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Italy in the space (of products)

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Abstract

We discuss the international specialization of Italy as a determinant of its rate of economic growth, documenting an incomplete economic evolution: Italy is still a follower economy in some aspects while it is being followed in some others. We show that the productivity level associated to the export bundle increased until 2000, but then slowed down, and finally started decreasing after 2005. In parallel, Italy first improved its position in the international "product space" in the long run, but without any sensible evolution after 1990, and the country is absent from the most sophisticated section of the map. Results are also confirmed when comparing Italy to a panel of other countries.

JEL Classification: *F14; L16; O52*

Keywords: *Structural Change; Products Network; Italian Economy.*

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"*It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change.*" - Charles Darwin

1. Introduction

It is widely recognized that the process of economic growth is a non-homogeneous phenomenon; the term used by economists in order to define this side of the question is "structural change".

There has been a long tradition in studies on "structural change", a fundamental aspect of the economic growth process. Even if, like us in the present paper, Matsuyama (2005) focuses on sector composition of output, he recognizes that structural change is a "complex, intertwined phenomenon" which constitutes "sector composition , organization of the industry, financial system, income and wealth distribution, demography, political institutions, and even the society's value system". Economic growth and structural change are the simultaneous manifestations of what the Nobel laureate Simon Kuznets defined as "modern economic growth" (Kutznets, 1973).

Technological progress reflects in the introduction of cost-reducing innovations and new goods for production and/or consumption. As a consequence, the sectoral composition of the economy is affected, with a differentiated impact among industries, as a result of several specificities, which are mainly different productivities in the supply side, and demand elasticities in the demand side. For many years, economic theory has pointed at the nature of the goods produced and exported in terms of a country's long term growth.

At first, we should recall that, in the Keynesian demand-driven tradition, national growth depends on world demand growth and on export and import elasticities (**?**), which are said to depend on a country's model of specialization.

Differently from the previous model, most of the recent contributions look at the supply-side in order to find relationships between structure and growth. Lucas (1988) proposes a model where sector-specific self-reinforcing learning-by-doing processes are at the core of the analysis, through the accumulation of human capital at sectoral level. One result of the model is that countries exhibit different rates of growth, because (under certain conditions) they specialize in the production of goods with different intensities of learning-by-doing. Also in Krugman (1989), positive feedbacks play a relevant role in defining both international specialization and the growth of the economy: fast-growing countries also show high (low) income elasticities of exported (imported) goods. All this depends on the interaction between increasing returns and product differentiation. Again, Grossman and Helpman (1991) analyze some cases with dynamic comparative advantages determined by local accumulation of knowledge or by international spillovers of technical information. Their conclusion is that economic growth and international specialization are indubitably connected.

The empirical literature on trade and growth provides mixed results on the same subjects. Recently, the empirical relationship between trade and growth in terms of "quality" of a country's specialization was interestingly re-proposed by Hausmann *et al.* (2006), who (re-) assess that "what you export matters for growth". This approach may be useful in the discussion on the Italian specialization and process of growth; indeed, similar arguments have been proposed in the past by specific literature on this subject.

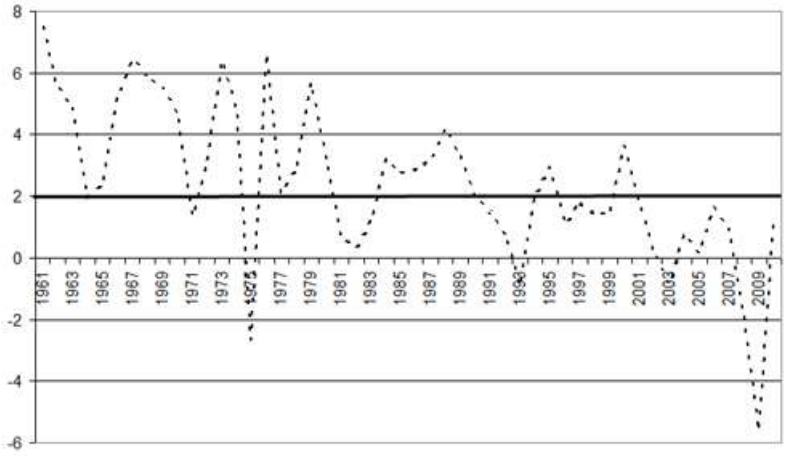
It would be useful to introduce our discussion on the Italian experience showing this well-known (especially to Italians) diagram of the time series of the rates of growth of per capita

income (see Figure 1).

The rate of growth of the Italian Economy has steadily decreased in this long period of 50 years. In part, it was predictable, since "backwardness advantages" slowly disappear along with the process of catching-up, and the growth of an economy would approach its "steady state" rate should be expected. Nevertheless, starting from the mid 90s, this decrease in the Italian economy became severe, going well below 2%, which is (empirically) considered the long term rate of growth of developed economies. The reasons for the decrease were looked for in a variety of causes, which were partly connected. They range from firm size, low R&D and patent activity to institutional setting, etc.; a key role has been attributed to the Italian model of specialization: a long literature focuses on the Italian "model" of export specialization, that has been at the heart of the debate on the causes of the slowdown of the Italian Economy.

In a nutshell, this paper focuses on the Italian sector structural change in terms of international specialization. It discusses some aspects of the recent evolution in the Italian Economy. First of all, we start from reviewing past literature on this point, and later we will go deeper into this aspect on the basis of some new evidence derived from some new analysis tools, recently proposed in literature, that focus on the channels through which structural change may take place, i.e. vertical and horizontal linkages among sectors (i.e., the product network).

Figure 1: *Per capita GDP annual growth, Italy*



Source: WB-WDI

2. Italian Specialization: a long and not concluded debate

The interpretation of the Italian economic evolution could be summarized by the observation that Italy, after WW II, started out still as a *follower* country, but now it is a relevant component of the industrialized elite of the world: Italy is now a *followed* country. We will show, in some way, that this transition is not fully complete, and to some extent, Italy is still a follower in some aspects while it is already being followed for other aspects.

Even official documents (Banca d'Italia, 2003; ISTAT, 2002) heavily stressed the significant aspect of the (low) competitiveness of the Italian industrial system as one of the main issues for the slow growth of the Italian economy in recent years. Both the documents based their

arguments on the structural characteristics of the economy, especially on the high share of small firms and the high share of the so-called "traditional sectors", which is relevant to the purposes of the current paper.

This kind of constraint on the Italian economy had already been emphasized in the late seventies (Conti, 1979; Modiano, 1982; Onida, 1978). The main problems were blamed on the low income elasticity and high price elasticity of the traditional sectors which characterize the Italian productive structure. According to this line of thinking, Italy suffers competition from PVS, in particular from emerging economies (East Europe and Asia) in sectors where (low) labor costs are the main competitive factor; contemporaneously, Italian economic growth is limited by the fact that traditional sectors are characterized by low income elasticities.

These problems were more potential than real at that time, and they were considered as Cassandra's prophecy. It was a period of a relatively fast economic expansion and above all, it was the golden age of the "Italian industrial districts"; in fact, the relatively good aggregate performance of the economy in the past and at that time put (relatively) aside those considerations for at least a decade. They re-emerged recently, in a context of slowed growth and high unemployment. With a much reduced and declining rate of growth of the economy, the same analysis was proposed as a possible explanation of the economic difficulties of the countries.

In short, the evidence of the specialization model pointed out that Italy has an "anomalous" role of the so-called traditional sectors (export composition), if compared to countries at similar level of per capita income and a weak ability to bring about (sectoral) structural change (specialization persistence through time). We can say that the two main issues, regarding the sectoral composition of Italian trade (exports), were highlighted:

- Distorsion (specialization in "traditional" sectors)
- Rigidity (persistence of the specialization model)

The possible (theoretical) explanations of the Italian "anomaly" ranged from factor proportions to dynamic externalities, vertical differentiation and quality ladders (see De Benedictis, 2005). They are not alternatives, and it is possible that there is a grain of truth in all of them. Italy is a country which is relatively well endowed with "advanced" factors at world level, but it is a fact that the average level of education is lower if compared to other developed countries; it is possible that positive feedbacks due to the presence of dynamic externalities reinforced the initial model of specialization.

In fact, several contributions (Iapadre, 1996; De Nardis and Traù, 1999) confirm that Italy shows a high degree of comparative advantages in sectors like textiles, clothing, leather and footwear, furniture, etc. It is the so-called and well-known "Made-in-Italy", i.e., a model of specialization that is more similar to poor than to rich countries. In Table 1 below, this can be easily seen.

As mentioned before, this feature may have several possible consequences.

Firstly, traditional sectors may have low demand elasticity; if a country has a high share of resources concentrated in those sectors, its overall rate of growth will be determined by the (relatively) slow growth of world demand.

Secondly, those products may be sensible to price competition, that is to say, a (developed) country whose economy is characterized by labor-intensive sectors will suffer from strong competition from emerging economies (with much lower labor costs). Associated with those

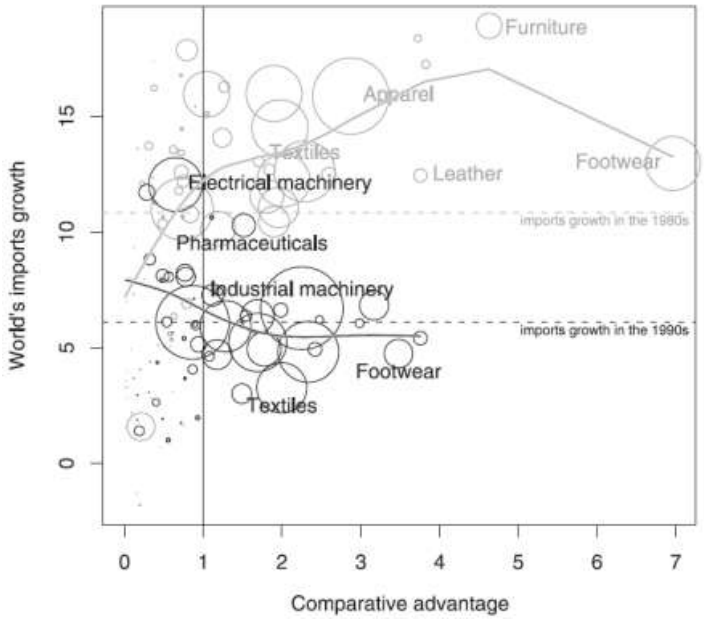
Table 1: *Rank correlation of RCAs of Italy and 23 countries (1994)*

Taiwan	0.44
Thailand	0.40
Romania	0.40
Czech Rep.	0.36
Hungary	0.35
Poland	0.29
Brazil	0.27
Hong Kong	0.27
Bulgaria	0.26
Indonesia	0.26
Korean Rep.	0.20
Spain	0.20
China	0.17
Philippines	0.14
Argentina	0.13
Mexico	-0.09
Germany	-0.09
United Kingdom	-0.14
France	-0.16
Malaysia	-0.24
Singapore	-0.33
USA	-0.40
Japan	-0.40

Source: De Nardis and Traù (1999, p.13)

conditions, we may add that firm size is generally small in those sectors, and as a consequence, market power is small also. Moreover, RD and technological progress, a key engine of economic growth, is not typical in those kinds of productions (and firm sizes). The first point can be highlighted in Figure 2 (from, De Benedictis, 2005)

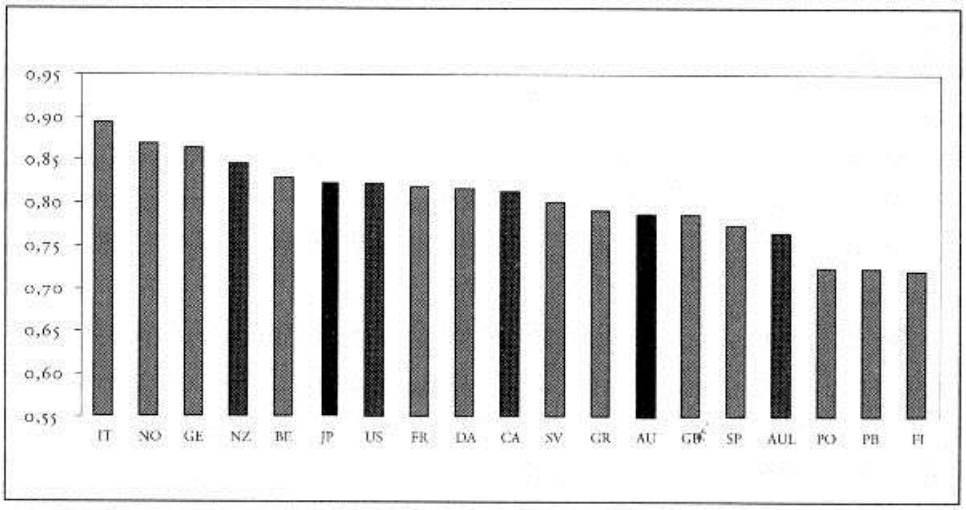
Figure 2: *Italian comparative advantages and world demand dynamics: 80s and 90s*



Source: De Benedictis (2005)

The figure links sector world growth with the Italian comparative advantages (size of the circles is proportional to the Italian export shares); light grey refers to the first period (the 80s), dark grey to the second (the 90s). In the figure, there are also two (non-parametrically) fitted regression lines: the line of the 80s shows an overall positive slope, indicating that the comparative advantage of Italy was stronger in sectors with a higher world demand growth (with the notable exceptions of Footwear and Leather) The relationship reversed in the 90s or, at best, disappeared. A second evidence was the specialization persistence of the Italian economy, as showed in Figure 3 (higher values mean higher degrees of similarity, i.e., persistence): Italy seems to be the most immobile economy.

Figure 3: *Index of similarity of manufacturing export structure between 1982 and 2001 in OECD countries*



Source: De Nardis and Traù (2005, p. 132)

This has been confirmed in several papers; as an example Brasili *et al.* (2000) stress that it is true that the Italian sectoral structure seems more rigid if compared to other industrialized countries, but it is also true that:

- All advanced countries have a more rigid structure than developing economies
- The Italian structure is converging toward the structure of high income countries
- All economies seem to move towards a more symmetric structure

Some converging indications also come from De Benedictis and Tamberi (2002).

Notwithstanding this evidence, it was not clear if this situation effectively played its potential negative role. A second, more recent strand of literature has provided a better interpretation of the Italian model of specialization. Nevertheless, the Italian share in world exports has been growing for a long period and, considering this growing penetration of Italian exports in international markets, it is (and it was) difficult to give a univocal interpretation of the strength or weakness of the Italian position in the international division of labor.

A first contribution was made by De Nardis and Traù (1999). In their analysis, they developed two indexes in order to reveal the real degree of competition "suffered" by Italian

producers in the international market. First of all, they showed that the similarity between Italian specialization and that of developing countries largely disappears when we look at fine product definitions and consider different segments of international demand. While both Italy and a typical emerging country produce, for instance "clothing", they actually produce different products within that macro-sector.

Secondly, if we compare (through price levels) product quality levels, we discover that, in general, Italian firms operate in demand segments that are different from firms in developing countries (and obviously, with a higher quality level, i.e., with higher prices).

A recent confirmation comes from Monti (2005): in an analysis from 1985 to 2001, he confirms the previous results that is distinguishable for different levels of quality of goods. Only a relatively small share of Italian exports was actually exposed to direct competition with emerging countries, in part as a consequence of a shift of Italian products toward higher quality segments of the world demand. Then, a paper by Felettigh and Federico (2010), even if underling the usual "weaknesses" (characteristics) of Italian specialization, concludes that price elasticity of Italian exports on average is not different from that of Germany, France and Spain (with the exception of motor vehicle sectors): from this point of view, one cannot conclude that Italian products are more exposed to (price) competition of emerging countries.

Nevertheless, we believe that it is worth going into this research subject in depth, also because even if the competition with emerging economies is not direct, it can be considered a potential threat; we will provide some new evidence on this issue by using some new tools of analysis recently proposed in literature

3. The level of sophistication of Italian export: $PRODY$ and $EXPY$

There is an intrinsic difficulty in passing from quantitative to qualitative analysis of trade flows due to a relative scarcity of data of the "content" of trade (in terms of technology, skills, etc.). In recent years, some authors have made efforts to by-pass this limit, introducing an indirect way of taking into account the concept of export *sophistication*. A key point, for our purposes, is that the export basket composition of a country is important for its subsequent economic growth: the more a country is able to develop new and *sophisticated* products, the faster will it grow.

In literature, the term *sophistication* is used to describe specific qualities of a product that improve its value. These qualities include not only technology but also labor skills, design, value chain organization, brand, packaging and all the intrinsic quality attributes[1].

The idea is that the presence of these qualities increases product value and hence the ability to remunerate inputs, so that countries that specialize in the production of those goods tend to have higher per capita income.

We do not have , in general, information available on those detailed aspects, if not for limited examples (countries, sectors, periods). For this reason, in "What you export matters" (Hausmann *et al.*, 2006), the degree of sophistication of each product was measured by taking a weighted average of the per-capita GDPs of the countries exporting that product, where the weights reflect the RCA of each country in that product. So far, for each product, they generate an associated income/productivity level which is called $PRODY$.

[1] See Lall *et al.* (2006)

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

Where x_{jk} is total exports of product k by country j, $X_j = \sum_k (x_{jk})$ (total exports by country j), and Y_j stands for GDP per capita of country j. $PRODY$ is a measure of GDP per capita of the "typical" country that exports product k, or, in other words, it measures the content of average labor productivity (per capita income) associated to any exported goods. Goods exported by a richer country are usually more sophisticated and associated with higher wages.

Time changes of $PRODY$ of product k may be due to different reasons: if the set of countries exporting product k changes; if their incomes change. Variations in the degree of specialization of one or more exporting countries and the entry and/or exit of one or a few countries from the basket of exporters of product k, affect the value of the index.

The authors then measure the sophistication of a country's export basket as a whole creating a second variable called $EXPY$. $EXPY$ is simply the weighted sum of the $PRODY$ levels of each product k that country j exports, with weights representing the share of goods in the country's export basket (X_j): it represents the average productivity level corresponding to a country's export basket.

$$EXPY_j = \sum_k \frac{x_{jk}}{X_j} PRODY_k$$

$EXPY$ is not affected by population sizes. One key caveat to these results is that they consider only exports of merchandises: no-tradable goods and services, like tourism and financial services, are excluded; however, these metrics of export sophistication require standardized disaggregated data by product and such data are only available for merchandise exports. In this paragraph, we show the degree of sophistication of the Italian export basket using the $EXPY$ index. In our analysis, trade data are from COMTRADE, GDP data are from World Bank, World Development Indicators. In particular, we considered GDP per capita in PPP (constant 2005 international $), following the original paper, and exports according to the SITC 4 digit Rev.2 classification.

The number of countries reporting COMTRADE data varies from year to year. Thus, Table 2 shows our sample size of $EXPY$ for each reference year[2].

Table 2: *Sample size of EXPY*

Year	1980	1985	1990	1995	2000	2005	2010
n° of countries	82	88	103	112	110	105	95

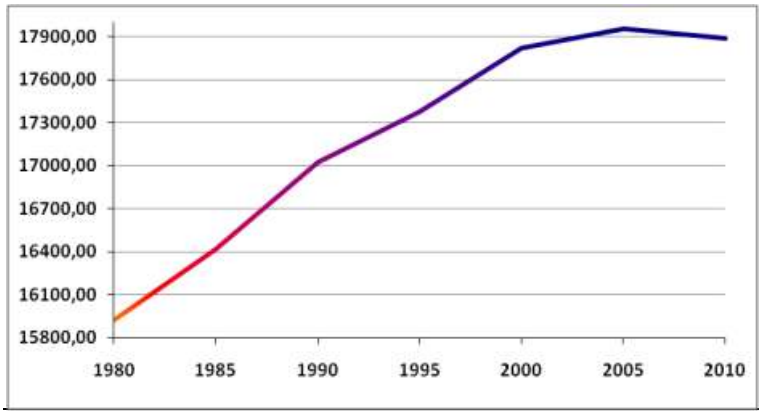
We calculate the Italian $EXPY$ at an interval of five years from 1980 to 2010. In calculating $EXPY$, we used values of the $PRODY$ indexes in the most recent year, which is $PRODY$ in 2010[3] (sectors data available in 2010 are 773). This procedure (holding $PRODY$ fixed) is

[2] Belgium and Luxembourg have been combined considering them as a single entity.

[3] In Appendix 1, Tables 3, 4 and 5 show $EXPY$ of Italy referring to $PRODY$ of 1980, 1990 and 2000, and it can be noticed that its patterns, on the whole, are similar. In Appendix 2, the level of GDP per capita

common in literature. The consequence of this choice is that changes of $EXPY$ solely reflect changes in the product composition of the Italian export basket. Looking at the overall trend in Figure 4, it may be argued that Italian $EXPY$ performed well during the period taken into account. This means that the income/productivity level associated to Italian export bundle increased in these past thirty years. However, the figure highlights that the index sharply increased mostly in the 1980s and in the 1990s, while it slowed down in the early years of the new century and, moreover, started to decrease in the period 2005-2010. This information denotes that Italian export sophistication was slightly decreasing, and it evidently depends on the fact that from 2005 to 2010 Italy changed its export basket toward products with lower $PRODY$. This reduction is really small, and we do not give it too much importance.

Figure 4: *$EXPY$ of Italy from 1985 to 2010 (PPP- constant 2005 international $)*



Source: our elaboration from UN-COMTRADE and WB-WDI data

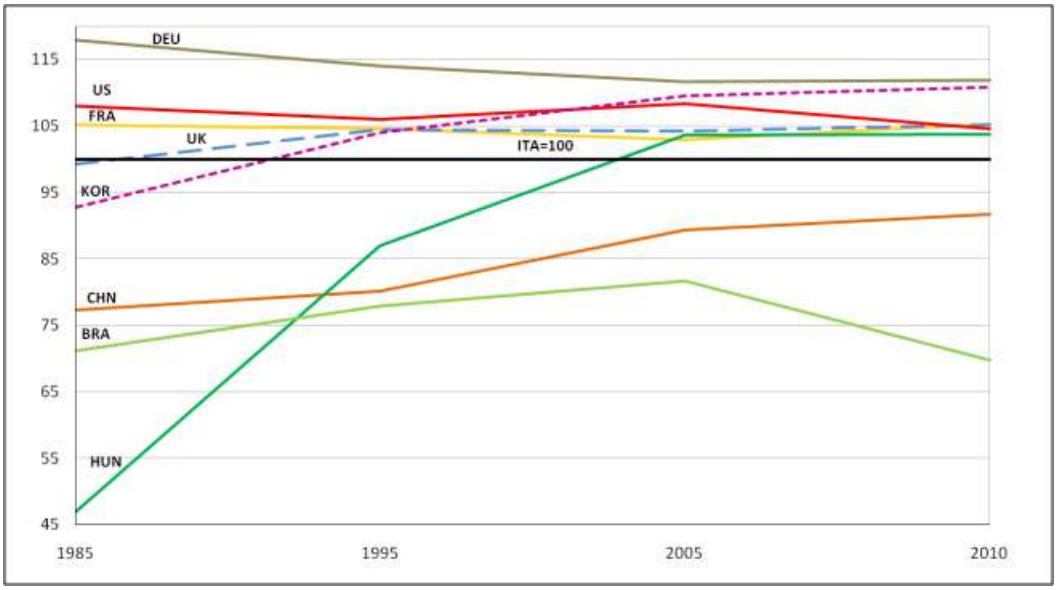
4. $EXPY$ of Italy compared to other countries

In this paragraph, we compare the $EXPY$ levels of Italy and of some developed and emerging countries (see Figure 5). Italian $EXPY$ is taken constant (equal to 100) in order to evidence the relative levels. Firstly, Italy shows an $EXPY$ lower than that of France, United States, United Kingdom and Germany. Among these countries we note in particular that: Germany recorded the highest $EXPY$ index due to its specialization in automobiles and machinery sectors, electrical equipment and chemicals; United Kingdom in 1985 had an $EXPY$ similar to Italy, but in the course of time it succeeded in upgrading its production and now it has a higher level. The second observation we make is that Italy improved its relative level a little bit in the early years (diminishing curves for USA, and Germany), but differences have become stable in more recent years: there was a phase when Italy tried to catch up with the others but was not able to do so completely. This fact can be better appreciated if we look at the relative $EXPY$ pattern of emerging countries. Hungary, which in 1985 had a very low level of $EXPY$, in recent years has reached a value that is similar to other West European countries, and, especially, higher than Italy. A similar pattern also characterizes South Korea:

PPP (constant 2005 international $) in year 2010 can be seen, and in Appendix 3, there is a complete list of $EXPY$ of countries present in all the four reference years. A previous analysis on similar lines in Di Maio and Tamagni (2008)

its $EXPY$ increase has been remarkable. Also in this case, before the 90s, South Korea's $EXPY$ was lower than Italy's, but in 2010 it was about 20% higher. Moreover it reached the level of developed countries. We should recall that the government was an active player in the industrial upgrading of South Korea. It adopted policies to enter industries that were consistent with the country's latent (and evolving) comparative advantage. Beginning with the automotive sector, and then passing on to electronics, it accumulated physical and human capital according to changes in underlying comparative advantage (**?**).

Figure 5: *$EXPY$ of Italy compared to other countries*



Source: elaboration from COMTRADE and WDI data

Moving on to China's case, we can appreciate that, also for this country, sophistication level was 77% of Italy in 1985, and it shot up to 91% in 2010: in this case, Italy (still) has not been overtaken. Rodrik, in his *What's So Special about China's Exports?* (Rodrik, 2006), exhibits that, although labor intensive exports (toys, garments, simple electronics assembly) have always played an important role in China's export basket, China also exports a wide range of highly sophisticated products such as consumer electronics. Also in this case an active industrial policy of the government, e.g., asking foreign investors to enter into joint ventures with domestic firms, was a relevant component of China's success in many products and markets: promoting foreign investors, China explicitly promoted domestic firms.

Differently from other countries, Brazil has experienced a sharp decrease in its relative $EXPY$ since 2005, which is probably linked to its increase in the export of crude petroleum and other minerals, whose main exporters are not often high income countries.

In conclusion, Italian $EXPY$, i.e., the sophistication level of Italian exports, slowly increased until around 2000 compared to other developed countries, while less developed areas were catching-up. In about ten years since then, Italy has stopped gaining ground compared to developed countries and has been outstripped by some developing countries.

5. Product space and its implications

A step further was to deepen the concept of sophistication and upgrade it with the term of *complexity* both for products and for economies; goods and countries differ from each other in the amount of capabilities they "embed": complexity refers to the amount and diversity of capabilities present in each of them.

At country level, the first step is to define "diversity", which is simply related to the number of distinct products that it makes. The analogous concept for a product is "ubiquity": it is related to number of countries that produce it. Diversity and ubiquity are crude approximations of the variety of capabilities available in a country or required by a product. Using a recursive process, based on both the aspects mentioned above (diversity is used to correct the information carried by ubiquity, and ubiquity is used to correct the information carried by diversity), a measure of complexity is derived. For countries, we refer to this as the Economic Complexity Index (ECI). The corresponding measure for products gives us the Product Complexity Index[4].

Just to clarify the concept, let us take the ECI; consider that "capabilities" include chunks of tacit knowledge difficult to identify and observe, and as a consequence, difficult to transfer. For this reason, "ultimately, the complexity of an economy is related to the multiplicity of useful knowledge embedded in it and it is expressed in the composition of a country's productive output and reflects the structures that emerge to hold and combine knowledge" (Hausmann and Hidalgo, 2011, p. 18)

Indeed, the authors find that changes over time in the comparative advantage of a nation are associated with the pattern of relatedness across products: countries develop comparative advantage mainly in nearby goods. In fact, new capabilities will be more easily accumulated if they can be combined with others that already exist (Hausmann and Hidalgo, 2011). Moreover, they describe the concept of comparative advantage through a network representing products traded across world countries: the "product space". All countries face the same map of the product space, but they will only trade a limited subset of products.

In order to build the product space, we need a measure of the distance between each pair of products, and this is based on the probability that all countries of the world export both goods with comparative advantage[5]. The idea behind it is that if two goods need the same capabilities (institutions, infrastructure, physical factors, technology, or some combination that can all be embedded in pieces of knowledge), this should show up in a higher probability of a country having a comparative advantage in both of them (Hausmann *et al.*, 2006). This new measure, called *proximity* is computed using outcomes that are export data which best represent the comparative advantage of a country and must pass a rather strict market test compared to the production for the domestic market. Before proceeding with the construction of the product space, we provide an intuition of proximity. As mentioned before, *proximity* is the likelihood that two products will be exported in tandem; it is defined as the inverse measure of distance between goods i and j in year t

[4] For detailed information, see the original work by Hausmann and Hidalgo (2011) The ATLAS of economic complexity.

[5] In this vein, the Revealed Comparative Advantage (RCA) of a country by Balassa (1965) is taken into account. He suggested that comparative advantage is "revealed" by observed trade patterns, and hence it is discovered looking through data ex-post and not analyzing relative price of endowments ex-ante. It is calculated as the ratio of the share of a product in a country's export basket to the share of that product in world trade. A country has RCA greater than 1 in a certain product if that product has a larger share of its exports than that of world exports.

$$\varphi_{i,j,t} = minP(x_{i,t}|x_{j,t}), P(x_{j,t}|x_{i,t})$$

Where x is the traded flow (i traded given j is traded, or the opposite) where for any country c

$$x_{i,c,t} = \begin{cases} 1 & \text{if} \quad RCA_{i,c,t} > 1 \\ 0 & \text{otherwise} \end{cases}$$

RCA being an index of Revealed Comparative Advantage[6].

After having computed the proximity matrix for all products and having used the tools of network analysis, the *Product space* was created.

In Figure 6, we show the most recent version of the Product space's map, based on international trade data for the years 2006-2008, from COMTRADE, classified according to SITC4. It should be noted that a full understanding of the map requires the use of colors in its representation: for this reason, to fully appreciated the map, we advise you to look at the electronic version of this paper. In this map, each node represents a product. Its size is proportional to the money moved by that particular industry in world trade, and they are colored according to different "communities" since products in the same communities require similar capabilities (for the precise meaning of each color, look at the legend and at icons accompanying the figure). Finally, the Product space is made by linkages that connect goods according to their proximity.

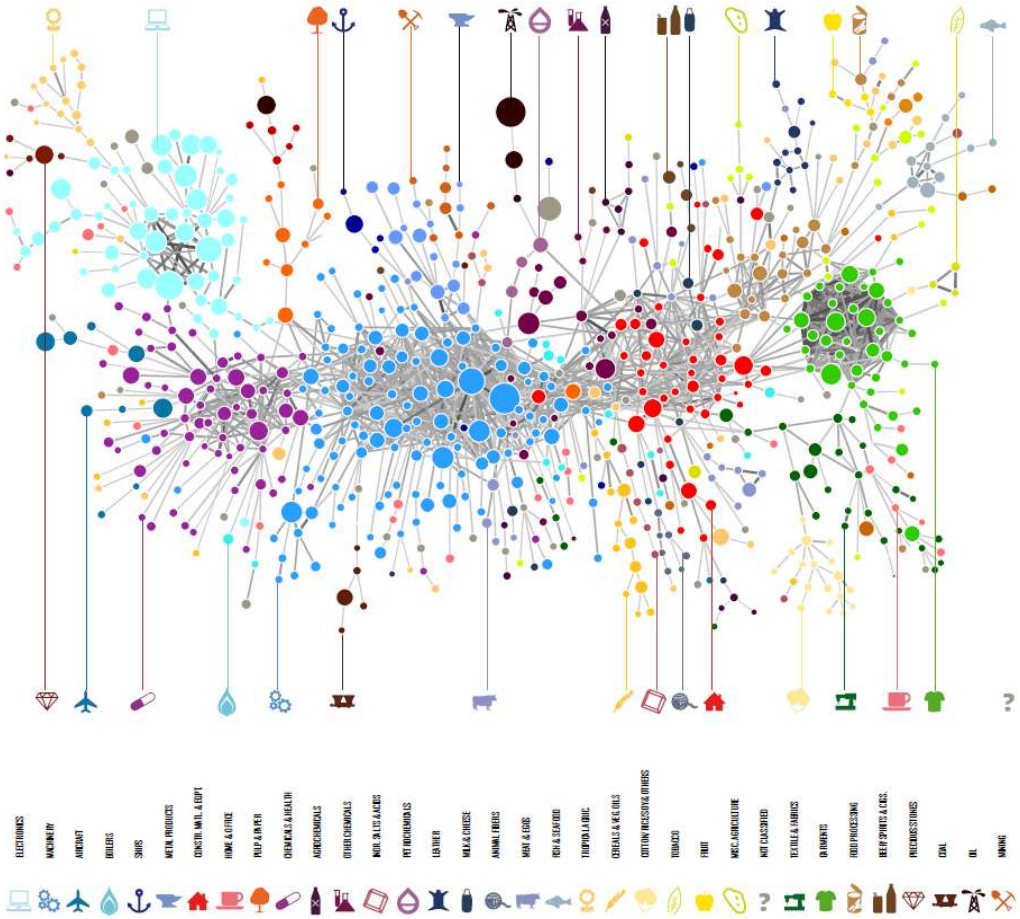
From Figure 6, it can be noticed that the Product space is very heterogeneous, with highly dense areas in some parts and highly scattered in others. There is a positive relationship between the centrality of communities in the map and the complexity that their products have: communities that are set in peripheral areas, such as cotton, rice, petroleum generally have low complexity. Machinery and mechanics in general (blue circles), on the contrary, is a very complex and highly connected community.

In any case, it should be considered that the map is built so that product complexity grows progressively from right to left: roughly speaking, this means that in order to produce products in the right area (agriculture, clothing, etc.) an economy needs simple, that is "traditional", and diffused capabilities, while products on the left require very complex capabilities (educated people like scientists and skilled workers, etc.).

We may note that there are two different communities, health-related chemicals (purple on the left) and clothing-textiles (green on the right), with intermediate characteristics: they are not fully connected to other parts of the Product space, but they are strongly internally connected. This indicates that they require specific capabilities that are only weakly re-employable in other productions. Finally, electronics, usually considered as very complex products, is closely related within its cluster but even more weakly connected with the rest of the Product space. It is important to understand that this does not mean that electronic products in general are not connected or "useful" for the implementation or evolution of other products: they are in fact known as general purpose technologies. Their (relative) isolation in the Product space simply says that, in order to produce them, an economy needs specific capabilities and resources (broadly speaking), i.e., capabilities that are important within this community but not outside of it. This heterogeneous structure of the Product space leads to significant implications for structural transformation and its speed. If a country produces goods poorly connected with

[6] If a product is related to many others, this means that this product is "central". In the cited paper, authors also propose a precise measure of centrality.

Figure 6: *The product space*



Source: Hausmann and Hidalgo (2011, p. 45)

others, such as fishing or mining, the redeployment of its capabilities will be more challenging as there is no set of products requiring similar pieces of knowledge near them.

Therefore, many countries can reach the core only by crossing long irregular distances. The inability to make long jumps is associated with the difficulty to move from low complex goods to high complex products: "Countries that are specialized in a dense part of the product space have an easier time at changing their revealed comparative advantage than countries that are specialized in more disconnected products" (Hausmann and Klinger, 2007).

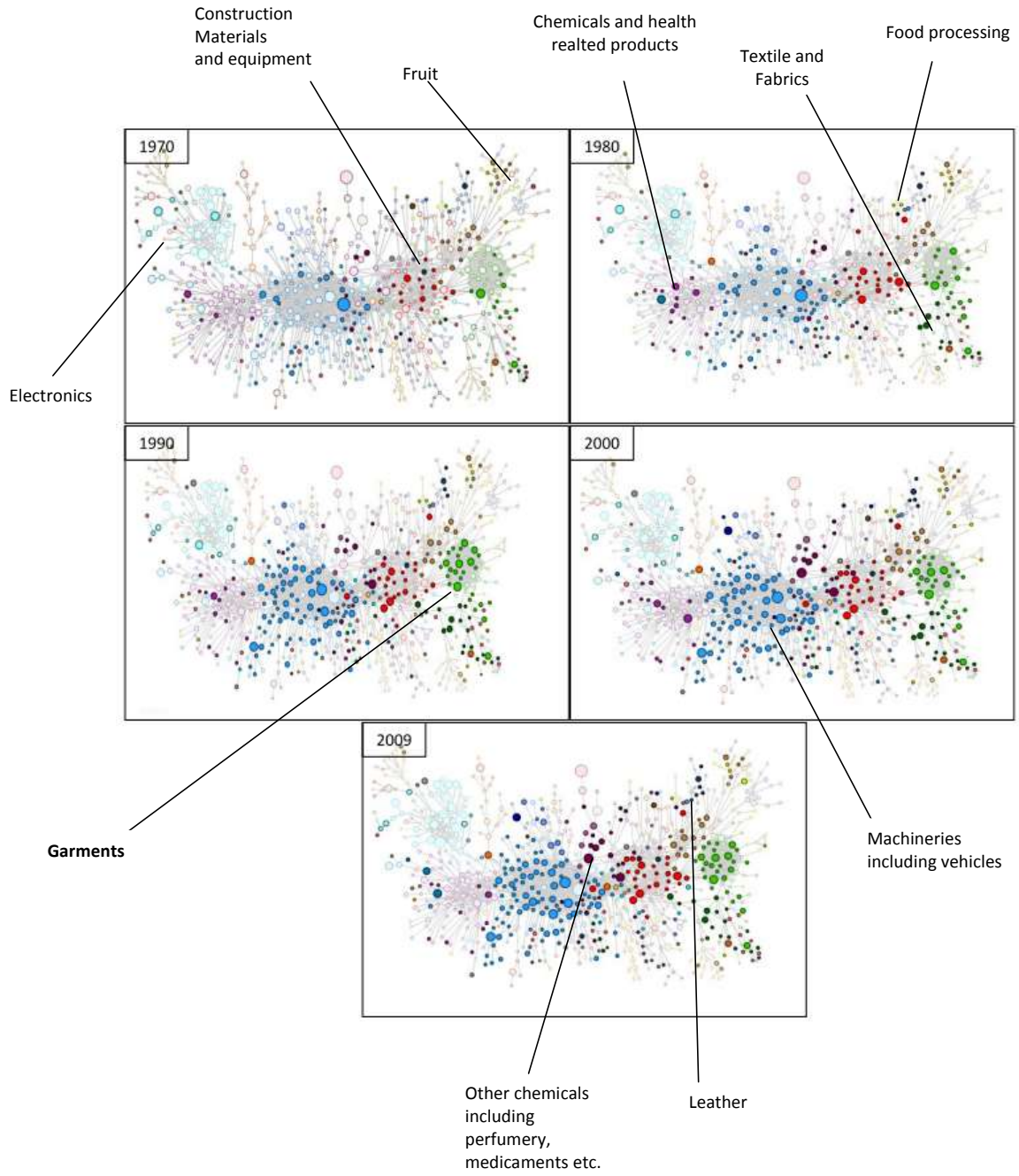
6. Italian evolution in the product space

Figure 7 shows Italy's evolution in the Product space from 1970 to 2009. In the background, in very light colors, the same world product space in Figure 6 is reproduced, while circles that have brighter colors indicate products for which Italy has significant exports[7].

Analyzing the Italian Product space in greater depth, we may summarize its evolution in three points:

[7] "Significant" means when the RCA index is greater than or equal to 1

Figure 7: *Italian evolution in the Product space*



Source: http://macroconnections.media.mit.edu/apps-for-economic-development/

1. We observe that Italy, since 1970 , when industries were booming, has improved its Product space moving from the (right) periphery to the center;

2. Main changes are evident in the first 20 years, while from 1990 to 2009 we do not see strong differences;

3. The country did not "occupy" the left part of the figure, where electronics and health-

related chemical products are concentrated;

Initially, Italy was present in agricultural and food-related products, and some other scarce products on the right side of the figure: above all clothing products and materials for construction. In the course of time, the initial products were joined by more capital intensive sectors, especially in the "blue" community of mechanics and machinery, but the initial areas were maintained and even reinforced (especially for clothing-textiles and construction products). In some cases, since products from land are strictly linked to food products (light brown), Italy has achieved comparative advantage in food/beverage products such as wine, macaroni and pasta, spirit liquor, cheese etc. Italy has clearly developed traditional sectors like garment (green), textile (dark green) together with the machinery and mechanical sectors (sky blue): in the period under scrutiny, Italian firms moved to and dominated these sectors. Many of these nodes represent labor intensive production processes, but in some other cases, they represent qualitative products. In fact, Italy is well-known for its outputs rich in know-how, creativity and design (all qualities characterized by *made in Italy*), even if, sometimes, they are relatively scarce in technology and use of capital. In addition, Italy produces a significant quantity of machinery tools and mechanical products. It is important to stress that these products are situated in the core of the Product space. Among mechanical products, the vehicles sector is significant.

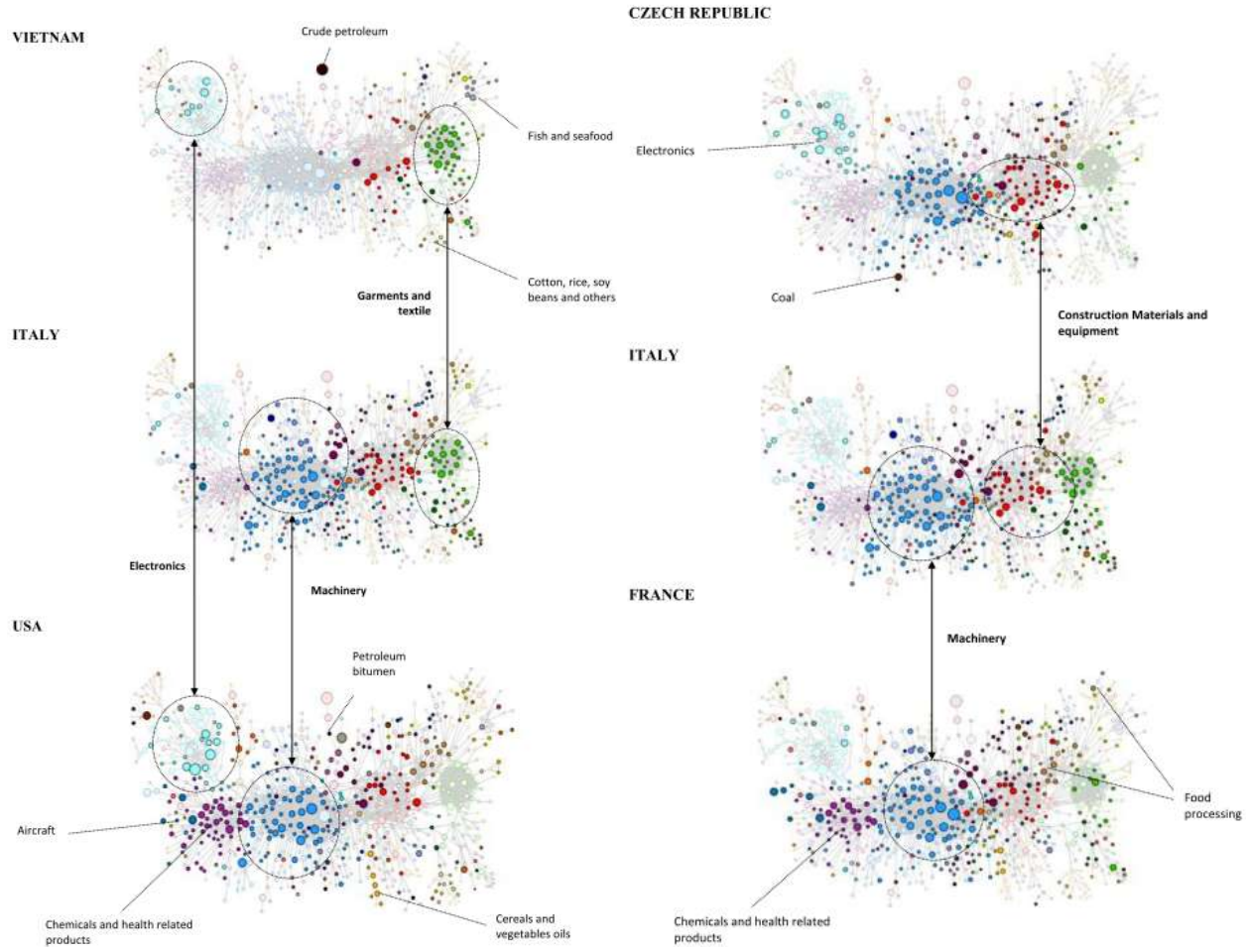
In short, Italy was going to have a thicker Product space toward the core of the map where many products are linked by a dense network of lines. As stressed by Hidalgo and colleagues, countries that have occupied the dense part of the Product space will have many nearby activities that could be moved to existing capabilities with only minor adjustments. Nevertheless, Italian evolution appears to be an "extensive" growth, i.e., growth was concentrated in the same product communities that were present in the first year (green, red, blue), while it was not able to move to other communities. In fact, concerning underdeveloped industries, we can confirm the previous argument where we notice that electric and electronics products (light blue) were almost absent with the exception of certain products: for instance, former in 1980, Italy had comparative advantage in calculating and ticketing machines, typewriters (Olivetti products) and clocks, while in 2009 Italy specialized in home appliances such as dishwashers, air conditioning machines and laundry equipment. During the 70s and the 80s electronics was more widespread in Italy because in those years there was the country was able to join its capabilities in mechanics with imported electronics leading to the emergence of small, high-productivity enterprises in robotics (**?**). Then, in 1990s, in concomitance with the decrease in industrial investments, this sector started to decline. Similar to electronics, the chemical industry is poorly spread even though in the course of time there was a slight increase. Among the chemical products exported by Italy, there are drugs and perfumery, cosmetic and toilet preparations, positioned "near" the core of the Product space.

7. The product space of Italy compared to other countries

After the analysis of the evolution of the Italian Product space, we propose a "double" comparison in a cross section dimension: first with a couple of non-EU countries, one developed and one developing, then with a couple of EU countries (again at different stages of development, see Figure 8). We first chose to compare Italy with Vietnam and the United States. Vietnam is a very populated country, and thanks to the economic reforms of the mid 1980s, it is experiencing

a noticeable economic growth: its per capita GDP grew at an average annual rate of 5.9% from 2000 to 2010[8]. Looking at Figure 8 (panel a), we see that agriculture is certainly a key economic sector in Vietnam. The country is an important exporter of rice, coffee (in lime green) and cotton (in cream), and even its fishing sector (in grey) is heavily developed. Moreover, Vietnam, like Italy, has a Product space that is rich in green nodes: garments and textile goods are produced with comparative advantage; differently from Italy, information technology and high-tech industries (in light blue) form a large and fast-growing part of the national economy (even if, probably, in the low segments of this sector).

Figure 8: *Product space of Italy and some comparators in 2009*



(a) Vietnam and USA

(b) Czech Republic and France

Source: http://macroconnections.media.mit.edu/apps-for-economic-development/

The USA presents a Product space typical of rich economies, concentrated on the center of the map, machineries and mechanics (including vehicles), and technological products, like chemicals and electronics. Due to the richness of natural endowments, it has some specific characteristics, like agriculture (yellow), and raw materials and petroleum (at the top of the map, in dark brown) With respect to Italy, the USA has a Product space that is equally

[8] Data come from World Development Indicators, GDP is measured in PPP (constant 2005 international $)

diversified in general. Products cover almost the entire map, but with a higher presence of high-tech products (electronics and chemicals) and weaker in "traditional" ones (clothing sectors). Similar considerations can be drawn from the comparison with two European economies, the developed France and the transition economy of the Czech Republic (Figure 8, panel b). France, in particular, has been chosen instead of another country (Germany or the UK), because it popularly competes with Italy in the high segments of the fashion sector.

The conclusion we may derive from this comparison is not different from the previous one: Italy is similar to the developing country "on the right", similar to a developed country "in the center" and different from it "on the left". Italy has a denser space with respect to the Czech Republic, especially in the central sections with blue circles (machinery), while it is more similar in the red circle area (products related to construction). In this sense, it is more similar to France in mechanics, even if France is also as specialized as the USA but differently from Italy, in health-related chemicals (purple). An interesting observation is that Czech specialization in electronics is more evident than Italian specialization as it was also for Vietnam. In addition, differently from the US case, France did not "occupy" that area of production. Also interestingly, neither the Czech Republic nor France shows any particular strength in the green area (clothing and textiles) "patrolled" by Italy. In conclusion, Italy shows features of developed countries. In fact, it has a high density of products situated in the core of the Product space. It shows rather developed capital intensive (blue) and machinery (light blue) communities, but it also has some aspects typical of developing countries, such as labor intensive (green) communities. Finally, it was not able to enter more technological "modern" sectors, as opposed to less developed economies that were recently able to do so.

8. Conclusions: from complexity to opportunities

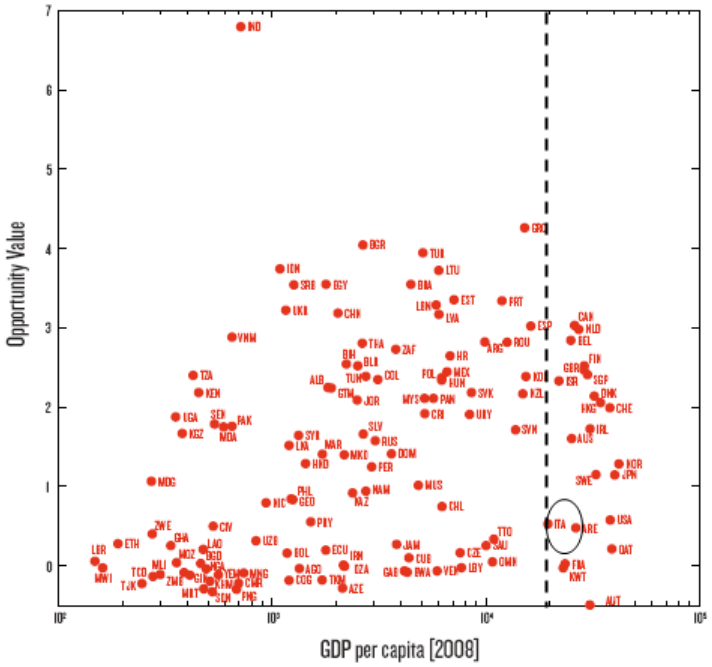
Our analysis surveyed the literature on the Italian model of international specialization. Several authors have suggested that this model has been one of the reasons for the slow-down of the Italian economy. We then showed that actually the "sophistication", i.e., the richness and complexity of the Italian export basked increased during the period of its economic growth, while this evolution strongly slowed down at first, and later decreased in correspondence with a (euphemistically speaking) poor performance of the per capita income in the past decades. In parallel, we showed that the Italian economy evolved from a low level to a high level of complexity (as explained in the paper), moving from the peripheral to the central areas of the world Product space. Also in this case, this evolution is evident in the first period (1970-1990), while its evolution stopped in the past few years.

In practice, it can seem that the evolution was partially incomplete: products in the area on the left were "not reached" (lack of specific capabilities for electronics and chemicals). In addition, the comparison with the two pairs of rich and developing countries (at different stages of development) confirmed our previous impressions. The results are that Italy shows characteristics that are typical of a developing economy along with others that are more typical of a rich and complex economy. "Made-in-Italy" products are poorly connected to others, and this fact may indicate that positive feedback mechanisms (learning-by-doing) are a possible explanation of the persistence phenomenon. Moreover, considering that product communities that are on the left of the Product space are partly isolated from the others, this means that specific capabilities, as already stressed, are needed even in this case. As a consequence, the Italian specialization model seems to have objective difficulties in exiting old sectors and

entering new ones.

In short, Italy is a complex economy, and this is a positive aspect, but with some clear weaknesses that we identified in an incomplete evolution. At this point, we may ask, what perspectives can we imagine? We intuitively explore the Italian opportunity to "move the production" to nearby and complex products, given the actual position in the Product space, keeping in mind that countries that export more complex products, with their current level of income, will have a faster growth in the future. For this reason, the "opportunity value" is made up of two variables: "distance", that measures how far a product has not yet been exported from the country's export basket, and "complexity". This value is high for countries located in the dense part of the Product space and for which the nearest not exported products are highly complex.

Figure 9: *Opportunity Value and GDP per capita*



Source: Hausmann and Hidalgo (2011, p. 48)

It is evident that Italy, among the rich countries, is one of the economies with the lowest opportunity value, that is, one of the economies with the highest costs of "structural change" and also with the lowest possibility of sustained growth. Since the Italian economy has a general high complexity, we may expect that the country has the capability to further develop its model of specialization. Nevertheless, we have to stress that Italy is present in and absent from product clusters relatively isolated in the product space: this stresses some objective difficulties for economic agents to move forward. As a consequence, our final note is in favor of industrial policies. The possibility of getting out of this situation may be linked to an explicit effort of public intervention. This depends on the fact that the present institutional asset and market forces are evidently going in a negative direction. We do not have the time and place to go into this debate in depth, and so we limit ourselves to observe that these issues, that of the linkages between industrial policies, the slow-down of the rate of growth of economy and of the model of specialization in Italy have already been proposed by Traù, in an analysis of the Italian economy during the XX century (De Nardis and Traù, 2005).

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A. Appendix 1: Italian $EXPY$ with $PRODY$ of different years

Table 3: *$EXPY$ of Italy from 1980 to 2010 (PPP-constant 2005 international $), $PRODY$ 1980*

Year	EXPY	EXPY GROWTH%
1980	13391.875	
1985	13360.706	-0.23%
1990	13796.484	3.16%
1995	14011.793	1.54%
2000	14083.957	0.51%
2005	14148.783	0.46%
2010	14146.015	-0.02%

Table 4: *$EXPY$ of Italy from 1980 to 2010 (PPP-constant 2005 international $), $PRODY$ 1990*

Year	EXPY	EXPY GROWTH%
1980	14445.739	
1985	14409.201	-0.25%
1990	14849.679	2.97%
1995	14959.965	0.74%
2000	15039.633	0.53%
2005	15146.187	0.70%
2010	15128.166	-0.12%

Table 5: *$EXPY$ of Italy from 1980 to 2010 (PPP-constant 2005 international $), $PRODY$ 1990*

Year	EXPY	EXPY GROWTH%
1980	14851.135	
1985	14933.127	0.55%
1990	15454.998	3.38%
1995	15746.095	1.85%
2000	16088.455	2.13%
2005	16148.384	0.37%
2010	15947.116	-1.26%

Source: COMTRADE and WDI indicators

B. Appendix 2

Figure 10: *GDP per capita PPP (constant 2005 international $) of all countries in 2010*

	COUNTRY NAME	GDP2010		COUNTRY NAME	GDP2010
1	United States	42642,17831	48	Ecuador	7324,997681
2	United Arab Emirates	42352,95998	49	Jamaica	7084,336436
3	Switzerland	37441,02247	50	China	6810,087315
4	Austria	35266,12433	51	Belize	5934,152531
5	Canada	35243,32728	52	Egypt, Arab Rep.	5676,142928
6	Ireland	35183,75188	53	Jordan	5157,136108
7	Germany	33498,88408	54	Maldives	5135,968513
8	Iceland	32961,93648	55	Armenia	4838,931526
9	Denmark	32608,19903	56	Bhutan	4780,12001
10	United Kingdom	32187,0471	57	Sri Lanka	4555,038928
11	Finland	31532,55286	58	Georgia	4550,186015
12	Japan	30902,6616	59	Bolivia	4352,61167
13	France	29647,90748	60	Guatemala	4283,696276
14	Korea, Rep.	27026,7855	61	Morocco	4218,967387
15	Spain	26934,4283	62	Indonesia	3879,81243
16	Italy	26753,30911	63	Cape Verde	3573,459791
17	Israel	26020,63528	64	India	3240,498662
18	Cyprus	25961,32601	65	Guyana	2794,161562
19	Greece	24990,03579	66	Moldova	2789,438499
20	Malta	22950,52659	67	Cameroon	2046,127492
21	Bahamas, The	22769,92232	68	Kyrgyz Republic	2039,305587
22	Czech Republic	22557,46347	69	Cambodia	1942,989995
23	Hungary	16514,33279	70	Mauritania	1743,875902
24	Estonia	16353,20847	71	Cote d'Ivoire	1703,612216
25	Croatia	16121,2627	72	Kenya	1477,303608
26	Lithuania	15390,81833	73	Ghana	1468,824497
27	Antigua and Barbuda	14850,85143	74	Zambia	1401,149955
28	Argentina	14362,61581	75	Burkina Faso	1126,548608
29	Chile	13595,89975	76	Afghanistan	1082,949263
30	Malaysia	13186,24219	77	Mali	954,9824016
31	Latvia	12938,0177	78	Ethiopia	933,8377242
32	Belarus	12813,54688	79	Madagascar	868,924802
33	Lebanon	12604,97362	80	Mozambique	845,0198164
34	Mexico	12498,33814	81	Malawi	791,3116778
35	Botswana	12459,20778	82	Burundi	366,4425346
36	Mauritius	12269,51984			
37	Bulgaria	11486,35823			
38	Kazakhstan	10889,97215			
39	Costa Rica	10258,58166			
40	Brazil	10055,89161			
41	Azerbaijan	8918,712931			
42	Dominica	8897,928041			
43	Colombia	8487,597261			
44	Dominican Republic	8386,921383			
45	Albania	7667,374419			
46	Algeria	7520,791452			
47	Bosnia and Herzegovina	7330,625428			

Source: WDI indicators

C. Appendix 3

Figure 11: *EXPY of 43 countries (taking into account PRODY of 2010)*

		1985EXPY			1995EXPY			2005EXPY			2010EXPY
1	Switzerland	20832,61	1	Switzerland	21433,29	1	Switzerland	22309,87	1	Switzerland	22726,89
2	Japan	20169,98	2	Japan	20831,01	2	Ireland	21282,65	2	Ireland	22645,31
3	Germany	19242,75	3	Germany	19810,18	3	Japan	20977,15	3	Japan	21125,59
4	Finland	19128,69	4	Finland	19771,95	4	Germany	20059,97	4	Germany	20006,85
5	Barbados	18610,92	5	Austria	18725,54	5	Finland	19745,61	5	Korea, Rep.	19830,33
6	Austria	17876,26	6	United States	18410,37	6	Korea, Rep.	19674,15	6	Finland	19818,68
7	Canada	17722,83	7	Belgium-Luxembourg	18194,23	7	United States	19459,14	7	France	19156,57
8	United States	17638,99	8	France	18167	8	France	18993,87	8	Belgium-Luxembourg	18941,24
9	France	17168	9	United Kingdom	18143,03	9	Belgium-Luxembou	18951,43	9	Austria	18822,61
10	Belgium-Luxembourg	16974,09	10	Korea, Rep.	18067	10	United Kingdom	18709,04	10	United Kingdom	18817,27
11	Denmark	16918,57	11	Canada	18034,7	11	Hungary	18615,62	11	United States	18705,03
12	Iceland	16555,7	12	Spain	17987,68	12	Austria	18489,43	12	Hungary	18555,4
13	Ireland	16464,08	13	Italy	17378,93	13	Spain	18156,84	13	Israel	18015,68
14	Italy	16325,36	14	Denmark	17284,95	14	Italy	17960,52	14	Italy	17888,18
15	United Kingdom	16204,03	15	Ireland	17027,46	15	Denmark	17526,37	15	Denmark	17845,64
16	Israel	16056,74	16	Israel	16868,19	16	Israel	17211,27	16	Spain	17633,01
17	Spain	15338,06	17	Iceland	15675,58	17	Canada	16836,13	17	China	16406,47
18	Korea, Rep.	15144	18	Hungary	15117,53	18	China	16055,64	18	Canada	15663,53
19	Hong Kong, China	13872,58	19	Hong Kong, China	14599,84	19	Iceland	15846,81	19	India	14305,38
20	China	12613,38	20	China	13929,23	20	Brazil	14657,84	20	Iceland	14296,77
21	Argentina	11904,84	21	Brazil	13533,51	21	India	13828,84	21	Argentina	14115,61
22	Brazil	11615,86	22	Argentina	13207,79	22	Greece	13733,97	22	Greece	13927,45
23	Australia	11061,76	23	India	12212,03	23	Argentina	13670,32	23	Hong Kong, China	13036,99
24	Cyprus	10488,83	24	Barbados	11271,35	24	Cyprus	12224,35	24	Brazil	12467,48
25	Greece	9821,901	25	Greece	11096,31	25	Hong Kong, China	11797,88	25	Barbados	12210,83
26	Macao	9672,022	26	Australia	10969,08	26	Indonesia	11353,43	26	Cyprus	12170,03
27	India	9564,838	27	Indonesia	10551,8	27	Australia	10808,97	27	Jordan	11138,38
28	Chile	9220,793	28	Chile	10402,29	28	Dominica	10443,08	28	Egypt, Arab Rep.	10458,45
29	Jordan	8832,077	29	Jordan	10302,83	29	Jordan	10010,75	29	Indonesia	10383,15
30	Ecuador	8693,388	30	Venezuela	9768,598	30	Egypt, Arab Rep.	9917,921	30	Morocco	10193,97
31	Bolivia	8332,95	31	Cyprus	9582,745	31	Colombia	9911,588	31	Chile	9248,907
32	Zimbabwe	8315,566	32	Morocco	9034,649	32	Barbados	9809,317	32	Colombia	8929,245
33	Morocco	8162,136	33	Zimbabwe	9019,227	33	Morocco	9519,722	33	Australia	8780,688
34	Dominica	8111,781	34	Macao	8935,292	34	Chile	9272,347	34	Bolivia	8727,798
35	Hungary	7668,474	35	Dominica	8922,312	35	Bolivia	9023,4	35	Ecuador	8713,615
36	Indonesia	7551,655	36	Bolivia	8901,943	36	Venezuela	8710,576	36	Dominica	8680,044
37	Jamaica	7171,505	37	Colombia	8574,779	37	Kenya	8535,976	37	Kenya	8131,982
38	Egypt, Arab Rep.	6356,818	38	Ecuador	8189,44	38	Ecuador	8426,372	38	Algeria	8101,681
39	Venezuela	6012,141	39	Egypt, Arab Rep.	8186,002	39	Algeria	7998,723	39	Venezuela	8015,788
40	Colombia	5052,293	40	Kenya	7763,316	40	Cote d'Ivoire	7943,635	40	Jamaica	7608,883
41	Cote d'Ivoire	5025,147	41	Jamaica	7041,569	41	Zimbabwe	7572,34	41	Cote d'Ivoire	6294,793
42	Algeria	4995,406	42	Algeria	6778,205	42	Jamaica	6883,604	42	Macao	5894,271
43	Kenya	4606,449	43	Cote d'Ivoire	4220,458	43	Macao	6318,232	43	Zimbabwe	4903,391

Source: COMTRADE and WDI indicators

Italia nello spazio (dei prodotti)

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Sommario

In questo lavoro discutiamo del modello di specializzazione italiano in relazione al processo di crescita economica, evidenziando una evoluzione economica incompleta: l'Italia è un paese inseguitore per alcuni aspetti anche se già inseguito per altri. Mostriamo che il livello di produttività associato al paniere di beni esportati è aumentato fino al 2000, ma, dopo un rallentamento, diminuito negli ultimi anni. Parallelamente, l'Italia ha migliorato, nel lungo periodo, la sua posizione nello "spazio dei prodotti" internazionale, ma senza apprezzabili cambiamenti dopo il 1990, tanto che il paese è assente dalla sezione più sofisticata della mappa. I risultati sono anche confermati dal confronto con alcuni altri paesi.

Classificazione JEL: *F14; L16; O52*

Parole Chiave: *Cambiamento strutturale; Network di prodotti; Economia Italiana*