

Challenges Relating Sustainable Structural Transformation

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Abstract

For the past fifteen years, export diversification and sophistication emerged as the indicators for measuring and qualifying structural transformation. While the economics development pioneers describe the transformations of the productive structure, contemporary work focuses on exports. Such an approach, in the current context of global fragmentation of production, is problematic. Concerning the current global production fragmentation, such an approach is questionable. There has been a shift from "trade-in goods" towards the exchanges of tasks known as "trade-in tasks." In task swaps, the link between the technology content of exports and production activities is broken. The article is proposins to detail the new challenges implied by the global context and revise the operational definition of productive transformation so that the latter is considered. Then it defines a "sustainable" structural transformation resulting from profound changes in the economy and leading to a virtuous transformation circle.

Key words: exports, transformation, sustainable, macroeconomics

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1. Introduction

As was the case for the old industrialization countries, the economic development of the third countries implies that the GDP growth is accompanied by a powerful transformation dynamic of their economies and raises the question of processes to guide these structural changes. This notion of structural transformation occupied a central place in the pioneering theory of economic development. Subsequently, it was relegated to the background of the academic and strategic debates, which carried their attention to financial issues and the economic growth objective from the eighties.

Productive transformation is then downgraded to a mere economic growth consequence and capital accumulation, whereas until then, it was considered its primary driver. For the past fifteen years, the structural transformation analysis and the industrial policies adopted have become central themes of international institutions and a study object for development economists. With C. Monga, they describe and prioritize policies to promote the productive accessible transformation to developing economies open to the globalized economy. They no longer discuss the usefulness of an industrial policy but rather the best policies to bring out the sectors most able to bring the productive transformation of the economy as a whole. In this context, they show the value of using comparative advantages as support for productive transformation. The first has shown a quadratic relationship between productive diversification, value-added or sectoral employment, and economic development (Persaud & Meade, 2012).

The latter was interested in exports and have developed an indicator of export sophistication, allowing them to empirically show that the export sophistication is unique with economic development. Since then, export diversification and sophistication have become the indicators for measuring and qualifying structural transformation. Therefore, the recent literature is mainly empirical; it does not propose a theoretical model of productive transformation but attempts to describe the relationship between these two variables and income and endeavors to study their determinants. Thus, while the pioneer development economists set out to describe the evolution of the production structure and employment at a high level of aggregation - they only retained three

sectors - recent empirical literature focuses on the export structure. It can therefore address the issue of structural change at a very high disaggregation level (Botchwey, 2019).

2. Literature review

2.1. Export Diversification

The fundamental work on diversification focuses on the evolution of the sectoral distribution of employment, production and exports. The real work on diversification focuses on the evolution of the sectoral distribution of employment, production, and exports. Using labor and sectoral value-added as a production measure, Botchwey (2019) show that the production diversification increases in a non-monotonous manner with income. Their relationship is illustrated with a quadratic U-curve: economies tend to diversify up to an estimated income level of \$ 9,000 per capita in PPP from which they re-specialize. Lee & Zhang (2019) confirm this relationship on international trade data. In these studies, the turning point is estimated at \$ 20-25,000 per capita in PPP; the degree of export concentration is therefore much higher for equivalent income levels. De Mcintyre et al. (2018) finds a monotonic negative relationship between the concentration of exports and income. Thus, while the various authors agree on the concentration decline in the first phases of economic development, there is no real consensus concerning the exports concentration from the most developed countries.

However, when it does occur, the reconcentration of exports appears at very high-income levels, so we can conclude that the developed economies have more diversified productive structures than those of the developing economies. This diversification that accompanies economic development may result from an equal distribution of exports or the introduction of new products. However, these mechanisms differ according to their position concerning the technological boundary. On the one hand, high-income economies will relocate production, requiring production factors that they no longer have in abundance and specialize in intensive technology and R&D activities. On the other hand, countries far from the technological frontier having accumulated tiny endowments have meager diversification opportunities. However, they have access to technologies already developed in high-income economies (Pineres et al, 2018). Thus, the innovations nature changes with economic development. Innovation consists of the introduction of new goods never produced and new goods not previously locally produced. As economies grow closer to the technological frontier, innovation will shift from imitation to the introduction of new goods.

Thus, changes like innovation (imitation or creation) that arise from positioning about the technological frontier impact the appearance of new productions; they are expected to be more frequent in developing economies far from the technological frontier and imitators than in developed economies located at the frontier and creators. In other words, developed countries that already have a diversified productive structure have fewer opportunities for diversification than developing economies. Discovery episodes' are therefore more common in developing economies (Ibid.).

In the early stages of economic development, diversification consists of introducing new products and, as development shifts towards an equal distribution of exports. Export growth occurs at an extensive margin; it consists of new exports to old or new markets or old exports to new markets. In the second case, export growth occurs on the intensive margin; the result increases and a better distribution of existing exports. The extensive margin sums up the capacity of countries to introduce new varieties on the international market. Overall, the growth of exports is explained mainly by the intensive margin, and the extensive margin tends to decrease with economic development. Overall, the growth of exports is explained mainly by the intensive margin, and the extensive margin tends to decrease with economic development. These trends are therefore consistent with the evolution of the innovation nature. Indeed, the extensive margin is particularly dynamic in the least developed economies, especially in Sub-Saharan Africa. Therefore, entrepreneurship would be dynamic in low-income countries, but these new exports have a very short lifespan of almost two years.

Diversification seems to be a process inherent in economic development (Cadot et al, 2011a), we indeed notice a divide between high income countries and others. Diversification seems to be an inherent process in economic development; we notice a divide between high-income countries and the rest of them. Their concentration does not exceed, on average, 2.5, while it approaches 3-3.5 in other economies. We also note that the exports concentration from the most impoverished countries

decreased over the period; it increased for the other three categories of higher-income countries. Over the past two decades, and mainly in middle-income economies, the intensification of trade has been accompanied by increased concentration. The economic development of these countries, therefore, seems to be accompanied by a concentration of exports. Moreover, OECD (2019) or IMF (2016) note significant disparities between countries. They note, among other things, that some countries have been able to diversify their productive structure without having any real impact on their economic development.

López (2020) also introduces the notion of "bad structural transformation", he speaks of a structural change of the "growth reducing" type or "productivity-reducing structural change". They note, for example, that in Latin America and Sub-Saharan Africa, labor has migrated in the "wrong" direction, that is, from more productive activities to less productive activities, especially informal ones. Píneres et al. (2018) underline the existence of an additional parameter ("something more"), which can explain these disappointing results. They propose the level of sophistication of exports as a determining factor of the impact on economic development.

2.2. Exports Sophistication

Structural change economists describe the labor migration from the primary sector to the production one; therefore, they assert the superiority of the second as an economic development engine. This raises the underlying question of so-called "desirable" productions, because they generate economic development. While the superiority idea of specific productions is old, Wei et al. (2019), have empirically shown that products have different impacts on economic development and some productions are therefore more promising than others. Over the years, there have been proposed many "sophistication" or "complexity" indicators. These different classifications seek to measure the production process's complexity. The first classification proposed by the OECD in 1989 and directly measures product complexity via its R&D intensity. It groups industries into four categories according to their technological intensity. However, the data scarcity limits the technological production intensity, hence the same aggregate level of this first classification. We are talking about an indirect approach by the exporting countries characteristics.

3. Research methodology

Our research is a qualitative one and aims to critique export diversification and sophistication as indicators for measuring and qualifying structural transformation and, therefore, development ideology. Information gathering was carried out exclusively from a documentary analysis; the documentary resources serve both as theoretical support and investigative ground for research. Moreover, given the objectives of our research program, the literature review pays particular attention to primary sources. Primary sources include materials published by the World Bank and various researchers that are focusing on macroeconomics. All primary sources have been studied in conjunction with the specialized literature.

This technical documentation, which includes scientific literature (monographs and scholarly journal articles), emanates from several recognized specialists in development and the activity of the World Bank in particular. This work was based on a qualitative and structural analysis approach of deconstruction of discourse by corpus and themes that underlie the different aspects of the exports issue. Our project was to question export diversification and sophistication as indicators for measuring and qualifying structural transformation. Such an approach to the object of study seemed particularly well indicated. In all formal research, particularly in human and social sciences, the research obstacles and limits remain crucial.

For this reason, in recent years, this question has itself been the subject of complete research. Furthermore, advances in this field, especially in qualitative research, make it possible with more precision and certainty to identify, classify and categorize many of the central epistemological obstacles to knowledge and the limits inherent in this research type. As a result, certain vital biases that may affect or mar the researcher's work are relatively well known and preventively neutralized. For others who are less so, it is up to the researcher to identify them and take them into account,

particularly by seeking to know them better and imposing on himself critical vigilance throughout the process—the research.

4. Findings. The exporting countries sophistication measure

These literature classifications are based on two postulates: the productive structure modernization depends on the endowments factor accumulation, and the exporting countries' characteristics can indirectly estimate this accumulation. Indeed, it is "illusory" to establish an exhaustive list of all the direct and indirect factors involved in the production of goods. In addition to the "traditional" endowments factor, the place of production can also be explained by logistics, activities proximity, natural resource requirements, infrastructure, or the fragmentation level of production, etc. Political factors are also determining the case, such as trade restrictions, tariff barriers, or trade agreements. The level product sophistication level is a "mix of all these factors." This is why the product sophistication level is estimated through the average income of their exporters. Income is used as a proxy for all the elements likely to impact the productive structure; this consists of an outcome measure. Therefore, these classifications are well constructed from the exporting countries' characteristics, which points to their income. The Sophistication Index is based on equivalent reasoning. They classify products according to their absolute productivity/income level estimated by the exporting countries' income level.

Mathematically, the Sophistication Index is the weighted average by the country's exports in the total exports concerning the countries exporting that type of good. The weight used to construct the PRODY index which reveals the comparative advantage of each country for a specific product (OECD, 2019). Each product is associated with a productivity/income level of the PRODY index. By definition, PRODY implies that each country export products according to its income level, which means that poor countries export cheap goods and rich countries expensive ones. PRODY index implies that emerging countries must diversify into products exported by rich countries. Subsequently, Hausmann proposed a new indicator as the Product Complexity Index presented in the Atlas of Economic Complexity. All the factor endowments or "non-tradable inputs." are called capabilities.

Table 1 shows the five most and less complex products. Highly technology-intensive products are products in the electronics, machinery, and communication sectors. Surprisingly, in 2014, the most complex product relies on processed metals. These metals are often processed and valued in industrialized economies. In the case of "tubes, pipes and pipe fittings," 97% of world exports is produced in Japan. Therefore, ubiquity is extremely low, and Japan has a diversified export basket; consequently, it was the most complex country during 2014. At the same time, the most miniature complex products are natural resources (agricultural and mining). Tin minerals are 44% exported by African countries and by Burma, which exports 14%, these economies have entire exports (Lee & Zhang, 2019).

Table no. 1 The complex products in 2018 (HS4 classification)

HS4 Code	Product	PCI	Industry
Top 5 of the most complex			
8457	Machining centers, stationary machines, and multi-station machines for metalwork	5,1	Electrical machinery and equipment
7805	PCI piping tubes, pipes and accessories	6,6	Base metals and thereof articles
9204	Accordions and similar instruments	5,6	Optical instruments and devices
8113	Cermet and articles thereof	5	Base metals and thereof articles
8444	Machines for spinning -extrusion-, drawing, texturing, or slicing of artificial textile materials	5,7	Electrical machinery and equipment
Top 5 least complex			
0714	Cassava, arrowroot or salep roots, artichokes, sweet potatoes, and similar roots and tubers	-3,8	Vegetable products

2615	Niobium, zirconium, tantalum, vanadium or and their concentrates	-3,8	Mineral products
5303	Jute and other bast textile fibers	-4,7	Textiles and thereof articles
2609	Tin ores and concentrates	-3,8	Mineral products
1801	Cocoa beans and broken beans, roasted or raw	-4,6	Food industry products

Source: The Economic Atlas Complexity (online, 2021)

At the same time, researchers propose a country-wide indicator called the Economic Complexity Index (ECI), which consists of the diversity of the export basket corrected by the ubiquity of the products composing it. Countries with diversified exports and low ubiquity are those with accumulated diversified skills. These countries have a high complexity level. On the other hand, if the export basket is made up of goods, certainly varied, but with high ubiquity, then the country has a low complexity level. In the country approach, the diversification level of the export basket is corrected by the ubiquity of the products composing it.

Table no. 2 The ten most and least complex countries

10 most complex		10 least complex	
Country	ECI	Country	ECI
UK	1,5	Malawi	-1,4
Hungary	1,5	Papua New Guinea	-1,5
Finland	1,6	Congo	-1,5
Finland	1,6	Congo	-1,5
Czech Republic	1,6	Libya	-1,6
Austria	1,7	Mauritania	-1,6
South Korea	1,8	Guinea	-1,7
Swiss	1,9	Sudan	-1,7
Sweden	1,7	Yemen	-1,7
Germany	1,9	Nigeria	-2,1
Japan	2,2	Angola	-2,3

Source: The Atlas of Economic Complexity (online, 2021)

Table 2 lists the ten most and least complex countries. Surprisingly, Hungary and the Czech Republic are more complex than the United States or France. Followed by Slovakia and Slovenia. In order to clarify this result, we looked at the exports structure of these 4 Eastern European countries. In 2014, they diversified their exports were, and their main exports: “cars” and “vehicle parts and accessories” (which represent around 10% of total exports), have low ubiquity. It turns out that five countries are responsible for more than half of their total exports. In terms of complexity, cars are only at the 414th position and “vehicle parts and accessories” at the 155th position in a classification comprising 1240 products. At the same time, the less complex countries are major natural resources exporters. These economies are also distinguished in illustrating the relationship between economic complexity and income per capita. We note the existence of a nonlinear relationship with a reversal beyond \$ 40,000 per capita in PPP. The sophistication levels of countries with incomes below \$ 20,000 per capita are widely dispersed.

Some low-income countries manage to achieve a high level of complexity, for example, the Philippines (whose sophistication level comes from exports of "integrated electronic circuits" and "automatic data processing machines"). Similarly, we notice a wide dispersion in countries' income levels with a sophistication group around 1. On the one hand, in China, Mexico, and Romania, the income per capita (in PPP) is less than \$ 20,000, while in Singapore, Holland, and Denmark, per capita income exceeds \$ 40,000 (PPA). The few high-income countries with low sophistication are essential natural resource exporters. This is, for example, the case of Norway, Oman, or Australia.

Combining the notions of diversification and sophistication, the PCI effectively seems to have an explanatory power more significant than the PRODY. The indicator exceeds the PRODY circularity limit made and consists of a characteristics mix between countries and products. However, by endeavoring to associate a sophistication level with the products - the export approach - rather than

with the carried out production process, all of these classifications face certain limitations that must emphasize.

To conclude, the same sophistication level can come from very diverse export structures. The export basket average sophistication may result from a sophisticated structure such as the high-income economies. It can also come from a few very sophisticated significant exports. Thus, if sophistication complements the analysis of export diversification, the reverse is also true. The literature often dissociates these two dimensions of structural transformation; only they can lead to biased conclusions of the structural transformation underway process.

5. Conclusions

The research paper underlines that the export limits approach, generally ignored by the literature, becomes particularly problematic in value chains. If the diversification and sophistication of the export are supposed to characterize productive transformation because they signal the accumulation of new domestic capabilities, integration into GVCs can blur it. Indeed, to date, exports are no longer necessarily the continuity of production; concluding productive transformation from the sole analysis of exports can therefore be risky. However, the use of trade data internationally seems inevitable. International, however, seems inevitable. This is why, in order to correct the bias induced by the export approach, we propose adding the dimension of sustainability to the usual definition of productive transformation. Sustainability includes the continuity notions and depth of the transformation process.

Entering the industrialization era does not necessarily mean entering a virtuous circle of transformation. With insertion into value chains, manufacturing exports can expand while being concentrated and without gaining complexity. They, therefore, stimulate structural change but do not always allow its continuity. Indeed, industrialization can materialize through specialization in specific activities. By being confined to the most straightforward stages, developing countries amplify their comparative advantages in low-skilled labor-intensive activities, which in the long run can block the transformation process continuity. We, therefore, mean by continuity the entry into a virtuous circle of transformation (it, therefore, avoids the specialization trap). Thus, we define sustainable, productive transformation as a process of diversification and export sophistication resulting from the capabilities accumulation that allows the country to enter over time in a virtuous circle of sustainable transformation.

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