

Distr.
LIMITED
E/ESCWA/EDID/2019/WP.12
3 September 2019
ORIGINAL: ENGLISH

Economic and Social Commission for Western Asia (ESCWA)

The ‘Sophistication’ of Arab Exports: Measurements and Main Tendencies

Mohamed A. Chemingui and Hayoung Park



United Nations
Beirut, 2019

Note: This document has been reproduced in the form in which it was received, without formal editing. The opinions expressed are those of the authors and do not necessarily reflect the views of ESCWA.

19-00955

1. Introduction

The past couple of decades witnessed an increasing interest among countries in issues related to the quality of growth through economic transformation, which can engender both static and dynamic gains. Static gains refer to the rise of productivity as the factors of production shift to more productive sectors. Dynamic gains, on the other hand, accrue through accumulation of production factors and the efficiency with which they are combined, resulting notably from skill upgrading and positive externalities resulting from allowing workers to access to better technologies (UNCTAD, 2016). Thus, growth quality is very crucial and essential for sustained development promoted by the facilitation of income generation in a more equal manner across the income distribution, ensuring that countries are better shielded from the potentially adverse effects of price shocks and cycles and providing a platform for diversifying the available source of future growth (Rodrik, 2015; UNECA, 2013). The attention to the quality of growth is evident when looking to SDG's sub goal 8.1 which aims to "Achieve Transformation of economies towards high levels of productivity through diversification with a focus on high value-added sectors" (OWG, 2014). Encompassing many stages, the continuous process of economic transformation refers to the joint interrelated of both structural change – referring to as the movement of labor and other productive resources from low-productivity to high-productivity economic activity between sectors and within each sector, and the raise within-sector productivity growth through the adaptation of new technologies and management practices that increases the efficiency of the production – and economic development – referred to as an increases of value-added and rapid technological shift which contribute in boosting the economic growth per capita.

Generally, economic transformation occurs when an economy structurally moves over time from one that is dominated by activities associated with subsistence and lower productivity to a one that is based on higher and more sophisticated level of economic activities (Ibrahim 2012). Economic activities also tend to differ with respect to the capacity to absorb workers. The sectors with highest labor productivity employ the smallest share of the workforce. On the other hand, tradable services are becoming very important due to their high technological base, hence specialization in service such as information and communication technology (ICT) might cause high-quality employment. This process can be materialized by a technological shift which drives to a modernized and more sophisticated goods and methods of production, which entail diversified production base and an upgrade of goods produced within each industry, industrial upgrading can arise at the firm or and the country level, another way was economic transformation can be conceived is through the increased production of sophisticated products incorporating the most advanced and complexes economies' capabilities.

Over the last decade, spanning 2006-2016, Arab countries have had small economic growth rates about 3.7% annually, whereas, during the same period, East Asian and Sub-Saharan African countries recorded much higher annual growth rates. This sub-par performance of Arab countries is still regarded as inadequate given the abundance of the great challenges faced by these countries in terms of reining in unemployment and poverty. This relatively slow pace of economic and social development increasingly raises the question of the suitability of the production apparatus and export structure of these countries. The analysis of exports seems to be a good indicator of the production system given that exports make up that part of the production system that is entirely subject to international competition. In other words, exports, in which a country has a comparative advantage, are a genuine demonstration of a country's ability to raise the value of its production system in international markets. Moreover, from a practical viewpoint, export data are often more

readily available, coherent and compatible across time and countries than production data, making them amenable for direct comparisons between countries and over time.

In this regard, economic literature has shown that economic development is linked to an increase in the sophistication of a country's production, and exports. Hausmann et al. (2007) demonstrated that what a country produces, and exports matters for growth. Specializing in some products will bring higher growth and greater knowledge spillovers than others. Ultimately, some products are more sophisticated, in the sense that they are associated with higher productivity levels, and those countries that latch on to such products will perform better. Over time, the sophistication of a country's production structure may evolve.

The objective of this paper is to estimate and analyze the recent trend in the level of sophistication of Arab economies using the appropriate databases and techniques. It will also provide a ranking of Arab economies in terms of sophistication of exports both at regional and global levels. After this introduction, section 2 presents the methodology used to estimate the trends in export sophistication for Arab countries as well as for the rest of the world. Section 3 analyzes the results and the last section concludes.

2. Methodology

As development entails structural change (a shift of production towards greater capital, skill and technology intensity), it is important to analyze and trace changes in the production, trade, industrial and other structures, both within and across countries. With liberalization and globalization, the pattern and evolution of exports is attracting greater interest in developing countries. Primary products are steadily losing their shares of world trade, and within manufactures, technology intensive products are growing faster than others. In addition, it is widely believed that technology-intensive exports imply greater development benefits to exporting countries: they often reflect higher skill and technical endowments in those countries and they imply more rapid transfer and diffusion of new technology. There is therefore considerable interest in analyzing the technological structure of exports in developing as well as developed countries. In the latter, it is now commonplace to compare the shares of technically advanced products in production and exports and several institutions – like the US National Science Board, the OECD, and the EU – do so regularly. As the organization of trade changes with 'fragmentation', there is also interest among developing countries in entering production networks that have the potential to raise exports and acquire new skills and technology. Since activities differ in the extent to which they can be fragmented, it is useful to analyze 'fragmentability' by looking at product characteristics like process divisibility, the value-to-weight ratio of components, technological needs and so on..

To formalize the notion of sophistication, economic literature provided a measure of export sophistication (EXPY). Using the framework developed in Hausmann et al (2007). This index aims to capture the productivity level associated with a country's export and is a proxy for the through either an increase in the quality of previously produced goods, or a move into new, more sophisticated products. The proposed methodology consists of four main and inter-linked steps. In the first step, we will calculate the total exports of category p from each country over the world during the selected period. If countries are indexed by j , products indexed by l and p represents an export category, total exports of category p from each country is given by:

$$X_j^p = \sum_l x_{jl}^p$$

The second step consists of calculating the productivity level associated with each product. To do so, let Y_j denote the per-capita GDP of country j . Then the productivity level associated with product k in category p , $PRODY_k^p$, equals the weighted average of per capita GDPs, where the weights represent the revealed comparative advantage of each country in that product:

$$PRODY_k^p = \sum_j \frac{(x_{jk}^p / X_j^p)}{\sum_j (x_{jk}^p / X_j^p)} Y_j$$

The numerator of the weight, (x_{jk}^p / X_j^p) , is the value-share of the product in the country's category p export basket. The denominator of the weight, $\sum_j (x_{jk}^p / X_j^p)$, aggregates the value shares across all countries exporting that product in that category.

In the third step, we will derive the export sophistication index. To do so, the $PRODY$'s are used to compute the productivity level associated with country j 's export basket of goods, manufactured goods, or services, $EXPY_j^p$ (export sophistication). Specifically, $EXPY_j^p$ is the average income and productivity level associated with all products in each category exported by a country. It is computed as the weighted average of all relevant $PRODY$'s, where the weights represent the share of the relevant product in the country's export basket. Thus,

$$EXPY_i^p = \sum_l \left(\frac{x_{il}^p}{X_i^p} \right) PRODY_l^p$$

$EXPY$ s are constructed for each country and for each year with available data.

The fourth and final step is to classify Arab countries per level of the sophistication performance during the considered period of analysis. The ranking will not be limited to Arab countries, but it will cover all countries included in the international trade databases.

For the specific case of this assessment, the evaluation of sophistication level has been carried out at HS 6 level of product classification for the period 1990-2016. However, an important adjustment has been integrated to this approach to consider the structure of Arab economies, and mainly the rich oil producers countries such as Qatar, Bahrain, and UAE. Thus, instead of using national GDP per capita, we used the weighted average GDP per capita for the OECD countries. This adjustment allows the achievement of two major objectives. First, to avoid the shortcoming of the original approach which classify rich oil economies among the top performer in sophistication performance. Second, it will allow the analysis to be more robust in terms of comparison with the OECD countries that are found to be the major performers in sophistication over the world.

3. Results

3.1. The global ranking of Arab countries

Empirical researches have proven a significant link between economic diversity and sustained growth in the comparison studies between high-income countries and low and middle level ones. The increase in GDP per capita and the decline in volatility are consistent with the diversification of production and export performance (Papageorgiou and Spatafora 2012). Therefore, production and export diversification connected to each other and dynamically redistributing resources from the less productive sector to the activity resulting from structural change (McMillan and Rodrik, 2011).

When we compare OECD and Arab countries these changes include redistribution from agriculture and natural resources to manufacturing and technology-oriented production. Because the latter is more likely to improve productivity and competitiveness. However, as the country becomes richer and reaches the status of advanced production, the level of diversification tended to be saturated. (Cadot, Carrere, and Strauss-Kahn, 2011). The development patterns of Arab countries have weaknesses, however, and increasing economic diversification is paramount. Greater diversification would reduce exposure to volatility and uncertainty in the global oil market which is related to the major part of economic development in Arab economies depending on natural resource extraction industry.

Figures 1 and 2 show the sophistication ranking of 186 countries for manufactured exports in 2006 and 2016. The 186 countries include 19 Arab countries, 24 OECD countries, and 143 countries from the rest of the world. Figure 3 shows the changes in global ranking for the 19 Arab countries. In general, when comparing 2006 and 2016, the situation of the best performers in terms of exports sophistication in the Arab region remained stable.

Figure 1: Global Ranking of exports sophistication in 2006

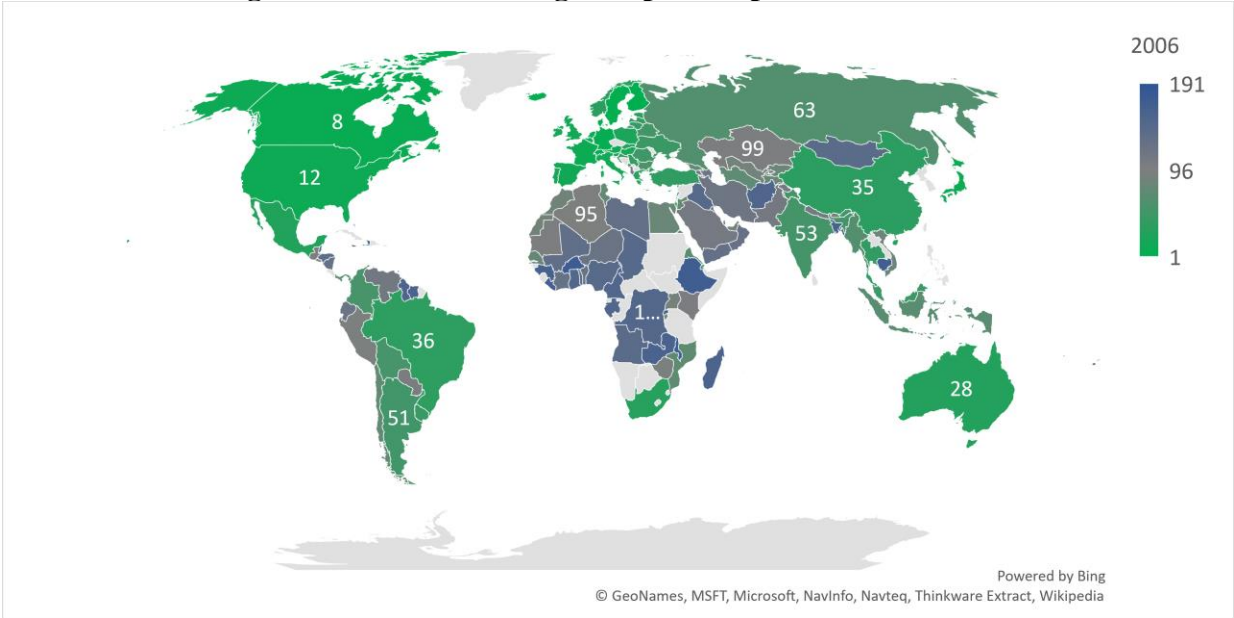


Figure 2: Global Ranking of exports sophistication in 2016

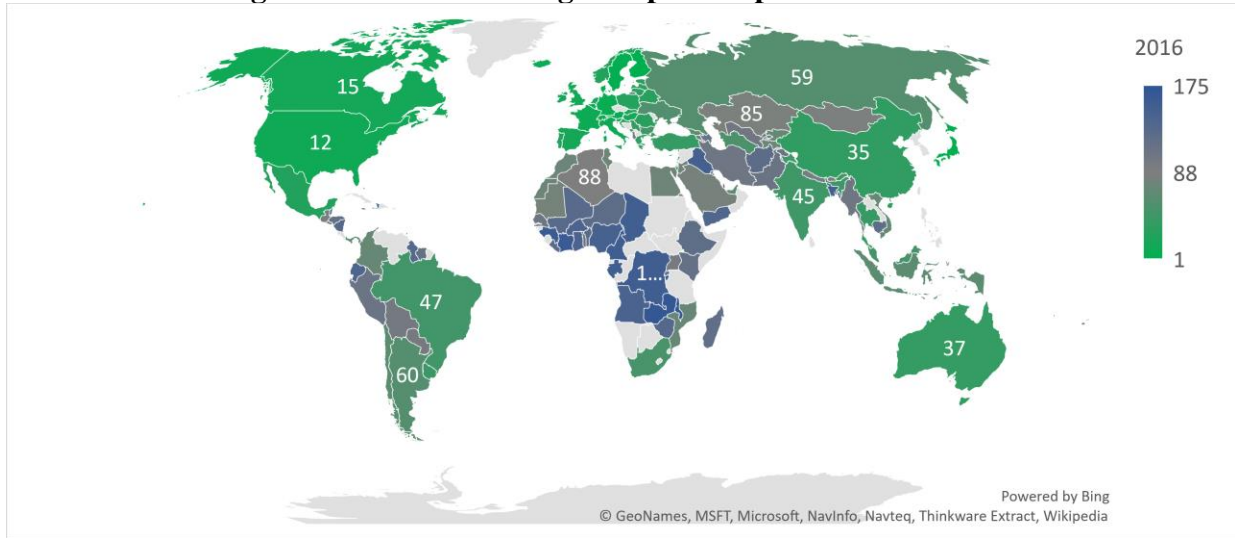
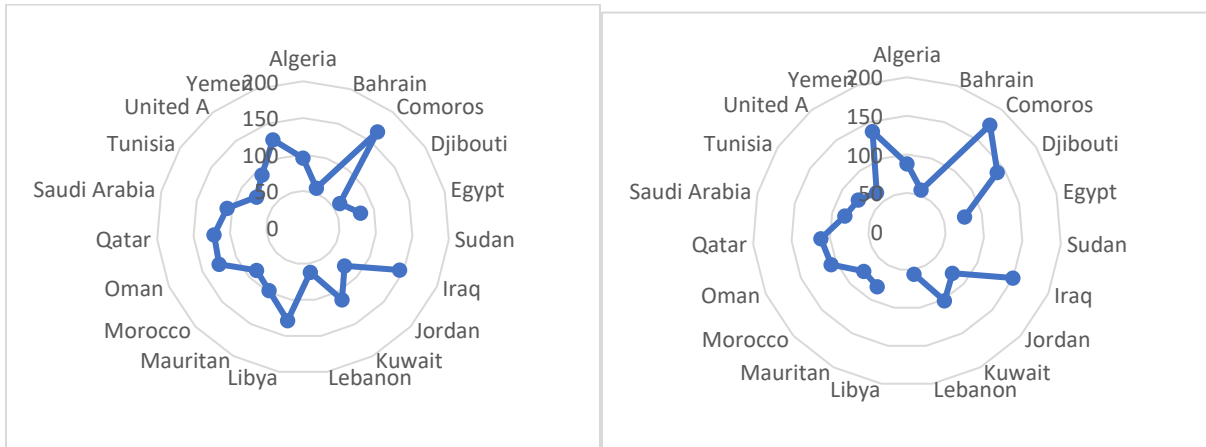
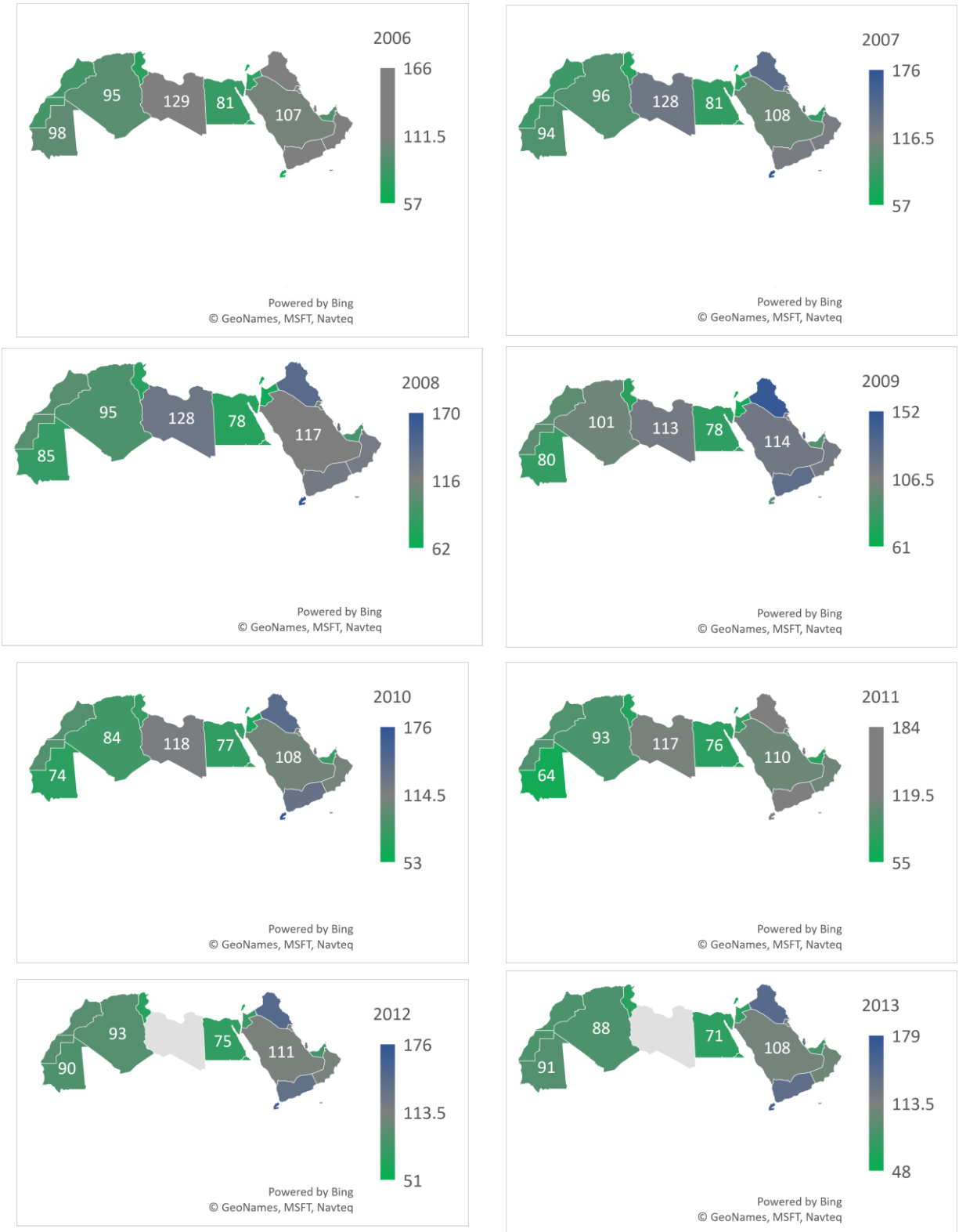


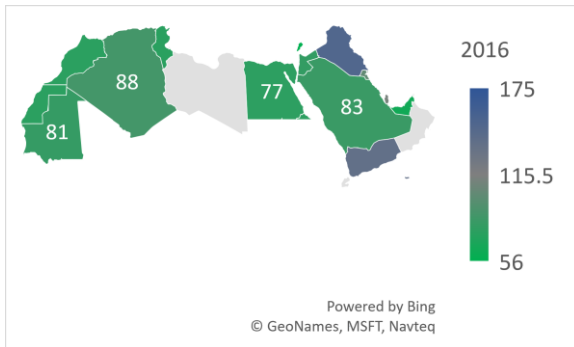
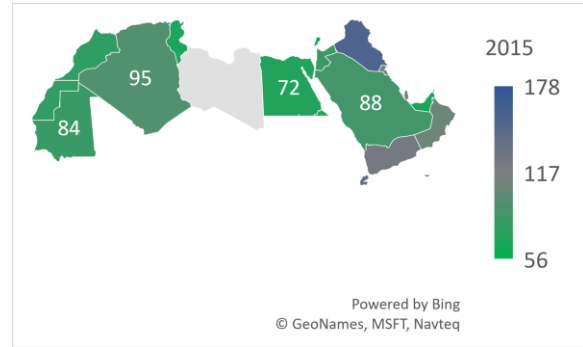
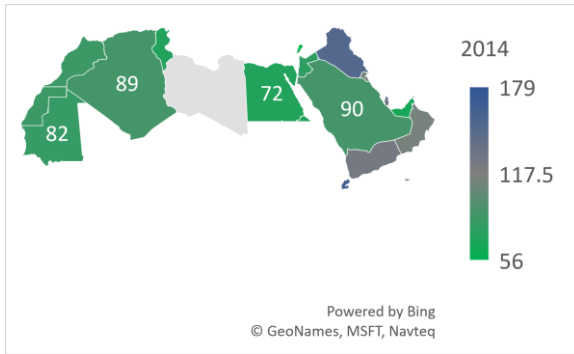
Figure 3: Global ranking of export Sophistication of Arab countries in 2006 and 2016



Turning to the country level, the following Figure 4 shows the global ranking of each Arab countries over the considered period of analysis: 2006-2016.

Figure 4: Global Ranking of exports sophistication for Arab countries over the period 2006-2016





3.2.Sophistication performance at country level

The export sophistication can be indicated by the number, variety and rarity of the goods it exports (Hausmann, et al 2007). While the extent of economic complexity is not exactly linked to the level of economic development of a country, it is still effective to predict the future modalities of economic growth (Hausmann. et al, 2011). Furthermore, countries with more complex production structures generally show better performance in the following years.

Turning to the export performance by sophistication level, 10 categories have been considered in the present assessment. Level 1 is composed of the most sophisticated products while level 10 is composed of the less sophisticated products. The classification of products by sophistication level has been done at HS 6 level of product classification.

Tables 1 and Table 2 display the distribution of manufactured exports by sophistication level of the 19 Arab countries respectively in 2006 and 2016 while tables. In general, most high and medium technology products score relatively high on the sophistication scale while most low-sophistication products are from the low technology or resource-based technology categories. There is no low technology product in the top two sophistication groups, and no high technology product in the bottom two. However, many products do not conform to *a priori* expectations, and we may speculate about their location determinants. In general, and for most Arab countries, exports are concentrated in the less sophisticated levels. However, Morocco, Tunisia, United Arab Emirates and Egypt are much more diversified than the rest of the countries.

Table 1: Distribution of Arab countries' manufactured exports by sophistication level in 2006

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10
Algeria	0.1%	0.0%	0.1%	0.1%	16.9%	0.6%	0.5%	1.0%	68.3%	12.4%
Bahrain	0.1%	1.6%	11.4%	2.1%	2.9%	3.7%	16.5%	13.0%	42.5%	6.2%
Comoros	0.1%	0.2%	1.0%	1.0%	1.0%	0.6%	3.5%	2.0%	1.7%	88.8%
Djibouti	0.6%	4.6%	5.4%	6.1%	8.6%	5.2%	13.9%	3.6%	6.9%	45.3%
Egypt	0.3%	1.1%	3.2%	2.4%	4.7%	5.3%	5.6%	10.4%	30.9%	36.1%
Iraq	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	0.1%	99.6%	0.1%
Jordan	0.2%	1.5%	2.9%	5.1%	7.5%	6.9%	8.4%	8.9%	15.1%	43.4%
Kuwait	0.1%	0.7%	0.5%	0.5%	1.6%	1.8%	0.6%	0.6%	92.6%	1.0%
Lebanon	0.6%	2.1%	3.2%	5.0%	7.9%	7.8%	12.1%	12.4%	32.8%	16.1%
Libya	0.0%	0.4%	0.2%	0.0%	0.2%	0.4%	0.3%	0.7%	96.5%	1.1%
Mauritania	0.0%	0.1%	0.5%	0.3%	0.9%	0.3%	29.4%	1.7%	52.3%	14.5%
Morocco	0.2%	0.5%	1.9%	2.4%	3.0%	7.0%	13.4%	12.6%	12.1%	46.7%
Oman	0.1%	0.4%	0.6%	0.7%	1.2%	1.6%	1.8%	3.1%	69.1%	21.5%
Qatar	0.0%	1.2%	0.4%	0.3%	2.1%	2.4%	0.7%	0.8%	62.7%	29.4%
Saudi Arabia	0.5%	0.8%	0.8%	0.7%	2.5%	3.7%	1.1%	0.9%	87.0%	1.9%
Tunisia	0.4%	0.9%	2.3%	4.2%	5.3%	14.3%	4.9%	6.3%	24.3%	37.1%
United Arab Emirates	0.2%	0.9%	3.2%	1.8%	3.6%	3.0%	2.3%	3.9%	75.7%	5.4%
Yemen	0.1%	0.2%	0.2%	0.4%	0.4%	0.7%	0.8%	1.6%	93.0%	2.6%

Table 2: Distribution of Arab countries' manufactured exports by sophistication level in 2016

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10
Algeria	0.0%	0.0%	0.0%	0.2%	0.2%	22.8%	0.1%	23.7%	36.9%	16.0%
Comoros	0.0%	0.0%	0.2%	0.1%	0.1%	0.5%	0.4%	0.1%	6.2%	92.6%
Egypt	0.4%	0.9%	2.9%	5.8%	5.4%	9.7%	10.7%	13.5%	33.1%	17.6%
Iraq	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.8%	98.7%	0.3%
Jordan	0.3%	0.5%	1.5%	4.8%	9.5%	5.4%	16.0%	8.9%	15.3%	37.6%
Kuwait	0.2%	1.4%	0.6%	1.8%	1.6%	2.9%	3.9%	16.9%	68.9%	1.8%
Lebanon	0.8%	2.0%	2.1%	5.0%	8.5%	10.1%	22.6%	10.0%	32.2%	6.7%
Mauritania	0.3%	0.1%	4.0%	0.1%	18.5%	0.7%	1.3%	7.2%	30.5%	37.3%
Morocco	0.2%	2.3%	2.9%	10.9%	3.9%	5.6%	8.3%	13.3%	16.6%	35.9%
Qatar	0.3%	0.1%	2.2%	0.7%	2.6%	1.2%	2.1%	14.3%	26.6%	50.0%
Saudi Arabia	0.6%	0.9%	1.8%	3.5%	4.5%	5.6%	5.9%	9.3%	64.9%	3.0%
Tunisia	0.3%	1.3%	1.6%	6.8%	4.9%	9.0%	12.5%	18.4%	17.2%	27.9%
United Arab Emirates	0.4%	3.7%	4.7%	4.2%	4.5%	5.8%	10.3%	17.5%	44.1%	5.0%
Yemen	0.0%	0.1%	0.3%	0.2%	0.5%	0.3%	1.3%	4.2%	82.0%	11.0%

Tables 3 and 4 shows the changes in the distribution of manufactured exports by sophistication level between 2006 and 2016. Compared with most Arab countries, exports are much more distributed among all levels of sophistication. Compared to the OECD countries, which

show strong trade performance, the achievements regarding export sophistication structure from low and middle countries has shown the difficulties to shift the export structure by establishing domestic producers that can contribute to diversified and more technologically sophisticated production.

Table 3: Distribution of the OECD's countries manufactured exports by sophistication level in 2006

	L1	L2	L3	L4	L5	L6	L7	L8	L9	LX
Australia	3.5%	3.9%	19.0%	8.4%	4.1%	5.9%	16.9%	8.8%	11.9%	17.5%
Austria	8.2%	11.6%	17.5%	13.1%	14.2%	9.9%	8.8%	9.5%	4.0%	3.2%
Belgium-	5.9%	9.9%	13.8%	14.3%	15.4%	11.2%	8.2%	7.8%	9.5%	3.9%
Canada	6.0%	20.6%	14.0%	11.1%	15.5%	7.2%	6.9%	5.8%	9.0%	4.0%
Denmark	16.1%	8.9%	11.1%	10.8%	13.0%	9.6%	7.6%	7.0%	11.9%	4.1%
Finland	19.7%	8.8%	9.5%	11.9%	21.4%	8.7%	6.1%	4.3%	6.8%	2.7%
France	5.0%	15.0%	17.1%	14.0%	11.8%	9.6%	10.3%	5.8%	8.2%	3.3%
Germany	6.0%	13.9%	18.6%	16.9%	14.0%	10.0%	8.9%	5.0%	4.3%	2.5%
Greece	2.7%	4.8%	11.0%	9.3%	11.2%	11.4%	7.6%	10.8%	16.4%	14.7%
Iceland	12.4%	9.2%	12.9%	4.3%	6.1%	21.6%	2.6%	21.6%	8.0%	1.3%
Italy	4.7%	9.8%	14.7%	13.7%	12.6%	12.6%	9.2%	8.0%	9.4%	5.3%
Japan	4.9%	13.9%	16.1%	15.3%	11.0%	10.9%	14.6%	5.5%	4.2%	3.7%
Mexico	0.8%	7.0%	9.4%	13.8%	9.9%	18.1%	10.8%	4.9%	19.3%	6.1%
Netherlands	7.9%	8.7%	10.7%	9.2%	11.1%	12.1%	13.6%	6.1%	16.2%	4.6%
New Zealand	16.0%	11.6%	12.7%	16.8%	7.9%	9.3%	9.7%	6.0%	6.4%	3.6%
Norway	4.8%	2.6%	6.2%	4.3%	20.6%	3.7%	1.7%	3.6%	49.4%	3.0%
Portugal	3.9%	5.3%	14.1%	13.0%	12.1%	10.2%	12.7%	8.6%	9.8%	10.4%
Czech Republic	2.4%	5.2%	9.9%	13.6%	14.4%	10.0%	21.7%	6.9%	8.2%	7.8%
Spain	4.5%	7.3%	17.5%	14.1%	11.9%	13.6%	11.8%	6.2%	6.4%	6.6%
Sweden	11.6%	13.6%	17.0%	16.5%	11.1%	9.4%	7.3%	4.7%	6.9%	2.0%
Switzerland	15.9%	13.5%	10.1%	16.3%	12.2%	7.2%	5.9%	4.6%	11.7%	2.6%
Turkey	0.6%	3.1%	8.9%	8.2%	8.5%	15.4%	10.8%	11.9%	13.7%	19.0%
United Kingdom	4.0%	9.8%	15.5%	14.0%	13.5%	9.0%	10.7%	6.6%	13.9%	2.9%
USA	5.8%	14.6%	15.4%	11.4%	11.2%	11.1%	12.1%	6.5%	7.4%	4.5%
OECD countries	5.8%	11.8%	14.9%	13.4%	12.6%	10.5%	11.0%	6.2%	9.2%	4.5%

Table 4: Distribution of the OECD's countries manufactured exports by sophistication level in 2016

	L1	L2	L3	L4	L5	L6	L7	L8	L9	LX
Australia	2.3%	2.5%	3.2%	3.6%	39.0%	6.0%	4.9%	5.3%	13.2%	20.1%
Austria	10.9%	14.4%	13.2%	15.0%	14.6%	10.7%	9.6%	6.0%	3.1%	2.4%
Belgium-	9.2%	9.0%	13.5%	12.4%	15.6%	11.8%	8.1%	10.1%	6.5%	3.7%
Canada	5.8%	18.2%	8.8%	10.7%	11.1%	9.5%	6.8%	7.5%	18.4%	3.2%
Denmark	24.0%	6.5%	10.6%	10.7%	14.0%	10.2%	6.9%	8.6%	5.5%	2.9%
Finland	25.3%	11.2%	12.5%	10.0%	8.2%	7.4%	7.2%	11.3%	3.6%	3.3%
France	5.5%	7.9%	11.0%	25.7%	14.4%	9.8%	10.8%	6.8%	5.5%	2.7%
Germany	7.1%	16.0%	15.5%	18.0%	12.9%	10.8%	8.5%	5.5%	3.5%	2.2%
Greece	1.5%	3.4%	7.9%	10.5%	11.2%	8.0%	12.6%	30.2%	7.8%	6.9%
Iceland	9.5%	2.7%	25.3%	25.5%	5.1%	11.7%	1.9%	9.2%	5.9%	3.1%
Italy	5.3%	11.4%	12.1%	14.6%	15.8%	11.0%	10.5%	10.2%	5.8%	3.3%
Japan	7.4%	25.2%	12.5%	13.9%	9.4%	10.3%	11.8%	4.2%	3.0%	2.4%
Mexico	2.2%	12.9%	4.5%	17.9%	13.2%	9.6%	10.1%	14.9%	8.9%	5.8%
Netherlands	10.6%	6.2%	9.9%	9.7%	11.8%	10.7%	11.5%	16.5%	8.5%	4.6%
New Zealand	14.7%	24.8%	12.2%	7.0%	11.4%	10.5%	5.6%	5.1%	5.3%	3.2%
Norway	9.6%	3.2%	9.5%	4.3%	4.7%	25.5%	3.7%	7.0%	27.8%	4.7%
Portugal	5.1%	5.0%	9.0%	12.9%	12.3%	11.2%	11.0%	18.8%	7.3%	7.5%
Czech Republic	4.1%	12.0%	12.3%	11.8%	7.5%	8.8%	24.4%	9.2%	5.4%	4.5%
Spain	5.7%	8.5%	12.5%	17.5%	13.0%	10.9%	10.0%	10.2%	5.3%	6.3%
Sweden	17.4%	14.4%	14.6%	10.5%	11.6%	7.1%	8.5%	10.3%	3.4%	2.2%
Switzerland	13.3%	9.4%	9.0%	7.5%	17.9%	5.6%	6.2%	3.4%	26.3%	1.4%
Turkey	1.2%	4.1%	5.9%	13.7%	13.9%	10.9%	10.9%	11.3%	16.8%	11.4%
United Kingdom	5.0%	13.5%	11.7%	16.5%	11.7%	9.5%	9.9%	8.7%	10.8%	2.8%
USA	6.8%	11.3%	9.9%	18.7%	10.9%	9.2%	9.9%	11.6%	8.1%	3.5%

When comparing each Arab country performance in terms of export sophistication to the OECD's countries in 2006 and 2016, many specific observations could be made. First, for many Arab countries the bulk of their exports is concentrated on levels 8, 9 and 10 which show a very poor level of sophistication. This is the case of Algeria for example. Only Lebanon is found to be the most diversified economy with a much better distribution of its exports by sophistication level. Figure 6 displays the relative variations of export sophistication by level and Arab countries compared to the OECD countries respectively in 2006 and 2016. In general, change in sophistication scores over time capture shifts in the location of export production between different income groups, and, by implication, the impact of changes in production fragmentation, local capabilities, transportability, trade arrangements, and so on. While the scores *per se* do not allow the distinction between these factors affecting location. For this reason, presenting the results at a higher level of disaggregation may be more helpful as it will provide useful preliminary insights. Doing that is possible with the results of this estimation that has been made at HS 6 level. In fact, detailed results show that within each group, there are interesting differences at the product level

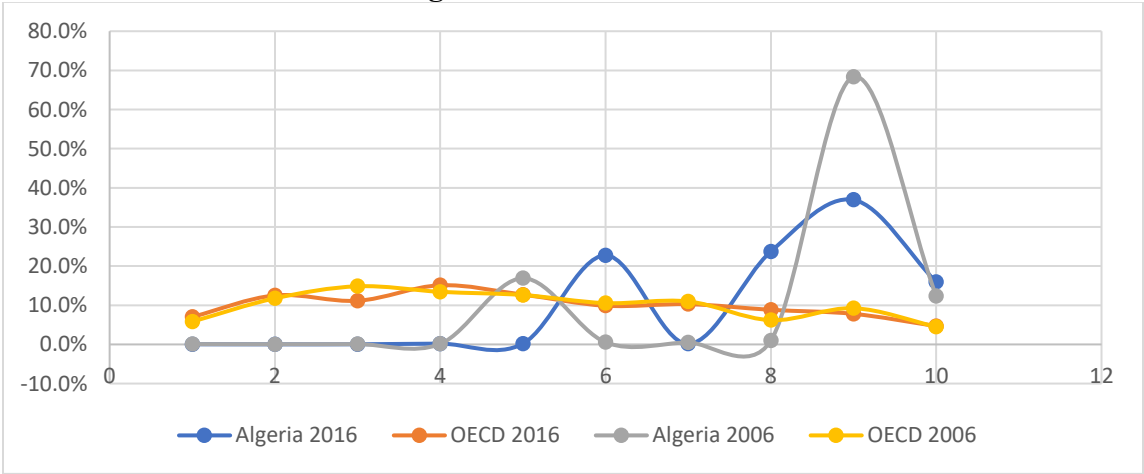
in changes in sophistication scores. Accordingly, some products moving to poorer countries and others to richer ones.

Another way in which we can use the sophistication index data by industry is to consider how the standing of individual countries by industry relative to their own income level has changed over time. Hence if countries show a rise in their outlier status, so that the difference between their actual index score and that predicted for their income level rises, this is prima facie evidence of upgrading within the industry category concerned. Conversely where their actual score is below that predicted, and this gap widens this can be taken as evidence of downgrading. Such comparisons are only suggestive, and it is difficult to draw strong inferences from these sophistication data without specific information on technologies and products, production capacities and determinants of location. The sophistication index cannot, as it stands, cast light on these factors; in combination with more data, however, it can be a useful tool to analyze competitive performance.

When we look at the changes in the levels of exports by sophistication levels, it gives pieces of evidence to identify the structure of a country's overall export sophistication to a degree of change in its export share by sophisticated levels. However, there is still a limit to accurately grasp for the cause of this structural change. It is unclear whether it is the result of country endogenous development or reduced production replaced by other countries in the market of the low sophisticated products. From Figure 5 to figure 17, it covers the comparative changes of Arab countries in the structure of exports by sophistication level respectively in 2006 and 2016.

Figure 6 shows that the portion of the low sophisticated product, level 9, which accounted for the largest portion of Algeria's manufactured products trade, fell sharply from 68.3% in 2006 to 36.9% in 2016. In addition, the portion corresponding to level 8 and level 6 increased from 1.0% to 23.7% and from 0.6% to 22.8%, respectively. On the other hand, exports of level 5, which is the mid-level of export sophistication, accounted for 16.9% in 2006, down from 0.2% in 2016. Regarding the changes in export sophistication level, Algeria has shown that the structure of manufactured export sophistication is actively changing.

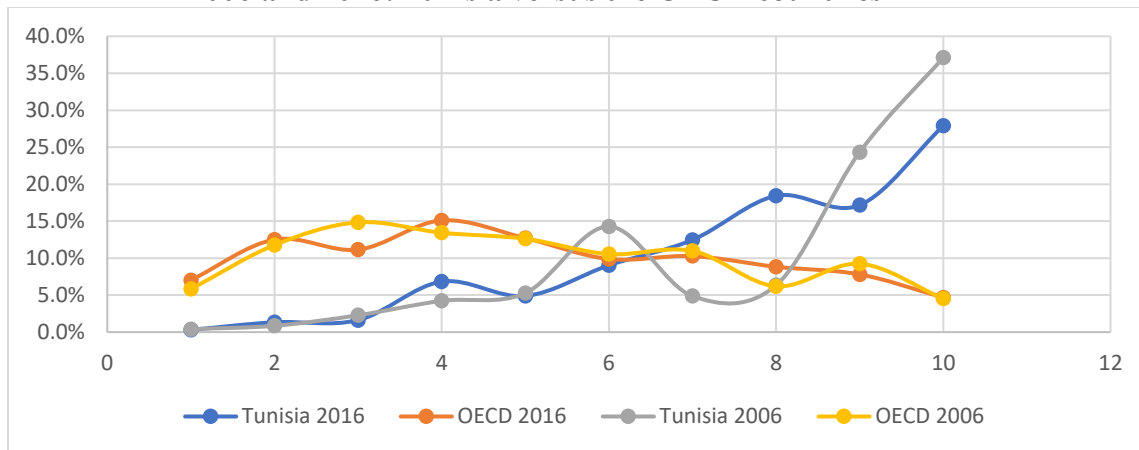
Figure 5: Comparative changes in the structure of exports by sophistication level (in %) in 2006 and 2016: Algeria versus the OECD countries



In Figure 6, there is general adjustment of export products of Tunisia that the proportion of products with the low sophistication level is decreased and the intermediate sophistication level is slightly increased. The percentage of product level 10 and level 9 decreased from 37.1% and

24.3% in 2006 to 27.9% and 17.2% in 2016, respectively. Although the overall sophistication level of export products has risen, there remains a limit to the high level of sophistication.

Figure 6: Comparative changes in the structure of exports by sophistication level (in %) in 2006 and 2016: Tunisia versus the OECD countries



In the case of Morocco, Figure 7 indicates that the share of low-level sophisticated products in level 10, 46.7% in 2006, dropped to 35.9% in 2016. In addition, the proportion of high-sophisticated products in level 4 increased from 2.4% in 2006 to 10.9%. Overall, the proportion of low sophisticated products has decreased and the proportion of high sophisticated products has increased, indicating that the structure of manufactured export sophistication has developed overall.

Figure 7: Comparative changes in the structure of exports by sophistication level (in %) in 2006 and 2016: Morocco versus the OECD countries

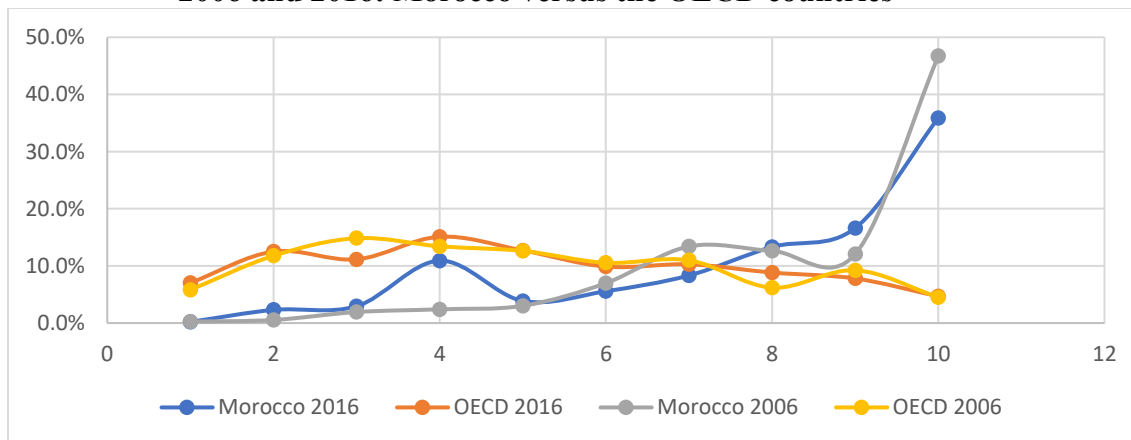
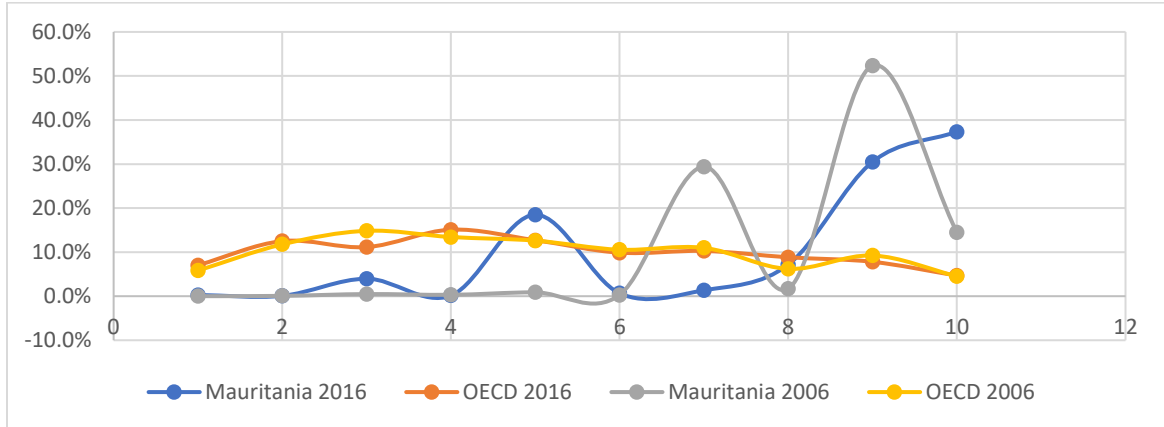


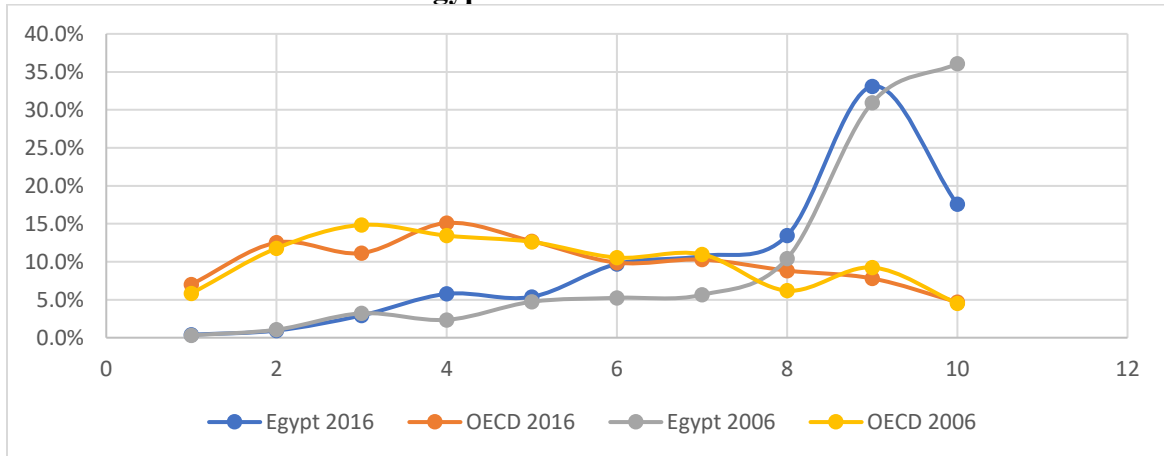
Figure 8 shows that in Mauritania, the proportion of sophisticated products in level 4 increased from 0.9% in 2006 to 18.5% in 2016 and the share of low-level sophisticated products in level 7 and level 9 decreased from 29.4% and 52.3% in 2006 to 1.3% and 30.5%, respectively. Nevertheless, the share of level 10 increased from 14.5% in 2006 to 37.3% in 2016, resulting in an increase in the share of exports of low-level sophisticated products. It can be seen that the development effect of the export sophistication structure has partially offsetting.

Figure 8: Comparative changes in the structure of exports by sophistication level (in %) in 2006 and 2016: Mauritania versus the OECD countries



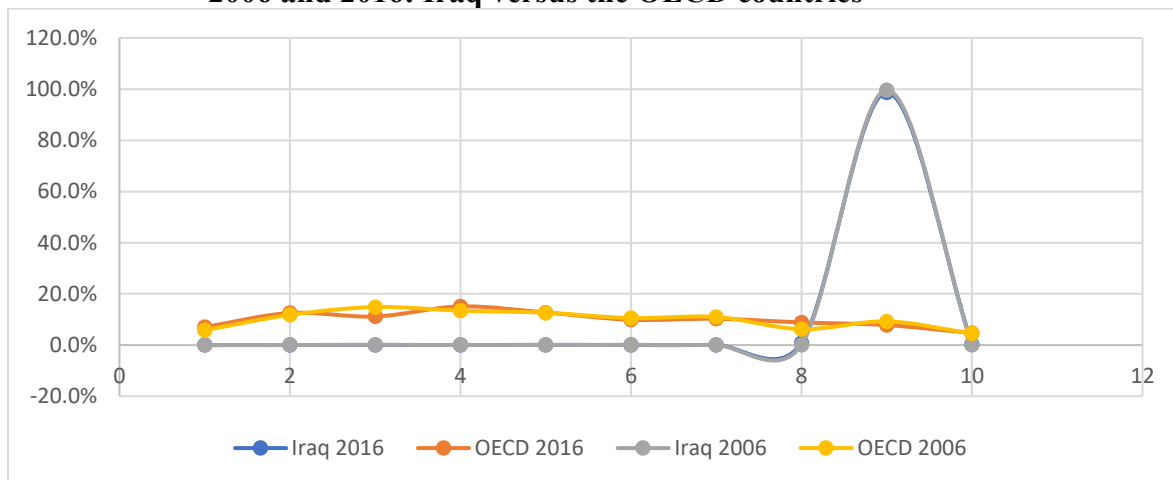
In Figure 9, the structure of the overall export sophistication showed little variation in Egypt. The proportion of low sophisticated products with level 10, which accounted for 36.1% in 2006, declined to 17.6% in 2016. The proportion of exports of manufactured products belonging to the middle sophistication level can be seen as the overall increase from 2006 to 2016. Each level slightly increased from 2.4% to 5.8% in level 4, from 5.3% to 9.7% in level 6, from 10.6% to 5.7% in level 7, 10.4% to 13.5% in level 8, respectively.

Figure 9: Comparative changes in the structure of exports by sophistication level (in %) in 2006 and 2016: Egypt versus the OECD countries



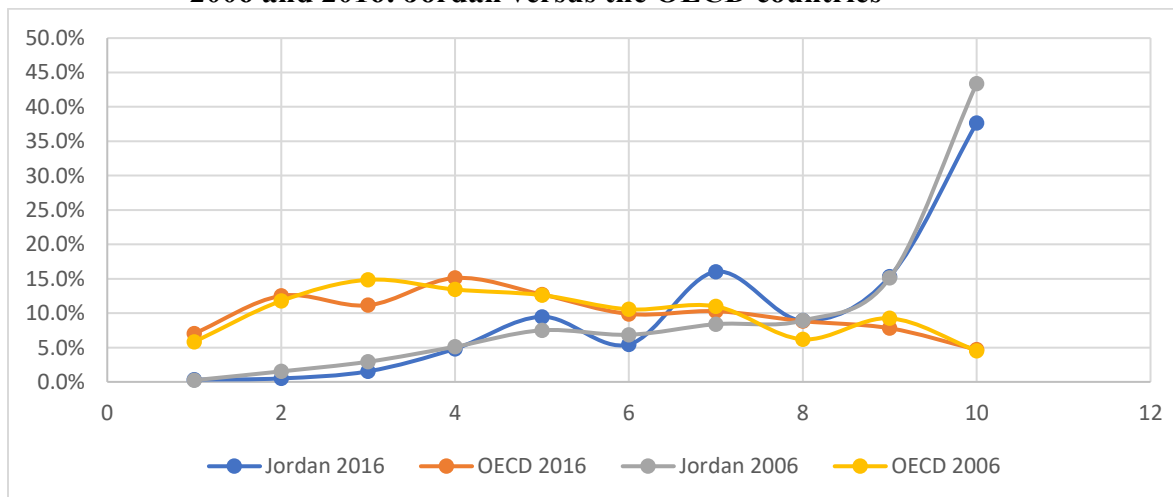
In contrast to the facts that the export sophistication structure of each Arab country showed a small and large change according to the extent of progress, the change in Iraq's exports structure in 2016 compared to 2006 was hardly measured in Figure 10.

Figure 10: Comparative changes in the structure of exports by sophistication level (in %) in 2006 and 2016: Iraq versus the OECD countries



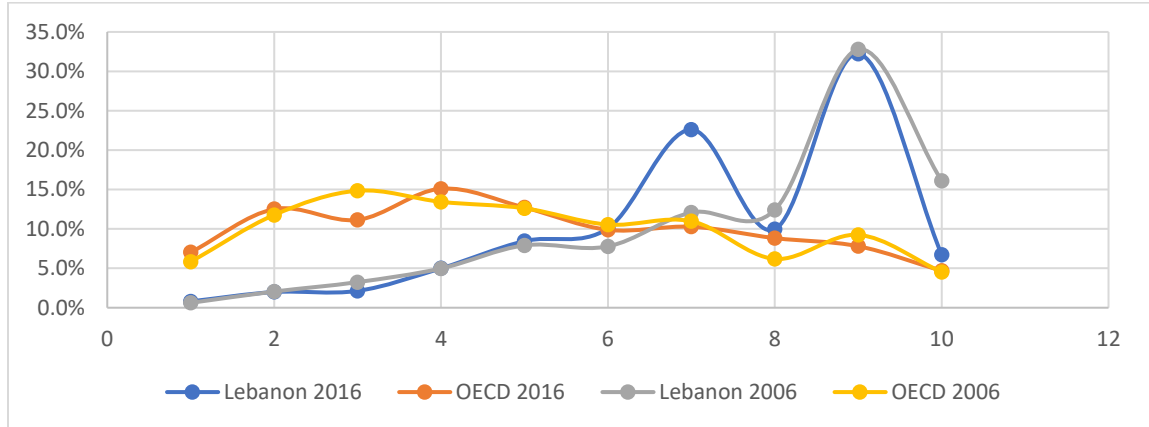
In the case of Jordan, Figure 11 indicates that the overall modalities of the export structure are continuing without extreme changes. Notwithstanding, the share of export of sophisticated products in intermediate level increased from 8.4% in 2006 to 16.0% in 2016. Also, the proportion of low-level sophisticated products decreased from 43.4% in 2006 to 37.6% in 2016. Therefore, it can be seen that the export structure of manufactured products has progressed to a higher level.

Figure 11: Comparative changes in the structure of exports by sophistication level (in %) in 2006 and 2016: Jordan versus the OECD countries



In Figure 12, the share of low sophisticated products with level 9 in Lebanon decreased from 16.1% in 2006 to 6.6% in 2016. In addition, the share of intermediate sophisticated products in exports rose from 12.1% in 2006 to 22.6% in 2016. While the overall export sophistication structure of manufactured products has improved, there is no significant change in the proportion of low sophisticated products with level 9.

Figure 12: Comparative changes in the structure of exports by sophistication level (in %) in 2006 and 2016: Lebanon versus the OECD countries



Interestingly, Kuwait (Figure 13), Saudi Arabia (Figure 14), Qatar (Figure 15), UAE (Figure 16), and Yemen (Figure 17), have found similar patterns of change in overall export sophistication structure of manufactured products, except for the differences in degree. In these countries, the proportion with the product level 9 decreased by 2016 compared to 2006 that from 92.6% to 68.9% in Kuwait, from 87.0% to 64.9% in Saudi Arabia, from 62.7% to 26.6% in Qatar, from 75.7% to 44.1% in UAE, from 93.0% to 82.0% in Yemen, respectively. Despite the similarity, the share of level 10, which has not changed much in other GCC countries, increased in the case of Qatar from 29.4% in 2006 to 50.0% in 2016.

Figure 13: Comparative changes in the structure of exports by sophistication level (in %) in 2006 and 2016: Kuwait versus the OECD countries

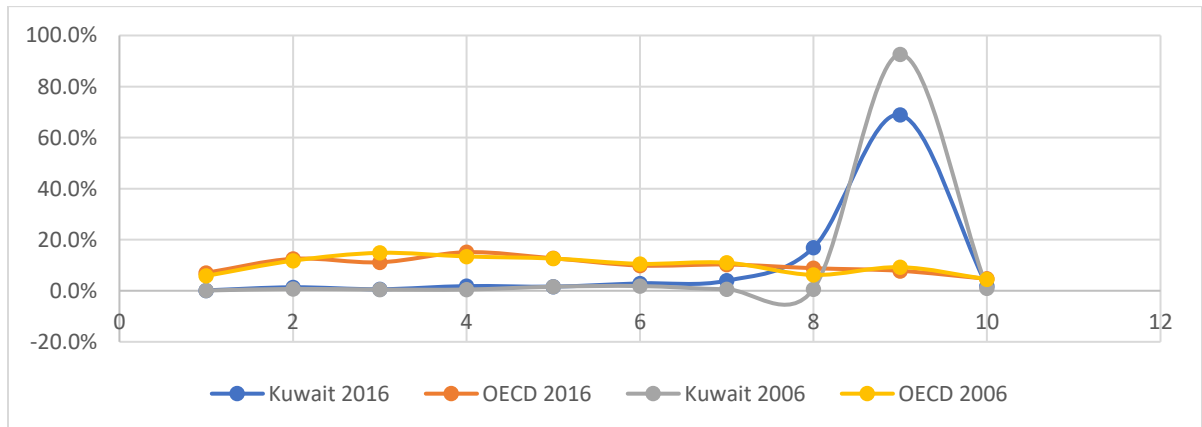


Figure 14: Comparative changes in the structure of exports by sophistication level (in %) in 2006 and 2016: Saudi Arabia versus the OECD countries

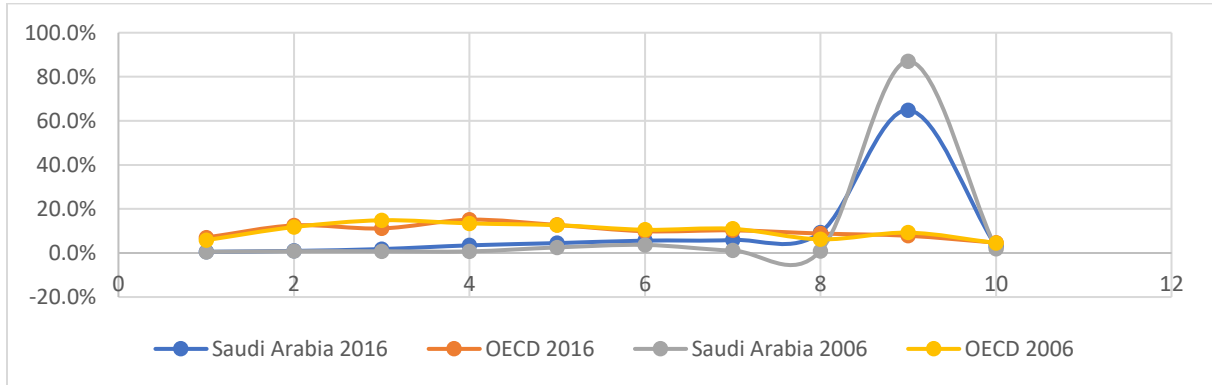


Figure 15: Comparative changes in the structure of exports by sophistication level (in %) in 2006 and 2016: Qatar versus the OECD countries

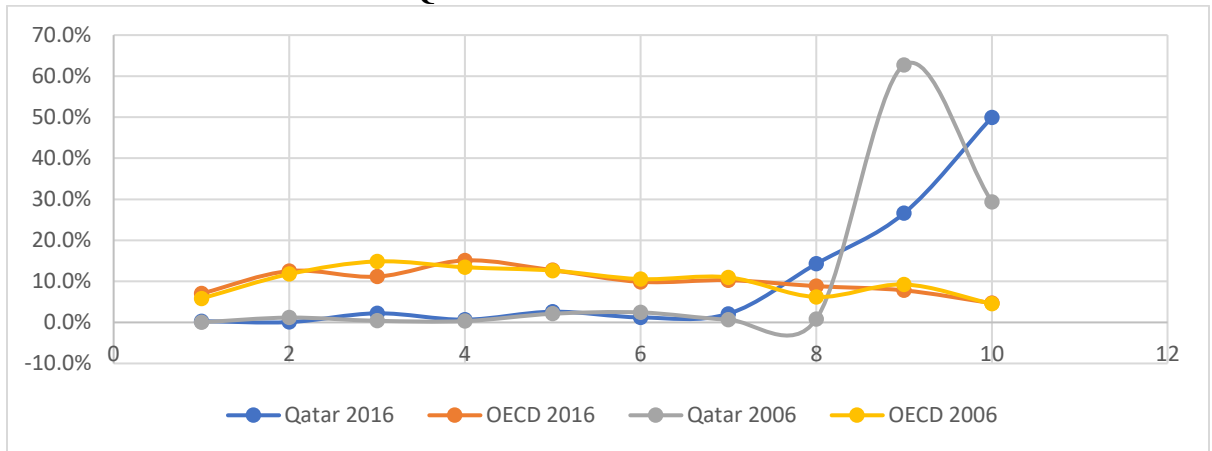


Figure 16: Comparative changes in the structure of exports by sophistication level (in %) in 2006 and 2016: UAE versus the OECD countries

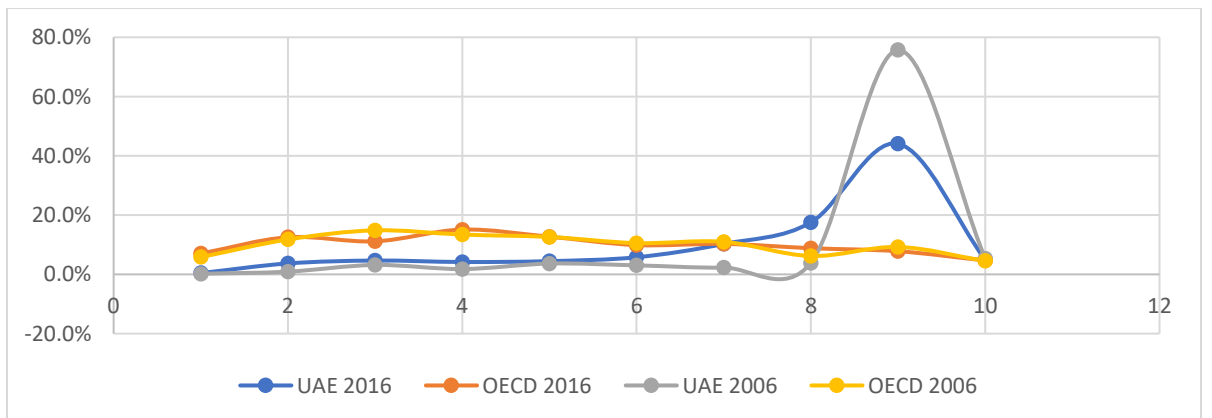
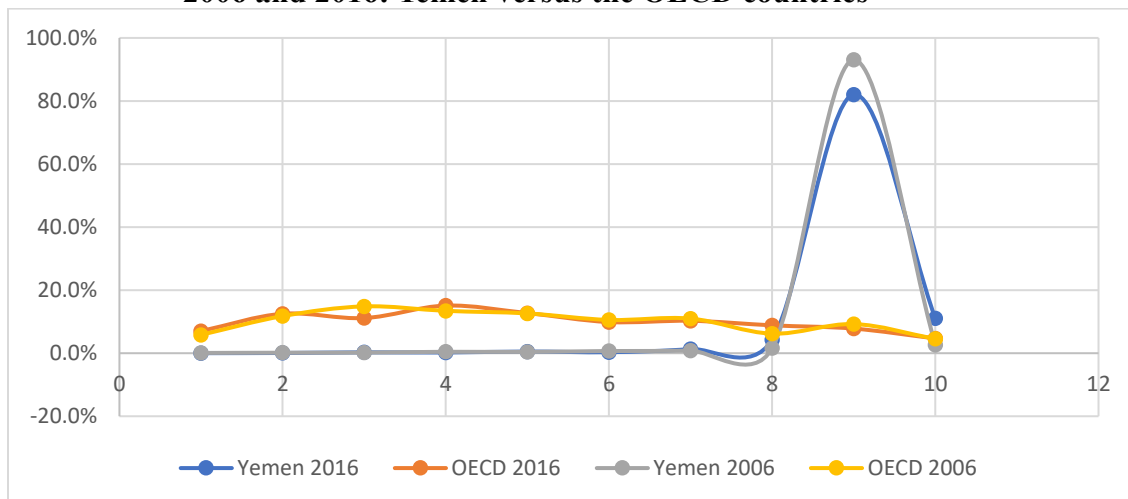


Figure 17: Comparative changes in the structure of exports by sophistication level (in %) in 2006 and 2016: Yemen versus the OECD countries



4. Conclusion

In general, sophistication provides a new and useful way of analyzing trade and location patterns and tracking competitiveness in developing countries. Its main advantage is that it can be calculated quickly at any level of detail and for any period. In this regard, it has an edge over existing taxonomies that classify products according to parent industry characteristics and cannot provide unique scores for products at disaggregated levels. Its main disadvantage is that it is not a specific technology measure and it captures many other factors affecting the export location, making care essential when interpreting the results.

Our initial results are rather plausible. First, sophistication is highly correlated with technology, except when its impact is diluted by fragmentation, which allows technology-intensive activities to locate exports in countries that theory would not predict. However, all ‘fragmentable’ activities do not fragment to similar extents.

Sophistication provides a useful tool to map this and identify activities with ‘location inertia’. This can lead to further research on the causes of inertia – economies of agglomeration, links with innovation systems, special skill needs, government policy and so on – and provide insights to countries that wish to attract or upgrade those industries. In this respect, going in depth using the product space map is the best option to identify options for economic transformation and sophistication considering both existing comparative advantages and proximities between products which represents a major determinant of any transformation strategy. Second, resource-based exports have the obvious pattern that has little to do with income levels. However, there are exceptions caused by technological factors, marketing and brands, and government protection and subsidization. In the case of the Arab region, the methodology applied here has been improved to take into consideration the large level of GDP per capita for some countries which may generate implausible results. For this reason, deflating by the OECD’s average GDP per capita has been used as a proxy of the world best sophistication experience. Third, in the aggregate sophistication does not have a strong relationship with growth rates. Exports by richer countries do not grow relatively fast: industrial catch-up means that exports by poorer countries are likely to grow more rapidly, aided by the relocation of activities within global value chains. Fourth, exports at the bottom of the sophistication scale do not grow rapidly. Most products in this category have low income-elasticity of demand and may be suffering declining prices. The poorest countries lack the

industrial capabilities to move into more attractive products or attract high-tech production networks. Low wages *per se* are not the driver of relocation but low wages for technically proficient workers, backed by modern infrastructure, suppliers and other capability and institutional factors needed for modern industry. By the same reasoning, having high per capita incomes is not a guarantee of a sophisticated export structure. This is the case of all Arab oil-rich countries. Fifth, Arab sophistication scores conform broadly in line with their economic structures and trade patterns. . Finally, while this paper is only a first cut at using the sophistication index for the region, it suggests that the technique can be useful in several ways and should be developed in the future for a more policy-oriented objective to identify options for higher export sophistication of Arab economies.

Appendix: The structure of exports by product sophistication and major destinations, 2016

Morocco	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.7	3.8	7.1	8.4	8.4	15.7	11.5	12.0	13.4	17.6	1.3
OECD	0.3	0.9	2.5	4.9	4.9	5.4	9.6	13.7	16.7	33.5	7.5
Row	0.1	0.6	1.9	2.4	2.9	4.9	11.4	13.8	15.1	34.7	12.2
Total	0.3	0.9	2.6	4.4	4.5	5.8	10.2	13.7	16.1	33.1	8.4
United Arab Emirates	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	1.2	4.6	7.0	7.9	11.2	12.3	15.0	21.3	11.6	7.1	0.7
OECD	0.2	0.6	2.4	1.9	1.3	1.7	2.1	13.3	71.7	4.5	0.2
Row	0.5	2.2	3.3	2.8	4.0	5.3	5.7	19.2	54.1	2.5	0.5
Total	0.5	1.9	3.5	3.2	4.0	5.0	5.7	17.3	54.5	3.9	0.4
Bahrain	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.7	3.8	6.5	6.7	7.3	12.1	14.9	25.8	11.7	8.6	1.7
OECD	0.6	1.2	14.5	4.9	1.9	3.4	4.4	34.0	25.6	9.4	0.2
Row	0.3	2.7	5.6	2.5	3.0	2.6	4.7	48.4	24.8	5.0	0.3
Total	0.6	2.7	8.8	4.9	4.3	6.5	8.6	35.1	20.0	7.8	0.8
Comoros	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.0	0.0	0.4	0.1	0.4	0.2	0.6	5.9	5.6	15.5	71.3
OECD	0.1	0.4	0.8	0.8	1.2	1.1	1.4	2.1	2.9	22.6	66.6
Row	0.1	0.2	1.3	0.8	1.2	0.9	1.5	2.0	8.1	2.8	81.1
Total	0.1	0.3	0.9	0.7	1.1	0.9	1.4	2.5	5.1	14.6	72.4
Djibouti	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.0	0.1	0.1	2.4	1.4	0.4	1.9	6.5	13.0	15.6	58.7
OECD	0.7	1.1	2.2	12.1	4.6	8.9	6.2	9.2	3.2	23.1	28.9
Row	0.4	1.8	3.1	5.0	4.2	7.2	11.5	16.9	13.4	12.3	24.1
Total	0.2	0.7	1.3	4.5	2.7	3.6	5.4	10.1	11.9	15.5	44.0
Algeria	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.4	0.1	0.2	0.5	10.9	16.2	1.8	9.9	40.1	19.8	0.1
OECD	0.1	0.1	0.0	0.1	6.0	15.4	0.4	12.2	55.0	10.5	0.1
Row	0.1	0.5	0.3	0.6	1.2	2.1	0.8	30.6	59.1	3.1	1.7
Total	0.1	0.1	0.1	0.2	5.7	14.0	0.5	14.1	54.8	10.1	0.3
Egypt	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.9	1.7	4.2	7.6	11.5	16.5	14.0	16.2	14.1	12.1	1.3
OECD	0.3	1.1	2.8	2.4	3.5	6.3	5.7	13.5	32.4	31.1	0.9
Row	0.5	1.0	2.2	3.7	5.5	9.9	8.8	13.4	36.1	13.8	5.1
Total	0.5	1.3	3.0	4.1	6.1	9.9	8.6	14.2	28.2	22.1	1.9
Iraq	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11

Arab	0.1	0.1	0.6	0.0	0.2	1.3	2.3	8.8	84.1	2.1	0.3
OECD	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	99.4	0.0	0.0
Row	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	99.2	0.2	0.0
Total	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.6	98.9	0.1	0.0
Jordan	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.6	1.7	6.0	9.2	12.4	16.6	16.9	14.5	12.2	7.1	2.8
OECD	0.3	0.7	1.2	2.0	2.0	2.9	5.1	8.5	17.6	54.8	5.0
Row	0.1	0.5	0.9	1.9	2.9	4.2	3.7	12.8	16.5	33.2	23.3
Total	0.4	1.1	3.3	5.2	6.9	9.4	10.0	12.4	14.8	27.4	9.0
Kuwait	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.6	2.5	3.8	6.5	7.3	7.0	7.4	29.6	32.1	2.7	0.4
OECD	0.1	0.1	0.2	0.2	0.4	0.6	0.4	14.6	82.9	0.6	0.0
Row	0.0	0.4	1.1	0.8	1.9	3.3	2.0	20.8	68.8	0.9	0.0
Total	0.1	0.4	0.8	0.8	1.5	2.1	1.5	18.2	73.8	0.9	0.0
Lebanon	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	1.0	2.1	4.1	7.6	10.7	16.0	19.1	17.5	12.1	8.3	1.3
OECD	0.3	1.1	1.7	3.3	4.0	7.8	11.3	24.8	33.7	11.1	0.9
Row	0.6	2.2	3.9	5.4	7.1	8.4	9.2	16.8	30.8	14.0	1.7
Total	0.7	1.8	3.3	5.6	7.6	11.4	14.1	19.7	23.9	10.7	1.3
Libya	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.4	2.2	1.5	0.7	1.5	1.2	3.1	15.4	68.5	5.0	0.6
OECD	0.0	0.2	0.2	0.0	1.5	4.4	0.2	6.3	85.5	1.7	0.1
Row	0.2	0.8	0.1	0.2	0.3	0.2	0.3	3.6	92.9	1.4	0.1
Total	0.1	0.4	0.2	0.1	1.3	3.8	0.3	6.3	85.7	1.8	0.1
Mauritania	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.3	2.3	0.5	1.0	1.0	2.5	5.1	52.0	18.1	15.6	1.7
OECD	0.4	0.1	0.8	0.4	12.8	6.8	16.9	12.3	23.7	19.1	6.7
Row	0.1	0.1	0.6	1.8	12.5	5.6	16.9	4.8	27.4	29.6	0.8
Total	0.2	0.1	0.7	1.2	12.5	6.1	16.7	8.6	25.7	24.8	3.4
Oman	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.4	3.0	3.5	6.0	9.0	10.9	10.8	25.7	14.8	12.7	3.2
OECD	0.1	0.3	0.6	1.4	1.5	2.5	1.7	4.7	51.9	35.0	0.3
Row	0.1	0.5	0.4	0.9	2.0	2.9	0.9	6.4	81.1	4.6	0.3
Total	0.1	0.7	0.8	1.6	2.7	3.8	2.4	8.3	64.2	14.6	0.7
Palestine	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.3	0.8	2.5	5.5	7.1	11.6	9.9	13.6	19.1	15.5	14.1
OECD	0.4	1.2	2.6	6.1	14.8	7.0	12.0	6.1	12.4	29.5	8.1
Row	0.3	0.5	2.5	4.5	5.8	10.5	8.2	23.2	17.4	12.9	14.3

Total	0.3	0.6	2.5	4.7	6.4	10.5	8.6	21.1	17.4	14.0	14.0
Qatar	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.3	1.2	2.8	4.4	9.5	11.8	6.8	24.0	23.1	15.7	0.4
OECD	0.0	0.2	1.0	0.4	0.7	0.6	0.4	8.4	56.6	31.7	0.0
Row	0.4	0.6	1.1	1.1	2.6	2.4	1.0	8.0	62.0	20.7	0.1
Total	0.2	0.4	1.1	0.9	1.8	1.8	0.9	9.1	56.4	27.3	0.1
Saudi Arabia	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	1.0	2.3	3.6	5.3	10.4	11.1	7.3	11.6	40.7	5.3	1.4
OECD	0.1	0.4	0.6	0.7	1.5	1.7	0.8	5.2	88.3	0.6	0.0
Row	0.4	1.0	1.6	1.7	3.5	5.1	2.7	7.4	74.8	1.8	0.0
Total	0.3	0.8	1.3	1.5	3.0	3.8	2.1	6.6	79.0	1.5	0.1
Sudan	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.0	0.3	0.3	0.4	1.1	0.5	0.4	6.5	51.0	15.8	23.9
OECD	0.0	0.1	0.2	0.1	0.2	0.2	0.5	2.0	84.3	7.4	5.2
Row	0.0	0.1	0.0	0.1	0.2	0.2	0.3	1.9	92.7	1.7	2.8
Total	0.0	0.1	0.1	0.1	0.4	0.2	0.4	2.9	82.3	5.9	7.6
Somalia	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.0	0.0	0.1	0.1	0.1	0.1	1.1	1.7	15.3	12.5	68.8
OECD	0.2	0.7	1.5	0.9	1.3	2.0	4.6	11.7	4.5	26.6	46.0
Row	0.1	0.5	1.7	1.4	2.6	3.8	3.7	3.2	9.6	20.8	52.5
Total	0.0	0.1	0.3	0.3	0.4	0.6	1.6	2.2	14.3	14.0	66.2
Syria	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.4	0.9	3.6	3.7	6.9	11.4	19.5	16.7	13.3	15.1	8.6
OECD	0.1	0.3	0.7	0.7	1.0	1.7	1.5	11.8	72.0	6.5	3.7
Row	0.2	1.1	3.0	2.8	5.3	6.4	10.3	12.2	22.4	14.5	21.7
Total	0.2	0.6	2.1	2.2	3.9	6.3	10.0	14.0	42.6	10.9	7.2
Tunisia	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.9	2.1	4.7	7.0	12.4	19.1	15.4	15.5	9.3	12.4	1.1
OECD	0.2	0.8	2.8	5.7	7.8	7.5	8.3	14.1	24.8	26.3	1.7
Row	0.2	0.8	1.9	3.4	5.6	7.6	10.2	13.4	13.3	38.6	5.0
Total	0.3	0.9	2.9	5.6	8.0	8.7	9.2	14.2	22.1	26.1	2.0
Yemen	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Arab	0.5	0.6	3.4	1.1	1.6	2.5	5.2	35.4	25.6	17.6	6.5
OECD	0.1	0.4	1.2	1.1	0.8	1.1	1.1	8.7	59.8	24.4	1.2
Row	0.1	0.1	0.1	0.1	0.3	0.4	0.3	2.8	90.3	5.3	0.4
Total	0.1	0.2	0.7	0.4	0.5	0.8	1.1	8.1	75.4	11.2	1.3

References

- Cadot, O., Carrere, C., and Strauss-Kahn, V. (2013). Trade diversification, income, and growth: What do we know?. *Journal of Economic Surveys*, 27(4), 790-812.
- Hausmann, R., Hwang, J., and Rodrik, D. (2007). What you export matters. *Journal of economic growth*, 12(1), 1-25.
- Ibrahim, M. J. (2012). Technological Change and Economic Transformation, *Technological Change*. Teixeira, A. (Ed.), ISBN: 978-953-51-0509-1, InTech. Available from: <http://www.intechopen.com/books/technological-change/technological-change-and-economic-transformation>.
- McMillan, M. S., and Rodrik, D. (2011). Globalization, structural change and productivity growth (No. w17143). National Bureau of Economic Research.
- OWG (Open Working Group) (2014) Open Working Group Proposal for Sustainable Development Goals. New York: UN.
- Papageorgiou, C., and Spatafora, M. N. (2012). Economic diversification in LICs: Stylized facts and macroeconomic implications (No. 12-13). International Monetary Fund.
- Rodrik, D. (2015) 'The Future of Economic Transformation in Developing Countries'. SET Blog, 23 June. <http://set.odi.org/23-june-2015-the-future-of-economic-transformation-in-developing-countries/>
- UNCTAD (United Nations Conference on Trade and Development (2016)
- UNECA (UN Economic Commission for Africa) (2013) 'Economic Transformation for Africa's Development'. C-10 Meeting, April. Washington, DC: UNECA.