

The Global Economic Diversification Index 2022



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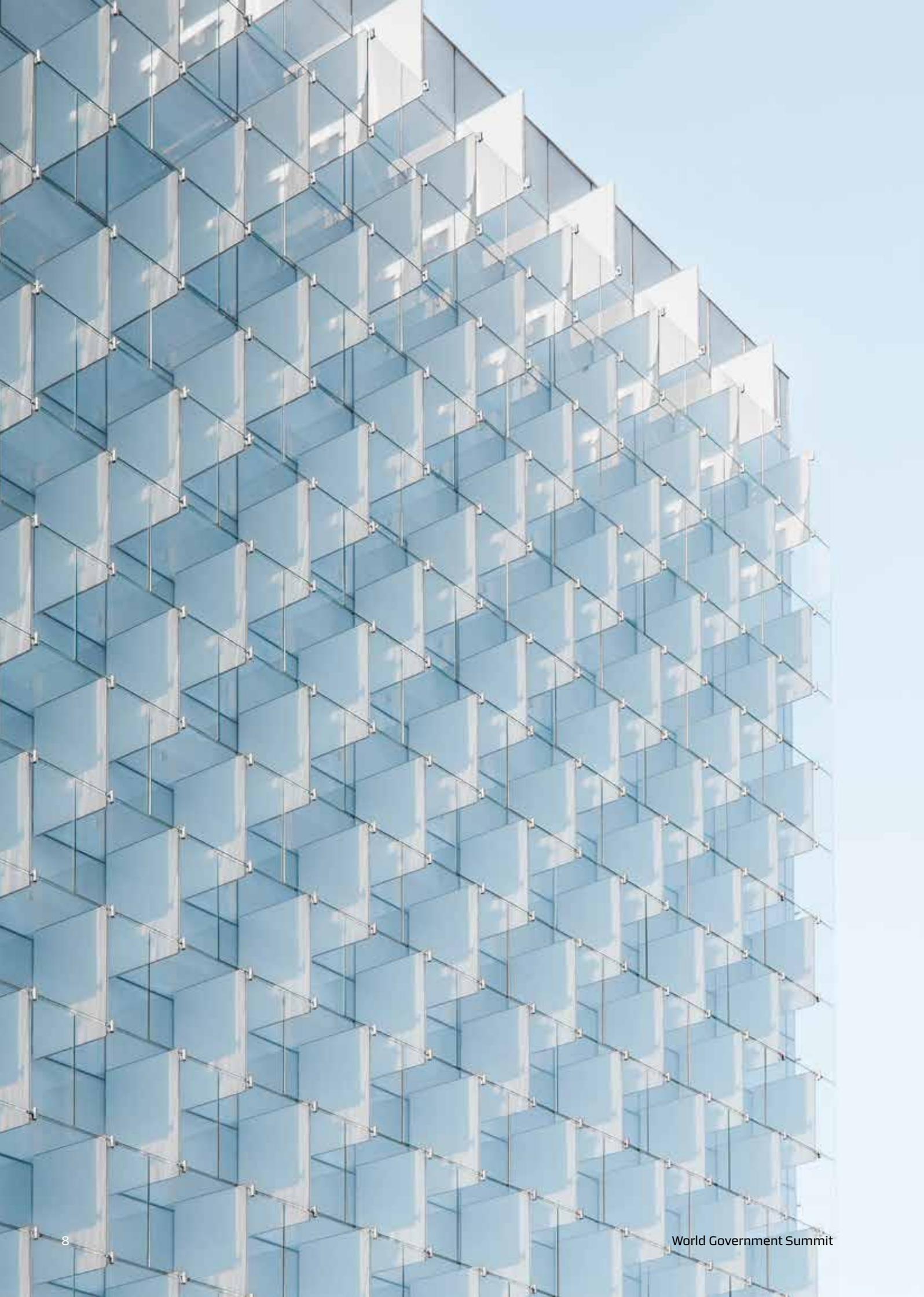


Table of Contents

Executive Summary	10
Introduction	16
Benefits of Economic Diversification	23
How Do Nations Diversify?	24
Making the case for the EDI	28
Measuring Economic Diversification	30
Background on Constructing the Global Economic Diversification Index (EDI)	38
Measuring Diversification: the EDI's Approach and Methodology	40
Methodology & Data	56
Conceptualizing and Realizing the EDI	58
Data Pre-Treatment	59
Assessment of Candidate Methodologies	60
PCA Output	62
Main Results	66
Global Rankings Over Time	67
Regional Performance Over Time	76
Have Commodity Dependent Nations Diversified?	83
Concluding Remarks & Way Forward	92
Bibliography	96
Appendix A. Data Indicators & Metadata	100
Appendix B. Regional, Income & Commodity Producers Groupings	106
Appendix C. Mathematical Appendix	110
Acknowledgments	112
Copyrights	113

Executive Summary

The well-known Natural Resource Curse (or Paradox of Plenty) implies that nations/regions with an abundance of natural resources tend to have lower and more volatile economic growth.

Extensive research finds that resource-abundant countries tend to underperform their resource-poor counterparts, with evidence of a negative relation between real GDP growth per capita and resource exports. Resource-based economies also suffer from exposure to adverse external shocks, rendering them vulnerable to macroeconomic instability.

Economic diversification is key in addressing issues related to macroeconomic stability, economic growth and development.





Economic diversification has become an everyday term in the lexicon of oil exporters, the Gulf Cooperation Council (GCC) countries and natural resource dependent countries. While diversification efforts have been underway in many fossil fuel-based economies (including in the GCC) in the past several decades, there has been little effort to quantify outcomes or assess the success of such policies. The Global Economic Diversification Index aims to fill this gap. While trade diversification has been extensively covered in academic works, this examines diversification from a multi-dimensional angle, exploring income/activity, trade and government revenue diversification. **We identify and examine some 25 indicators spanning a combination of the three dimensions of diversification – output, trade, and revenue – across a total of 89 countries over the past two decades. The report also examines a wider spectrum of commodity-dependent nations versus a subset of oil and gas exporting economies.**

We define a country as resource dependent if over 60% of its total merchandise exports in value terms consist of natural resources and the ratio of natural resources exports to GDP is above 10%.

These nations' tax revenues as a percentage of GDP fall mostly below 20%.

To ensure transparency and replicability, the EDI is based solely on publicly available indicators, data and information. Additionally, the EDI is built using quantitative indicators only, and no survey or perception indicators.

The econometric setting for the EDI is a panel with a significant number of cross-sections: this consists of a large number of indicator series and relatively short time series. The objective is to design a weighting scheme such that the large number of indicators can be reduced to a smaller number of diversification indices: potentially three sub-indices (production, trade, and government revenue), and a combined global diversification indicator. The complete indicator input dataset covers comparable data on 89 countries over the 2000–2019 period. After assessing multiple methodologies, principal component analysis was chosen to generate the EDI.

Key Findings



Overtime, the gap between the most and least diversified nations has widened, instead of narrowing. For the least diversified nations, overdependence on commodity prices has meant volatility in growth and a long path to catch up to the top performers. Hence, the evidence does not suggest growing convergence between the most and least diversified nations.



Seven nations have consistently remained in the top 10 ranks across the entire period. All are among the high-income nations and of these, other than the US and two Asian nations (Japan and Singapore), all others are from Europe. China joined the top 10-league from 2008 onwards. Services-led nations stand out among the top-ranked - the UK, Ireland, Singapore and Switzerland to name a few - highlighting the rising importance of the services sector (and adoption of new technologies) and its pivotal role in enabling a “catch up” with established highly industrialized nations. On the other end, 7 nations have remained in the bottom 10, with 4 oil producing nations (2 from the GCC) and 2 low-income and agriculture-dependent countries.



Over the 2000–2019 period, the nations that have **most improved their EDI scores include China, the US, Saudi Arabia, Germany and Oman:** that only two among them are oil-exporting nations underscores the urgency of diversification efforts. The GCC nations, with the exception of Bahrain, are among the top 20 nations that have improved EDI scores over the entire period.



Low and lower-middle income nations within the commodity-producing nations have the lowest EDI scores overtime. While ranked relatively high within this group, Australia and New Zealand have slipped into the 40th to 50th percentile in 2019. Among the GCC nations, Saudi Arabia notably has made a significant improvement in the recent years, and while the UAE continues to rise in the rankings (69th in 2000 to 57th in 2019), Bahrain’s performance has stagnated over time (after being a first mover in terms of diversification efforts). Oman and Kuwait are low ranked, but the former has embarked on a diversification path (translated into a significant improvement in scores compared to 2000) while the latter has lacked a willingness to undertake economic reforms (via the Parliament).



Regional performance identifies **North America as the best performer** and **Sub-Saharan Africa as the worst performer** on a comparative basis despite increasing scores over time across overall EDI and most sub-indices. The fastest pace of improvement in the EDI has been within the MENA region, followed by the Eastern European & Central Asia and the Western European regions. In the MENA region, the uptick has picked up pace in the last few years (2016-19) likely reflecting the renewed focus on driving non-oil private sector growth as well as new revenue enhancing measures such as VAT and excise taxes.



There is a **positive correlation between the EDI and GDP per capita**. The UAE and Norway are examples of nations in the process of diversification, both inching closer to the mean EDI score in 2019. By 2019, almost all countries resource rents readings have declined (versus 2000), and many have improved on their EDI scores.



Breaking down the EDI by the three sub-indices shows that:

- More than 90% of the countries tracked have improved their output diversification score between 2000 and 2019. Ranked highly are financial hubs like Switzerland and Singapore in addition to the usual suspects US, Germany, China and Japan.
- In the trade sub-index, the leading exporting nations stand among the top 10. Close to three-quarters of the nations have made significant improvements over the time period, underscoring increased trade linkages and globalization efforts post-2000 (especially after the entry of China into the WTO). A few services exporting nations have also made significant gains - like Singapore and Ireland. In the Middle East, several non-oil exporting nations have surpassed the GCC rankings - notably Morocco, Tunisia and Jordan which have a relatively more diversified export basket and diverse set of trade partners.
- Unsurprisingly, Nordic countries rank highly in the revenue sub-index (due to high and diverse taxes) while many commodity producers rank near the bottom.

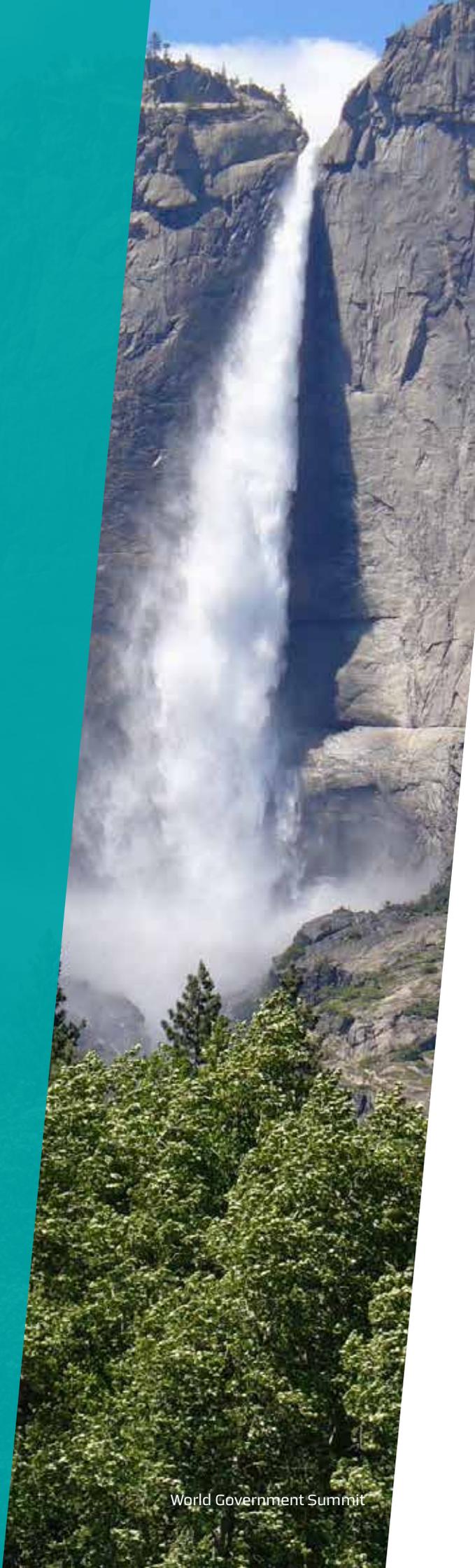
Dimensions of Diversification and the Global EDI

A data-driven approach facilitates evidence-based policymaking:

- Informs the design of strategy, policy measures and tools
- Allows for evaluation of policies' impact
- Gauges effectiveness of policies by interpreting the evidence
- Enables monitoring of outcomes of policies as well as help identify problem areas

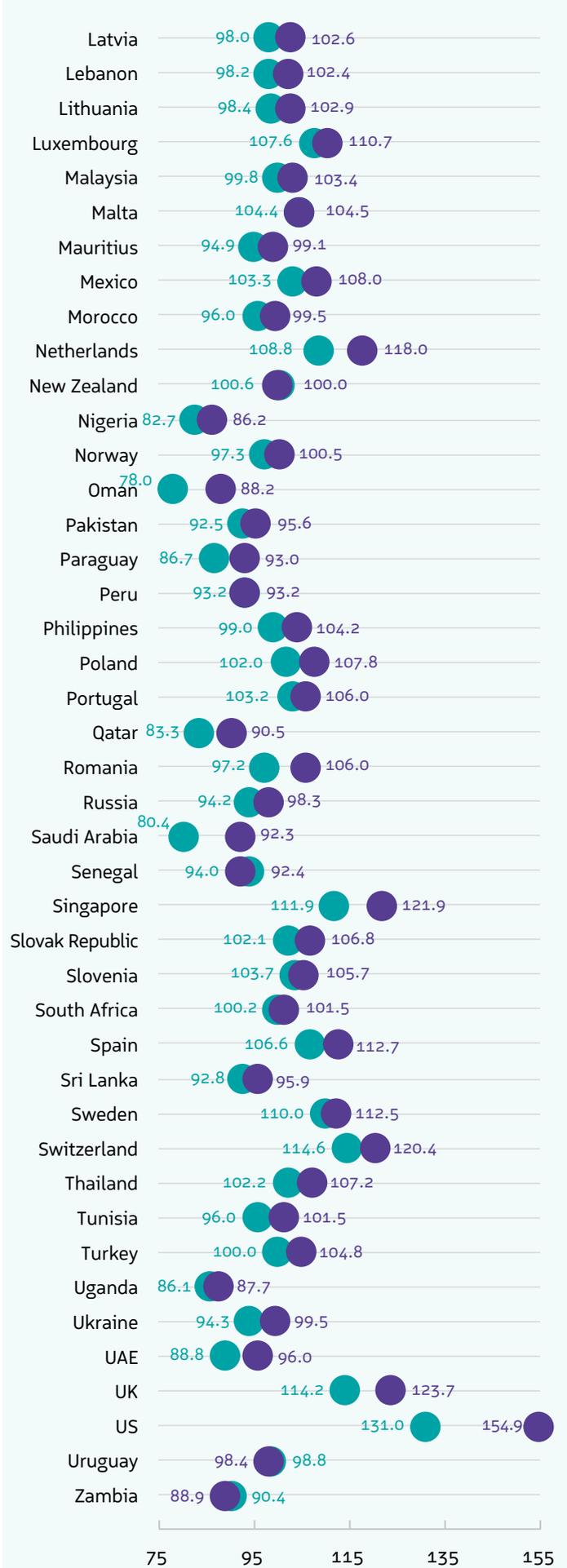
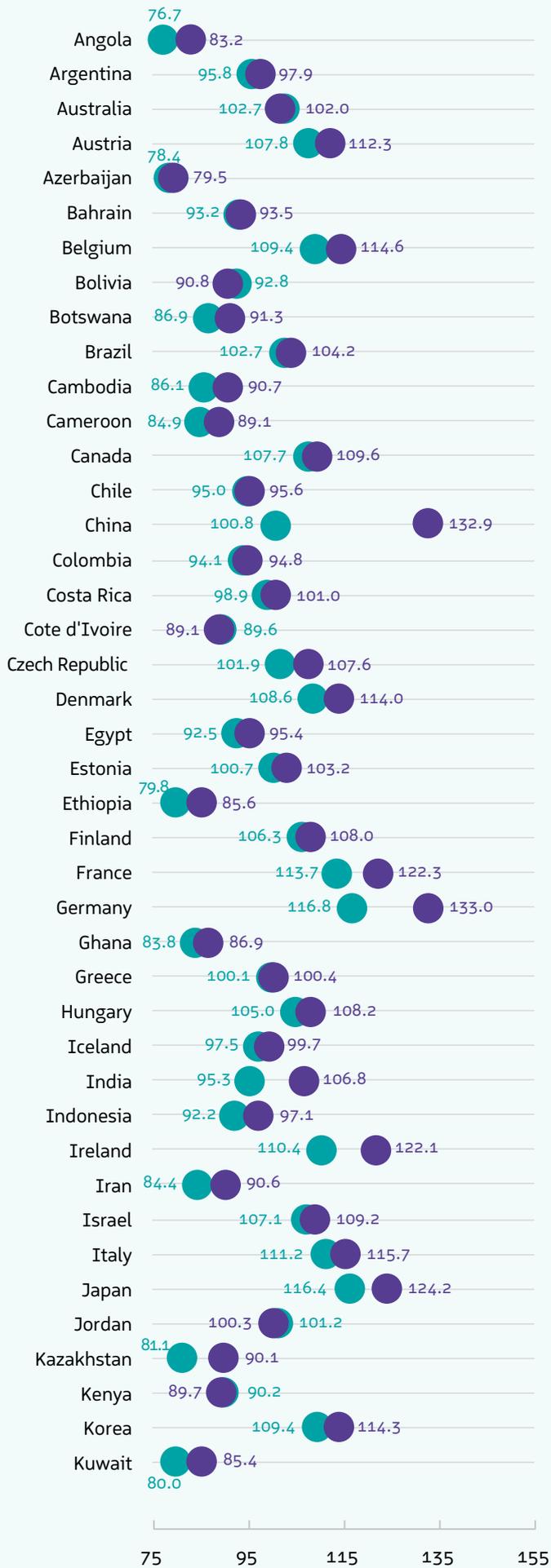
The next phase of the EDI will focus on the underlying factors, strategies and policies that matter for and drive diversification. The policy challenge facing resource-dependent countries is how to successfully turn resource rents into an engine of growth rather than a barrier to economic development, avoiding the 'resource curse.' There have been examples of countries overcoming natural resource dependence: Norway, Australia, Chile and Malaysia are a few examples. There are others, like Nigeria, that remain persistently mired in resource dependence.

So, what sets them apart? Analysis combining economic, structural and institutional factors is likely to provide the answer. Among macroeconomic variables that act as drivers of diversification are the real exchange rate (an overvalued exchange rate, via reduced profitability, discourages entry of investors into new economic activity/products), inflation (correlating negatively with private sector development), net inflows of foreign direct investment (FDI), terms of trade (higher the terms of trade, the greater the export concentration) and private investment as a share of GDP (positive impact on diversification). Greater trade liberalization and greater access to and inclusiveness of finance support export diversification while structural factors like population, human capital (via specialization, increased skills, level of innovation and higher productivity), infrastructure and institutions also support greater economic diversification.



EDI Scores 2000 vs 2019

● 2000 ● 2019



Chapter 1

Introduction



The call for greater economic diversification efforts is growing stronger in oil and gas exporting nations given the high volatility of fossil fuel prices and their impact on macroeconomic stability. Ever more ambitious global commitments (UN COP and related) to address climate change through swift climate action have added to the urgency of economic diversification **given that oil and gas account for 31.81% and 21.26% of global greenhouse gas (GHG) emissions in 2020¹**. Initiated as a policy to reduce the macroeconomic impact of oil price volatility, diversification efforts now also double as a move to a greener economy. While diversification efforts have been underway in many fossil fuel resource-based nations (principally in the GCC) in the past two decades, there has been little effort to quantify outcomes or assess the success of such policies.

This report examines the underlying theoretical rationale for economic diversification and proceeds to quantify and develop a Global Economic Diversification Index.

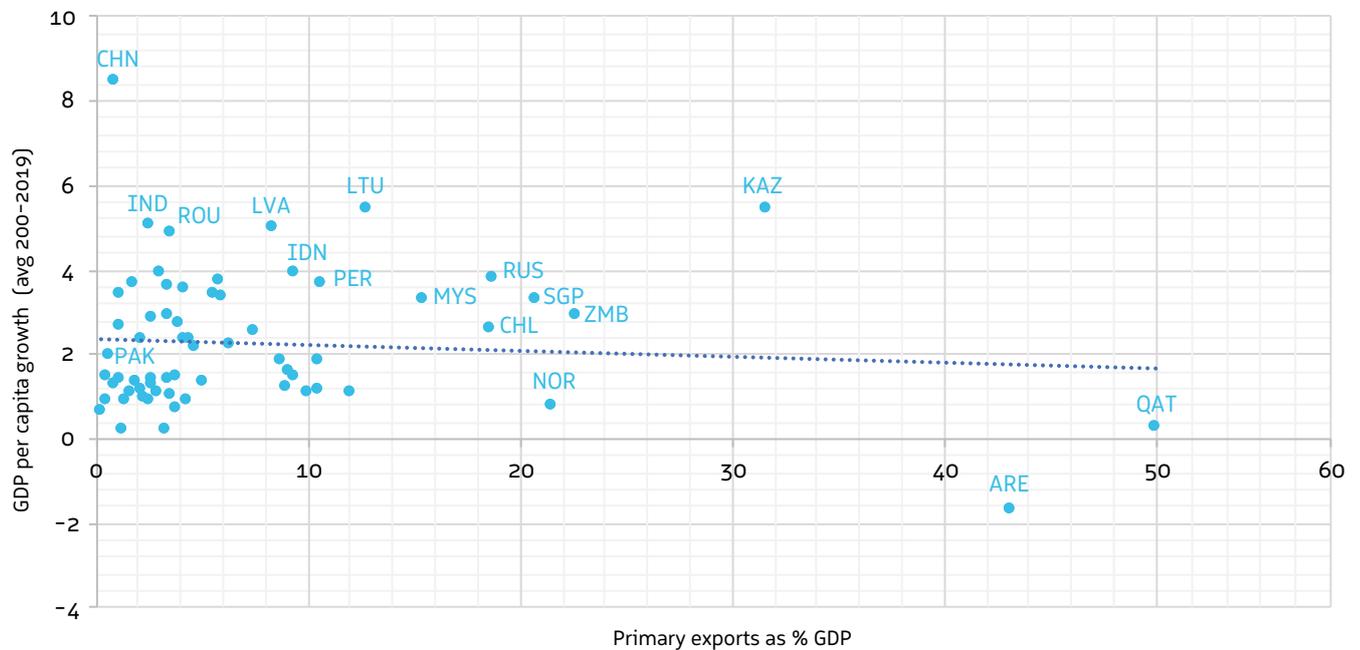
¹ Source: <https://ourworldindata.org/emissions-by-fuel>

Countries with plentiful natural resources tend to suffer from the Natural Resource Curse (also known as the Paradox of Plenty), referring to the paradox that countries and regions with an abundance of natural resources, specifically non-renewable resources like minerals and fuels, tend to have lower and more volatile economic growth (e.g. some Middle Eastern nations in the 1980s reporting negative growth) and worse development outcomes than countries with fewer natural resources. Sachs and Warner (2001) found that resource-rich economies tend to grow more slowly, and lag, on average, behind resource-poor economies, with a robust negative relationship between real GDP growth per capita and the ratio of resource exports to GDP in a sample of 97 developing countries over the period 1970–1989.

The paper also finds that

a one standard deviation increase in primary products export share **reduced the country's growth rate by 0.6-1.5% points.**

A Negative Relation Between GDP per Capita Growth and Primary / Fuel Exports



The natural resource curse is also associated with the so-called 'Dutch disease' whereby the concentration of income from natural resource exports negatively impacts a nation's non-natural resource sectors by causing an increase of the real exchange rate and wages.

This pattern was evident in the Australian gold booms in the 19th century, oil-rich nations in the early 70s and Colombian coffee in the late 70s among others. Real exchange rate appreciation weakens competitiveness of the country's exports, causing traditional export sectors to shrink - together labelled the spending effect.

Harding and Venables (2013) find that the response to a resource windfall is to decrease non-resource exports by 35-70%. This goes hand-in-hand with the resource movement effect, i.e. resources (capital and labour) shift to the production of domestic goods that are not traded internationally (e.g. construction industry) - to meet the increase in domestic demand - and to the booming natural resource sector, thereby resulting in a

decline in production in the traditional export sectors. Ismail (2010) finds that a 10% oil windfall is on average associated with a 3.4% fall in value added across the manufacturing sector.

Various Sachs (1995, 1999, 2001) papers show the impact of wealth shocks creating excess demand for non-traded products and driving up input costs and wages.

While the resource sectors tend to generate large financial revenues, they are unlikely to generate commensurate jobs (either direct or indirect) given their intensive capital nature and limited ability to generate forward and backward linkages, resulting in limited spillover effects on the rest of the economy, also minimising productivity gains. Gylfason (2001) finds that commodity resource abundance also crowds out human capital, entrepreneurial activity and innovation (discouraged by rent-seeking behaviour).

The rentier state argument is important in this context. **The rentier economy² is characterized by:**

A prevalence of rent extraction versus productive activity

Exports earnings mitigate need for a productive domestic sector

Domestic employment is taken up by distribution or consumption of rent, not in productive enterprise

Government budgets can rely on rent for operating revenues

One of the common tenets associated with a rentier model is **'no representation without taxation.'** Most oil-rich rentier states have relied on a combination of rents and minimal taxation for their state revenues, and when levied, taxes fall on its own agencies (for example, state-owned companies in the oil sector) and foreign companies³. The result is a lack of diversification and the concentration of government revenue from natural resource rents.

More recent empirical analysis has called into question **whether the 'resource curse' hypothesis holds true**, with research emphasizing the role of institutions in determining the path of economic development in resource-abundant countries (Gylfason, Herbertsson, and Zoega's (1999), Mehlum et al (2006), Lederman and Maloney (2007), Bravo-Ortega and de Gregorio (2007) and others.

Frankel (2010) finds that **"endowments of 'point source' commodities (oil and minerals and some crops) can lead to poor institutions, such as corruption, inequality, class structure, chronic power struggles, and absence of rule of law and property rights."** There exist, however, cases of resource-rich countries which have performed well or exceptionally well in terms of resource wealth management and economic as well as institutional development in comparison to their resource-rich peers (e.g. Norway and Indonesia versus Nigeria and Venezuela).

Bjørnland and Thorsrud (2014), using a Bayesian Dynamic Factor Model (BDFM) for Australia and Norway find that **a booming resource sector has substantial productivity spillovers on non-resource sectors.**

A related stylized fact is that **natural commodity dependence leaves countries vulnerable to commodity market and price shocks and volatility** by increasing exposure to adverse external shocks and vulnerability to macroeconomic instability.

There are two major impacts related to commodity-price fluctuations that typically lead to large terms of trade variations:

1

export revenues increase (decrease) as commodity price increases (decreases)

2

government spending increases during a price boom and falls when prices drop

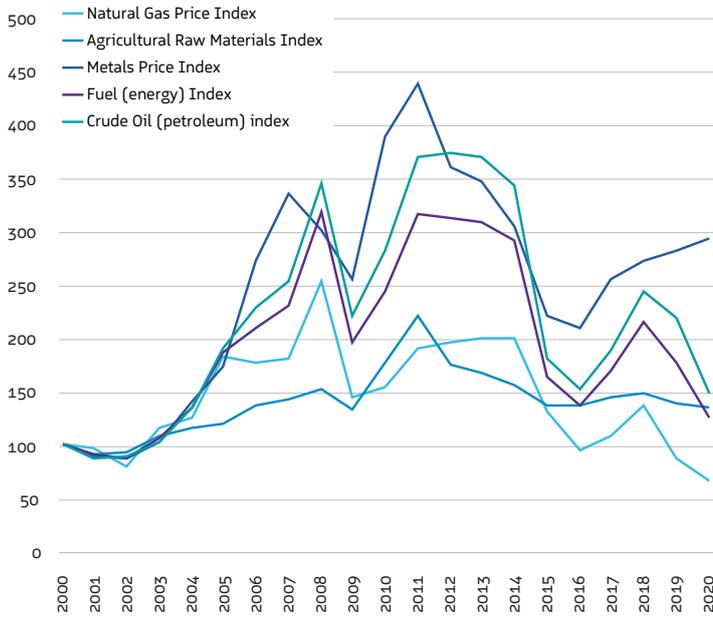
This procyclicality has been observed extensively in oil-producing nations, and is at times accompanied by a reduction in capital spending to finance deficits. The result is a commodity boom-bust cycle that is exacerbated by pro-cyclical fiscal policy.

² See Beblawi 1987.

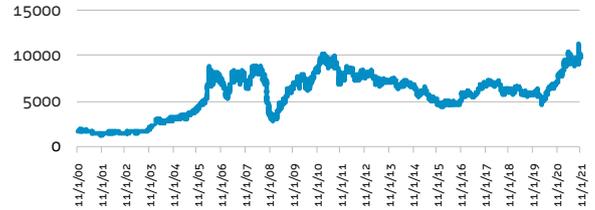
³ In recent years, many of these oil-exporting nations have introduced taxes and embarked on a phased removal of subsidies. This runs contrary to the "social contract" stipulations in the rentier state literature. Krane, in a chapter on "Subsidy reform and tax increases in the rentier Middle East" (<https://www.bakerinstitute.org/files/13993/>), suggests that social contracts are "less rigid than portrayed in the rentier literature".

Variations in Commodity Prices During the Period 2000-2020

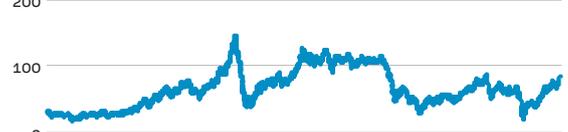
Commodity Price Fluctuations 2000-2020



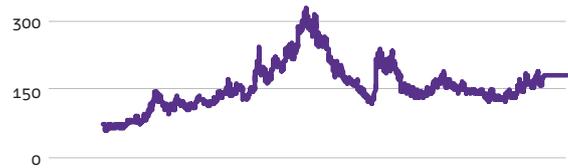
Copper Price (LME - Copper Grade A Cash USD/MT)



Brent Oil Price (USD/bbl)



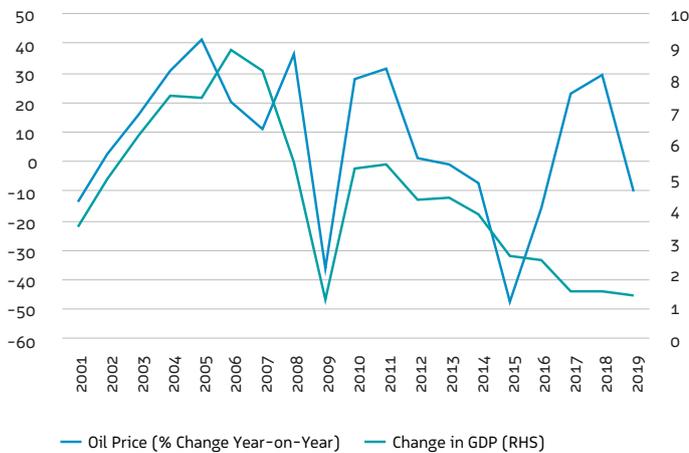
Coffee - ICO Colombian Arabica NY c/lb



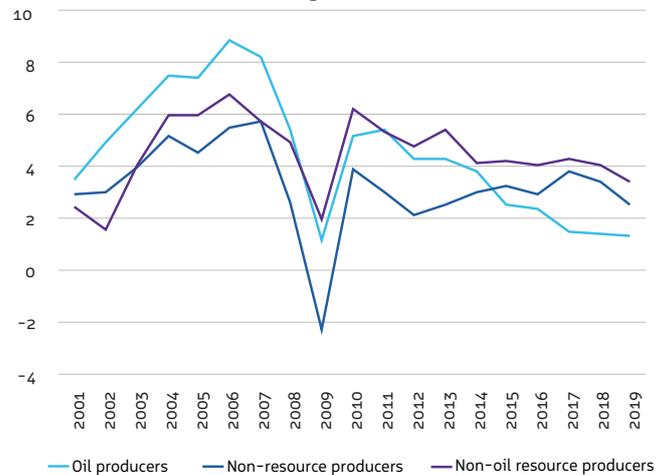
Source: International Monetary Fund, World Economic Outlook Database, Oct 2021, Refinitiv

Volatility of Economic Growth in Resource-Based vs Non-Resource-Based Economies

GDP Growth In Oil-Producing Countries Fluctuates With Oil Price Movements



Volatility in GDP Growth is Highest Among Oil Producers



Source: World Bank WDI

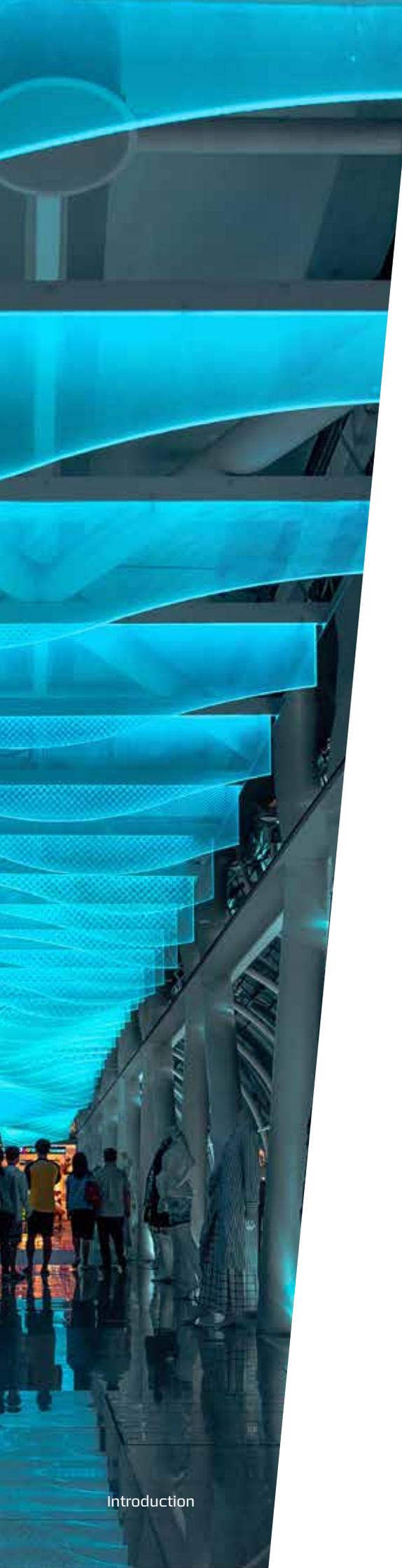
Erbil (2011) finds that fiscal variables are strongly procyclical in oil-producing countries during the period 1990-2009, government expenditure is procyclical in low- and middle-income countries, but countercyclical in high-income countries that implement income stabilization policies. The difference seems to stem from external financing constraints as well as political and institutional factors. Oil stabilization funds and sovereign wealth funds, which accumulate government windfall revenues, have been increasingly used by oil-producing nations as an instrument to cope with oil revenue volatility.

Furthermore, fossil-fuel subsidies are a substantial drain on government finances in many of these nations. Coady et.al. (2019) finds that “pre-tax subsidies” (i.e. energy prices consumers pay that are below the costs incurred to supply them with this energy) are highest in the Middle East, North Africa, Afghanistan and Pakistan (MENAP) region at USD 152bn (for the year 2017) followed by the CIS nations (USD 49bn); post-tax subsidies (sum of pre-tax and tax subsidies; “reflect[ing] differences between actual consumer fuel prices and how much consumers would pay if prices fully reflected supply costs plus the taxes needed to reflect environmental costs and revenue requirements”) accounted for 13% of regional GDP in MENAP, largely due to the substantial undercharging for supply and environmental costs of petroleum.

Fiscal gains from the removal of subsidies for the MENAP region are estimated at around

22% of government revenue

7% of regional GDP.



Benefits of Economic Diversification

Economic diversification is key to addressing these macroeconomic stability, economic growth and development issues. To address these risks, oil & gas exporters and other commodity exporters have focused on economic diversification as a policy priority and objective of their economic strategies.

Two critical questions which need to be addressed are:

What are the benefits of economic diversification?

How can nations diversify?

Economic diversification leads to more balanced economies and is key to sustained economic growth and development. For the GCC and other fossil-fuel producers and exporters it would help reduce exposure to volatility and uncertainty in the global oil market and avoid the related boom-bust cycles. More diversified economies are less volatile in terms of output, while lower output volatility is associated with lower overall economic uncertainty for households, businesses and governments and higher economic growth prospects.

Economic diversification can further support:

Re-orienting economies towards more knowledge based and innovation-led activities

Greater private sector activity, including in the tradables sector

Greater skill diversity in the labor force, higher labor mobility and lower transition costs, job creation, increased productivity growth and more sustainable growth

More sustainable public finances that are less dependent on revenues from natural resources

Greater private sector investment given more stable economic growth rates

Greater overall macroeconomic stability including of disposable income and consumption

How Do Nations Diversify?

Theories of economic growth start from the basic Malthusian classical growth model which posits that exponential population growth would outstrip available resources, resulting in decreasing returns to production and declining growth. Neoclassical growth theory takes a less dismal view by allowing for productivity growth, with economic growth a function of labor, capital and technology inputs. The seminal Solow–Swan growth model is the most popular. Variations include models incorporating land and depletable natural resources such as oil & gas and mineral resources.

In contrast, endogenous growth theory postulates that growth is generated due to internal factors, including technological progress (which is made endogenous unlike in standard neo-classical models).

Economic diversification is intrinsically linked to structural transformation

The shift from agriculture towards industry (in the 60s–70s), and increased globalization and technological change (e.g., ICT) produced a move towards services. Endogenous growth theory literature also highlights the importance of the nature of the sector in which a country specializes, as the returns to scale depend on the sector itself. Such transformations are well documented: many of today’s highly industrialized nations (e.g., East Asian nations) have seen massive transformations from their predominantly agriculture-based, low-productivity economies towards creating new, high-productivity, jobs in mostly urban-based economic activities that facilitate growth. In recent decades, there has been a similar move

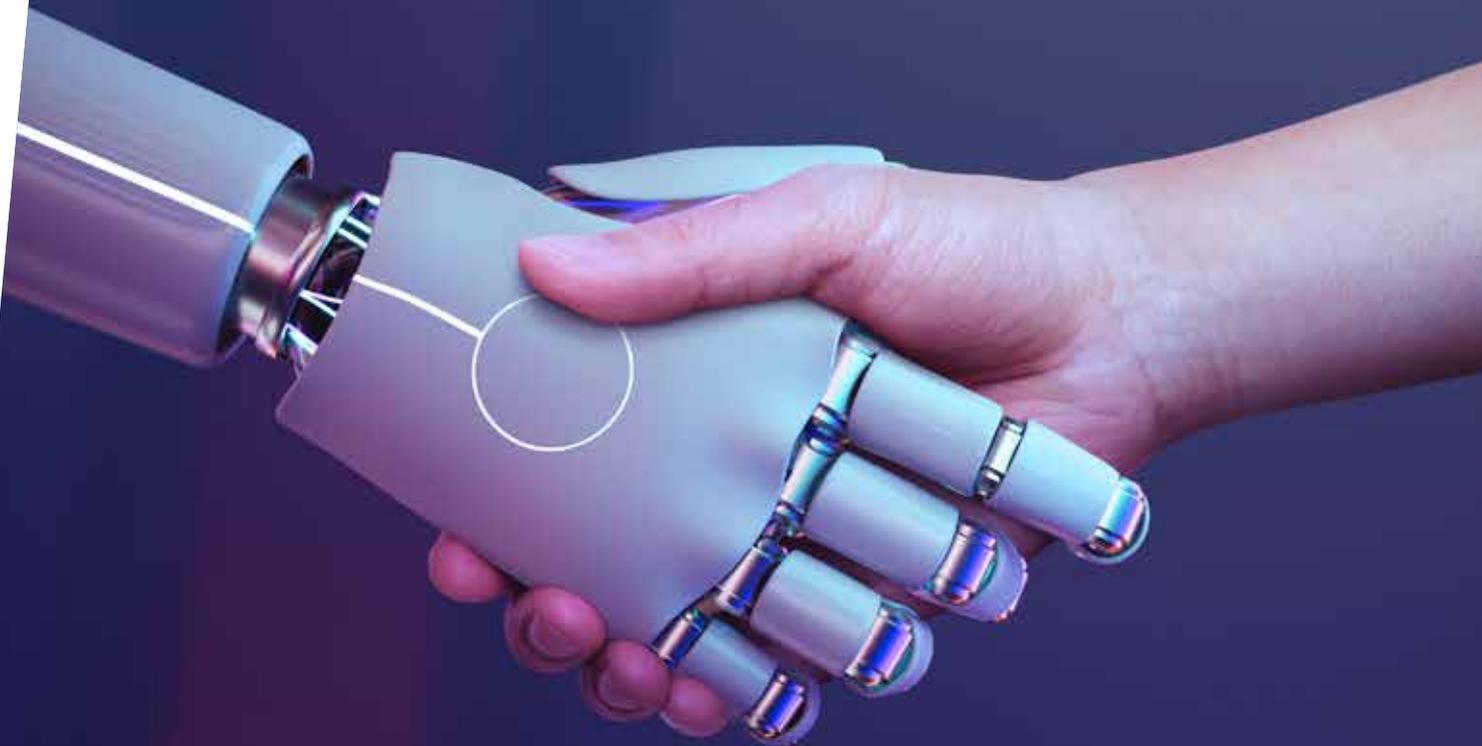
from manufacturing towards services – the latter now accounts for much of the value added and most of the employment in the OECD countries.

Successful production diversification involves resource reallocation across and/or within industries from low-productivity activities to those with higher productivity and higher value added.

Increases in income per capita at early stages of development are typically accompanied by a transformation in a country’s production and export structure. Imbs and Wacziarg (2003) find stages in diversification which tend to follow a U-shaped pattern: countries first diversify with economic activity spread more equally across sectors as countries’ levels of GDP per capita increase, but relatively late in the development process, at a transition point, sectoral distribution tends to move back to re-specialization. Essentially, economic development is associated with increasing diversification in lower- and middle-income countries but reverts to growing specialization at higher per capita income levels. Bahar and Santos (2018) find that natural resource rich countries tend to be outliers in the income per capita versus concentration of exports relationship: not only does a larger share of natural resource exports increase non-resource export concentration (a displacement effect), but also capital-intensive export products (versus labor-intensive ones) tend to dominate the export baskets of such nations. **The introduction of technology into the mix affects outcomes:**

use of new technologies can lead to greater automation (for example, within agriculture, enabling the move to higher productivity activities or the move to the 4th Industrial Revolution), more innovation and allow countries to catch up to the 'technological frontier,' which can lead to greater diversification and structural transformation.

Hidalgo et al. (2007) and Hausmann et al. (2014) suggest that countries diversify by moving away from products they specialize in to others that require similar capabilities and hence occupy an adjacent 'product space.' A 'complexity' index is created that includes both the export diversity of the countries that produce it and the number of countries that export it. Natural resources appear in the low-density, low-complexity part of the product 'forest' relative to other goods, and might therefore offer fewer possibilities for jumping to other industries, making it the single most difficult category of goods to diversify from. Crude oil has by far the lowest rating of all products, followed by iron ores and cotton. Ahmadov (2014) and Lederman and Maloney (2012) also find that among primary commodities, oil is the most strongly correlated with export concentration.



Additionally, as globalization deepens and participation in global value chains (GVCs) expands, countries can create value by focusing on intermediate products/inputs and not necessarily on a final, complete product.

There are two kinds of GVCs:

Simple

wherein the input crosses the border once for production i.e., use of steel in buildings; and

Complex

where it crosses the border at least twice e.g., components production and assembly for iPhones.

Studies have found that participation in GVCs promotes not only output growth, but also productivity growth across sectors.

If a country's production is unbalanced in favour of a particular sector/product, especially in resource-rich countries, growth tends to fluctuate along with the price of these commodities. **Conversely, the more diversified, the less vulnerable is a nation to swings in product or natural resource prices.** Similarly, countries that are highly dependent on the export of one or a set of commodities or have a limited number of trading partners are relatively more vulnerable to external shocks. **Empirical studies finding that resource dependence undermines long run economic performance are aplenty.** Often, smaller, land-locked nations tend to be concentrated in particular sectors – often agricultural goods or mineral products – making them more vulnerable to sector-specific shocks: this creates further challenges as they embark on a diversification plan.

Economic Diversification Is Multi-Dimensional

Our discussion above has noted that **economic diversification is a multi-dimensional, complex and dynamic phenomenon**, involving the diversification of economic activity, the diversification of international trade (products, services and trading partners) as well as the diversification of government revenues away from a dependence on natural resource or commodity revenue.

Box 1. GCC Experience of Economic Diversification

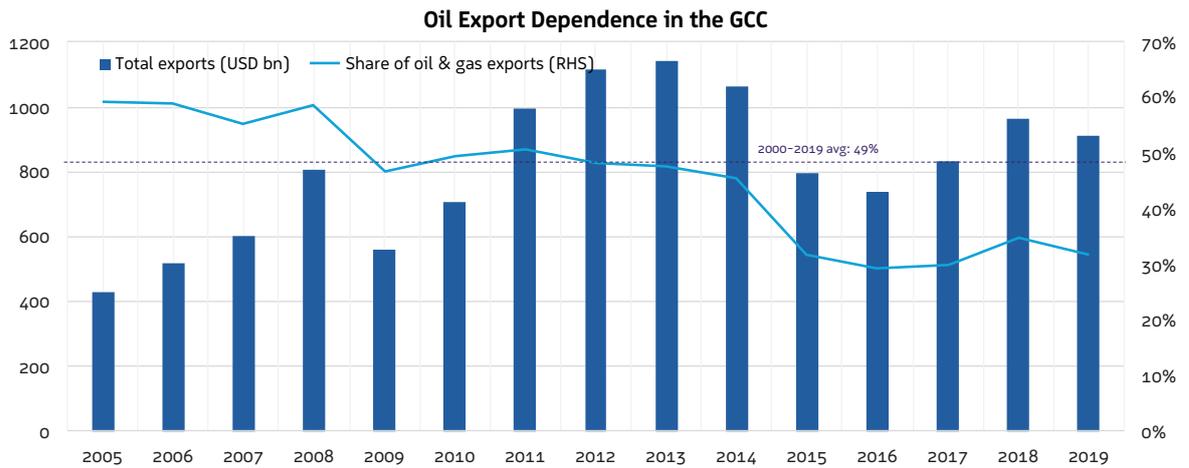
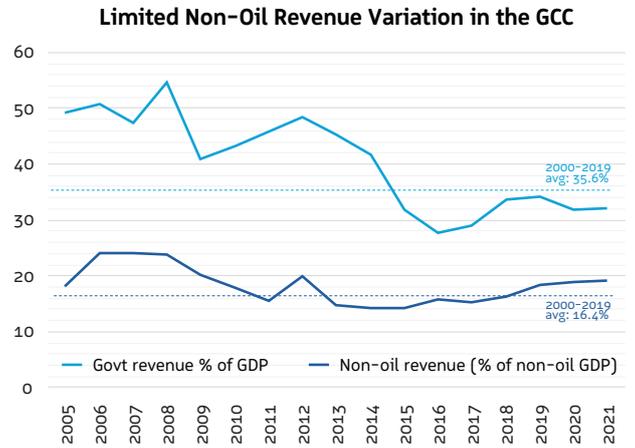
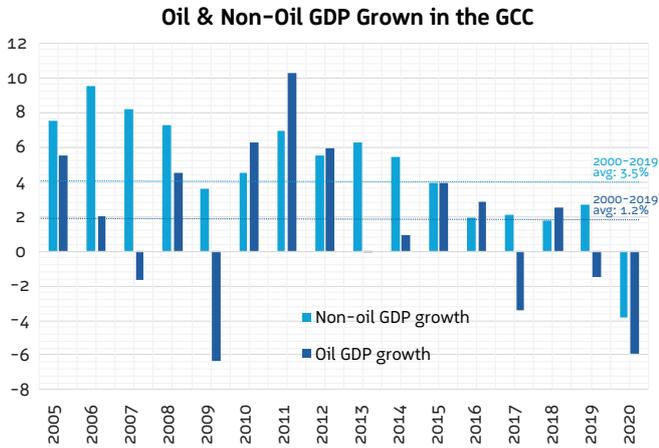
The GCC nations' diversification efforts were constrained by the lack of arable land and limited domestic labor. However, entities like SABIC, IPIC and Dubai Aluminium established in late 70s/ early 80s focusing on heavy (oil-related) industries and the development of a services sector (Bahrain's offshore banking sector in 1975 or the establishment of the Jebel Ali Free Zone in Dubai) were signs of moving away from a focus on just the oil sector for development. However, with the government sector serving as both the major investor and employer, and investment into real estate and development of downstream gas- and energy-intensive industries, oil price shocks in late 1990s questioned the sustainability of oil revenues and called for an urgent need for change.

While there has been an improvement in non-oil sector growth (in line with the various Vision documents), **the oil sector continues to dominate – accounting for more than 40% of GDP in most GCC nations**

Furthermore, **activity in the non-oil sector is still reliant on government projects** (which in turn depends on oil revenues) and while regional sovereign wealth funds are some of the largest globally, their investment in the domestic economy remains limited (and a recent phenomenon).

In the last decade or so, there has been a concerted effort to diversify revenues as well, with the introduction of VAT and excises taxes. However, **consumption taxes remain a small part of revenues in comparison to oil and gas in the nations that have rolled out VAT so far** (Qatar and Kuwait have yet to introduce additional taxes). Despite the efforts taken in terms of diversifying output and revenue, trade is quite skewed to exports of oil and gas in the GCC. **An export-oriented (rather than re-export) non-oil private sector is yet to shape up**, and as such sectors are still dominated by state-owned enterprises.

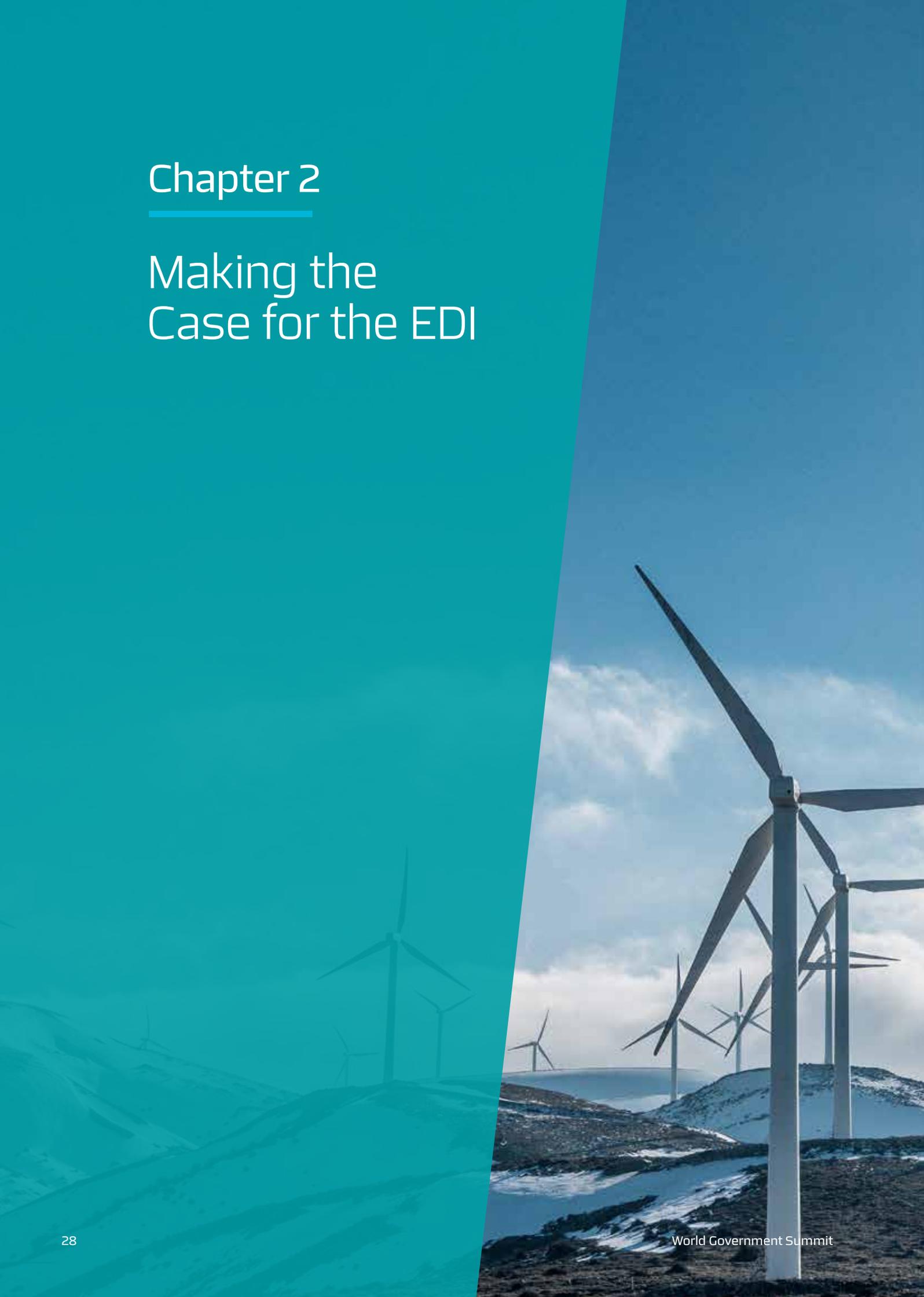
GCC Experience of Economic Diversification



Source: International Monetary Fund, various issues of MENAP Regional Economic Outlook

Chapter 2

Making the Case for the EDI





There is general agreement that economic diversification is a risk-reducing strategy for the sustainable economic growth and development of resource-rich countries.

What qualifies as a resource-rich/commodity-dependent country? Commodity-dependent nations have been identified using two common measurements:

a country is resource dependent if

over 60% of its total merchandise exports in value terms consist of natural resources⁴

and the ratio of natural resources exports to GDP is

above 10%⁵

Studies on economic diversification branch out from understanding the determinants of economic diversification to studying the impact of policies on economic development. However, causal identification remains challenging. Since there are country-specific factors that support or deter diversification, often country-specific studies are undertaken to understand their growth trajectories. More generally, despite much public discussion and analysis of economic diversification, there is no agreed or available measure or index of economic

⁴ Share of agricultural products or fuels by SITC, in total merchandise (UNCTAD).
Note: IMF & World Bank refer to a minimum threshold of 25%.

⁵ The list of commodity dependent nations is specified in the Appendix.

Measuring Economic Diversification

Building on the discussion in the previous chapter, output or activity diversification is an important component of overall diversification.

Being dependent on natural resources implies that the economic structure of the nation will be concentrated in a limited number of activities. Much of the empirical work in this area has centered around the 'Dutch Disease' or 'resource curse' hypothesis. **Structural transformation from the natural resource sector to sectors that generate higher value added and higher productivity is considered imperative for a sustainable development path.**

The manufacturing sector is characterised by:

- Economies of scale,
- Agglomeration externalities,
- Knowledge spillovers and
- On-the-job accumulation of human capital, such as learning-by-doing (Krugman 1987, Lucas 1988 among others).

Consequently, a move from the agriculture/resource-based sectors to manufacturing is seen as a growth-boosting step - be it in the form of export-led industrialization as practiced by the East Asian economies or the import substitution policies favored by larger Latin American nations like Argentina, Brazil and Mexico (in the 1970s).

Felipe & Mehta (2016) find that during the period 1970-2010

the global share of total employment concentrated in manufacturing remained relatively stable at approximately

14%

while manufacturing's share of output remained nearly unchanged throughout this period at approximately

17%

implying that not all countries can be successful in increasing their share of the worldwide production of manufactured goods.

A further move into services has been observed as well: an analysis among low-income nations by the IMF (2014) finds that **the share of agriculture in output has declined significantly over the past decade** in favor of non-tradeable activities like construction, wholesale trade, and transportation (as opposed to industry and manufacturing).

However, **these can be a source of long-term growth only if these sectors are able to generate a sustained increase in productivity over time.**

Recent research also highlights the **rise of the global value chain and ‘servicification’⁶ of manufacturing** as a means to transform to a higher production frontier.

Global Value Chains (GVCs)

refer to the phenomenon whereby production is fragmented into networks across many countries globally.

This creates new opportunities for productivity gains and profitability and allows for an expansion of markets. Integrating into GVCs is another way for natural resource/commodity-dependent nations to enter new industries, and if need be, learn to make ‘simple’ items for export markets before gradually evolving to supply more complex, highly specialized and potentially high-value inputs. Ignatenko et.al. (2019) find that GVC-related trade has a positive impact on income per capita and productivity (with a more significant impact among upper-middle and high-income countries) compared to conventional trade. The paper also finds that the share of services exports in world exports (in value-added terms) over 2000-13 is almost twice as large as official statistics on gross exports, implying a rise of the servicification of manufacturing and growing trade in services.

Servicification of Manufacturing

can be defined as manufacturing increasingly buying, producing and selling services⁷ which helps manufacturing firms become more productive (for e.g. via the adoption of new technologies).

In addition, services like transport and communication are increasingly necessary for manufacturing, with manufacturing firms requiring more services to participate in value chains. Miroudot (2017) finds that the share of services value added in manufacturing exports goes as high as 40% for ‘textiles & apparel’ and ‘food and beverages,’ whereas on average, a bit more than one third of manufacturing exports consists in value-added originating in service industries.

⁶ Servicification refers to the increasing use of services in manufacturing activities.

⁷ National Board of Trade (2010): “Servicification of Swedish Manufacturing”

Trade Diversification Is Linked to Output Diversification

As a result, discussion of economic diversification is typically limited to the trade structure of a nation (e.g., commodity producers), linking the vulnerability of a nation to external shocks and therefore its economic growth and development. The combination of a high concentration of exports (by product, commodity or country) and a large share of commodities in those exports has important implications for development. Export concentration in commodities can negatively impact development via different channels: being vulnerable to negative terms-of-trade shocks and commodity price volatility can result in lower volume and quality of investments as well as experiencing the ‘natural resource curse’ with lower growth prospects and socio-economic development outcomes. **Low export diversification can be seen as a precursor of economic vulnerabilities while an improvement over time signals a change in the productive structure of a country.**

Empirical evidence has focused on the strong linkage between trade diversification, export-led growth and total GDP and/or per capita income of countries.

McIntyre et.al (2018) find that export diversification had a more significant impact on reducing output volatility than improving long-run growth in 34 small states (studied over the period of 1990-2015). Bahar and Santos (2018) find that commodity exporters non-resource export baskets are more concentrated (i.e. less diversified, though the relation is much weaker in OECD nations), but also that these non-resource exports are generally biased towards capital-intensive goods. Giri et.al. (2019), in exploring the key drivers for diversification, find that reducing barriers to trade is the most important driver of diversification for commodity exporters, followed by improving education outcomes at the secondary level and financial sector development.





Trade diversification can occur via:

1. Growth in existing 'traditional' export products accompanied by quality improvements and higher value-added transformations

2. Export of existing products to new markets

3. Growth in exports of new products to new markets, or a combination. Export diversification can emerge from both the 'intensive margin' (1) or the 'extensive margin' (as captured by (2) and (3)).

However, **empirical studies show different results as to these margins' contribution to economic growth:** studies by Cadot, Carrere and Strauss-Kahn (2009, 2011, 2013) find that diversification or reconcentration occurs at the extensive margin. Brenton and Newfarmer (2007) find that expanding existing products in existing markets (growth at the intensive margin) has greater weight in export growth than growth at the extensive margin, but also that among the latter new markets margin is more active than the traditional 'new products' extensive margin. Hidalgo and Hausmann (2009), Hausmann, et.al. (2007) and Hausmann and Klinger (2006) explain economic development as a process of learning how to produce (and export) more complex and sophisticated products. Vietnam is a good example of a low-end agricultural exporter transforming itself into a mid-range manufacturing exporter (machines, textiles, footwear) in less than two decades.

IMF (2016), discussing economic diversification efforts in the oil-exporting Arab nations, states that

- **Economies with a more diversified export structure better weathered international trade shocks, citing a UNDP report on export concentration and diversification; and**
- **Output volatility tends to be lower in economies with a more complex structure.**

Given that several energy exporters 'diversified' their export baskets by building capacity and investing in the production of energy-intensive products that use crude petroleum or natural gas as inputs (e.g., petrochemicals, refined fuels, aluminium), **the discussion of diversification needs to be expanded further than trade.**

Government Revenue Diversification & Patterns of Taxation

Beyond output and trade, government revenue diversification is another dimension of a nation's extent of diversification.

Governments with a highly concentrated tax/revenue base dependent on natural resource revenues become fiscally constrained, with limited fiscal space to address economic shocks or undertake investment.

Government spending and development investment become subject to volatile natural resource revenues, with external, exogenous events having a detrimental effect on fiscal stability and economic performance.

The literature on the procyclical nature of fiscal policy in commodity-producing nations is clear: **public spending increases (declines) during periods of higher (lower) commodity prices leading to pro-cyclical fiscality**; lack of automatic stabilizers and low non-oil tax bases add to the problem. While many nations have commodity stabilization and sovereign wealth funds to manage the wealth generated from commodities – intended to offer protection against external shocks – opacity related to their assets and operations make it difficult to analyze their effectiveness.



Stylised Fact 1.

Natural-resource based nations that are fiscally dependent on resources (i.e. natural resource revenues account for a substantial share of the government's finances) tend to have a low- or less-diversified tax base.

Tax structures are often divided into

DIRECT TAXES	INDIRECT TAXES
Personal income tax	Taxes on goods and services
Corporate tax	Value Added Tax/Sales Tax
Property taxes	Trade taxes

Stylised Fact

OECD nations raised the largest part of their revenue from consumption/income taxes while developing countries tend to rely on indirect taxes.

The OECD's revenue statistics 2020 report finds that on average, **tax revenue as a percentage of GDP** (i.e. the tax-to-GDP ratio) was

33.8% in 2019 compared to **31.8%** in 2009

With regard to tax structure, OECD nations raised the largest part of their revenue from **income taxes**

34.3% of total tax revenue in 2018

In contrast, developing countries tend to rely on **indirect taxes** (mostly trade taxes, given the ease of collection at ports and borders) though, as a percentage of total revenue, **these indirect taxes have declined over the past two decades.**

With greater trade liberalization and reduction in average tariffs, the reliance on **trade taxes has significantly decreased** with trade taxes now

making up around **20%** of total tax revenue in lower- income countries.

Taxing goods and services has replaced trade taxes, with even oil-rich GCC nations introducing VAT in recent years.

Stylised Fact

Though direct taxes as a percentage of GDP have grown over time, tax-to-GDP ratio remains consistently low across developing regions⁸.

A report by the International Center for Tax and Development⁹ found that "overall tax collection exhibited a strongly upward trend in the developing world over the two decades ending in 2009/2010, and this pattern was relatively consistent across income groups and regions." The Tax Revenue Diversification Index by Compaoré et al (2020) finds that

tax revenue diversification helps reduce tax revenue volatility thereby strengthening fiscal resilience.

The paper also finds that there is a direct relation with economic development: as the economy develops, tax sources diversify but beyond a certain point it becomes more difficult for richer nations to further diversify their tax revenue.

⁸ This is true even prior to 2000s: between 1970-2000, the average tax level in the OECD nations increased to 35.5% from 30.1% while in the developing nations it only inched up to 17% from 16.2% (Bahl, Roy W. and Bird, Richard Miller, Subnational Taxes in Developing Countries: The Way Forward (September, 25 2008). Institute for International Business Working Paper No. 16 <https://ssrn.com/abstract=1273753>

⁹ Wilson Prichard, Alex Cobham, and Andrew Goodall (2014): "The ICTD Government Revenue Dataset", Working Paper No. 19 (Brighton, UK: International Centre for Tax and Development, September), 36.

Thomas and Treviño (2013) cite multiple studies with evidence that higher resource rents (revenue) lead to significantly lower non-resource tax revenue, holding other factors constant.

One of their findings is that



Mirzoev et al (2020) finds that in the GCC, which collectively accounts for a fifth of the world's oil production

fiscal revenue generated from the **HYDROCARBON INDUSTRY**, about 80 cents from a dollar of hydrocarbon GDP

than what is generated from **NON-HYDROCARBON INDUSTRIES**, about 10 cents from a dollar vs. 14½ cents globally

HYDROCARBON INDUSTRY



80 cents

is much higher

NON-HYDROCARBON INDUSTRY



10 cents

The paper recommends that the GCC countries need to increase their non-oil fiscal revenue while estimating that their financial wealth could be depleted by 2034 (if no preventive reform measures are undertaken), highlighting the urgency for revenue diversification measures amid fiscal consolidation and sustainability policies.



Stranded Assets, in the Context of Climate Change

The world's commitment to combat climate change via energy efficiency and green energy transition presents a threat to oil producing nations globally.

A global shift away from fossil fuels to renewable energy implies that the main source of wealth and income of the GCC and other oil producers could rapidly depreciate in value (due to the fall in demand and prices).

Together, **Middle East oil producers** account for



48.3%
of the world's oil



40.3%
of its gas reserves

(Source: BP Statistical Review of World Energy, Jul 2021).

Fossil-fuel assets risk becoming 'stranded assets' i.e. assets that are not able to meet a viable economic return as a result of unanticipated or premature write-downs. Similarly, the region's banking and financial sector faces stranded assets risk given its heavy exposure to the oil & gas sector, which could become a source of systemic risk. In a 2020 publication, Mirzoev et al (2020) estimated, prior to the pandemic, that if the GCC's current fiscal stance remains unchanged, the region's existing financial wealth (then estimated at USD 2 trillion) could be depleted as early as 2034 and non-oil wealth depleted within another decade (real oil price was assumed at USD 55 a barrel in this exercise).

To mitigate climate change risks, the region's oil producers must accelerate their economic diversification away from oil and gas. **Decarbonization and economic diversification are complementary strategies:** a win-win opportunity, as



by diversifying into renewable and sustainable energy and climate risk mitigating industries and activities



the GCC can create jobs and a new alternative export base.

Furthermore, **privatization of oil and gas assets should be part of an overall strategy of sharing the risk of potentially stranded assets with investors** (which is already happening in the GCC countries through their recent privatization efforts). Proceeds of the privatization of fossil-fuel assets need to be invested in a transformation of the economies, sustainable diversification based on partnership with the private sector, and a strategy focused on investing in human capital and sectors capable of competing in increasingly digitized economies.

Background on Constructing the Global Economic Diversification Index (EDI)

In summary, while trade diversification is an important dimension of economic diversification, so are activity and government revenue diversification.

A combination of the three dimensions of diversification - **output, trade and revenue** - can lead to structural transformation, more balanced economies, more sustainable growth and economic development

They form the components of the **Global Economic Diversification Index (EDI)**.

The EDI is composed of three sub-indices:

- A. PRODUCTION
- B. TRADE
- C. GOVERNMENT REVENUE DIVERSIFICATION

The composite EDI combines and aggregates the above three dimensions of economic diversification, thus filling a gap in the existing literature and empirical analysis.

The current edition of the **Economic Diversification Index (EDI)** is based on the analysis of available data and information from 80+ countries, covering all geographies, resource- and non-resource-based economies and both OECD and developing economies. To analyze and measure the development and evolution of economic diversification, the empirical analysis starts from the year 2000, the earliest date with a consistent set of data for all the indicators included in the EDI. This allows a historical time series analysis of the evolution and extent of economic diversification across countries.

This cross-country time series empirical analysis helps identify countries that were able to successfully diversify (e.g., Mexico, Malaysia, Indonesia) compared to others (e.g., Nigeria, Azerbaijan) that were not able to diversify.

The EDI provides a basis for countries to compare themselves with their regional and local peers, with countries with similar resource endowments as well as internationally with more diversified countries.

The EDI allows oil-exporting and other commodity exporting countries to measure their existing state of economic diversification and provide insight on the factors that can foster or, alternatively, impede diversification. Given the importance of peer comparisons, the EDI is designed to allow countries to visualize their global ranking on each measure of diversification (production, government revenue, trade), across regional and income groups and within their natural resource grouping (e.g., OPEC).

For the sake of transparency and for the EDI to be **'reproducible research'** it is solely based on publicly available indicators, data and information. The set of indicators and sub-indicators of economic diversification has been defined **based on research, analysis and the existing literature on economic diversification** surveyed in chapter 1 and above. **It should be noted that the EDI is based solely on quantitative indicators, with no survey or perception indicators thereby providing a quantitative benchmark and ranking of the economic diversification of countries.** The full list of indicators and metadata is detailed in Appendix A.

It is planned for the EDI to be published, reviewed and updated on an annual basis.

Measuring Diversification: the EDI's approach and methodology

The EDI is an innovative and important addition to the analysis, discussion and policy work related to economic diversification. The components of the EDI are as follows:

A. Production/Activity Diversification

Indicators under this category **measure how diversified economies are across commodity and non-commodity sectors, products, services and activities**. The main source for data ¹⁰ in this category is the World Bank's World Development Indicators dataset (unless specified otherwise). Identifying the sectors of economic activity – agriculture, industry/manufacturing and services – is the main set of indicators within this category. The **share of each sector's value added to GDP** has been used, allowing comparisons across countries and time. As a country becomes more developed, it moves from being dependent on agriculture to industry and/or services. The share of agriculture has declined as a percentage of GDP across all country groupings over the period 2000-2019, though it is still more than 15% of GDP in South Asia and Sub-Saharan Africa. For commodity-dependent nations, the manufacturing share to GDP has remained steady at around 10-11% over the time period.

Production/ Activity Diversification Indicators

Real GDP

Agriculture value added as a percentage of GDP

Gross fixed capital formation as a percentage of GDP

Industry value added as a percentage of GDP

Manufacturing value added as a percentage of GDP

Resource rents as a percentage of GDP

Services value added as a percentage of GDP

Medium- and high-technology manufacturing value added share in total manufacturing value added

Manufacturing value added per capita

¹⁰ Further details, including metadata, are available in Appendix A.

For many of the oil producing nations, petroleum/ mining and quarrying are grouped under the broader industry category, a main reason why the Middle East and North Africa (MENA) and commodity-dependent nations' share is much higher than the highly industrialized East Asian nations or Western Europe over 2000-2019. Industry as a percentage of GDP for the whole period is high for commodity-dependent nations (35%), but manufacturing is significantly less in comparison (12%). In contrast, for the East Asia group, these are at 32% and 22% respectively.

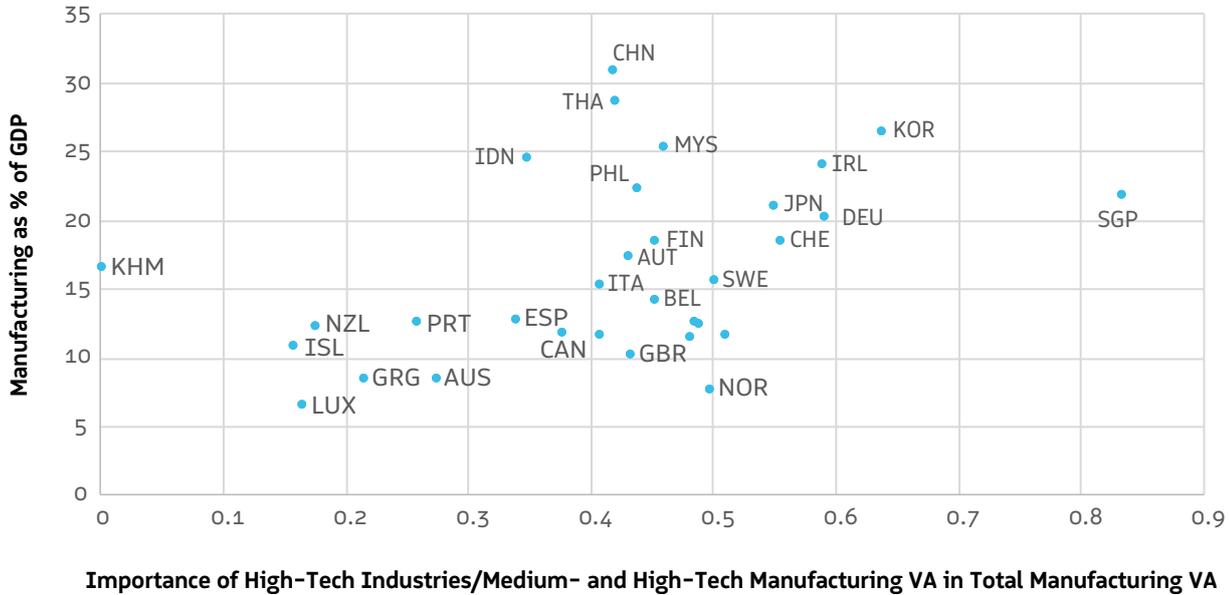
However, using the natural resource for further value addition (i.e. forward linkages) would imply that instead of exporting the resource in its raw state, it is used to produce intermediate or finished goods. This helps in job creation and mobility (across sectors) as well as technology transfer and industrialization, thereby leading to greater diversification. In nations that have initiated diversification efforts, the reliance on resource-based manufacturing is high (e.g., aluminium smelting, petrochemicals).

To overcome these issues, we have included two additional indicators: **manufacturing value added per capita and medium- and high-tech manufacturing value added in total manufacturing value added**. The former allows for comparisons independent of country size, while both help gauge industrialization intensity, i.e. how productive the industrial sector is as well as the use of technology and innovation to increase productivity.

Western Europe and North America top the list of manufacturing value added per capita, while it is not surprising that Sub-Saharan Africa falls at the other end of the spectrum. In terms of medium- and high-tech manufacturing value added in total manufacturing value added, all regions except South Asia, Sub-Saharan Africa and North America show an increase over time. North America's average is the highest amongst all country groupings, but it has inched down to 0.423 in 2016-19 from 0.462 in the initial period 2000-2003. The East Asia/Pacific and Western European regions have gained, implying a shift in focus to high-tech manufacturing,¹¹ while the pace of growth has been sharper in the MENA and Eastern Europe/Central Asia regions (albeit from a relatively lower base).

¹¹ Singapore has a value close to 80% and Switzerland is in the mid-60%.

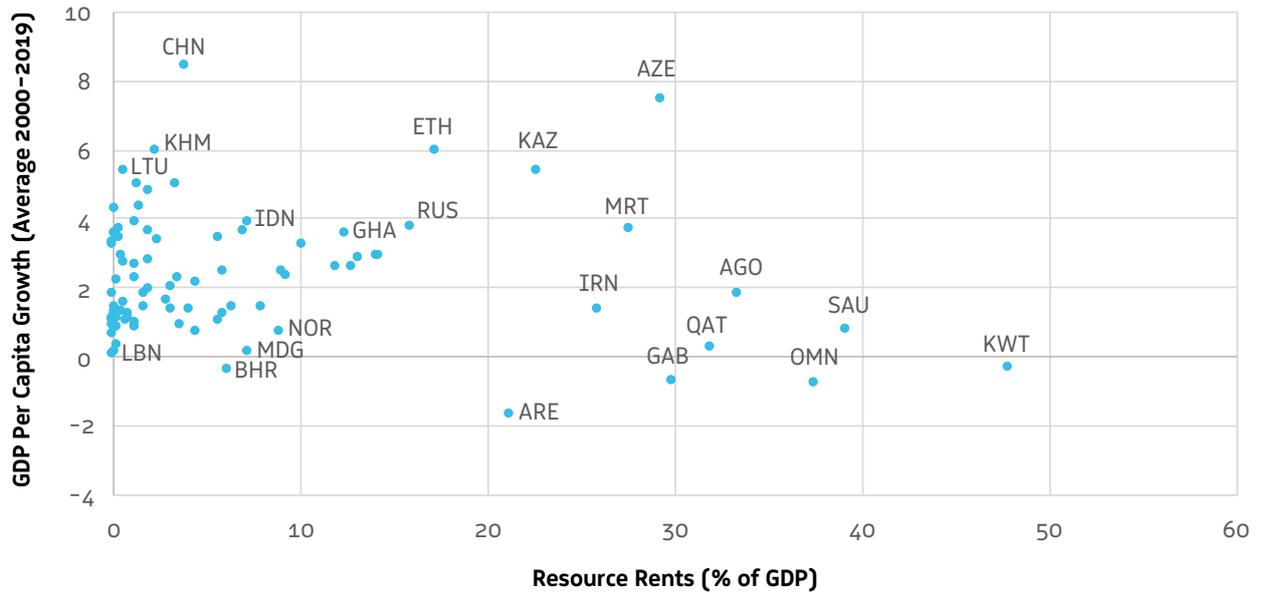
Relatively High Dependence (40–50%) on Medium and High-Tech in Most Industrialised Countries' Manufacturing Value Added



Gross fixed capital formation as a percentage of GDP is another variable used within this category: in theory, as private investment increases, growth in the productive non-resource sector will improve. However, sometimes this investment can be concentrated in a few sectors (e.g., financial, construction/ real estate). This indicator has been consistently on the rise for all countries (grouped by income) except the high-income group, and at the fastest pace in the low-income group. Interestingly, for commodity-dependent nations, GFCF was below the global average for the initial period (2000–2003), after which it began to inch up.

In addition, we have included **resource rents as a percentage of GDP**, which includes the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents and forest rents. As commodity exporters diversify, they lower their dependence on resource rents and score higher on the EDI.

Negative Correlation Between Natural-Resources Rents and Growth Rate of Real GDP per Capita (2000–2019)



Lastly, **real GDP** is added as a variable to account for the size of an economy. In smaller-sized economies, land-locked and/or island nations, diversification would be limited due to scale (e.g. focus on financial services in Switzerland). For such countries, greater integration with the global economy is key for overcoming limitations due to size.

Other indicators, such as Research and Development (R&D) expenditure as a percentage of GDP that would have added value (a higher share would translate into increased output diversification), were not included due to data limitations. Another missing indicator is employment by sector given difficulty to obtain consistent time series data over the entire period. Furthermore, though it is no longer the case that output diversification implies a simple move from agriculture to manufacturing and then to services, data constraints (especially on time series availability across nations) prevent the inclusion of indicators related to value chains and servicification as part of the EDI (in its current edition).

B. Trade Diversification

Many countries pursue protectionist policies that can lead to economic activity diversification, through tariffs, restrictive quotas, subsidies and other domestic content policies favoring domestic production and activity. However, protected industries become highly dependent on the captured domestic market and are not able to compete internationally. By contrast, countries that have successfully diversified have a diversified export basket. The objective of the Trade Diversification sub-index is to measure the extent of diversification of a country's exports of goods and services. Data in this section has been sourced from the WTO, UNCTAD and UNIDO.

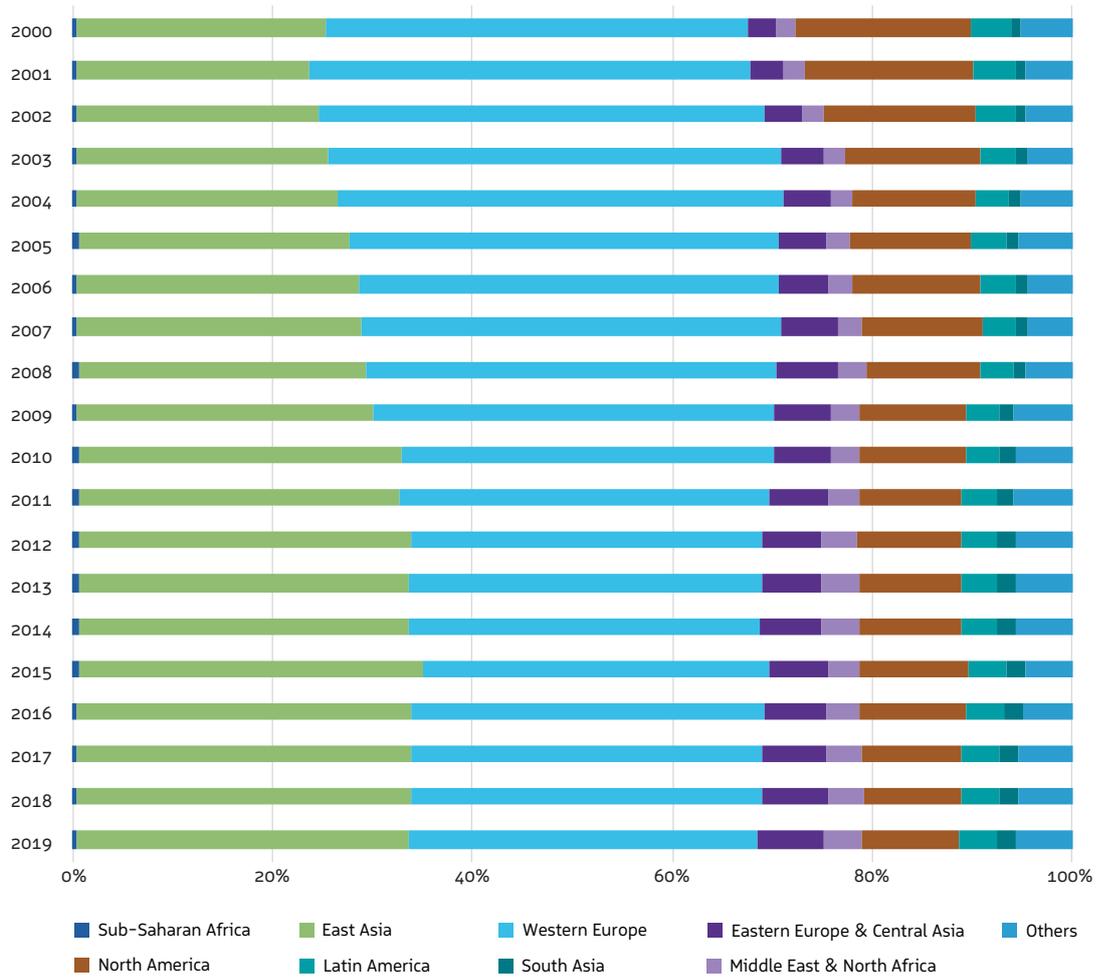
The indicators in this sub-category include both total exports and imports of a country, in addition to **fuel exports as a percentage of merchandise exports**. Patterns of total exports and imports are similar: largest in North America, East Asia Pacific and Western Europe, while Sub-Saharan Africa is the lowest placed. Three country groupings – MENA, Eastern Europe and Sub-Saharan Africa – have a relatively higher share of fuel exports, given their dependence on oil. Moving away from commodities to manufacturing/services, trade diversification indicators include **manufacturing exports (as percentage of GDP, and as a percentage of merchandise exports)** and the **overall share of services exports**¹². Some oil-dependent countries report impressive growth in their manufacturing exports because refined oil products are sometimes categorized as 'manufactured goods.'

Trade Diversification Indicators

Total value of exports
Fuel exports as a percentage of merchandise exports
Export market concentration index (Hirschman-Herfindal Index, HHI)
Total value of imports
Manufactured exports as a percentage of total merchandise exports
Medium- and high-technology manufactured exports as a percentage of manufactured exports
Merchandise exports as a percentage of GDP
Total value of services exports
Export product concentration index
Import product concentration index

¹² Though Global Value Chains and its importance was discussed in the context of economic diversification in chapter 1, data limitations (e.g., OECD-WTO TiVA database) do not allow an analysis for time series, cross-sectional data.

East Asia & Western Europe Together Account for More Than Two-Thirds of the Share of Manufactured Goods in Global Exports



Source: WTO

To further identify if countries are moving towards more complex production structures (also reflecting the impact of innovation), the indicator **'medium- and high-tech exports as percentage of manufactured exports'** indicator is also included within this sub-index. This indicator aims to capture both productivity and competitiveness of the export basket: by using the same productive capabilities and human capital (skills) to diversify into a range of export products, this reduces the dependence on natural resources. South Asia, which posted high ratings of manufacturing exports as a share of total exports, reports very low shares for medium- and hi-tech manufactured goods. Among oil-producing nations in the MENA region, Oman, Qatar and Saudi Arabia have relatively high levels for this indicator (ranging between 20-60%, but with manufacturing exports as % of total exports less than 15%).

The **Herfindahl-Hirschman Market Concentration Index** is used to measure the dispersion of value of trade across an exporter's partners. A country with trade (export or import) that is concentrated in a very few markets will have an index value close to 1 i.e., not a diversified trade portfolio. The lower the number, the more markets a nation exports to: the trend overall has been of greater diversification, reflecting increased globalization. Except for South Asia, all regional groupings show a decline in values over time.

In addition, two indicators are used to gauge market concentration (excluding services): **the export/import product concentration index** measures the degree of concentration of exports/imports at the country level (i.e., if the exports/imports of country A are concentrated on certain products). Not surprisingly, the highest export concentration values are for the more commodity-producing nations (hovering around 0.42 over 2000-19): Sub-Saharan Africa (0.4-0.41, holding relatively steady), MENA (0.3-0.4, declining over time) and Latam (0.3-0.4, with a rising trend).

As a country diversifies its productive base and exports, it tends to undergo a structural transformation: not only will it move up the value chain, but its productive sectors will also progress towards products with higher 'product spaces' that require more and more sophisticated 'capabilities' (see "Economic Complexity" by Hausmann & Hidalgo), thereby further enhancing economic development.

Quality of exports is a quantitatively significant and robust predictor of subsequent economic growth and diversification. Countries with higher per capita incomes tend to gravitate towards higher quality as well as newer goods and services. To this end, we initially included the indicator export unit value index

as a proxy; however, since the indicator sourced from the IMF's Export Diversification Toolkit database was available only till 2014 it was dropped from the final list. Including measures of trade restrictiveness that impede trade diversification was considered, but data limitations (availability of a time series) have resulted in removing this indicator also.

The trade diversification sub-component is the most researched among diversification concepts. In this respect, **the IMF's Export Diversification Index and the Economic Complexity Index are two available indices exploring the trade dimension of diversification:**

THE IMF'S EXPORT DIVERSIFICATION INDEX/ TOOLKIT

puts together data on both export diversification and quality upgrading. Product diversification indices are further disaggregated into the extensive margin and intensive margin (we have included product and market diversification indicators within the EDI). The quality upgrading (i.e. producing higher-quality varieties of existing products) has been captured by unit values of exports, which we have included as part of the EDI sub-component. The IMF has a revised version of this indicator, correcting for factors like production cost differences, firms' pricing strategies and the fact that shipments to more distant destinations typically consist of higher-priced goods.

THE ECONOMIC COMPLEXITY INDEX (ECI)

measures the relative knowledge intensity of an economy. Simply put, it takes data on exports and reduces a country's economic system into two dimensions: (i) The 'diversity' of products in the export basket, and (ii) the 'ubiquity' of products in the export basket. Diversity is the number of products that a country can export competitively, while ubiquity is the number of countries that are able to export a product competitively. A cross-country export matrix is used to calculate the indices, and the results indicate a strong correlation between the ECI and GDP per capita - richer countries tend to rank higher in the ECI.

C. Government Revenue Diversification

Countries with limited economic diversification typically also have highly concentrated government revenue (tax and non-tax) structures, with a high dependence on limited sources of revenue, such as trade and natural resource taxation. A high dependence on a limited source of revenue exposes public finances to volatility and uncertainty, undermines fiscal sustainability and leads to a pro-cyclical bias of fiscal policy. In addition, since governments tend to increase spending when resource revenues are high but find it difficult to cut spending when revenues decline (a ratchet effect) there tends to be a build-up of debt. By contrast, a more diversified government revenue base leads to more stable, sustainable public finances and as result greater macroeconomic stability. More reliable, stable sources of revenue imply better growth prospects as well as debt and fiscal sustainability.

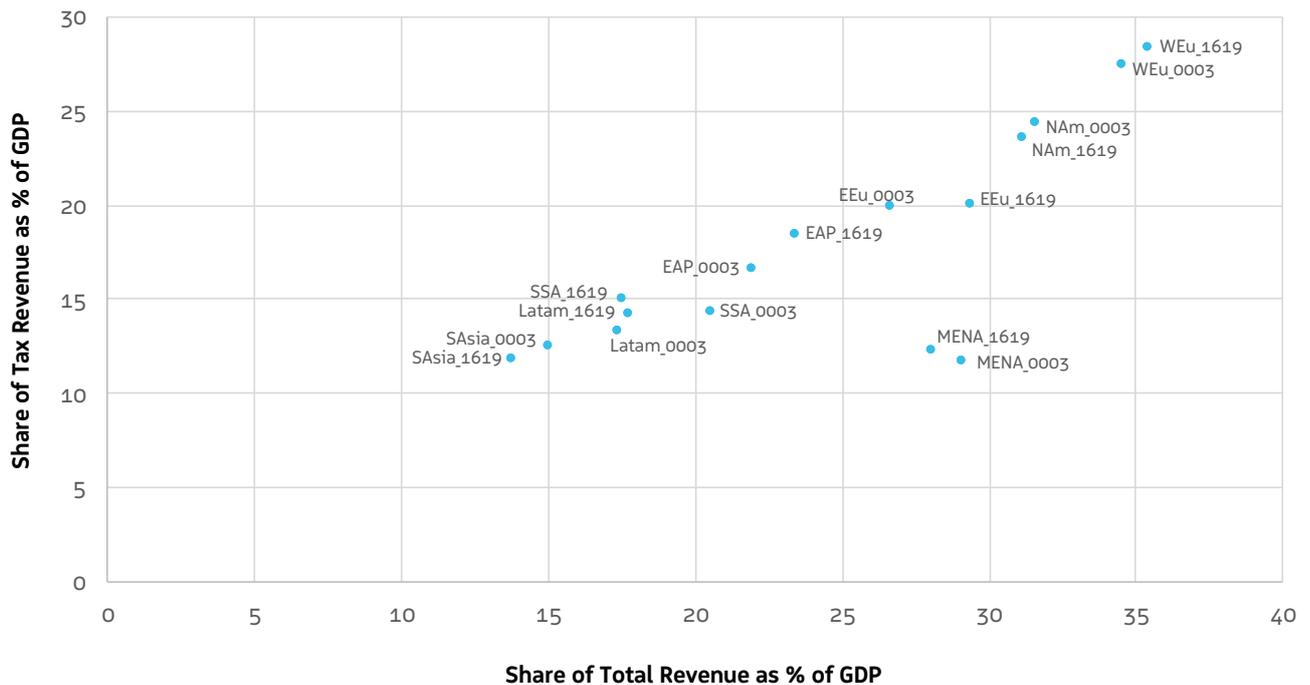
The government revenue diversification sub-index aims to capture the breakdown between commodity and non-commodity revenue, the concentration of revenue by type and as a share of total revenue and of GDP. **Tax revenue to GDP**, more generally accepted as a crude measure of tax effort, can be used as a basis for cross-country, regional and income group comparisons. The sub-index examines the diversification of non-commodity revenue by source of revenue and taxation (by different types of taxes, including **trade, income & social security, corporate, property, VAT and sales taxes** and other forms).

Government Revenue Diversification Indicators

Excise tax revenue as a percentage of GDP
Income tax revenue as a percentage of GDP
Goods & services tax revenue as a percentage of GDP
Tax revenue as a percentage of GDP
Total revenue as a percentage of GDP
Trade revenue as a percentage of GDP

Overall tax as a percentage of GDP is quite low for commodity producers, standing at an average of around 14% over the 2000-19 period (versus overall revenue at around 25% of GDP). Western Europe has the highest shares across all indicators in this category (except for trade revenues as a percentage of GDP). The widest margin is in terms of income taxes as percentage of GDP: North America and Western Europe have shares of close to 15% vs under 5% in South Asia, MENA and LatAm. As a result of the establishment of the WTO and trade liberalization measures, the share of taxes on international trade has been decreasing over time and is close to zero in high-income nations (but highest in Sub-Saharan Africa).

Tax Revenues Within Mena Remains a Small Part of Its Overall Revenues (vs Relatively High Levels of Both in Western Europe)



The indicators have been sourced from the IMF, OECD and the UNU-WIDER Government Revenue dataset.

Box 2.2. Potential EDI Sub-Categories for Future Editions of the EDI

Beyond the sub-indices focusing on output, trade and revenue, there are additional dimensions which would aid in diversification efforts of nations: this includes **(a) financial; and (b) labour market diversification.**

Data limitations have resulted in these not being covered in the current edition of the Economic Diversification Index.

For the commodity-producing nations (especially the oil producers), **financial diversification is an important dimension.** Given that oil funds are frequently managed by sovereign wealth funds (SWFs), how these funds are invested makes a significant difference to the nation's overall wealth. Financial diversification will increase with international portfolio diversification of both SWFs and international investment funds. Indicators related to this dimension could be captured from gross international reserves, balance of payments data and any information related to foreign direct investment (FDI) flows or income from foreign assets. Data opacity of the sovereign wealth funds is a significant drawback.

Labor market diversification is another dimension. Employment and the move towards the services sector is touched upon in the main text. However, the case of the Gulf Cooperation Council nations is quite unique: large segments of the local population work in the public sector, at relatively higher wages than the rest of the economy, but low productivity levels are a mainstay (Steffen Hertog's blogpost "Why the GCC's Economic Diversification Challenges are Unique", Aug 2020). Diversification needs to happen via a vibrant private sector, preferably in the the production of non-hydrocarbon tradable goods and services, employing both citizens and expatriate labor. This would involve heavy investments into upskilling and technology advancements: more diverse skills and knowledge increases labor mobility, improves responses to economic shocks, adaptation to technology change and innovation and also facilitates the move to a knowledge-based economy and greater role for the private sector. Data would include employment by sector and by skill levels in addition to productivity levels and ease of mobility among others.

A. Summary Statistics of Output Variables

	Real GDP in US billions	GFCF as % of GDP	Resource rents as % of GDP	Agriculture as % of GDP	Industry as % of GDP	Services as % of GDP	Manufacturing as % of GDP	Medium- and High-tech Manufacturing Value Added share in total Manufacturing Value Added	Manufacturing Value Added per capita
Mean	709,000,000,000.00	22.9	7.1	7.8	29.4	55.3	14.5	2,687.26	0.3
Median	173,000,000,000.00	22.2	2.1	4.1	26.7	55.3	14.2	1,549.67	0.3
Maximum	18,300,000,000,000.00	61.5	62.0	45.9	74.8	79.3	40.1	24,372.76	0.9
Minimum	3,850,000,000.00	6.6	0.0	0.0	9.4	21.8	2.5	9.36	0.0
Std. Dev.	1,910,000,000,000.00	5.9	11.1	8.7	11.0	10.2	5.7	3,023.23	0.2
Skewness	5.91	1.4	2.3	1.8	1.4	-0.3	0.7	2.10	0.4
Kurtosis	43.64	8.1	8.1	5.7	5.0	2.9	4.1	10.11	2.7
Jarque-Bera	132889.7	2575.0	3491.8	1467.6	842.3	25.2	245.0	4943.4	47.8
Probability	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sum	1.26E+15	40828.07	12560.81	13805.91	52318.9	98422.79	25478	4675832	530.5739
Sum Sq. Dev.	6.47E+27	62973.78	218248.6	134593.2	215872.9	185694.6	57980.57	1.59E+10	53.00131
Observations	1780	1780	1780	1780	1780	1780	1760	1740	1740

Output Variables Across Regional Groupings, 4-Year Averages for the Period 2000–2019



B. Summary Statistics of Trade Variables

	Total Exports (USD millions)	Total Imports (USD millions)	Services Exports	Merchandise exports as % of GDP	Fuel exports as % of GDP	Manufacturing exports (% of total exports)	Medium & High-tech exports as % of manufactured exports	HH Market Concentration Index	Exports concentration Index	Imports concentration Index
Mean	180000000000	176,000,000,000	4.01E+10	68.2	20.1	50.4	39.2	0.1	0.3	0.1
Median	53700000000	51,400,000,000	1.01E+10	58.2	6.2	59.7	39.7	0.1	0.2	0.1
Maximum	2660000000000	3,140,000,000,000	8.76E+11	343.5	99.7	438.9	91.7	0.8	0.9	0.8
Minimum	482294	1,811,177	7298509	17.0	0.0	0.0	0.0	0.0	0.1	0.0
Std. Dev.	339000000000	356,000,000,000	8.36E+10	40.3	28.1	33.1	22.5	0.1	0.2	0.1
Skewness	4.0	4.5	5.0	2.2	1.6	0.9	0.0	3.7	1.2	4.4
Kurtosis	22.4	28.8	37.4	11.1	4.1	13.2	1.9	18.8	3.9	28.8
Jarque-Bera	32589.1	55345.8	95302.92	6304.8	803.9	7963.4	88.9	22503.6	515.8	55294.2
Probability	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sum	3.2E+14	3.13E+14	7.15E+13	121343.5	35803.9	8.96E+04	69006.37	193.0028	477.2202	222.0634
Sum Sq. Dev.	2.04E+26	2.25E+26	1.24E+25	2886517	1403343	1.95E+06	890630.5	16.83219	66.38897	14.22771
Observations	1780	1780	1780	1780	1780	1780	1760	1780	1780	1780

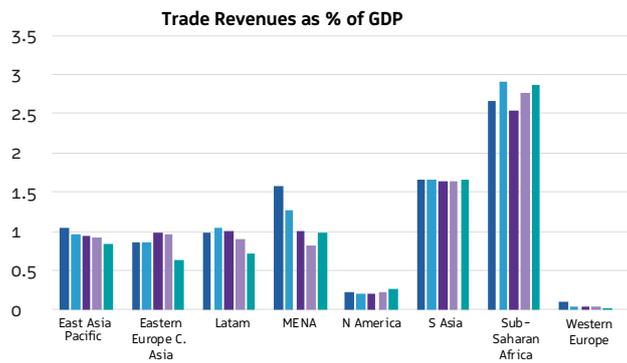
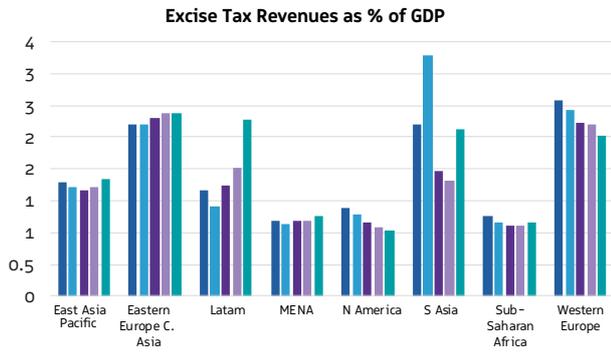
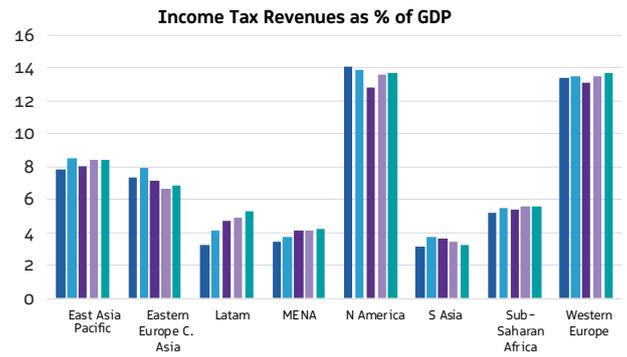
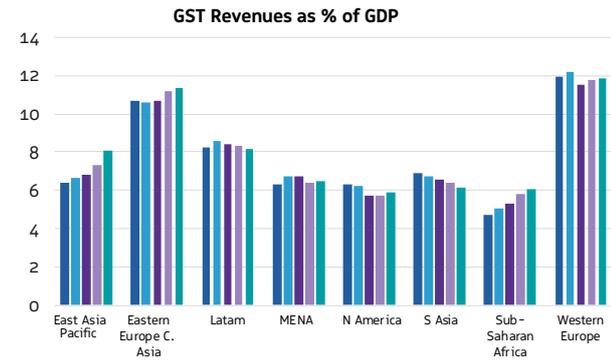
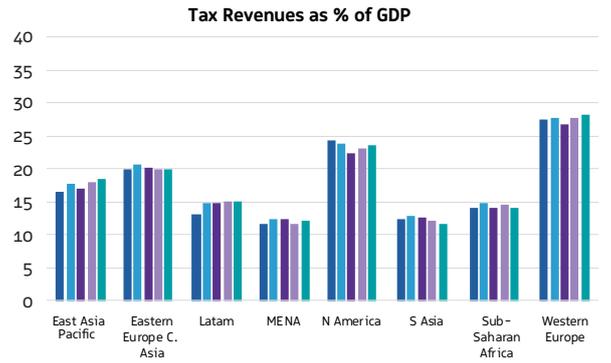
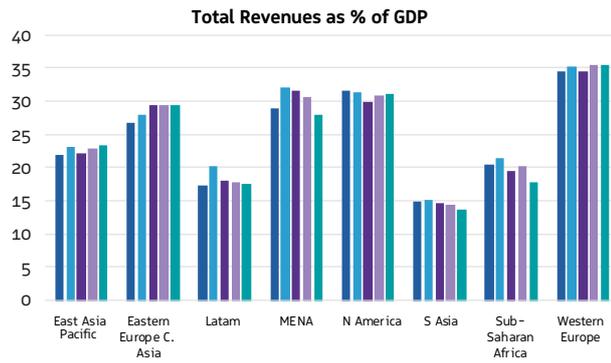
Trade Variables Across Regional Groupings, 4-Year Averages for the Period 2000–2019



C. Summary Statistics of Revenue Variables

	Total revenues as % of GDP	Tax revenues as % of GDP	GST revenues as % of GDP	Income tax revenues as % of GDP	Excise tax revenues as % of GDP	Trade tax revenues as % of GDP
Mean	26.3	18.2	7.6	8.5	2	1.1
Median	26.0	18.0	6.7	8.8	2	0.7
Maximum	73.3	48.4	31.6	22.1	21	22.6
Minimum	0.1	0.6	0.0	0.0	0	0.0
Std. Dev.	10.5	8.2	5.2	4.3	2	1.8
Skewness	0.7	0.3	1.1	-0.1	2.8	4.2
Kurtosis	4.0	3.4	4.9	2.6	26.3	31.5
Jarque-Bera	194.0	40.3	640.9	12.7	41947.1	64768.9
Probability	0.0	0.0	0.0	0.0	0.0	0.0
Sum	46748.32	32480.93	13365.79	14898.17	3482.411	1996.797
Sum Sq. Dev.	1.98E+05	120376.2	47627.29	32213.63	4326.33	5394.621
Observations	1780	1780	1760	1760	1760	1760

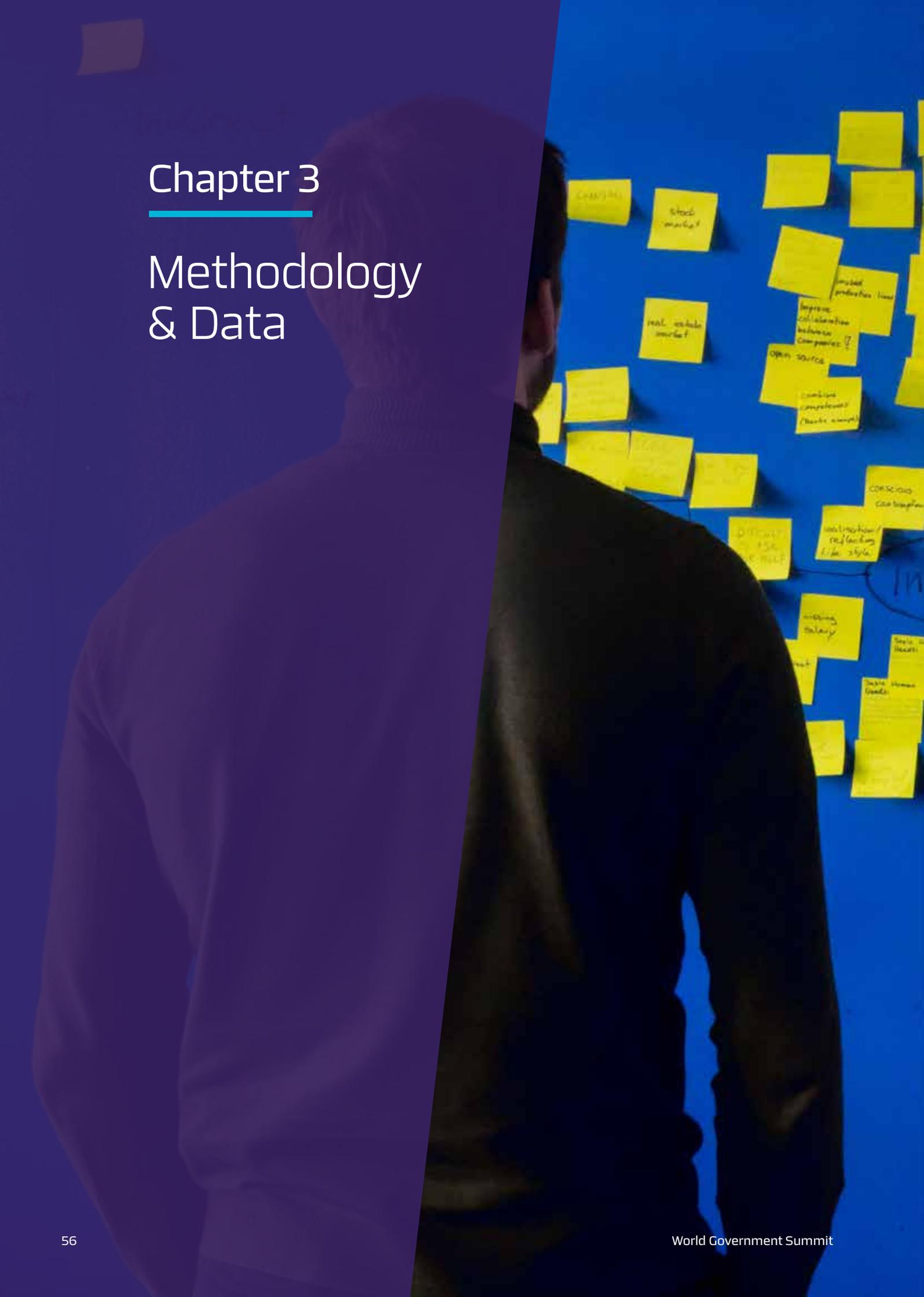
Revenue Variables Across Regional Groupings, 4-Year Averages for the Period 2000-2019



■ 2000-2003 ■ 2004-2007 ■ 2008-2011 ■ 2012-2015 ■ 2016-2019

Chapter 3

Methodology & Data





This chapter presents the methodology behind the Economic Diversification Index (EDI).

It **first** addresses general issues in developing this kind of index, **then** presents the specific solutions adopted. **Finally**, it provides an overview of how the sub-indices and overall index are computed.

Conceptualizing and Realizing the EDI

Economic diversification is not a concept captured in a single data point. Rather, as the main report makes clear, it covers a wide range of indicators that currently do not have expression as a single aggregate index. The starting point is therefore a high-dimensional dataset, i.e. observations on a set of indicators for a sample of countries over a given time period. The desired end point is a set of three sub-indices capturing the key dimensions of diversification as set out in the main report – output, revenue and trade – and an overall index bringing together the three sub-indices. Selection of the detailed indicators is based on the analysis in the main text, i.e. a review of the literature as well as analytical priors.

The econometric setting for the EDI is a panel with a significant number of cross-sections: this consists of a large number of indicator series and relatively short time series. The objective is to design a weighting scheme such that the large number of indicators can be reduced to a smaller number of diversification indices: potentially three (production, trade, and government revenue), and/or one (diversification).

Conceptually, the problem is one of dimensionality reduction: for the set of indicators relevant to each sub-index and the overall index, the objective is to reduce the number of dimensions in the dataset from the number of indicators to just one.

Two general approaches are available to solve this kind of problem:

DATA COMPRESSION APPROACH

This reduces the dimensionality of a dataset by uncovering the key components of variation across indicators and using a purely mathematical approach to summarize them according to a pre-defined criterion.

PREDICTION APPROACH

This uses a given function of the indicator set to predict a variable of interest that should be strongly correlated with economic diversification.

With these two general approaches in mind, exploratory analysis of the EDI dataset examined the following potential methodologies:

DATA COMPRESSION:

- Principal component analysis (**PCA**).
- Principal factor analysis (**PFA**).

PREDICTION:

- Bayesian model averaging (**BMA**).
- Artificial neural network (**ANN**).

The two data compression techniques are well established in the economics literature and have been used by international organizations such as the World Bank (Logistics Performance Index). The two prediction methodologies are much newer and have not been widely used to produce indices in this way. Examination of their performance was therefore more speculative, with the objective of ascertaining whether or not it was possible to improve on classical techniques. A key limitation of the prediction techniques is that economic diversification – the variable the model should predict – is not observable, as noted above.

The models therefore rely on observable proxies, in this case measures of GDP volatility from IMF quarterly GDP data, namely the standard deviation and coefficient of variation of GDP, as well as predicted volatility from an autoregressive conditional heteroskedasticity (ARCH) time series model of quarterly GDP.

Data Pre-Treatment

In developing an index like the EDI,

a key requirement is that scores be comparable across countries and through time.

As such, each EDI observation must be based on the same underlying indicators. While many statistical techniques can deal easily with missing values for one of a set of indicators, the case of a multi-indicator index is different. To take a simple example, consider an index based on two indicators, A and B, which are aggregated by taking the arithmetic (simple) mean. If B is missing for one country, then the mean is simply A. If A is missing for another country, then the mean is simply B. If both series are observed for a third country, then the mean is $(A+B)/2$. So the three index scores in this case are not comparable, even if all variables are measured on the same scale: each observation is based on different information sets.

In the context of the EDI, this requirement would mean that the index could only be calculated for those country and year pairs where all component indicators are observed. This constraint is a major one, which would significantly reduce coverage in both the country and time dimensions.

In an effort to ensure the broadest coverage possible, the dataset is therefore pre-treated using linear interpolation and extrapolation to fill in missing observations to the extent possible¹³. The output is a complete input dataset for 89 countries for the 2000–2019 period.

The only other pre-treatment applied to the data is standardization. To eliminate any potential impact of different variable scales, all input data are converted to series with mean zero and unit standard deviation.

¹³Though Global Value Chains and its importance was discussed in the context of economic diversification in chapter 1, data limitations (e.g., OECD-WTO TiVA database) do not allow an analysis for time series, cross-sectional data.

Assessment of Candidate Methodologies

Overview of Methodologies

PFA

is a standard dimensionality-reduction technique. It starts from a modified correlation matrix of a set of indicators. The principal diagonal of that matrix (all entries equal to unity) is replaced with the R^2 from a multiple regression of the variable in question on all other variables in the set, and therefore is strictly less than unity. This step essentially separates out common variation in the set of variables and idiosyncratic variation in individual variables. The modified correlation matrix is then decomposed into its eigenvectors and eigenvalues. Each eigenvector is a linear combination of the variables in the set, with given weights ('loadings'). The eigenvector that corresponds to the largest eigenvalue (the principal eigenvector) is the one that accounts for the largest possible proportion of the common variation in the indicators. In applying PFA to develop an index from a set of indicators, it is standard to use the principal eigenvector as the output index. The interpretation is then that the index is the linear combination of the underlying indicators that accounts for the maximum possible proportion of their common variance.

PCA

is conceptually very similar to PFA. The only difference is that it starts from a standard correlation matrix of the indicator variables, not the modified one used for PFA. As such, it assumes that the indicator variables only have common variation. An indicator produced using PCA is therefore the linear combination of the indicators that accounts for the maximum possible proportion of the total variance in the set of underlying indicators.

BMA

takes a different approach to creating an index. The problem conceptually is again to aggregate an underlying set of indicators into a single index. However, BMA is a technique for prediction and inference rather than dimensionality reduction. It is akin to a regression model, but accounts systematically for model uncertainty, for instance in relation to prior expectations on parameters, or the set of variables being used. By estimating a potentially large number of models, BMA makes it possible to derive a set of parameter estimates that can be used to construct an index that is a linear combination of the underlying indicators, based on a weighted average of estimated parameters from the set of models. The interpretation is that the index is a 'good' predictor of some output variable of interest, across the range of models estimated.

ANN

Many machine learning techniques are available for prediction problems. One popular one is an ANN. It is designed to make predictions using input variables based on complex optimization procedures that feed outputs potentially through a number of layers of analysis, in an analogous way to how information is processed in the human brain. Whereas the techniques discussed above all involve linear predictions, ANNs can capture more complex, nonlinear patterns of variation. The interpretation of an ANN-based EDI is again that it is a 'good' predictor of some outcome of interest, with the additional specification that it accounts for nonlinear effects.



Selection

In pre-analysis, candidate indices were produced using the four methodologies discussed above. The two prediction methodologies yielded similar results, but they were not intuitive. The reason is that the output variable used to test prediction accuracy – GDP volatility – is not perfectly correlated with economic diversification, and so resulted in the introduction of significant noise into the model. The two data compression methodologies produced much more intuitive results. Given the similarity in the two methodologies, results only differed slightly.

PCA was therefore preferred because it is the simpler of the two approaches, which aids transparency and replicability in other contexts. The final EDI and its sub-indices were therefore produced using PCA.

PCA OUTPUT

The strategy for applying PCA to the detailed indicators relied on two steps:

STEP 1:

Use PCA to produce the three sub-indices: output, revenue, and trade¹⁴

STEP 2:

Aggregate the three sub-indices into an overall EDI by taking the arithmetic (simple) mean

The rationale for using the simple mean in the second stage is that it is the simplest and most transparent approach, and there is no a priori reason for believing that any one of the three sub-indices is more important to the overall measurement of economic diversification than the others.

¹⁴Indices are produced using the standard sum of squares approach, and are converted from variables with mean zero and unit standard deviation to variables with mean 100 and standard deviation 10.



Table 1 shows the factor loadings produced by PCA.

The principal eigenvector accounts for **33.5%** of the observed variation in the underlying series.

The loadings show that real GDP, services as a percentage of GDP, medium- and high-technology manufacturing as a percentage of GDP and manufacturing value added per capita correlate positively with the EDI output sub-index, while the remaining variables correlate negatively.

This finding is intuitive in most cases, but **the contrast between industry and services shows that the data tend to support the importance of the services sector as a determinant of output diversification.** Resource rents exhibit a strong negative correlation, which means that **resource-dependent economies tend to score lower on this sub-index.** This fact perhaps explains the result for industry, which includes extractive industries.

Table 1

Variable	Loading
Real GDP	0.244
Agriculture value added as a percentage of GDP.	-0.331
Gross fixed capital formation as a percentage of GDP.	-0.029
Industry value added as a percentage of GDP.	-0.290
Manufacturing value added as a percentage of GDP.	0.172
Resource rents as a percentage of GDP.	-0.392
Services value added as a percentage of GDP.	0.491
Medium and high technology manufacturing value added share in total manufacturing value added.	0.401
Manufacturing value added per capita.	0.402

Table 2 shows PCA loadings for the trade sub-index.

The principal eigenvector accounts for **37.3%** of the observed variation in the individual indicators.

Table 2 shows that export market concentration, product concentration of exports/imports and fuel exports are all negatively correlated with trade diversification, but the remaining variables are positively correlated.

This result is intuitive, as the **positively correlated variables all capture aspects of country performance that suggest deeper integration into the global trade system.** The case of fuel exports is important, as it suggests that **countries with significant reliance on that sector tend to be less diversified from a trade point of view.** It therefore complements the finding on revenue diversification, where resource rents (for instance, from extractive industries) are negatively correlated with revenue diversification.

Table 2

Variable	Loading
Total value of exports.	0.441
Fuel exports as a percentage of merchandise exports.	-0.263
Export market concentration index (Hirschman-Herfindahl Index, HHI).	-0.079
Total value of imports.	0.445
Manufactured exports as a percentage of total merchandise exports.	0.300
Medium and high technology manufactured exports as a percentage of manufactured exports.	0.356
Merchandise exports as a percentage of GDP.	0.025
Total value of services exports.	0.435
Export product concentration index.	-0.338
Import product concentration index.	-0.101

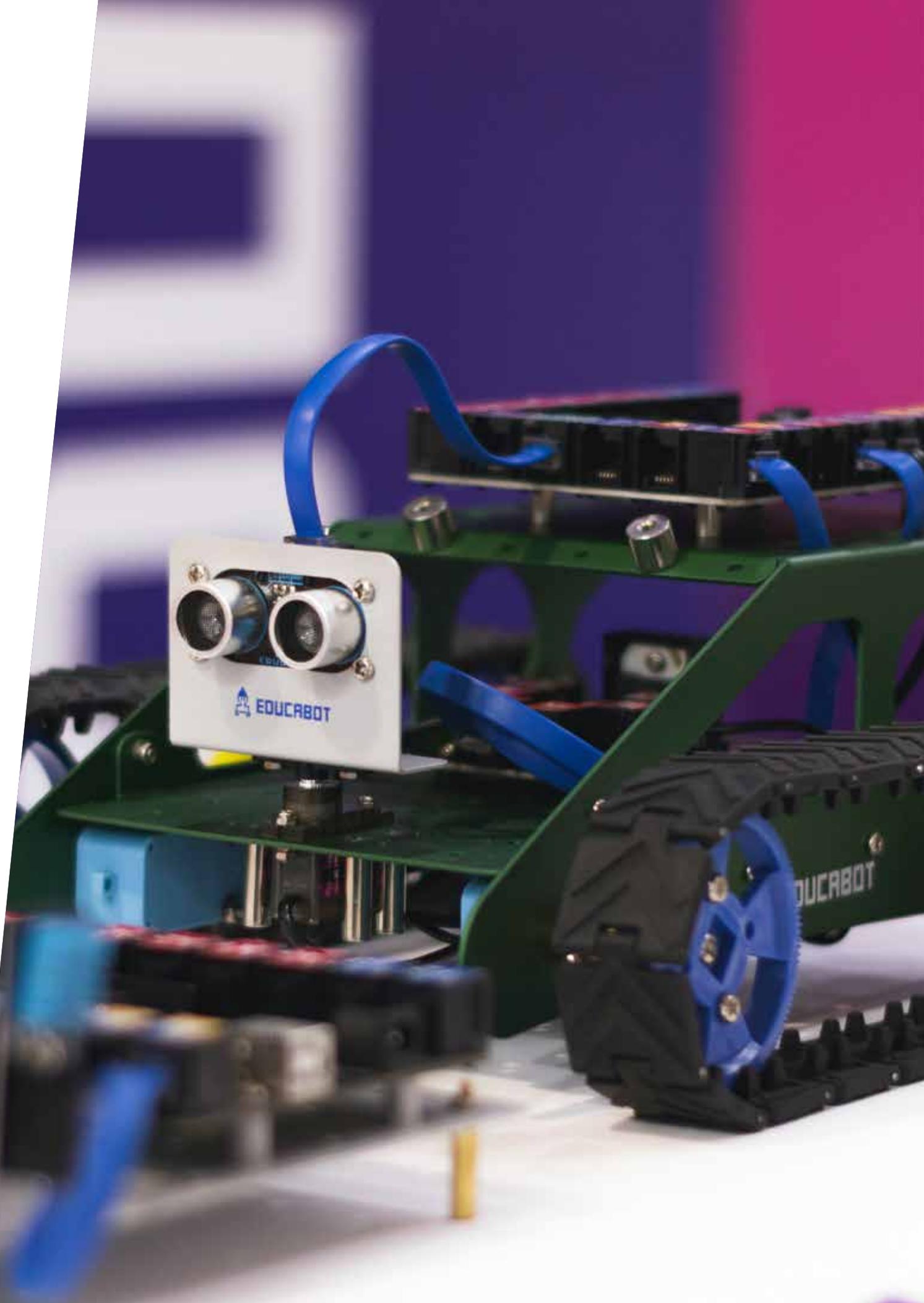
Table 3 shows PCA loadings for this sub-index.

The principal eigenvector accounts for **51.9%** of the observed variation in the individual indicators.

Table 3 shows that all variables except trade revenue are positively correlated with the EDI revenue sub-index. This interpretation is intuitive: **higher proportions of revenue from different sources in GDP should indeed be indicative of greater diversification.** But reliance on revenues from trade (tariffs) is usually associated with underdevelopment of the tax system in general, in particular income and consumption taxes; so the finding for this last variable is also intuitive, as it suggests that **revenues tend to be less diversified if there is high reliance on trade taxes to raise revenue.**

Table 3

Variable	Loading
Excise tax revenue as a percentage of GDP.	0.301
Income tax revenue as a percentage of GDP.	0.482
Goods and services tax revenue as a percentage of GDP.	0.453
Tax revenue as a percentage of GDP.	0.540
Total revenue as a percentage of GDP.	0.367
Trade revenue as a percentage of GDP.	-0.213



Chapter 4

Main Results



Global Rankings Over Time

In 2019, the average score of the unweighted Economic Diversification Index (EDI) stood at 102.7 compared to that of the highest performer, the United States, at 154.85.

This compares to an average score of 97.9 and a top score of 131.0 in 2000.

Overtime, the gap between the most and least diversified nations has widened; for the least diversified nations, overdependence on commodity prices has meant volatility in growth and a long path to catch up to the top performers. The evidence does not suggest growing convergence between the most- and least-diversified nations. This could potentially be a result of the low rate of adoption of new technology in the lower-ranked nations:

Innovation is important to boost productivity and increase a nation's capability to develop and improve export sophistication (new products, better quality), increase output diversification, thereby enabling 'catch up' with advanced competitors.

Table 4.1 Economic Diversification Index, Top 10 Nations



Among the top 10, seven nations have consistently remained in the list across the period. All are among the high-income nations. Of these, other than the US and two Asian nations (Japan and Singapore), all are from Europe. There has been one major change in the composition of the top performers: China joined the top 10 list from 2008 onwards (it was among the top 15 since 2007, supported by its entry to the WTO), moving up from 33rd position in 2000. Services-led nations stand out among the top-ranked - the UK, Ireland, Singapore and Switzerland to name a few - highlighting the rising importance of the services sector (and adoption of new technologies) and its pivotal role in enabling a 'catch up' with established highly industrialized nations. Needless to say, nations in the top 10th percentile have improved most on their scores over time.

Table 4.2 Bottom 10 Nations, EDI



Seven nations have continuously remained in the bottom 10 nations across the period, with 4 of them oil-producing nations (two from the Middle East: Oman & Kuwait). Low-income and agriculture-dependent Ethiopia and Ghana fall within this category. Saudi Arabia, Iran and Qatar were in the bottom 10 in the early 2000s. Though improvements across the trade and revenue components have borne fruit, they are still in the bottom quartile as of 2019.

Table 4.3 Top 10 Average & Lowest 10 Average EDI Scores

	2000	2004	2008	2012	2016	2019
Top 10 average	115.01	117.18	121.37	123.03	124.43	127.35
Lowest 10 average	80.44	81.78	82.08	82.51	87.05	86.07

The readings of the EDI show that the gap between the top and bottom performers has widened to its greatest extent in 2019. Over the 2000–2019 period, the top 5 nations that have most improved their scores include China, the US, Saudi Arabia, Germany and Oman (Table 4.4): that two among them are oil-exporting nations underscores the urgency of diversification efforts. Other than Bahrain, all other Gulf Cooperation Council (GCC) nations fall within the top 20–most nations that have improved EDI scores over time.

Table 4.4 Top 20 Countries That Have Most Improved EDI Scores Over 2000–2019



Since the concept of economic diversification is more important for commodity-producing nations, Table 4.5 captures their rankings over time. It can be seen that the low and lower-middle income nations within the commodity-producing nations have consistently scored the lowest in EDI. While ranked relatively higher overall, Australia and New Zealand have slipped into the 40th to 50th percentile in 2019. Among the GCC nations, Saudi Arabia notably has made a significant improvement in the recent years, and while the UAE continues to rise in the rankings, Bahrain’s performance has been quite underwhelming.

Table 4.5 Commodity Producers, EDI Rankings Heatmap

	2000	2004	2008	2012	2016	2019
Malaysia	39	40	49	39	40	36
Australia	27	31	38	35	41	41
Norway	47	45	46	45	38	45
New Zealand	35	33	37	40	44	48
Iceland	46	43	45	49	46	49
Uruguay	42	55	52	54	55	53
Russia	56	56	54	52	53	54
Argentina	51	53	50	48	51	55
United Arab Emirates	69	68	69	66	52	57
Chile	53	58	60	61	63	59
Colombia	57	57	58	63	61	62
Bahrain	59	66	66	67	60	63
Peru	60	63	64	65	65	64
Paraguay	71	75	68	64	68	65
Saudi Arabia	80	81	82	81	69	67
Bolivia	62	70	78	76	74	69
Iran	75	76	80	70	67	71
Qatar	77	79	74	77	66	72
Kazakhstan	79	74	75	71	70	73
Kenya	67	64	62	62	72	74
Cote d'Ivoire	68	65	70	75	77	75
Cameroon	74	72	67	73	71	76
Zambia	66	71	73	74	76	77
Oman	84	85	84	83	79	78
Uganda	73	69	71	69	78	79
Ghana	76	83	76	80	82	80
Nigeria	78	77	77	79	81	81
Ethiopia	82	82	81	82	84	82
Kuwait	81	78	79	84	80	83
Angola	85	80	83	78	83	84
Azerbaijan	83	84	85	85	85	85

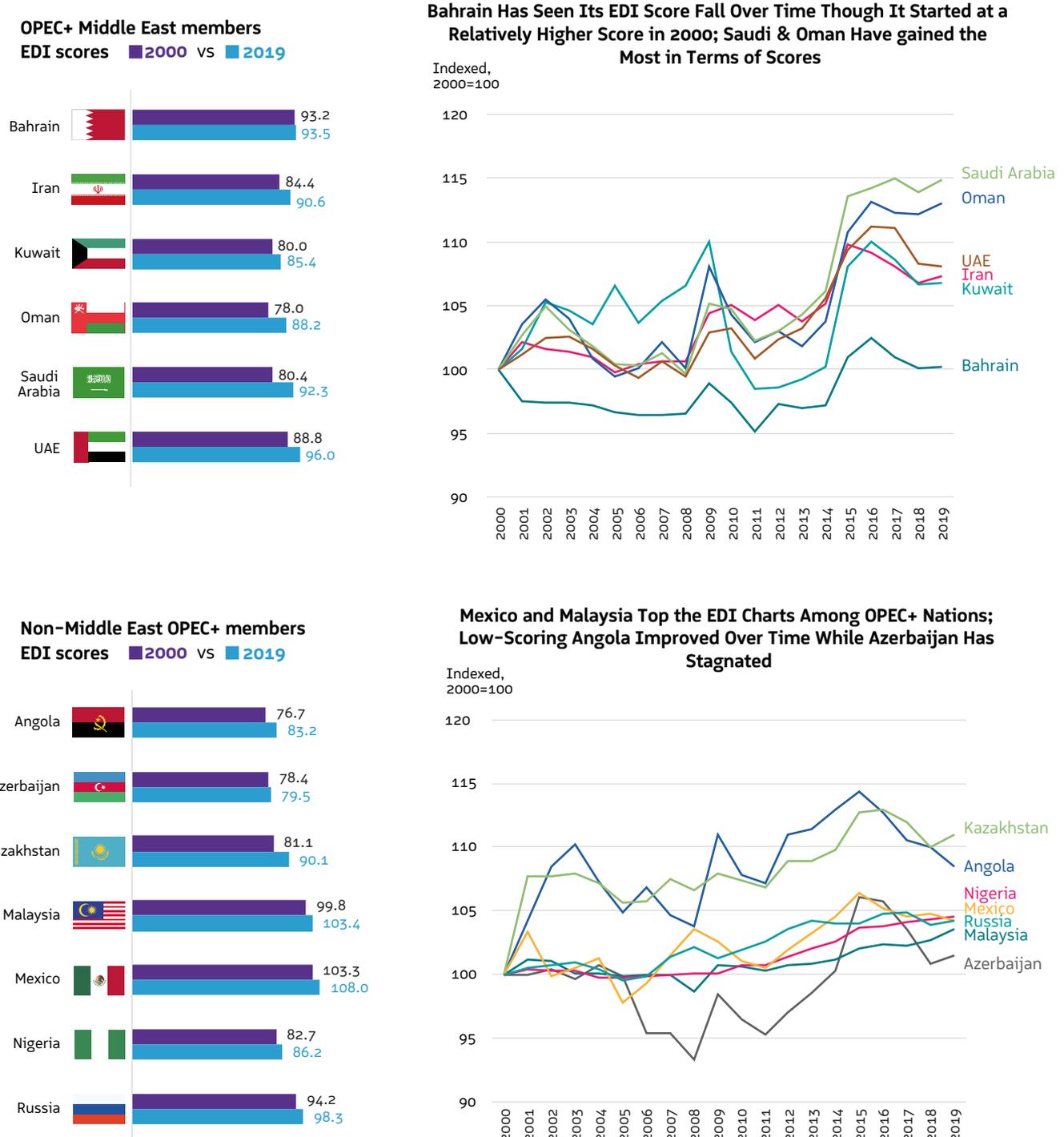
Least Improvement  Most Improvement

Note: Burkina Faso, Gabon and Mauritania – included in the commodity producing nations – are not part of the overall list due to insufficient data in one or more of the sub-components.

Limiting the analysis to OPEC+ producers (Chart 4.1 below), low-income nations constantly remain in their lower rankings (a few perpetually struggle with corruption and political instability). Nations like Malaysia¹⁵ and Mexico¹⁶ that undertook extensive diversification methods have seen efforts bear fruit with higher rankings. Among the GCC nations, Bahrain had been a first mover in terms of diversification

efforts, but has stagnated over time, and others, such as the UAE and Saudi Arabia, have caught up. Oman and Kuwait are low-ranked, but the former has embarked on a diversification path (translated into an improvement in scores overtime compared to 2000) while the latter has faced a few internal impediments to economic reforms (via the Parliament).

Chart 4.1 EDI Scores Of Opec+ Producers (Separated by Middle East & Others), 2000-2019



Note: The list does not include a few OPEC members (Algeria, Congo, Equatorial Guinea, Gabon, Iraq, Libya and Venezuela) and OPEC+ members (Brunei, South Sudan and Sudan) due to lack of available data.

Table 4.6 EDI Scores, by Region and Over Time

	2000	2004	2008	2012	2016	2019
North America	119.4	120.3	125.3	128.2	130.4	132.2
Western Europe	107.8	109.2	111.4	110.9	112.3	113.2
East Asia	101.9	103.3	104.5	106.5	107.5	108.9
Eastern Europe & Central Asia	96.7	96.7	98.8	99.7	101.3	101.4
Latin America	96.1	95.2	95.2	95.7	97.4	97.7
MENA	91.4	91.8	92.3	92.7	97.0	96.4
South Asia	93.5	96.5	96.5	96.2	95.6	94.9
Sub-Saharan Africa	67.1	68.3	68.1	68.3	69.2	68.9

Least Improvement  Most Improvement

Table 4.6 above highlights the divergence patterns across regions. North America, which tops the list, has improved its score at a faster pace compared to the limited gains in Sub-Saharan Africa (bottom of the list). Both Western Europe and East Asia have seen a gradual improvement in their overall EDI scores. The MENA region has seen an improvement towards the latter part of the 2010s as many oil exporters started to accelerate their diversification plans.

¹⁵Malaysia's successful diversification derived from a concerted effort to improve competitiveness via both horizontal (growth in both manufacturing and services sectors and vertical diversification (to higher value added products, from upstream to downstream activities) away from commodities, as well as efforts to develop its SME sector. (Chapter 4 in Cherif et al. (2016))

¹⁶Mexico was helped by multiple factors like investments in high-productivity manufacturing clusters (especially the automobile sector - accession to NAFTA played an important role in attracting FDI into this sector) and investments into human capital for high-skilled workforce among others, as well as its proximity to the US.

The EDI is comprised of three sub-components: output, trade and revenue. The table below lists the top 10 nations for the year 2019, ranked for overall EDI and by sub-index.

Table 4.7 Performance By Sub-Index - Top 10 Nations, by Overall EDI and Output, Trade and Revenue Sub-Indices (2019)

	Output Sub-index	Trade Sub-index	Revenue Sub-index	EDI (Avg of the 3 sub-indices)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

United States	Denmark	China	New Zealand
Ireland	France	Italy	South Africa
Switzerland	United Kingdom	Korea	Luxembourg
Singapore	Netherlands	Finland	
Japan	Norway	Iceland	
Germany	Sweden	Belgium	



THE OUTPUT SUB-INDEX ranks a financial hubs like Switzerland and Singapore highly – the high loadings for the services indicator likely resulted in this particular order for the year 2019. The presence of services-export-based nations like UK, Ireland and a few European nations is not surprising. When comparing the 2019 results to the initial year, more than 90% of the countries tracked have improved their output score.

IN THE TRADE SUB-INDEX, the leading exporting nations stand among the top 10. From the list of countries in the Middle East, several non-oil exporting nations have surpassed the GCC rankings – notably Morocco, Tunisia and Jordan, which have a relatively more diversified export basket and diverse set of trade partners. Within the trade sub-component, close to three-quarters of the nations have made significant improvements over the time period. However, in addition to major exporting nations like China and the United States that made a significant improvement, some services exporting nations (Ireland, Singapore) have increased their scores. From the Middle East, both the UAE and Saudi Arabia have seen a significant jump within the trade component.

THE REVENUE SUB-INDEX rankings are the most intuitive: the Nordic countries feature predominantly among the top-ranked, given their high levels and diversity of taxation which enable their public funding of healthcare, education, child and elder care and so on. Towards the bottom of the list are many of the oil-producing nations (be it from the GCC or Africa, or commodity-producing nations like Argentina) that have seen least diversification in terms of sources of revenue. Not only has the dispersion of scores been the lowest among the sub-components, but the gap between the highest and lowest scores have also declined.

Regional Performance Over Time

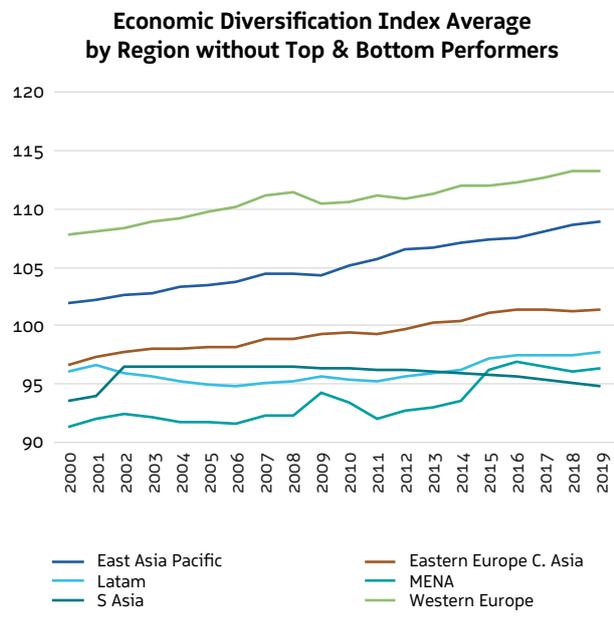
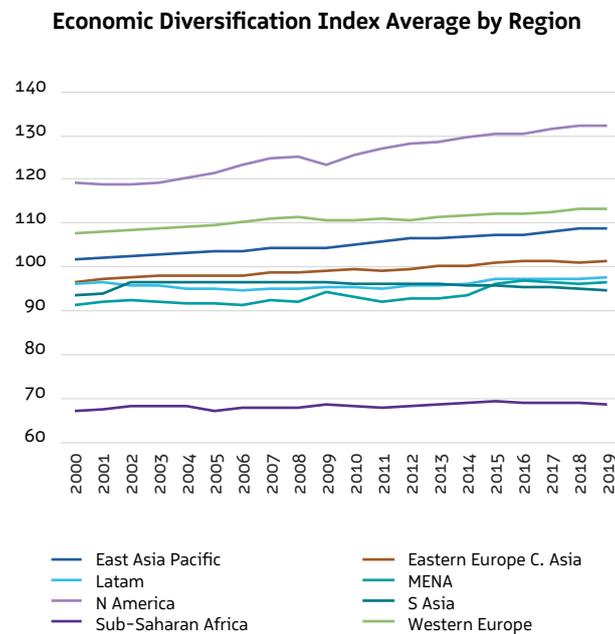
Across overall EDI (and most sub-components), the main finding is that **North America is the best performer** (unsurprising considering the top ranking of the US across all years) and

Sub-Saharan Africa region remains the worst performer (even if their average scores have improved over time).

South Asia's performance declined in both the trade and revenue sub-indices, while the output sub-index remained steady, thereby resulting in a drop in overall EDI over the period.

The MENA region has witnessed a reasonable improvement in its overall EDI, thanks to gains made in both the trade and revenue sub-indices.

Chart 4.2 Performance of EDI Over 2000–2019 by Region



Though the MENA region's performance within the output **sub-index has improved over the period 2000-2019**, it remains one of the lagging regions.

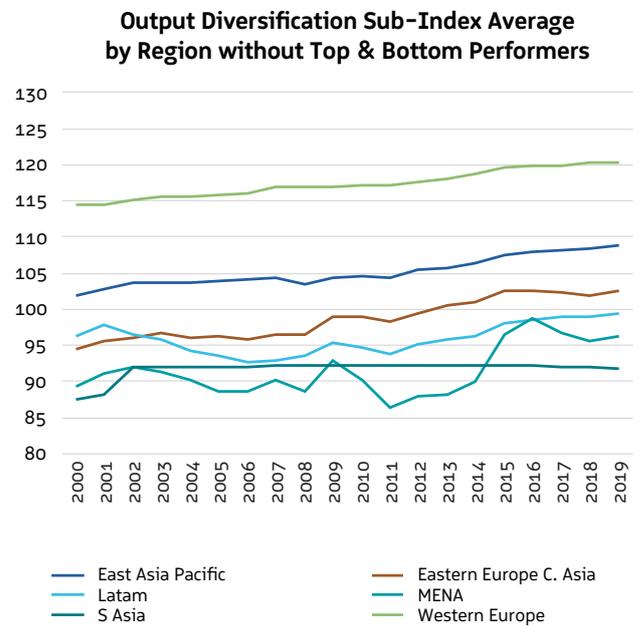
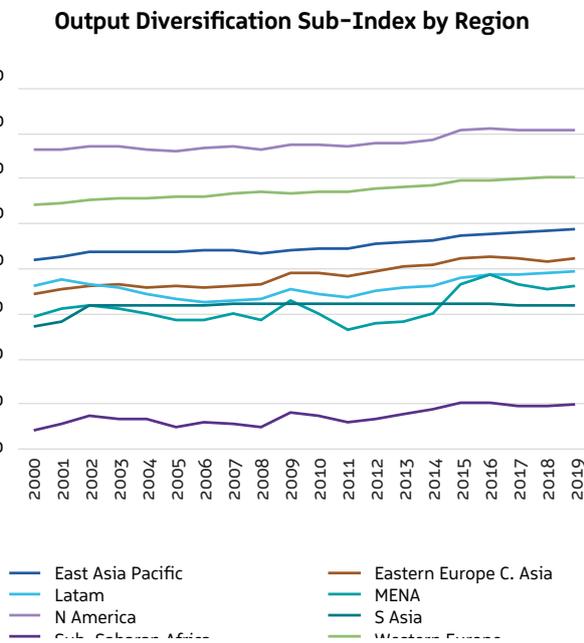
From the initial period to the 2008 financial crisis, the **output sub-index was trending lower in MENA** (similar to Latam) but there has been a stronger uptick in the years after 2010.

South Asia has remained stagnant over time.

Considering the PCA loadings, while South Asia's services as a percentage of GDP has been rising, the region scores very poorly in the other two indicators which are positively correlated with the output sub-index. It shows a declining trend over time for the indicator medium- and high-technology manufacturing as a percentage of GDP.

Manufacturing value added per capita for **South Asia stands at an average of 338.8** in 2016-19, which is **only just above 1/16th of the reading for North America** in that period.

Chart 4.3 Output Sub-Index



The East Asia Pacific region has seen a significant improvement in the trade sub-component, catching up with the Western Europe average score by 2014 and then moving in tandem.

Eastern Europe's scores have inched up from an average of

96.1772 in 2000-2003  **100.99** in 2016-2019

The only region clocking in a **worse score over time is South Asia**: it was the worst performer in the medium- and high-technology manufactured exports as a percentage of manufactured exports. in 2016-2019

South Asia **10%**  North America **60%**

Interestingly, **South Asia** which was on par with East Asia and Pacific region in the services exports indicator till 2007 **saw a massive drop afterwards**; in the 2016-2019 period

East Asia Pacific's services exports  **6x**  that of South Asia's services exports

The MENA region's

drop in its fuel exports as a share of GDP

47%
2004 - 2007



38.5%
2016 - 2019

was accompanied by an **increase in manufactured exports** as a percentage of total merchandise exports

35.8%
2004 - 2007



42.9%
2016 - 2019

and **increase in medium- and high-technology manufactured exports** as a percentage of manufactured exports

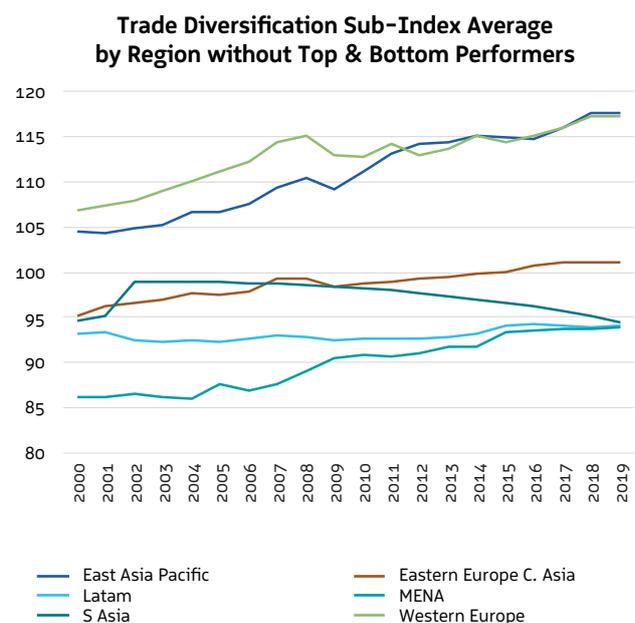
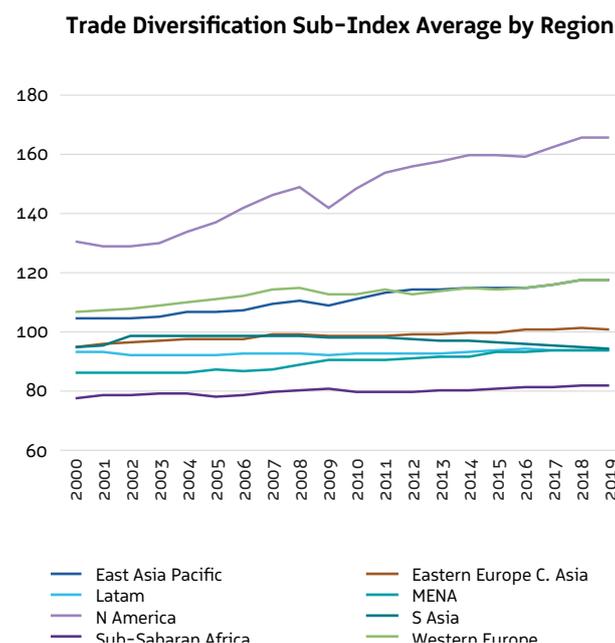
25%
2000 - 2003



36.9%
2016 - 2019

- the former loading negatively and latter two loadings positively correlated with the trade sub-index.

Chart 4.4 Trade Sub-Index



Within the revenue sub-index, **Western Europe is the leading region**, with steady increases registered in both East Asia Pacific and Latam.

In contrast to the other sub-indices, North America is not the leader in the revenue component; instead, it has seen marginal variations.

South Asia once again posts a decline over time: total revenue as a % of GDP is the lowest among all regions and fell from

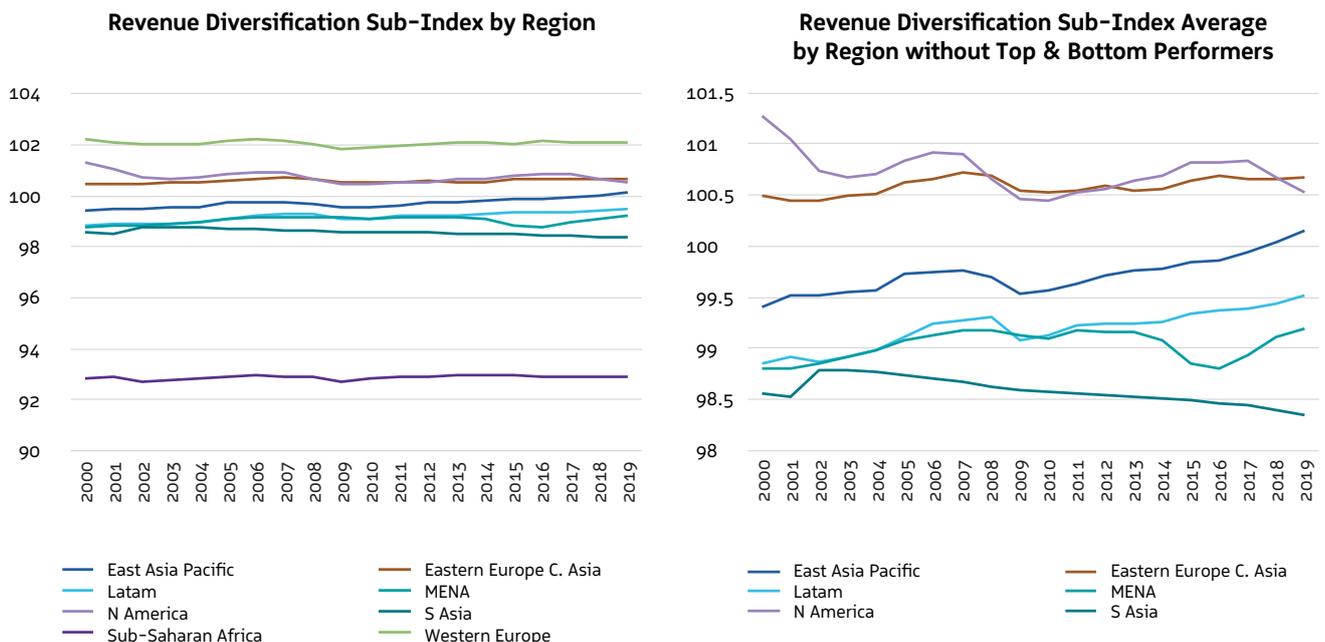
15% in 2004-2007  **13.7%** in 2016-2019

It also has the lowest share of income tax as a percentage of revenue (3.2% in 2016-19, less than one-fourth of that of Western Europe during that period).

Furthermore, it continues to be reliant on trade revenue (negatively correlated to the revenue diversification sub-index): as % of GDP, trade revenue stands at

1.6% in South Asia below only **Sub-Saharan Africa's 2.8%**

Chart 4.5 Revenue Sub-Index



Exploring the Regional Patterns Further Shows the Wide Disparities.

Across all regions, the median score is the **lowest in Sub-Saharan Africa** for both years 2000 and 2019, even though median scores have increased across all regions.

In 2000, the gap between the maximum and minimum score was the **highest in East Asia** (Japan's highest score was **30.3** points ahead of the lowest scorer in the region).

This pattern changes in 2019, with the gap widest in North America (given the highest score of the US), East Asia and Western Europe.

By comparing the inter-quartile range (height of the blue box), **the least variability is seen in South Asia and Latam** in 2000, and **the most in MENA**.

The variation in scores has reduced most in Sub-Saharan Africa, though the median score has increased only by 2 points.

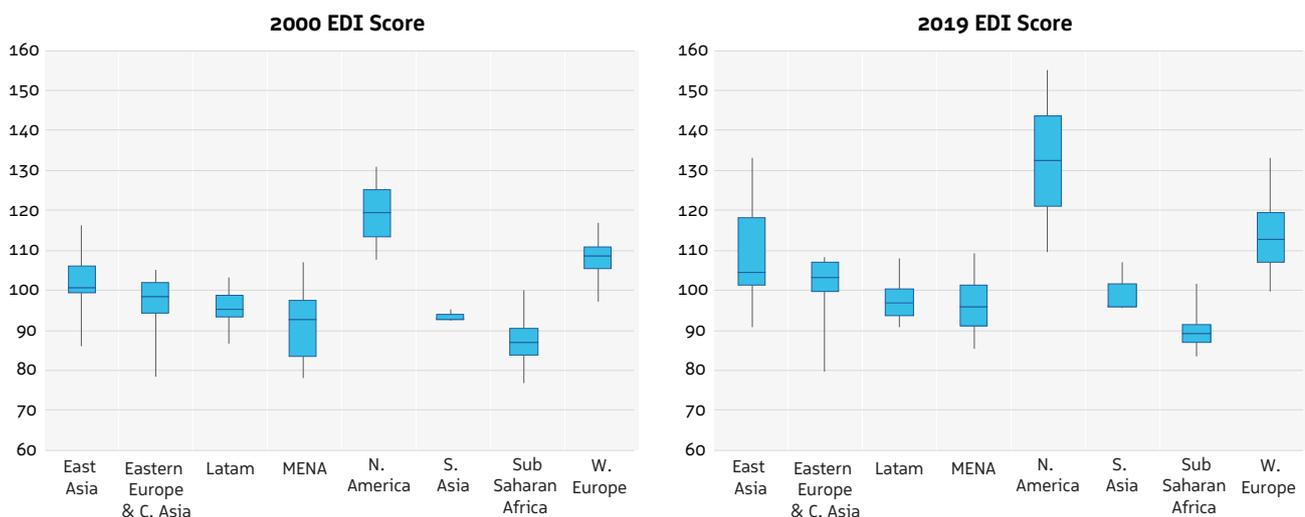
The spread has also narrowed in Eastern Europe and Central Asia, however, the lowest reading in the group (Azerbaijan) remains almost unchanged.

It is also interesting to note that the distribution for East Asia is skewed to the right in both 2000 and 2019 (i.e. higher EDI scores are more spread out). **The lower-income and commodity-producing nations score lower than the median value while the highest is China**

Cambodia the lowest at **90.7** China the highest at **132.9**

In Western Europe, there are **5 nations that scored higher than 120 in 2019** (top performer being Germany), while **Iceland scored just below 100**. The commodity-producing nations (Norway, Iceland) were the lowest scorers within Western Europe.

Chart 4.6 Regional Disparities in EDI Scores (2000 vs 2019)



Results are unsurprising when it comes to diversification scores by income class. **The top 10 highly diversified nations all fall in the high-income category**, except for China (upper middle-income group) once it makes its entry into the top 10 from 2008 onwards.

Outside of high-income nations and China, only **Mexico features within the top 25** during the 2000-2019 period. At the other extreme, **the low-income nations have the lowest scores** (except in the revenue diversification sub-index).

However, in addition to the low-income nations, a few high- and upper middle-income nations appear at the bottom of the list: these are mostly commodity-producing nations like for example Azerbaijan (upper middle-income) or Kuwait and Oman (high-income) and less diversified.

The low-income nations are less integrated into the global economy, accounting for their lack of improvement even in the trade sub-index. Interestingly, **the revenue diversification score is least in the upper middle-income region**. Within this component, income tax as % of GDP (with a high positive loading in the PCA) in upper middle-income nations is equivalent to that in lower-middle ones and just over half of high-income nations.

Furthermore, **upper middle-income nations tax revenue as a share of overall GDP stays around the 15-17% range** during 2000-19, compared to around **22% for high income nations**.

Chart 4.7 EDI Performance by Income Class (& by Sub-Index) Over Time



A scatterplot of EDI and income level (measured by GDP per capita, PPP basis) for 2019 offers some interesting insights. **The chart shows a positive correlation between EDI and GDP per capita.** However, the top left quadrant is a clear example of how a few nations (mostly commodity producers) score high on per capita income but below average on the overall EDI score.

Qatar is a key example: if it ups the pace of diversification, it can move into the top right quadrant with a high EDI score along with high income levels. UAE and Norway are examples of nations that are in the process of diversification and inching closer to the mean EDI score in 2019. Similarly, the lowest ranked high-income country (Kuwait in 2019) is close to 50 and 25 points away from China (ranked 3rd) and Mexico (ranked 22nd) respectively.

Chart 4.8.A EDI 2019 Score and Income Level Oil Producing Countries (Measured By GDP per Capita, PPP Basis)

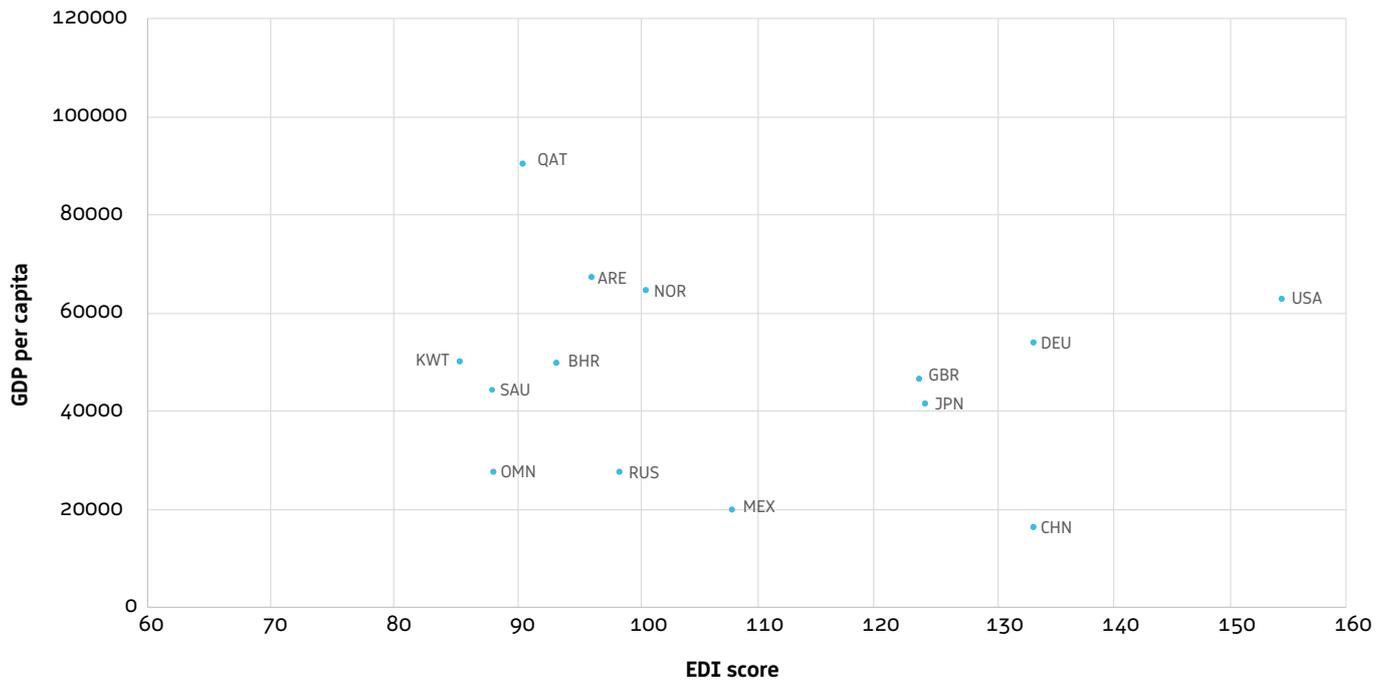
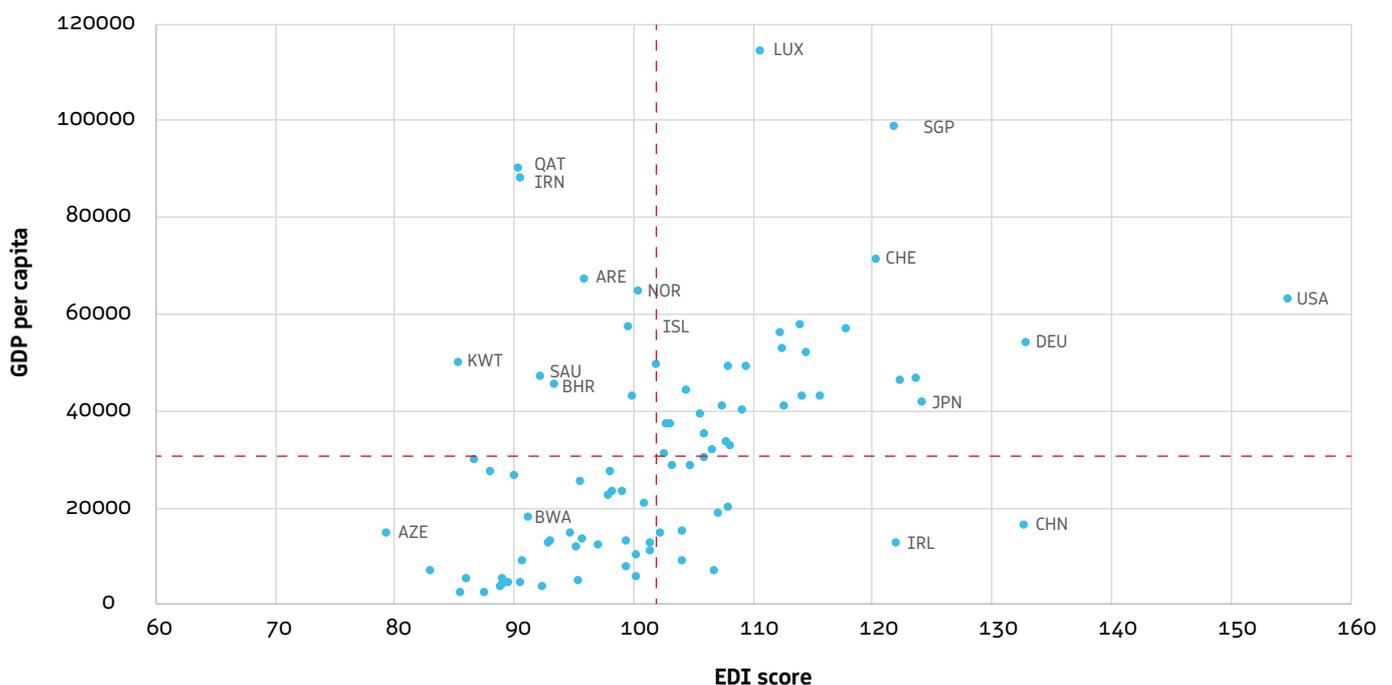


Chart 4.8.B. EDI 2019 Score and Income Level (Measured by GDP per Capita, PPP Basis)

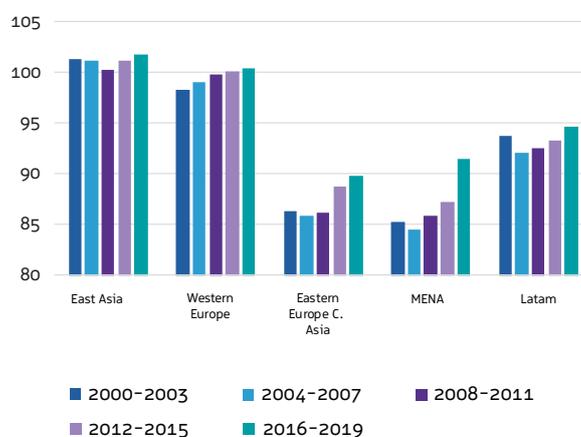


Have Commodity-Dependent Nations Diversified?

The global economic diversification index aims to track the progress commodity-producing nations have made over time.

Overall EDI has been lowest among the commodity-dependent nations within the Sub-Saharan Africa region: on average, these countries have been able to inch up from just 64.4 in 2000-03 to 65.7 in 2016-19 period. Among the others, the fastest pace of increase in EDI has been within the MENA region, followed by the Eastern European & Central Asia and the Western European regions. Gains registered in Western Europe has been slow and steady over time while in the MENA region the uptick has picked up pace in the last few years (2016-19) – not surprising since there has been a renewed focus on driving private-sector non-oil growth (in addition to revenue-enhancing measures via the recent introduction of VAT and

Chart 4.9 EDI Across Commodity Producers, by Region



As can be gauged from Chart 4.10, for the commodity producers' group **there has been an uptick in their overall score**

89.8 in 2000-2003  **92.5** in 2016-2019

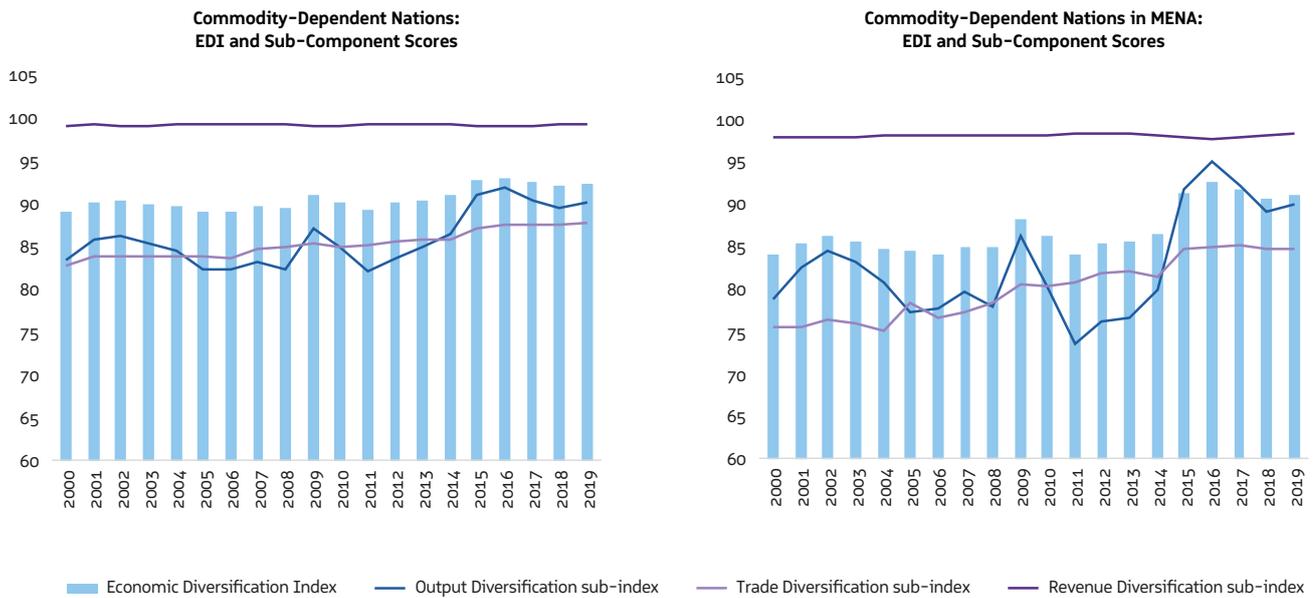
The gains in both output and trade diversification sub-indices seem to be overshadowed by the steady pattern in revenue diversification.

However, if we restrict the analysis to MENA region's commodity exporters, the average **EDI score shows a significant improvement,**

85.3 in 2000-2003  **91.4** in 2016-2019

once again supported by gains in output and trade.

Chart 4.10 Commodity Dependent Nations' Overall EDI Performance (& by Sub-Index)



Tables 4.8 Commodity Producers, EDI Output Sub-Index Scores, Heatmap

	2000	2004	2008	2012	2016	2019
Iceland	100.9	104.4	104.0	105.1	108.6	108.4
Australia	108.2	107.6	104.7	106.2	108.4	106.5
Norway	100.9	103.3	101.8	104.2	109.3	105.4
New Zealand	103.8	107.7	105.7	105.8	107.2	105.3
Uruguay	102.3	95.7	97.9	98.7	103.3	103.9
Malaysia	95.1	94.4	90.3	95.1	100.1	101.6
Argentina	94.9	94.9	97.2	100.4	102.4	99.7
Bahrain	94.8	95.9	92.6	93.8	104.3	99.7
Chile	96.3	95.2	88.3	89.6	92.9	98.4
Colombia	95.7	93.4	91.6	91.4	96.9	97.1
Russia	90.1	91.4	91.7	94.9	98.9	95.4
Qatar	77.4	76.9	83.4	78.9	96.8	94.1
United Arab Emirates	91.8	90.5	80.9	79.6	98.7	94.1
Peru	93.4	91.4	86.6	87.4	91.8	93.2
Paraguay	85.4	82.7	87.6	91.5	91.5	93.1
Iran	83.7	83.2	80.1	86.4	94.6	88.8
Saudi Arabia	68.8	70.6	62.1	66.7	93.3	88.6
Kazakhstan	77.7	80.4	78.3	82.9	91.6	88.5
Zambia	87.3	81.2	78.5	82.3	82.9	87.7
Bolivia	87.3	84.3	79.3	78.9	87.0	87.6
Nigeria	76.6	77.1	80.8	83.3	95.4	86.4
Cameroon	79.3	86.1	82.6	85.2	87.6	86.1
Cote d'Ivoire	87.9	87.6	85.4	82.1	83.0	85.5
Oman	61.4	66.9	61.6	63.3	84.9	84.3
Gabon	57.1	63.9	55.3	60.1	78.8	81.6
Ghana	69.1	59.4	74.0	73.0	77.5	80.0
Uganda	75.1	79.9	75.8	76.7	76.8	79.8
Kuwait	73.8	81.3	84.5	64.0	91.9	79.7
Kenya	83.5	84.6	84.7	82.7	79.7	77.7
Ethiopia	65.1	63.9	63.1	65.1	68.2	70.6
Azerbaijan	62.7	62.1	52.0	59.6	76.9	68.7
Angola	40.8	61.8	50.3	61.3	76.7	66.0

Tables 4.9 Commodity Producers, EDI Trade Sub-Index Scores, Heatmap

	2000	2004	2008	2012	2016	2019
Malaysia	105.79	106.41	106.01	107.34	107.44	108.76
Russia	91.62	92.54	97.62	98.40	97.48	99.14
Australia	97.26	97.52	95.62	96.95	96.20	97.44
Argentina	95.20	94.49	97.76	99.37	97.98	97.06
United Arab Emirates	74.59	80.13	83.41	92.36	99.12	94.45
Norway	87.26	89.12	92.14	91.51	95.53	93.19
New Zealand	94.98	95.57	93.99	93.36	93.34	92.28
Kenya	88.14	90.66	92.10	92.53	91.59	92.23
Uruguay	94.28	90.55	91.51	91.80	91.68	90.68
Saudi Arabia	75.09	77.60	80.36	83.83	85.06	89.91
Ethiopia	77.01	82.09	86.46	84.34	86.05	88.90
Chile	88.90	88.45	89.13	89.01	89.48	88.33
Colombia	88.61	91.77	90.29	83.87	90.25	88.25
Paraguay	76.96	79.65	81.34	84.48	86.30	87.93
Iceland	88.34	90.16	91.92	89.10	89.40	87.88
Peru	87.53	87.36	87.19	87.20	87.39	87.12
Angola	87.02	84.75	87.12	94.43	85.08	86.77
Iran	72.05	75.18	77.35	82.38	84.03	85.10
Uganda	84.93	89.88	90.02	94.14	90.92	84.74
Cote d'Ivoire	83.46	89.08	81.80	82.86	86.97	84.10
Bahrain	87.63	78.58	80.45	81.33	85.83	83.64
Kazakhstan	66.09	80.79	81.77	82.63	85.10	82.76
Bolivia	91.87	83.25	76.78	77.74	82.27	82.67
Cameroon	77.14	79.41	88.20	79.98	86.64	82.61
Oman	75.49	71.55	75.24	79.93	82.35	82.40
Ghana	85.08	84.40	86.23	81.65	84.52	82.16
Mauritania	73.26	74.93	78.11	78.56	82.34	80.47
Zambia	84.18	86.38	82.56	82.01	85.91	80.13
Qatar	75.23	73.14	78.56	78.79	83.08	79.76
Kuwait	68.04	69.09	72.84	74.29	74.10	77.48
Nigeria	73.36	76.16	78.79	72.77	69.22	75.64
Azerbaijan	74.24	75.72	67.04	69.07	72.45	70.47

Tables 4.10 Commodity Producers, EDI Revenue Sub-Index Scores, Heatmap

	2000	2004	2008	2012	2016	2019
Iceland	103.16	103.23	102.81	102.46	104.28	102.86
Norway	103.71	103.61	103.52	103.30	102.59	102.84
New Zealand	102.95	103.15	102.60	102.43	102.54	102.61
Bolivia	99.14	99.57	100.60	100.13	101.01	102.17
Australia	102.50	102.48	101.63	101.55	101.68	102.14
Uruguay	99.64	99.93	100.28	100.24	100.36	100.45
Russia	101.01	99.95	99.59	99.45	99.68	100.28
Chile	99.71	99.88	100.30	100.29	100.09	100.16
Mauritania	98.37	98.62	98.49	98.87	99.48	100.09
Malaysia	98.58	98.95	99.08	99.36	99.05	99.89
United Arab Emirates	100.12	100.23	100.84	100.98	98.31	99.54
Azerbaijan	98.24	98.93	100.51	99.37	99.46	99.36
Peru	98.78	98.97	99.35	99.43	98.84	99.18
Colombia	98.00	98.37	98.36	98.78	98.93	99.12
Kuwait	98.17	97.98	98.26	98.30	97.95	99.08
Zambia	99.78	99.28	98.99	99.11	98.94	99.06
Kenya	98.92	99.24	99.31	99.16	99.32	99.05
Burkina Faso	97.74	98.18	98.03	98.67	99.01	98.97
Kazakhstan	99.61	99.72	99.48	99.46	98.31	98.94
Uganda	98.10	98.21	98.11	98.02	97.90	98.61
Saudi Arabia	97.30	97.47	98.03	97.88	97.18	98.50
Cameroon	98.17	98.01	98.41	98.46	98.62	98.46
Ghana	97.38	97.97	97.79	98.08	98.67	98.35
Paraguay	97.83	97.87	97.80	98.08	98.12	98.07
Iran	97.62	97.24	97.53	97.28	97.82	97.83
Oman	97.22	97.67	97.35	98.00	97.50	97.79
Cote d'Ivoire	97.37	97.25	97.80	97.66	97.68	97.69
Qatar	97.39	97.73	97.72	98.28	97.77	97.49
Ethiopia	97.17	97.22	97.00	97.38	97.65	97.34
Bahrain	97.31	97.27	97.00	96.94	96.63	97.10
Argentina	97.28	97.51	97.37	97.46	97.42	97.03
Angola	102.33	100.40	101.51	99.79	97.83	96.84
Nigeria	98.26	98.00	97.60	96.99	96.48	96.47

Least Improvement  Most Improvement

Tables 4.8 to 4.10 Show the Changes in Scores by Sub-Indices for Commodity Producers.

Top-ranked nations within the output sub-index have seen some ups and downs over time, but the overall list of nations has remained the same – Australia and New Zealand were way ahead of their counterparts in 2000, but Iceland and Norway have caught up over the 20-year period.

A common factor across these nations is the increasing share of services to GDP (rising to 60% in Norway and 66% in the other three).

With respect to the trade sub-index, the consistent presence of Malaysia on top of the list must be lauded (it is ranked 28th globally in 2019): over time, the country has rolled export-oriented development policies like increasing goods exports sophistication, greater investments in high-productivity and value-added sectors (improving linkages with the domestic economy) and also supporting FDI inflows with the creation of free zones (offering subsidies and tax incentives). None of the other commodity producers have come close to this score.

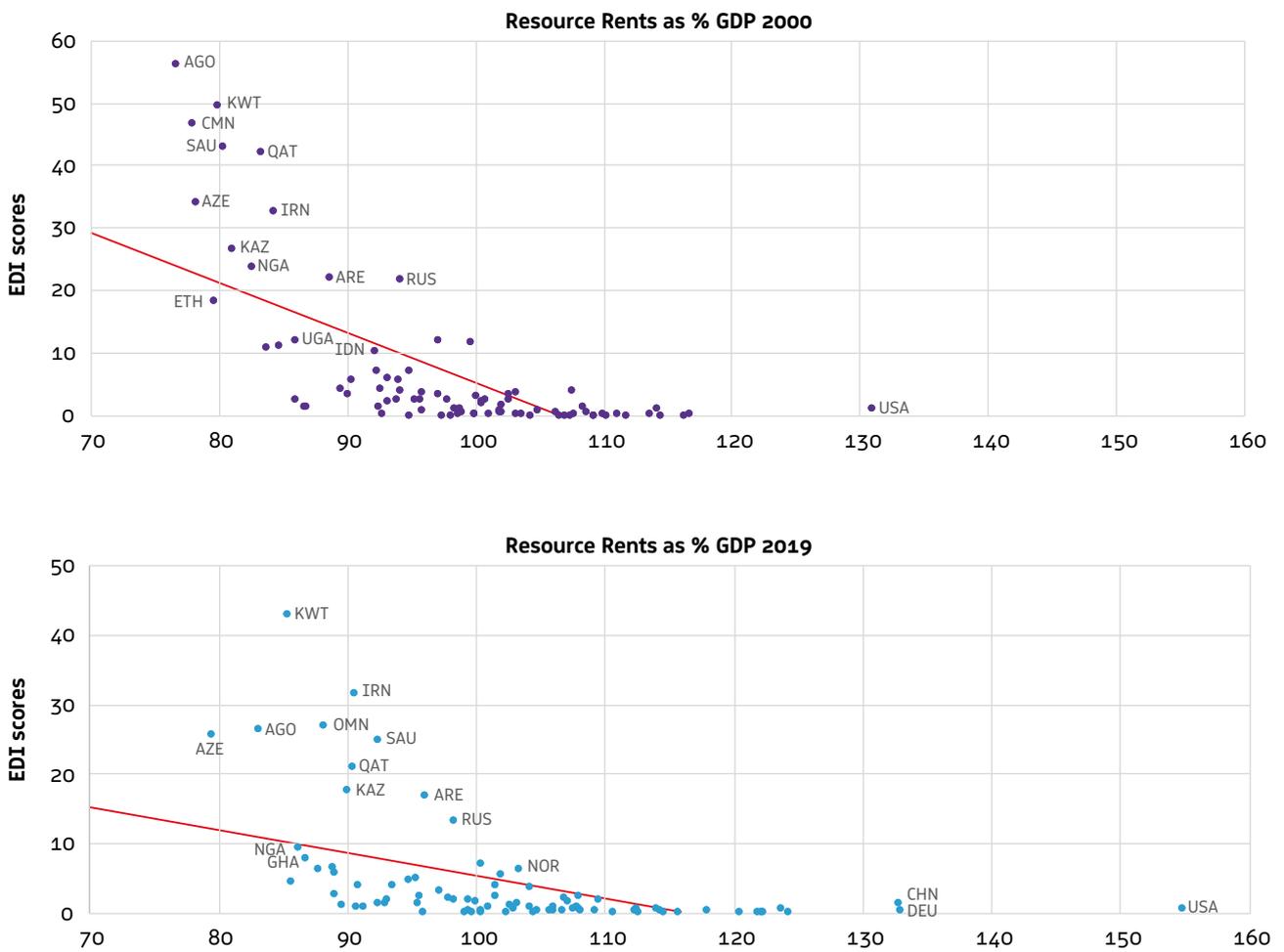
Nations that have improved significantly in this sub-index are some of the oil exporters (like Norway, the UAE and Saudi Arabia).

In the revenue sub-index, the Nordic nations Iceland and Norway top the list among commodity producers, mirroring the global pattern (these two nations are ranked 3rd and 4th globally). The Middle East's oil exporters' relatively weak tax structures have led to low scores in this sub-index. Saudi Arabia and the UAE's introduction of VAT and excise taxes from 2018 have slightly improved their scores in this regard (the UAE's collection of various fees and charges added to the 'tax' revenue component prior to that)¹⁷.

¹⁷ Officially, the data for UAE starts from 2010 onwards only. This statement is based on Article IV reports on UAE

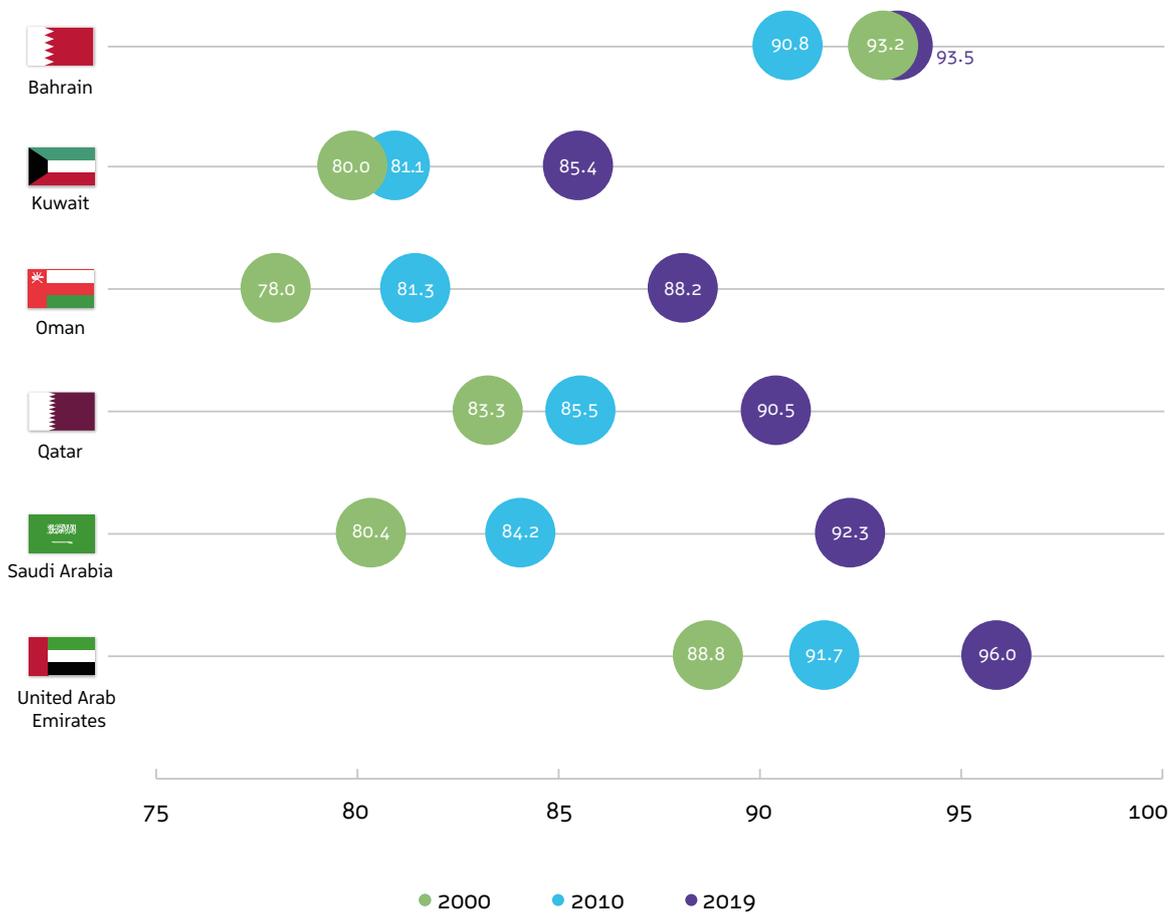
The chart below confirms that countries with higher resource rents as a % of GDP score lower on the economic diversification index in 2000. By 2019, almost all countries' resource rents readings have declined compared to 2000, and many have improved their EDI scores. This only shows correlation and not causation.

Chart 4.11 Scatter Chart with EDI Scores and Resource Rents as a % of GDP



As can be seen from the Chart 4.12, the GCC region has seen a significant improvement in its EDI scores over the 2000-2019 period, supported by its diversification plans. However, Bahrain, which used to be a leader in the region in early 2000 has not seen much improvement in its score, as opposed to the UAE or Saudi Arabia both of which have registered a major improvement.

Chart 4.12 EDI Performance Across the GCC 2000 - 2010 - 2019





Chapter 5

Concluding Remarks & Way Forward



For resource-dependent nations, the policy challenge is how to successfully turn resource rents into an engine of growth rather than a barrier to economic development, avoiding the ‘resource curse’.

This inaugural edition of the Global Economic Diversification Index has developed a multi-dimensional analysis and quantification of economic diversification: **output, trade and government revenue diversification.**

We find that over the past two decades – and contrary to initial assumptions – **the gap between the most and least diversified nations has widened instead of narrowing.**

The evidence does not suggest convergence between the most and least diversified nations. However, we also find that commodity exporters that embarked on reforms to strengthen economic diversification have seen their efforts evidenced in higher rankings. **There have been examples of countries overcoming natural resource dependence: Norway, Australia, Chile, Malaysia are a few examples.**

So, what set them apart?

Nations that were initially taking the lead on diversification but have not evolved over time have seen others catching up

underscoring the need for a sustained strategy of targeted reforms (e.g. facilitating adoption of new technologies, institutional, labour, fiscal, trade reforms) to promote diversification.

While GCC nations have benefitted from the recent spate of diversification-oriented reform policies, there is still a long road ahead for them to climb to the higher percentile scores. **Analysis combining economic, structural and institutional factors is likely to provide the answer.**

Among macroeconomic factors that act as drivers of diversification are:

THE REAL EXCHANGE RATE (an overvalued exchange rate, via reduced profitability, will discourage entry of investors into new economic activity/products),

INFLATION (negative relation with private sector development),

NET INFLOWS OF FOREIGN DIRECT INVESTMENT (impact depends on the existing stock of FDI and the stage of diversification – a U-shaped relation),

TERMS OF TRADE (higher the terms of trade, the greater the export concentration),

INVESTMENT AS A SHARE OF GDP (positive impact on diversification).

A number of institutional and structural factors can further support economic diversification efforts

- Greater trade liberalization
- Increased capacity to innovate and absorb new technologies
- Higher access to and inclusiveness of finance support for export diversification
- Population characteristics, including size
- Human capital (via specialization, increased skills, level of innovation and higher productivity)
- Infrastructure
- Institutions



Future editions of the Global Economic Diversification Index will be aimed at widening the country and period coverage of the index as well as expanding the list of indicators in an effort to cover additional dimensions of diversification (e.g. labour flows).

Additionally, future editions will undertake empirical analysis of the factors driving or impeding economic diversification by attempting to answer the following questions:

Which policies have been successful?

Which factors and policies have been detrimental to economic diversification, condemning countries to being commodity export-dependent economies cursed by their natural resources?

Chapter 6

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Appendix A

Data indicators & Metadata

Tables A.1: **EDI Sub Indicators**

Sub Index	Variables	Sources
OUTPUT	Real GDP:	IMF
	Agriculture, forestry, and fishing, value added , as a percentage of GDP: Corresponds to ISIC divisions 1–5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production.	WDI
	Gross fixed capital formation, as a percentage of GDP: Includes land improvements, plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings.	WDI
	Industry as a percentage of GDP: Industry corresponds to ISIC divisions 10–45 and includes manufacturing (ISIC divisions 15–37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas.	WDI
	Manufacturing value added, as a percentage of GDP: Manufacturing refers to industries belonging to ISIC divisions 15–37.	WDI
	Resource rents, as a percentage of GDP: Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents.	WDI
	Services value added, as a percentage of GDP: Services correspond to ISIC divisions 50–99 and they include value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services, imputed bank service charges, import duties.	WDI
	Medium and high technology manufacturing value added share in total manufacturing value added	UNIDO
Manufacturing value added per capita	UNIDO	

Tables A.1: EDI Sub Indicators

Sub Index	Variables	Sources
TRADE	Exports of goods and services (current USD): Exports of goods and services comprise all transactions between residents of a country and the rest of the world involving a change of ownership from residents to non-residents of general merchandise, net exports of goods under merchanting, nonmonetary gold, and services	WDI
	Fuel exports, as percentage of merchandise exports: Fuels comprise the commodities in SITC section 3 (mineral fuels, lubricants and related materials)	WDI
	Export market concentration index (Hirschman–Herfindahl Index, HHI): A measure of the dispersion of trade value across an exporter’s partners. A country with trade (export or import) that is concentrated in a very few markets will have an index value close to 1. A country with a perfectly diversified trade portfolio will have an index close to zero	WITS
	Imports of goods and services, in current USD: Represents the value of all goods and other market services received from the rest of the world (e.g. value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services)	WDI
	Manufactured exports, as a percentage of total merchandise exports: Comprises commodities in SITC sections 5 (chemicals), 6 (basic manufactures), 7 (machinery and transport equipment), and 8 (miscellaneous manufactured goods), excluding division 68 (non-ferrous metals)	WDI
	Medium and high technology exports, as a percentage of manufactured exports: Share of medium and high-tech manufactured exports in total manufactured exports	WDI
	Merchandise trade, as a percentage of GDP: Merchandise trade as a share of GDP is the sum of merchandise exports and imports divided by the value of GDP	WDI
	Total value of services exports, in current USD: Services refer to economic output of intangible commodities that may be produced, transferred, and consumed at the same time	WDI
	Export product concentration index: Annual product concentration index of exports	UNCTAD
	Import product concentration index: Annual product concentration index of imports	UNCTAD

Tables A.1: EDI Sub Indicators

Sub Index	Variables	Sources
REVENUE	Excise tax revenue as a percentage of GDP	IMF
	Income tax revenue, as a percentage of GDP	IMF
	Goods and services tax revenue, as a percentage of GDP	IMF
	Tax revenue, as a percentage of GDP	IMF
	Total revenue, as a percentage of GDP	IMF
	Trade revenue, as a percentage of GDP	IMF

Tables A.2: List of missing output indicators data - that were interpolated/ extrapolated

Agriculture, value added (% of GDP)	Gross fixed capital formation (% of GDP)	Industry (% of GDP)	Manufacturing value added (% of GDP)	Resource rents (% of GDP)	Services value added (% of GDP)	Medium & high technology manufacturing value added share in total manufacturing value added	Manufacturing value added per capita
Bahrain 2000-2005	Ethiopia 2000-10	Bahrain 2000-05	Bahrain 2000-05	Iceland 2000-10	Bahrain 2000-05	Burkina Faso 2000-05, 2017-19	Burkina Faso 2000-05, 2017-20
Canada 2018-19	Kuwait 2018-19	Canada 2018-19	Canada 2018-19	Iran 2019	Canada 2018-19	Mauritania 2000-05, 2017-19	Mauritania 2000-05, 2017-20
Estonia 2019	Qatar 2018-19	Japan 2019	China 2000-03		Japan 2019		
Iceland 2017-18	UAE 2000	New Zealand 2019	Japan 2019		Kenya 2000-05		
Iran 2018-19	Zambia 2000-09		Mauritania 2019		New Zealand 2019		
Israel 2019			New Zealand 2019		Peru 2019		
Japan 2018-19			Russia 2000-01				
Jordan 2019							
New Zealand 2017-19							
Peru 2019							
Singapore 2019							
Tunisia 2019							
US 2018-19							

Tables A.3: List of missing trade indicators data - that were interpolated/ extrapolated

Exports of goods and services	Fuel exports (% of exports)	HH Market Concentration Index	Imports	Manufacturing exports	Medium & hi-tech exports manufactured exports (% of total manufactured exports)	Services exports
UAE 2000	Angola 2000-06, 2008, 2019	Angola 2000-06,2008	UAE 2000	Angola 2000-14, 2019	Angola 2000-14, 2019	Austria 2000-04
	Azerbaijan 2019	Burkina Faso 2006		Azerbaijan 2019	Burkina Faso no data	Bahrain 2019
	Bahrain 2019	Cambodia 2017-18		Bahrain 2019	Singapore 2003	Belgium 2000-01
	Bolivia 2019	Cameroon 2018		Bolivia 2016-19		Burkina Faso 2000-04
	Burkina Faso 2006	Ethiopia 2017-18		Burkina Faso 2006	2019 data missing for all countries	Cote d'Ivoire 2000-04
	Cambodia 2006-07, 2009	Gabon 2010-19		Cambodia 2019		Ethiopia 2019
	Cameroon 2018-19	Ghana 2014-15		Cameroon 2018-19		Gabon 2006, 2016-19
	Estonia 2018-2019	Iran 2007-09, 2012, 2015, 2018		Estonia 2019		Ireland 2000-04
	Ethiopia 2000, 2005-06, 2019	Kenya 2011-12, 2014-16		Ethiopia 2019		Iran 2017-19
	Gabon 2010-2019	Mauritania 2015, 2018		Gabon 2010-19		Lebanon 2000-01
	Ghana 2002, 2004	Nigeria 2004-05, 2015		Ghana 2002		Mauritania 2000-11
	Iran 2007-09, 2012, 2019	Pakistan 2000-02		Iran 2007-09, 2012, 2019		Qatar 2000-10
	Kenya 2011-12, 2014	Qatar 2009, 2011		Jordan 2005		Senegal 2019
	Lebanon 2019	Sri Lanka 2018		Kenya 2011-12, 2014		UAE 2018-19
	Mauritania 2000-06, 2016-19	Tunisia 2018		Kuwait 2005, 2012		
	Nigeria 2004-05	Zambia 2016		Lebanon 2019		
	Oman 2019	2019 data missing for all countries		Mauritania 2001-03, 2006		
	Qatar 2012			Netherlands 2019		
	Saudi Arabia 2019			Nigeria 2004-05		
	Sri Lanka 2018-19			Oman 2019		
	Sweden 2019			Spain 2010-11, 2013		
	Uganda 2019			Sri Lanka 2018-19		
	Ukraine 2019			Sweden 2019		
	UAE 2002-04, 2006, 2009-11			Ukraine 2019		
				Uganda 2019		

Tables A.4: List of missing revenue indicators data - that were interpolated/ extrapolated

Excise tax (as % of GDP)	Income tax (as % of GDP)	GST (as % of GDP)	Tax revenues (as % of GDP)	Total revenues (as % of GDP)	Trade tax (as % of GDP)
Angola 2016-18	Angola 2016-18	Angola 2016-18	Angola 2016-18	Angola 2016-18	Angola 2016-18
Australia 2018	Australia 2018	Australia 2018	Australia 2018	Australia 2018	Australia 2018
Bahrain 2005-08, 2012	Bahrain 2012	Bahrain 2012	Bahrain 2018	Bolivia 2008-18	Bolivia 2008-18
Bolivia 2014-18	Bolivia 2014-18	Bolivia 2008-18	Bolivia 2008-18	Chile 2018	Chile 2018
Botswana 2000-05	Botswana 2000-02	Burkina Faso 2018	Botswana 2000-02	China 2000-04	China 2000-04
Burkina Faso 2018	Burkina Faso 2018	Chile 2018	Chile 2018	Cote d'Ivoire 2000, 2015-17	Cote d'Ivoire 2000, 2015-17
Chile 2018	Cameroon 2018	China 2018	China 2000-04	Gabon 2018	Gabon 2018
Cote d'Ivoire 2000, 2015-17	Chile 2018	Colombia 2000	Cote d'Ivoire 2000, 2015-17	India 2012, 2017-18	India 2012, 2017-18
Egypt 2018	Cote d'Ivoire 2000, 2015-17	Costa Rica 2002-03	Gabon 2018	Iran 2018	Iran 2018
Ethiopia 2000	Ethiopia 2000	Cote d'Ivoire 2000, 2015-17	India 2012, 2017-18	Kazakhstan 2018	Kazakhstan 2018
Greece 2018	India 2012, 2017-18	India 2012, 2017-18	Iran 2018	Kuwait 2000, 2018	Kuwait 2000, 2018
India 2012, 2017-18	Indonesia 2000, 2016-18	Indonesia 2000, 2016-18	Kazakhstan 2018	Madagascar 2018	Madagascar 2018
Indonesia 2000, 2016-18	Iran 2006, 2017-18	Iran 2017-18	Kuwait 2000, 2016-18	Malaysia 2016-18	Malaysia 2016-18
Iran 2010-18	Kazakhstan 2018	Kazakhstan 2018	Madagascar 2018	Mexico 2018	Mexico 2018
Kazakhstan 2018	Kenya 2016	Kenya 2016	Malaysia 2016-18	Morocco 2000-01	Morocco 2000-01
Kenya 2016	Kuwait 2000, 2016-18	Kuwait 2000, 2016-18	Nigeria 2008-18	New Zealand 2018	New Zealand 2018
Kuwait 2000	Madagascar 2018	Madagascar 2018	Oman 2014	Nigeria 2018	Nigeria 2018
Madagascar 2018	Malaysia 2016-18	Malaysia 2016-18	Pakistan 2016-18	Oman 2014	Oman 2014
Malaysia 2016-18	Mauritania 2008-18	Mauritania 2008-18	Qatar 2009-18	Pakistan 2016-18	Pakistan 2016-18
Mauritania 2006-18	Nigeria 2008-18	Nigeria 2016-18	Saudi Arabia 2005-2008	Paraguay 2018	Paraguay 2018
Pakistan 2016-18	Oman 2014-18	Pakistan 2016-18	Senegal 2018	Romania 2016-18	Romania 2016-18
Russia 2007	Pakistan 2016-18	Russia 2000-01	Tunisia 2018	Russia 2018	Russia 2018
Saudi Arabia 2005-08	Saudi Arabia 2005-2008	Saudi Arabia 2005-2008	UAE 2000-10	Senegal 2018	Senegal 2018
Senegal 2018	Senegal 2018	Senegal 2018	Uruguay 2017-18	Tunisia 2018	Tunisia 2018
Tunisia 2018	Tunisia 2018	Tunisia 2018	Zambia 2018	Turkey 2002-2005	Turkey 2002-2005
Uruguay 2017-18	UAE 2004, 2010	UAE 2000-10		Uruguay 2018	Uruguay 2018
Zambia 2000, 2017-18	Uruguay 2017-18	Uruguay 2017-18		Zambia 2018	Zambia 2018
	Zambia 2000, 2017-18	Zambia 2000, 2017-18			
2019 data available only for Argentina, Bahrain, Colombia, Cote d'Ivoire, Ethiopia, Kuwait, Oman, Saudi, UAE	2019 data available only for Argentina, Bahrain, Colombia, Cote d'Ivoire, Ethiopia, Saudi, UAE	2019 data available only for Argentina, Bahrain, Colombia, Cote d'Ivoire, Saudi, UAE	2019 data available only for Argentina, Botswana, Colombia, Cote d'Ivoire, Oman, UAE	2019 data available only for Argentina, Botswana, Colombia, Cote d'Ivoire, Israel, Oman, UAE	2019 data available only for Argentina, Bahrain, Colombia, Cote d'Ivoire, Saudi Arabia, UAE

Appendix B

Regional, Income & Commodity Producers groupings

B.1: Regional Grouping*

East Asia & the Pacific	Eastern Europe & Central Asia	Latam & Caribbean	MENA	North America	South Asia	Sub-Saharan Africa	Western Europe
Australia	Azerbaijan	Argentina	Bahrain	Canada	India	Angola	Austria
Cambodia	Czech Republic	Bolivia	Egypt	United States	Pakistan	Botswana	Belgium
China	Estonia	Brazil	Iran		Sri Lanka	Burkina Faso	Denmark
Indonesia	Hungary	Chile	Israel			Cameroon	Finland
Japan	Kazakhstan	Colombia	Jordan			Cote d'Ivoire	France
Korea	Latvia	Costa Rica	Kuwait			Ethiopia	Germany
Malaysia	Lithuania	Mexico	Lebanon			Gabon	Greece
New Zealand	Poland	Paraguay	Morocco			Ghana	Iceland
Philippines	Romania	Peru	Oman			Kenya	Ireland
Singapore	Russia	Uruguay	Qatar			Madagascar	Italy
Thailand	Slovak Republic		Saudi Arabia			Mauritania	Luxembourg
	Slovenia		Tunisia			Mauritius	Malta
	Ukraine		Turkey			Nigeria	Netherlands
			UAE			Senegal	Norway
						South Africa	Portugal
						Uganda	Spain
						Zambia	Sweden
							Switzerland
							United Kingdom

* World Bank classifies Malta as part of MENA & Turkey as Europe

* IMF classifies Malta as part of Euro area & Turkey as Emerging Europe

*Note: Italics denote landlocked nations

B.2: Income Grouping **

High income	Low income	Lower middle income	Upper middle income
Australia	Burkina Faso	Angola	Argentina
Austria	Ethiopia	Bolivia	Azerbaijan
Bahrain	Madagascar	Cambodia	Botswana
Belgium	Uganda	Cameroon	Brazil
Canada		Côte d'Ivoire	China
Chile		Egypt	Colombia
Czech Republic		Ghana	Costa Rica
Denmark		India	Gabon
Estonia		Indonesia	Jordan
Finland		Iran, Islamic Rep.	Kazakhstan
France		Kenya	Lebanon
Germany		Mauritania	Malaysia
Greece		Morocco	Mauritius
Hungary		Nigeria	Mexico
Iceland		Pakistan	Paraguay
Ireland		Philippines	Peru
Israel		Senegal	Romania
Italy		Sri Lanka	Russian Federation
Japan		Tunisia	South Africa
Korea		Ukraine	Thailand
Kuwait		Zambia	Turkey
Latvia			
Lithuania			
Luxembourg			
Malta			
Netherlands			
New Zealand			
Norway			
Oman			
Poland			
Portugal			
Qatar			
Saudi Arabia			
Singapore			
Slovenia			
Spain			
Sweden			
Switzerland			
United Arab Emirates			
United Kingdom			
United States			
Uruguay			

** The regional groupings are based on the World Bank's country classifications by income level, 22-2021 update using the GNI per capita, Atlas Method. Retrieved on 26th July 2021 from: <https://data.worldbank.org/indicator/NY.GNP.PCAP.CD>

B.3: Commodity-producer groupings

Given the 20-year time series, resource dependent nations have been classified as those where natural resource rents are, on average, at least 10 percent of their GDP throughout the years. Resource rents as % of GDP has been obtained from the World Bank (World Development Indicators). Additionally, the UNCTAD's definition has been used to define a country as dependent on commodities when these account for more than 60% of its total merchandise exports in value terms (on average for the full period). Share of commodities has been sourced from the WTO – using the merchandise exports by product group (SITC 3-digit) data.

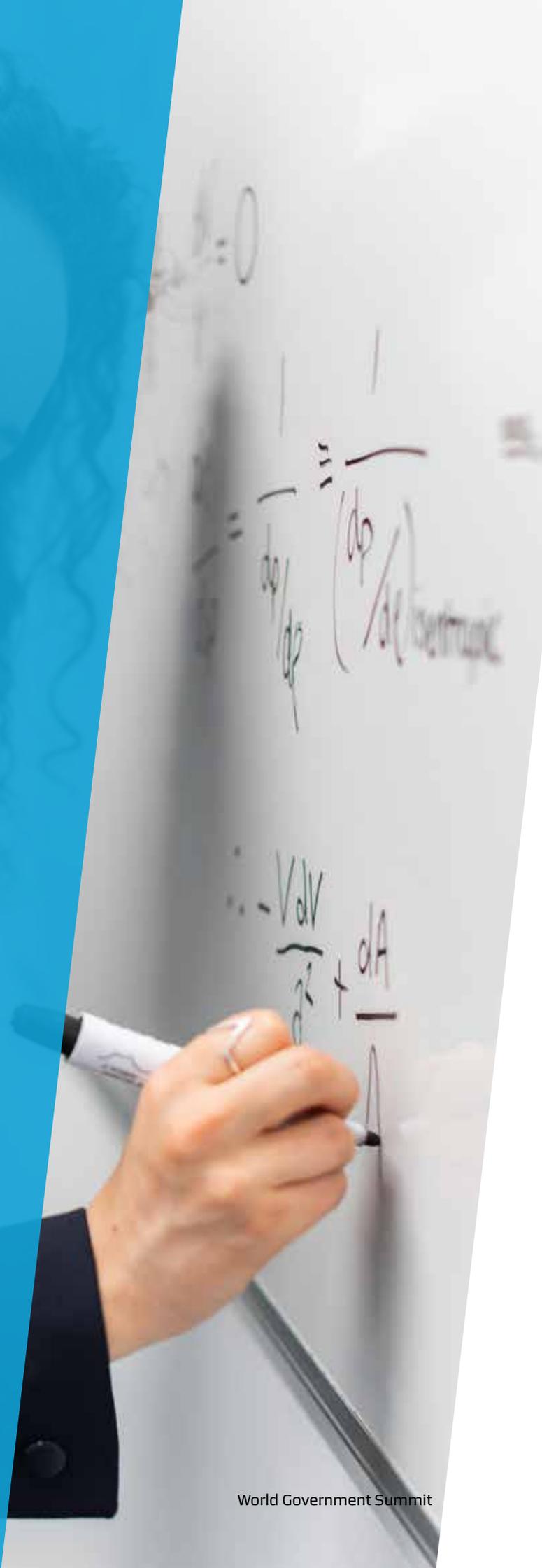
The report identifies all the below-mentioned nations as commodity dependent:

either with resource rents > 10% of GDP OR share of commodities in exports > 60%.

Country Name	Main Resource/ Commodity	Resource Rents (% of GDP)	% share of all commodities in total merchandise exports
Angola	Fuel exports	33.4	96.6
Argentina	Agricultural exports	3.5	65.7
Australia	Fuel, mining & agricultural exports	6.4	73.0
Azerbaijan	Fuel exports	29.3	95.6
Bahrain	Fuel exports	6.1	82.8
Bolivia	Fuel exports	9.0	86.3
Burkina Faso	Minerals, ores and metals	11.9	44.3
Cameroon	Fuel & agricultural exports	7.9	87.2
Chile	Minerals, ores and metals	12.8	84.2
Colombia	Fuel exports	5.9	69.2
Côte d'Ivoire	Agricultural exports	5.6	76.5
Ethiopia	Agricultural exports	17.2	81.8
Gabon	Fuel exports	29.9	87.5
Ghana	Agricultural exports	12.4	51.5
Iceland	Agricultural exports	0.0	83.8
Iran	Fuel exports	25.6	77.6
Kazakhstan	Fuel exports	22.6	85.2
Kenya	Agricultural exports	3.2	67.3
Kuwait	Fuel exports	47.8	92.4
Malaysia	Fuel exports	10.1	29.1
Mauritania	Minerals, ores and metals	27.6	80.8
New Zealand	Agricultural exports	1.6	70.9
Nigeria	Fuel exports	14.1	92.7
Norway	Fuel exports	8.9	77.5
Oman	Fuel exports	37.5	81.2
Paraguay	Agricultural exports	1.6	88.4
Peru	Minerals, ores and metals	7.0	67.9
Qatar	Fuel exports	31.9	89.0
Russia	Fuel exports	15.9	71.3
Saudi Arabia	Fuel exports	39.2	86.2
Uganda	Agricultural exports	13.2	67.1
United Arab Emirates	Fuel exports	21.2	42.0
Uruguay	Agricultural exports	1.2	71.7
Zambia	Minerals, ores and metals	14.3	82.5

Appendix C

Mathematical Appendix



PRINCIPAL FACTOR ANALYSIS (PFA)

Let X be a random vector with finite variance. It can be expressed as a linear function of unobserved factors and an error term as follows:

$$X = a + bf + e$$

Where: a is a vector of means; f is the matrix of factors; b is the matrix of loadings; and e is a vector of errors.

The variance-covariance matrix of X (Σ) can be written as follows:

$$\Sigma = bb' + \Psi$$

Where: Ψ is the variance-covariance matrix of the errors, which is assumed to be diagonal. The first term in the expression is a normalization that identifies the matrix of loadings based on an assumption that the factors are uncorrelated.

PRINCIPAL COMPONENT ANALYSIS (PCA)

PCA is an application of factor analysis in which the factors are assumed to be fixed rather than random, and the residuals are homoskedastic.

ARTIFICIAL NEURAL NETWORK (ANN)

An ANN can be represented schematically as follows:

$$Y_n = f(w_{n-1} Y_{n-1})$$

Where: Y is the output; w is the weight vector; and f is a function, in the case explored for the EDI a rectified linear model for input and intermediate layers, and a simple linear function for the output layer.

Errors are back-propagated through the network:

$$E_{n-1} = w'_n E_n$$

Weights are updated at each pass with learning rate L :

$$w_n = w_{n-1} - L \frac{\delta E_{n+1}}{\delta w_n}$$

The model is run using stochastic gradient descent.

Bayesian model averaging (BMA)

Consider a linear regression model where the matrix of explanatory variables is partitioned into subset: one that is sure to be included in the model, and a second where inclusion is uncertain.

$$Y = X_1 B_1 + X_2 B_2 + e$$

Model uncertainty means that it is possible to obtain an estimate with lower mean squared error than the unrestricted OLS estimate using all variables. There are $I = 2^{k_2}$ models, where k_2 is the number of variables in X_2 . Model M_i is obtained by including a subset of those k_2 variables such that $0 \leq k_{2i} \leq k_2$, so that it can be written as follows:

$$Y = X_1 B_1 + X_{2i} B_{2i} + e_i$$

A model averaging estimate of B_1 is given by:

$$\widehat{B}_1 = \sum_{i=1}^I \lambda_i \widehat{B}_{1i}$$

Where: λ_i is a weight; and \widehat{B}_{1i} is the estimate of B_1 obtained by conditioning on Model M_i .

To introduce Bayesian prior beliefs, models are weighted based on their posterior probability. Under equal prior probabilities, the weights are given by:

$$\lambda_i = \frac{p(Y | M_i)}{\sum_{j=1}^I p(Y | M_j)} = \frac{c (g/(1+g))^{k_{2i}/2} (Y' M_{-1} A_i M_{-1} Y)^{-(n-k_{2i})/2}}{\sum_{j=1}^I c (g/(1+g))^{k_{2j}/2} (Y' M_{-1} A_j M_{-1} Y)^{-(n-k_{2j})/2}}$$

Where: c and g are constants; $M_{-1} = I - (X' X)^{-1} X'$;

and $A_i = \frac{g}{1+g} \{M_{-1} - M_{-1} X_{2i} (X'_{2i} M_{-1} X_{2i})^{-1} X'_{2i} M_{-1}\}$.

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