**Available online at www.fooddynamics.org**

**Int. J. Food System Dynamics 3 (1), 2012, 22-34**

INTERNATIONAL JOURNAL ON FOOD SYSTEM DYNAMICS

# Sophistication and Performance of Italian Agri-food Exports

Anna Carbone and Roberto Henke

*University of Tuscia-Viterbo, Italy*
*National Institute of Agricultural Economics (INEA), Rome, Italy*
acarbone@unitus.it , henke@inea.it

Received March 2012, accepted June 2012, available online July 2012

## ABSTRACT

Non-price competition is increasingly important in world food markets. Recently, the expression export sophistication has been introduced in the economic literature to refer to a wide set of attributes that increase product value. An index has been proposed to measure sophistication in an indirect way through the per capita GDP of exporting countries (Lall et al., 2006; Haussmann et al., 2007).

The paper applies the sophistication measure to the Italian food export sector, moving from an analysis of trends and performance of Italian food exports. An original way to disentangle different components in the temporal variation of the sophistication index is also proposed.

Results show that the sophistication index offers original insights on recent trends in world food exports and with respect to Italian core food exports.

*Keywords: international trade; sophistication; Italy; food sector; quality*
*JEL: Q17*

## 1 Introduction

Non-price competition is increasingly important in both national and global food markets. To meet a well-established trend in food demand, suppliers are increasingly focussed on product diversification with respect to a variety of attributes. As a consequence, the struggle in international food markets is no long solely explained by price competition; attributes can play a key role in successfully selling a product in specific market segments.

The economic literature on international food trade has increasingly tried to understand the role played by price and non-price competition, focusing mainly on the comprehensive concept of quality (Fisher, 2010). For example, among others, unit value indices have been widely used as proxies to measure quality of export flows, despite limits and drawbacks highlighted by some authors (Gehlhar and Pick, 2002; Ninni *et al*. 2006; Schott, 2004).

A recent strand of literature has introduced the concept of export sophistication (Lall *et al*., 2006; Hausmann *et al*., 2007). Product sophistication is defined as the content of a good in terms of technology, design, quality, branding, scale economies and any other factors affecting its value (Fontagné *et al*., 1999). Sophistication is seen as a major export driver in competitive markets. Per capita GDP is a measure of a country's productivity, hence, sophistication of exports is indirectly measurable by the per capita GDP of all the exporting countries (Rodrick, 2006).

This paper analyses trends and performance of Italian food exports applying sophistication indices together with more traditional indicators. The focus is on a group of export items for which international competitiveness is largely based on attributes other than price. These have been selected according to

their importance for the Italian food trade balance.

Italy is a net importer of agri-food products due to its structural lack of agricultural land. In addition, other structural characteristics of the Italian agri-food sector, such as the fragmentation of the supply, the lack of water in many regions, the insufficient development of the cooperative sector, the high cost of labour – among others – do negatively influence costs. This means that competitiveness should necessarily be pursued on a different ground than price. Indeed, the country is an important actor in the world food processing system and has developed a food industry with a world-wide reputation for high quality (e.g. wine, cheese, olive oil, pasta, processed coffee and so on). The high reputation of many Italian food products is also witnessed by the large number of counterfeits and by the diffusion of the so called "Italian sounding". Overall, food exports have increasingly limited the negative trade balance of the Italian agri-food sector, contributing to reduce the financial burden of agri-food imports and to increase efficiency and productivity.

The performance of Italian agri-food exports on the world market has varied over time: during the Eighties and the beginning of the Nineties exports suffered from inadequate quality (Carbone, 1994). In the mid-Nineties they gained larger market shares thanks to a generous exchange rate policy. However, in the last 10-15 years, the whole Italian agri-food sector made a significant effort to improve quality and the strategy proved to be successful in terms of export growth (INEA, 2009)[*]. In their competitive strategies, producers mainly focused on attributes such as: authenticity, handicraft nature, strong Italian identity, origin, typicity and tradition.

Nevertheless, to the Authors' knowledge, there is a lack of in-depth analyses looking at the Italian agri-food export dynamics from a comprehensive medium-long term perspective.

The objective of the paper is twofold. First, the performance of Italian food exports is assessed both at a general and at a detailed product level. Second, as a methodological objective, an application of the sophistication concept to the food sector is presented. To measure export sophistication we adopt an index known as Prody, specific to each exported item. The Prody index is a weighted average of the per-capita GDPs of all the countries exporting a product, where the weights reflect the revealed comparative advantage (RCA) of each country in that product. The assumption is that the sophistication of exported goods is directly tight to the level of per-capita GDPs of countries exporting that good. The index produces a ranking of goods in terms of sophistication. The ranking offers a synthetic description of the market segment where a product is competing, hence, its capability to remunerate production inputs, including labour.

Following Minondo (2007), in this work we apply the Prody index on an *ad hoc* classification of each product. Each product is in fact split into two sub-items on the basis of the unit value (UV) of each country exports. This identifies a high and a low quality sub-item for each traded good.

Furthermore, we introduce an innovation in the analysis of the index dynamics that allows us to disentangle different factors in the product sophistication trends.

The paper is organized as follows. Section 2 presents data sources and discusses the main methodological issues and the way the Prody index has been calculated here; furthermore a short appendix at the end of the paper provides data and sample calculation of Prody for one product. Section 3 shows the results obtained and offers some comments on the observed trends highlighting cases of strength and weakness. Concluding remarks are reported in Section 4.

## 2 The Sophistication Concept And Measurment Issues

The term sophistication includes all the attributes of a good that contribute to increasing its value such as intrinsic attributes, production technology, design, brand, packaging, but also special labour skills and scale economies that generate market power increasing profitability, and any other marketing attributes that increase product value. Recent studies have associated this concept of sophistication to the level of prosperity of the exporting countries, that is to their level of per capita GDP (Lall *et al.*, 2006; Hausmann *et al*., 2007). The underlying idea is that, other things being equal, the more a country is specialised in producing and exporting high value products, the higher is the remuneration of inputs and, consequently, the higher the level of its GDP. As a consequence, the Prody index that is associated to each exported good offers a synthetic indication of its level of sophistication. At the same time, the index gives also an

[*] An example, among others, is given by the wine sector, especially in Southern Italian regions, where an impressive effort was made in order to improve varieties of vines grown and technological skills for processing wine, so that the final product improved a lot and finally managed to catch up international standard quality. The result has been a tremendous growth rate of exports of wine from these regions, which now compete on the international markets with the more traditional wine producers of the Northern Italian regions.

idea of the type of countries exporting a specific good, so that it gives indirect information about the type of competition that the good in question has to deal with on the international markets (Lall *et al*., 2006). The core idea that product sophistication is important as an export driver and that it is linked to the country productivity level mirrors Porter's view of the competitive advantages of locations and the strand of empirical literature that stemmed out from his seminal work (Porter, 1985; Ketels, 2006; Sterns and Spreen, 2010).

Summing up the sophistication of a given exported item is the result of the sum of the per capita GDP of the countries exporting that item, each of them weighted with the trade specialisation of each country in that item. This measure is called Prody and can be calculated in slightly different ways; here we followed Hausmann *et al*. (2007) and propose the following version of the index:

$$Prody_i = \sum_j s_{i,j} GDPpc_j \quad (1)$$

where $s_{ij}$ is the weighting factor of the per-capita GDP (GDPpc) of each country j exporting the i product and it is given by:

$$s_{i,j} = \frac{RCA_{i,j}}{\sum_j RCA_{i,j}} \quad (2)$$

Where RCA (*Revealed Comparative Advantage*) is the Balassa index and is given by:

$$RCA_{i,j} = \frac{\frac{X_{i,j}}{X_j}}{\sum_j \frac{X_{i,j}}{X_j}} \quad (3)$$

where $X_{i,j}$ is the amount of the agri-food product i exported by the country j and $X_j$ is the total agri-food exports of the country j.

Clearly, this index does not catch all the possible factors influencing the exporting performance of a good. Different localisation factors are, as it is well known, at work. This is particularly true for the agri-food sector, for which comparative advantages such as those linked to resource endowment, transport costs and policy interventions, are crucial in explaining the dynamics of export goods (Di Maio and Tamagni, 2008;Carbone et al., 2009). As a consequence, it is necessary to use these indexes together with other indicators, in order to be able to catch all the most important factors influencing the export dynamics and their evolution over time. We focussed on a set of processed food exports and excluded agricultural products in order to limit the influence of these other localisation factors.

Following the methodology suggested by Minondo (2007), we slightly modified the way the Prody index is applied. The aim is to attain a narrower and more accurate definition of export items for which the actual content may vary significantly from country to country. In order to do that, different quality levels are considered when defining products. Each category is split into two by calculating the world median (50% of the observations) of the export unit values; then each export flow from each exporting country is assigned to the high (low) sub-category on the basis of its unit value being above (below) the median of the distribution[†].

The mathematical expression is as follows:

$$Prody_{iq} = \sum_j \frac{\frac{X_{j,iq}}{X_j}}{\sum_j \left( \frac{X_{j,iq}}{X_j} \right)} GDPpc_j$$

[†] The index we built – differently from Minondo – is based on two quality levels rather than three. The reason is that dealing with agri-food products implies a smaller absolute range of values for prices, so that two quality levels seem more appropriate.

(4)

Where $X_{j,iq}$ represents country *j* exports of commodity *i*'s *q* variety, where *q* can be low or high, and $X_j$ represents country j's total exports. The Minondo's version of the Prody index is, hence, exactly the same as the general version with the only difference that it is calculated for a narrowly defined export category identified by its unit value.

Particularly interesting is the analysis of the trends over time of these indices. Indeed, the evolution of the Prody index associated to a product reflects changes in the sophistication level of the product. Given the index construction, its time variation includes two different effects. Firstly, it changes according to variations of the per capita GDP of each exporting country. Secondly, changes in the Prody values reflect changes in the set of exporting countries, with new exporters joining the market and others leaving it, and changes in the degree of specialization of each country.

We catch these two distinct effects by calculating the index for 2006-07 twice: once with GDP at 2006-07 and once with GDP at 1996-97 (i.e. Prody at constant per capita GDP). Then, subtracting the variation at constant GDP from the variation at current GDP, the GDP component of the total Prody variation, here referred to as the "GDP effect", is measured. The residue reflects changes in the countries specialisation pattern that we called "GEO effect". This change is due to changes in the weights $s_{i,j}$; in other words, it catches changes in the RCAs of exporting countries and entry/exit of others. To our knowledge, there are no attempts in the same direction in literature. However, Lebre, De Freitas and Salvado (2009) are thinking in a similar manner when they calculate the sophistication index associated to a country (called Expy) with current and constant Prody.

Data used are taken from the Comtrade data bank of the United Nations (*United Nations Commodity Trade Statistics Database*, at website: http://comtrade.un.org.). We chose the 6 digit classification (HS6) that includes 700 items for the agro-food sector (out of 5000 that represent total trade) and aggregated them into 95 export headings. Then, among these, we chose 26 items that represent the hard core of the Italian agro-food exports. For each exported item we took the total export to the world, here represented by 76 countries (accounting for 90% of world agri-food trade). The export flows considered are the average of two-year flows at the ends of the period under study: 1996-97 and 2006-07. The choice of the time span was made with the aim to avoid recent years that have been characterized by high levels of turbulence. Values are expressed in thousands of US dollars and quantities in thousands of tons. Finally, per capita incomes are taken from the data bank *World Development Indicators* of the World Bank, and are expressed in US dollars in Parity of Purchasing Power (PPP) at 2005.

## 3 The Analysis

In previous studies on the agri-food sector it has been highlighted that the Italian trade specialisation is deeply connected to quality. It is not clear, though, to what extent this tendency has increased over time (Ninni *et al*., 2006; Carbone et al, , 2009). The aim here is to focus on this matter from a new perspective, analysing in detail the case of the processed export-oriented agri-food products through the values and the dynamics of their Prody index.

The items included in the analysis represent altogether 62.8% of Italian agri-food exports. These have been selected according to a combination of the following criteria: first of all, the value of the Italian share over world markets[‡]; secondly, the presence of Revealed Comparative Advantage (RCA)[§]; lastly, a positive Normalised Trade Balance (NTB)[**]. Worldwide reputation was also considered in the selection. It is worth stressing once more that the list includes only processed products. Overall, the 26 selected items are those considered in trade analysis as the "hard core" of the Italian quality, well reputed, agri-food products (also referred to, in literature and by practitioners, as the agri-food *Made in Italy* products).

Table 1 shows a list of the selected products together with the indicators used for the selection.

Figures in the first two columns shows: i) the role played by Italian exports within the world market for each item; ii) the Italian Revealed Comparative Advantage for each item. For almost all the items included in the analysis Italy is an important world supplier. This is even more evident when considering that Italy is a small country in agri-food international markets, contributing a share of about 4% of total agri-food exports. At the same time, for almost all these items Italy shows strong comparative advantages, with

[‡] Calculated as $X_{i,IT}/X_{i,W}$, where *i* is the *i*th item, IT is Italy and W is World.

[§] For the formula see previous section. The index varies from 0 to ∞. When RCA>1 the country has a competitive advantage for exporting that item in world markets.

[**] The formula for NTB is given by: NTBi = [(Xi-Ii)/(Xi+Ii)] *100 were Xi are the exports of item I and I are the corresponding imports.

many RCA values well above 1. There are only two items, “Confectionery” and “Prepared vegetables”, with RCA<1, these have nevertheless been included in the analysis for reasons that will be illustrated below.

**Table 1.**
Italian agri-food exports in selected items: main indicators

| 2006-07 | Italy /World Share | Italian RCA | NTB % |
|---|---|---|---|
| Fresh cheeses | 13.7 | 3.4 | -14.0 |
| Grated cheeses | 20.0 | 5.0 | 84.2 |
| Herb cheeses | 22.4 | 5.6 | 77.2 |
| Other cheeses | 7.3 | 1.8 | -3.9 |
| Processed coffeee | 22.0 | 5.5 | 81.1 |
| Processed rice | 4.4 | 1.1 | 91.3 |
| Virgin olive oil | 25.6 | 6.4 | -17.7 |
| Non virgin olive oil | 32.8 | 8.2 | 31.7 |
| Mixed olive oil | 28.4 | 7.1 | 39.7 |
| Meat cuts | 10.9 | 2.7 | 60.9 |
| Chocolate products | 8.1 | 2.0 | 48.2 |
| Fresh pasta | 24.8 | 6.2 | 92.8 |
| Pasta | 62.2 | 15.6 | 95.4 |
| Confectionery | 3.0 | 0.7 | -20.9 |
| Bakery | 9.7 | 2.4 | 41.3 |
| Peeled tomatoes | 44.5 | 11.2 | 85.4 |
| Prepared vegetables | 3.6 | 0.9 | -6.4 |
| Prepared fruit | 4.4 | 1.1 | 29.2 |
| Fruit juices | 4.8 | 1.2 | 32.3 |
| Sauces and other condiments | 6.1 | 1.5 | 50.7 |
| Ice creams | 11.7 | 2.9 | 39.1 |
| Mineral water | 5.8 | 1.5 | 80.5 |
| Sparkling wine | 10.1 | 2.5 | 28.8 |
| Wine < 2 lt | 20.1 | 5.1 | 96.2 |
| Wine > 2 lt | 17.6 | 4.4 | 57.4 |
| Vermouth | 57.2 | 14.4 | 97.4 |
| Total 22 items (over tot. AF) | 11.8 | - | 42.5 |
| Total Agri Food | 4.0 | - | -11.3 |

Source: our elaboration on WB data

The NTB values (third column in the table) confirm that Italy is overall a net importer on agri-food markets, while for many of the selected items is a solid net exporter. Few exceptions can be seen in the table: i) “fresh cheese” and “other cheese” have been included because they are part of a larger cheese industry that is export oriented and well reputed. The same holds for “Virgin olive oil” and “Prepared vegetables”, both contributing to important export industries. Finally, “Confectionery” has a negative NTB (-20.9) but includes many products that are traditional and important within the Italian food exports.

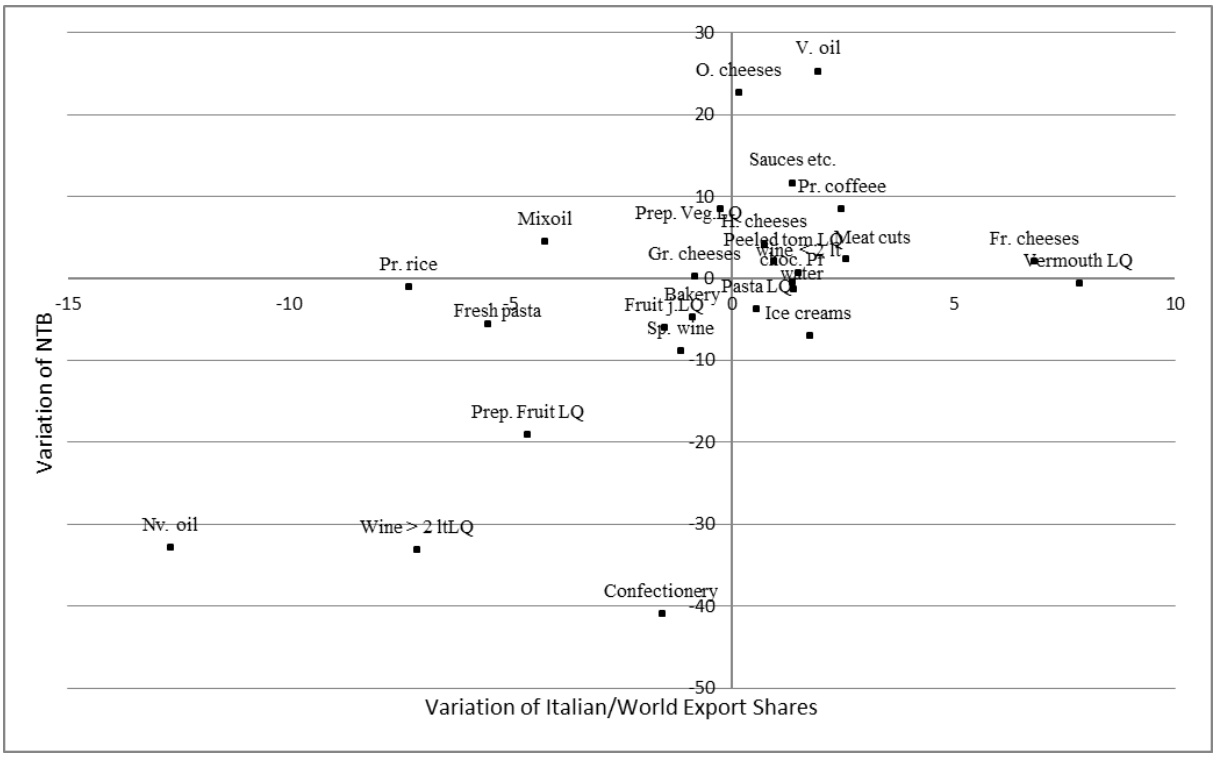


**Figure 1.** Trends in Net Trade Balance (NTB) and Italian shares Over World Exports

Figure 1 shows a scatter plot with variations of NTB and of Italian share of world exports for the 26 items under study (1996/97- 2006/07). This gives a first, rough idea of the dynamics of the international performance of these products. The first evidence to be noted is that products are widely scattered on the graph. This, of course, means that there is a variety of different situations with products that had a negative performance and others that improved their international position. The most crowded quadrants are: the top-right (positive trends for both indicators), and the bottom-left (negative trends for both indicators), indicating that in most cases the dynamic of the two indices are aligned. It is worth highlighting some cases of interest, like the ones of the three different categories of olive oils present in our dataset that show deeply divergent performances. The olive oil of higher quality (i.e. virgin olive oil) faced a positive performance both in terms of NTB and market shares while the lower quality olive oil (i.e. the non-virgin olive oil) had a very negative performance during the decade under study, with both NTB and market shares in sharp decline. In an intermediate position we find the third olive oil category (i.e. olive oil mix) that slightly improved its NTB thanks to an increase of exports (also thanks to imports of non v. olive oils that are used to make the mix) but at the same time reduced its world share. Another case worth pinpointing is the one of wines. Wines of better quality (i.e. wine in bottles smaller than 2litres) improved their already positive performance, while bulk wines (i.e. wine in bottles bigger than 2litres) severely declined both in terms of NTB and in terms of market share. A different situation is that of ice creams, whose share on world exports increased while NTB worsened as a result of an increase of intra-industry trade with increased imports as well as exports (consumers appreciate variety).

In order to gain deeper insights of this mixed picture, with the aim to better understand major changes in international markets of these products and on the Italian performance, we now switch to the sophistication analysis.

In Table 2 items are ranked according to the values of the 2006/07 Prody index[††]. Looking at the index values, it is clear that the range of values is quite wide, going from 33,513 US $ for herbal cheeses to 9,536 US $ for prepared fruit. It is interesting to notice that in comparison with the results obtained in a previous work by the authors, that analysed the whole range of Prody values for agri-food exports in the disaggregation at 95 items (Carbone et al., 2009), the 26 items studied here are ranked in the upper part of the distribution, thus confirming that these products compete in relatively sophisticated markets where attributes matter.

[††] In the Appendix at the end of the paper a sample of index calculations is provided.

**Table 2.**
The Prody index for selected Italian Agri-food exports (Constant 2005 USD in PPP)

| Products | PRODY 96/97 | PRODY GDPcorr 06/07 | PRODY GDPcost 06/07 | total variation | GDPeffect | GEO effect |
|---|---|---|---|---|---|---|
| Herbal cheeses | 27,992 | 33,513 | 28,169 | 5,521 | 5,345 | 177 |
| Grated cheeses | 18,723 | 32,278 | 26,436 | 13,555 | 5,842 | 7,714 |
| Other cheeses | 26,466 | 29,668 | 23,436 | 3,202 | 6,232 | -3,030 |
| Bakery products | 25,771 | 28,187 | 22,550 | 2,416 | 5,636 | -3,220 |
| Ice creams | 24,797 | 26,667 | 21,190 | 1,870 | 5,477 | -3,607 |
| Meat cuts | 21,530 | 26,288 | 19,943 | 4,757 | 6,344 | -1,587 |
| Confectionery | 18,043 | 25,791 | 19,567 | 7,747 | 6,224 | 1,523 |
| Fresh cheeses | 26,079 | 25,693 | 18,877 | -386 | 6,816 | -7,202 |
| Chocolate products | 21,843 | 25,009 | 19,682 | 3,166 | 5,328 | -2,161 |
| Fresh pasta | 18,332 | 24,892 | 19,500 | 6,559 | 5,392 | 1,167 |
| Virgin olive oil | 21,927 | 24,622 | 21,569 | 2,695 | 3,053 | -358 |
| Wine < 2 lt | 18,770 | 23,237 | 18,937 | 4,467 | 4,300 | 167 |
| Non-virgin olive oil | 19,837 | 20,897 | 16,790 | 1,059 | 4,107 | -3,048 |
| Vermouth LQ | 18,641 | 20,157 | 16,116 | 1,517 | 4,041 | -2,525 |
| Processed coffee | 17,676 | 20,012 | 14,872 | 2,336 | 5,140 | -2,803 |
| Mineral water | 18,939 | 19,989 | 15,270 | 1,050 | 4,719 | -3,669 |
| Processed rice | 21,766 | 19,950 | 15,856 | -1,816 | 4,095 | -5,911 |
| Mixed olive oil | 4,732 | 19,522 | 15,645 | 14,790 | 3,877 | 10,913 |
| Sauces and other condiments | 13,184 | 17,556 | 13,787 | 4,373 | 3,769 | 603 |
| Prepared vegetables LQ | 10,093 | 15,622 | 12,110 | 5,529 | 3,512 | 2,017 |
| Peeled tomatoes LQ | 13,584 | 15,545 | 11,996 | 1,961 | 3,549 | -1,588 |
| Wine > 2 lt LQ | 10,424 | 14,878 | 11,765 | 4,454 | 3,113 | 1,341 |
| Fruit juices LQ | 11,722 | 12,149 | 9,841 | 427 | 2,308 | -1,881 |
| Pasta LQ | 9,933 | 11,711 | 9,510 | 1,778 | 2,201 | -423 |
| Sparkling wine | 9,575 | 10,581 | 8,069 | 1,005 | 2,512 | -1,507 |
| Prepared fruit LQ | 7,141 | 9,536 | 7,066 | 2,394 | 2,470 | -75 |

LQ = Low Quality (
Source: our elaboration on WB and UN data

Furthermore, the ranking seems to confirm the general hypothesis on which the sophistication measure is built: at the top of the spectrum there are products for which brand, technology and other features included in the sophistication concept are clearly present and intense (i.e. cheese, ice creams, meat cuts, confectionery and chocolate products). On the other end of the spectrum, at the bottom of the range, there are more basic or less processed products (i.e. wine in large bottles, that is in a lower position in the ranking than wine in small bottles; lower quality olive oil; processed or preserved fruits and vegetables; pasta; sparkling wines). It must be said that the relatively low value of the Prody index for sparkling wine is not convincing though it is clear that the value is the result of a highly skewed distribution of RCA due to a very small number of large exporting countries (with high per capita GDP but not much specialized, i.e. without high RCA value for sparkling wines) and a number of small exporting countries relatively more specialized in these exports (and with low per capita GDP).

It is also worth highlighting that for 19 out of the 26 products considered, Italian exports turned out to be of “high quality” on the base of their unit values that are above the world median (see section 2). For the other 7 products, Italian exports are classified “low quality” (i.e. vermouth, prepared vegetables, peeled tomatoes and paste, wine > 2lt, fruit juices, pasta and prepared fruit). It is also worth underlining that, compared to 1996/97, only 2 products change the levels of quality: “fruit juices” shifts from high to low quality , while “sparkling wine” shifts from low to high. Finally, we note the concentration of relatively low quality Italian exports at the bottom of the sophistication ranking. Thus, both the unit values and the sophistication index seem to confirm that for these products competition is more on price than on

attributes with respect to the ones ranked at the top of the distribution.

The dynamic analysis provides additional understandings. Prody index increases for almost all the products in the time span observed, although the extent of the variation widely differs (Table 2 and Figure 2).

Figure 2 allows us to roughly identify different behaviours among the products under study:

- Two products ("Grated cheese" and "Mixed olive oil") face an outstanding increase of the Prody index, much higher than any other in the sample, though they start the period at different levels of sophistication;
- A second, large group includes products with different level of sophistication and a steady increase of the index (the variations are comprised between 4,000 and 7,000 US $): "Confectionery", "Fresh pasta", "Prepared vegetables", "Herbal cheese", "Meat cuts", "Wine < 2lt", "Wine > 2l"t and "Sauces" ;
- The remaining products (with the two exceptions discussed below) also increased their sophistication index during the period but to a far less extent (400-3000 US $);
- Finally, there are two products whose Prody index decreased (both lie slightly below the line), namely "Fresh cheese" and "Processed rice". Also in this case, like in the previous ones there is no correlation between the index value at the beginning of the period and the amplitude of the variation.

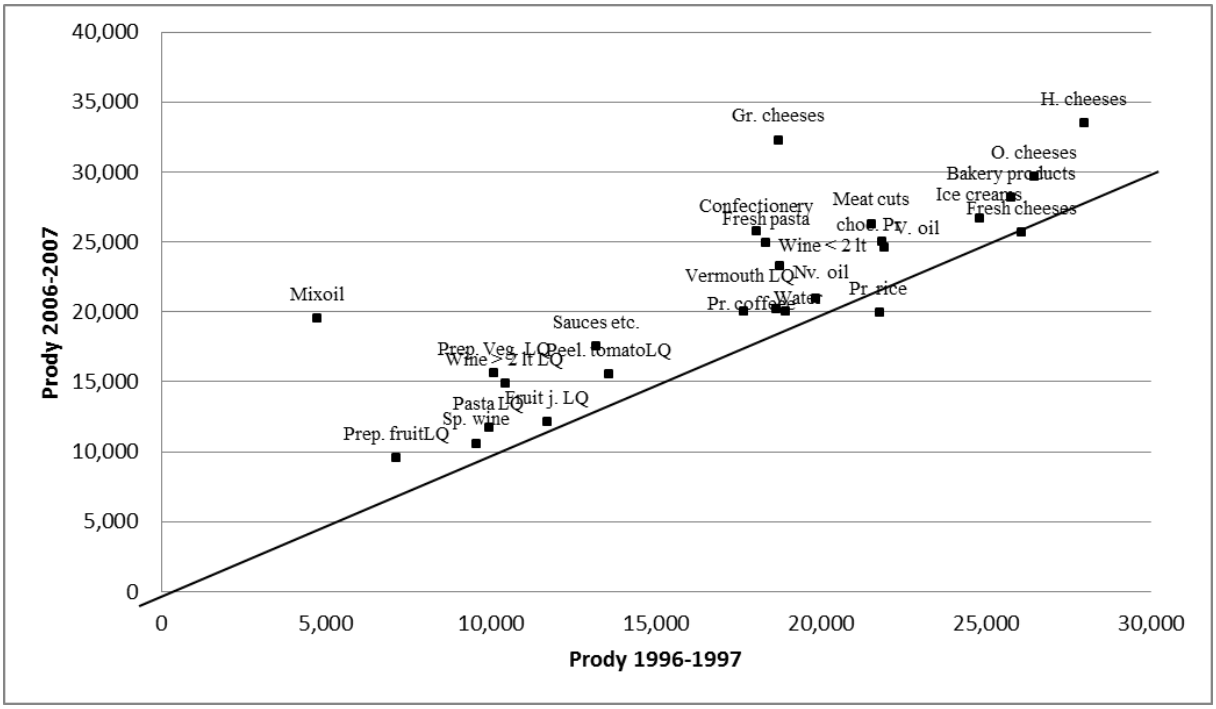


**Figure 2.** Prody index for Italian selected agri-food exports (Constant 2005 USD in PPP

Table 2 and Figure 3 allow us to analyse the two different components of the Prody variation, the so called "GDP effect" and "GEO effect" (see section 2). In our set of products the Prody index always includes a positive and significant trend linked to the increase of GDP. Vice versa, countries' specialization moved in different directions: in some cases it gives a positive contribution to the sophistication growth. This happens when rich countries enter the international market for that product and/or increase their specialization. Grated cheese and Mixed olive oils show the wider positive "GEO effect" in the sample and this explains the intense overall dynamic of the Prody index previously highlighted. Also positive, though relatively smaller variations of the "GEO effect" are observed for "Fresh pasta", "Confectionery", "Prepared vegetables", "Sauces" and "Wine >2lt.".

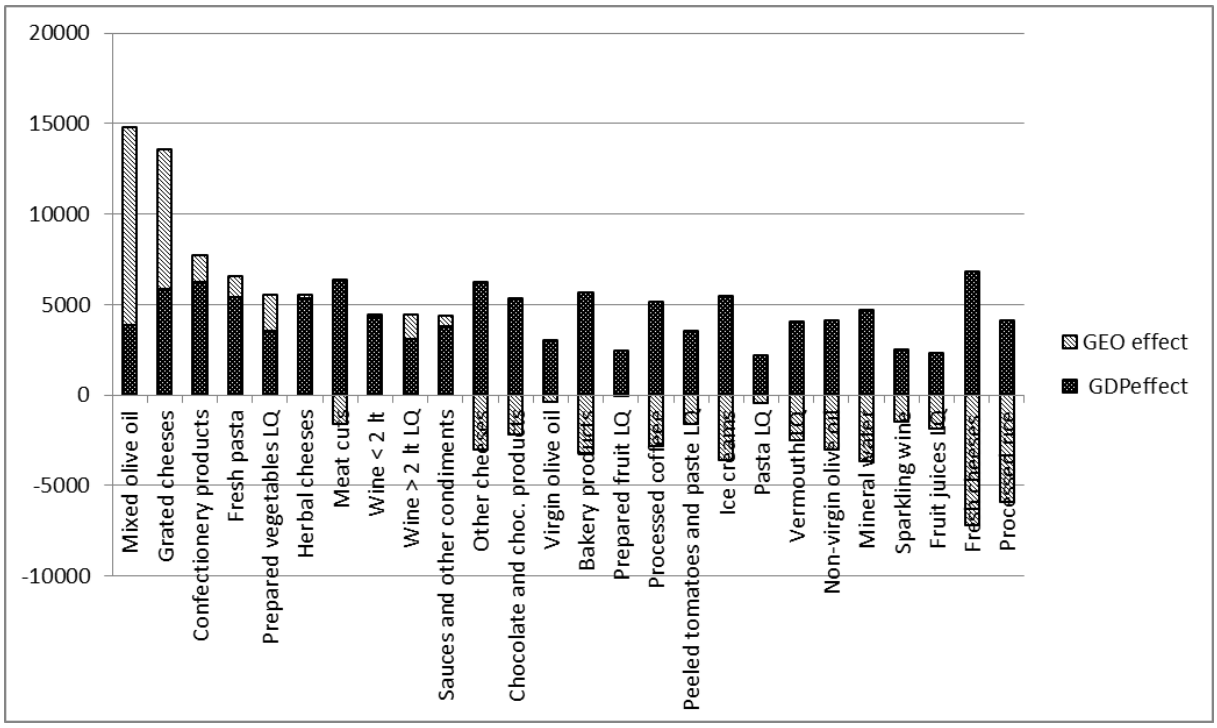


**Figure 3.** Prody index and its components. Variations 1996-97/2006-07

Most frequently, however, the re-localization dynamics has been towards countries with lower GDP and, hence, had a negative effect on the Prody index. This means that at the world level there has been a wide shift in the localization of production (and export) of these products towards poorer countries that may well compete with Italy on a price base. This has been particularly strong for "Fresh cheese" and "Virgin Olive Oils", followed by "Processed coffee", "Other cheese", "Bakery products", Ice creams", "Mineral water" and many others. The dimension of this effect varies considerably from case to case and it is not possible to find any relation with the direction of the movement as well as any specificity either of the product or of the production process. In any case, this re-localisation can be a serious threat to Italy due to its special difficulties in reducing production costs.

The analysis of sophistication gives an overall idea of how the world market is evolving for the products under study. Let's now give a closer look at the dynamics of the Italian performance.

To this aim, in Figure 4 the growth rate of the Prody index is compared with the dynamic of the Italian RCA for each product in our selection. The interpretation of the graph is as follows: in the top-right quadrant (positive trend both in the RCA and in the Prody index) there are products for which Italy is increasingly competitive in progressively more sophisticated markets that adequately remunerate inputs used in the production process. In this quadrant that tells, let's say, a virtuous story, we find the majority of the studied products, 14 out of 26. These are: "Sauces", "Meat cuts", "Mineral water", "Virgin olive oil", "Ice creams", "Chocolate products", "Peeled tomatoes", "Pasta", "Wine <2lt", and some categories of cheese. Lastly, "Prepared vegetables", for which a relevant increase in sophistication has been registered, lay exactly on the X axis due to a flat trend in RCA.

The bottom-right quadrant associates a positive growth of the Prody index with a decrease of the RCA. This means that while at the world level the market for these products has become more sophisticated and allows for better remuneration, Italy has not been fully able to engage this competition. This is the case for a number of products: "Wine > 2lt", "Confectionary", "Fresh pasta", "Bakery", "Sparkling wine", "Fruit juice", "Non virgin olive oil", "Prepared fruit" and "Mixed olive oil" (this last one does not appear in the graph as it is an outlier due to its huge increase in the Prody index).

In the left side of the graph there are only two products. In the upper half (positive variation of RCA and negative variation of Prody index there is "Fresh cheese", a product that, as already seen, is facing a slight reduction in sophistication and for which Italy is increasing its export specialization. In the bottom half (negative variation of both the indicators) a decrease of sophistication is accompanied by a loss of specialisation. Here there is only "Processed rice" whose market is driving towards stronger price competition from which Italy is apparently lagging behind.

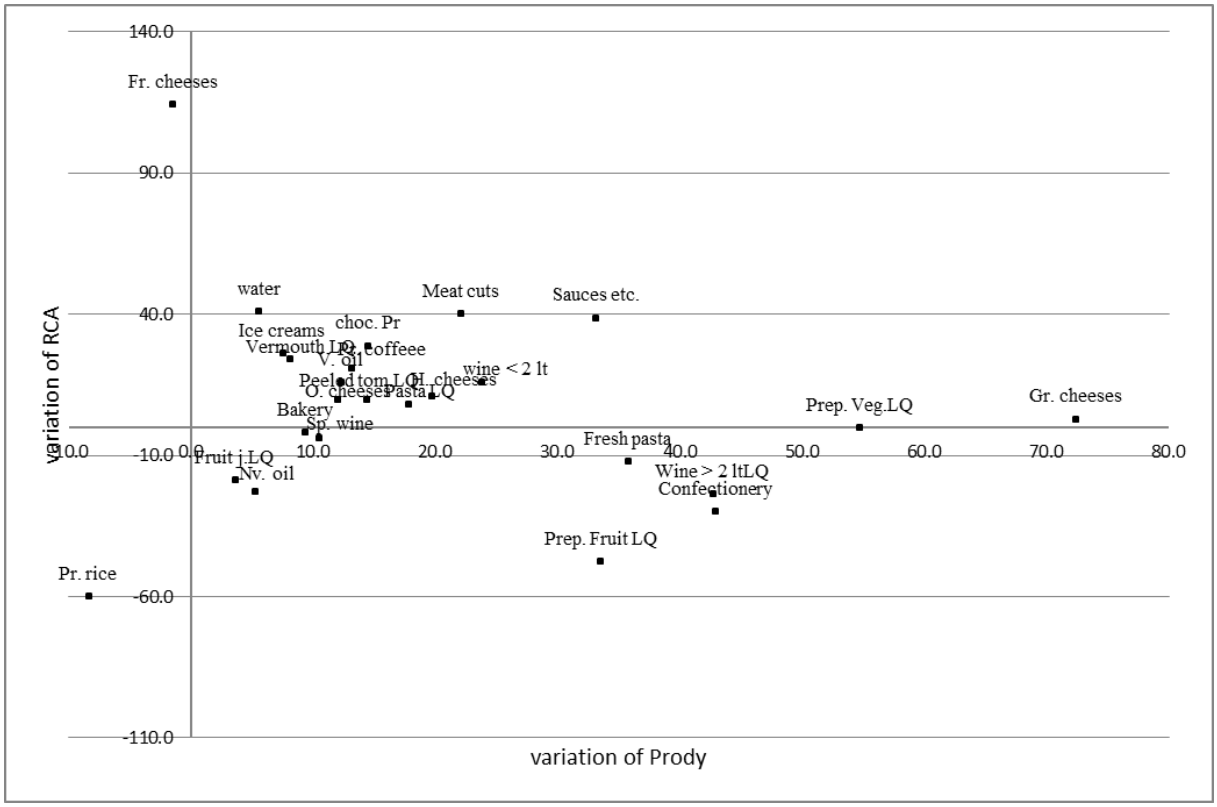


**Figure 4.** Variations (%) of Prody and RCA indices (1996-97/2006-07)

It is worth noting that, among the selected products, for only one of them does Italy show a loss of revealed competitive advantage while the world market sophistication level is increasing: "Fresh cheese". This positive result is even more noticeable if compared to the different results obtained for Italy when considering the other agri-food products not included in the set of this study (Carbone et al., 2009). For many of those items an increasing level of sophistication corresponded to a clear loss of the Italian comparative advantage.

## 4 Concluding Remarks

The analysis is based on the use of a sophistication measure for exports – known as the Prody index – that gives some cues about the kind of competition that products are going to find in world markets. The index sums up a very large set of data, it is easy to process and it gives an immediate synthetic idea of product ranking with respect to sophistication. Furthermore, the combination of this index with more traditional ones (i.e. NTB, RCA, shares and UV) offers a more sound assessment of the export performance of processed and export-oriented Italian agri-food products. The exercise here proposed, that focused on a single sector at a high disaggregation level, also shows the versatility of the index and its capability to be a useful tool for detailed trade analysis. Furthermore, focusing only on processed products allows to substantially avoid the distortions that may arise by applying the sophistication indices to products that are deeply dependent on natural resources and other localisation factors, not caught by the sophistication concept (Carbone et al., 2009). In addition to that, Made in Italy food products seem to well fit the sophistication concept also due to increasingly importance of differentiation and quality (both of the final product and of the processing process) as competitive leverages.

For the 26 selected items the Prody index range is quite wide, nevertheless they are overall in the upper part of the Prody distribution of the total agri-food exports. Furthermore, comparing the top ranked products to the ones ranked at the bottom it is clear that the first ones tend to be more processed, high value products for which segmentation, technology and branding are important, while at the bottom we find comparatively simpler and less processed products. This result is consistent with the hypothesis upon which the sophistication measure is built: more sophisticated goods are produced and exported mainly by richer countries.

Coming to the results specifically referring to the Italian Trade Balance, it has been found that, in the selected basket of products, the majority are relatively high UV (19 out of 26) and that these are mostly concentrated at the top of the sophistication ranking. Yet, among the items that are in the lower part of the Prody distribution, there are 7 of them that are classified as Low Quality according to their UV. In other words, for these products, the two indicators (Prody and UV) converge in indicating that Italy tends to compete more on segments where prices are relevant, reducing the possibility to gain a better remuneration for its resources.

The dynamic analysis gives more meaningful insights. In particular the decomposition of the index variation in two different effects – that we called "GDP-effect" and "GEO-effect" – shows that, on the one hand there has been a generalised upwards shift of GDP as one could expect in the time period observed. On the other hand, though, the "GEO-effect" was very much mixed with a prevalence of negative values. This result indicates that a re-localization process has been in place at the world level, with shifts of production and export of many food products towards poorer countries that may well compete on a price base, while for some others an opposite tendency has been highlighted.

The results for the so-called hard core of Italian agri-food exports show that this sector is, overall, in good health and that the level of sophistication of the majority of items is actually an important element of its capacity to be competitive on the international markets and to adequately remunerate inputs. There is a group of products for which international markets are moving towards higher sophistication levels and, at the same time, Italy is increasingly competitive in the international arena as it is shown by rising Revealed Comparative Advantage. These products have a strong national identity, a well settled reputation, and a high quality level. Good examples are "Wine<2lt", "Grated cheese", "Processed coffee", "Pasta", "Bakery products", "Virgin Olive Oil" and "Sauces". For this bundle of products, Italy has proved to be able to compete in international markets where the sophistication level is increasingly high.

Unfortunately, the analysis also highlighted some potential weaknesses. Besides the low quality level of some export flows, other elements emerge when looking at the Prody dynamics in conjunction to the Italian RCA dynamics. There are some products for which it has been observed that, on the one hand, international competition is increasingly based on the sophistication ground and, thus, are likely to bring increasing opportunities for higher remuneration; on the other hand, for these very products Italy is losing ground in international markets. In other words, some exported items within the Italian Food Trade Balance seem no more capable to compete in markets where the competition is becoming more and more sophisticated. These exports have an overall less strong Italian identity and/or are less rooted in place of origin and traditional local culture. As a consequence, on the one hand, these Italian products meet a more intense international competition in world markets that are less segmented by country of origin; on the other hand, for these products factors like innovation, customer care, distribution channels are important drivers of the competitive struggle. With regard to these aspects, the Italian agribusiness system is persistently penalised by many constraints among which it is worth to recall: *i*) small size of farms and firms; *ii*) scarce attitude/tradition in cooperation sector; *iii*) ineffective public intervention for structural adjustment and in favour of public goods, such as: delays in the modernisation of the legislation on the retail sector that are still affecting the chain structure and performance; insufficient funds for public research in food sector as well as inadequate incentives to private research; absence of any effective coordination action for such a complex chain structure. Altogether, these factors have contributed to determine: a) insufficient investments in R&D (due to lack of scale and scope economies and in search for complementarities in new piece of innovations); b) lack of large globalised retail chains able to compete with those of major competitors countries that benefit of worldwide retail chain that convey and push national production in foreign markets; c) difficulties in defining and coordinating strategies to promote the reputation of Made in Italy food through opinion leaders and chain actors, such as big buyers, oenologists, specialised journalists, restaurant reviewers and so on. The consequence is a jeopardised and unstable reputation, a faint feedback from the market and slow and not proactive attitude to act and react in a fast changing competitive environment.

## Acknowledgments

Financial support received from the Italian Ministry of Education, University and Research (Scientific Research Program of National Relevance 2007 on "European Union policies, economic and trade integration processes and WTO negotiations") is gratefully acknowledged. The Authors wish to thanks the members of the group for the comments given during the research group seminars.

## References

Carbone, A. (1994). Il commercio con l'estero dei prodotti agroalimentari made in Italy. *Rivista di Politica Agraria*, **2**: 13-25.

Carbone, A., Henke, R., and Subioli, G. (2009). Gli indici sophistication nell'analisi del commercio agroalimentare. *Rivista di Economia Agraria*, **LXIV** (3-4):, 359-400.

Di Maio, M., Tamagni, F. (2008). L'anomalia del modello di specializzazione italiano e l'evoluzione del commercio internazionale. *QA–Rivista dell'Associazione Rossi-Doria*, **3-4**: 5-28.

Fisher, C. (2010). Food quality and product export performance: an empirical investigation of the EU situation. *Journal of Food and Agribusiness Marketing,* **22** (3): 210-233.

Fontagné, L., Freudenberg, M., Ünal-Kesenci, D. (1999). Trade in technology and quality ladders:where do eu countries stand?. *International Journal of Development Planning Literature*, **14** (4): 561-582.

Gehlhar, M.J., Pick, D. H. (2002). Food trade balances and unit values: what can they reveal about price competition?. Agribusiness 18 (1), 61-79.

Hausmann, R., Hwang, J.,and Rodrik, D. (2007). What you export matters. *Journal of Economic Growth*, **12** (1): 1-25.

INEA-Istituto Nazionale di Economia Agraria, (2009). Il commercio con l'estero dei prodotti agroalimentari. Rapporto 2008. Napoli, Edizioni Scientifiche Italiane.

Ketels, H.M. (2006). Michael Porter's competitiveness framework-recent learning and new research priorities. *Journal of Industry Competition and Trade*, **6** (2): 115-136

Lall, S., Weiss, J., and Zhang, J. (2006). The "sophistication" of exports: a new trade measure. *World Development*, **34** (2): 222–237.

Lebre De Freitas, M., and Salvado, S. (2009). Industry similarities and comparative advantages in Portugal: an empirical assessment based on 2005 trade data. GEE papers, 0010. Available at: http://ideas.repec.org/p/mde/wpaper/0010.html

Minondo, A., (2007). Exports' quality-adjusted productivity and economic growth. Available at: www..etsg.org/ETSG2007/papers/minondo.pdf

Ninni, A., Raimondi, M., and Zuppiroli, M. (2006). On the success of "Made in Italy": An appraisal of quality-based competitiveness in food markets. Università di Parma-Italy WP Series: Economia e Politica Economica 10/2006. Available at: http://ideas.repec.org/p/par/dipeco/2006-ep10.html

Porter, M. (1985). Competitive advantage: creating and sustaining superior performance. New York Free press, New York

Rodrik, D. (2006). What's so special about China's exports?. NBER Working Paper, 11947. Available at: http://www.cebc.org.br/sites/500/522/00000017.pdf

Schott, P.K. (2004). Across-product versus within-product specialization in international trade. *Quarterly Journal of Economics*, **119** (2): 647–678.

Sterns, J. A., Spreen, T.H. (2010). Evaluating sustainable competitive advantages in Brazilian and U.S. processed citrus supply chains: an application of porter's diamond framework. *International Journal of Food Systems Dynamics* **1**(2): 167-175

## Appendix

Below a simplified example of calculations for static Prody and its dynamics is given. Due to space constraints the example is limited to one product (namely, Grated cheese of High Quality), data are given for only two countries (Italy and Denmark, that are major exporters of this product), while the final result is obviously related to the whole set of countries exporting Grated cheese:

Calculation of Prody Index for Grated Cheese-High Quality, year 2006-07 (mean)

| data/ calculations | gr. Cheese exports | tot. Food exports | $GDPpc_j$ | $RCA_{ij}$ | $\Sigma_j RCA$ | $s_{ij}$ | $Prody_{iq}$ |
|---|---|---|---|---|---|---|---|
| | current USD | | in PPP-2005 USD | | | | |
| Italy | 162,219,462 | 17,972,480,879 | 28,219 | 3.4860 | | 0.1412 | |
| Denmark | 88,168,132 | 2,969,421,234 | 34,828 | 11.4675 | | 0.4645 | |
| … | … | … | … | … | | … | |
| … | … | … | … | … | | … | |
| World* | 434755168 | 167908678573 | | | 24.6894 | | 32,278 |

* Italy and Denmark are 2 of the 31 countries exporting High Quality grated cheese; the other 28 export Low quality (7 out of the total 76 countries present in the Database export none). The median of the Unit Value is 5.2 USD, Italian UV is 8.5 USD and Denmark UV is 5.7 USD.

Decomposition of Prody time trends for Grated Cheese

| products | PRODY 96/97 | PRODY GDPcorr 06/07 | PRODY GDPcost 06/07 | total variation | GDPeffect | GEO effect |
|---|---|---|---|---|---|---|
| | a | b | c | d=b-a | e=d-f | f=c-a |
| Grated cheeses | 18,723 | 32,278 | 26,436 | 13,555 | 5,842 | 7,714 |