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Measuring Country Competitiveness: A Survey of Exporting-based Indexes

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Abstract

In the context of increasing globalization and world trade flows, this survey reviews the most recent literature related to country competitiveness. Although Krugman (1994) maintains that competitiveness at country level is a "*dangerous obsession*", this concept is becoming more prominent in public debate. However, it lacks a clear definition and confusion between the country and firm levels. This survey focuses on competitiveness from an export perspective because "*what you export matters*" (Hausmann et al., 2007), and tries to fill the gap between the former understanding and the new theoretical insights/stylized facts. More precisely, this literature review investigates four complementary indexes related to a country's productive and export structure: *(i)* productive diversification, *(ii)* export sophistication, *(iii)* product space, and *(iv)* economic complexity. It proposes nine building blocks for competitiveness at country level.

Keywords: Country competitiveness - Diversification - Sophistication - Product space - Complexity

JEL Classification: F10 - F63 - O10

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1 Introduction

Globalization, intensification of world trade flows, and the emergence of new competitors (especially low-cost competitors such as Chinese manufacturers) are putting the spotlight on the competitiveness of individual economies. Competitiveness is the capacity to face foreign competition. However, its meaning varies according to the level of analysis: firm, industry or country.

From a firm point of view, the concept of competitiveness matters and relates to the firm's ability to win market share compared to its (main) competitors in the domestic and international markets. The capacity of the firm to adapt to a specific competitive environment depends on a structural competitiveness (i.e. the firm's ability to differ from other through a product differentiation, an upgrading of the quality or a monopolistic position), and a price competitiveness (i.e. the firm's ability to respond to national and international competition by adjusting its prices). Less competitive firms, i.e. those unable to respond quickly to competitive pressure, are merely ousted from the market. Besides, Krugman (1994: 31) says that: *"when we say that a corporation is uncompetitive, we mean that its market position is unsustainable - that unless it improves its performance, it will cease to exist"*.

From an industry point of view, the concept of competitiveness also matters and relates to the competitiveness of the firms operating in the focal industry. When those firms gain market share over their foreign competitors, the domestic industry's export market share increases at the expense of foreign ones. However, industry competitiveness is more than a simple aggregation of the competitiveness of the individual firms forming the industry. For example, because firms are heterogeneous (within an industry), industry competitiveness can increase based on a reallocation of domestic resources towards the most efficient firms (Melitz, 2003). Thus, industry competitiveness is related also to the reallocation of productive resources at the inter-firm (or intra-industry) level.

From a country point of view, this is *prima facie* evidence that the concept of competitiveness has not achieved a consensus among economic thinking. While there is agreement over firm and industry competitiveness, economists seem reluctant to reach agreement on country competitiveness. Two main arguments could explain this skepticism.

On the one hand, there is a general belief in economic thinking that countries do not compete with one another. This belief is based on the theory of comparative advantage (Ricardo, 1817): two countries, participating in a common trade, are specialized in two different ranges of products, and hence, are not in competition with each other. In other words, the gains achieved by one country are not achieved at the expense of the other country. Consequently, countries do not compete with each other in the same way as firms compete; rather they are partners. Each exporter country is the destination market for another, and

each exporter country can specialize in producing goods in which it holds comparative advantage. On the other hand, the economic literature provides two famous critiques against country competitiveness. Porter (1990) suggests that competitiveness is an amorphous concept, and at country level, only economic prosperity is relevant, while Krugman (1994, 1996a, 1996b) describes competitiveness at country level as a *"dangerous obsession"* (only productivity matters). By this he means that the concept of competitiveness is *"elusive"* if someone tries, for example, to compare the competitiveness of a country to the competitiveness of a firm (*"countries [...] do not go out of the business. They may be happy or unhappy with their economic performance"*, Krugman, 1994: 31). Krugman highlights the lack of a definition of this complex concept despite it figuring increasingly in public debate; policy makers frequently refer to it but without providing a common and meaningful definition.

Keeping in mind Ricardo's trade specialization patterns (complementary productions), and Porter's and Krugman's recommendations (productivity matters), I confront the consensus of the economic literature with the context of increased globalization and world trade flows which require countries individually to perform better than do their neighbors. Two dimensions can be presented.

On the one hand, the New (New) Trade Theory (Krugman, 1981; Melitz, 2003) and New (New) Economic Geography (Krugman, 1991; Baldwin and Okubo, 2006; Ottaviano, 2011) have enriched the theoretical field: international openness and regional integration suggest that territories are segmented, i.e. some of them become more concentrated while others remain undeveloped (spatial polarization phenomenon). On the other hand, certain practices (cluster initiatives, export promotion, foreign direct investment attractiveness or re-industrialization policies)¹ shed light on the emergence of new territorial arrangements at both the regional and national levels.

These two dimensions converge to increase the inequalities among territories which because they are unequal, must defend themselves. In a globalization context, defensive strategies emerge more strongly at regional and country level. Country competitiveness originates from these inequalities, and more accurately, from the presence of a win-lose system across territories. Competitiveness consists of exploiting globalization (i.e. exploiting competitive pressure) because of the intensification of world trade flows and the emergence of new challengers which quickly oust the market leaders. Every country needs to defend its com-

¹The most famous representation of country competitiveness is based on the cluster initiatives. E.g. in 2005, France launched a policy to promote competitiveness clusters to respond to poor French export performance. According to Fontagné et al. (2013: 899): *"the goal of the French cluster policy is to promote innovation through increased collaborations between firms, private research centers, and universities, and to strengthen the competitiveness of French products on international markets"*. An OECD (2014) report links export promotion to competitiveness and notes the decline in French export performance from the mid 1990s. It proposes several reforms to improve French competitiveness including research and innovation, competition policy, taxation, labor market, and training/qualification standards.

petitiveness in order to attract more investment, to help domestic firms and industries to generate more income, to stimulate innovation and job-creation, to strengthen their export portfolio, and especially to increase wealth. These competitiveness benefits facilitate countries' greater global integration and higher future growth. Thus, new economic theories and economic policy are converging towards an acknowledgement of the importance of country competitiveness in a world in which individual countries are more and more challenged in their productive opportunities. So, there is a gap between the previous consensus of the economic literature and the current theoretical insights/stylized facts. This gap constitutes the motivation of the paper.

This survey aims to fill this gap and investigates countries' productive and export structures. More precisely, it considers three perspectives to encompass country competitiveness. Firstly, productivity and competitiveness are different: productivity measures the efficiency of use of domestic inputs to achieve a given level of output, and competitiveness, according to the most popular definition proposed by D'Andrea Tyson (1992: 1), is *"our ability to produce goods and services that meet the test of international competition while our citizens enjoy a standard of living that is both rising and sustainable"*. Unlike productivity (which is related to efficiency), competitiveness rests on the ability to compete. Secondly, exports are the link between a country's internal and external performance. A focus on exports allows an estimation of the ability of the firms established within a given country to export from this territory based on its domestic labor force. In a continuously evolving environment, greater competitiveness stems from the ability to export reactively. Thirdly, export dynamics represent the aggregation of three forces: *(i)* the first one refers to increased market share by product (i.e. each mono- or multi-product firm exports progressively more); *(ii)* the second one refers to reallocation of resources towards the most productive firms within a single industry producing the same product (i.e. the most productive firms, best placed to face competitive pressure, earn an export premia; the other ones focus on the domestic market or leave it when they become unproductive); and *(iii)* the third one refers to reallocation of resources towards the most competitive products within or between firms.

The purpose of the paper is to review the most recent theoretical and empirical studies related to countries' productive and export structures. I focus on four complementary indexes²: *(i)* productive diversification, *(ii)* export sophistication, *(iii)* product space, and *(iv)* economic complexity which reveal the main means that countries' can use to strengthen their competitiveness. These means are presented in the form of nine propositions which constitute the build-

²Note that this survey does not refer to global competitiveness indexes such as the Global Competitiveness Index (from the World Economic Forum) or the World Competitiveness Yearbook (from the Institute for Management Development), because these have been questioned by economists who point to lack of explicit theoretical foundation (Lall, 2001; Siggel, 2006) and lack of clear justification for the econometric variables (Debonneuil and Fontagné, 2003; Grégoir and Maurel, 2003).

ing blocks of competitiveness at country level³. Table 1 summarizes the main findings of this literature review.

The remainder of the paper proceeds as follows. Each section details one index related to country competitiveness. Section 2 reviews the productive diversification; section 3 presents the export sophistication; section 4 explores the product space; section 5 deals with the economic complexity, and section 6 offers some concluding remarks.

2 Productive diversification

The first index is productive diversification based on *(i)* sectoral diversification (Imbs and Wacziarg, 2003), *(ii)* country export diversification by product (Cadot, Carrère, and Strauss-Kahn, 2011; Cheptea, Fontagné, and Zignago, 2014), and *(iii)* firm export diversification by product for a given country (Mayer, Melitz, and Ottaviano, 2014; Lelarge and Nefussi, 2010). These are considered as a set of tools to support the evolution of the exported product portfolios within certain market constraints.

2.1 Sectoral diversification

In terms of sectoral diversification, the core contribution rests on Imbs and Wacziarg's (2003) *"stages of diversification"*. They distinguish two stages in a country's economic development process. In the first stage, economies grow through an increase in sectoral diversification. In the second stage, economic activity becomes more concentrated again (above a certain level of per capita income); the income threshold represents the break point at the junction of the two stages. Thus, the evolution of sectoral concentration follows a U-shaped curve in relation to the level of per capita income. This relationship is confirmed for both within- and between-country variations.

Using country-sector level data from the International Labor Office (1-digit level, 1969-1997, employment shares across sectors), from the United Nations Industrial Development Organization (3-digit level, 1963-1996, manufacturing data) and from the Organisation for Economic Co-operation and Development (OECD) (2-digit level, 1960-1993, for employment and value added per sector), Imbs and Wacziarg estimate the relationship between various measures of sectoral concentration (i.e. Gini, Herfindahl, Coefvar, Maxmin, and Logvar)⁴ and

³For other surveys of competitiveness, see e.g. Reinert (1995), Boltho (1996), Chaudhury and Ray (1997), Lall (2001), or Siggel (2006).

⁴The Gini coefficient describes the inequality of sector shares, the Herfindahl index denotes the sectoral concentration of employment or value added, Coefvar is the coefficient of variation of sector shares, Maxmin is the max-min spread, and Logvar is the log-variance of sector shares.

the level of national per capita income. They show that the relationship between income and diversification is non-monotonic.

The main novelty of Imbs and Wacziarg’s (2003) paper is that it is based on the robust empirical fact that the concentration of economic activity follows a U-shaped curve which is related directly to the country’s per capita income. Each country follows a particular trend in terms of economic development; in other words, each performs differently according to the stage of diversification.

Imbs and Wacziarg’s paper contributes to the theoretical debate on the evolution of sectoral diversification over time and across countries: they show that there is a general pattern of initial diversification followed by specialization, but that this pattern emerges relatively late in the development process. Among low-income countries, the force of diversification is the stronger driver whereas among high-income countries, the force of concentration (or specialization) predominates. In other words, there is a positive link between diversification and economic growth in low-income countries, and between specialization and economic growth in high-income countries. However, there is no theoretical consensus on how to measure sectoral diversification. Each of these forces comes into play at different points in the respective development processes. However, in the early stages of economic development, countries are specialized in exploiting their natural resources and factor endowments (i.e. their natural competitive advantages). Consequently, the above two stages reflect resources reallocation, and depend on the economic force that is dominating the country’s growth process.

Proposition 1: A country is competitive if a process of sectoral specialization substitutes for a process of diversification beyond a certain level of per capita income.

2.2 Country export diversification by product

The first main contribution to work on country export diversification by product is Cadot, Carrère, and Strauss-Kahn (2011). Following Imbs and Wacziarg’s (2003) framework, they provide an in depth analysis of export diversification and economic development at country level. They revisit the topic from a different perspective using a decomposition of Theil’s entropy index⁵ which maps directly onto the extensive (i.e. variation in the number of new products exported or the number of new markets for existing exports) and the intensive margins (i.e. variation in export values among existing exports) of export diversification. For a given country and a given year, Cadot et al. split the 4,991 export lines into active and inactive: the evolution of the between

⁵Theil’s entropy index, which estimates inequality in export shares, was a pioneering contribution on economic inequality.

component of the Theil index corresponds to changes at the extensive margin while the evolution of the within component reflects changes at the intensive margin.

Using country-product level data from the United Nations Commodity Trade Statistics (UN Comtrade) (Harmonized System 6-digit (HS6), 1988-2006, 156 countries including 141 developing ones, 4,991 products), Cadot et al. decompose Theil's entropy index, denoted T , into within-groups (T^W) and between-groups (T^B) as follows:

$$T = \left(\frac{1}{K}\right) \sum_{k=1}^K \left(\frac{x_k}{\mu}\right) \ln \left(\frac{x_k}{\mu}\right) \quad (1)$$

$$T^W = \sum_{h=0}^H \frac{K_h}{K} \frac{\mu_h}{\mu} T_h = \sum_{h=0}^H \frac{K_h}{K} \frac{\mu_h}{\mu} \left[\left(\frac{1}{K_h}\right) \sum_{k \in G_h} \frac{x_k}{\mu_h} \ln \left(\frac{x_k}{\mu_h}\right) \right] \quad (2)$$

$$T^B = \sum_{h=0}^H \frac{K_h}{K} \frac{\mu_h}{\mu} \ln \left(\frac{\mu_h}{\mu}\right) \quad (3)$$

$$T^W + T^B = T \quad (4)$$

where x_k is the dollar value of the export line k (i.e. for the product k), regardless of which group it belongs to, and μ represents the average dollar value of the K total number of potential export lines: $\mu = \frac{1}{K} \sum_{k=1}^K x_k$. Cadot et al. consider some partition of the total number of potential exports into $H+1$ groups denoted $G_h = 0, \dots, H$. K_h is the number of export lines in group h and μ_h the average dollar value. T_h stands for Theil's index for group h , calculated using T on the K_h lines.

The key novelty of Cadot, Carrère, and Strauss-Kahn's (2011) paper rests on the decomposition of Theil entropy index into within- and between-groups. This decomposition also handles the trial and error process of exports where country diversification is based on both new products and new markets.

On the one hand, they note that diversification and respecialization take place along the extensive margin. They find a hump-shaped relationship between export diversification and income, similar to Imbs and Wacziarg's U-shaped curve between employment and production. In other words, the first mirrors the second. On the other hand, Cadot et al. suggest that countries move between diversification cones when they accumulate capital (Schott, 2004; Xiang, 2007). More precisely, countries move from old inactive cones to new active ones: there is an adjustment process between these two stationary equilibria along the economic development path. *"During the transition phase, new-cone*

lines become active, while old-cone ones do not want to die. As a result, exports diversify, and the total number of active lines rises. As time passes, however, comparative advantage catches up on old lines, and they slowly die, reducing diversification", (Cadot et al., 2011: 601). So, the hump-shaped relationship between export diversification and economic development is explained by this slow and transitory adjustment of the journey between diversification cones.

According to Imbs and Wacziarg (2003), Cadot et al. analyze the relationship between export diversification and income at country level. However, on the one hand, while Imbs and Wacziarg deal with country-sector level, Cadot et al. focus on country-product level. On the other hand, Cadot et al. extend Imbs and Wacziarg's conclusions by explaining that diversification and subsequent respecialization occur mostly along the extensive margin, especially early in the development process.

Proposition 2: A country is competitive if it is able to alternate respecialization and diversification (of exports) renewing its product portfolio with new export lines and/or new markets.

The second main contribution in the context of country export diversification by product is Cheptea, Fontagné, and Zignago (2014). Using an alternative methodology, they decompose countries' export growth (i.e. market share) into: *(i)* a geographical composition effect, *(ii)* a sectoral composition effect, and *(iii)* a pure performance (or exporter) effect. The pure performance effect measures the degree to which an exporter country weights its gains or losses in terms of market share (after controlling for the two previous composition effects). Thus, developing an econometric shift-share decomposition of export growth, Cheptea et al. identify for each exporter the contribution to the intensive margin (i.e. variation in export values among existing exports) of the composition effects (by product and by destination) and of the performance effect in the evolution of market share. Furthermore, in relation to the competitiveness issue, they shed light on the impact of emerging countries on the reshaping of world trade.

Using country-product level data from the Base pour l'Analyse du Commerce International (BACI)⁶ (HS6, 1995-2009, 5,037 products, 240 countries, importer and exporter flows in values and quantities), Cheptea et al. apply a shift-share decomposition of the export growth of European countries, as follows:

$$\ln \left(\frac{XV_{ijq}^t}{XV_{ijq}^{t-1}} \right) = \alpha_i^t + \beta_j^t + \gamma_q^t + \epsilon_{ijq}^t \quad (5)$$

⁶See Gaulier and Zignago (2010).

where XV_{ijq}^t and XV_{ijq}^{t-1} are the values of the exporting country i 's exports to the destination (or importer) country j for the group of products q in a given year t or $t-1$. α_i^t is the amount of growth in year t that can be attributed to the export performance of country i . β_j^t and γ_q^t are the contribution of the average geographical and product trade structure in year t to the annual growth rate of exports between $t-1$ and t .

The main novelty of Chepeta, Fontagné, and Zignago's (2014) paper is the shift-share decomposition of market share rather than the traditional constant market share analysis. Compared to the previous studies, this alternative decomposition, at product variety level, presents some empirical advantages: one splits the country's market share into geographical, sectoral and pure performance effects; the other estimates competitiveness rather than considering it to be a residual.

On the one hand, they explain that countries are not specialized in sectors or products but in varieties of the same product (Schott, 2004). On the other hand, they attribute the European losses to a negative performance effect of their exporters (the geographical and sectoral effects contribute positively to export growth). Chepeta et al. also investigate the reconstruction of the world market due to new competitors. Emerging countries, such as China, India, Brazil, and Korea, are characterized by increased export performances: they are more competitive in terms of market share appropriation, product specialization, and export upgrading. The reshaping of world trade flows is a result of these emerging countries gaining market share from the developed countries.

Previously, Cadot et al.'s (2011) methodology based on the extensive margin, suggests that countries travel between diversification cones: the transition from old inactive cones to new active ones increases diversification while the disappearance of old cones promotes more specialization. Chepeta et al.'s methodology which focuses on the intensive margin, suggests that market shares vary across countries according to their competitiveness in a given year and a given variety of product. In other words, along the intensive margin, market share travels towards the most competitive countries (including new competitors): this highlights the role of competitiveness in the reshaping of world trade flows between developed and emerging countries. Hence, a country is more competitive than another country when it accumulates greater market share, and maintains it across time.

Proposition 3: A country is competitive if, in the presence of new competition, it strengthens its competitive advantage on the product and/or quality spectrum.

2.3 Firm export diversification by product for a given country

The first main contribution in terms of firm export diversification by product for a given country is Mayer, Melitz, and Ottaviano (2014). They develop a new theoretical framework and take as a starting point that multi-product firms are heterogeneous and dominate world trade flows due to their ability to respond to different market environments by varying the number of products they export. In other words, they are able to adapt their production to the destination country's market conditions, and to adapt their product portfolios towards the best performing goods. In addition, tougher competition contributes to redefinition of the firm's export basket. Consequently, there is a pro-competitive effect underlying the impact of the destination market on both the host country's export structure and the firms' productivity.

Using country-firm-product level data from the French Customs (Combined Nomenclature 8-digit level (CN8), for 2003 and for the whole range of manufacturing sectors: 103,033 firms, 229 destination countries, 10,072 products), Mayer et al. develop a model of multi-product firms which highlights how differences in market size and geography affect the within-firm distribution of export sales across destinations. Studying the intensity of the link between competition and firm productivity, they focus on a set of French exporters and find a strong relationship between market size/geography and export product mix. In this context, focusing on the best products automatically assigns more workers to their production. As a consequence, the relative market share of the most efficient products increases and *"firms respond to increased competition by dropping their worst performing products"*, (Mayer et al., 2014: 496). Thus, the spectrum of exported products is endogenously modified. Mayer et al. conclude that the evolution of the firm's product portfolio is driven by the level of competition across markets: in the face of tougher competition, the firm will skew its product mix towards its core products in order to increase competitiveness. The within-firm evolution of the product mix has repercussions for firm productivity.

The main novelty of Mayer, Melitz, and Ottaviano's (2014) paper is the presence of a pro-competitive effect: tougher competition has an impact on both the mix of the exported product and the firm's productivity. Differences in competition across export markets generate substantial firm-level markup responses. In turn, the trading environment induces a new product mix centered on the firm's most successful products. The main advantage of this framework is that it captures the role of geography (through destination markets) on firm export sales.

Proposition 4: A country is competitive if its domestic firms adapt their product mix to both their core products and the market conditions in the destination countries.

The second main contribution to work on firm export diversification by product for a given country is Lelarge and Nefussi (2010). Starting from the idea that the gap in terms of production costs between developed and emerging countries encourages firms settled in the developed countries to establish specific strategies, Lelarge and Nefussi focus on French firms' strategies in the face of low-wage competition. On the one hand, the firms, bounded by a new competition, become more diversified: the evolution of product portfolios depends on the firm's ability to adapt in the face of foreign competition. On the other hand, only the most productive firms are able to survive the competitive pressure and gamble on innovation for future survival. In other words, the presence of new low-wage competition implies innovation along key segments (in developed countries): Bloom, Draca, and Van Reenen (2012), for instance, show that Chinese low-skill production (note that China is unquestionably a new world challenger) prompts creativity and high-skill innovation in the United States, Europe and Japan.

Using country-firm-product level data from the Community Innovation Survey from the SESSI⁷ (1999-2004, 10,000 manufacturing firms with more than 20 employees), from the Institut National de la Propriété Intellectuelle and the Office Européen des Brevets (firm innovation behavior), from the French Customs (CN8, world trade flows), from the Classification des Produits Français (HS6, type of products), from the Bénéfices Industriels et Commerciaux-Bénéfice Réel Normal and from the Enquêtes Annuelles d'Entreprises (tax data), Lelarge and Nefussi focus on the relationship between the intensity of the international competition and the dynamic of product portfolios as follows:

$$STRAT_{bt} = \beta_0 + \beta_1 PEN_{bt-1}^S + \beta_2 PEN_{bt-1}^N + \beta_3 VC_{bt-1} + \epsilon_{bt} \quad (6)$$

$$PEN_{bt-1}^S = \sum_{\lambda} \omega_{b\lambda t} \frac{M_{F\lambda t}^S}{A_{Ft}} \quad (7)$$

$$PEN_{bt-1}^N = \sum_{\lambda} \omega_{b\lambda t} \frac{M_{F\lambda t}^N}{A_{Ft}} \quad (8)$$

where $STRAT_{bt}$ is one of the indexes⁸ testing the reallocation strategies of each activity a across each industrial firm b for a given year t . PEN_{bt}^S denotes the penetration index from South countries, S , and PEN_{bt}^N denotes the penetration index from North countries, N . $\omega_{b\lambda t}$ is the share of firm b for a given sector λ

⁷SESSI or Service des Etudes et des Statistiques Industrielles.

⁸ $CONCAT_{bt-max_a(\omega_{bat})}$ is the concentration index of activities, where ω_{bat} is the share of the activity a in the firm b 's portfolio in year t . $AUG_{bt} = \sum_{a \in Aug} \Delta\omega_{bat}$ is a reallocation index of existing activities, where $\Delta\omega_{bat}$ is the variation of the share of the activity a between $t-2$ and t for the firm b , and where Aug is the activities that remain between $t-2$ and t . $INERTIA_{bt} = 1 - \frac{1}{2} \sum_a |\Delta\omega_{bat}|$ is the inertia index (ordered between 0 and 1): its value decreases when a firm modifies its activities.

in year t . $M_{F\lambda t}^S$ and $M_{F\lambda t}^N$ are the imports from South and North countries to France, denoted F , in year t for sector λ . A_{Ft} is the coefficient of absorption for France in year t . VC_{it-1} represents control variables.

The main novelty of Lelarge and Nefussi's (2010) paper is its anticipation of competition from South countries, on which basis, firms in the North implement adaptation behaviors and strategies. So, the increased diversification of product portfolios depends on a pro-active effect, i.e. an ex-ante reaction to potential competition. Unlike the previous studies, Lelarge and Nefussi show the existence of preventive action to protect high-skilled activities (in the North) against new competitors (from the South).

Lelarge and Nefussi show that efficient firms invest in product innovation to counter low-wage competition. These firms are able to improve product quality, promote goods in which they hold competitive advantage, and register more patents than the other firms. Low-wage competition impacts positively on the most efficient firms and pushes them to search for differentiation strategies to preserve competitiveness. Furthermore, the competition from emerging countries induces reallocation within-firms in each of the developed countries.

Lelarge and Nefussi (like Mayer et al.) analyze the relationship between new competition and the dynamic of the exported product portfolio at the multi-product firm level. Mayer et al. suggest that these firms tend to specialize their production based on their core competences, and to adapt their export structure to the destination markets. Lelarge and Nefussi suggest that these firms should reallocate their resources and invest more in innovation. While Mayer et al. consider the role of geography based on the characteristics of the destination countries, Lelarge and Nefussi focus on the role of individual, within-firm, productive reallocation strategies. The former is related to firms' reactions bounded by new competition, and the latter refers to an anticipation of firm behaviors in order to face foreign competition.

Proposition 5: A country is competitive if, in the presence of an increase in international competition, its domestic firms adopt defensive strategies involving innovation and resources reallocations.

Productive diversification as an index of competitiveness, focuses on the role of countries' or firms' strategies related to export structures and destination environment. The following indexes focus on a new view of the performances of countries as individual competitors.

3 Export sophistication

The second index refers to export sophistication following Lall et al. (2006) and Hausmann et al. (2007), as a new way of classifying products based on the level of income in each exporter country, and on the revealed comparative advantage (RCA) of each exporter country for each given product.

The first main contribution in terms of a country's level of export sophistication is Lall, Weiss, and Zhang (2006). They propose a product level export sophistication index which includes each exporter's income level (i.e. per capita GDP). This index identifies the market segments in which the exporter country can compete based on the greater sophistication of its products. The index is aimed at promoting exports, evaluating the country's strategies in terms of competitiveness (i.e. individual performance), and understanding international trade from a new perspective.

Using country-product level data from the Standard International Trade Classification (SITC)⁹, second revision (3-digit and 4-digit levels, and, respectively, 237 and 766 products for 1990 and 2000) and from the UN Comtrade (HS6, importer/exporter trade flows) for a panel of 97 exporter countries divided into 10 income groups (based on World Bank data), Lall et al. construct $US(k)$, a unique sophistication score by product, as follows:

$$US(k) = \sum_{g=1}^G x_g^{WX}(k) \times Y_g \quad (9)$$

where $US(k)$ is the unique sophistication score as a dollar value for each product k . $x_g^{WX}(k)$ is the share in world exports, denoted WX , of each product k for each income group g . Y_g is the group's average income. US score gives the weighted average income for 10 income groups of exporter countries (indexed $G = 1, \dots, 10$) according to World Bank data. The index is provided by the range of unique scores. Based on this measure, Lall et al. normalize their index as follows:

$$SI(k) = \left[\frac{US(k) - US(min)}{US(max) - US(min)} \right] \times 100 \quad (10)$$

where $SI(k)$ represents the normalization of the sophistication index of product k ; this normalization is ordered from zero to 100. $US(min)$ and $US(max)$ define, respectively, the minimum and the maximum of the unique sophistication dollar

⁹SITC and HS are two different trade classifications. The SITC nomenclature focuses on the economic functions of products (depending on the stages of development); the HS nomenclature focuses on a breakdown of the products' individual categories.

value of all products.

The main novelty of Lall, Weiss, and Zhang's (2006) paper rests on a new classification of products at the international level. This sophistication classification links each product to the characteristics of the exporter country, and provides a new way to analyze a country's export structure and competitiveness. Also, Lall et al. (2006: 236) suggest that: *"our sophistication index can be used as a preliminary step for country competitiveness analysis, allowing a rapid mapping of location shifts in exports of interest to a country"*.

In this framework, sophistication captures a range of factors including technology, product fragmentation, and natural resources availability to examine the export performance of individual countries. An export is sophisticated if the exporter countries have an average level of income that is sufficiently high (or higher than that of other countries). Each product acts as a guarantee (of quality) for each exporter: a country that is able to export sophisticated products, is a powerful competitor in world markets. However, sophistication is not a direct measure of a country's competitiveness. Lall et al. suggest that what matters for country competitiveness is the country's international position for products with strong and sustainable market predictions. This is measured by sophistication. So, indirectly, sophistication is an indication of competitiveness gains or losses in relation to products dominated by high- or low-income exporters. They extend this argument: *"more direct relevance for competitiveness is comparisons of changes in sophistication within a particular sector or product category relative to a country's income level"*, (Lall et al., 2006: 233).

Unlike the previous frameworks (related to productive diversification), Lall et al. study the relationship between the sophistication of each product and the level of income of the exporter country. However, according to Cadot et al. and Cheptea et al., they favor country-product level (i.e. the most disaggregated level of analysis) to investigate country competitiveness. Furthermore, on the one hand, the evolution of world market shares highlights some products with strong market prospects; on the other hand, the level of sophistication indicates the type of world market segments in which a country is competitive (in terms of its main sophisticated products). This process allows judgments about the competitiveness of the country, and changes in world market shares link (product) sophistication to (country) competitiveness. As a consequence, Lall et al.'s sophistication index allows simultaneous comparisons between export structures, and discussion of individual country's competitiveness.

Proposition 6: A country is competitive if it exports sophisticated products with strong and sustainable market outlooks (i.e. products able to compete with others in the world market).

The second main contribution to work on a country's level of export sophistication is Hausmann, Hwang, and Rodrik (2007). Following Lall, Weiss, and

Zhang's (2006) product classification, they refine the methodology used to assess export sophistication using a new index which they call *EXPY*: it represents the productivity/income level of each country's export basket¹⁰. Export sophistication is captured by comparing the income levels of each exporter country for each given product. Unlike the previous indexes, *EXPY* has the advantage that it links anticipated productivity to capabilities and investors involved in the discovery of the true production costs (Hausmann and Rodrik, 2003). Furthermore, some traded products involve high levels of productivity, and countries that produce these sophisticated goods perform better and grow faster. Consequently, the *EXPY* index measures the quality of each country's export basket.

Using country-product level data from the UN Comtrade (HS6, 1992-2003, 5,000 products, importer/exporter trade flows) and from the World Trade Flows¹¹ (HS4, 1962-2000, export volume and per capita GDP PPP adjusted), Hausmann et al. calculate two consecutive indexes, named *PRODY_k* and *EXPYⁱ*. On the one hand, *PRODY_k* is defined at product *k* level, as an income/productivity measure. This index is established for the entire set of products between 1999 and 2001 as follows:

$$PRODY_k = \sum_{i=1}^I \left[\frac{x_k^i / \sum_{k=1}^K x_k^i}{\sum_{i=1}^I x_k^i / \sum_{i=1}^I \sum_{k=1}^K x_k^i} \times Y^i \right] \quad (11)$$

With $X^i = \sum_{k=1}^K x_k^i$, $X_k = \sum_{i=1}^I x_k^i$ and $X = \sum_{i=1}^I \sum_{k=1}^K x_k^i$,
I rewrite and simplify the previous expression (11) as follows:

$$PRODY_k = \sum_{i=1}^I \left[\frac{x_k^i / X^i}{X_k / X} \times Y^i \right] \quad (12)$$

$$PRODY_k = \sum_{i=1}^I RCA_k^i \times Y^i \quad (13)$$

where *PRODY_k* is a weighted average of the per capita GDP of countries exporting a given product *k*: this represents the income level associated with this product. The numerator denotes the value-share of each product *k* in country *i*'s overall export basket, and the denominator aggregates the value-shares

¹⁰Before Lall et al. (2006) and Hausmann et al. (2007), Michaely (1984) developed a similar index, named the '*income level of exports*', using the SITC at the 3-digit level where each country's weight corresponds to its market share in the global exports of a relevant commodity.

¹¹See Feenstra et al. (2005).

across all countries exporting each product k . The weights reflect the RCA¹² (Balassa, 1965) of each country i in each product k . Y^i sets out the per capita GDP of each country i .

On the other hand, $EXPY^i$ is constructed at country i level, as an income/productivity measure of a country i 's export basket (i.e. country's specialization pattern). This index is defined for all exporter countries from 1992 to 2003 (minimum 48 countries in 1992, maximum 133 countries in 2000) as follows:

$$EXPY^i = \sum_{k=1}^K \left[\left(\frac{x_k^i}{X^i} \right) \times PRODY_k \right] \quad (14)$$

where $EXPY^i$ is the productivity level associated with country i 's export basket. K represents all of the entire product range. The $EXPY^i$ index mainly relates to emerging economies characterized by less diversified production structures. Furthermore, Hausmann, Hwang, and Rodrik's methodology differs from Lall, Weiss, and Zhang's (2006) method in two ways: (i) for each product, it includes the RCA of each exporter country (using RCA as a weight guarantees that the size of the country does not distort the ranking of products), and (ii) it ranks products in terms of countries' implied productivity.

The theory on which these two indexes are built is self-discovery theory developed by Hausmann and Rodrik (2003). Spillovers relative to the discovery of new production costs allow entrepreneurs to focus their investment on high productivity activities. So, growth is matched by resources reallocation from low- to high-sophisticated products, which is the main novelty of Hausmann, Hwang, and Rodrik's (2007) paper. In addition, countries with a high level of $EXPY$ achieve higher export growth. Consequently, this framework highlights differences in the specialization schemes of countries that in other respects are similar, and suggests that the gains from specialization depend on the country's capacity to position itself along the quality spectrum.

Following Lall, Weiss, and Zhang (2006), Hausmann et al. analyze the relationship between the export sophistication and the country's income level. Building on Lall et al.'s conclusions, Hausmann et al. capture the productivity level associated with each country export basket. While Lall et al. link sophistication to competitiveness, Hausmann et al. link sophistication to productivity through a self-discovery process: entrepreneurs identify their productive activities and reallocate resources towards the most sophisticated products. In addition, the $PRODY$ and $EXPY$ indexes provide a new quality ranking of products at the international level.

¹²The RCA indicator is defined from the country's relative export structures and measures the weight of a given product in the export basket of a given country vis-a-vis the weight of this product worldwide.

One of the first applications of the *PRODY/EXPY* indexes was proposed by Jarreau and Poncet (2012)¹³ to test the *EXPY* robustness and relevance for a sample of Chinese provinces in the 1997-2009 period (using BACI and Chinese Customs data). Jarreau and Poncet confirm that regions exporting sophisticated products grow faster. Specialization in high-tech and innovative products is beneficial to province, region, and country growth. However, these gains are limited to the ordinary activities driven by domestic firms. In other words, the split between ordinary/processing activities and domestic/foreign firms produces a paradox: processing trade activities and/or foreign firms are substantial contributors to the upgrading of Chinese exports but they do not provide direct gains in terms of export performance at the level of the Chinese provinces.

Proposition 7: A country is competitive if its resources are allocated towards the most sophisticated products (i.e. products that are ranked higher on the quality spectrum).

Export sophistication as an index of competitiveness, focuses on the role of product quality to support the export performances of countries. The following indexes focus on the role of relatedness between products.

4 Product space

The third index which explores product space, is proposed by Hidalgo, Klinger, Barabasi, and Hausmann (2007) as a network of relatedness between each pair of products.

Hidalgo et al. suggest that countries grow faster by upgrading the products they export. They create a product space or a network of relatedness in which the most sophisticated products are located in a densely connected core and the less sophisticated ones are located in the less well connected periphery. Generally, product space appears to be heterogeneous, sparse, and segmented. Countries work on developing products that are close to their current production which allows efficient reallocation of productive capabilities.

Using country-product level data from the SITC, second revision (4-digit level, 1962-2000) and from the World Trade Flows (HS4, 1962-2000), Hidalgo et al. construct the product space between pairs of products as follows:

$$\phi_{k1,k2} = \min [P(RCA_{k1}|RCA_{k2}), P(RCA_{k2}|RCA_{k1})] \quad (15)$$

¹³Other applications of the export sophistication, product space, and economic complexity indexes are referenced in Table 1.

where $\phi_{k1,k2}$ represents the proximity between products $k1$ and $k2$, i.e. the minimum pairwise conditional probability that a country will export a product given that it exports another product. RCA (expressed in the previous mathematical expressions 11, 12, and 13) measures whether a country exports more of a particular product as a share of its total exports, than the average country.

Based on this proximity measure, Hidalgo et al. define a density index in order to measure the average proximity of a new potential product $k2$ to the country's current productive structure as follows:

$$\omega_{k2} = \frac{\sum_{k1} k1 \phi_{k1,k2}}{\sum_{k1} \phi_{k1,k2}} \quad (16)$$

where ω_{k2} represents the density around the product $k2$ given the country's export basket. In other words, density provides an overview of the distance (in a given country product space) between a product exported by a country with a RCA and a new potential product. $k1 = 1$ if the $RCA_{k1} > 1$, and 0 otherwise.

The main novelty of Hidalgo, Klinger, Barabasi, and Hausmann's (2007) paper is the notion of the network of relatedness across products which represents a mapping of the core and periphery for each country's entire set of exported products. In this methodology, the segmentation criterion is the sophistication of the different products. The future productive structure of each country depends on currently produced and exported goods. In other words, countries' future competitive advantage is linked to the relatedness of their current products.

The proximity measure between each pair of goods sets the particular product space for each country. Hidalgo et al. study the production dynamics within the product space and show that the structure of the network affects the country's specialization pattern. Consequently, the economic development opportunities differ from country to country. Not all countries face the same development opportunities. For instance, the lack of connectedness between products explains why poor countries cannot survive structural transformation, and cannot converge towards higher income levels or more sophisticated products.

Previously, the index developed by Cadot, Carrère, and Strauss-Kahn provides evidence of a process of transition in which countries travel from old inactive cones to new active ones. The shift-share decomposition in Cheptea, Fontagné, and Zignago suggests a process of transition involving changes in market shares across countries which then reshapes the world market. Hidalgo et al.'s notion of product space suggests a process of transition involving a move from old to new products which induces a structural transformation process.

So, diversification cones, market shares and products are moving constantly, and perhaps countries are most competitive when these three dimensions are controlled simultaneously vis-a-vis their key product segments.

Drawing on the previous frameworks, Hidalgo et al. conduct an in depth examination of the relationship between a country's growth process and the sophistication of its exports (at the product level). Beyond this relationship, product space captures the relatedness between two products, and the ability of a country to produce a good depends on its ability to produce another good that is similar in terms of factors, institutions, and infrastructures. Consequently, a country's structural transformation depends on its ability to leapfrog in its product space.

An early application of the product space framework was proposed by Kali, Reyes, McGee, and Shirell (2013). They focus on the relationship between products in global trade, and the characteristics of a country's pattern of product specialization, during the period 1965 to 2000 (using World Trade Flows and SITC data for 187 countries). On the one hand, they show that both density (i.e. synergies between products) and proximity (i.e. transitions towards new products) matter for a poor country to reach higher income products and higher growth rates. On the other hand, they find that greater proximity within the network induces a higher growth rate but due to the arc-shape of the high probability region, this positive effect decreases at higher values.

Another application of the product space framework was provided by Poncet and Starosta de Waldemar (2015). They use Chinese Customs data to measure the density of the links between a product and the local product space among Chinese firms during 2000 to 2006. The firm's export performance increases when it exports goods with denser links to those currently produced in the firm's locality. They find also that more productive firms benefit from consistency with local comparative advantage and export more.

Proposition 8: A country is competitive if, in the presence of proximate opportunities, it exploits product relatedness to export more.

Product space as an index of competitiveness, focuses on the role of the network of relatedness between products. The last index provides a global view of the phenomenon including not only the role of the proximity between products but also the role of countries and capabilities as a tripartite network, and maps countries' path dependent growth.

5 Economic complexity

The fourth index deals with economic complexity according to Hausmann and Hidalgo (2009, 2011a), as the structure of the global network linking the country to its products and its productive capabilities.

Hausmann and Hidalgo interpret economic development and growth trends as providing economic complexity. This complexity is quantified by the structure of the bipartite network which connects countries to the products they export (note that the country/product bipartite network is part of the country/capabilities/product tripartite network). This bipartite network is the bases for the definition of two indexes for product and country complexity. They are based on the method of reflections, i.e. iterative and joint calculation of product ubiquity and country diversification. The level of economic complexity of each country induces the development of products that can be exported in the future. In other words, future products, able to fuel and sustain subsequent growth, depend on the country's existing capabilities.

Using country-product level data from the SITC, fourth revision (4-digit level, 1962-2000), from the UN Comtrade (HS4, 1,241 products, 103 countries) and from the North American Industry Classification System (HS6, 318 products, 150 countries), Hausmann and Hidalgo construct an index of economic complexity depending on the method of reflections (this method produces a symmetric set of variables for the two types of network nodes, i.e. countries and products) as follows:

$$D_{i,N} = \frac{1}{D_{i,0}} \sum_k AM_{ik} D_{k,N-1} \quad (17)$$

$$U_{k,N} = \frac{1}{U_{k,0}} \sum_i AM_{ik} U_{i,N-1} \quad (18)$$

$$D_{i,0} = \sum_k AM_{ik} \quad (19)$$

$$U_{k,0} = \sum_i AM_{ik} \quad (20)$$

where the method of reflections consists of iteratively calculating the average value of the previous-level properties of a node's neighbors for $N \geq 1$. $D_{i,N}$ and $U_{k,N}$ denote average values for country i 's diversification (D) and product k 's ubiquity (U). These are defined based on the initial condition given by the degree of country/product links. $K_{i,0}$ is the observed level of country diversification, i.e. the number of products exported by the country. $K_{k,0}$ is the observed level of product ubiquity, i.e. the number of countries exporting a given product. AM_{ik} is the adjacency matrix which equals 1 if country i is a

significant exporter of product k , and 0 otherwise. A country is a significant exporter of a given product if its RCA ≥ 1 .

The main novelty of Hausmann and Hidalgo's (2009, 2011a) papers is application of the method of reflections where the productive structure depends on the bipartite network country diversification/product ubiquity. The connections between countries and products shed light on the availability of productive capabilities in each country.

Following the self-discovery process (Hausmann and Rodrik, 2003), Hausmann and Hidalgo's approach can be understood as providing one of the building blocks in a theory explaining the accumulation of knowledge and productive capabilities at country level. The country's productive structure rests on two processes related to finding new products in the form of so far unexplored combinations of already existing capabilities, and countries exploration, accumulation, and combination of new capabilities and previously existing capabilities. Consequently, a country's productive structure revolves around the current product space. Also, country productivity depends on the diversity of non-tradable capabilities. Only countries with good endowments of productive capabilities (i.e. diversified countries) are able to develop more complex products. Thus, economic complexity explains income gaps between countries, and predicts the complexity of the country's future exports and future growth. According to Hidalgo et al. (2007), Hausmann and Hidalgo map the paths to prosperity¹⁴: they link the country/product network to economic development.

The main advantage of the economic complexity framework over the product space framework comes from the tripartite network linking countries, products, and capabilities. On the one hand, products are not identical: they do not require the same set of capabilities, institutions, or productive structures, and differ also in the number of countries that export them successfully. On the other hand, countries do not follow the same route to economic development: they have different ability to produce and export more or less sophisticated goods; *"this suggests that there is something intrinsically different about the set of products that countries make"*, (Hausmann and Hidalgo, 2011a: 310).

However, the Dixit-Stiglitz production function (which supports Hausmann and Hidalgo's framework) assumes a symmetry in the continuum of products by country, and ignores any intrinsic characteristics. Hausmann and Hidalgo (2011a) suggest that in order to analyze the economic complexity of the productive structure of each country, to be more compatible with the stylized facts, the continuum of products should be replaced by a continuum of their varying densities. Tacchella, Cristelli, Caldarelli, Gabrielli, and Pietronero (2013) shed light on a new quantitative method to predict the complexity of the productive system and country competitiveness. They propose a new metrics *"by weighting the*

¹⁴See Hausmann, Hidalgo et al. (2011b).

complexity of the productive systems of the exporters of a given product through the inverse of their fitness (i.e. competitiveness)", (Tacchella et al., 2013: 1686).

One of the first applications of economic complexity was provided by Poncet and Starosta de Waldemar (2013a, 2013b). They apply Hausmann and Hidalgo's indexes to 221 Chinese cities between 1997 and 2009 (using Chinese Customs and BACI data). The locations with a productive structure geared towards complex products, enjoy higher subsequent economic growth. Export upgrading and domestic embeddedness strengthen productive capacities and encourage the adoption of new technologies to promote future economic growth.

Proposition 9: A country is competitive if the accumulation of knowledge and productive capabilities conditions its future export structure.

6 Conclusion

In this survey, I have reviewed the most recent theoretical and empirical literature related to country competitiveness based on four complementary indexes: *(i)* productive diversification, *(ii)* export sophistication, *(iii)* product space, and *(iv)* economic complexity. In order to benefit from an expansion of the world market (prompted by the entry of new competitors), country competitiveness should be defined as the ability to initiate a structural transformation process through the reallocation of productive resources in favor of the exporter's best performing products.

Furthermore, two main findings have emerged. Firstly, increased international competition has different effects on developed and developing countries. The former will attempt to reposition themselves to face stronger competitive pressure; the latter will strive for a sustainable position at the international level. These effects are both mutual and different. On the one hand, the emergence of new competitors induces an intensification of world trade flows and introduces new or sudden and unexpected competitive pressure. This prompts a profound reshaping of the world market. On the other hand, these new competitors, despite being emerging exporters, move quickly from labor- to knowledge-intensive production at the expense of the former leaders. This encourages an upgrading in the quality of exported products. The consequent increased international competition forces each country to defend its own competitive advantage.

Secondly, the four complementary indexes identified contribute to the competitiveness debate at country level and suggest that both the patterns of specialization and the export structure matter. They also suggest that each country continuously builds new competitive advantage in order to withstand to competitive pressure from a changing environment. Also, because the global econ-

omy evolves rapidly, each country needs to be on the global trade map. The first index (i.e. productive diversification) refers to a more "traditional" view of a country's export performance; the other three indexes refer to new export performance perspectives. These three indexes suggest directions for further research in the fields of economic geography and international trade.

TABLE 1. SURVEY SUMMARY

Country competitiveness indexes	References	Main contribution (Indexes)	Propositions A country is competitive if ...
Productive diversification: Set of tools to support the evolution of the exported product portfolios within certain market constraints	Sectoral diversification (country/sector level data): Imbs and Wacziarg (2003)	Sectoral concentration and level of per capita income - U-shaped curve (Gini, Herfindahl, Coefvar, Maxmin, and Logvar)	... a process of sectoral specialization substitutes for a process of diversification beyond a certain level of per capita income
	Country export diversification by product (country/product level data): Cadot, Carrière, and Strauss-Kahn (2011)	Export diversification and economic development - Extensive and intensive margins - Hump-shaped curve (Theil's entropy index)	... it is able to alternate respecialization and diversification (of exports) renewing its product portfolio with new export lines and/or new markets
	Cheptea, Fontagné, and Zignago (2014)	Market share and variety of exported products - Composition effects and pure performance effect (Shift-share methodology)	... in the presence of new competition, it strengthens its competitive advantage on the product and/or quality spectrum
	Firm export diversification by product for a given country (country/firm/product level data): Mayer, Melitz, and Ottaviano (2014)	Characteristics of destination countries and product mix - Pro-competitive effect (Multi-product firms framework)	... its domestic firms adapt their product mix to both their core products and the market conditions in the destination countries
Export sophistication: New way of classifying products based on the level of income in each exporter country, and on the revealed comparative advantage of each exporter country for each given product	Lelarge and Nefussi (2010)	Evolution of product portfolios and low-wage competition - Pro-active effect (Concentration, Reallocation, and Inertia)	... in the presence of an increase in international competition, its domestic firms adopt defensive strategies involving innovation and resources reallocations
	(Country/product level data): Lall, Weiss, and Zhang (2006) Hausmann, Hwang, and Rodrik (2007) Applications: Kumakura (2007); Yao (2009); Jarreau and Poncet (2012)	Characteristics of exporter countries and promotion of exports - Individual strategies of competitiveness (Unique Sophistication score) Implied productivity and revealed comparative advantage - Self-discovery - Quality spectrum (PRODY and EXPY)	... it exports sophisticated products with strong and sustainable market outlooks (i.e. products able to compete with others in the world market) ... its resources are allocated towards the most sophisticated products (i.e. products that are ranked higher on the quality spectrum)
Product space: Network of relatedness between each pair of products	(Country/product level data): Hidalgo, Klinger, Barabasi, and Hausmann (2007) Applications (country, region or firm level data): Hausman and Klinger (2007, 2008ab, 2010ab); Hausmann, Klinger, and Lopez-Calix (2010); Usui and Abdon (2010); Abdon and Felipe (2011); Bayudan Dacuyucuy (2012); Boschma, Minondo, and Navarro (2013); Kali, Reyes, McGee, and Shirell (2013); Boschma and Capone (2014); Lo Turco and Maggioni (2014); Poncet and Starosta de Waldemar (2015)	Network of relatedness between products and productive structure - Core and periphery - Exports upgrading (Revealed proximit, density index)	... in the presence of proximate opportunities, it exploits product relatedness to export more
Economic complexity: Structure of the global network linking the country to its products and its productive capabilities	(Country/product level data): Hausmann and Hidalgo (2009, 2011a, 2011b) Applications (country or firm level data): Hidalgo (2009, 2011); Felipe, Kumar, Abdon, and Bacate (2012); Poncet and Starosta de Waldemar (2013a, 2013b); Tacchella, Cristelli, Caldarelli, Gabrielli, and Pietronero (2013)	Bipartite/tripartite network and economic development - Productive capabilities (Method of reflections: Country diversification and product ubiquity)	... the accumulation of knowledge and productive capabilities conditions its future export structure

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