ECONOMICS WEB INSTITUTE

PROXIMITY IN PRODUCT SPACE AND DIVERSIFICATION STRATEGIES

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1. Overview

How difficult is to produce a certain good if you already have the skills and the infrastructure to make something else? Well, other things equal, it will depend on how near is the new product to the old one.

In this contribution, we are distributing for free a few key datasets derived from an interesting methodology to elicit **technological proximity between any two products** proposed in a 2007 paper - published in "Science" magazine - whose title is "The Product Space Conditions the Development of Nations" by C. A. Hidalgo, B. Klinger, A.-L. Barabasi, R. Haussman [1], widely complemented by this site and somewhat anticipated by R. Hausmann and B. Klinger (August 2006).

In particular, we distribute the list of high proximities and the overall matrix of proximities, where many hundreds of products are evaluated in their distance from each other. To locate where your country is at the present, we add the competitive positioning of all countries in the world for the same products as well as a wider database, which includes the destination countries.

More importantly, in this paper we outline the kind of strategies that can make use of these data to contribute to deliver a strategy of diversification of national economies and firm conglomerates.

2. Why governments should care about product proximity

In many countries, the exports are heavily concentrated in few products; any temporary market crisis or production disruption (e.g. a bad harvest for agricultural produces) heavily hits the country in macroeconomic terms, with a rise of trade deficit, a fall in GDP, employment, and tax revenue.

This **fragility** can be purposefully used by other countries to menace trade barriers for those key products to obtain political and economic subjugation, especially if they overall dominate that country, as we measured using a network approach [2].

Accordingly, UNCTAD and the South Centre are prompting since many years those countries who mostly suffer from export concentration to diversify their economies. More recently, climate change mitigation could represent a difficulty for oil-producing countries, relying on such exports to move the entire economy, if no intentional diversification is put in place, as advocated in this book.

Many plans are indeed underway in several countries with this aim. However diversification can easily fail, since the investors in the new fields might find difficult or impossible to carry out certain productions because of lack of business partners, of a skilled workforce, of a suitable infrastructure.

This often leads governments to work on the attraction factors (labour, infrastructure, capital) in a horizontal way, dispersing much energies and funds in a variety of diversification

directions. This is exactly **what private managers of large firms would not do**: a all-round diversification without any references to the company core competences (Prahlad and Hammer). By trying to be good at everything, you'll turn out to be excellent in nothing [2].

This kind of "**blind diversification**" can work if a country has already so many skills and broad infrastructure to be able to nurture a lot of different ventures, but might turn out not to be the fastest way to develop heavily specialised economies.

The success of "blind diversification" crucially depends on the current position in the "product space", i.e. the competitive production fields. As Hidalgo et al. state: "...not all countries face the same opportunities when it comes to development. Poorer countries tend to be located at the periphery [of the product space], where moving toward new products is harder to achieve. More interestingly, among countries with a similar level of development and seemingly similar levels of production and export sophistication, there is **significant variation in the option set** implied by their current productive structure..."

3. What is "product space"?

Industrial and non-industrial processes leads to a huge variety of products, both targeted to final consumption or to intermediate steps along the global value chains.

A rationalisation of this variety is offered by standard classification of products categories, which are based on the principle of nest: broader categories embrace a lot of narrower ones, which in turns comprehend an even larger numer of even narrower categories.

The basic classification we shall use is the SITC. Each product category has a number code, which states transparently to which broader category it belongs. For instance, the category 0111 (a 4-digits category) "Meat of bovine animals, fresh or chilled" is included in 011 (3-digits) "Meat of bovine animals, fresh, chilled or frozen", where clearly 0012 is "Meat of bovine animals, frozen".

All belong to category 0 (1-digit) "Food and live animals".

In this analysis, the level of detail will be always 4-digits. The product space can be given a network representation, leveraging the proximities between any two products, as shown in this graph.

Countries are moving in the product space, as widely documented by these maps. Their growth in GDP is linked to the kind of products they are capable to produce, because the value added is unevenly distributed across sectors, with some commodities providing low (or no) value added to the country, dominated as they are by unstable huge world markets where each country is a pricetaker, which drives economic profits to zero.

To increase GDP, macroeconomics policy should be matched by industrial developments in the "rich" region of the product space, often in the realm of differentiated products. The product space should be explored as widely as possible, in order to give indications about every kind of potential directions of diversification.

However, even the largest available international datasets have their defects; in particular, those used in Hidalgo et al. refer to **merchandise trade**. The policymaker should be aware thus that the quantitative analysis here presented has a bias towards manufacture with services ignored - which is particularly painful since in most countries, large parts of GDP are generated in this sector and synergies between current manufacture productions and new services might increase the value added of the former.

In particular, tourism is not convered, even if it is an interesting option for many developing countries with beautiful sites and amazing cultural diversity.

Moreover, the standardisation of categories has the specific disadvantage of "freezing" the picture to the past, with a lot of quickly developing entirely new sectors labelled as "Others" within very traditional (and possibly mature) industries.

All this means that the diversification strategy should not be bound to the results of this paper, but be ready to **explore** also other directions.

4. What is "proximity"?

As Hidalgo et al. put it: "The concept of proximity formalizes the intuitive idea that the ability of a country to produce a product depends on its ability to produce other ones... we measure proximity by using an outcome based method founded on the assumption that similar products are more likely to be exported in tandem".

Accordingly, proximity is the percentage of countries that exports both products out of the total number of countries that export one of them.

A proximity of 1 means that all countries that export one product do export also the other, suggesting that those production are very similar and require the same industrial skills. A proximity of more than .75 means that a high proportion of countries that export one product do export also the other. If yours is in latter category, but still does not export the other

good, it should be easy to add it to the basket of products exported in a competitive way.

5. The practical use of these data

Choose a product your country (or your firm) already produces. You should try to classify it in some broad categories and find it in the SITC classification: in this way you shall establish which is his numerical code with four digits, key to the other datasets.

To verify whether your country produce that good in an internationally competitive way, browse this Excel file, looking for the code you have obtained. You shall find the values for exports of each country cumulatively for 1998, 1999 and 2000. To get more updated values see the UN COMTRADE database, whereas for older values in single years see here.

To find out which other goods you might produce, browse this other Excel file searching the product code of your starting product: you will find one or more products whose proximities is higher than .6. In particular, you shall find their SITC code: to establish their full names, you should look back again to the classification.

In this way, you shall have a short list of candidates for new productions.

6. Ten steps towards a strategy of intentional diversification

A task force of economists, consultants, engineers, and industrial specialists should generate a broader list of candidates for new productions, including services and other potential directions.

Each product, however, should be quite narrowly defined so as:

* to identify a list of international firms currently producing it;

* to identify a list of national firms whose production lies in sectors near or overlapping with it;

* to conduct explorative interviews with key managers of the abovementioned companies to establish their criteria of locational choice for new plants and premises;

* to evaluate the strong and weak points of the country (or subnational regions of it) for investors;

* to prepare an **investment package** which includes favourable conditions for those specific products, e.g. networks of suppliers and retailers, locational advantages, etc.

* to implement a road show to meet potential investors, both attracting Foreign Direct Investments and soliciting endogenous entrepreneurship;

* to widely diffuse information about the investment package through Internet sites, so as to pressure investment decisions;

* to establish focal dates to launch pilot projects.

Meanwhile, participation of territorial and branch bodies, both public and private, can nurture the consensus towards the new investments, which have to be carefully monitored as they can turn out to be pioneering innovation cases, whose success has to spread out to engender a large scale impact on country skills, competitiveness, and GDP.

Such a strategy might well be complemented by pro-trade strategies that we have already proposed, such as bilateral import promotion and proximity international trade.

7. Corporate diversification

Not only public bodies are crucially interested in the product space and the learning trajectories that structure it. Also large firms have often to evaluate the opportunity to **diversify**.

Evolutionary economics has already identified an original approach to diversification, as exemplified in this paper and in this other. Moreover, it has explored the product space to localise innovation. In particular the entire DRUID Summer Conference 2007 has been devoted to appropriability, proximity, routines and innovation.

The present document adds a numerical measure for companies that want to somewhat "objectively" evaluate how difficult certain directions of diversification might be.

Bibliography

[1] C. A. Hidalgo, B. Klinger, A.-L. Barabasi, R. Haussman, "The Product Space Conditions the Development of Nations", Science, vol.317, p. 482-487 (2007).

[2] Observing Trade: Revealing International Trade Networks and Their Impacts, Princeton University, March 9-11, 2006.

[3]This informal observation is rooted in a much deeper consideration of the importance of idiosyncratic and specific skills, cumulated over time and difficult to imitate, to carry out productive routines in general, and export-oriented routines in particular.

A competence-based theory of international trade beyond statical neoclassical comparative advantages is emerging from evolutionary economists who identify a strong role for **innovation**, **income distribution**, and **learning dynamics** in the long-lasting, difficult, and **path-dependent process** of building **absolute advantages.**

The composition of international trade is, in this perspective, determined by **historically arising national differences** in **technological, organisational and financial capabilities** rather than relative "natural" factor endowments.

For an easy introduction of this strand of research see pp. 17-23 of Gjerding (1997).

The underlying formal micro-foundation to individual agents is linked to populations of bounded-rational exporters and importers. Their cognitive limitations can influence the success of export-led growth, as exemplified by this paper at EWI, where the linkages between literacy and exports are explored.

In terms of policies, this strand tends to suggest solutions suitable to realistic settings of bounded-rational agents, for instance recognising that the capabilities required to be good importers are much easier to acquire than those needed to be good exporters, which justifies the potential success of a strategy of bilateral import promotion.

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