  will be relatively lower].

Using the same illustration as above, in 2011, the extractive sector's contribution to government revenue as a share of total fiscal revenue for Norway and Zambia was 23.54% and 25.17%, respectively. In the same year,  $NIPC$  for the two countries was 15.82% and 5.57%. Thus, although both countries collected almost the same fraction of their fiscal revenues from the extractive sector, the index takes into account Norway's larger non-resource tax base giving it a revenue dependence score lower than that of Zambia's.<sup>18</sup> Calculations using square root transformed  $NIPC$  values are shown below.

<sup>17</sup> Fenochietto and Pessino (2013) find that countries with higher values of GDP per capita are relatively closer to their tax capacities while for developing countries, high levels of tax exemptions and low tax rates in part are responsible for the greater distance between actual tax revenues collected and what could be collected (tax capacity). Resource rich countries, in particular, display greater inefficiencies in tax collection. For example, from 2010 to 2012, tax exemptions to mining companies in Sierra Leone cost the government USD 597.6 million, equivalent to 57.7% of total domestic revenues collected or 140% of international aid receipts over the same period (NRW, 2014). Similarly, it is estimated that earlier changes in legislation in Zambia could have raised additional copper revenues as large as 3.7% of GDP between 1997 and 2012 (Simpasa et al. 2013)

<sup>18</sup> The extent to which oil, gas and mineral revenues are the main source of public finance will also affect how dependent an economy is on extractives. However, because of limited data, the EDI does not include public expenditure from commodity revenues.

Norway	Zambia
$[Rev_{2008} * (1 - NIPC_{2008})]$	$[Rev_{2008} * (1 - NIPC_{2008})]$
$= 23.54 \times (1 - 0.16)$	$= 25.17 \times (1 - 0.06)$
$= 19.77$	$= 23.66$

### 3.3 Extractives value added

Lower levels of dependence on oil, gas and minerals require diversification of economic activity within GDP. Therefore, we take account of the extent to which a country can add value domestically to oil, gas and minerals. To illustrate the point, think of a country that is highly dependent on oil. Its GDP is entirely driven by oil exports. Think of another country with the same size of the oil sector, but this country processes its oil into petroleum products domestically. While the traditional measures of extractives consider both countries as highly dependent on the sector, our index adjusts the extractives value added term in Equation 1 by how good the country is in domestic value addition. The reason is to give a higher weight to the country that processes its raw materials domestically and treat it as relatively less dependent on resource extraction.

We illustrate the reasoning by taking Equatorial Guinea as an example. From 2000 to 2012, the extractive sector value added as a share of total value added in Equatorial Guinea ranged from about 87% to 98%. However, the high value added figure exists within a largely underdeveloped industrial base, where the average manufacturing value added as a share of GDP during the same period was 7.14%.<sup>19</sup> Equatorial Guinea's value added figures are largely based on primary extraction of crude oil rather than processing it into petroleum products.<sup>20</sup>

Therefore, when calculating the *EDI*, the third term in Equation 1,  $EVA_{ct} \times [(1 - MVA_{ct})]$ , shows the value added contribution from the extractive sector adjusted by per capita manufacturing value added (MVA). Higher values of per capita manufacturing

<sup>19</sup> Calculated using data from UNSD National Accounts, National Accounts Main Aggregates Database and African Development Bank Group, Open Data for Africa

<sup>20</sup> U.S. Energy Information Administration (2013).

value added reflect a more mature industrial base with higher capacities to turn raw materials into processed or semi-processed goods, hence retaining more value within the resource producing country.<sup>21</sup>

One caveat is in order. A country that domestically adds value to its own extractive commodities is, by intuition, dependent on the extractive sector. Our argument is that, such dependence is relatively better than a dependence on raw extractive commodity exports without domestic value addition. One justification for our argument is that value addition allows countries to fetch higher prices for their exports. For instance, from 2005 to 2010, average annual prices for iron ore stood at USD 62.94 PMT while the average price of hot rolled steel and steel wire rods during the same period were more than five times that of iron ore prices – selling for USD 677 PMT and USD 732 PMT, respectively.<sup>22</sup> Greater value addition also means higher level of transferable skills that can increase technology transfer and employment mobility within and between sectors.

Using our country illustration, in 2011, value added figures from the extractive sector (%*EVA*) for Norway and Zambia were 22.92% and 12.02%, respectively. Per capita manufacturing value added for the two countries were US\$7,666.34 and US\$116.62 respectively. Using normalized values for both *EVA* and *MVA*, the calculations for the third component of *EDI* in Equation 1, are as follows:

Norway	Zambia
$EVA_{2008} \times (1 - MVA_{2008})$	$EVA_{2008} \times (1 - MVA_{2008})$
$= 68.79 \times (1 - 0.50)$	$= 55.62 \times (1 - 0.005)$
$= 34.40$	$= 55.34$

Although Norway’s *EVA* (% GDP) is higher than that of Zambia’s, by taking into account Norway’s capacity to process the raw materials, the *EDI* ranks Zambia as more dependent on resource extraction in value added terms.

<sup>21</sup> Our calculations show that the Pearson correlation between normalized values for *MVA* and UNIDO’s Competitive Performance Index was approximately 0.63.

<sup>22</sup> Calculated using data from IndexMundi Commodity Prices

Finally, we take the geometric mean of the three components to construct the EDI.<sup>23</sup> The EDI values range from 0 to 100, with 100 being the highest dependence score. Putting together the three components of Equation 1, the *EDI* values for Norway and Zambia in 2011 were 34 and 45, respectively. Out of the 73 countries for which data was available in 2011, Norway and Zambia ranked 33 and 41 on the Index, respectively.

#### 4. The EDI calculation and the results

Due to limited availability of extractive industry data, the index values were calculated for 81 countries between 2000 and 2011 although not all countries have data for all the years. Table 2 and Figure 5 list the EDI scores for 73 countries in 2011 and rank the countries for that year in terms of their dependence on the extractive sector (EDI value of 0 indicates no dependence and a value of 100 high dependence). Table 3 lists the EDI values for all years between 2000 and 2011.

**Table 2: Ranking based on EDI values and its components for 2011**

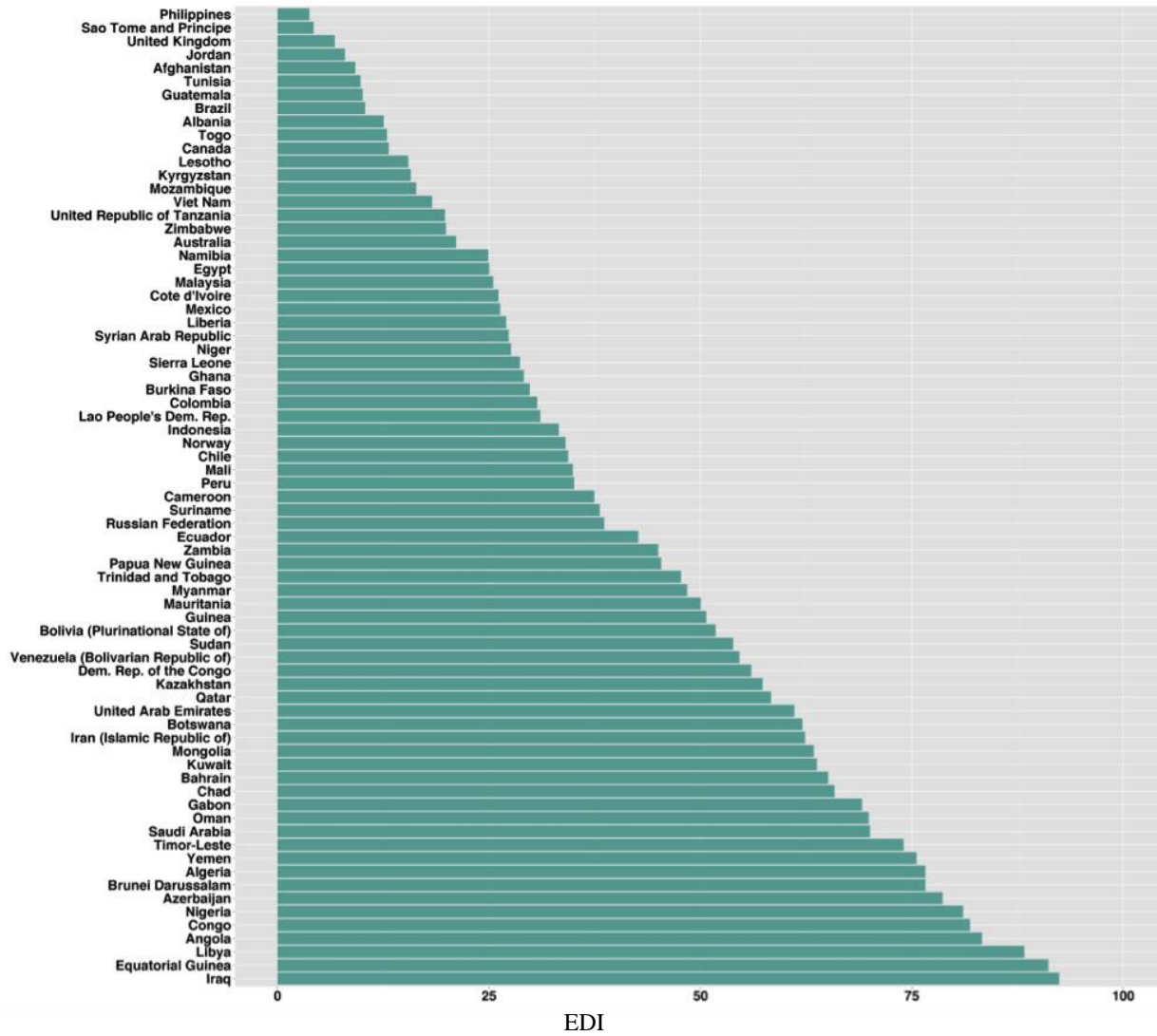
Rank	Country	EDI	EI Export Share	HTM	Export Component	Revenue	NIPC*	Revenue Component	EI Value Added	MVA	Value Added Component
				*					*	*	
1	Philippines	3.77	9.57	0.24	7.24	0.44	0.06	0.41	19.62	0.08	18.06
2	Sao Tome and Principe	4.27	4.89	0.03	4.75	2.15	0.05	2.04	8.03	0	8.02
3	United Kingdom	6.77	20.19	0.4	12.03	1.86	0.12	1.63	24.12	0.35	15.79
4	Jordan	7.96	15.82	0.16	13.29	1.3	0.03	1.26	34.54	0.13	30.22
5	Afghanistan	9.2	18.63	0.04	17.91	2.68	0.03	2.61	16.69	0	16.69
6	Tunisia	9.83	16.2	0.16	13.61	1.73	0.09	1.57	49.95	0.11	44.31
7	Guatemala	10.08	11.33	0.12	9.95	4.05	0.03	3.91	29.12	0.1	26.29
8	Brazil	10.36	31.14	0.26	23	2.04	0.07	1.89	32.46	0.21	25.56
9	Albania	12.54	31.35	0.05	29.66	2.7	0.19	2.19	32.35	0.06	30.44
10	Togo	12.94	22.33	0.06	20.88	4.19	0.16	3.52	29.46	0	29.46
11	Canada	13.15	38.29	0.35	25.02	3.87	0.14	3.31	47.36	0.42	27.43
12	Lesotho	15.47	25.38	0.02	24.76	3.5	0.13	3.03	50.09	0.01	49.37
13	Kyrgyzstan	15.75	29.28	0.07	27.36	12.83	0.06	12.06	12.23	0.03	11.84
14	Mozambique	16.4	63.03	0.06	59.46	3.14	0.06	2.94	25.26	0	25.26
15	Viet Nam	18.28	12.19	0.24	9.23	15.64	0.18	12.84	53.92	0.04	51.58
16	United Republic of Tanzania	19.81	43.61	0.08	40.28	6.3	0.03	6.1	31.61	0	31.61
17	Zimbabwe	19.91	35.53	0.06	33.41	5.18	0.08	4.76	50.32	0.01	49.63
18	Australia	21.12	70.65	0.24	53.93	6.62	0.16	5.57	50.67	0.38	31.34

<sup>23</sup> Because raw data for the value added is skewed to the right, we perform a statistical transformation by taking the natural log. Raw data for MVA is also highly skewed to the right; we set all MVA<=USD 100 at 100 then we perform square root transformation on the variable. To put the two indicators on a common basis, we normalize them using the min/max normalisation method where  $normalised\ value = \frac{value - \min(x)}{\max(component) - \min(x)}$ , i.e. normalized values of EVA and MVA are first calculated after which value added component is calculated. We perform square root transformation on HTM.

19	Namibia	24.94	53.28	0.09	48.22	7.97	0.12	7.05	51.15	0.11	45.63
20	Egypt	25.02	45.18	0.18	37.27	7.99	0.03	7.73	59.01	0.08	54.37
21	Malaysia	25.5	20.4	0.38	12.73	34.02	0.08	31.39	55.84	0.26	41.49
22	Cote d'Ivoire	26.1	26.17	0.1	23.5	30.05	0.15	25.59	30.25	0.02	29.55
23	Mexico	26.32	22.02	0.37	13.81	33.65	0.05	31.87	51.77	0.2	41.43
24	Liberia	27.03	21.37	0.04	20.53	23.46	0.07	21.77	44.21	0	44.21
25	Syrian Arab Republic	27.32	39.41	0.11	35.11	8.82	0.04	8.47	69	0.01	68.51
26	Niger	27.61	45.07	0.09	41.16	12.46	0.11	11.04	46.3	0	46.3
27	Sierra Leone	28.64	52.22	0.05	49.87	13.59	0.04	13.09	35.98	0	35.98
28	Ghana	29.11	46.87	0.08	43.22	14.08	0.14	12.08	47.4	0	47.26
29	Burkina Faso	29.81	49.19	0.05	46.84	10.63	0.04	10.24	55.2	0	55.2
30	Colombia	30.69	70.12	0.17	58.05	13.19	0.19	10.67	54.06	0.14	46.69
31	Lao People's Dem. Rep.	31.06	42.4	0.05	40.08	14.47	0.02	14.21	53.03	0.01	52.61
32	Indonesia	33.24	42.73	0.25	31.85	23.7	0.1	21.28	61.81	0.12	54.19
33	Norway	34.05	73.54	0.21	58.15	23.54	0.16	19.81	68.79	0.5	34.26
34	Chile	34.34	63.56	0.17	52.65	17.02	0.06	16.08	59.92	0.2	47.85
35	Mali	34.89	54.82	0.08	50.68	19.1	0.02	18.65	44.94	0	44.94
36	Peru	35.06	71.98	0.13	62.31	15.63	0.07	14.51	54.37	0.12	47.64
37	Cameroon	37.47	45.17	0.08	41.77	28.38	0.03	27.51	46.77	0.02	45.78
38	Suriname	38.08	45.88	0.04	43.85	38.49	0.06	36.21	44.51	0.22	34.78
39	Russian Federation	38.63	72.23	0.27	52.85	30.57	0.08	28.21	50.18	0.23	38.66
40	Ecuador	42.66	58.99	0.09	53.49	30.69	0.04	29.52	54.92	0.1	49.18
41	Zambia	45	75.56	0.08	69.3	25.17	0.06	23.77	55.62	0.01	55.33
42	Papua New Guinea	45.36	72.42	0.06	67.98	24.4	0.13	21.18	65.15	0.01	64.82
43	Trinidad and Tobago	47.69	64.96	0.17	54.02	44.41	0.06	41.52	75.46	0.36	48.36
44	Myanmar	48.42	55.81	0.05	52.93	53.44	0.01	52.9	41.69	0.03	40.53
45	Mauritania	50.03	63.25	0.03	61.18	31.21	0.13	27.23	75.18	0	75.18
46	Guinea	50.65	88.02	0.05	84.03	25.25	0.12	22.34	69.2	0	69.2
47	Bolivia	51.79	81.8	0.08	75.6	33.56	0.05	31.72	60.76	0.05	57.93
48	Sudan	53.86	93.2	0	93.2	30.31	0.06	28.38	60.37	0.02	59.05
49	Venezuela	54.58	91.62	0.15	78.09	36.15	0.03	35.17	73.05	0.19	59.2
50	Dem. Rep. of the Congo	56	84.24	0.08	77.15	37.79	0.09	34.41	66.14	0	66.14
51	Kazakhstan	57.32	86	0.16	71.97	52.92	0.06	49.64	63.97	0.18	52.72
52	Qatar	58.32	86.7	0.18	70.73	68.83	0.05	65.16	88.39	0.51	43.04
53	United Arab Emirates	61.08	73.58	0.26	54.51	75.32	0	75.26	80.2	0.31	55.55
54	Botswana	62.04	90.42	0.06	84.95	41.69	0.06	39.25	77.72	0.08	71.61
55	Iran (Islamic Republic of)	62.35	76.91	0.21	60.58	65.29	0.03	63.13	71.12	0.11	63.38
56	Mongolia	63.38	85.93	0.04	82.67	48.62	0.03	46.96	67.75	0.03	65.56
57	Kuwait	63.74	92.53	0.19	74.99	52.69	0.01	52.32	89.39	0.26	66.01
58	Bahrain	65.12	72.26	0.12	63.39	88.41	0.01	87.59	72.25	0.31	49.74
59	Chad	65.88	95.09	0.06	89.43	43.08	0.05	40.85	78.25	0	78.25
60	Gabon	69.11	85.15	0.06	80.31	55.19	0.04	52.72	83.29	0.06	77.97
61	Oman	69.92	76.69	0.16	64.39	83.44	0.01	82.53	86.16	0.25	64.31
62	Saudi Arabia	70.06	84.79	0.3	59.17	92.49	0	92.14	84.51	0.25	63.07
63	Timor-Leste	74.03	58.13	0.01	57.33	75.26	0.01	74.23	95.36	0	95.36
64	Yemen	75.55	90.97	0.06	85.76	71.5	0.03	69.48	72.37	0	72.37
65	Algeria	76.61	98.59	0.1	88.51	68.74	0.05	65.5	79.66	0.03	77.58
66	Brunei Darussalam	76.62	96.53	0.06	91.18	91.4	0.01	90.56	88.12	0.38	54.47
67	Azerbaijan	78.62	95.64	0.09	87.36	74.81	0.07	69.3	84.33	0.05	80.28
68	Nigeria	81.05	94.74	0.09	85.91	78.23	0.02	76.86	80.65	0	80.65
69	Congo	81.86	87.75	0.07	81.6	79.07	0.08	72.69	92.46	0	92.46
70	Angola	83.28	99.78	0.04	95.49	81.25	0.07	75.34	84.53	0.05	80.29
71	Libya	88.29	95.77	0.09	87.08	94.15	0.01	93.13	85.15	0	84.85
72	Equatorial Guinea	91.13	95.85	0.09	86.79	90.74	0.02	89.35	97.6	0	97.6
73	Iraq	92.43	99.11	0.09	89.97	98.52	0.01	97.74	90.09	0	89.81

\* = Normalized or transformed values

Figure 5: EDI Results for 2011





**Table 3: EDI Scores (2000 -2011)**

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
1. Afghanistan	--	--	--	--	--	--	--	--	6.04	2.09	3.71	9.2
2. Albania	--	--	--	--	--	--	--	--	--	5.94	10.25	12.54
3. Algeria	81.49	76.65	74.07	77.46	78.44	81.57	82.29	81.28	82.04	69.15	75.44	76.61
4. Angola	84.27	79.49	80.08	82.93	85.01	86.31	86.19	84.25	83.74	76.99	80.79	83.28
5. Argentina	8.51	8.4	19.63	17	12.37	12.35	12.57	10.24	8.7	9.23	--	--
6. Australia	12.08	15.73	14.37	12.59	11.57	13.56	14.81	14.05	16.44	19.19	19.09	21.12
7. Azerbaijan	55.66	58.47	66.8	60.28	57.09	59.03	68.21	69.87	79.07	73.46	77.71	78.62
8. Bahrain	65.61	62.01	60.68	60.93	62.31	64.43	64.93	63.2	62.94	59.54	62.76	65.12
9. Bolivia	23.96	26.18	26.29	29.13	32.86	40.36	47.36	47.65	51.85	50.19	49.42	51.79
10. Botswana	70.82	67.29	69.49	68.6	68.27	67.41	68.28	61.46	58.33	52.42	58.35	62.04
11. Brazil	6.07	5.91	6.57	8.17	7.67	9.21	10.34	9.08	10.54	8.34	9.67	10.36
12. Brunei Darussalam	74.49	74.47	75.07	75.26	77.29	78.89	79.88	78.12	76.85	76.09	77.74	76.62
13. Burkina Faso	--	--	--	--	--	--	--	--	4.01	9.98	17.12	29.81
14. Cameroon	46.89	41.91	40.96	39.16	40.27	42.7	49.04	46.72	47.08	38.02	38.27	37.47
15. Canada	--	--	5.58	6.26	6.75	7.38	8.38	8.83	10.15	12.53	12.95	13.15
16. Central African Republic	--	--	--	--	--	--	17.37	--	--	--	17.02	--
17. Chad	--	--	--	--	58.75	68.95	78.82	79.18	81.38	67.66	75.74	65.88
18. Chile	19.82	16.07	14.84	19.77	32.55	36.5	45.94	44.9	37.85	31.14	37.56	34.34
19. Colombia	23.99	20.27	19.76	20.4	19.96	20.73	22.01	21.71	25.4	28.9	24.72	30.69
20. Congo	82.2	77.06	76.43	76.59	78.04	84.64	87.01	84.03	85.2	77.83	82.32	81.86
21. Cote d'Ivoire	5.14	3.98	4.95	4.89	13.15	18.34	23.22	21.34	26.2	22.14	22.61	26.1
22. Dem. Rep. of the Congo	35.88	30.89	45.75	44.62	45.13	47.69	44.38	42.6	42.68	39.6	48.11	56
23. Ecuador	38.53	29.45	28.24	31.2	37.53	39.46	42.53	41.1	44.29	31.79	36.84	42.66
24. Egypt	15.53	14.18	12.63	11.12	17.5	6.76	28.71	24.42	29.95	25.87	26.37	25.02
25. Equatorial Guinea	91.29	88.94	88.86	87.93	93.2	94.1	91.58	89.91	92.93	91.06	90.38	91.13
26. Gabon	74.05	71.92	68.67	66.45	66.73	73.9	73.21	71.68	74.33	64.92	68.25	69.11
27. Gambia	17.01	12.33	7.85	13.27	7.4	10.61	12.04	16.25	16.92	--	--	--
28. Ghana	22.24	16.62	16.3	15.99	13.54	--	10.66	10.88	12.4	11.83	13.56	29.11
29. Guatemala	--	--	--	--	--	--	--	--	--	--	8.36	10.08
30. Guinea	47.73	48.33	44.23	38.53	42.74	49.28	53.42	48.74	47.86	44.79	50.62	50.65
31. Guinea-Bissau	--	--	--	--	1.58	0.49	0.81	--	--	--	--	--
32. Guyana	47.89	48.07	46.59	49.07	47.9	42.88	42.04	43.38	44.76	42.92	--	--
33. Indonesia	38.43	35.76	31.48	31.1	32.75	35.03	36.87	33.15	35.46	31.75	32.3	33.24
34. Iran (Islamic Republic of)	66.7	62.96	68.86	69.27	69.57	70.78	69.86	69.18	66.61	61.29	63.12	62.35
35. Iraq	--	--	--	--	93.49	94.18	92.76	93.26	93.31	88.91	90.66	92.43
36. Jordan	--	--	--	--	6.53	6.89	6.2	5.34	6.26	8.15	6.63	7.96
37. Kazakhstan	37.62	44.4	40.5	42.81	46.7	52.89	52.03	48.26	54.06	53.34	55.63	57.32
38. Kuwait	68.83	73.09	73.22	72.32	74.69	75.65	78.62	77.06	77.39	76.53	77.24	63.74
39. Kyrgyzstan	6.49	10.08	10.44	12.03	12.61	11.13	8.63	7.4	7.85	7.71	13.59	15.75
40. Lao People's Dem. Rep.	--	--	5.03	7.73	10.04	17.74	30.91	35.05	34.54	31.95	28.15	31.06

41. Lesotho	--	--	--	--	--	4.8	7.65	6.45	16.82	8.4	9.22	15.47
42. Liberia	--	--	--	--	--	--	--	--	7.82	15.62	17.74	27.03
43. Libya	75.05	74.9	81.91	85.43	85.44	87.63	87.86	86.6	85.23	82.6	85.18	88.29
44. Madagascar	--	--	--	--	--	--	--	--	--	--	9.43	--
45. Malaysia	17.71	18.3	16.51	17.27	20.12	22.67	24.83	24.95	28.57	25.98	25.01	25.5
46. Mali	--	--	--	--	--	--	22.83	35.9	32.74	34.44	36.95	34.89
47. Mauritania	28.16	26.13	23.6	35.59	38.16	39.7	50.68	36.5	46.83	44.56	47.25	50.03
48. Mexico	19.33	17.67	18.13	20.49	22.41	24	25.2	25.15	26.56	23.1	24.09	26.32
49. Mongolia	26.11	19.23	22.58	27.57	34.56	39.53	54.75	60.65	54.37	57.67	60.71	63.38
50. Mozambique	--	--	--	--	--	--	--	--	5.58	9.89	14	16.4
51. Myanmar	--	--	--	22.16	26.35	26.97	34.25	26.81	27.26	27.14	31.07	48.42
52. Namibia	25.69	28.2	33.38	20.52	22.72	20.96	26.13	26.46	26.12	21.19	21.98	24.94
53. Niger	20.93	18.25	15.87	14.66	14.19	13.77	14.31	16.77	23.72	24.25	23.88	27.61
54. Nigeria	85.99	81.19	72.26	78.86	81.81	85.56	85.62	82	81.94	76.11	78.09	81.05
55. Norway	38.33	42.11	36.26	35.82	36.33	38.52	39.27	35.29	36.95	33.49	32.53	34.05
56. Oman	80.41	76.12	74.66	75.04	75.33	75.91	73.82	70.78	69.62	66.97	69.36	69.92
57. Papua New Guinea	41.7	41.86	33.41	38.32	40.63	46.48	55.18	54.96	50.9	38.69	44.7	45.36
58. Peru	--	--	--	--	29.04	33.19	39.23	39.88	36.73	32.72	35.86	35.06
59. Philippines	--	--	--	--	--	--	--	4.05	3.55	3.9	4.02	3.77
60. Qatar	75.84	70.94	69.11	67.58	62.89	64.15	61.5	59.27	54.2	54.46	59.03	58.32
61. Russian Federation	--	--	28.02	28.71	33.84	39.84	40.43	36.84	37.92	35.82	37.44	38.63
62. Sao Tome and Principe	--	--	--	--	--	0	0	9.27	4.35	--	1.38	4.27
63. Saudi Arabia	72.79	70.71	69.26	71.95	71.08	74.27	74.29	72.15	73.41	69.07	68.97	70.06
64. Senegal	16.16	15.82	17.24	16.69	16.88	15.56	19.63	17.17	19.62	20.45	--	--
65. Sierra Leone	8.76	6.25	9.16	10.84	14.51	17.65	18.64	19.53	17.03	14.74	15.88	28.64
66. Sudan	--	--	--	--	--	--	--	--	72.87	61.77	56.49	53.86
67. Suriname	--	--	--	--	--	--	25.14	40.55	42.5	38.34	34.8	38.08
68. Swaziland	8.8	7.03	8.3	7.86	8.57	11.56	9.41	8.91	10.48	9.15	--	--
69. Syrian Arab Republic	--	--	--	--	53.82	45.51	43.13	38.51	42.49	36.8	38.24	27.32
70. Timor-Leste	--	--	--	27.75	79.09	87.33	77.88	79.65	87.83	86.83	77.74	74.03
71. Togo	--	--	--	--	--	--	--	--	--	--	16.69	12.94
72. Trinidad and Tobago	42.12	40.1	38.41	47.54	45.91	50.92	54.79	51.86	53.22	50.58	47.2	47.69
73. Tunisia	8.98	--	--	--	8.33	10.09	9.93	10.51	11.12	10.07	10.05	9.83
74. United Arab Emirates	59.02	58.53	56.33	58.47	58.34	58.67	61.99	60.58	62.72	53.25	56.87	61.08
75. United Kingdom	4.93	4.86	4.85	4.48	4.75	5.86	5.65	5.49	7.07	5.2	6.05	6.77
76. United Republic of Tanzania	--	--	--	17.31	2.49	8.52	9.66	9.77	9.63	13.47	20.14	19.81
77. Venezuela	62.09	56.7	58.71	63.61	60.88	61.16	60.68	60.1	59.4	40.5	52.57	54.58
78. Viet Nam	30.07	28.31	25.89	26.37	28.94	31.19	30.51	26.61	24.97	20.02	17.4	18.28
79. Yemen	79.89	76.69	75.55	76.24	72.81	75.77	77.68	74.79	78.03	66.84	69.44	75.55
80. Zambia	28.06	27.7	5.96	7.39	4.67	11.03	17.72	29	37.91	41.67	45.41	45
81. Zimbabwe	--	--	--	--	--	--	--	--	--	--	--	19.91

Figure 6 shows EDI scores in 2000 against scores in 2011. The figure further demonstrates our examples of the staples thesis with reference to Mongolia, Nigeria and Botswana. As depicted in Figure 6, Mongolia's EDI value in year 2000 was about 26.11, but by 2011 the value increased to about 63. Hence Mongolia is becoming more dependent on its minerals, before the decline materializes. Nigeria maintains the value of EDI over 80 both in the year 2000 and 2011. Hence over the past decade, Nigeria is not moving along the lines predicted by the staples thesis. In the case of Botswana, the EDI declined from 71 to 62 between 2000 and 2011.

**Figure 6: Scatterplot of EDI scores (2000 and 2011)**

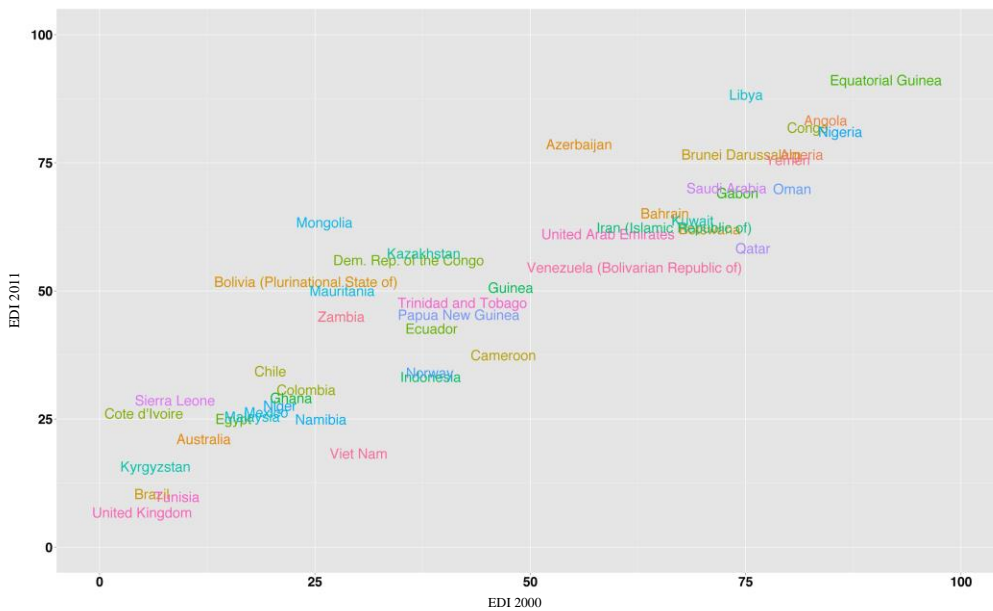


Table 4 compares our EDI results from 2009-2011 against resource dependence classifications made by the IMF, the McKinsey Global Institute (MGI) and ICMM.<sup>24</sup> EDI values were calculated for forty-nine of the fifty-one countries classified as resource dependent by the IMF<sup>25</sup>, all countries, except Albania and Vietnam, have EDI values higher than 25. Because the EDI quantifies resource dependence, it allows for ranking among countries. For instance, while natural resources play an important role in Vietnam and Nigeria, both classified as resource rich by the IMF, the EDI provided

<sup>24</sup> In order to compare ICMM, IMF and MGI classifications, we use the most recent data available out of the 2009 to 2011 EDI results. Both ICMM and MGI use 2010 data in their criteria/classification and the IMF classification looks at 2006 to 2010 period.  
<sup>25</sup> The IMF classifies fifty-one countries as resource rich and twelve countries as LIC/LMIC prospecting natural resource exporting countries

a nuanced picture of the resource dependence between the two countries. Vietnam is less dependent with an EDI score of 18.28 and Nigeria more dependent with an EDI score of 81.05.

Of the eighty-seven countries classified as resource driven by MGI, the EDI was calculated for 69 of the countries. The MGI list of resource driven economies also includes future producers including Afghanistan, Guatemala, Madagascar, Sao Tome and Principe, Togo and Uganda, as well as countries that meet all three criteria, for example Republic of Congo, Norway, Saudi Arabia and Venezuela.<sup>26</sup> One difference is that our EDI ranks Timor-Leste as a relatively high dependence country (EDI score 74.03); however, the MGI does not include Timor-Leste as a resource driven country. Similar to the IMF classification, among those countries in the MGI resource driven list, we cannot compare the degree of dependence between countries.

Lastly the ICMM's MCI for 2010 ranks two hundred and ten countries on the contribution of the non-fuel minerals to the national economies. Zambia ranks the highest on the MCI with a score of 97.7 while it scores 45 on our EDI. Similarly, Australia's MCI score is 87.9 and is ranked 22<sup>nd</sup> on the MCI. However, Australia's EDI score is 21.12. On both the EDI and MCI, Zambia is ranked higher than Australia but there is a larger difference between scores on our EDI than on the MCI. Both the MCI and EDI capture the importance of the sector, however the EDI also evaluates this importance against the performance of other sectors in the economy. Therefore, while Chile and the Republic of Congo rank 12 and 13 on the MCI, their EDI scores are 34.34 and 81.86, respectively. Both Namibia and Tanzania have high mineral exports but the sectors contribution to fiscal revenues and value added are not as high, therefore they rank relatively lower on our EDI with scores less than 25. However, both countries are ranked in the top quartile on the MCI in 2010. Lastly, as the MCI looks at non-fuel minerals, oil rich countries such as Algeria and Nigeria are ranked 103 and 162, respectively while they have EDI scores greater than 75.

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<sup>26</sup> The three criteria are: resource exports greater than 20% of total exports in 2011; resource revenues more than 20% of government revenue on average from 2006 to 2010; and resource rents<sup>26</sup> greater than 10% of GDP in 2011.

**Table 4: EDI scores against ICMM, IMF and McKinsey Classification<sup>27</sup>**

Country	EDI ††	ICMM (MCI 2010)	IMF †	McKinsey†
Philippines	3.77	69.9		
Sao Tome and Principe	4.27	15.6	Prospecting	Future producer
United Kingdom	6.77	52.1		
Jordan	7.96	41.7		
Swaziland	9.15	19.8		
Afghanistan	9.2	40.6	Prospecting	Future producer
Argentina	9.23	51		
Madagascar	9.43	77.1	Prospecting	Future
Tunisia	9.83	30.3		
Guatemala	10.08	60.7	Prospecting	Future producer
Brazil	10.36	79.6		YES
Albania	12.54	56.5	YES	
Togo	12.94	76.2	Prospecting	Future producer
Canada	13.15	67.1		YES
Lesotho	15.47	43.2		
Kyrgyzstan	15.75	56.9	Prospecting	YES
Mozambique	16.4	49.3	Prospecting	YES
Central African Republic	17.02	45.5	Prospecting	YES
Viet Nam	18.28	44	YES	YES
United Republic of Tanzania	19.81	82.3	Prospecting	YES
Zimbabwe	19.91	58.7		YES
Senegal	20.45	67.6		YES
Australia	21.12	87.9		YES
Namibia	24.94	86.5		YES
Egypt	25.02	55.4		YES
Malaysia	25.5	33.4		YES
Cote d'Ivoire	26.1	31.3	YES	YES
Mexico	26.32	55.5	YES	YES
Liberia	27.03	89.2	YES	
Syrian Arab Republic	27.32	58.5	YES	YES
Niger	27.61	55.9	YES	YES
Sierra Leone	28.64	51.3	Prospecting	YES
Ghana	29.11	84.9	Prospecting	YES
Burkina Faso	29.81	90.2		YES
Colombia	30.69	59.4		YES
Lao People's Dem. Rep.	31.06	91.1	YES	YES
Indonesia	33.24	66.4	YES	YES

<sup>27</sup> **Resource driven countries (MGI)** for which EDI values were not calculated due to lack of data: Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Eritrea, Iceland, India, Israel, Jamaica, South Korea, Lithuania, Northern Mariana Islands, New Caledonia, South Africa, Tajikistan, Turkmenistan, Uganda, Uzbekistan. **Resource rich countries (IMF)** for which EDI values were not calculated due to unavailable data include: Turkmenistan, Uzbekistan and Uganda (prospecting). **Mining Contribution Index (ICMM)** is calculated for 212 countries, listed in Table 4 are those for which the EDI could be calculated. Countries not included in the table did not have sufficient data for EDI values to be calculated.

Norway	34.05	37.8	YES	YES
Chile	34.34	92.1	YES	YES
Mali	34.89	94.2	YES	YES
Peru	35.06	88	YES	YES
Cameroon	37.47	27.7	YES	YES
Suriname	38.08	85.9	YES	YES
Russian Federation	38.63	47.6	YES	YES
Ecuador	42.66	34.5	YES	YES
Guyana	42.92	93.1	YES	YES
Zambia	45	97.7	YES	YES
Papua New Guinea	45.36	95.5	YES	YES
Trinidad and Tobago	47.69	52.4	YES	YES
Myanmar	48.42	55.4		YES
Mauritania	50.03	95.3	YES	YES
Guinea	50.65	65.3	YES	YES
Bolivia	51.79	88	YES	YES
Sudan	53.86	49.4	YES	YES
Venezuela	54.58	33.6	YES	YES
Dem. Rep. of the Congo	56	93.2	YES	YES
Kazakhstan	57.32	54	YES	YES
Qatar	58.32	28.3	YES	YES
United Arab Emirates	61.08	86.6	YES	YES
Botswana	62.04	61.9	YES	YES
Iran	62.35	54.7	YES	YES
Mongolia	63.38	93.3	YES	YES
Kuwait	63.74	25.5		YES
Bahrain	65.12	82.5	YES	YES
Chad	65.88	18.4	YES	YES
Gabon	69.11	64.2	YES	YES
Oman	69.92	65.8	YES	YES
Saudi Arabia	70.06	23.1	YES	YES
Timor-Leste	74.03	14.6	YES	
Yemen	75.55	22.9	YES	YES
Algeria	76.61	47.8	YES	YES
Brunei Darussalam	76.62	20.3	YES	YES
Azerbaijan	78.62	13.3	YES	YES
Nigeria	81.05	28.6	YES	YES
Congo	81.86	91.5	YES	YES
Angola	83.28	17.2	YES	YES
Libya	88.29	30.4	YES	YES
Equatorial Guinea	91.13	34.2	YES	YES
Iraq	92.43	29.5	YES	YES

†† Latest EDI values 2009 – 2010; † YES indicates that the country is included in the classification and blank if not included.

## 5. Concluding Remarks

Dependence on the oil, gas and mineral industry is often measured by the share of earnings from these commodities in total export earnings and by the tax revenue generated from these commodities as a share of total fiscal revenue.

Alternatively, the composite index we introduced in this paper focuses on adjusted variables consisting of: a) the share of export earnings from extractives in total export earnings; b) the share of revenue from extractives in total fiscal revenue; and c) extractives industry value added in total value added. We adjust these indicators to capture countries' productive capabilities, which determine the presence of alternative sources of export earnings, tax revenues and a diversified industrial sector.

The comparison between Zambia and Norway is instructive. For instance, traditional dependence measures of extractives dependence would not have accounted for Zambia's relatively lower domestic productive capacity. The countries have very similar values for export earnings and revenues from extractives. Thus, under the traditional measures of dependence, without taking into consideration the productive environment under which the extractive sector exists, the two countries would be considered as being equally dependent on the extractive sector.

To a large extent, the EDI reflects the prevailing trends in global commodity prices and does not differentiate between changes in the level of dependence resulting from short-term external shocks or long-term trends. Lower dependence, for instance, could reflect low global prices, as was the case for countries including Angola, Norway, Kuwait, and Nigeria during the economic and financial crisis that started in 2008. Decline in dependence could also reflect decline in global demand for main commodity exports – for instance through fall in revenues from the sector – and not necessarily greater diversification in its manufacturing or tax revenue base.

Nevertheless, at a given point in time and under prevailing economic conditions, the index quantifies how dependent countries are on oil, gas and mineral extraction.

## Annex:

### Data and sources

**EIX** is export revenue from oil, gas, and minerals as a share of total export revenue (Source: UNCTADStat and calculated using SITC product codes 27, 28, 68, 321, 322, 325, 333, 334, 335, 342, 343, 344, 355, 667, and 971).

**HTM** is export revenue from high-skill and technology intensive manufactures as a share of total HTM exports (Source: UNCTADStat using trade products by group. For classification method, see <http://www.unctad.info/en/trade-analysis-branch/data-and-statistics/other-databases/>).

**Rev** is revenue generated by the extractive industry as a share of total fiscal revenue (Source: Arab Monetary Fund; IMF estimates (for methodology see: *Fiscal Regimes for Extractives Industries: Design and Implementation*, Fiscal Affairs Department and Resource Blessing, Revenue Curse? Domestic Revenue Effort in Resource-Rich Countries by Ernesto Crivelli and Sanjeev Gupta); Extractive Industries Transparency Initiative (for countries that report revenue from profits/taxes, royalties, government production entitlement and other significant benefits to the government)); and International Centre for Tax and Development. Supplemented by national statistics data for Australia, Bolivia, Brazil, Canada, Myanmar, Norway, Timor-Leste and United Kingdom)

**NIPC** is the total non-resource tax revenue from income, profits and capital gains as a share of GDP (Source: International Centre for Tax and Development, IMF Government Financial Statistics and IMF World Economic Outlook). For missing data, mean was imputed using data from 2000 onwards<sup>28</sup>. Instead of NIPC, for Angola, Albania, Azerbaijan, Bahrain, Cote d'Ivoire, Congo, Rep., Colombia, Ghana, Guinea, Guinea-Bissau, Guyana, Indonesia, Iraq, Kuwait, Mauritania, Niger, Sudan, Chad, Togo, Timor-Leste, Vietnam, Congo, DRC, non resource tax (%GDP) was used.

**EVA** is extractives industries value added as a share of total value added (Source: World Bank's African Development Indicators; African Economic Outlook; Arab Monetary Fund; UNSD National Accounts Main Aggregates; Caricom Stats; OECD StatExtracts and supplemented by data

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<sup>28</sup> For Guinea, Indonesia and Vietnam, values were imputed using data from 1990 onwards.



gathered from national statistics departments for Afghanistan, Albania, Australia, Azerbaijan, Bahrain, Brazil, Canada, Colombia, Guyana, Indonesia, Iran, Kazakhstan, Malaysia, Mongolia, Mozambique, Norway, Tanzania, Timor-Leste, United Kingdom, Vietnam and Zimbabwe)

***MVA*** is the per capita manufacturing value added (Source: World Bank World Development Indicators, and African Development Bank Group, Open Data for Africa)

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