Export quality in the machinery sector: Some evidence from main competitors

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Abstract

The paper compares the export quality of Italy, Germany, Japan and China. The empirical analysis is based on export unit value for a sample of machinery products exported to the USA over the decade 1996-2006. The results point to four stylised facts. First, Italy, Germany and Japan are positioned in production with high unit value. Second, some evidence of qualitative upgrading of Italian exports is found in the machinery industry. Third, German exports show the highest quality in all the machinery divisions. Finally, China has dramatically increased its medium-high technology exports in the course of the decade, but these are concentrated in the lowest quality segment of the market. Nevertheless, Chinese unit value of machinery exports are rising over time, suggesting a qualitative catching-up.

Keywords: Export Quality, Machinery Sector, Index Numbers
JEL Classification: F14, L1, C43

1. INTRODUCTION

In the debate on the decline of the Italian economy, the link between the slowdown in growth and the changes in international markets has been given particular attention. Italy has been affected by the recent dynamics in international specialisation, with particular reference to changes in the comparative advantages of China and other newly industrialised countries[1].

Since the mid 1990s, Italy's performance in foreign markets has, in fact, worsened, as is shown by the decreasing Italian share of total world exports. The most significant negative changes have occurred in the *Made in Italy* industries (textiles and clothing, footwear, furniture and building materials), whereas positive variations have taken place in the production of steel, industrial machinery and road vehicles (ICE, 2007).

Since these trends can be observed even if a longer period is taken into consideration, a specialisation model is configured which sees a weakening of the comparative advantage of traditional *Made in Italy products* and a strengthening of some divisions of the machinery sector. This evidence, and the relevant size of the machinery industry[2], leads to this sector's being considered as one of the strong points in the Italian economy's model of international specialisation.

Some studies (Baldwin and Harrigan, 2007; Scott, 2004) underline how specialisation in terms of quality plays an important role in the dynamics of competition between developed and developing countries and, therefore, how an analysis which only takes into account exports in volume terms would be misleading.

However, it is not easy to realise a measure of "objective" quality, since product quality incorporates elements which are difficult to synthesize into a single variable. In the specific case of international trade, the quality of exported goods can be measured in terms of unit value.

In effect, the unit values of Italian exports have grown, in all sectors, at a rate which is greater than that of production prices. Such a phenomenon is true not only for the mechanics and machinery appliances sector, but also for the principal areas of specialisation (Textiles and clothing, Leather and footwear, and Furniture) (ICE, 2007).

Several studies seem to suggest a process of qualitative upgrading of Italian exports: firms have reacted to international competition, repositioning their supply to foreign markets towards higher

[1] For example, Faini and Sapir (2005) show how the loss of competitiveness and Italy's slow growth over the last decade depend substantially on the model of specialisation, biased toward low technological products, hence particularly exposed to competition from emerging countries.

[2] In 2006, the machinery sector represented 13.5% of industrial production and 20.7% of total Italian exports (ICE, 2007). Furthermore, as a result of the positive balance of trade in mechanical products (almost 50 billion euros), Italy recorded a substantial equilibrium in foreign trade in 2007, as opposed to a primary structural deficit of about 60 billion euro due to the importing of natural resources. In the first months of 2008, too, the *performance* of Italian machinery exports continued to be satisfactory, even though different indicators have shown continuing marked losses in the competitiveness of Italian products.

quality products and no-price competition market segments (Lanza and Quintieri, 2007; Quintieri, 2007a; Quintieri, 2007b; Foresti, Guelpa and Trenti, 2007; Lamieri and Lanza, 2006; Lanza and Stanca, 2006; De Nardis and Pensa, 2004; Amighini and Chiarlone, 2003). Most of these works have concentrated on *Made in Italy* sectors (Armenise *et al*, 2007; Borin and Quintieri, 2007; Colacurcio, 2007; Marianera, 2007; Mosca and Oddo, 2007; Olearo, 2007). Less attention has been given to the machinery industry, as underlined by Lissovolik (2008), even though this sector has grown in importance relative to some traditional sectors and has brought Italian specialisation closer to that of the other industrialised countries[3]. This tendency would diminish the anomaly of Italian specialisation, the only industrialised country still specialised in sectors with a high intensity of unskilled labour (Bugamelli, 2001).

This paper provides empirical evidence of this qualitative upgrading in the machinery and transport equipment sector. The dynamics of the unit value of exports signals an on-going restructuring of the Italian industrial system through a qualitative improvement in supply.

The analysis refers to the main export destination market for machinery products, the USA, over the 1996-2006 period. Furthermore, the great penetration of Chinese exports into this market allows comparison of Italian *performance* with that of one of the main developing countries[4]. Moreover, Germany and Japan, two of Italy's traditional competitors, were also considered.

This paper is organised as follows. Paragraph 2 presents the methodology and the data. Paragraph 3 describes the commercial position of Italy and its principal competitors in the machinery sector. Paragraph 4 analyses the quality of exports. Finally, there are some concluding remarks.

2. METHODOLOGY AND DATA

The empirical analysis concentrates on export quality. As underlined in the literature, product quality is a complex, difficult-to-measure, variable, since it incorporates all the tangible and intangible characteristics which influence the consumer's economic evaluation (Aiginger, 2001). A measure of "objective" quality is difficult to realise, while it is possible to measure perceived quality through the price which the consumer is willing to pay (Stiglitz, 1987).

In this work, the unit value (UV) of exports, defined as the ratio between the value and the quantity of exports, is used as a proxy of prices.

[3] Mechanical goods, except for appliances for domestic use which are included in consumer goods, come into the category of investment goods, while in the PAVITT classification these are considered, with some exceptions, amongst specialised suppliers and science based sectors.

[4] Considering a high income country as the United States, notice that the prices of goods exported by advanced countries might be higher than those from developing countries, even without differences in quality (Feenstra *et al*, 2004; Schott, 2004).

Unit values have the advantages of being available for a high number of countries and for a good level of disaggregation.

The use of UV has, though, some limits. Price, in fact, would represent a more appropriate indicator of quality since two products sold at the same price, if different in physical weight, might have different unit values. This holds mainly for some products such as, for example, machinery and transport equipment. Therefore, some caution should be taken in interpreting the results. However, as underlined by Capotorti (1983), it may be reasonable to suppose that the unit value of the lighter product, probably made of a lighter material or by saving on material, might reflect higher quality. The second limit is that UV above that of competitors may indicate either high quality or a worsening of price competitiveness. This ambiguity can be overcome if, over a long time period, the unit export values remain significantly above those of competitors. If a producer sells his products at higher prices than his competitors over a long period of time, it is reasonable to suppose that this can be done because the products possess one or more additional qualitative characteristics valued by buyers (Borin and Lamieri, 2007).

The price-quality indicator used in this work is given by:

$$PQ_j^t = \frac{\sum_g v_{gj}^t}{\sum_g q_{gj}^t} \qquad j = i, W \qquad (1)$$

where v_{gj}^t is the value of the exports of good *g* by country *j* at time *t* and q_{gj}^t represents the quantity.

Following the methodology introduced by Capotorti (1983) and applied by Borin and Lamieri (2007), the quality of the goods exported by each country is compared by using the index of price-quality difference or relative quality index. This index quantifies, at time *t*, the difference in terms of price and/or quality between the exports of country *i* and those of competitors, e.g, world (W), on the destination market:

$$\Gamma PQ_i^t = \frac{PQ_i^t - PQ_W^t}{PQ_W^t} \qquad (2)$$

It is positive if the price and/or quality of the exported goods from country *i* to the destination market is higher than that of the competitors.

This indicator is the result of three effects. First, a country may export at higher UV than that of competitors. Secondly, a country's exports may be concentrated in products which might be sold at higher UV on the world market. Finally, a country may be specialised in those products that sell at a higher UV than those of competitors.

According to Capotorti (1983) and Borin and Lamieri (2007), these three effects may be measured by separating the index of relative quality into internal difference (ΓP), composition difference

(ΓC) and combined difference (ΓCB), following a methodology analogous to that of "*Constant Market Shares*"[5].

The formula is:

$$\Gamma PQ_i^t = \Gamma P_{i_t} + \Gamma C_i^t + \Gamma CB_i^t \qquad (3)$$

The "internal difference" is determined in the following way:

$$\Gamma P_i^t = \sum_g \frac{q_{gW}^t}{\sum_g q_{gW}^t} \cdot \frac{P_{gi}^t - P_{gW}^t}{PQ_W^t} \qquad (4)$$

$$\text{with } P_{gj}^t = \frac{v_{gj}^t}{q_{gj}^t} \quad j = i, W$$

If positive, it indicates that, given equal commodity composition, an exporting country sells its products in a specific sector at a higher UV than that of world exports.

The "composition difference" is expressed by:

$$\Gamma C_i^t = \sum_g \frac{P_{gW}^t - PQ_W^t}{PQ_W^t} \left(\frac{q_{gi}^t}{\sum_g q_{gi}^t} - \frac{q_{gW}^t}{\sum_g q_{gW}^t} \right) \qquad (5)$$

A positive value points out that the export shares of commodities with greater world UV are higher for country *i* than for competitors.

The" combined difference", defined as:

$$\Gamma CB_i^t = \sum_g \frac{P_{gi}^t - P_{gW}^t}{PQ_W^t} \cdot \left(\frac{q_{gi}^t}{\sum_g q_{gi}^t} - \frac{q_{gW}^t}{\sum_g q_{gW}^t} \right) \qquad (6)$$

shows whether the country is specialised in commodities with higher UV than average world export UVs, suggesting possible market power.

The variation of these indicators, calculated for each period, may be used to evaluate changes in relative quality.

This paper takes into consideration the machinery exports of Italy, Germany, Japan and China towards the US market over the 1996-2006 period considering the world as competitor. The empirical analysis is based on data about exports in terms of value and volume at the 6-digit level of the "Harmonised System" (HS-1996) classification from the United Nations Comtrade data bank.

The analysis considers all the 6-digit items of HS classification belonging to section 7 of the Standard International Trade Classification (SITC), namely the machinery sector, identified through the correspondence table between these two classifications.

[5] *Constant Market Shares* is a method of quantitative analysis which allows to measure how the dynamics of a country's exports are effected by their product composition, their market share and their competitiveness.

For a comparison between each country and the world, the analysis refers only to products exported towards the USA by all the four countries[6].

The data are aggregated at the 2-digit SITC (Rev. 3) level.[7]

3. DESCRIPTIVE ANALYSIS

3.1 An overview of machinery exports

Traditionally, Italy's main competitors in the machinery sector are Germany, the USA and Japan, which represent the three largest exporters of machinery products[8] (table 1). In recent years China has moved from 17th (with 1.7% of world exports) position in 1996 to 3rd position in 2006 (with a share of 9.2%) in the international ranking. Italy reach 10th position. However, this position changes significantly if a greater level of disaggregation is considered. Considering the *Trade Performance Index* of the *International Trade Centre* (UNCTAD-WTO), Italy is in 2nd position in the Electronic Components and Non-electronic Machine category (table 3).

TABLE 1 - *Top exporters in the Machinery sector (% share of world exports)*

COUNTRY	2006 Ranking	Share	2001 Ranking	Share	1996 Ranking	Share
Germany	1	11.0	2	11.9	3	12.3
United States	2	9.9	1	15.2	1	15.0
China	3	9.2	8	3.8	17	1.7
Japan	4	8.3	3	11.0	2	14.0
France	5	4.0	4	5.3	4	5.7
Republic of Korea	6	3.9	10	3.5	9	3.3
United Kingdom	7	3.8	5	4.7	5	5.6
China, Hong Kong	8	3.5	12	3.1	10	2.9
Singapore	9	3.1	11	3.2	7	4.0
Italy	10	3.1	9	3.7	6	4.7

Source: elaborations on Comtrade data (UN)

In 2006, the main destinations of mechanical exports were the USA with a value of imports of 724 billion dollars, followed by China ($ 357 billion) and Germany ($ 341 billion).

[6] Product codes with no quantity information, or whose quantity entries are lower than 50 kg for one country, are dropped.

[7] World exports have been calculated using the "World Aggregate" proposed by the United Nations Statistics Division. For a list of the countries, see http://comtrade.un.org/kb/article.aspx?id=10224&query=world. For a detailed description of product types included in each 2-digit SITC sector, information is available on request.

[8] Germany, the USA and Japan accounted for more than 40% of world exports in 1996 and 30% in 2006.

Similarly, the United States are the principal export destination for Germany, which exports 11% of its mechanical products to this market, Japan (27%) and China (22%), while, for Italy, they represent the 3rd destination market (7.2%)(table 2).

TABLE 2 - *Main destination markets for Italy, Germany, China and Japan (2006)*

Country	**Market**	**Share (%)**
ITALY	Germany	12.8
	France	11.4
	United States	7.2
	Spain	7.1
	United Kingdom	6.1
	Total	*44.6*
GERMANY	United States	11.0
	France	9.5
	United Kingdom	8.1
	Italy	6.3
	Spain	5.2
	Total	*40.1*
JAPAN	United Sataes	27.1
	China	11.7
	Rep. Of Korea	4.9
	Other asian countries	4.9
	China, Hong Kong	4.8
	Total	*53.3*
CHINA	United States	22.2
	China, Hong Kong	20.6
	Japan	7.7
	Germany	5.2
	Low Countries	4.4
	Total	*60.0*

Source: elaborations on Comtrade data (UN)

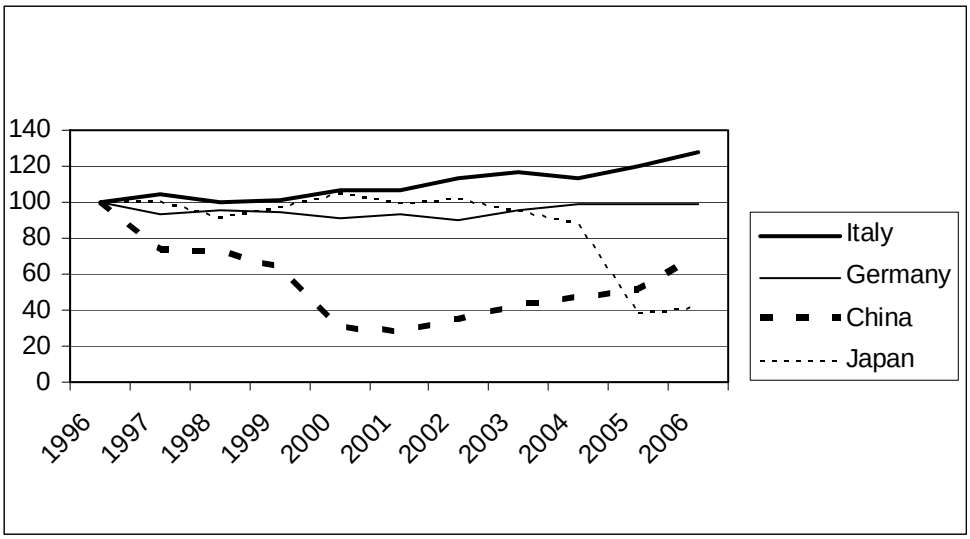
Figure 1 illustrates the trend of Italian exports in the Machinery sector by comparing Italian unit value (UV) with that of its main competitors in the US market[9].

As can be noted, the growth in prices applied by Italian exporters is clearly greater than that of competitors, in a context where dynamics have been constant, or even negative.

Figure 2 shows the dynamics of Italian UVs, exports value and volume between 1996 and 2006. Despite there having been an increase in the prices of exported goods of about 25%, the volume sold on the US market has increased, by more than 40% in 10 years.

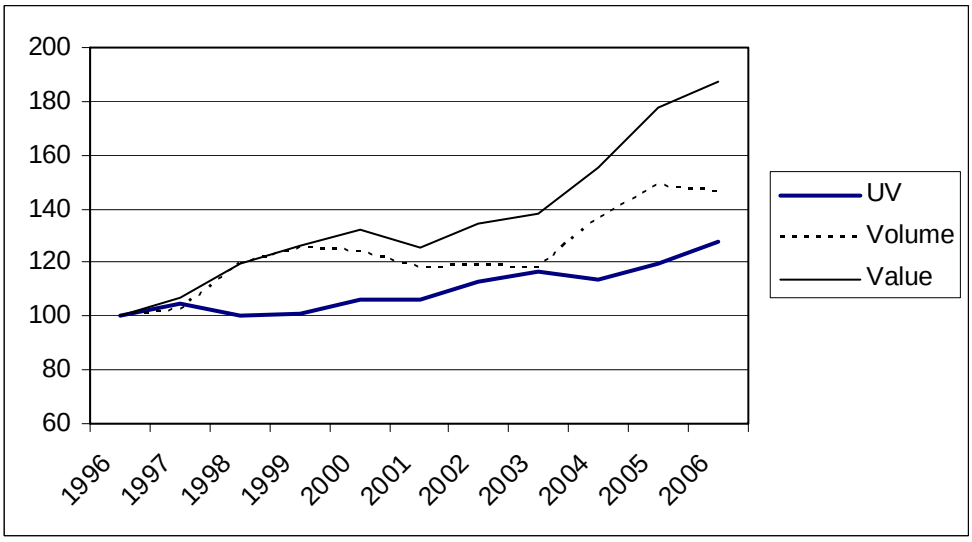
[9] In order to calculate UVs, all products included in SICT7 classification exported to the US by each country were considered.

FIGURE 1 - *Unit Values of the machinery exports towards the United States (1996=100)*



Source: elaborations on Comtrade data (UN)

FIGURE 2 - *Unit Value, volume and value of Italian machinery exports towards the United States (1996=100)*



Source: elaborations on Comtrade data (UN)

3.2 The competitive position of Italy and other major exporters

The competitive position of Italy and other major exporters, as described by the trend in exports shares (table 1), is confirmed by the *Trade Performance Index* (TPI) of the *International Trade*

Centre (UNCTAD-WTO) which measures each country's level of competitiveness in a specific export sector[10].

As can be seen from table 3, Italy performs well in the Non-electronic machinery and Electronic components categories for the entire period considered, occupying second position in the international ranking [11].

First position is occupied by Germany which exhibits a better performance in all categories, with the exception of "Office and telecommunication machines". In this category Japan had the best commercial performance until 2001, when its dominant position began to be eroded by the progressive entry of developing countries, particularly China, onto the world market. At the same time, in fact, China has made up ground both in the category of "Office and telecommunication machines" and in that of "Non-electric machines".

The commercial performance of China in the "Non-electric machines" category may be evaluated differently if net exports are considered[12]. In fact, the volume of imports exceeds that of exports, indicating a growing processing trade in this category which has helped China to export relatively sophisticated goods by assembling high quality imported products (Amiti and Freud, 2007).

[10] The *Trade Performance Index* covers 184 countries and 14 different export sectors. The index calculates the level of competitiveness and diversification in a particular export sector by using comparisons with other countries. In particular, it brings out gains and losses in world market shares and sheds some light on the factors causing these changes. Moreover, it monitors the evolution of export diversification for products and markets. The TPI is limited by its purely quantitative approach, although it does provide a systematic overview of sectoral export performance and comparative and competitive advantages. For more detail, see www.intracen.org/countries/toolpd99/tpi_tot.pdf.

[11] The classification used in the *Trade Performance Index* corresponds to the following items of the SITC Rev. 3 classification: the "Electronic components" aggregation includes Electrical machinery (77); "Office machines and telecommunication" include some Office machines and automatic data-processing machines (75) items and Telecommunications (76) products; "Non-electric machines" includes Power generating machines (71), Machinery specialized for particular industries (72), some items of Metalworking machinery (73) and of General industrial machines (74); "Transport material" includes Road vehicles (78) and some other transport equipment (79) items.

[12] As is known, the value of a country's net exports represents a reliable measure of its position in the world market, because re-exports, which would distort the data, are excluded. Secondly, the indicator considers the international divisions of productive processes, as many imported intermediate goods belong to the same sector as the final exported goods.

TABLE 3 - *Trade Performance Index Ranking (TPI) in the machinery sector*

	Exporting countries	2001	2002	2003	2004	2005
ITALY				**Ranking**		
Electronic Components	115	3	3	3	2	2
Office machines and telecommunication	103	27	23	25	25	24
Non-electric machines	137	2	2	2	2	2
Transport Material	121	17	15	15	16	18
GERMANY						
Electronic Components	115	1	1	1	1	1
Office machines and telecommunication	103	20	19	16	15	15
Non-electric machines	137	1	1	1	1	1
Transport Material	121	2	2	1	1	1
JAPAN						
Electronic Components	115	4	5	5	5	4
Office machines and telecommunication	103	1	2	4	5	9
Non-electric machines	137	8	8	8	10	8
Transport Material	121	7	8	4	3	4
CHINA						
Electronic Components	115	22	22	25	32	30
Office machines and telecommunication	103	2	3	3	4	3
Non-electric machines	137	30	29	25	28	24
Transport Material	121	31	29	27	29	31

Source: elaborations on International Trade Centre (UNCTAD-WTO)

Below we analyse the evolution of commercial specialisation in the machinery divisions using the Balassa index for the decade 1996-2006 [13]. As known, if the Balassa index is above 1, the country has a Revealed Comparative Advantage in the division considered (tab. 4).

Italy has the largest comparative advantage in the division of Machinery specialized for particular industries (72), followed by Metalworking machinery (73), Other transport equipment (79) and, with a positive trend over the considered decade, the division of General industrial machines (74)[14].

Germany and Japan had a comparative advantage in several machinery divisions, particularly in the "Non-electrical machinery" division (72, 73, 74), Road vehicles (78) and Other transport equipment

[13] The Balassa index is calculated as a ratio between the export share of the machinery sector with respect to the country's total manufacturing exports and the world export share of the same sector with respect to total world manufacturing exports, towards the USA, at the 2-digit SITC Rev. 3 classification.

[14] Italy, 2nd in the world ranking relative to commercial performance in the Electronic components aggregation (table 3), is not specialised in Electrical machinery (77) which, however, is part of this aggregation. This may be attributed to the fact that some subcategories of 77 division present an index which is lower than 1 (http://www.intracen.org/appli1/TradeCom/TP_EP_CI.aspx?RP=381&YR=2006).

(79). However, whilst it seems that in “Non-electrical machinery” Germany’s comparative advantage was reduced over the decade, that of Japan showed a positive trend for the same period. For Road vehicles and Other transport materials, on the other hand, the data exhibit a strengthening of commercial specialisation for both countries.

In some high technology categories, such as Office machines (75) and Telecommunications (76), over the decade Japan lost, in (75) from 2003 and in (76) from 2005, the comparative advantage which it held at the beginning of the period at the same time as China’s strengthening of its commercial specialisation in the same sectors. China, in fact, is specialised in Telecommunications (76) for the whole period and, with significant increases from 1998, in the Office machines sector (75).

TABLE 4 - *Balassa Index towards the USA in the machinery sector*

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
71 Power generating machines											
Italy	0,54	0,60	0,57	0,52	0,64	0,67	0,67	0,61	0,69	0,90	0,88
Germany	1,87	1,81	1,72	1,68	1,90	1,71	1,70	1,78	1,76	1,70	1,82
Japan	1,31	1,16	1,09	1,22	1,29	1,38	1,43	1,51	1,54	1,52	1,34
China	0,15	0,14	0,13	0,13	0,17	0,15	0,14	0,15	0,17	0,20	0,23
72 Machinery specialized for particular industries											
Italy	2,63	3,06	2,92	3,13	3,14	3,26	3,06	3,20	3,04	3,00	3,08
Germany	3,21	2,87	2,74	2,78	2,77	2,60	2,47	2,39	2,33	2,22	2,14
Japan	1,34	1,46	1,45	1,48	1,66	1,48	1,57	1,65	1,89	1,94	1,96
China	0,12	0,11	0,11	0,16	0,18	0,22	0,25	0,29	0,25	0,25	0,34
73 Metalworking machinery											
Italy	2,16	1,88	2,04	2,26	2,06	2,04	1,80	2,55	2,53	2,35	2,51
Germany	2,44	2,50	2,38	2,57	2,50	2,41	2,60	2,48	2,59	2,57	2,30
Japan	2,21	2,46	2,58	2,43	2,84	3,08	2,86	3,01	2,94	3,22	3,40
China	0,29	0,26	0,22	0,29	0,31	0,31	0,36	0,32	0,30	0,28	0,28
74 General industrial machines											
Italy	1,72	1,83	1,81	1,86	1,90	1,91	2,00	2,24	2,31	2,43	2,36
Germany	2,16	2,04	1,98	1,87	1,95	1,74	1,64	1,70	1,84	1,87	1,82
Japan	1,24	1,23	1,17	1,13	1,21	1,22	1,21	1,25	1,28	1,29	1,20
China	0,68	0,67	0,70	0,75	0,79	0,85	0,93	0,88	0,83	0,78	0,82
75 Office machines											
Italy	0,27	0,23	0,17	0,16	0,16	0,17	0,13	0,18	0,17	0,13	0,10
Germany	0,23	0,19	0,20	0,23	0,24	0,18	0,18	0,18	0,16	0,16	0,16
Japan	1,56	1,60	1,48	1,26	1,16	1,25	1,09	0,92	0,88	0,82	0,74
China	0,72	0,91	1,12	1,15	1,25	1,34	1,72	2,46	2,56	2,51	2,43
76 Telecommunications											
Italy	0,06	0,07	0,06	0,06	0,09	0,14	0,07	0,10	0,07	0,06	0,07
Germany	0,16	0,15	0,13	0,14	0,15	0,15	0,18	0,21	0,19	0,17	0,16
Japan	1,20	1,17	1,27	1,33	1,15	1,02	1,02	1,11	1,06	0,93	0,74
China	1,46	1,30	1,34	1,27	1,21	1,41	1,73	1,74	1,85	1,93	1,93
77 Electrical machinery											
Italy	0,41	0,30	0,28	0,23	0,33	0,36	0,44	0,41	0,49	0,37	0,43
Germany	0,72	0,70	0,67	0,67	0,73	0,80	0,89	0,98	0,99	1,06	1,02
Japan	1,16	1,05	0,98	1,02	1,08	0,98	0,88	0,84	0,89	0,88	0,87
China	0,54	0,61	0,67	0,78	0,77	0,96	0,96	0,88	0,85	0,85	0,87
78 Road vehicles											
Italy	0,26	0,25	0,26	0,21	0,23	0,23	0,25	0,30	0,35	0,41	0,43
Germany	1,32	1,47	1,57	1,53	1,59	1,53	1,68	1,78	1,68	1,77	1,68
Japan	1,55	1,57	1,66	1,68	1,77	1,90	2,07	2,06	2,06	2,18	2,42
China	0,13	0,10	0,14	0,15	0,17	0,16	0,15	0,19	0,23	0,22	0,20
79 Other transport equipment											
Italy	2,31	2,30	2,60	3,40	2,04	1,54	2,75	1,80	1,92	2,78	2,53
Germany	1,31	1,24	1,12	1,55	1,84	2,38	2,07	1,09	1,06	1,21	1,53
Japan	0,41	0,58	0,53	0,52	0,35	0,42	0,36	0,45	0,39	0,44	0,55
China	0,06	0,11	0,18	0,08	0,09	0,09	0,05	0,06	0,06	0,07	0,11

Source: elaborations on Comtrade data (UN)

Table 5 gives correlation coefficients between the comparative advantages in the Machinery sector in 2006. As can be noted, Italy and Germany exhibit a commercial specialisation which is very similar, as do Germany and Japan. China, on the other hand, is specialised in different divisions from those where the traditional exporters register significant comparative advantages.

However, China's Balassa index registers higher values at the end of the period than at its beginning in all of the Machinery categories, even in those where it is not specialised. This shows a repositioning of Chinese specialisation away from traditional sectors towards medium-high technology sectors, as it also pointed out by Spadafora (2007).

TABLE 5 - *Correlation Matrix, machinery sector, 2006*

	Italy	**Germany**	**Japan**	**China**
Italy	1			
Germany	0,76	1		
Japan	0,35	0,68	1	
China	-0,60	-0,89	-0,49	1

Source: elaborations on Comtrade data (UN)

4. QUALITY COMPETITIVENESS IN THE US MARKET

4.1 The Italian position

Several empirical studies have found some evidence that Italy is experiencing a process of quality upgrading in traditional *Made in Italy* sectors: food (Marianera, 2007), footwear (Borin and Quintieri, 2007), textiles and clothing (Armenise *et al*, 2007), furniture (Colacurcio, 2007), glassware and ceramics (Olearo, 2007) and jewellery (Mosca and Oddo, 2007). This work concentrates on the machinery sector (tab. 6).

The Italian relative quality index with respect to world competitors on the US market is generally positive over the 1996-2006 period or, from 2000 for Machinery specialized for particular industries (72) and for Electrical machinery (77). The only exceptions are those of Metalworking machinery (73) and Road vehicles (78). The positive value of the relative quality index would indicate that the difference in Italian UVs with respect to world UVs reflects an increase in the quality of goods. Evidence that the higher UVs relative to those of the rest of the world are a signal of higher quality and not lower competitiveness comes from export profitability of the machinery sector (excluding transport equipment), which exhibited a percentage change of 4% 2005[15] (ICE, 2007).

The breakdown of the relative quality index into its components, following the methodology presented in paragraph 2, shows the relevant contribution made by the internal difference indicator

[15] The data refer to all Italian exports and not just to those towards the US.

and the importance of the composition effect. The UVs of Italian exports have systematically been, on average, higher than those of competitors and, furthermore, Italy specialises prevalently in the products with the highest UVs in the world. The negative value observed in difference effect is an indicator that Italy is not specialised in products where UV difference between Italy and its competitors is most marked, with the exception of Other transport equipment industry (79). For this division combined difference index suggests that, over recent years, specialisation is shifting towards products with higher UVs.

For Metalworking machinery (73) Road vehicles (78), the favourable effect of internal difference does not translate into good export quality; this is due primarily to the combined difference component which suggests that, in these sectors, Italy is not specialised in the products which sell at a higher UV than competitors.

Figure 2 shows the relationship between relative quality (vertical axis) and specialisation indices (horizontal axis) in the machinery divisions. The relative quality was measured as the percentage variation of UVs for each country from the world UV over the last three years[16]. The specialisation index considered is the Balassa end-of-period index reported in table 4. The graph allows industries to be divided into 4 groups. The first group, in the first quadrant (top left), includes the "niche specialisations", characterised by high quality and low specialisation; therefore, the divisions in which the country only shows high quality in some products, the exports of which, however, are insufficient to determine a relevant market share. The second group includes the "top" sectors characterised by high quality and high share. In the third (low quality, high share) are the divisions where the country's specialisation is linked to factors other than quality, such as price competitiveness which influences the index of relative quality by reducing its level. The fourth group includes the "neglected" sectors characterised by low quality and low specialisation.

Figure 3 shows how, with the exception of the Metalworking machinery (73), the sectors in which Italy is most specialised are characterised by a high relative quality index, particularly significant in the case of Other transport equipment (79). For Metalworking machinery (73), the data suggest that the high specialisation in this category is due to factors other than quality. Amongst the categories where Italy is under-specialised, good quality of exports is to be found in the cases of Office machines (75), Telecommunications (76), Power generating machines (71) and Electrical machinery (77), suggesting specialisation in particular "niches" of products. Italy is under-specialised and poorly qualified in Road vehicles (78).

4.2 The position of Germany, Japan and China

[16] In the case of "Road vehicles" the average is calculated for 2003-2005 because of a lack of available data for 2006.

The analysis of export UVs reveals that specialisation in terms of quality plays an important role in the dynamics of competition between developed and developing countries, such as China.

It emerges from the work of Baldwin and Harrigan (2007) and Schott (2004) that international specialisation, resulting from different resource endowments, takes place through variety within product categories rather than between products. A country's advantages in terms of productivity determine exports with a higher price than that of competitors and not lower, because more productive countries specialise in higher quality varieties of products. Although Chinese exports cover the majority of products exported by Italy, Germany and Japan, the difference in price-quality between Chinese exports and those from other countries on the US market is negative for all divisions (table 7). From the breakdown of the aggregate price-quality index for China, a preponderance of the internal difference effect emerges combined with a composition difference effect, showing how China exports to the US the products with the lowest UV. Figure 3 suggests that the penetration into the US market of Chinese products in the Office machines (75) and the Telecommunications (76) categories is explained by factors other than quality, presumably a favourable price competitiveness. The other divisions show unfavourable indices with regards to both quality and comparative advantage and represent, therefore, "neglected sectors".

Notwithstanding, then, the exponential increase in Chinese exports over 1996-2006 in all of the categories analysed, it emerges from price-quality analysis that China does not compete directly with Italy, Germany or Japan because these countries operate in different market segments. In fact, as can be seen in tables 8 and 9, the price-quality difference index for Germany and Japan is generally positive for the whole period considered, just as it is for Italy.

Breakdown of the index shows the relevant contribution of the internal difference and of composition difference effect both for Germany and Japan. UVs of products exported by Germany and Japan are always, on average, higher than those of their competitors. Germany has greater market shares in products with the highest UVs on a worldwide level in all categories with the exception of Office machines (75). A particular trend can also be noted for Japan in the Telecommunications (76) division where, despite the combined difference indicator's being positive between 1998 and 2002 and becoming negative from 2003 on, the composition difference effect is positive for the whole period (table 9). This could indicate that Japan, specialised in products with a higher price than that of its competitors, maintained production of goods with the highest prices on the world market over successive years, so guaranteeing itself a niche position regarding products of the highest quality.

The combined difference indicator for Germany is generally negative, as it is for Italy and Japan. Only in the Other transport equipment (79) division does Germany present positive values for this

indicator, particularly in recent years. It seems, then, that specialisation has shifted towards products with higher UVs. As can be noted from figure 3, Germany only occupies the quadrants regarding “top sectors” and “niche sectors”. Germany presents high relative quality both in specialisation divisions and in those where it is under-specialised, such as Office machines (75) and Telecommunications (76).

From a comparison between countries, it emerges that Germany and Japan compete directly in terms of high specialisation and high quality in the Power generating machines (71), Metalworking machinery (73), General industrial machines (74) and Road vehicles (78) divisions.

Despite being under-specialised in the Office machines (75) and Telecommunications (76) divisions, Italy, Germany and Japan are characterised by high export quality. Italy competes directly with Germany in the Machinery specialized for particular industries (72), General industrial machines (74) and Other transport equipment (79) categories. Italy is only in direct competition with Japan in the General industrial machines (74) division.

TABLE 6 - *Relative Quality Indices: Italy (% difference with respect to world exports)*

71 Power generating machines

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	-16.8	33.3	17.8	40.7	197.4	151.9	126.1	116.4	162.0	137.0	163.0
Composition difference	24.0	2.3	5.4	5.1	70.2	98.0	268.3	89.9	80.5	55.5	109.3
Combined difference	-19.8	-22.7	-14.9	-17.9	-78.3	-98.4	-142.5	-142.1	-208.9	-144.1	-207.0
Relative Quality Index	-12.6	12.9	8.3	27.9	189.4	151.6	251.9	64.2	33.7	48.4	65.3

72 Machinery specialized for particular industries

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	-25.62	-27.05	-26.51	-9.24	-15.15	43.40	99.68	5.07	6.86	15.86	25.32
Composition difference	26.44	27.14	22.26	22.68	16.58	68.93	96.65	33.82	39.05	29.42	34.57
Combined difference	-22.82	-19.47	-21.28	-21.10	-15.91	-66.25	-111.97	-24.13	-29.07	-28.47	-34.98
Relative Quality Index	-22.00	-19.38	-25.53	-7.67	-14.47	46.08	84.36	14.76	16.85	16.81	24.91

73 Metalworking machinery

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	-21.69	-16.70	-16.45	-10.83	19.41	28.09	37.30	36.84	28.17	44.58	24.39
Composition difference	-34.41	-14.85	-28.37	-28.19	-4.65	18.32	15.75	-13.16	-17.04	-13.84	-7.05
Combined difference	6.03	-13.27	-5.52	-12.18	-31.21	-59.20	-69.55	-31.10	-33.40	-45.78	-26.44
Relative Quality Index	-50.08	-44.82	-50.35	-51.20	-16.45	-12.80	-16.50	-7.42	-22.27	-15.04	-9.10

74 General industrial machines

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	10.03	7.13	11.93	27.46	233.11	282.92	663.96	15.56	26.43	31.76	29.99
Composition difference	30.74	41.79	21.08	3.83	168.05	137.06	329.65	27.37	29.49	27.88	30.01
Combined difference	-36.77	-28.41	-38.06	-31.91	-228.49	-191.58	-431.35	-38.37	-45.68	-40.83	-31.91
Relative Quality Index	4.00	20.51	-5.05	-0.62	172.67	228.40	562.26	4.56	10.25	18.82	28.09

75 Office machines

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	108.73	503.86	520.66	513.51	426.03	1113.85	2132.27	953.87	1274.07	234.66	241.86
Composition difference	-28.64	-5.58	-4.04	-0.31	11.93	45.75	43.21	2.35	1.02	-2.81	-15.86
Combined difference	-109.50	-193.04	-88.89	-86.83	-6.09	165.78	231.52	-88.23	-89.73	-45.78	-87.22
Relative Quality Index	-29.40	305.23	427.73	426.37	431.87	1325.38	2407.01	867.99	1185.36	186.07	138.77

76 Telecommunications

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	-0.69	240.33	-1.71	198.44	2218.59	2473.31	3205.22	277.66	120.12	54.15	123.62
Composition difference	-9.51	89.01	13.03	-1.43	123.43	20.56	60.33	-40.62	-25.51	18.81	12.84
Combined difference	7.02	-136.31	-23.58	-29.60	-957.33	-395.69	-712.23	-100.14	-2.43	-18.44	-62.24
Relative Quality Index	-3.18	193.03	-12.26	167.40	1384.69	2098.18	2553.32	136.90	92.18	54.52	74.22

77 Electrical machinery

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	60.4	115.0	15.5	124.2	970.0	929.9	1782.8	96.9	67.9	132.1	110.7
Composition difference	-58.3	-56.6	-37.8	-37.3	90.1	59.6	201.2	18.1	31.1	10.4	-9.0
Combined difference	-59.5	-111.6	-32.0	-111.0	-740.1	-615.3	-1269.1	-117.4	-83.6	-121.2	-110.9
Relative Quality Index	-57.3	-53.2	-54.3	-24.1	320.0	374.2	714.9	-2.4	15.3	21.4	-9.2

78 Road vehicles

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	-41.81	-34.58	-34.40	-33.71	82.11	89.06	477.74	45.56	33.28	144.99	-
Composition difference	15.03	1.30	-2.19	3.97	9.21	28.29	61.29	8.12	8.79	-23.77	-
Combined difference	-38.23	-32.67	-29.08	-31.03	-76.12	-115.65	-505.67	-83.89	-69.27	-149.05	-
Relative Quality Index	-65.01	-65.95	-65.67	-60.78	15.20	1.70	33.37	-30.21	-27.20	-27.82	-

79 Other transport equipment

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	13.43	1.64	-0.34	9.70	13.08	32.42	58.45	136.51	106.38	104.11	136.07
Composition difference	286.50	221.45	25.33	98.62	175.47	186.87	137.32	106.28	87.95	391.92	179.73
Combined difference	8.41	-14.19	1.41	3.35	-38.92	-22.57	-25.58	2.22	35.72	390.87	49.77
Relative Quality Index	308.33	208.90	26.41	111.67	149.63	196.72	170.19	245.01	230.04	886.91	365.58

Source: elaborations on Comtrade data (UN)

TABLE 7 - *Relative Quality Index: China (% difference with respect to world exports)*

71 Power generating machines

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	-61.67	-41.87	-46.76	19.01	6.73	-8.03	17.49	-26.75	-19.18	-23.12	-17.93
Composition difference	-49.20	-29.28	-15.95	-6.93	-26.40	-28.81	-8.67	40.78	-15.18	-17.84	-24.08
Combined difference	25.06	-9.29	-18.66	-84.92	0.13	4.66	-7.14	-58.34	-10.85	-0.67	-0.30
Relative Quality Index	-85.81	-80.45	-81.37	-72.84	-19.53	-32.18	1.68	-44.31	-45.20	-41.62	-42.32

72 Machinery specialized for particular industries

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	-78.71	-80.78	-78.65	-59.24	-40.18	-12.10	43.36	-35.27	-31.78	-32.12	-32.40
Composition difference	16.07	4.19	11.35	-33.25	-25.53	17.45	44.35	-9.96	8.20	4.53	-2.37
Combined difference	-17.47	-5.22	-14.64	2.43	-13.95	-55.58	-120.91	-10.47	-17.76	-15.45	-4.40
Relative Quality Index	-80.10	-81.82	-81.94	-90.06	-79.66	-50.23	-33.20	-55.70	-41.34	-43.03	-39.17

73 Metalworking machinery

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	-76.65	-81.54	-84.22	-86.70	-39.77	-40.99	-32.88	-32.89	-31.09	-27.81	-29.37
Composition difference	12.11	5.68	-2.03	3.85	-0.74	-11.04	-6.77	-3.04	-7.33	-17.80	-16.92
Combined difference	-19.90	-8.81	0.04	-4.80	-29.36	-20.47	-28.89	-36.08	-34.25	-27.81	-25.37
Relative Quality Index	-84.44	-84.67	-86.20	-87.66	-69.86	-72.50	-68.55	-72.02	-72.68	-73.42	-71.66

74 General industrial machines

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	-79.06	-74.88	-76.97	-73.19	201.81	154.69	414.19	-16.50	-17.18	-15.37	-13.05
Composition difference	-33.17	-33.05	-23.31	-16.20	71.28	60.88	155.86	-16.06	-16.28	-12.78	-7.04
Combined difference	25.64	24.40	16.59	8.99	-250.07	-175.82	-362.55	-22.17	-16.31	-12.33	-13.68
Relative Quality Index	-86.60	-83.53	-83.69	-80.40	23.03	39.75	207.51	-54.72	-49.77	-40.47	-33.77

75 Office machines

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	-90.46	-91.63	-89.80	-89.79	-75.94	-42.23	11.52	-66.80	-61.92	-16.08	-19.80
Composition difference	-6.84	1.10	0.93	0.50	3.35	25.93	31.11	-0.49	-1.38	-4.72	-4.70
Combined difference	5.49	-1.20	-1.81	-0.86	-4.37	-43.66	-51.89	-0.03	0.84	-3.53	-0.07
Relative Quality Index	-91.81	-91.73	-90.69	-90.15	-76.96	-59.96	-9.25	-67.32	-62.46	-24.33	-24.57

76 Telecommunications

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	-88.13	-34.94	-74.89	-29.74	927.96	555.65	912.72	-13.76	-15.13	-4.69	-8.35
Composition difference	1.30	26.10	-21.09	-0.05	87.49	50.17	139.67	-22.22	-24.49	-14.28	-10.90
Combined difference	-1.53	-58.88	10.24	-41.66	-681.75	-261.29	-291.69	-0.48	3.04	1.08	3.15
Relative Quality Index	-88.36	-67.71	-85.75	-71.45	333.70	344.53	760.69	-36.46	-36.57	-17.89	-16.11

77 Electrical machinery

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	-56.6	-35.2	-74.0	-30.9	484.5	561.2	825.1	-8.1	-4.8	10.5	0.0
Composition difference	-12.1	-21.8	-26.6	-27.7	32.5	11.0	45.6	-16.0	-21.4	-26.3	-20.6
Combined difference	-10.2	-23.0	15.3	-18.1	-363.4	-435.7	-544.6	-25.0	-22.2	-23.7	-14.5
Relative Quality Index	-79.0	-80.1	-85.3	-76.7	153.6	136.4	326.1	-49.0	-48.4	-39.5	-35.0

78 Road vehicles

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	-67.95	-74.90	-75.06	-72.67	4.32	-9.49	11.92	-39.68	-36.38	-8.36	-
Composition difference	-15.03	-26.56	-29.32	-27.81	-30.25	-33.76	-14.73	-41.25	-39.98	-57.60	-
Combined difference	2.12	17.56	20.70	17.61	-17.94	-8.14	-30.53	18.42	15.95	-4.87	-
Relative Quality Index	-80.85	-83.90	-83.68	-82.86	-43.86	-51.39	-33.34	-62.52	-60.42	-70.83	-

79 Other transport equipment

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	-78.08	-56.90	-47.95	-63.22	-68.10	-63.22	-50.66	-38.19	-55.37	-53.47	-29.64
Composition difference	-18.97	101.64	9.56	-15.77	-46.39	55.44	-20.43	-31.65	-50.14	-54.94	-55.45
Combined difference	14.50	-51.98	-4.49	6.57	30.99	-42.34	1.56	2.29	23.52	27.97	8.04
Relative Quality Index	-82.56	-7.25	-42.88	-72.42	-83.50	-50.12	-69.53	-67.55	-82.00	-80.44	-77.05

Source: elaborations on Comtrade data (UN)

TABLE 8 - *Relative Quality Index: Germany (% difference with respect to world exports)*

71 Power generating machines

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	-15.4	-9.1	-20.0	6.1	107.2	79.3	163.8	77.1	60.2	62.4	51.7
Composition difference	80.1	192.4	162.3	133.2	141.4	232.8	229.6	-3.1	16.9	8.6	26.8
Combined difference	-46.6	-124.4	-115.9	-116.0	-179.7	-203.7	-234.6	-46.7	-31.3	-48.8	-31.0
Relative Quality Index	18.1	59.0	26.4	23.4	68.9	108.4	158.8	27.2	45.8	22.1	47.4

72 Machinery specialized for particular industries

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	22.95	7.36	9.15	17.49	26.54	135.48	219.50	41.00	45.87	41.00	48.43
Composition difference	13.33	1.08	7.83	27.50	29.32	124.40	135.75	47.77	53.59	52.71	64.96
Combined difference	-12.00	-1.11	-3.69	-8.81	-18.51	-102.64	-146.43	-13.23	-7.88	-8.70	-12.61
Relative Quality Index	24.28	7.32	13.29	36.17	37.34	157.24	208.83	75.54	91.58	85.01	100.78

73 Metalworking machinery

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	56.33	49.69	81.26	74.23	79.66	73.75	94.52	107.30	92.04	88.34	96.36
Composition difference	8.37	5.64	33.50	10.10	8.11	4.58	15.23	5.57	13.49	18.85	17.44
Combined difference	-39.02	-31.82	-29.49	-30.44	-44.88	-39.66	-40.05	-40.05	-25.01	-33.56	-35.91
Relative Quality Index	25.68	23.50	85.27	53.89	42.89	38.67	69.70	72.83	80.53	73.62	77.88

74 General industrial machines

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	89.47	73.64	76.37	135.13	984.75	717.74	1654.99	115.94	129.27	124.66	138.64
Composition difference	13.89	20.12	18.96	19.51	192.09	202.11	526.32	24.64	33.23	24.63	36.28
Combined difference	-69.94	-56.68	-56.32	-84.28	-791.98	-465.03	-1008.23	-55.97	-55.75	-54.22	-65.34
Relative Quality Index	33.42	37.07	39.00	70.36	384.86	454.83	1173.08	84.62	106.75	95.07	109.58

75 Office machines

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	88.32	15.55	85.31	107.46	254.78	307.49	1030.55	423.88	317.69	138.43	153.97
Composition difference	38.41	0.63	1.17	0.25	-19.05	3.97	-17.47	-9.02	-12.18	-24.53	-27.99
Combined difference	-32.02	-5.60	-10.24	-10.43	-102.36	-73.54	-429.66	-326.45	-222.66	-51.67	-72.79
Relative Quality Index	94.70	10.57	76.24	97.27	133.38	237.92	583.41	88.41	82.85	62.24	53.19

76 Telecommunications

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	133.91	463.29	150.17	382.92	3228.62	2724.98	4698.17	247.83	254.82	280.66	244.15
Composition difference	38.43	92.67	-0.57	88.10	105.64	131.43	928.85	160.89	81.59	71.21	52.52
Combined difference	10.83	-103.30	-19.36	-20.08	279.87	199.55	-1125.05	-191.06	-105.57	-201.09	-133.52
Relative Quality Index	183.17	452.66	130.24	450.94	3614.13	3055.96	4501.96	217.66	230.84	150.79	163.15

77 Electrical machinery

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	231.1	215.8	79.7	300.7	2376.7	2208.1	4227.6	194.0	228.4	297.2	222.4
Composition difference	-17.0	-2.9	19.4	-7.4	104.8	125.2	250.1	71.8	64.1	90.1	-9.5
Combined difference	-166.6	-150.4	-76.0	-201.6	-1427.4	-1179.8	-2348.8	-51.2	-38.1	-108.8	-155.8
Relative Quality Index	47.5	62.5	23.1	91.8	1054.1	1153.5	2128.8	214.6	254.4	278.5	57.1

78 Road vehicles

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	10.91	-6.25	-3.13	13.88	210.92	183.26	333.36	81.86	96.35	69.71	-
Composition difference	-6.94	-4.02	-4.56	4.07	46.66	67.21	95.06	11.84	19.35	29.12	-
Combined difference	-14.22	-7.30	-6.25	-12.48	-66.69	-106.72	-239.75	-19.46	-16.75	-9.72	-
Relative Quality Index	-10.25	-17.58	-13.95	5.46	190.89	143.76	188.67	74.24	98.95	89.11	-

79 Other transport equipment

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	80.92	-1.47	11.57	22.82	26.05	48.72	20.23	68.88	69.65	76.88	233.47
Composition difference	104.66	69.43	51.47	104.21	178.80	111.01	97.67	66.53	56.89	223.46	226.61
Combined difference	63.67	24.64	-0.05	7.97	-64.50	-102.60	5.63	-21.83	4.36	53.42	313.88
Relative Quality Index	249.25	92.60	62.99	135.00	140.36	57.13	123.52	113.58	130.90	353.76	773.97

Source: elaborations on Comtrade data (UN)

TABLE 9 - *Relative Quality Index: Japan (% difference with respect to world exports)*

71 Power generating machines

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	35.0	42.1	34.1	64.3	228.0	131.3	182.7	72.6	60.7	47.4	88.0
Composition difference	-27.3	-24.4	-31.4	-18.0	66.9	68.3	122.6	-6.2	-9.4	-2.0	1.8
Combined difference	-34.6	-28.5	-15.0	-30.0	-197.4	-130.7	-191.7	-44.9	-35.9	-29.4	-74.3
Relative Quality Index	-26.9	-10.9	-12.3	16.2	97.5	68.9	113.7	21.5	15.4	16.0	15.4

72 Machinery specialized for particular industries

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	60.62	59.74	49.35	84.93	118.60	309.36	621.84	86.31	97.38	87.63	100.28
Composition difference	5.85	4.32	1.97	8.93	-14.58	32.57	38.48	-27.18	-24.78	-21.70	-26.92
Combined difference	-1.20	-5.39	-5.90	-38.74	-85.68	-257.08	-573.10	-70.52	-81.41	-72.55	-80.24
Relative Quality Index	65.27	58.67	45.43	55.12	18.34	84.85	87.21	-11.39	-8.80	-6.63	-6.88

73 Metalworking machinery

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	22.71	14.91	28.63	58.60	69.76	80.73	105.31	52.96	56.85	63.64	62.38
Composition difference	1.89	0.19	16.78	16.06	9.65	9.82	22.13	8.55	5.60	5.54	9.34
Combined difference	-16.14	-19.09	-30.52	-23.50	-54.46	-61.63	-89.85	-44.68	-38.87	-45.38	-47.45
Relative Quality Index	8.45	-3.99	14.89	51.16	24.95	28.91	37.59	16.82	23.58	23.79	24.26

74 General industrial machines

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	50.86	61.46	37.57	107.14	690.20	740.88	1672.05	96.78	101.06	97.85	91.42
Composition difference	2.10	-3.42	-3.49	-5.88	124.45	113.97	335.81	-3.96	-3.29	-3.45	-0.64
Combined difference	-47.94	-50.40	-33.84	-72.42	-475.84	-461.40	-1087.21	-57.71	-61.85	-62.66	-55.42
Relative Quality Index	5.03	7.64	0.24	28.84	338.81	393.45	920.65	35.11	35.92	31.74	35.36

75 Office machines

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	11.55	3.03	17.93	-1.09	51.90	158.34	348.11	42.20	42.47	0.33	5.01
Composition difference	10.08	-0.49	-0.41	-1.00	5.21	26.34	31.75	0.39	0.64	-18.19	-16.15
Combined difference	-17.44	-0.26	-1.12	-0.12	-2.52	-25.77	-37.56	-10.86	-10.92	-0.05	-3.65
Relative Quality Index	4.19	2.28	16.40	-2.21	54.59	158.91	342.29	31.72	32.18	-17.91	-14.79

76 Telecommunications

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	52.12	269.63	38.57	320.28	2671.82	2116.31	2054.32	85.90	108.82	75.10	72.24
Composition difference	52.36	123.17	38.14	158.85	288.57	244.33	440.73	23.26	18.91	32.69	46.81
Combined difference	-19.53	-137.75	5.84	53.62	97.66	286.28	677.53	-3.00	-16.61	-52.48	-33.29
Relative Quality Index	84.95	255.06	82.55	532.76	3058.05	2646.92	3172.58	106.16	111.13	55.32	85.75

77 Electrical machinery

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	283.8	226.3	107.0	349.4	4084.9	2700.9	4259.2	238.9	293.3	233.5	265.0
Composition difference	34.4	28.3	21.6	14.0	197.8	101.7	205.5	42.3	35.8	57.5	59.2
Combined difference	-176.9	-132.3	-86.5	-236.0	-2915.4	-1550.3	-2577.5	-137.5	-182.1	-141.6	-155.4
Relative Quality Index	141.3	122.2	42.2	127.4	1367.3	1252.3	1887.2	143.7	147.1	149.4	168.8

78 Road vehicles

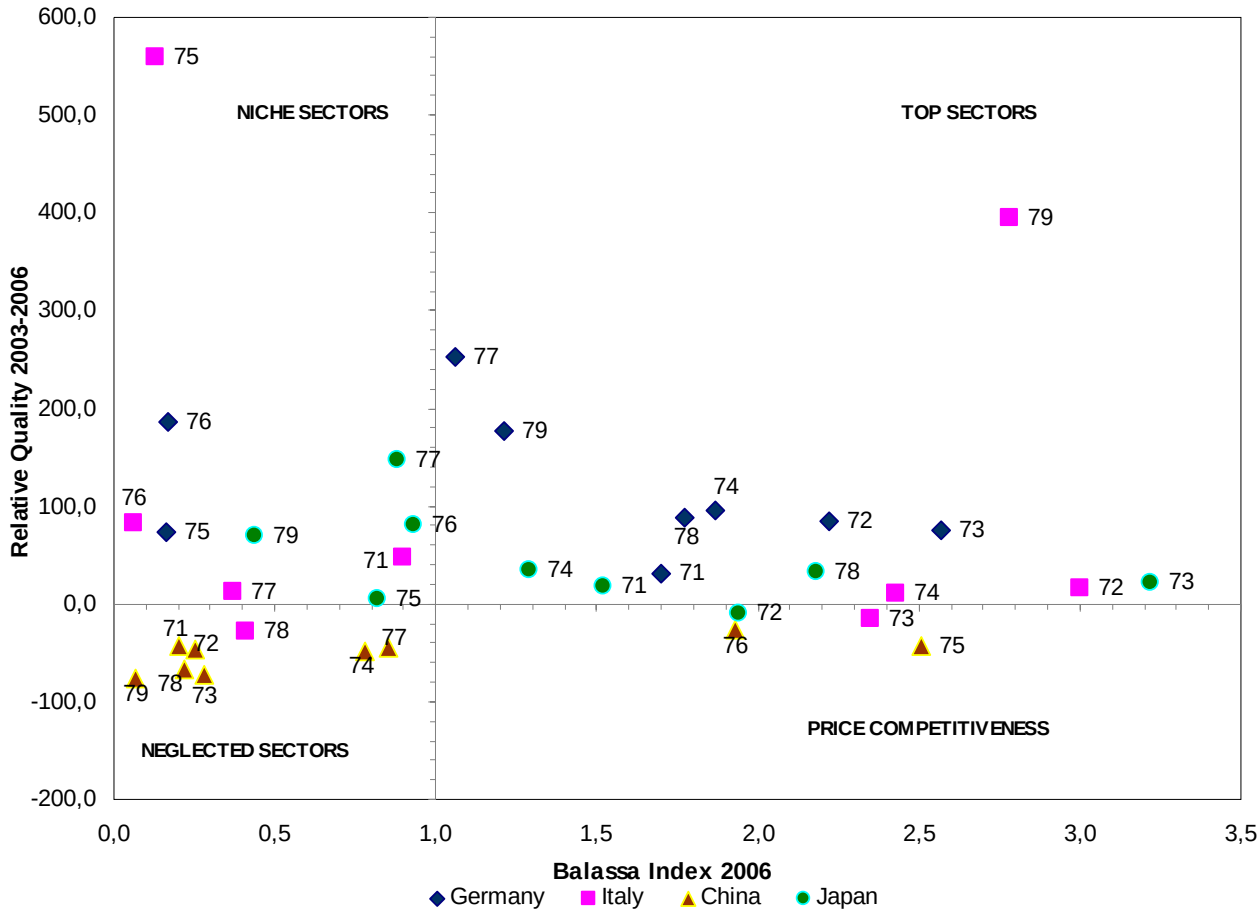
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	1.16	-15.40	-13.86	-3.89	223.45	193.77	339.84	89.72	179.22	0.67	-
Composition difference	8.64	15.28	22.65	21.44	95.65	79.12	116.46	33.15	39.93	14.41	-
Combined difference	-11.59	-20.40	-29.20	-28.13	-118.41	-119.64	-248.37	-59.90	-145.25	-10.76	-
Relative Quality Index	-1.79	-20.53	-20.40	-10.58	200.69	153.25	207.93	62.97	73.91	4.32	-

79 Other transport equipment

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Internal difference	68.34	-4.09	-1.20	60.76	18.15	41.12	-5.34	475.83	53.73	107.51	88.65
Composition difference	154.15	140.96	51.24	90.54	82.02	8.16	78.37	43.76	-3.49	38.58	52.54
Combined difference	-92.45	-29.19	-22.18	-78.67	-48.74	-53.12	-29.59	-400.14	-38.75	-84.10	-68.33
Relative Quality Index	130.04	107.67	27.86	72.63	51.43	-3.84	43.44	119.46	11.49	61.99	72.86

Source: elaborations on Comtrade data (UN)

FIGURE 3 - *Relative Quality and Export Specialisation*



Source: elaborations on Comtrade data (UN)

5. CONCLUSIONS

Over the decade analysed, indicators of price and relative cost competitiveness highlighted a relevant and progressive loss of competitiveness for Italian exports. This trend, combined with a gradual contraction of market share in volume terms, also involved the sectors with the most dynamic world demand, such as industrial machinery. Despite the relative increase in export prices, market shares in value terms were stable.

This evidence stimulated great debate amongst Italian economists.

A pessimistic vision attributes this increase in export prices to a loss of competitiveness due to the anomalous Italian model of specialisation. According to a less pessimistic view, the increase in unit values might be the result of a vertical differentiation of produced goods, as a strategic decision by Italian firms, rather than a loss of competitiveness of Italian exports. As shown in recent studies (Baldwin *et al.*, 2007; Schott, 2004), international specialisation, resulting from different factor endowment, takes place through variety within product categories rather than between products.

Richer countries tend to export more units at higher prices to a given market, consistent with producing higher quality.

This paper joins this debate with the aim of providing further empirical evidence regarding the machinery industry.

Our analysis points out that, on the US market, Italy, Germany and Japan are positioned in production with high unit values. In particular, Germany shows the highest quality indices in all the machinery divisions, therefore confirming its high quality reputation. As expected, Chinese machinery exports are concentrated in the lowest quality segment, even though the Chinese model of specialisation is evolving towards products of medium-high technological levels. However, Chinese export unit values are rising over time, suggesting a qualitative catching-up.

With reference to the Italian debate mentioned above, our analysis provides some indications consistent with the less pessimistic interpretation. The trend of prices of Italian machinery exports in the past decade would not be necessarily a signal of the inability to hold down production costs, but it might be the result of a strategy of quality upgrading. Italian firms would vertically differentiate their production towards commodities with higher unit value allowing them to gain market power.

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