

Analytical study of Algerian product space, based on the theory of economic complexity

دراسة تحليلية لفضاء المنتجات الجزائري على أساس نظرية التعقيد الاقتصادي

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المخلص: تهدف هذه الورقة البحثية إلى تسليط الضوء على مبادئ التعقيد الاقتصادي وموقع الجزائر من مؤشر التعقيد الاقتصادي العالمي ومقارنته بالدول الأخرى. كما يناقش نظرية فضاء المنتجات، وهي وسيلة لأي دولة لدراسة مدى تعقيد سلة التصدير وتطورها، بهدف التركيز على المنتجات التي ينبغي للدولة أن تشجع صادراتها بسبب ميزتها التنافسية وتأثيرها على زيادة التعقيد الاقتصادي للدولة.

الكلمات المفتاحية: التعقيد الاقتصادي؛ مؤشر التعقيد الاقتصادي؛ فضاء المنتجات؛ سلة المنتجات؛ الميزة التنافسية.

Abstract : This research paper aims to highlight the principles of economic complexity and the location of Algeria from the index of global economic complexity and compare it with other countries. It also discusses the theory of product space, which is a means for any country to study the complexity and sophistication of its export basket, with the aim of focusing on products that the state should encourage its exports because of its competitive advantage and impact on the increasing economic complexity of the state.

Key Words: economic complexity; economic complexity index; product space ; basket of product; competitive advantage.

JEL Classification: A10

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Introduction:

The theory of economic complexity created by researchers Ricardo Hausmann of Harvard University and Cesar Hidalgo of MIT (Hausman, 2011) provides a funky perspective for understanding the process of economic growth based on the productive knowledge that exists in society as an indicator of the future growth of the state. This theory considers that economic development is the process of learning how to produce and export more sophisticated and complex products that appear in the form of the various products that the State produces and exports.

The theory is to measure the diversity and sophistication of the country's different exports as a measure of its economic complexity, as the number of different products produced and exported by the State is based on the diversity of the state-owned production knowledge which is the first part of the assessment of economic complexity. While the scarcity of such exports in the global market is the complexity of these exports, scarce products are hard to produce and therefore the more diversified and scarcity exports, the more complex the state economy will be (Hausman, 2011).

The product space (OEC, 2010) is a map that illustrates the similarity of different products in terms of the productive knowledge needed for their production and export. This map provides pathways that make it easier to assemble productive knowledge to reach out to produce new products that build on previous productive knowledge.

By the foregoing, the following question can be formulated:

What do we mean by economic complexity? And what is the location of Algeria in the product space?

1. The economic complexity:

1.1. Definition of economic complexity:

Economic complexity is a new focus of research that radically relies on a new methodology, describing the economy as an evolutionary process for ecosystems that are fragmented from industrial and financial technologies as well as comprehensively interconnected infrastructures (Pietronero and Masud Cader, 2017, p. 01).

The complexity of the economy is linked to the multiplicity of knowledge contained therein, so this economic complexity can be expressed in a country's productive efficiency components and reflect emerging structures so that it can combine knowledge (Hausman, 2011, p. 18).

Through previous definitions, it can be said that economic complexity and the theory of economic complexity depend on the industrial sector and the productive knowledge of each country. Therefore, the main factors influencing the economic complexity of the state were concluded: (وزارة الثقافة, 2017, p. 12)

Diversity: Which shows the number of products produced by the state, the amount of different knowledge contained in the country is represented by the number of various products produced by this country.

Ubiquity: which indicates the spread of a particular product among the countries of the world, while the more sophisticated products need a greater amount of the productive knowledge that these products need and that they can produce.

1.2. The economic complexity index:

To measure the economic complexity of a country, the economic Complexity Index (ECI) (Hausman, 2011, p. 20), which represents a numerical value for the complexity of the state economy, has been designed. The higher its value, the greater the complexity and sophistication of the state economy. It is a measure of the intensity of the relative knowledge of the economy given the intensity of the relative knowledge of its exports. The product complexity index (PCI) is a measure of the relative knowledge intensity of the product, given the knowledge intensity of the exporters (Economic complexity rankings),

Table 01 shows the index of economic complexity of the world's countries in 2016, where Japan topped the rankings.

Table 1 : « The index of economic complexity of the world's countries in 2016 »

N°	Countries	2016	N°	Countries	2016
01	Japan	2.22938	64	Egypt	-0.0702666
02	Switzerland	2.0544	65	Qatar	-0.131597
03	Germany	1.95551	66	Georgia	-0.136839
04	South Korea	1.79864	67	Kazakhstan	-0.140565
05	Sweden	1.75485	68	Australia	-0.16901
06	Singapore	1.71625	69	Argentina	-0.179818
07	Austria	1.61209	70	Chile	-0.216857
08	United Kingdom	1.59265	71	Mauritius	-0.245542
09	United States	1.58101	72	Indonesia	-0.253646
10	Czech Republic	1.57717	73	Jamaica	-0.26616
11	Finland	1.55487	74	Moldova	-0.300825
12	Slovenia	1.44667	75	Vietnam	-0.332587
13	Ireland	1.44421	76	Dominican Republic	-0.352578
14	France	1.34955	77	Iran	-0.389103
15	Hungary	1.29993	78	Guatemala	-0.392704
16	Slovakia	1.28447	79	Uganda	-0.44042
17	Denmark	1.23615	80	Albania	-0.487843
18	Belgium	1.21917	81	Cuba	-0.507612
19	Italy	1.21412	82	Senegal	-0.53243
20	Poland	1.14721	83	Azerbaijan	-0.545569
21	Netherlands	1.10655	84	Honduras	-0.574449
22	Norway	1.03384	85	Sri Lanka	-0.579077
23	Estonia	1.02913	86	Paraguay	-0.642897
24	Mexico	0.932908	87	Syria	-0.644997
25	China	0.911251	88	Kenya	-0.658893
26	Romania	0.871347	89	Uzbekistan	-0.663603
27	Malaysia	0.865661	90	Pakistan	-0.666548

28	Spain	0.841379	91	Peru	-0.68778
29	Croatia	0.831182	92	Algeria	-0.715288
30	Canada	0.767588	93	Liberia	-0.7467
31	Saudi Arabia	0.766112	94	Morocco	-0.75663
32	Hong Kong	0.749425	95	Venezuela	-0.803681
33	Belarus	0.723198	96	Cambodia	-0.860402
34	Lithuania	0.703753	97	Mali	-0.885402
35	Thailand	0.671775	98	Zimbabwe	-0.897424
36	Latvia	0.650211	99	Laos	-0.988196
37	Serbia	0.581892	100	Ecuador	-0.989348
38	Portland	0.555	101	Turkmenistan	-1.00243
39	Bulgaria	0.53637	102	Tanzania	-1.00641
40	Bosnia & Herzegovina	0.482107	103	Libya	-1.05141
41	Russia	0.467258	104	Ethiopia	-1.06155
42	Ukraine	0.455412	105	Nicaragua	-1.06876
43	Panama	0.441168	106	Tajikistan	-1.07242
44	Philippines	0.434081	107	Bolivia	-1.09992
45	Turkey	0.404726	108	Angola	-1.10671
46	New Zealand	0.371123	109	Mongolia	-1.11654
47	Costa Rica	0.3146	110	Bangladesh	-1.22314
48	Lebanon	0.248075	111	Zambia	-1.22629
49	United Arab Emirates	0.246693	112	Republic of the Congo	-1.28535
50	India	0.236866	113	Madagascar	-1.32037
51	Brazil	0.229095	114	Ghana	-1.41096
52	Greece	0.222362	115	Gabon	-1.432
53	Uruguay	0.175781	116	Sudan	-1.43747
54	Kuwait	0.128739	117	Yemen	-1.46949
55	El Salvador	0.112086	118	Cote d'Ivoire	-1.51738
56	Macedonia	0.105846	119	Nigeria	-1.54415
57	Tunisia	0.0973685	120	Mauritania	-1.59462
58	Jordan	0.0687142	121	Mozambique	-1.61157
59	Trinidad & Tobago	0.00787162	122	Malawi	-1.6499
60	Colombia	-0.00253314	123	Cameroon	-1.68947
61	Oman	-0.00355699	124	Papua New Guinea	-1.74395
62	South Africa	-0.0292484	125	Guinea	-1.9858
63	Kyrgyzstan	-0.0461406			

Source : (atlas media, 2018)

To generate a more accurate measure of the number of capabilities available in a country, or required by a product, we need to correct the information that diversity and ubiquity carry by using each one to correct the other. For countries,

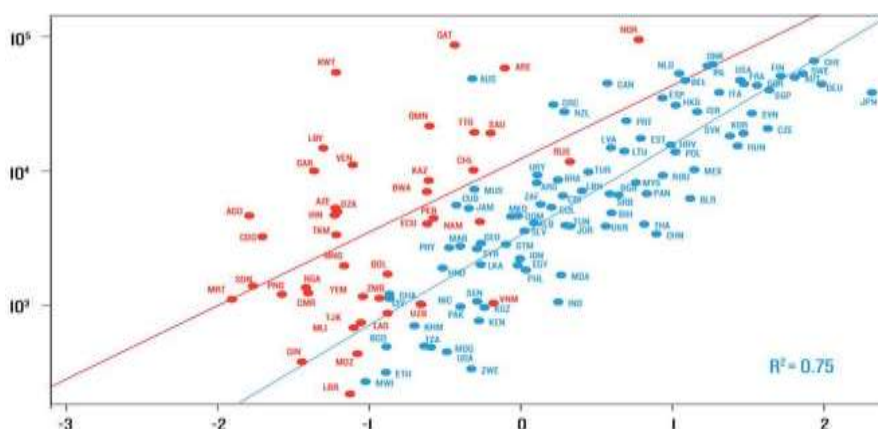
this requires us to calculate the average ubiquity of the products that it exports, the average diversity of the countries that make those products and so forth.

1.3. The importance of economic complexity:

Through the definition of economic complexity, the latter reflects the amount of knowledge contained in the productive structure of the economy. It is not coincidental, then, that there is a strong correlation between the measurement of economic complexity and the share of gross domestic product (GDP) per capita that states can generate.

Figure 01 illustrates the relationship between the index of economic complexity and the per capita income of GDP in the 128 countries studied by the "Atlas of Economic Complexity (Hausman, 2011, p. 27)."

Fig. 1 : « The relationship between the index of economic complexity and the per capita income of GDP »



Source: (Hausman, 2011, p. 28)

Here, we separate countries according to their export intensity of natural resources. In red, countries that represent natural resources, such as metals, gas and oil, have at least 10% of GDP gross domestic product (GDP). For 75 countries whose exports are not dependent on natural resources and that appear in blue. Economic complexity represents 75% of the variation in per capita income from GDP. However, since figure 10 illustrates states with a significant presence of natural resources, they are relatively rich without the need for their economy to be complex. If we observe the revenues obtained through strategic activities, which have more to do with geology than knowledge, the economic complexity can explain 73% of the variation in the share of income for all 128 countries (Hausman, 2011, p. 27).

By studying the economic complexity of the impact of the economic complexity index on future growth, Harvard University Development Center researchers have used their findings to show that the diversity and sophistication of state exports are pivotal in determining their future economic growth, as they have developed the

growth index The future, "which measures the growth of the expected economy for the next 10 years for all countries of the world¹. (Hausman, 2011, p. 30)

In short, it can be said that the importance of economic complexity lies in the fact that it helps explain the differences in the rate of income of countries, and more than that it expects future economic growth. Economic complexity is therefore not easy to achieve, but the states that are able to achieve it tend to reap significant gains.

2. Product space:

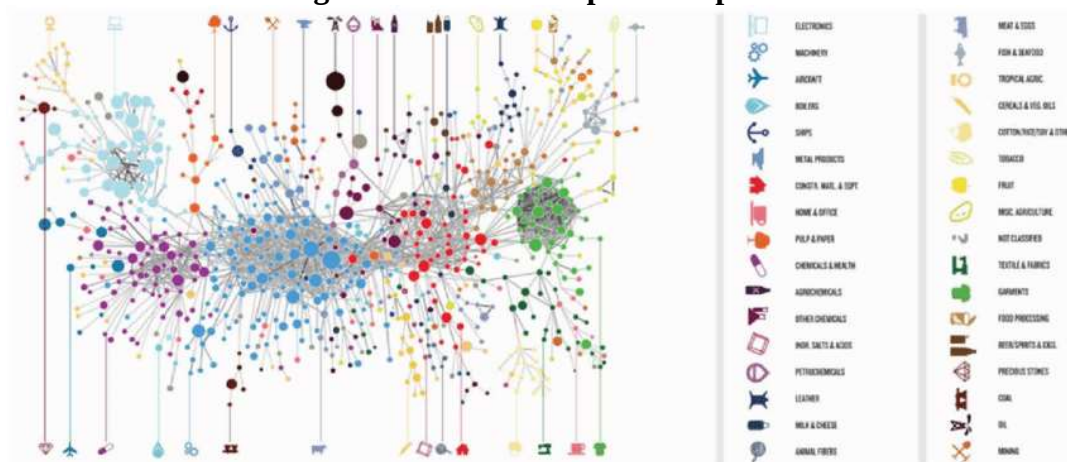
The product space is a map that illustrates the similarity of different products in terms of the productive knowledge needed for their production and export. This map provides pathways that make it easier to assemble productive knowledge to reach out to produce new products that build on previous productive knowledge (OECD, 2010).

When linking countries to products, it is important to take into account the volume of exports of these countries as well as the global trade of products. Because, even for the same product, we expect the volume of exports of a large country like China to be larger than that of a small country like Uruguay. In the same vein, we expect that the volume of exports of products representing a large share of world trade, such as automobiles or sports footwear, is to represent a large portion of the country's exports of products that represent only a small fraction of world trade, such as cotton, seeds or potato flour (Hausman, 2011, p. 25).

To make countries and products identical, we use the Bela Balassa² * definition of the apparent revealed comparative advantage (RCA) * *. The definition of Palasa states that a country that has an RCA in a product when its exports are more than the fair share and this share is equal to the total sum of the world trade represented by the product (Hausman, 2011, p. 25).

For example, in 2008, the export volume of soybeans amounted to \$24 billion, soybeans accounting for 0.35% of world trade. Of this total, Brazil exported almost \$11 billion, and since Brazil's total exports that year amounted to \$140 billion, soybeans accounted for 7.8% of Brazil's exports. This represents my mobile 21 times "fair share" of Brazil's soybean exports (7.8% divided by 0.35%), so it can be said that Brazil has a visible comparative advantage in soybeans.

Fig. 2 : « Overview of product space »



Source : (atlas of economic complexity)

Figure 02 shows an overview of the product space, where each point represents a different product, so that the point size is directly proportional to the comparative advantage of the state in exporting the product. The points representing the different products are colored by sector if the state has a feature Relative to the production of the product, while the point is colored in black as the state did not issue the product with comparative advantage. The lines link the products that are highly likely to be exported together, ie similar products with the production knowledge required to produce them.

On the other hand, the links between different products in the product space are not distributed evenly. So that the links between the different products are dense in the space structure and weak in the limbs.

3. Algerian product space:

“Algeria is the 58th largest export economy in the world. In 2016, Algeria exported \$31.2B and imported \$48.6B, resulting in a negative trade balance of \$17.3B. In 2016 the GDP of Algeria was \$159B and its GDP per capita was \$15k. The top exports of Algeria are Petroleum Gas (\$13.1B), Crude Petroleum (\$10.3B), Refined Petroleum (\$5.6B), Nitrogenous Fertilizers (\$444M) and Ammonia (\$417M), using the 1992 revision of the HS (Harmonized System) classification.

Its top imports are Wheat (\$1.7B), Packaged Medicaments (\$1.37B), Refined Petroleum (\$1.25B), Cars (\$1.25B) and Raw Iron Bars (\$1.14B). The top export destinations of Algeria are Spain (\$4.53B), Italy (\$4.42B), the United States (\$3.61B), France (\$3.43B) and Turkey (\$1.61B).

The top import origins are China (\$8.35B), France (\$5.33B), Italy (\$4.4B), Spain (\$3.54B) and Germany (\$2.83B)” (MIT, ?).

Fig.3: «Total exports of Algeria in 2016»

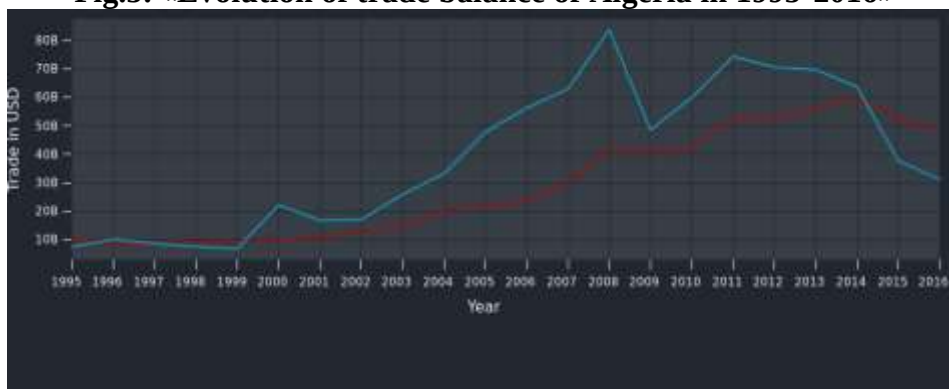
Source: (MIT)

In 2016 Algeria imported \$48.6B, making it the 48th largest importer in the world. During the last five years the imports of Algeria have decreased at an annualized rate of -1.6%, from \$52.5B in 2011 to \$48.6B in 2016. The most recent imports are led by Wheat which represent 3.5% of the total imports of Algeria, followed by Packaged Medicaments, which account for 2.83%. (MIT,?)

Fig.4: «Total imports of Algeria in 2016»

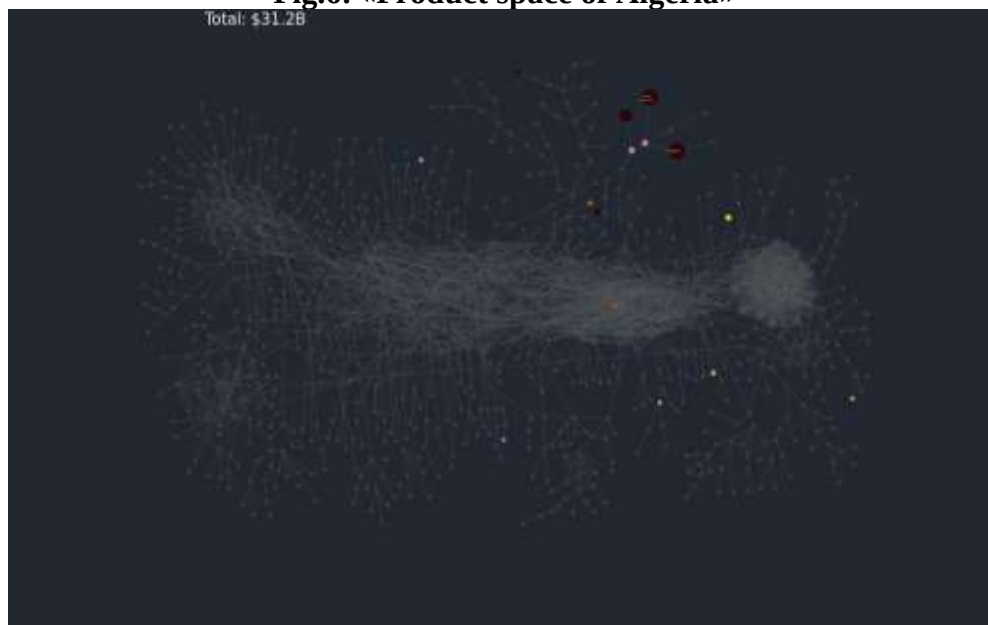
Source: (MIT)

As of 2016 Algeria had a negative trade balance of \$17.3B in net imports. As compared to their trade balance in 1995 when they still had a negative trade balance of \$2.89B in net imports (MIT,?).

Fig.5: «Evolution of trade balance of Algeria in 1995-2016»

Source: (MIT, ?)

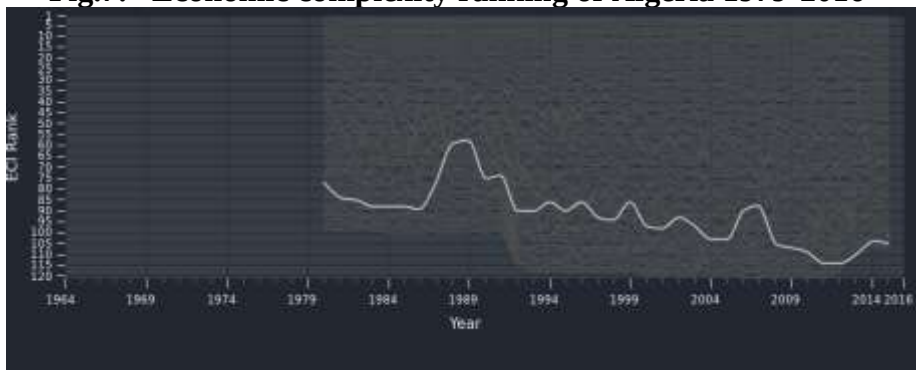
Algeria exports 21 products with revealed comparative advantage (meaning that its share of global exports is larger than what would be expected from the size of its export economy and from the size of a product's global market) (MIT). Given the Algerian product space as shown in Figure 06, which represents the area of Algerian export products for 2016, it can be seen that the products produced by Algeria, which have a comparative advantage, are very small, if not almost non-existent. In order for Algeria to move towards the production of new and sophisticated products, production knowledge must be obtained.

Fig.6: «Product space of Algeria»

Source: (MIT, ?)

The values of economic complexity varied in Algeria between 1979 and 2016. Algeria ranked 77th among the world's countries in economic complexity in 1979 and reached the highest rank in 1989, where it ranked 58th. Then the value of the index of economic complexity In Algeria, which led to reach 114th place in 2011 and 2012. As shown in Figure 07 below.

Fig.7: «Economic complexity ranking of Algeria 1979-2016»



Source: (MIT, ?)

Conclusion:

The road to a complex Algerian economy is a long but not impossible one. Requires the restructuring of the industrial sector to adopt new economic activities that increase the economic complexity and abandon activities that do not improve the exploitation of domestic resources.

Results and Recommendations

- According to the theory of economic complexity, the index of economic complexity in any country corresponds to the development of its basket of commodities ;
- To further complicate Algeria's export basket, the most complex industries in all sectors should be stimulated and supported because of their impact on the complexity of the Algerian economy. Its export basket must also be diversified;
- Reduce dependence on exports of raw materials and focus on new and more developed products with added value to the Algerian economy;
- Give importance to the role of human capital development, institutional capacity and infrastructure.

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Citations :

¹ Technical box 3.1 : The growth regression

* Bela Balassa is a Hungarian economist (1928-1991) – web site: <https://fr.m.wikipedia.org> – consulted on : 14/11/2017.

** RCA Is an indicator used in the international economy to calculate the apparent comparative advantage also called the Palasas index for his researcher Bella Palasa and Mark Noland (1965) – web site: <https://fr.m.wikipedia.org> – consultd on : 14/11/2017.