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COMPETITIVENESS IN MANUFACTURING. GERMANY VS. ITALY – A COMPARISON

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WP EP01/2012

This Working Paper contains the contributions written in English forthcoming in a Special Issue of the Journal of Industrial and Management Economics / Economia e politica industriale (39, (2), 2012). The title (and the topic) of the whole Special Issue is "Competitiveness in Manufacturing: Germany vs. Italy"**.**

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GERMAN AND ITALIAN MANUFACTURING PERFORMANCES: A PREMISE TO A COMPARISON

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Abstract

This Special Issue of *Economia e Politica Industriale/Journal of Industrial and Business Economics* aims to shed light on the reasons for the differences between Germany and Italy through the discussions of five research papers. The contributions compare the microeconomic features of the two countries and investigate the competitiveness and internationalization of their economies. This introduction provides the readers with a structural overview to enable them to better understand the comparison, underscoring the few similarities and the main basic differences that characterize the two countries. It also provides a summary of the topics discussed in each of the five articles and reflects on why we believe the contributions offer an original reflection on the topic.

Keywords: Manufacturing Industries; International Trade; Human Capital; Internationalization Processes; Industrial Policy; Germany; Italy

Jel classification: F14 - Country and Industry Studies of Trade; L25 - Firm Performance: Size, Diversification, and Scope L52 - Industrial Policy; Sectoral Planning Methods

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1. Introduction

The high performances and results achieved by Germany's manufacturing industries are the main factors that make it the European Union's most competitive country, at least according to the general consensus. And that gap has widened in recent years. Table 1, below, compares Germany with the major EU countries based on the industry competitiveness, industry sustainability and business environment indicators selected by us among those provided by a recent EU report (EU, 2011).[1]

Table 1 – Germany (= one hundred) compared with the major EU countries

	Industry modernity and competitiveness	**Industry Sustainability**	**Business Environment**
France	91.0	50	85.0
Spain	68.1	90	86.8
U K	89.1	80	93.7
Italy	67.6	80	62.7
Germany	100	100	100

Source: EU (2011).

According to the three indicators shown in the table, the German economy is not only the most modern and most competitive in the EU, but also the most environmentally sustainable and business-friendly. Table 1 shows that the French and UK economies are closer to Germany in all except the sustainability indicator, highlighting the broader gap between Germany and the Italian and Spanish economies.

Nevertheless, those indicators do not help to explain the great success of Italian firms in the global marketplace, despite the fact that the Italian economy[2] is less efficient and less competitive. To discover the reasons for this gap, researchers need to investigate and analyze questions such as "why does the gap tend to shrink when the focus is on internationalization?"; "is that success strengthened by simple, partly exogenous factors,

[1]. Figures for each group and each country correspond to the simple average of the ratios (shares or increasing scores) of each country shown and Germany (= one hundred). The indicators used in this article for "industry modernity and competitiveness" are: labour productivity per person employed in manufacturing, 2010; share of science and technology graduates (% of the population of the twenty-twenty-nine age group), 2009; R&D performed by business (% of GDP), 2009; share of innovative enterprises as a % of the total number of enterprises, 2008; real effective exchange rates deflated by nominal unit labour costs (total economy) against a panel of thirty-six countries (1999 = one hundred: Q4 2010). The formula applied in this latter case is: -[(Q4 2010 country/ Q4 2010 Germany) – 2].
The "industry sustainability" indicator is based on "CO_2 intensity in industry and the energy sector" (2009 compared with 2000), disregarding the "energy intensity of environmental goods as % percentage of exports of goods" indicator as this would further enlarge the gap between Germany and the other countries. The "business environment" indicator is based on: "satisfaction with the quality of infrastructure"; "legal and regulatory framework"; and "burden of government regulation".

[2]. Even disregarding traditional consumer goods, Italy remains among the world's top five exporters, as shown in table 2.

such as the common currency or the impact of the international financial crisis?"; and, not least "can the Italian economy truly be defined as weak in relation to the other major EU economies given the success of the Italian firms in the world markets?".

This Special Issue of *Economia e Politica Industriale/Journal of Industrial and Business Economics* aims to shed light on the reasons for the differences between Germany and Italy through the discussions of five research papers. The contributions compare the microeconomic features of the two countries and investigate the competitiveness and internationalization of their economies. This introduction provides the reader with a structural overview to enable them to better understand the comparison, underscoring the few similarities and the main basic differences that characterize the two countries. It also provides a summary of the topics discussed in each of the five articles and reflects on why we believe the contributions offer an original reflection on the theme that inspires this Special Issue.

2.Structural overview of Germany and Italy: similarities

Industry[3] is a significant driver of both the Germany and the Italian economies, usually considered the EU's most "industrial" countries. Both economies feature the highest per capita values of industrial production in the world (Germany ranking first and Italy second, with Japan a close third). The weight of value-added and employment on their respective total values underscore the importance of industry to the economies of the two countries, but the global impact of the U.S. financial crisis and its fallout on other world economic sectors, starting autumn 2008, have caused those percentages to contract. Nevertheless, the per capita results achieved by the two countries remain higher than both the EU average and that of other comparable EU countries. Further, the differences between Germany and Italy, on the one side, and between the other major EU countries and the EU average, on the other, have widened in recent years, and the German and Italian industrial sectors have been able to fend off the crisis better than other countries.

In Germany the value-added weight of industry was similar to that of employment in 2000 but had far surpassed it in 2010, attesting to the boost in industrial productivity that has favoured the German economy in recent years. Conversely, Italy recorded a continuously higher ratio of employment in industry to value-added, implying that the Italian industrial productivity grows less than that of other sectors.

The significantly high levels of worldwide manufacturing exports attest to the major role played by industry in the German (Germany was the world's largest overall exporter before being recently overtaken by China) and Italian economies. Those export market shares have remained fairly constant over time, with a slight increase in the share of the German manufacturing exports and a slight decrease in Italian manufacturing exports. In fact, Germany and Italy were the only economies whose export market shares were not seriously eroded by the growing competition from the BRICs and other emerging countries. However, from the microeconomic viewpoint, the German economy outperformed the Italian economy, although this latter recorded a better-than-average performance versus other European economies.

[3]. Herein intended as all manufacturing sectors; mining and quarrying; and the services produced and distributed by utilities, excluding local public transport.

Table 2 – Main similarities

	Year	Germany	Italy	France	Spain	UK	EU-27
Industry value-added (incl. energy, excl. construction) /Total gross value-added (%) (1)	2000	25.3	23.3	17.8	20.9	22.0	22.4
Industry value-added (incl. energy, excl. construction) /Total gross value-added (%) (2)	2010	24.0	19.2	12.5 (2009)	15.8	15.6	18.7
Industry employment (incl. energy, excl. construction) /Total employment (%) (3)	2000	25.1	24.3	19.8	19.9	18.2	22.1
Industry employment (incl. energy, excl. construction) /Total employment (%) (4)	2010	21.8	20.4	14.8	14.2	11.6	17.8
Market share of total world manufacturing exports (at current prices and exchange rates) (%) (5)	2000-2003 (average)	11.2	4.9	6.3		4.7	
Market share of total world manufacturing exports (at current prices and exchange rates) (%) (6)	2004-2008 (average)	12	4.8	5.4		4	
Family-owned firms/Medium and large firms (source: EFIGE survey) (%) (7)	2009	89.8	85.6	80.0	83.0	80.5	
Family managers in medium and large family-owned firms (source: EFIGE survey) (%) (8)	2009	84.5	83.9	62.2	79.6	70.8	
Family managers in medium and large family-owned firms (source: EFIGE survey) (%) (9)	2009	28	66.3	25.8	35.5	10.4	
Stock market capitalization /GDP (%) (10)	1996	21.8	18	31.8		119.5	
Stock market capitalization /GDP (%) (11)	2006	43.3	63.3	80.4		139.1	
Corporate bank financing /External financing (%) (12)	2000	32.8	63.9	21.9	57.8	36.4	

Sources: (1) to (4) Eurostat; (5) and (6) Centro studi Confindustria (2010); (7) to (9) Bugamelli et al. (2011); (10) and (11) Franks et al. (2007); (12) Beck, Demirgüç-Kunt and Maksimovic (2008).

Table 3, below, shows the ranking of the two countries compared with China in terms of export performance (one of the drivers of internationalization) based on the trade performance index (TPI), an indicator provided jointly by the WTO and UNCTAD. This indicator,[4] shown alongside the "world market share" indicator, emphasizes Germany's

[4]. The TPI summarizes twenty-two simple indicators of the trade competiveness of a country in a group of sectors. Including raw materials (not considered in table 3), each country has fourteen different TPIs, each related to a different group of sectors. The TPI and technical notes for 2006

world leadership (or co-lead) position in nearly every manufacturing sector except for "leather products", "consumer electronics" and "clothing". The TPI overlap of Germany and Italy in some sectors mostly concerns intermediate consumables, investment goods and household consumer durables, specifically "basic manufactures", "non-electronic machinery" and "textiles". However, Italy's TPI ranking in the other product groups, where Germany is world leader, is erratic and only beats Germany in the "clothing" sector. Sectoral competition from China seems fiercer in the sectors led by Italy. This asymmetry between Germany and Italy in relation to Chinese competition is discussed in several of the articles published in this Special Issue.

Table 3 – TPI comparative analysis of exports, 2010

Countries →	**Germany**			**Italy**			**China**		
Indicators	World export market share %	World export market share rank	**TPI rank**	World export market share %	World export market share rank	**TPI rank**	World export market share %	World export market share rank	**TPI rank**
Manufacturing sectors									
Processed food	8.0	1	**1**	1.8	16	**37**	3.8	8	**23**
Wood products	10.3	1	**1**	2.9	9	**23**	6.1	4	**36**
Textiles	5.4	2	**2**	5.3	3	**1**	31.2	1	**3**
Chemicals	11.3	1	**1**	3.1	12	**23**	5.8	4	**25**
Leather products	3.8	5	**14**	11.8	2	**1**	35.7	1	**3**
Basic manufactures	10.3	2	**1**	4.7	5	**2**	11.6	1	**3**
Non-electronic machinery	9.3	2	**1**	6.4	5	**2**	10.2	4	**10**
IT & consumer electronics	3.8	6	**12**	0.7	21	**25**	36.3	1	**5**
Electronics components	8.8	5	**1**	2	11	**14**	16.7	1	**34**
Transport equipment	17.3	1	**1**	3	10	**20**	6.3	6	**13**
Clothing	4.8	3	**15**	5.7	2	**1**	36.8	1	**2**
Miscellaneous manufacturing	9.9	3	**1**	4	6	**2**	17.9	1	**9**

Source: UNCTAD/WTO.

While the export focus of the German and Italian manufacturing systems is high, the companies of each country adopt completely different operating methods. In this Special Issue, Foresti and Trenti (EPI Special Issue, 2012) argue that Italian firms are more "responsive" than German firms when tapping into new markets, and show a distinct ability to identify even modest business opportunities. On the other hand, German firms are more focused on establishing a continuous, long-term positioning in their respective foreign markets, and on creating external opportunities for the domestic supply chain as a whole. The intensity of the internationalization process in the two countries also differs,

can be found at http://legacy.intracen.org/appli1/TradeCom/Documents/TradeCompMap-Trade%20Performance%20Index-Technical%20Notes-EN.pdf .

although both chart the same course. According to co-authors Guerrieri and Esposito (EPI Special Issue, 2012), the inbound and outbound FDI flows, even though high and increasing in both countries, were less marked over the past decade in Italy than in Germany. International off-shoring is also considered a strategic lever of the internationalization of production, although the evidence on this topic is less abundant and more erratic. Breda and Cappariello (EPI Special Issue, 2012) cast light on how Italian manufacturing firms have developed fairly similar import policies for intermediate inputs to those adopted by the German companies,[5] which suggests that the new forms of competition emerging in recent years have driven the most dynamic Italian firms to launch not only structural reorganization but also to rethink their degree of vertical specialization (Arrighetti and Traù, 2012).

Another well-known aspect shared by both countries is their approach to corporate governance. For historical reasons, the capital of most German and Italian firms is often closely held, i.e., it is either in the hands of the founder's family or his descendants, which explains why the stock markets of the two economies have fewer listed companies than those of the United Kingdom and the United States. That situation clearly has an impact on both the ownership and the management of a firm (as attested to by the number of managers appointed from the founder's family circle), regardless of whether the firm is young and small in size or a more seasoned and larger enterprise (usually still classed as an SME), which can be defined as quality ladders and often rank among the world leaders of a niche market segment (Simon's "hidden champions", 1996). However, the fact that the firms are run mainly by managers appointed from within the founder's family circle could be another explanation for the different approaches to research and development and innovation taken by the two countries.

Lower recourse to the equity markets to finance the business could be the main characteristic of both Italy and Germany. Nevertheless, the dependence of companies on bank financing, one of the main features shared by Germany and Italy (the so-called "bank system" as opposed to the "Anglo-Saxon stock exchange-based system") seems to be less important now, and is a source of divergence between the two countries.

Both economies feature a highly dynamic set of firms that achieve higher-than-average performances and share specific traits (Arrighetti and Traù, 2012; Venohr and Meyer, 2007). The firms of both countries build long-term relationships both within the firm and with key external partners, enabling them to focus on and dominate niche market segments worldwide, leveraging product technology-based leadership, attentive customer relations, and a strategy of continuous improvement to optimize operational efficiency.

3. Structural overview of Germany and Italy: differences

Clearly, the traits of the German and Italian economies differ significantly and, in our opinion, the biggest differences are structural, mostly related to the size of the firms, the quality and supply of human capital produced by the educational system, the export policy, and the government research policies implemented and their practical relation to the economic interests of the relative country.[6] Not only the strategies implemented by each firm but also these structural factors play a major role in the internationalization strategies of the two countries, and so are worth a closer look.

[5]. Guerrieri and Esposito (EPI Special Issue, 2012) use a different methodology to underscore the more significant role played by off-shoring in German firms.

[6]. Some researchers emphasize the differences in the role and in the behavior of the worker-managed institutions (trade unions and work council), which we recognize but are not able to assess the weight of.

3.1. Firm size

The size of the companies is maybe the most significant difference between the two countries. We know that that gap is not sector-related, given that the size of German firms is far bigger than their Italian counterparts in any NACE group (see the rows two and three of table 4 for an example). The larger size of the German firms translates into an economic advantage for the country, as attested to by the positive correlation of the size of each enterprise with productivity, the tendency to innovate, the orientation to export (spurring an increase in the ratio of exports to total sales), the export of products with higher technological features, and strategies of internationalization. The recent counterfactual analysis conducted by Barba Navaretti *et al.* (2011) indicates that if Italy's industrial features matched those of Germany, above all in terms of firm size, Italy could greatly increase the volume and value of its exports.

Table 4 – Main differences

	Year	Germany	Italy	France	Spain	UK	EU-27
Firm size as percentage of EU-15 average (1)	2003	1.58	0.42	0.98	0.68	1.58	
Average firm size in manufacturing (2)	2009	35.8	9	13.8	11.7	20.0	
Average firm size in the leather and footwear sectors (3)	2009	19.6	8.7	13.4	8.6	12.4	
Average firm size in the electrical machinery sector (4)	2009	80.1	10.6	35.5	30.0	22.8	
New doctorate graduates/25-34 age group (5)	2009	2.6	1.6	1.4	0.9	2.1	1.4
Population with tertiary education/30-34 age group (6)	2009	29.4	19.0	43.3	39.4	41.4	32.3
R&D/GDP (%) (7)	2000	2.45	1.05	2.15	0.91	1.81	1.74
R&D/GDP (%) (8)	2000	2.45	1.05	2.15	0.91	1.81	1.74
EPO energy & environment patents/total EPO patents (9)	2007	6.2	4.7	5.5	6.1	5.8	
Environment and energy-saving objectives as percentage of non-crisis State aid (10)	2000	22.3	0.6	3.3	0.6	2.9	9.3
Environment and energy saving objectives as percentage of non-crisis State aid (11)	2010	34.8	5.2	3	14.9	29.2	19.6
Environmental goods/Total exports (%) (12)	2010	1.25	0.38	0.46	0.83	0.62	0.77

Sources: (1) Pagano and Schivardi (2003); (2)-(4) Bugamelli et al. (2011); (5)-(8) EU, IUS (2010, 2011); (9) OECD (2012); (10)-(11) EU (2012); (12) EU (2011).

3.2. Quality of human capital

According to several OECD[7] analyses, only a relatively small percentage of the Italian population has completed their regular studies and earned a qualification. This factor, which translates into a poorly educated or unskilled workforce, means that Italy's supply

[7]. See OECD (2011).

of human capital might satisfy the labour demands of non-specialized industry sectors, but not those that operate in medium/high technological sectors. On the other hand, Germany produces a workforce with higher educational qualifications than Italy, even though the impact of that variable on industry is not as simple.

According to the comparative analysis based on the human capital indicators for Germany and Italy performed by Clemens and Schumacher (EPI Special Issue, 2012), the educational level of the Italian population is significantly lower than that of the German population. However, Italy has started to bridge that gap and is enjoying a growth trend in the number of Italians to complete secondary and tertiary education, which has significantly increased educational levels over the past ten years. Moreover, the younger population has a significantly higher level of schooling than their predecessors, which is expected to further boost educational levels in the years ahead. Nevertheless, Italy's educational levels remain the lowest in Western Europe, and the country has even been overtaken by nations such as Finland, where educational levels lagged even Italy's (Toniolo, 2011). While the shortage of human capital has not prevented the country's economic growth in the past – in fact, several scholars believe it has actually favoured it – this will hardly be the case going forward. In fact, the scarcity of human capital will not only stunt Italy's growth and development in the technological and scientific arena, but also blinker it to modernity's global dimension and, thus, stop it from acquiring the mindset needed to understand and interact with the world's diverse cultures (Toniolo, 2011).

Quality of management is another factor. Recent contributions to the literature (Bloom and Van Reenen, 2007) have shown the significant impact on firm performance of the widespread adoption of appropriate management practices. However, the highly diverse management practices adopted is a further factor that separates Italy and Germany. Bloom and Van Reenen (2010) observed that on the management practices scorecard, Germany ranks at the top, while Italy ranks midway along with several other European countries (France, United Kingdom, Ireland and Poland) that score significantly lower (intermediate) points.

3.3. Export policy

Italian firms tend to adapt their offer to the demand structure and to exploit market opportunities in a extensive but episodic way. This approach contrasts strongly with the behaviour of the German firms, which tend to export to a smaller group of countries but in a more significant and continuous way. On the other hand, the product export mix has changed significantly in both countries over time. Foresti and Trenti (EPI Special Issue, 2012) point out that Italy has increased the weight of low price goods on total exports in 2009, albeit reduced with respect to 2000. In terms of high price products, Italy is recording a positive export growth trend, even though the gap with Germany remains substantial and that, meantime, this latter has also increased its market share of high price exports.

The same authors also emphasize the differences in terms of geographical export specialization. German exports to the dynamic Asian markets are greater than those of Italy, while Italy focuses more on supplying goods to areas of slower growth, such as South America, North Africa, and the Middle East. In particular, Italy and Germany differ significantly in terms of their positioning in the BRIC economies. While German exports to China and Hong Kong, for example, have spurred brisk growth since the early

2010s, Italy, which already started from a low baseline, recorded a negative trend and did not regain the ground lost until the close of the decade, when it returned to its start level (Foresti and Trenti, EPI Special Issue, 2012). In short, as underscored by Guerrieri and Esposito (EPI Special Issue, 2012), compared with Italian firms, German firms have been able to more effectively exploit the opportunities sparked by the opening up of the global markets that began in the late nineties, with the benefits perceived by both the supply side (increasing fragmentation of production and extension of the division of labour) and the demand side, accelerating the market entry of emerging countries and making full use of Europe's return to monetary stability. On the other hand, Italy's strategic approach to geographical market diversification is less rewarding with respect differs to that of Germany.

3.4. Research policy

In structural terms, both private sector and state-funded R&D activities in Germany cover a far broader spectrum than Italy's. That significant gap is attested to by all the indicators used, whether an input or an output of the scientific process. Firm size dictates the extent of R&D activity carried out, therefore the German firms' high rate of R&D investment is partly a result of their size (and partly because these operate in sectors where innovation-driven competition is more straightforward). On the other hand, the state's scope for R&D investment seems less dependent on structural issues and more related to policy issues. This was good for Germany. The specialization of German R&D in renewable energy, energy-saving and environmental products and services is driven by the choices of the different German governments and the way government funding is allocated. To date, we can observe two outcomes:

1. a strong reduction in CO_2 emissions not due to the recession (as was the case in Italy); and

2. a push to develop the "green" industries, which has enabled Germany to lead the world in this sector, leaving other Western countries behind. Unlike Germany, Italy's uncertain approach to the energy sector and, more recently, the government's decision to develop (at an unfortunate time) a nuclear industry has brought no benefits to the country's industrial specialization, although government incentives to use renewable energy sources have led to a slight reduction in CO_2 emissions.

The contribution of Clemens and Schumacher published here indicates that, in addition to the reduced endowment of human capital and technological know-how, the gap between Italy and Germany in developing knowledge-intensive products can be attributed to significant differences in the country innovation system. Analyzing the different components of the DIW aggregate innovation indicator, Germany is particularly successful in networking innovative firms and research institutions, while its major deficiencies are related to the financial support for innovation and the founding of start-ups, as well as the regulation of the final markets. In contrast, Italy shows a poor performance in all the items that make up the indicator.

A sector analysis particularly highlights these differences. According to Rolfo and Manello (EPI Special Issue, 2012), in the mechanical engineering industry the German firms pursued an intense growth strategy to increase their size in 2000-2010, involving the merger of large companies into corporate groups and technical updating. These

processes have been implemented mainly by the country's financial, local and national institutions and have enabled its industrial sector to achieve not only competitive advantages but also to spur technological innovation. Italy has taken similar pathways too, but the pattern ensuing from the changes is more dispersed and uncoordinated. If, in Germany's case, as Rolfo and Manello (EPI Special Issue, 2012) highlight, the impression given is that of a choral process, the picture painted by Italy is a pixilated scenario of individual initiatives. Over time, Germany has established a national industrial system that connects and meshes with important local hubs and branches across the country, whereas in Italy, instead of working hand-in-hand to develop a coordinated and multi-centred national industrial system, the local agglomerations have passively absorbed the impact of the change brought about by the individual efforts of the firms.

In our view, such a comparative approach is worth pursuing further, but the focus should shift to a set of specific sectors and the strategies of internationalization implemented by the leading firms of both countries. However, that would mean adding a new item to the research agenda (or as the theme of a later issue of this journal).

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MANUFACTURING COMPETITIVENESS IN EURO COUNTRIES. A GERMAN PERSPECTIVE[°]

Marius Clemens[*], Dieter Schumacher[**]

Abstract

The aim of the paper is to analyse the performance and characteristics of the manufacturing sector in Germany as compared to Italy and against the background of the Euro countries as a whole. We explore the factor endowment and compare specialisation patterns in production and foreign trade with respect to three aggregated industries: resource-intensive, labour-intensive and knowledge-intensive products. The analysis will suggest that the strong position of German industry is mainly based on its technological strength and supported by increasing price competitiveness vis-a-vis other countries in the Euro area.

Keywords: international trade, competitiveness, specialisation, manufacturing, knowledge-intensive industry

Jel classification: F14, O14, L60

We would like to thank Janna Czernomoriez, Wilfried Fuhrmann, Janine Hart, Jens Schmidt-Ehmcke and two anonymous referees of this journal for their helpful comments.

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1. Notion of "international competitiveness"

The notion of "competitiveness" is taken from the analysis of individual enterprises and, in many studies, microeconomic indicators such as unit labour costs or market shares are applied at the level of the overall economy (Buckley, Pass and Prescott, 1988). From this viewpoint, the international competitiveness of a country improves when it increases its share of world exports and when unit labour costs grow at a slower pace than those of other countries. Given that factor costs, such as wages, interest rates and the prices of intermediate goods, are liable to higher fluctuations over shorter periods, the price or cost competitiveness can be understood as a temporary advantage (Boltho, 1996).
However, unlike companies, countries do not compete against each other. There is no "Germany incorporated", there are various groups of players in the economy which have different interests (Krugman, 1994). From the perspective of an overall economy, increasing competitiveness does not equate to exporting as much as possible at a low price but to spurring national real income to a higher level. In addition, a negative trade balance is not evidence of lower competitiveness, and neither is a positive trade balance an indicator of greater competitiveness. In contrast, inter-temporal preferences, age distribution, population growth, business cycles or government debt are more important factors from a nation's perspective (Obstfeld and Rogoff, 1996).

An alternative approach therefore would be to redefine the competitiveness of an economy by arguing that the ability to sell is not the only important factor but also the ability to earn. The decisive question is not the large size of world market shares are and how they change, but whether, in the long-term, an economy can maintain its level of real income as high as possible and chart a stable course of economic growth. Based on that approach, indicators such as GDP per capita or labour productivity describe the market success of a country and taking account of important success factors such as investment in human capital, R&D expenditure and investment in physical capital (Fagerberg, 1996; Porter, 1990). Therefore, more than the share in foreign or domestic markets, the focus should be on the production structure and on the concentration of high quality, high technology exported goods sold at high prices rather than on exported goods of low quality with low tech content and low prices (Lall, Weiss and Zhang, 2006). Thus, a nation's competitiveness depends on both long-term technological capacity and shorter term advantages, such as wages, interest rates and the prices of intermediate goods.

The analysis presented in this paper focuses on technological strength, adopting the methodology of empirical research applied to the German economy and conducted in Germany, comparing it to other highly developed countries. The concept and practice of this research are presented in Schmoch, Rammer and Legler (2006), spanning from the origin and implication of knowledge to the market success of knowledge-intensive goods and services. Empirical results and policy recommendations are published in the annual reports of the Expert Commission on Research and Innovation (EFI) and the special reports of the research institutes involved.[8]

[8]. The reports are available at www.e-fi.de. The most recent contribution of DIW Berlin on economic structures, productivity and foreign trade in international comparison can be found in Belitz *et al.* (2011a).

On these methodological grounds, the paper analyses the competitiveness of the manufacturing sector in Germany compared with Italy and the whole of the Euro (twelve) countries.[9] The paper is structured as follows: section two explores data on human capital and the national innovation system, considered the most important determinants of technological competitiveness. Endowed with a higher capacity for innovation, and as suggested by the international trade theories that trace comparative advantage to differences in factor endowment, Germany should be specialised in knowledge-intensive manufacturing. Section three analyses the production and foreign trade specialisation of Germany, Italy and the euro zone and compares the results in three industries aggregated according to whether their products are resource-intensive, labour-intensive or knowledge-intensive. Section four then analyses the impact of changes in price competitiveness. The paper uses unit labour costs as a measure of the real exchange rate because of the fixed nominal exchange rates between euro countries. The final section presents the paper's conclusions that German industry's strong position is mainly achieved through technological strength supported by the increasing competitiveness of its prices compared with other countries in the euro zone.

2.Human capital and innovation

The most important factor that determines the long-term development and thus the "competitiveness" of nations is the human capital stock of an economy (Barro, 1992; Romer, 1990). Commonly used single indicators are years of schooling and adult literacy rates.[10]

A comparison of indicators for human capital in Germany and Italy shows that the educational level of the Italian population lags significantly behind that of Germany, a situation that is also reflected in the resources invested in research and development (table 1). Italy has been narrowing the education gap, given that ten years ago it had a considerably lower percentage of population with at least a secondary or tertiary education and that the percentage is now higher for the younger population, which means that the educational level of the Italian labour force should increase further.

Building technological capacity is a creative and interactive process that involves more than human capital and occurs within a system of norms, institutional regulations and organisations. Freeman (1995) defined these "national innovation systems" as «networks of institutions in the public and private sector whose activities and interactions initiate and diffuse new technologies». Similarly, in Nelson (1993), the term national innovation system refers to the enterprises, institutions, and surrounding conditions that influence the process that fosters innovation. The national innovation system is the primary factor in the "DIW innovation indicator" (Von Hirschhausen *et al.*, 2009), which evaluates the ability of countries to create and transform knowledge into marketable products and services.[11] DIW uses a system of indicators that provides a composite indicator of

[9]. The Euro (twelve) countries are Austria, Belgium, Finland, France, Germany, Greece, Italy, Ireland, Luxembourg, Netherlands, Portugal, and Spain.

[10]. Human capital is defined as stock of skills, competences, knowledge and personal attributes embodied in ability that is paid at the market rate. It cannot be equated with general education and experiences, but instead is influenced by combinations of both (Becker, 1964). The labor-specific part of schooling, literacy, health and other factors can be approximately summarized by income per capita (Knowles and Owen, 1995).

[11]. See Belitz *et al.* (2011b) for a more detailed presentation of the methodology and data processing. Unlike other innovation indicators, the DIW innovation indicator covers the societal

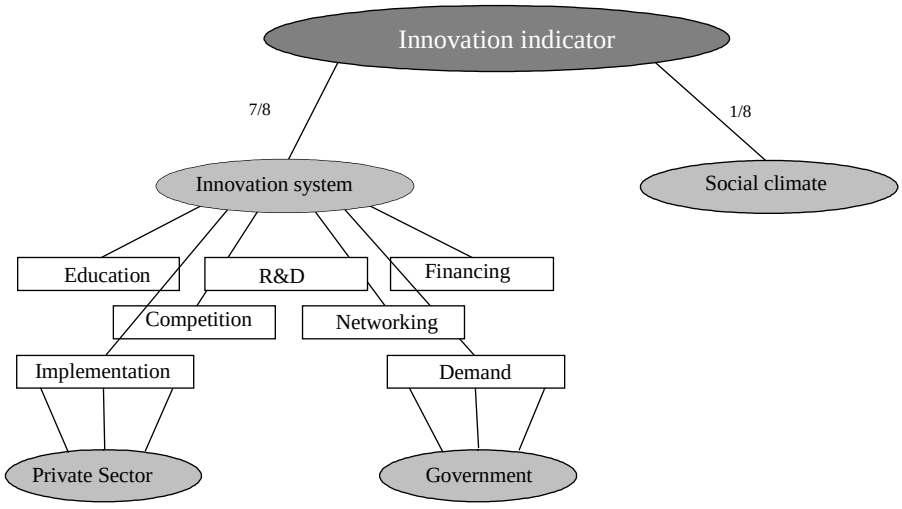
innovative capacity as well as a detailed profile of strengths and weaknesses. More than one hundred and fifty individual measures are merged to calculate an overall indicator for Germany and sixteen other highly developed countries.

Table 1 – Indicators of human capital in Germany and Italy, 2009

Population with secondary education (%)		
25-64 age group	84	41
25-34 age group	86	69
Population with tertiary education (%)		
25-64 age group	25	14
25-34 age group	24	20
Education spending (% of GDP)		
-2007	4.7	4.5
R&D spending (% of GDP)		
-2008	2.6	1.2
For information: GDP per capita 2009 (US-dollars)	40,700	35,100

Source: OECD (2011a); STI Indicators (2010).

Figure 1 – Composition of the DIW innovation indicator



Source: Belitz *et al.* (2011b).

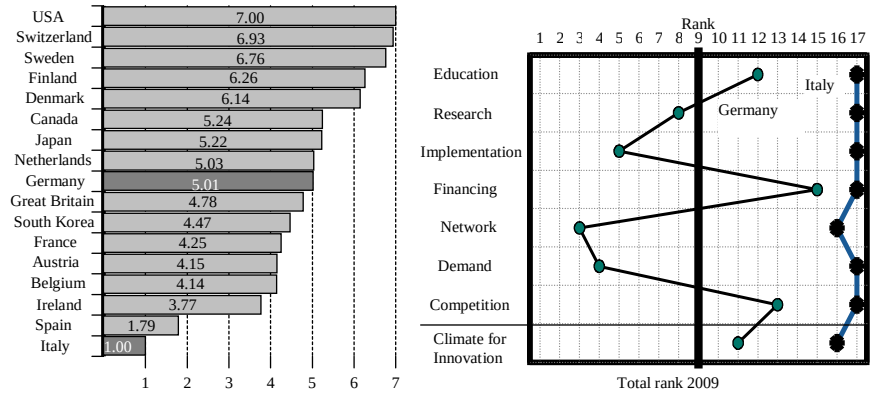
innovation climate. The innovation system comprises cultural and political components which could explain weaknesses in "traditional" system components. The innovation climate correlates positively with traditional factors of the innovation system and provides further insights to help us understand national innovation systems.

The innovation system ensures that highly qualified individuals (education), new knowledge (R&D), and sufficient capital (financing) come together in the process of innovation and that key players in innovation – particularly companies – are responsive to impulses from partners (networking), other competitors (competition) and national and international customers (demand) and implement new products, services, and organisational solutions (implementation). Each of these seven areas is underpinned by a number of separate indicators, which, taken together, provide a measure of the strength of a national innovation system. The "systemic strength" that is calculated in this fashion has a weight of seven to eight in the overall innovation indicator.

Moreover, a country needs a favourable social climate to encourage innovation, which is the final factor in the overall assessment. Clearly, there are implicit risks in the effort to develop new technologies and products and, in order to be innovative, a society must have both the desire and the will to change, must trust the actors who bring about innovation, and hold a fundamentally positive – but not necessarily uncritical – view of science and technology. For this reason, public opinion is evaluated through the results of surveys conducted on the process of change, social capital, trust, and science and technology to arrive at an assessment of a country's social climate for innovation.[12]

This "climate indicator" has a weight of one to eight in the overall assessment. In the overall ranking of the seventeen technologically leading countries in the 2009 innovation indicator, Germany classified as mid-range of the surveyed group, while the U.S. took first place (figure 2a) and Spain and Italy placed last. Drawing a distinction between the various components of a country's national "innovation system" and its "social climate for innovation" produces an "innovation balance sheet" that highlights the strengths and weaknesses of Germany and Italy relative to other countries (figure 2b).

Figure 2a – Innovation capacity
Figure 2b – Innovation capacity of Germany of selected countries, 2009 and Italy by components, 2009



Source: Belitz *et al.* (2011b).

[12]. There are two common sources that compare attitudes of societies in an international context. While World Value Survey data were especially used to consider openness to new technologies and formation of social capital, Eurobarometer data includes people's trust and concerns about advantages of science and technologies.

Germany is particularly successful in getting companies and research institutions to network in the innovation process and in meeting the international demand of high-technology sectors like mechanical engineering, the chemical industry, vehicle manufacturing and medical instruments. Germany's biggest weaknesses are deficiencies in the educational system and in the financial conditions for innovation and the founding of new companies, as well as the regulation of product markets that deters competition. In contrast, Italy has a weak performance in all components of the indicator. Thus, the results of the broader indicator confirm the figures on education and R&D in Germany and in Italy shown earlier.

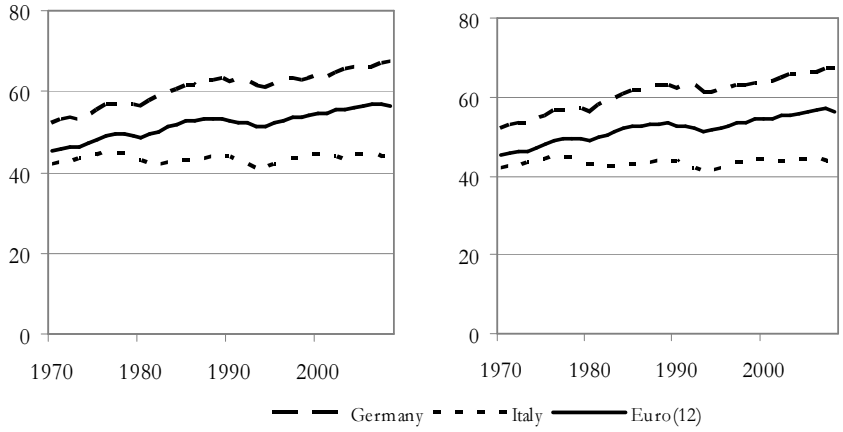
The assessment of the social climate for innovation ranked Germany as number eleven. The unfavourable climate for women's employment and the low level of confidence in companies and scientists that carry out research were the main cause of that negative result. However, these societal hurdles to innovation are offset by some positive aspects, such as the relatively outward-looking and tolerant attitudes of German citizens, as well as their optimistic assessment of the benefits and usefulness of science and technology. Evaluating the manufacturing systems of Germany and Italy in that light leads us to expect significant differences in the sectoral patterns of production and foreign trade in Germany and Italy. As opposed to Italy, Germany is expected to concentrate on industries that require high levels of human capital in terms of skilled workers and that invest significantly in research and development, i.e., knowledge-intensive industries.

3.Patterns of comparative advantage

3.1. Production

Figure 3a indicates the share of total manufacturing in the longer term and the declining relative importance of manufacturing. This situation complements the increasing share of services, in particular knowledge-intensive services such as communication, finance and business services, implying that manufacturing as a whole declines in relative importance. On the other hand, knowledge-intensive industries in manufacturing, such as pharmaceuticals, precision instruments, electronic and electric equipment generally, gained in importance. These trends were the main characteristics of long-term structural changes in the more advanced OECD countries over the past decades and are known as a shift towards a knowledge-based economy.

Figure 3a – Value added shares of manufacturing as % of total, 1970-2008 Figure 3b – Value added shares of knowledge-intensive industries as % of manufacturing, 1970-2008



Source: authors' calculations based on EU KLEMS (2009) and OECD STAN (2011) data.

The shifts in production patterns are due in part to the changing preferences of households, with higher income families demanding more knowledge-intensive goods and services, and in part to the changes in the inputs of manufacturing firms, which considerably increased their demand for knowledge-intensive services over the past twenty years. The competitiveness of manufacturing firms depends increasingly on their ability to provide a complete package that offers both the physical product and the related services, such as software, maintenance, training, logistics and planning. That situation has deepened the national division of labour and triggered a shift in value-added and employment from the manufacturing sector to the services sector that is greater than the shift in the value of production. Moreover, product-related services are produced by the manufacturing firms internally and gain in importance. Thus, the production of goods becomes more service intensive but does not translate into de-industrialisation. In addition the relocation of production processes to other countries (international outsourcing) replaces domestic value added with imports of intermediate goods. Increasing imports of labour-intensive goods from emerging economies in Asia also play an important role in accelerating structural changes in the most developed countries, where production is becoming more knowledge-intensive. After the mid-1990s, Germany inverted the general trend and resumed its higher manufacturing specialisation. In Italy and the Euro (twelve) countries, manufacturing as a percentage of total value added continued to decrease but remained stable in Germany. A more detailed picture of the manufacturing industries is presented in appendix A. The industries are sorted and aggregated by their main factor intensity into three groups: natural resource-intensive, labour-intensive and knowledge-intensive. The figures show fairly different patterns in terms of industries and factor intensity for the countries under consideration. In Germany, the largest industries are machinery, motor vehicles and chemicals, while Italy's biggest industries are fabricated metal products, machinery and textiles.

Italy has the smallest percentage of knowledge-intensive production requiring a high number of skilled workers and significant investments in R&D, amounting to some 40 % in 2009 and remaining fairly stable over the past forty years (figure 3b). In relation to Germany and other Euro (twelve) countries, Italy continues to have a high concentration

of labour-intensive production and a low level of technology, a situation that is only just starting to change. Conversely, the Euro (twelve) countries as a whole, and especially Germany, show a steady increase in the percentage of knowledge-intensive industries of almost 60% and 70%, respectively, in 2009.

3.2. Foreign trade

During the past fifteen years, the export and import of manufactured goods increased at a faster pace in Germany than it did in Italy (and other OECD countries) to account for a much higher share of GDP in Germany versus Italy (figures 4a and 4b). In 2009, manufacturing exports in Germany totalled approximately 40% of GDP compared with 25% in Italy. Moreover, after 1999, Germany increased its share (from 31% to 33% in 2009) of manufacturing exports to the Euro (twelve) countries, while Italy's share decreased (from 14% to 12.5%). The sharp decrease in foreign trade flows in 2009 was due to the worldwide recession triggered by the crisis in the financial markets.

Both Germany and Italy are net exporters of manufactured goods. In 2009, the German export surplus in manufactured goods was approximately 11% of GDP while the Italian surplus was lower at approximately 4%. Compared with 1995, Germany doubled the indicator while Italy recorded an even lower level in the fifteen-year period.

To a large extent, the high increase of Germany's imports reflects the part relocation of production processes abroad (international outsourcing). After 1990, West German firms moved quickly to integrate Central and Eastern European production facilities into their intra-firm division of labour, leading to an increase in imports and also the import content of exports. Sinn (2006) suggests that Germany is becoming a "bazaar economy" as the domestic value added of exports is dwindling. DIW input-output calculations paint a different picture (Schumacher, 2005, pp. 46-47), indicating a considerable increase in the import content of German exports, in other words, the value-added content of exports decreased per unit of exports. The dynamic growth in exports, however, means that an increasing percentage of Germany's total value added depends on exported goods, although value added is decreasing as a percentage of export value. Given that Germany continues to rely more heavily on production activities and that trade is a significant driver of its economy, it is far from being a "bazaar economy".[13]

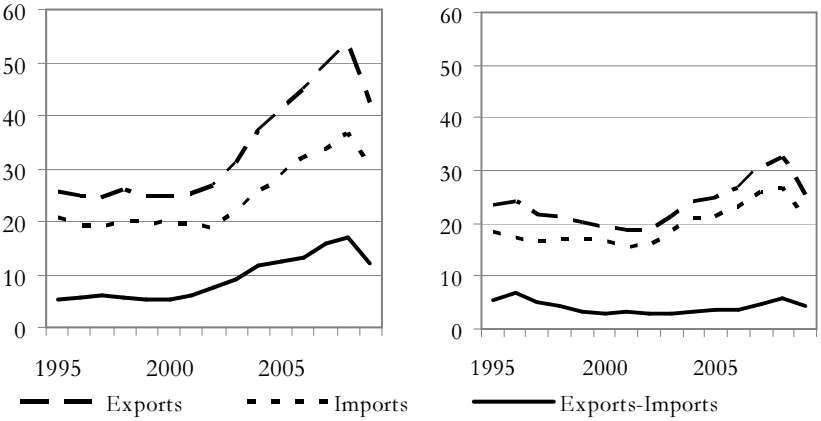
Appendix B shows the structure of exports and imports for Germany and Italy by product group in line with the industrial breakdown and sorted by factor intensity. The most important export product groups are machinery, motor vehicles, chemicals and textiles. Motor vehicles and chemicals account for a higher share of German exports compared with Italian exports, and vice versa for textiles and machinery.

Two indicators are used to measure the competitive positioning of an industry in international trade and to compare commodity patterns of trade in manufactured goods (details provided in appendix C). To compare the goods structure of a country's exports with the goods structure of world exports, the RCA1 indicator is used to identify the

[13]. See Breda and Cappariello (2010) for a comparative input-output analysis of Germany and Italy.

relative market share of an industry.[14] The value is positive when a country *j* has a higher share of industry *i* in total exports than the other countries, indicating a comparative advantage of country *j*. The value is negative when the export share is lower in relation to other countries, indicating a comparative disadvantage. The more the structures differ, the higher the absolute values of the indicator.

Figure 4a – Foreign trade in manufactured goods in Germany, 1995-2009
Figure 4b – Foreign trade in manufactured goods in Italy, 1995-2009



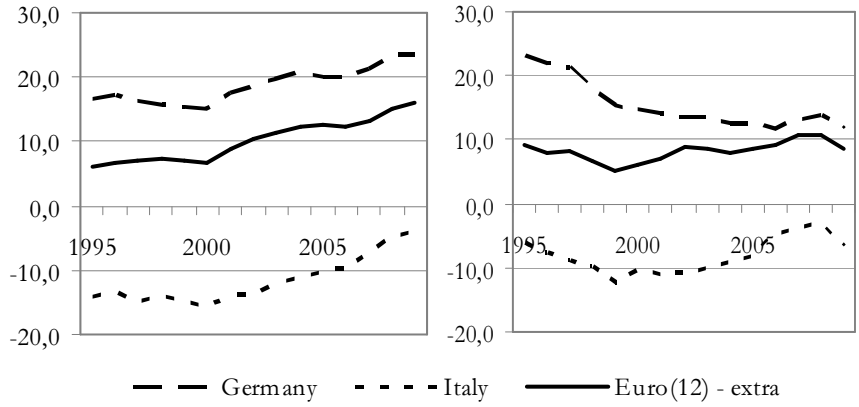
Source: authors' calculations based on United Nations (2011) data.

Figure 5a illustrates the specialisation of knowledge-intensive goods in manufacturing exports in 1995-2009. Starting 1999, Germany, Italy and the Euro (twelve) countries improved their position in world exports.[15] However, the 2009 values indicate the higher focus of Italy's exports on labour-intensive products and less on knowledge-intensive goods. Germany clearly has the comparative advantage in knowledge-intensive goods, well ahead of the other Euro (twelve) countries.[16]

[14]. The indicator was introduced by Balassa (1965) for quantifying "revealed comparative advantage" of a country by applying international trade data. For a presentation and evaluation of various indicators of comparative advantage used in empirical analysis see Vollrath (1991).

[15]. Euro (twelve) extra excludes trade within the euro area and gives more comparable results.
[16]. Since Germany and Italy are part of the Euro (twelve) group of countries, the RCA1 in knowledge-intensive goods for Euro (twelve) is overvalued compared with the euro area excluding Germany, but undervalued compared with the euro area excluding Italian export data.

Figure 5a – Specialisation of knowledge-intensive goods in foreign trade (RCA1), 1995-2009 Figure 5b – Specialisation of knowledge-intensive goods in foreign trade (RCA2), 1995- 2009



Source: authors' calculations based on United Nations (2011) data.

An alternative indicator used in empirical studies (RCA2) compares the export to the import pattern within a country, and thus, its net position in foreign trade. The value is positive when the percentage of exports is higher than that of imports, while the opposite is true for negative values. Changes in RCA2 give the combined effect of changes in the commodity composition of exports as well as imports.

The results displayed in figure 5b are fairly similar to the results of the RCA1 indicator for export specialisation, confirming that the results assign a higher comparative advantage in knowledge-intensive goods to Germany versus the average for the Euro (twelve) countries and a disadvantage for Italy. Italy and the Euro (twelve) countries improved their export-import positions up to 2008. Unlike the RCA1 result, however, Germany's net position declined, i.e., German imports of knowledge-intensive goods outperformed exports, primarily due to the substantial increase in imports from emerging countries, which have been narrowing the gap in the medium- and low-price segments of knowledge-intensive goods. During the financial crisis specialisation patterns changed in favour of resource and labour-intensive products. Furthermore, trade flows were diverted to the emerging markets as a result of their high growth opportunities and the relocation of production, which has an impact on both the export and import specialisation of industrial countries (Clemens, Mölders and Schumacher, 2011).

3.3. Trade between Germany and Italy

In relative terms, bilateral trade between the two countries plays a greater role for Italy, which is the smaller economy. However, the onset of the worldwide recession led to a decrease in German-Italian trade flows in 2009, reflecting the overall trend in foreign trade. Germany's export surplus increased from euro one billion in 1995 to euro five point two billion in 1999 and to euro sixteen point one billion in 2009. Appendix D shows the specialisation pattern by individual industry. The graph gives the values of the RCA2 indicator calculated using German and Italian statistics, alternating the presentation of the results from the German viewpoint. Although the values of the same trade flow are different in the two sources for a number of reasons, the values of the

structural indicator are very similar – as can be expected given that in bilateral trade the export of one country is the other's import.[17]

In 2009, the comparative advantage of Germany in trade with Italy clearly centred on office, accounting and computing machinery, electronic equipment, optical and medical instruments, wood, cork and furniture, printing, motor vehicles, and chemicals. Italy, on the other hand, had the advantage in textiles, fur and leather products, non-metallic mineral products, other manufacturing comprising labour-intensive consumer goods, fabricated metal products, rubber and plastic goods, machinery, basic metals, other transportation, and petroleum products. A pattern also in line with that of earlier years.

Aggregated by factor intensity, the pattern of comparative advantage in bilateral trade is similar to that of the two countries in overall foreign trade (figure 6a). Germany's bilateral trade also shows a decreasing comparative advantage in knowledge-intensive goods, although it has improved its significant disadvantage in labour-intensive goods. The consistency of the results (figure 6b) confirms those resulting from Germany's foreign trade statistics and reflects precisely the results produced by Italy's statistics (statistics are based on United Nations, 2011 data).
To sum up, the specialisation patterns in production and foreign trade highlight the endowment differences between Germany and Italy in terms of human capital and technological know-how. Italy continues to lag in the production and export of knowledge-intensive goods, but is closing the gap in exports. At present, Germany is exporting more labour-intensive goods to Italy and, as a result, the industrial patterns of German and Italian exports are moving closer, which in bilateral trade decreases the share of inter-industry trade driven by comparative advantage and increases the share of intra-industry trade.

Figure 6a – Specialisation in trade of manufactured goods between Germany and Italy (RCA2), 1995-2009, German statistics

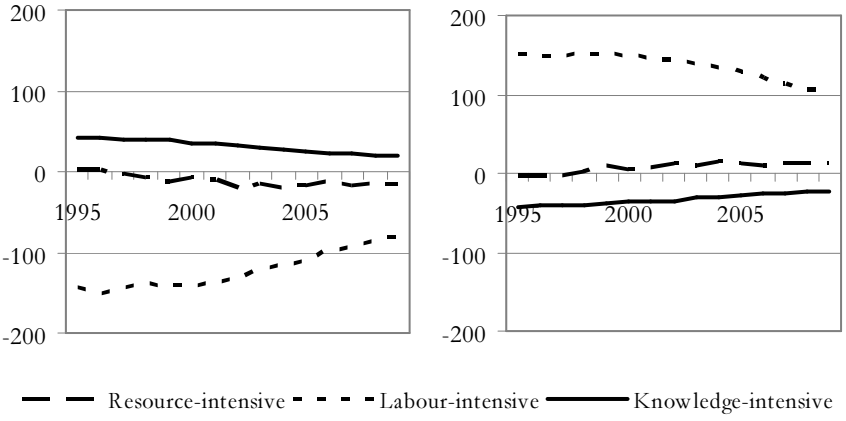


Figure 6b – Specialisation in trade of manufactured goods between Germany and Italy (RCA2), 1995-2009, Italian statistics

Source: authors' calculations based on United Nations (2011) data

[17]. Therefore, in bilateral trade, comparing the two export patterns of RCA1 and comparing the export and import pattern of the same country in RCA2 should, in principle, produce the same results. Divergences arise when the same trade flow is recorded differently in the exporting and importing country, e.g., FOB versus CIF valuation, net versus gross valuation of outward processing trade, different recording of the country of origin or the country of destination, and estimations in the statistics on intra-EU trade.

3.4. Intra-industry trade

The share of intra-industry trade in bilateral trade can be measured using the so- called Grubel-Lloyd index (Grubel and Lloyd, 1971). Here, it is calculated at the four-digit ISIC level and applied to trade structures (instead of absolute values). When the index value increases, so does the share of intra-industry trade. Appendix C illustrates the formula applied. [18]

Figure 7a shows that knowledge-intensive industries account for the highest portion of intra-industry trade between Germany and Italy, although labour-intensive and resource-intensive industries have also significantly increased their contribution. More specifically, the highest percentage of intra-industry trade is driven by motor vehicles, chemicals, basic metals, rubber and plastic products and machinery. In German trade with other Euro (twelve) countries, excluding Italy, intra-industry trade accounts for a larger share, i.e., Germany has more inter-industry division of labour with Italy than it has with other euro countries (figure 7b).

Horizontally differentiated intra-industry trade between similar countries can be explained by economies of scale and the higher demand of consumers, who prefer to choose from a wider array of product ranges. When horizontal intra-industry trade increases, it suggests a decrease in factor endowment differences, with Italy's human capital and technological know-how becoming more similar to Germany's. Nevertheless, the conclusion drawn by empirical studies is that vertically differentiated products account for a significant share of intra-industry trade, i.e., exported and imported varieties differ by quality. Taking price as an indicator of quality, Fontagné, Freudenberg and Péridy (1997), for example, estimated that two-thirds of intra-industry trade within the EU is vertically differentiated. This type of trade can be explained again by differences in factor endowment, the knowledge-rich country exporting higher qualities and the labour-rich country exporting lower qualities, based on the assumption that production is more knowledge-intensive when the quality of variety is higher.

Studies of DIW suggest that Germany's supplies are more concentrated on higher qualities than Italian supplies. The calculations of Freudenberg and Trabold (1999) give the following results with regard to Germany and Italy:

1. Among EU countries, German exports have the highest unit values in most product groups, also in labour-intensive goods. Italy has the highest unit value only in textiles.
2. Comparing the imports of R&D intensive goods in major OECD countries, the share of high-unit-value goods in German supplies is significantly higher than in Italian supplies and the opposite is true for low-unit-value goods.

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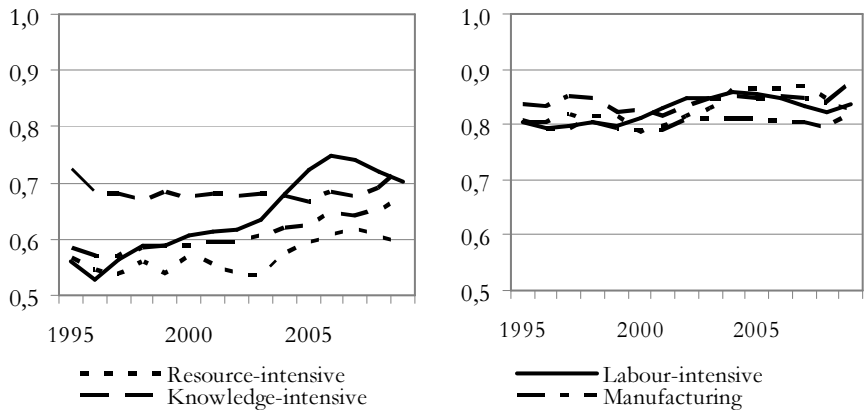
[18]. Inter-industry and intra-industry trade are complements. This is also reflected in the indicators, RCA2 measuring the difference between commodity patterns and the indicator of intra-industry trade measuring their similarity or overlap.

3. Comparing exports and imports of R&D intensive goods, Germany has a comparative advantage in high-unit-value goods while Italy has a comparative disadvantage in the high-price segment of the market.

Figure 7a – Intra-industry trade between Germany and Italy, Grubel-Lloyd index, 1995-2009; Figure 7b – Intra-industry trade between Germany and without Italy, Grubel-Lloyd index, 1995-2009



Source: authors' calculations based on United Nations (2011).

The results refer to the beginning of our reference period. More recent calculations for 1994-2005 confirm that the unit values of Italian exports are below the EU average and that the unit values of German exports are above average (Bennett *et al.*, 2008, p. 45). The same calculations also suggest that the gap between Germany and Italy did not diminish.

As a result, we can assume that a large part of intra-industry trade between Germany and Italy reflects differences in knowledge endowment and the fact that Italy has not yet caught up on the technology ladder. One example is machinery, given that Germany focuses on highly specialised machinery tailored to the needs of individual customers, while Italy mainly exports more standardised general purpose machinery.

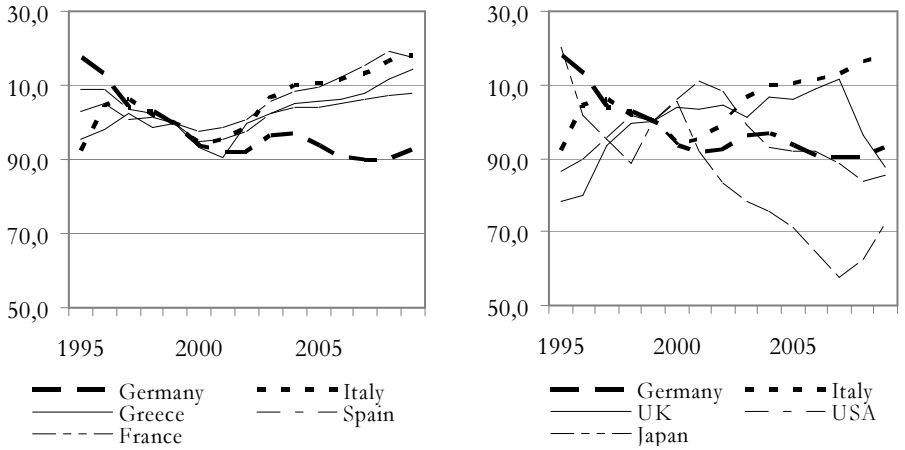
4.Shifts in price competitiveness

The specialisation patterns of Germany and Italy are also influenced by shifts in real exchange rates. In the past decade, differences in inflation rates have changed the levels of price competitiveness between Euro countries.

The impact of exchange rate fluctuations on quantities depends on the price elasticity of demand. Empirical analyses suggest a time lag of around one year before the reaction of export quantities to higher prices turns negative. It can also be assumed that the price elasticity of exports varies depending on the type of product. When price elasticity is lower, competition acquires greater importance in terms of quality, which is highly

dependent on R&D and human capital intensity. More recent theoretical and empirical studies conclude that the price elasticity of export demand differs according to the knowledge intensity of products. Lucke, Schröder and Schumacher (2005) introduce the concept of R&D intensity into a standard Dixit-Stiglitz/Krugman setting, treating R&D expenditure as a fixed cost of production.[19] The results support the hypothesis that the price elasticity is negative and that it tends to be smaller for knowledge-intensive goods than for other goods. Thus, exchange rate fluctuations have an impact on both the volume and trade commodity patterns. For example, a real devaluation of a currency would be expected to have a positive effect on the level of total exports and a negative effect on the share of knowledge-intensive goods, and vice versa for a real revaluation.

Figure 8a – Price competitiveness of selected euro countries (real exchange rates measured by unit labour cost, 1999 = 100), 1995-2009 Figure 8b – Price competitiveness of selected OECD countries (real exchange rates measured by unit labour cost, 1999 = 100), 1995-2009



Source: AMECO database (2011).

After the introduction of the single currency in 1999, the real exchange rate decreased in Germany and increased in other euro countries (figure 8a), improving the price competitiveness of German companies in relation to firms in other euro countries. By 2009, Germany had a cumulative price advantage over countries such as Greece, Spain and Italy of approximately thirty percentage points. Differences in real exchange rates between Germany and other euro area countries were influenced by the low unit labour costs in real factor markets. From the intra-European perspective, Germany appears to have gained in price competiveness versus other euro countries by repressing wages, whereas labour productivity in manufacturing significantly increased.[20]

The indirect objective of the European cohesion policy is to increase wages in regions with incomes below the EU average. The implementation of structural funds should assist

[19]. These authors consider the R&D intensity of products. The definition of R&D-intensive goods in their analysis is similar to the delineation of knowledge-intensive goods in this paper.

[20]. According to OECD data for 2000-2009, hourly manufacturing wages increased by 16.5% in Germany and by 30.5% in the combined total for the seventeen euro countries. GDP per hour worked increased by 9.7 % in Germany and 7.9% in the entire euro zone.

the real convergence process by transferring money inter-regionally.[21] Thus, an increase in unit labour costs in lower-than-average income countries is the expected result of a policy coordinated convergence process when productivity does not increase at a similar pace. Additionally, ECB (European Central Bank) policy that targets average inflation in the euro area fostered the price divergences between countries after fears of deflation led them to reduce interest rates in 2003.[22]

The intra-European perspective, however, only reveals half the picture. If the real exchange rates were related to other knowledge-abundant manufacturing producers, such as the U.S., the UK or Japan, Germany would not have made gains in price competitiveness outside the euro area (figure 8b). In 1999-2009, Italy also lost price competitiveness from a worldwide perspective.

Lower prices in Germany than in other euro countries supported German exports while Italy's higher prices weakened the country's exports. The price divergences also affected the structure of exports. Comparative advantage in German trade with other euro countries shifted from less price-elastic knowledge-intensive goods towards more price-elastic labour-intensive products. On the other hand, firms in Italy faced lower price competitiveness and, therefore, shifted exports towards more knowledge-intensive goods.[23] Therefore, the changes in real exchange rates also can explain some of the shifts in comparative advantage in bilateral trade between Germany and Italy shown in figures 6a and 6b. In trade with non-euro countries, Germany's export specialisation in knowledge-intensive goods was further strengthened by the strong technological position of German firms and a dynamic demand for highly sophisticated investment goods.[24]

5. Conclusion

The analysis suggests that the strong position of German industry is mainly related to its technological strength supported by its increasing price competitiveness versus other countries in the euro zone. Export-driven growth in Germany increased overall manufacturing production and favoured the production of more price-elastic labour-intensive goods. Italian manufacturing is to a large extent complementary to the German

[21]. The mechanism design stipulated that some funds could only be obtained in combination with additional new indebtedness.

[22]. In 2003, Germany and France had massive problems not only with their debt but also with low inflation (IMF, 2003). In contrast, Southern European countries were concerned with high inflation rates. The decrease of the Central bank rate turned real interest rates negative only in the high-inflation part of Europe, pushing the debt dynamic and creating price bubbles in the housing and banking sectors.

[23]. The convergence processes in technological performance could also have been strengthened by the temporary transfer payments made in 1999-2002 by Germany to Italy in line with the cohesion policy. This is a task for future research, which could analyse how much the European cohesion policy has influenced bilateral trade flows (Breuss, Egger and Pfaffermayr, 2010). However, this might be one of the reasons for the growth in higher wages in Southern European countries and for the lower-than-expected migratory flows to Germany.

[24]. See Schumacher (2005, pp. 46-48), for the impact of changes in exchange rates on the commodity pattern of German exports to non-euro OECD countries.

system. The focus in Italy still is more on less high-tech and less skill-intensive manufacturing. The gap in technological performance in foreign trade, however, has been narrowing over the past ten to fifteen years. The shift in Italian exports towards more knowledge-intensive goods is due in part to the drop in price competitiveness after the introduction of the euro, which slowed the export of labour-intensive goods, and in part to the higher supply of skilled labour. This trend is expected to continue as the Italian labour force further increases overall education levels.

The strong technological position of German enterprise can be challenged only in the longer term and could even be strengthened by new demand trends created by the shift towards "green growth" investment goods. Germany has a comparative advantage in "green" goods and technologies based on the technological developments made in the 1980s after the energy price hikes suffered in the mid-1970s and early 1980s. Indeed, German industry currently is a leading supplier of energy saving technology and goods for renewable energy production.

But there are also high risks that could diminish Germany's comparative advantage in knowledge-intensive industries and, thus, that of the entire euro area. For example, Germany's ageing society and low fertility rates weaken the rent system and could fuel the shortage of skilled labour. This situation is exacerbated by insufficient education funding, low labour-market immigration, and the poor level of integration of immigrants.
In the shorter term, the major risk for the European economies can be attributed to the uncertainty of what policy measures are needed to reduce the present current account imbalance between the euro countries and high public indebtedness. To restore a more balanced pattern of foreign trade within the euro area would mean narrowing the gap in price competitiveness by reversing the divergent trends in unit labour costs and inflation rates. In Germany, the real revaluation will have a negative effect on exports, in particular exports of labour-intensive goods. In Italy the real devaluation will have the opposite effect and accelerate exports, in particular the exports of labour-intensive goods. In the longer term, it will also be necessary to narrow the technological gap between the euro countries by increasing investments in education and R&D, in particular in those countries that still lag behind.

At present, economic policy is focused on public indebtedness and its consequences. Reducing the high level of public debt in a number of euro countries will require significant public spending cuts, which would diminish the demand for domestic production and imports.

The negative effect on exports will penalise all countries, and will have a particularly significant impact on the German export industry given its high export market shares in most European countries. The German economy would be much less vulnerable if it were to reduce its extremely high dependence on exports and, instead, stimulate domestic demand, which, in turn, would have a positive effect on the exports of other euro countries.

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Appendix A

Table A1 – Percentage breakdown of manufacturing value-added by industry, 2009

Natural resource-intensive		**18.7**	**25.6**	**25**
Food, beverages, tobacco	15t16	7.2	9.7	10.1
Wood and cork products	20	1.4	2.3	2
Paper, paper products	21	1.9	2	2.3
Coke ref., petrol products, nuclear fuel	23	0.6	2.5	1.3
Non-metallic mineral products	26	3	5.2	4.4
Basic metals	27	4.6	3.9	4.9
Labour-intensive		**14.1**	**30.8**	**20.8**
Textiles, fur and leather	17t19	1.6	10.9	4.8
Fabricated metal products	28	9.7	14.6	11.9
Other manufacturing nec	36t37	2.8	5.3	4.1
Knowledge-intensive		**67.2**	**43.6**	**54.2**
Printing	22	4.4	3.9	5
Chemicals	24	10.6	6.5	10.7
Rubber and plastic goods	25	4.6	4	4.6
Machinery, nec	29	17.1	14.5	12.8
Office, accounting and computing machinery	30	0.8	0.3	0.6
Electrical machinery	31	7.8	4.5	5
Electro. equip. (radio, TV and commun.)	32	2.1	2.4	2.4
Instruments, watches and clocks	33	4.5	2.3	3
Motor vehicles	34	12.7	3.1	7.5
Other transport (ships, aerospace, other)	35	2.6	2.1	2.6

Source: authors' calculations based on OECD STAN (2011).

Appendix B

Table B1 – Percentage breakdown of foreign trade in manufactured goods by commodity group, 2009

		Exports		Imports	
Natural resource-intensive		**16.6**	**21.7**	**20.5**	**25.4**
Food, beverages, tobacco	15t16	5.6	7.2	7	9.8
Wood and cork products	20	0.7	0.4	0.8	1.2
Paper, paper products	21	2.2	1.7	2.2	2.2
Coke ref., petrol. prod., nuclear fuel	23	1.6	3.4	3.1	2.5
Non-metallic mineral products	26	1.4	2.7	1.1	1.3
Basic metals	27	5.1	6.3	6.3	8.4
Labour intensive		**9.2**	**21.8**	**13.3**	**14.1**
Textiles, fur and leather	17t19	3.3	12.3	6.9	9.5
Fabricated metal products	28	3.6	4.7	3	2.2
Other manufacturing nec	36t37	2.3	4.8	3.4	2.4
Knowledge intensive		**74.2**	**56.5**	**66.2**	**60.5**
Printing	22	1.1	0.5	0.8	0.5
Chemicals	24	15.8	10.4	16	18.2
Rubber and plastic goods	25	3.8	3.8	3.3	2.8
Machinery, nec	29	16.7	21.7	10.1	8.9
Office, account. and computing machin.	30	1.6	0.4	3.1	2.1
Electrical machinery	31	5.9	4.5	5.2	3.8
Electro. equip. (radio, tv and commun.)	32	3.1	1.5	6.6	5
Instruments, watches and clocks	33	4.9	2.8	4.1	3.8
Motor vehicles	34	16.6	6.9	11.2	13
Other transport (ships, aerospace, other)	35	4.7	4	5.8	2.4

Source: authors' calculations based on United Nations (2011).

Appendix C

The formulae used are as follows:
X = exports; M = imports; i = product group; j = country; x = % share of total exports; m = % share of total imports.

Comparing exports of country j and exports of all countries (world trade):

$$RCA1_{ij} = 100 \ln [(X_{ij} / \Sigma_j X_{ij}) / (\Sigma_i X_{ij} / \Sigma_{ij} X_{ij})] \quad [1A]$$

or

$$RCA1_{ij} = 100 \ln [(X_{ij} / \Sigma_i X_{ij}) / (\Sigma_j X_{ij} / \Sigma_{ij} X_{ij})]$$

$$= 100 \ln [x_{ij} / x_{i, \Sigma j}]$$

Comparing exports and imports of country *j*:

$$RCA2_{ij} = 100 \ln [(X_{ij} / M_{ij}) / (\Sigma_i X_{ij} / \Sigma_i M_{ij})] \quad [2A]$$

or

$$RCA2_{ij} = 100 \ln [(X_{ij} / \Sigma_i X_{ij}) / (M_{ij} / \Sigma_i M_{ij})]$$
$$= 100 \ln [x_{ij} / m_{ij}]$$

Intra-industry trade in product group *i* for country *j*:

$$IIT_{ij} = 100 (2 * \min x_{ij} , m_{ij}) / (x_{ij} + m_{ij}) \quad [3A$$

Total for country *j*:

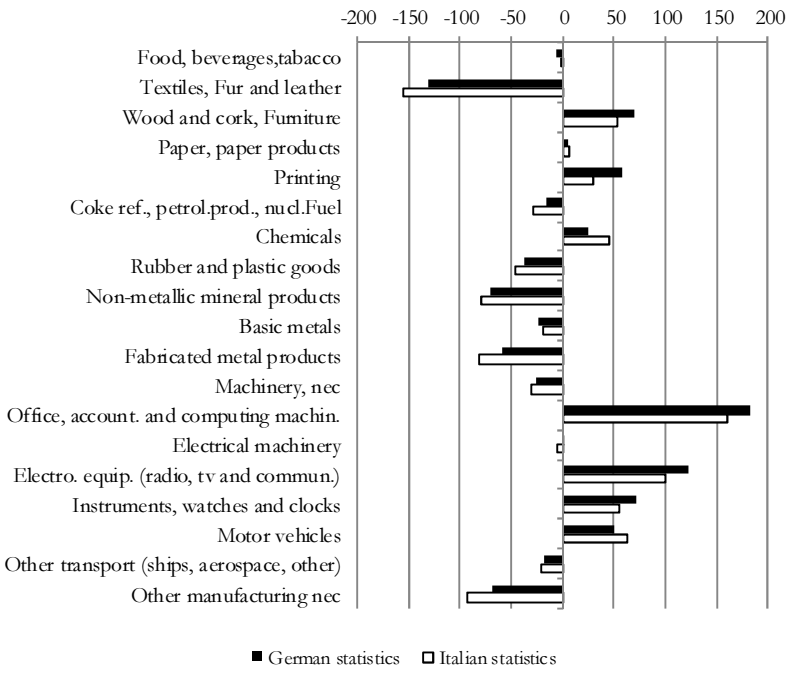
$$IIT_j = 100 (2 * \Sigma_i \min x_{ij} , m_{ij}) / \Sigma_i (x_{ij} + m_{ij}) \quad \square\square\square$$

$$= 100 (2 * \Sigma_i \min x_{ij} , m_{ij}) / (100 + 100)$$

$$= \Sigma_i (\min x_{ii} , m_{ii})$$

Appendix D

Figure D1 – Specialisation pattern in trade between Germany and Italy (RCA2 for Germany), 2009



Source: authors' calculations based on United Nations (2011).

A TALE OF TWO BAZAAR ECONOMIES: AN INPUT-OUTPUT ANALYSIS OF GERMANY AND ITALY[°]

Emanuele Breda[*], Rita Cappariello[**]

Abstract

The paper evaluates the extent of production internationalisation in Italy and Germany from 1995 to 2007. The analysis is based on a broad set of international outsourcing indicators to which we have added a new indicator to take account also of the import content of domestic inputs: the direct and indirect import content of production. In 2007, both countries showed a similar intensity of international off-shoring, although Italian manufacturing firms showed a slightly higher rate. From a dynamic viewpoint, both economies spurred substantial growth in off-shoring in 1995-2000, although the growth was stronger in Germany, where at least manufacturing started from a lower level. In 2001-2003, the intensity of off-shoring stagnated in both economies, although growth resumed at a fast pace in 2004-2007. That would suggest a change in strategic direction and a reorganisation of production in Italian firms. The new challenges posed by globalisation, the widespread take-up of information and communication technologies, and the adoption of the euro have induced the most dynamic Italian firms to rethink their organisation, including their degree of vertical specialisation.

Keywords: international outsourcing, input-output tables
JEL classification: F14, C67

We wish to thank Alessandra De Michele, Stefano Federico, Jean Imbs, Marco Magnani, Luigi Federico Signorini, and Roberto Tedeschi for their valuable advice, the two anonymous referees, and the seminar participants at the University of Lausanne, the Eurosystem seminar *Competitiveness and External Imbalances in the Euro Area Countries* (ECB, Frankfurt am Main, 25-26 March 2009), the meeting of the *Working Party on International Trade in Goods and Trade in Services Statistics* (OECD, Paris, 4-6 October 2010), and the 2nd *EPI Annual Conference* (Parma, 20-21 June 2011). The usual disclaimer applies. The views expressed herein are those of the authors and not necessarily those of the Bank of Italy. This paper is an update of the Bank of Italy *Occasional Papers 79*, December 2010.

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1.Introduction

Starting with evidence of a sharp decline in domestic value-added in manufacturing, in 2003, Sinn used the expression «bazaar economy» to define the role played by the international fragmentation of production in the German economy. In fact, international production relocation was particularly intense in the country, especially following integration with its Eastern European neighbours in the second half of the 1990s.[25]

The economic literature and debate express mixed feelings about internationalisation. Some authors claim that it destroys jobs at home and, more generally, weakens the value-added base of domestic production. Others point out that it increases firm competitiveness and that, on balance, therefore could have a positive effect on domestic value-added and employment. Not surprisingly, the «bazaar economy» argument has been widely debated in Germany. German firms moved part of their production abroad mainly to reduce labour costs[26] as a way to both narrow their competitive disadvantages and boost exports, although the move also reduced the portion of valued-added produced in the domestic market. In the words of Sinn:

«Although German industrial production increased by fifteen percent between 1995 and 2003, real value added of German industry increased by only five percent in the same period. […] Industrial employment decreased by ten percent in the same period without new jobs having been created to offset these losses. […] Competitiveness can no longer be measured in terms of German exports. […] Germany is becoming a bazaar economy that sells the world economical, high-quality products that were not produced in the country.» (Sinn, 2003).

Other authors have differing opinions on this issue. Belke, Mattes and Wang (2007) argue that traditional measures of trade openness usually overstate the actual degree of openness and, since both gross value of exports and value-added in export production increased from 1997 to 2001, internationalisation actually generated gains for German firms. Danninger and Joutz (2007) show that the increase in German export market share since 2000 was due not only to international outsourcing, but also to the increase in trade relationships with fast-growth countries.

[25]. Companies can use two different forms to relocate production abroad: international outsourcing and off-shoring. The former consists of the contracting-out of some of the intermediate production phases and the purchasing of component parts from foreign suppliers. The second sees domestic firms set up plants abroad to produce their intermediate products. Both forms share some of the same macroeconomic implications, and the paper includes both concepts, using the two definitions interchangeably.

[26]. Shipping costs also play a role, although not always in an obvious way. According to Baldwin and Venables (2010), changes in shipping costs could affect the relocation strategies of production stages between high and low labour cost countries in a non-linear fashion because of the technological relationship between stages of production.

All the studies that evaluate the consequences of internationalisation using industry-level data rely on a large and fairly differentiated set of international outsourcing indicators. Therefore, there is no unique and universally accepted measure of the phenomenon at the aggregate macro level.

Feenstra and Hanson (1996) estimate the share of imported inputs on total purchases of intermediate products in order to measure the increase in international outsourcing in the United States from 1972 to 1990. Hummels, Rapoport and Yi (1998) and Hummels, Ishii and Yi (2001) found that some OECD countries recorded an increase in outsourcing during the 1980s by measuring the import content of exports. Chen *et al.* (2005) computed a broader indicator, factoring in both the direct and the indirect import content of exports to measure the same phenomenon for a group of OECD countries. Egger and Egger (2003) use a measure of direct import content of production to estimate the average annual change in international outsourcing for a number of European countries in 1990-1997.[27]

Almost all the indicators used in the above studies are based on the information given by intermediate imported inputs from input-output tables, which enable the output of each sector to be split into two parts: the first consists of inputs to the other sectors; and the second of goods that satisfy final demand. These indicators provide a fairly full measure of the phenomenon since they make no distinction between the different channels of internationalisation chosen by the firms, including both types of intermediate inputs: parts and components; and the goods produced by subcontractors or affiliates abroad.[28] Moreover, the use of indicators based on input-output tables enables us to sidestep the arbitrary dichotomy between intermediate inputs and other categories of goods, which is very common in trade statistics. Alternatively, trade data is used to deduce the amount of intermediate imported inputs, assuming that the weight of imported intermediate goods and services on total inputs is the same in every industry of the economy. This

[27]. Among the studies that use such indicators to evaluate the impact of outsourcing on productivity and employment at sectoral level, Amiti and Wei (2005a, 2005b) found that off-shoring had a positive effect on productivity and job growth in the UK and the U.S., respectively, especially in services. Egger and Egger (2006), however, found that the relation between off-shoring and productivity for the manufacturing industry in twelve EU countries has a positive impact only in the longer term. Other studies based on survey data use ad hoc criteria to identify internationalised firms. Bugamelli *et al.* (2008) find a positive correlation between value-added (or labour productivity) growth and internationalisation using a panel of Italian manufacturing firms for the 2000-2006 period only when a very broad definition of outsourcing is adopted. Barba Navaretti and Castellani (2004) found no evidence of international outsourcing and FDI (foreign direct investment) having a negative effect on the domestic employment level for a sample of Italian firms. In terms of the impact of internationalisation on the skills structure of employment, Diehl (1999) and Jäckle (2006) found evidence that outsourcing abroad actually increased the intensity of domestic skills, whereas Marin (2004, 2006) found it had the opposite effect on German and Austrian multinational enterprises.

[28]. Moreover, these measurements do not take account of the international outsourcing of the entire production and distribution processes (export platforms) to foreign subsidiaries, as this case implies neither the flow of goods and services across home country borders nor a change in the import content of domestic production.

methodology is used in Feenstra and Hanson (1996) and many other studies (Amiti and Wei, 2005a, 2005b).

In this paper we use the input-output tables of imported products compiled by the national statistical institutes and available for the years up to 2007 for both Germany and Italy.[29] This enables us to outline the pattern of production fragmentation for two of the euro area's main economies also for more recent years, without resorting to the restrictive "import proportionality assumption" of Feenstra and Hanson (1996).[30] Although other studies have analysed the development of international outsourcing in the Italian economy using the same data (Bracci, 2006; Daveri and Jona-Lasinio, 2008; Falzoni and Tajoli, 2007), none of the studies focus on the methodological issues related to the different indicators adopted to proxy international outsourcing and their meaning, nor do they focus on cross-country comparison.[31] Moreover, we propose a new international outsourcing indicator, that of the direct and indirect import content of domestic production. Since this indicator also takes account of the value of inputs used indirectly in the production of domestic goods, we believe it is more useful than the other standard indicators to perform a synthetic evaluation of the macroeconomic consequences of international outsourcing.

While the analysis provides a statistical framework for comparing the development of vertical production specialisation in Germany and Italy, it provides no evidence on the direction of causality between firms' choice of outsourcing and productivity or competitiveness at a macro level. A micro-data or FDI approach is more suitable for this aim as it enables better control of the firms' choices to relocate the production abroad.

The analysis confirms that both Germany and Italy substantially increased the level of international outsourcing over the period analysed (1995-2007): recording steady growth in 1995-2000, a stagnation (or slight reduction) in 2001-2003 and fast growth in 2004-2007. Therefore, the marked increase in international outsourcing observed from 1995 to 2000[32] was not merely biased by the exceptional cyclical peak of international trade in 2000, but reflects a trend towards more internationally integrated production processes. Moreover, the evidence shown by all the indicators that Germany spurred a higher

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[29]. The German and the Italian economies are fairly similar in size and structure, making it reasonable to compare the international outsourcing levels of the two countries. In contrast, a comparison with smaller economies appears less appropriate because of their higher trade openness (OECD, 2007).

[30]. As for the Italian economy, Daveri and Jona-Lasinio (2008) show that quantifying intermediate imported inputs according to the Feenstra-Hanson methodology rather than using direct data on intermediate imported inputs leads to a significant downward bias of the most common indicators for international outsourcing, i.e. the ratio between intermediate imported inputs and total inputs.

[31]. In these studies only the two main indicators for international outsourcing are constructed, both based on the ratio between intermediate imported inputs and total inputs. Bracci (2006) shows the sectoral development of internationalisation in Italy between 1995 and 2003. Falzoni and Tajoli (2007) use the same data and indicators to verify the relationship between outsourcing and employment, in terms of level and skill composition. Adopting the same approach, Daveri and Jona-Lasinio (2008) are interested in studying the link between outsourcing and productivity.

[32]. See Breda, Cappariello and Zizza (2009).

increase than Italy in international outsourcing was due to both the faster pace of internationalisation growth within sectors and a more marked shift in the German economy towards more fragmented international sectors.

A comparison of a broad set of outsourcing indices, each of which capture a different aspect, demonstrates that both countries had a comparable level of international outsourcing in 2007, the final year of our analysis. Analysing the purely manufacturing sectors indicates that Italian firms are slightly more internationalised than German firms: in 2007 the total import content of production was 31.1% in Italy and 29.5% in Germany, despite Italy's higher share of low-tech sectors, which are the least internationally fragmented. This latter result appears to differ from the evidence found by another recent study (Guerrieri and Esposito, 2011), which uses FDI data to measure international outsourcing levels. Different data sets and concepts (input-output tables, or FDI, or trade in intermediates) can lead to different results, especially when the levels are compared, given that each captures different ways of outsourcing production abroad. Moreover, the result of Germany's stronger internationalisation dynamics compared with Italy in the same study match perfectly the patterns produced by our international outsourcing indicators based on the input-output tables.

The paper is structured into three sections. After the introduction, section one presents some of the indicators commonly used in the literature to measure the international fragmentation of production and the indicator adopted by the authors to measure the direct and indirect import content of production, the definition and construction of which are used to evaluate their respective ability to capture the different aspects of the object of our analysis. Section two analyses the trend of international outsourcing at the aggregate and the industry levels in Italy and Germany from 1995 to 2007. A comparison of the indices and a shift-share analysis to break down the variance of the indices into different components is presented in section three to indicate international outsourcing patterns in different sectors. In the last section we summarise the key results of our analysis and our conclusions.

2. Concepts and indicators

The literature uses a wide variety of international outsourcing measures, therefore it is necessary to define and describe the properties of the set of indicators used in the paper to measure the extent of international outsourcing in Italy and Germany.

The first group of indicators focuses on the weight of imported inputs on total inputs. Because of its design, this class of measures provides information on the firms' strategic approaches to the acquisition of intermediate inputs in external and/or domestic markets. This group of indicators therefore provides a direct measure of the industrie' international activity, i.e., firms' international outsourcing net of the degree of "vertical integration" found in the production process of each industry (the weight of physical inputs, regardless of their origin, on total production). Feenstra and Hanson (1996) use this index to measure international outsourcing in the U.S. manufacturing sector from 1972 to 1990. The same approach is adopted by the European Economic Advisory Group (2005) to measure outsourcing in a set of European countries from 1995 to 2000. Similarly,

Feenstra and Hanson (1996, 1999) propose two slightly different indicators for international outsourcing to evaluate its effects on U.S. wages: a *broad index*, the ratio between imported inputs from all sectors to total (domestic and imported) inputs employed in each industry,[33] and a *narrow index*, which restricts the scope to those inputs that are purchased from the same industry as that in which the good is being produced, i.e., the standard intra-industry trade measure. These indices are used by Bracci (2006), Falzoni and Tajoli (2007) and Daveri and Jona-Lasinio (2008) to measure the increase in international outsourcing by the Italian manufacturing sector from 1995 to 2003.

The general formula use to calculate the *broad* index is:

$$IITI\_broad = \sum_{i=1}^{n}\left[\left(\sum_{j=1}^{J}\frac{m_{ji}}{m_{ji}+d_{ji}}\right)\left(\frac{m_i+d_i}{M+D}\right)\right] \qquad [1]$$

with m_{ji} and d_{ji} corresponding respectively to imported and domestically-produced inputs from industry $j = 1,..,J$ used to produce output in industry $I = 1,..,n$; m_i and d_i corresponding to total inputs, both domestic and imported, of industry *i; M* and *D* to total inputs, both domestic and imported, of the economy. The term in the first brackets represents the weight of imported inputs on total inputs in sector *i*, whereas the *IITI* formula refers to the whole economy.

The formula to calculate the *narrow* index is:

$$IITI\_narrow = \sum_{i=1}^{n}\left[\left(\frac{m_{ii}}{m_{ii}+d_{ii}}\right)\left(\frac{m_{ii}+d_{ii}}{M+D}\right)\right] \qquad [2]$$

with m_{ii} and d_{ii} corresponding respectively to imported and domestically-produced intra-industry inputs; $m_{ii}+d_{ii}$ to total intra-industry inputs of industry *i; M* and *D* to total intra-industry inputs of the whole economy.

The second class of indices refers to the import content of domestic production by measuring the imported intermediate inputs as a share of gross production. Unlike *IITI* indices, this group of indicators does not focus on the firms' choice between domestic and external input markets but is intended to capture the firms' substitution of domestic production with foreign production phases. Since this measure of international outsourcing is sensitive to the degree of vertical integration, this class of indices is useful to evaluate the effects of international outsourcing on macroeconomic variables (employment, labour intensity skills, value added), although it is less reliable for comparing indices across industries. This measure was first introduced by Egger and Egger (2003) to calculate the average annual change of international outsourcing for eleven European countries in the 1990s. The index can be expressed as follows:

[33]. As indicated earlier, Feenstra and Hanson (1999) derive data on imported inputs for each industry by assuming that any manufacturing employs imported inputs in the same proportion, whereas most of the quoted studies are based on input-output tables.

$$ICP = \sum_{i=1}^{n} \left[\frac{\sum_{j=1}^{J} m_{ji}}{y_i} \cdot \frac{y_i}{Y} \right] \qquad [3]$$

with y_i representing the gross output of industry i and Y the country gross output. The expression [3] shows that the aggregate *ICP*, expressed as a share of total output, is the output-weighted sum of each industry's import content.

Using this index as our starting point, the indicator we propose to use differs because it includes the value of the inputs indirectly used in the production of goods. We believe this measure to be more useful from a macroeconomic viewpoint. An imported input can indeed be used in a sector whose output is in turn employed in another sector, and then possibly in a third sector and so forth, until it is eventually included in a final good. In this case the measure of the import content of production would include both *directly* and *indirectly* imported inputs, the latter being defined as those already contained in domestic inputs.

The measure for the direct and indirect import content is as follows:

$$DIICP = \sum_{i=1}^{n} \left[\frac{\sum_{j=1}^{J} \left(m_{ji} + \sum_{k=1}^{K} {}_{m}a_{kj} d_{ji} \right)}{y_i} \cdot \frac{y_i}{Y} \right] \qquad [4]$$

where $0 \leq {}_{m}a_{kj} \leq 1$ is a multiplicative coefficient of the imported input from sector k that is embodied in the domestic production of sector j, and subsequently used as an input in industry i (d_{ji}).[34]

Finally, a third class of proxies for vertical specialisation is the import content of exports. This measure was originally proposed by Hummels, Ishii and Yi (2001) to capture the situation of goods and services produced in multiple stages across different countries, with each country carrying out specific stages of the production sequence and then exporting the good-in-process to the next country. This measure not only includes the value of imports directly contained in the exports, but also the value of inputs indirectly used in the production of the exported good, i.e., imported inputs embedded in domestic inputs. The index of vertical specialisation is a reliable proxy for measuring "globalisation" because it is capable of capturing the production chains that link the different countries, whether as intermediate-phase producers or exporters of final goods. Chen *et al.* (2005) use this index to calculate vertical specialisation for a series of OECD countries by using the latest input-output tables available for each. Two ECB studies (2005a and 2005b) adopt this approach in the debate on the structural changes of European economies. The same indicator is used in Breda, Cappariello and Zizza (2009) to estimate the pattern of international outsourcing for a set of European countries from 1995 to 2000. The formulas illustrated below describe the calculations to obtain the direct import content of exports (*ICE*) and the direct and indirect import content of exports (*DIICE*):

[34]. See also the definition [A4] in the appendix.

$$ICE = \sum_{i=1}^{n} \left[\frac{\sum_{j=1}^{J} m_{ji}}{y_i} \cdot \frac{x_i}{X} \right] \qquad [5]$$

and

$$DIICE = \sum_{i=1}^{n} \left[\frac{\sum_{j=1}^{J} \left(m_{ji} + \sum_{k=1\ m}^{K} a_{kj} d_{ji} \right)}{y_i} \cdot \frac{x_i}{X} \right] \qquad [6]$$

with x_i the exports of industry $i = 1, .., n$ and X the country total export. Examining [5] and [6] shows that *ICE* and *DIICE* are, respectively, the export share-weighted average of each industry's *ICP* and *DIICP*. Since export-intensive industries are more exposed to international competition and generally have a higher degree of international fragmentation of production, we expect to find higher values for the aggregate indicators based on exports than for those based on production.

According to the theoretical definitions, the *IITI* index should result in higher values than the *ICP* and *DIICP* indices since the value of total inputs is always smaller than the value of total production or gross output. The relationship between the *IITI* and the *ICE-DIICE* indicators is less straightforward.

Finally, an index of international outsourcing made popular by some recent studies on the German economy is the share of domestic value-added on production:

$$VAP = \sum_{i=1}^{n} \left[\frac{v_i}{y_i} \cdot \frac{y_i}{Y} \right] \qquad [7]$$

with v_i as value added of industry $i = 1, .., n$. Unlike the other indicators illustrated above, this indicator decreases as the degree of international outsourcing increases. The well-known definition of the German economy as a «bazaar economy» proposed by Sinn (2003) is due to the significant decrease shown by the German manufacturing industry in this index after 1995. However, whereas the *IITI*, *ICP* and *ICE* groups of indices are designed as direct measures of international outsourcing, the ability of the *VAP* index to capture industries' international activity is less straightforward. Nevertheless, the time pattern of the *VAP* index may be useful to detect changes in the degree of industries' international outsourcing.

3. International outsourcing in Italy and Germany

3.1. Extent of internationalisation

The indicators presented in this section are constructed on the basis of two sets of annual input-output tables released by Eurostat and Istat, respectively; each set contains

information on domestically-produced inputs and imported inputs.[35] All the indices presented are calculated based on the total purchase of non-energy products and market services, with energy products excluded to prevent their highly volatile prices influencing the results.

The analysis of international outsourcing in Italy and Germany refers to 1995, 2000 and 2007, using the two sub-periods to analyse the dynamics from 1995 to 2007. Table 1 and table 2 show the values of the international outsourcing indices in 1995, 2000 and 2007 for Italy and Germany, respectively at different levels of industry aggregation, i.e., the whole economy, total manufacturing, manufacturing divided into low, medium and high-tech industries,[36] and market services industries.[37] The development of the *IITI* and the *ICP* indices for Italy and Germany is additionally illustrated for the whole economy, manufacturing and services in figure 1, figure 2 and figure 3, respectively.[38]

The level of international outsourcing in the two countries in 2007 appears to be comparable: as expected, international outsourcing is significantly less intense in the market services industry than in manufacturing sectors, mainly because of different production technologies (the service sector is usually more labour intensive than the manufacturing sector) and of weaker international competition.[39]

[35]. For methodological issues see for Italy, Istat (2006), for Germany, Eurostat (2008).

[36]. This classification is an adaptation to two-digit NACE codes of the classification by technological intensity adopted in Anderton (1999) and ECB (2005c). Low-tech products are: food, beverages and tobacco; textile products and clothing; leather and leather products; wood and wood products; paper and paper products, printing and publishing; non-metallic mineral products; basic metals and metal products; furniture and other manufactures. Medium-tech products are: chemical products and man-made fibres; rubber and plastic products; mechanical machinery and equipment; transport equipment. High-tech products are: electrical equipment and precision instruments.

[37]. The paper defines "market services" as: transportation, trade, financial, renting and business services. Although other services (education, personal and health services etc.) also include a market component, we consider these sectors as scarcely involved in international fragmentation and trade.

[38]. For Germany, the graphs do not include the 1996-1999 period due to the lack of available data.

[39]. Feenstra (1998) provides an interesting complementary explanation of the lower level of international fragmentation in the services industry with respect to manufacturing, which is based on the different ways in which goods trade and services trade are statistically measured. Every time an intermediate good crosses the border, the entire value of this good is counted in import or export statistics, whereas in intermediate services only the value-added is registered. The indicators of international fragmentation for manufacturing (and other merchandise) are therefore upward-biased because of the double-counting of value-added at numerators, and are magnified by the number of cross-border transactions. Chen, Kondratowicz and Yi (2005) try to assess the quantitative importance of such double-counting in manufacturing data by estimating homogenous indicators for vertical specialisation in manufacturing and services.

Table 1 – Measures of international outsourcing in Italy

Sectors	*Import content of production*		*Import content of exports*		*Imported inputs on total inputs (IITI)*	*Narrow index*	*Value added on production*
	only direct content (ICP)	*direct and indirect content (DIICP)*	*only direct content (ICE)*	*direct and indirect content (DIICE)*			
			1995				
Total	8.5	15.1	14.9	23.7	16.7	27.9	44.8
of which: manufacturing	16.9	26.0	17.6	27.1	25.6	37.8	30.1
Low-tech	14.4	23.2	15.2	24.4	21.9	28.5	30.4
Medium-tech	19.7	29.9	17.9	28.4	29.2	53.3	28.7
High-tech	24.7	32.3	27.2	34.3	38.7	60.9	33.4
of which: market services	2.6	6.7	3.3	8.7	6.9	6.6	57.5
			2000				
Total	8.9	15.6	16.8	25.4	16.9	29.7	42.9
of which: manufacturing	18.3	27.4	19.7	29.1	27.5	42.2	28.9
Low-tech	15.1	24.0	16.6	26.0	22.8	30.7	29.2
Medium-tech	21.5	31.4	20.2	30.3	31.4	57.1	27.3
High-tech	27.8	34.5	30.1	36.1	43.2	72.0	32.4
of which: market services	2.9	7.6	3.6	9.2	6.9	6.9	53.7
			2007				
Total	9.9	17.0	19.2	28.5	18.7	32.3	42.1
of which: manufacturing	21.3	31.1	22.8	33.0	31.4	47.6	27.1
Low-tech	18.6	28.0	21.3	31.0	27.7	38.2	27.5
Medium-tech	25.1	35.7	23.7	34.7	35.6	62.8	24.8
High-tech	25.0	33.4	25.1	33.4	39.5	58.0	33.0
of which: market services	3.2	8.2	4.4	10.4	7.5	8.3	52.4

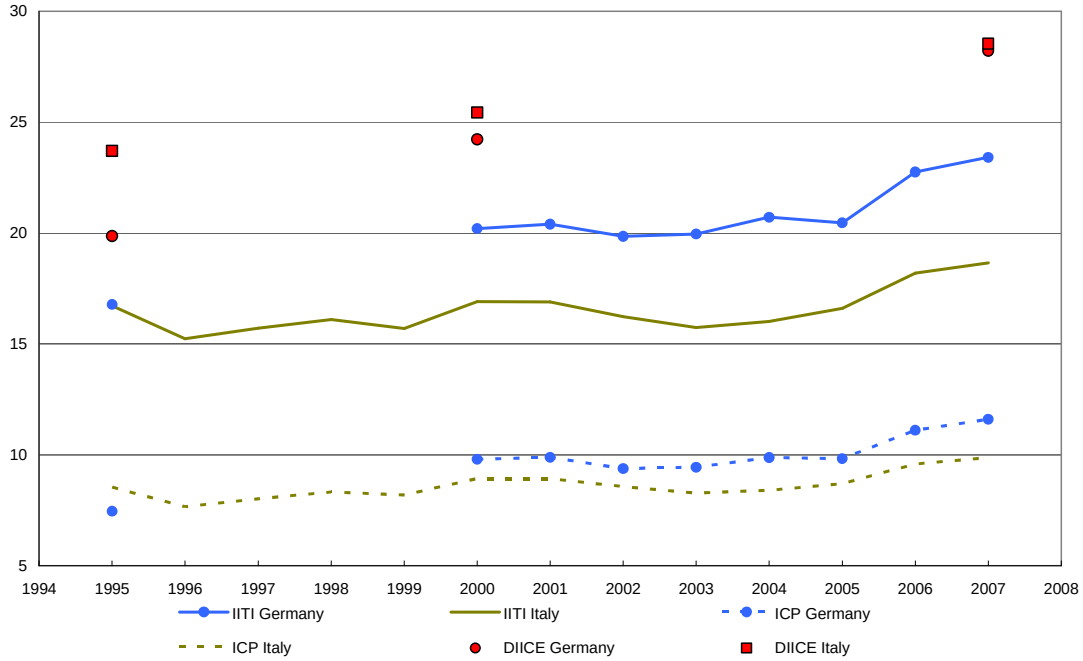
Source: our calculations on Istat data.

Table 2 – Measures of international outsourcing in Germany

Sectors	*Import content of production*		*Import content of exports*		*Imported inputs on total inputs (IITI)*	*Narrow index*	*Value added on production*
	only direct content (ICP)	*direct and indirect content (DIICP)*	*only direct content (ICE)*	*direct and indirect content (DIICE)*			
			1995				
Total	7.5	11.3	14.1	19.9	16.8	25.5	51.4
of which: manufacturing	14.1	20.4	15.6	22.1	23.6	33.6	36.2
Low-tech	13.2	19.1	16.4	22.5	21.9	30.2	34.8
Medium-tech	15.2	22.0	15.4	22.3	25.3	37.0	36.6
High-tech	13.8	19.7	14.4	20.2	23.8	34.4	39.8
of which: market services	2.7	4.5	7.0	9.1	8.6	9.6	64.3
			2000				
Total	9.8	14.8	17.2	24.2	20.2	31.3	47.1
of which: manufacturing	17.5	25.1	19.3	27.3	27.6	40.6	32.5
Low-tech	15.3	21.7	19.2	25.7	25.2	37.8	34.1
Medium-tech	19.1	28.0	19.4	28.2	28.7	41.1	29.5
High-tech	18.6	25.6	19.5	26.3	30.6	44.8	37.3
of which: market services	4.2	7.0	7.6	10.6	11.4	15.3	59.1
			2007				
Total	11.6	17.4	20.1	28.2	23.4	33.2	45.5
of which: manufacturing	20.4	29.5	22.4	31.4	31.3	41.2	30.0
Low-tech	19.3	27.0	23.7	31.3	30.2	42.7	29.7
Medium-tech	20.9	31.4	21.1	31.4	31.1	38.3	28.7
High-tech	21.4	29.3	24.4	32.0	34.6	47.2	35.8
of which: market services	4.6	7.6	8.7	12.0	13.0	17.2	59.1

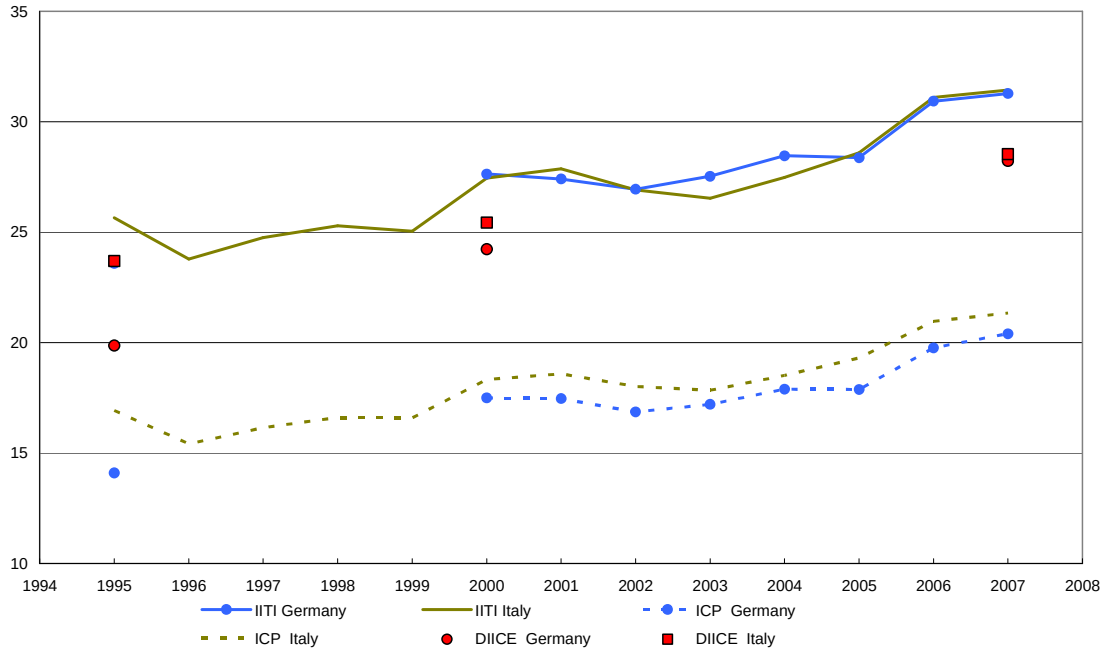
Source: our calculations on Eurostat data.

Figure 1 – International outsourcing



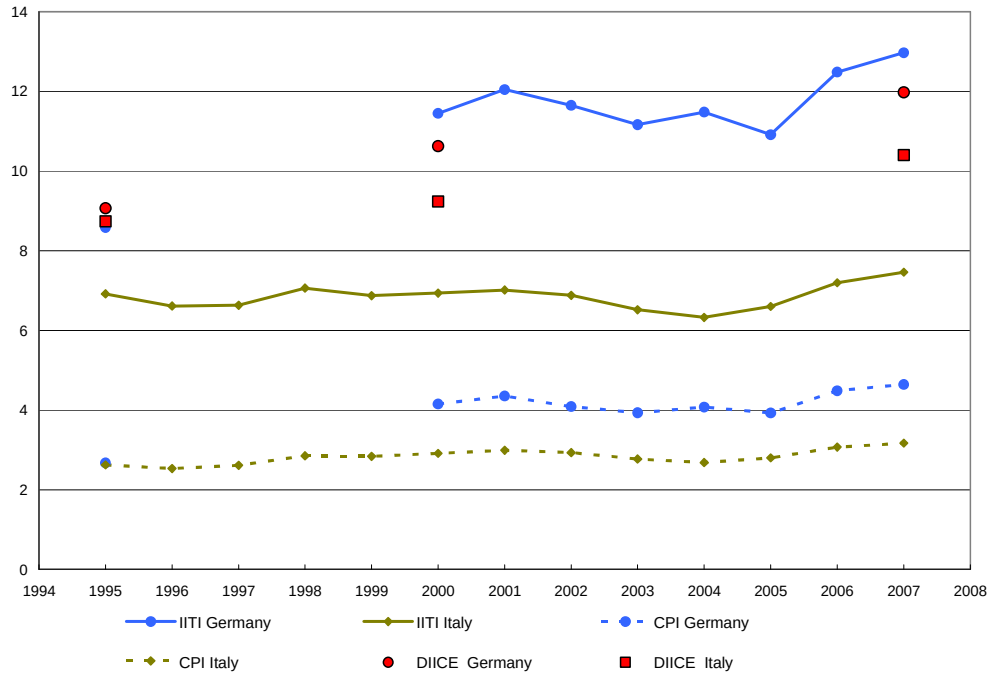
Source: our calculations on Istat and Eurostat data.

Figure 2 – International outsourcing in manufacturing



Source: our calculations on Istat and Eurostat data.

Figure 3 – International outsourcing in services



Source: our calculations on Istat and Eurostat data.

Overall, the international outsourcing indicators are higher for Germany than for Italy, but this is due entirely to the higher internationalisation of market services, which reflects a more intensive use of imported inputs in the German financial and banking sector. On the other hand, almost all the indicators for Italy show a higher degree of international fragmentation in manufacturing, although the values for the two countries stand in a very narrow range. Therefore, at least from a static viewpoint, the "bazaar" label seems to be appropriate also for the Italian manufacturing sector. Indeed, an international comparison based on the ratio of imported intermediate inputs to total intermediate inputs in 2003 shows that Italy and Germany, along with the UK, are the most internationalised countries among the largest OECD economies.[40]

In the manufacturing sector, the highest international outsourcing values are found in high-tech (notably office machinery) and medium-tech industries. In 2007, for every euro one hundred worth of goods produced in the high-technology sectors, the direct content of imported inputs in production (*ICP*) was around euro twenty-five in Italy and euro twenty-one in Germany, whereas the direct and indirect import content (*DIICP*) was euro thirty-three and euro twenty-nine, respectively. Thus, the higher degree of international outsourcing in high and medium-tech industries largely compensates for Italy's more "traditional" specialisation, i.e., the higher relative weight of low-tech sectors – the least internationalised – compared with Germany.

To analyse the dynamics of these indices, tables 3 and 4 present the yearly average percentage changes of international outsourcing in Italy and Germany in the two periods.

[40]. See OECD (2007, p. 36, figure 2.12).

Table 3 – Development of international outsourcing in Italy

Sectors	*Import content of production*		*Import content of exports*		*Imported inputs on total inputs (IITI)*	*Narrow index*	*Value added on production*
	only direct content (ICP)	*direct and indirect content (DIICP)*	*only direct content (ICE)*	*direct and indirect content (DIICE)*			
	Yearly average percentage variation 1995-2000						
Total	0.9	0.7	2.4	1.4	0.2	1.2	- 0.8
of which: manufacturing	1.6	1.0	2.3	1.4	1.4	2.2	- 0.9
Low-tech	1.0	0.7	1.8	1.3	0.8	1.5	- 0.8
Medium-tech	1.7	1.0	2.5	1.4	1.4	1.4	- 1.0
High-tech	2.4	1.3	2.1	1.0	2.2	3.4	- 0.6
of which: market services	2.1	2.4	1.7	1.1	0.1	1.1	- 1.4
	Yearly average percentage variation 2000-2007						
Total	1.5	1.2	2.0	1.7	1.4	1.2	- 0.3
of which: manufacturing	2.2	1.8	2.1	1.8	2.0	1.7	- 0.9
Low-tech	3.0	2.2	3.6	2.5	2.8	3.1	- 0.9
Medium-tech	2.2	1.8	2.3	1.9	1.8	1.4	- 1.3
High-tech	- 1.5	- 0.4	- 2.6	- 1.1	- 1.3	- 3.0	0.3
of which: market services	1.2	1.1	3.1	1.7	1.0	2.6	- 0.4
	Yearly average percentage variation 1995-2007						
Total	1.2	1.0	2.1	1.6	0.9	1.2	- 0.5
of which: manufacturing	2.0	1.5	2.2	1.7	1.7	1.9	- 0.9
Low-tech	2.2	1.6	2.9	2.0	2.0	2.5	- 0.9
Medium-tech	2.0	1.5	2.4	1.7	1.7	1.4	- 1.2
High-tech	0.1	0.3	- 0.7	- 0.2	0.2	- 0.4	- 0.1
of which: market services	1.6	1.6	2.5	1.5	0.6	2.0	- 0.8

Source: our calculations on Istat data.

Table 4 – Development of international outsourcing in Germany

Sectors	*Import content of production*		*Import content of exports*		*Imported inputs on total inputs (IITI)*	*Narrow index*	*Value added on production*
	only direct content (ICP)	*direct and indirect content (DIICP)*	*only direct content (ICE)*	*direct and indirect content (DIICE)*			
	Yearly average percentage variation 1995-2000						
Total	5.6	5.5	4.0	4.1	3.8	4.2	- 1.7
of which: manufacturing	4.4	4.3	4.4	4.3	3.2	3.8	- 2.1
Low-tech	3.0	2.6	3.1	2.6	2.8	4.6	- 0.4
Medium-tech	4.7	5.0	4.6	4.9	2.5	2.2	- 4.2
High-tech	6.1	5.4	6.3	5.4	5.1	5.5	- 1.3
of which: market services	9.2	9.2	1.7	3.2	5.9	9.8	- 1.7
	Yearly average percentage variation 2000-2007						
Total	2.4	2.3	2.3	2.2	2.1	0.8	- 0.5
of which: manufacturing	2.2	2.3	2.1	2.0	1.8	0.2	- 1.1
Low-tech	3.4	3.2	3.1	2.8	2.6	1.8	- 2.0
Medium-tech	1.3	1.6	1.3	1.5	1.1	-1.0	- 0.4
High-tech	2.0	2.0	3.3	2.8	1.7	0.7	- 0.6
of which: market services	1.6	1.1	2.0	1.7	1.8	1.7	0.0
	Yearly average percentage variation 1995-2007						
Total	3.8	3.7	3.0	3.0	2.8	2.2	- 1.0
of which: manufacturing	3.1	3.1	3.1	3.0	2.4	1.7	- 1.6
Low-tech	3.2	2.9	3.1	2.8	2.7	2.9	- 1.3
Medium-tech	2.7	3.0	2.7	2.9	1.7	0.3	- 2.0
High-tech	3.7	3.4	4.5	3.9	3.1	2.7	- 0.9
of which: market services	4.7	4.4	1.9	2.4	3.5	5.0	- 0.7

Source: our calculations on Eurostat data.

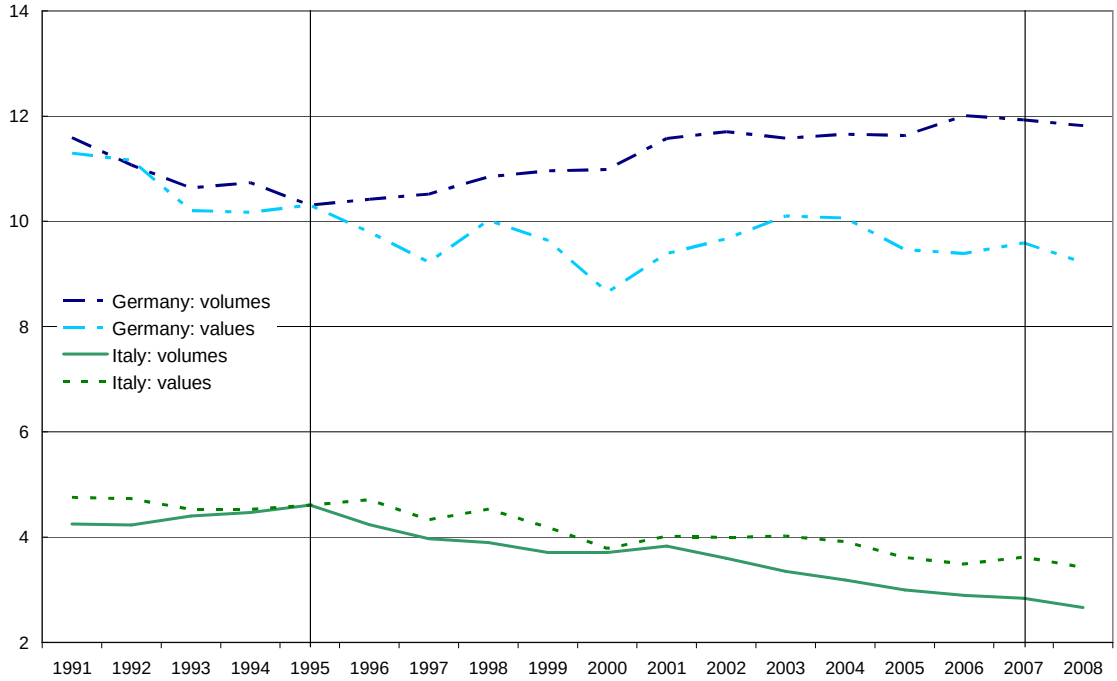
The results clearly show a significant increase in international fragmentation from 1995 to 2007 for all levels of industry aggregation in Germany according to almost all the indices. The increase in international outsourcing activities was slightly stronger in high-tech than in low-tech industries.

Also in the case of Italy, all the indicators for the whole economy show an increase in the level of outsourcing in 1995-2007 (table 3, third part). However, the growth in Italy's indicators is slower than Germany's, reflecting both the slower growth of internationalisation in Italian manufacturing firms, characterised by a higher level of outsourcing than their German counterparts in 1995, and the increasing relative importance of market services industries, which are structurally characterised by a lower intensity of imported inputs.

Moreover, looking at total export market shares shows a different pattern emerging in the two countries: while Italian exports lost market share during the entire period (1995-2007) and in both sub-periods (1995-2000 and 2000-2007), German exports were more

resilient, especially in terms of the share at constant prices (figure 4).[41] In a period that saw the major developing countries enter the world trade market (China and India being the most relevant examples), developed countries naturally lost export market shares. Italy was no exception, although Germany actually increased its share especially in 2000-2007, the second sub-period. The faster growth of internationalisation in German manufacturing has had, at the least, a simple impact on this development as it has inflated German trade exchanges, which include both the exports of final goods and the intermediate goods sent abroad for processing. On the other hand, further analysis is needed to test the extent of the growing internationalisation of production (especially by means of a reduction in labour costs) on the competitiveness of German manufactured goods.

Figure 4 – Export market shares of Germany and Italy°*



*=percentages of the world exports of goods; at 1995 prices and exchange rates.
Source: calculations on IMF and Istat data.

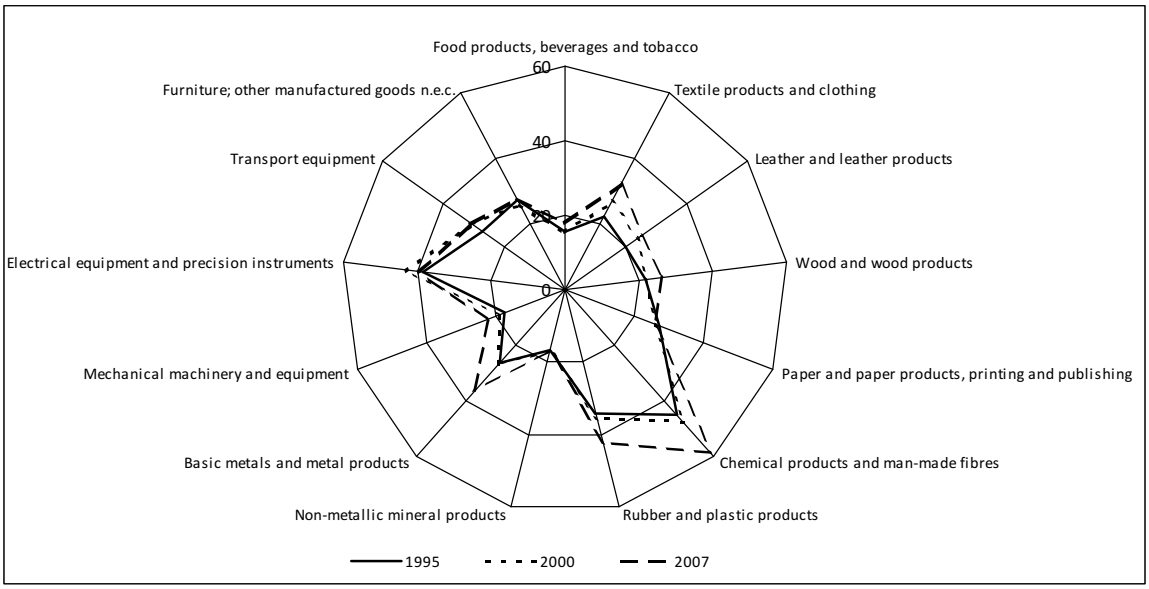
[41]. The evolution of the market shares at constant prices and exchange rates can be partly biased by statistical problems in the measurement of export unit values, which are used as deflators. In particular, Italian export unit values systematically overestimate the dynamics of the corresponding export prices, while the opposite seems to be true for German export unit values. However, considering the exports' market shares at current prices and exchange rates (that do not suffer from the above-mentioned measurement problems and seem more appropriate for analysing medium-long periods of time), we see that between 1995 and 2006 Italy lost almost one quarter of its market share, Germany only less than one tenth.

3.2. A look at manufacturing industries

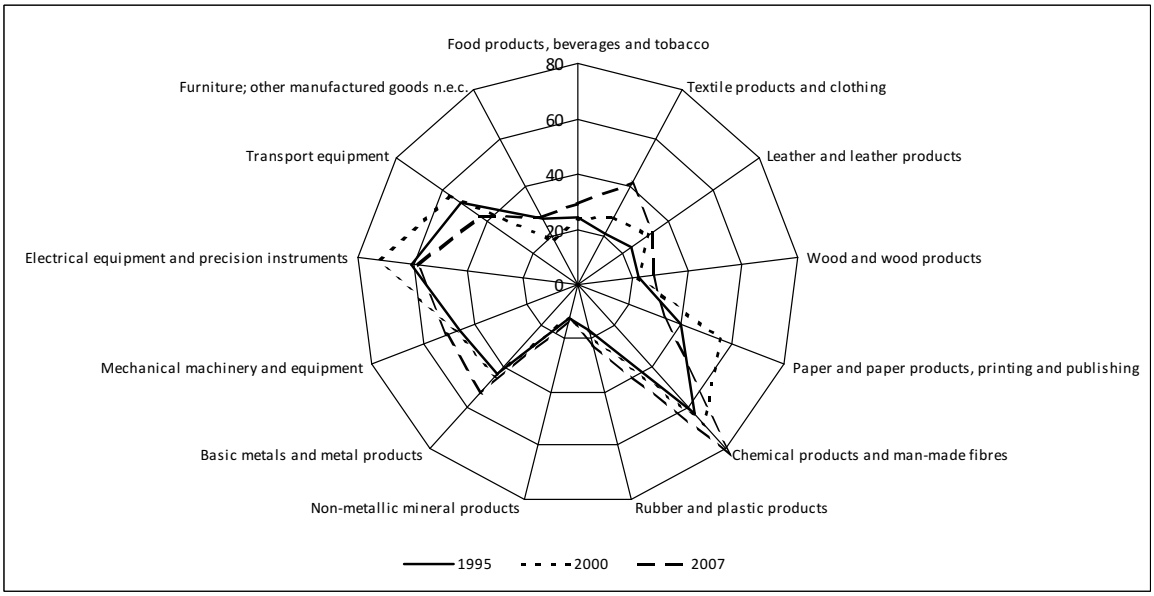
To obtain a more detailed picture, we shifted the analysis to outsourcing at the disaggregated industry level. Figures 5 and 6 show the development of some of the indices proposed for international outsourcing in manufacturing in 1995-2007 for Italy and Germany, respectively.

Figure 5 – Sectoral development of IITI_broad (a), IITI_narrow (b), ICP (c) and DIICP (d) in Italy

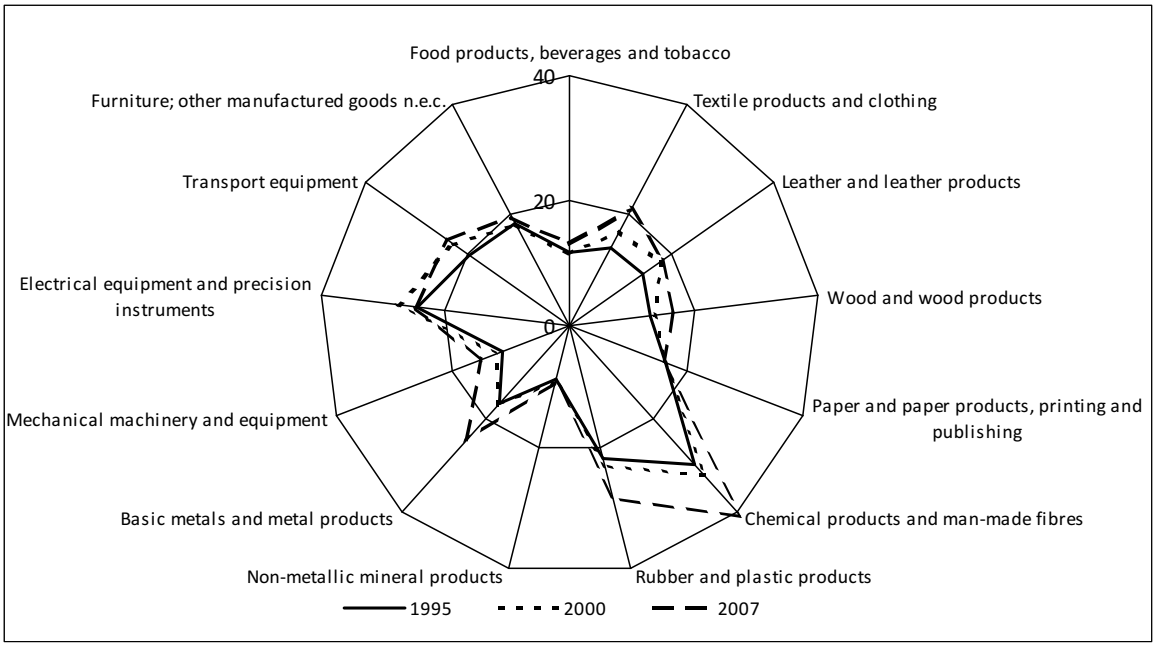
a.



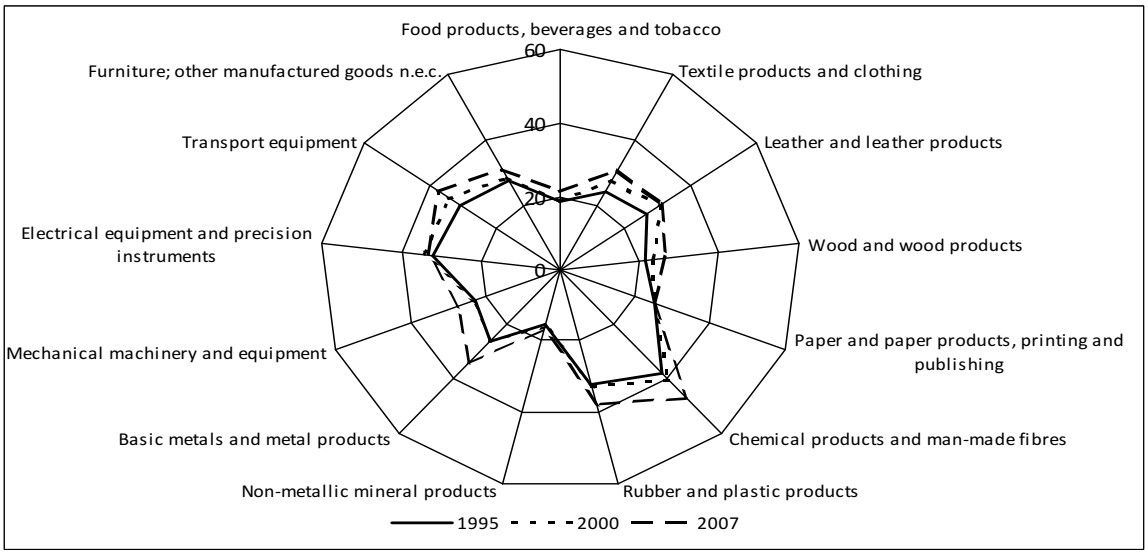
b.



c.



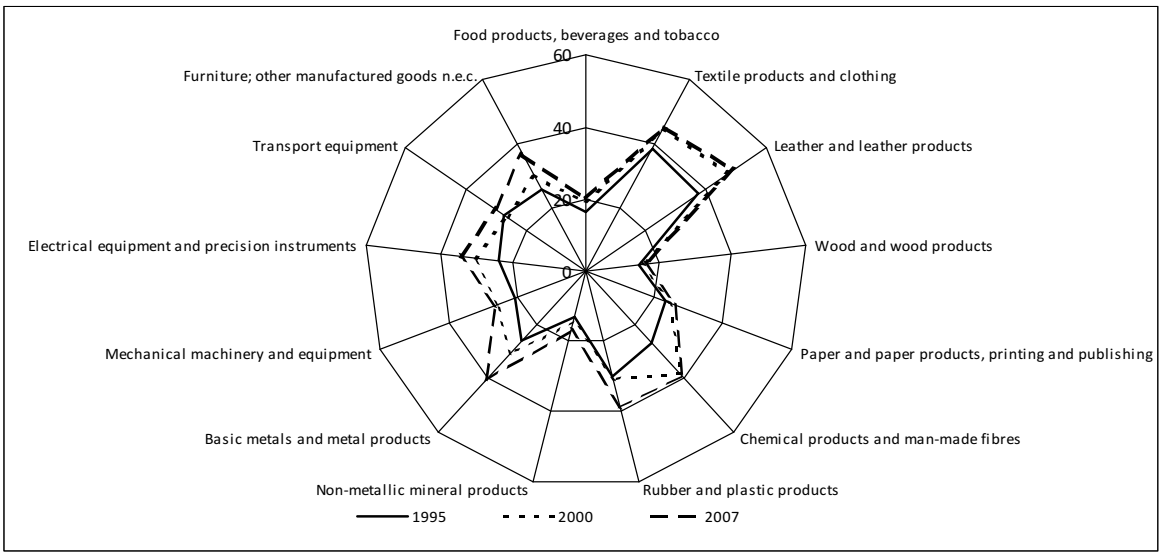
d.



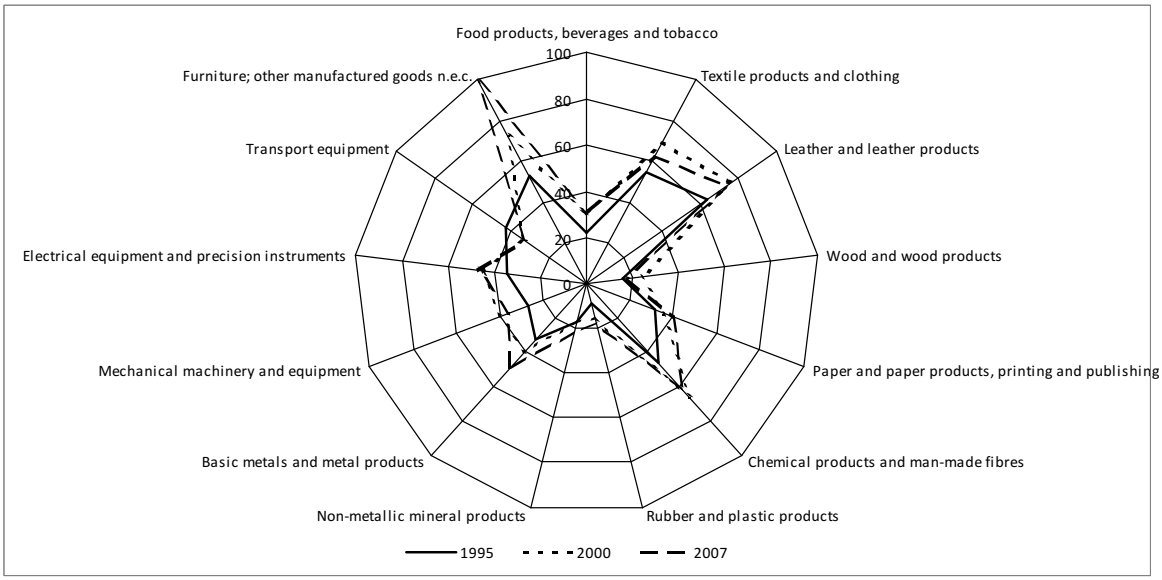
Source: our calculations on Istat data.

Figure 6 – Sectoral development of IITI_broad (a), IITI_narrow (b), ICP (c) and DIICP (d) in Germany

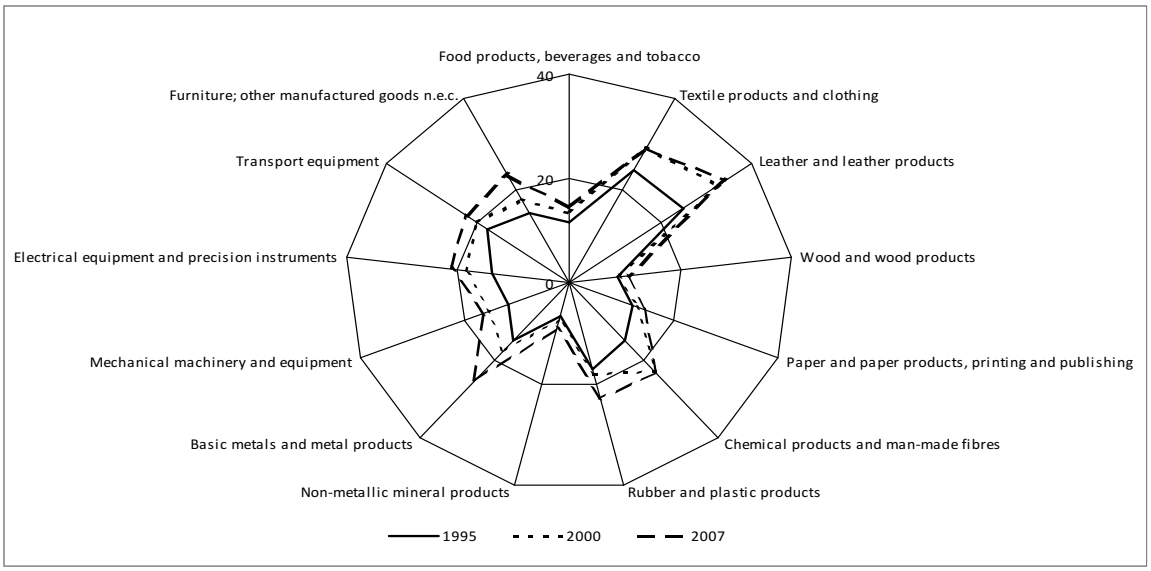
a.



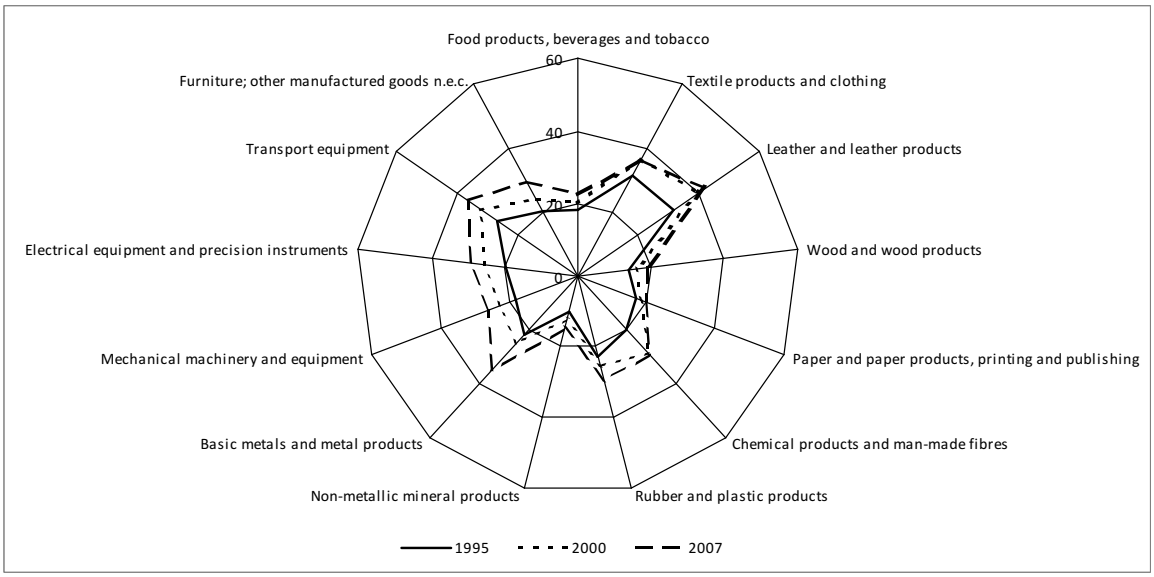
b.



c.



d.



Source: our calculations on Eurostat data.

The intensity of off-shoring is fairly different across industries. In 2007, the outsourcing intensity of Italy's chemicals and electrical equipment industries was equal to about 60% and 40%, respectively, as measured by the *IITI_broad* index (figure 5a), while the outsourcing intensity of the machinery industry, the most significant Italian manufacturing segment, amounted to as much as half (about 20%). The *ICP* indicator confirms both the ranking among industries and their development in the twelve-year period (figure 5c). On the other hand, looking at the *narrow* outsourcing indicator (figure 5b), which takes account of solely intra-industry trade, a quite different picture emerges:

chemicals and electrical equipment industries remain the most internationally integrated, although the mechanical industry appears to be fairly internationally integrated too, given that about 50% of all its intra-industry inputs are imported from abroad: this fact implies that the extra-industry inputs of mechanical products are almost completely domestic, thus suggesting a possible specialisation of the sector in high-quality products.

In Germany, the ranking of industries by intensity of international outsourcing seems to be even more dependent on the indicator used. When the *IITI_broad* and the *IITI_narrow* indices are used (figures 6a and 6b), chemicals, as well as the metal and electrical equipment industries, show the highest levels of outsourcing intensity, while transport equipment appears more internationalised when analysing the imported inputs on production (*ICP* index); this is true particularly when both direct and indirect import contents are considered, suggesting that German transport equipment firms outsource the production of lower-quality parts and/or final products abroad, keeping only the higher-quality production phases in Germany. Also "textile products and clothing" and "leather and leather products" show a very high level of international outsourcing, but their relative weight on Germany's total manufacturing production is almost nil.

The contribution to the overall increase of outsourcing in manufacturing in the twelve-year period can be explained in the case of Germany by metals, electrical equipment and chemical products, while in Italy the growth of international outsourcing has been driven by metals, chemicals and some traditional industries, in particular "textile products and clothing".

Despite the differing levels of international outsourcing in both countries, the outsourcing intensity in almost all industries was higher in 2007 than in 1995. A notable exception being the electrical equipment industry in Italy, among the relatively more important industries for its economy, where outsourcing decreased slightly from its 1995 level. As the size of this sector has contracted in Italy, this decrease could indicate an increasing specialisation in niche products, which would enable Italian firms to exert some monopolistic pressure and use a larger share of high-quality domestic inputs.[42] Finally, all the indicators except narrow outsourcing for transport equipment show an increase in the internationalisation of both countries.[43]

4. A shift and share analysis

Although all these indices are mainly focused on international outsourcing, there are also other forces driving their evolution. For example, an index can rise if a highly vertically specialised sector increases its share of the production of the whole economy, even when

[42]. For example, the electrical equipment sector includes lighting equipment, a market segment in which Italian firms are firmly established, above all thanks to their high-quality design.

[43]. This phenomenon could be explained, at least partly, by a sizeable reduction of the relative price of imported parts and components produced in the same sector (i.e. transport equipment) with respect to the other inputs used; this reduction, obtained by outsourcing to lower-cost countries, could (more than) offset the effect of the rising share in volume terms of parts and components on total inputs.

the outsourcing activity of the sector did not change at all or declined. Using a shift and share approach enables us to divide the variance of the indices into two parts across sectors: the change of intensity in industries' international outsourcing (the *within* component IO_i) and the relative change of the economy's structure (the *between* component θ_i),[44] according to the following formula:

$$\Delta INDEX_z = \sum_{i=1}^{n} \overline{\theta}_i \Delta IO_i + \sum_{i=1}^{n} \Delta\theta_i \overline{IO}_i \qquad [8]$$

with $INDEX_z$ as the value of the index z (z= *IITI_broad, IITI_narrow, ICP, DIICP, ICE, DIICE* and *VAP*) and Δ indicating absolute changes. By using a bar for the statistical mean of the value in the 1995-2007 period, one component is kept constant in order to isolate the variation of the other component, which is allowed to adjust. Therefore, $\sum_{i=1}^{n} \overline{\theta}_i \Delta IO_i$ captures the change in only international outsourcing, while $\sum_{i=1}^{n} \Delta\theta_i \overline{IO}_i$ captures only structural changes.

Tables 5 and 6 present the results. The *total* rows depict the overall change in the index, i.e., the sum of the *within* and the *between* components. The *within* rows show the actual variation of outsourcing intensity in each sector.

For Italy, the shift and share analysis seems to confirm an increase in international fragmentation for both the whole economy and the manufacturing sector. This rise is at least partly counterbalanced by a shift towards less internationally-integrated industries. For Germany, both components moved in the same direction, showing a clear increase in the level of outsourcing. Therefore, the different dynamics in the two countries can be partly explained by quite diverging changes in specialisation. At an aggregate level, the firms' propensity to use imported inputs grew within each sector in both countries; moreover, the shift in the economic structure towards more internationalised sectors was greater in Germany than in Italy. The two different dynamics of internationalisation and the quite diverging specialisation patterns could indicate a discrepancy in the "success rate" of outsourcing policies between the two countries. This holds true for the manufacturing sectors but even more so for the two whole economies.

[44]. The structural component differs with respect to the various indices. For example, in the case of the *ICP* index, the structural component is the share of the output of industry *i* to the economy wide output, whereas for the *IITI* index it is the share of the total inputs of sector *i* to economy wide total inputs. The within component, instead, captures the variation of the sector's international outsourcing activity focusing on the imported inputs.

Table 5 – Outsourcing and sectoral changes in Italy (1995-2007)

Sectors	*Import content of production*		*Import content of exports*		*Imported inputs on total inputs (IITI)*	*Narrow index*	*Value added on production*
	only direct content (ICP)	*direct and indirect content (DIICP)*	*only direct content (ICE)*	*direct and indirect content (DIICE)*			
				Total			
Within	2.09	2.88	4.32	4.96	3.20	5.43	-4 .19
Between	- 0.74	- 0.96	- 0.05	- 0.12	- 1.24	- 1.04	1.47
Total	1.35	1.92	4.27	4.84	1.96	4.39	- 2.72
				Manufacturing			
Within	4.66	5.18	5.08	5.64	5.94	7.93	- 3.30
Between	- 0.25	- 0.12	0.20	0.28	- 0.18	1.87	0.13
Total	4.41	5.06	5.28	5.92	5.75	9.80	- 3.16
				Market services			
Within	0.49	1.54	1.15	2.08	0.38	1.20	- 5.97
Between	0.06	- 0.10	- 0.01	- 0.41	0.16	0.54	0.85
Total	0.54	1.44	1.14	1.67	0.54	1.75	- 5.12

Source: our calculations on Istat data.

Table 6 – Outsourcing and sectoral changes in Germany (1995-2007)

Sectors	*Import content of production*		*Import content of exports*		*Imported inputs on total inputs (IITI)*	*Narrow index*	*Value added on production*
	only direct content (ICP)	*direct and indirect content (DIICP)*	*only direct content (ICE)*	*direct and indirect content (DIICE)*			
				Total			
Within	3.31	5.03	5.19	7.53	5.10	5.66	- 5.06
Between	0.83	1.06	0.84	0.84	1.50	1.95	- 0.90
Total	4.14	6.09	6.02	8.38	6.60	7.60	- 5.95
				Manufacturing			
Within	5.60	8.07	6.14	8.71	4.41	5.89	- 5.73
Between	0.69	1.08	0.67	0.64	1.21	1.64	- 0.46
Total	6.29	9.15	6.81	9.36	5.62	7.53	- 6.19
				Market services			
Within	1.57	2.64	0.37	1.57	2.49	5.33	- 4.69
Between	0.40	0.43	1.39	1.35	1.65	2.29	0.00
Total	1.97	3.07	1.76	2.92	4.14	7.63	- 4.69

Source: our calculations on Eurostat data.

Our results are consistent with national accounts data: in Italy, the value-added share of market services increased from 46.6% to 48.7% in 1995-2000, and reached 50.1% in 2007. Symmetrically, the value-added share of the manufacturing sector decreased in the same period, albeit at a slower pace in the final period of analysis. The pattern observed in Germany is partly different: from 1995 to 2000, the value-added share of market services increased fairly sedately (from 44.4% to 45.7%) before accelerating to a maximum of 47.4% in 2006, while in 2007 it declined to 47.1%. In a context characterised by a sizeable reduction in the value-added share of the construction industry after the peak of the early 1990s driven by reunification, the relative weight of industry decreased from 1995 to 2003, inverting the trend in 2004-2007, and the value-added share of German industry returned to the levels of the early to mid-1990s: this macro evidence further attests to the good performance of German manufacturing firms from the middle years of the last decade.

5.Conclusion

The growth of international trade in intermediate goods reflects, at least in part, the firms' choice to relocate their production abroad to exploit cost benefits related to labour or other production factors. In 2007, the final year of our analysis, the direct and indirect import content of the production of goods and services, which is our indicator of international outsourcing, was about 17% for both the Italian and the German economies (excluding energy products). The import content of exports was slightly higher in Italy than in Germany due to a different sectoral composition of exports, therefore, on this basis and from a static viewpoint, also Italy could be defined as a «bazaar economy».

In terms of solely the manufacturing sectors, the analysis implies that Italian firms are slightly more internationalised than German firms: in 2007, the direct and indirect import content of production was 31.1% in Italy and 29.5% in Germany, despite the higher share of low-tech sectors in the former, which are apparently the least internationally fragmented.

Although both Italy and Germany show similar levels of internationalisation at the end of the analysis period, different dynamic patterns led to those levels. During the whole of the twelve-year period, German firms, which started from a lower level of internationalisation, spurred faster growth compared with the Italian firms. In addition, it is important to note that this weaker pattern for Italy can be partly explained by a more pronounced structural shift of production towards the service sectors, which are far less internationalised than manufacturing. Moreover, while Italy experienced a slight acceleration in the second sub-period (2000-2007),[45] in Germany the dynamics were more pronounced in 1995-2000 and, successively, after 2004. The pattern in the first period seems to be related to the crises suffered by the Italian lira and the Spanish peseta in 1992 and 1995, which hampered the price competitiveness of German products and triggered a significant change in the strategies of the German firms. After a stasis in 2001-2004, the internationalisation process of German firms regained momentum, also in

[45]. All the indicators used in the analysis produced evidence of this slight acceleration, i.e., ICP, DIICP, DIICE and IITI.

response to the qualitative upgrading and/or increasing specialisation of Chinese exports in sectors of relevance to the German economy.[46]

As in the case for the whole economy, German manufacturing firms spurred faster growth from 1995 to 2007 according to almost all the indicators presented here, with the high-tech sectors fuelling the highest growth in international fragmentation. On the other hand, international fragmentation was significant in both the low and medium-tech industries in Italy. This structural change contributed to the positive performance of Germany's export market share in that period by boosting the price competitiveness of German goods.

Conversely, Italian firms spurred slower growth in the degree of internationalisation of production, at least up to 2005, while the slight acceleration that can be observed in the average of the second sub-period is the result of stagnation in 2000-2004 and a substantial increase in 2005-2007 (figure 1). This seems to signal a strategic change and a reorganisation of production in Italian firms, or at least a significant part of them. This hypothesis is fully consistent with the results of Brandolini e Bugamelli (2009), which explain the interruption of the fall of total factor productivity observed for the Italian economy in the middle years of the last decade with the firms' reorganisation of production processes. The new challenges posed by increased competition from low-wage countries (or more generally by globalisation), by the diffusion of information and communication technologies, and by the adoption of the euro (which, among other things, put a stop to the competitive devaluations of the lira) induced the most dynamic Italian firms to rethink their organisation, including their degree of vertical specialisation.

While this transformation process was still under way, the world economy was hit by the major financial crisis of 2008-2009, however, according to the Banca d'Italia *Survey of industrial and service firms*, revenues fell more slowly at those firms that had significantly changed their strategies in previous years.[47] In fact these developments need to be analysed in future research.

Although the input-output tables for more recent years are not yet available, the levels and structures of the international division of labour for Germany and Italy produced by our analysis for 2007 are likely to be the same or at least similar to those observed at the beginning of the global crisis, which had a particularly negative impact on the international trade in intermediate goods. In fact, the multiplicative effect of the "global supply chain" helps to explain the depth of the collapse in world trade during the crisis.[48] However, in its aftermath, the rate of international outsourcing could intensify due to the need of firms in the developed countries to both further increase their cost

[46]. Mannarino *et al.* (2008) find evidence of a strong qualitative upgrading in Chinese medium-high quality machinery exports in 1996-2006, even though German and Italian products remain positioned at higher quality levels. Looking at the whole manufacturing sector, Schott (2008) finds an increasing overlap of the exported product mix between China and the OECD countries during the 1972-2005 period, even though the quality gap (proxied by mean unit values differentials) between OECD and Chinese product varieties widened over time.

[47]. See Banca d'Italia (2010, p. 112).

[48]. See, for example, Bems, Johnson and Yi (2009) and Robertson (2009); but, for an almost opposite point of view, see also Altomonte and Ottaviano (2009).

competitiveness and, presumably, establish new export platforms near or in the markets that are recovering from the crisis at a faster pace, such as China, India, the Far East and Brazil.

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Appendix

In this section we present a more compact notation for the indices used in the paper by recasting them in matrix form.

For the *IITI_broad* index we use:

$$IITI\_broad = u' \, {}_mA \, Y \, [u'({}_mA + {}_dA) \, Y]^{-1} \qquad [A1]$$

with each element ${}_ma_{ij}$ of the *n*-dimensional square matrix ${}_mA$ representing the imported inputs from industry *i* utilised for the production of industry *j*, each element ${}_da_{ij}$ of the *n*-dimensional square matrix ${}_dA$ representing the domestically produced input from industry

i for the production of industry *j*, *Y* is the *n*-vector of gross output, *u* is a *nx1* vector of *1*'s and *n* the number of industries.

The *IITI_narrow* index is calculated as:

$$IITI\_narrow = u' ({}_mA^* I)Y \{u'[({}_mA + {}_dA)^* I]Y\}^{-1} \quad [A2]$$

where $({}_mA^* I)$ is the diagonal import matrix ${}_mA$ and $[({}_mA+{}_dA)^* I]$ the diagonal matrix of the total input matrix $({}_mA+{}_dA)$.

The expression for ICP index, as defined in [3], can be written as:

$$ICP = u' \, {}_mA \, Y \, [u' \, Y]^{-1} \quad [A3]$$

where each element ${}_ma_{ij}$ of the *n*-dimensional square matrix ${}_mA$ represents the imported inputs from industry *i* utilised for the production of industry *j*, *Y* is the *n*-vector of gross output, *u* is a *nx1* vector of *1*'s and *n* the number of industries.

The expression for *DIICP* index, as defined in [4], is a bit more complicated since it includes the inverse of the Leontief matrix, $(I-{}_dA)^{-1}$, which allows us to capture the imported inputs embodied in the domestic output:

$$DIICP = [u' \, {}_mA \, (I-{}_dA)^{-1} \, Y] \, [u'Y]^{-1} \quad [A4]$$

with each element ${}_da_{ij}$ of the *n*-dimesional square matrix ${}_dA$ representing the domestically produced input from industry *i* for the production of industry *j* and *I* is a *nxn* identity matrix.

The matrix notation for the *ICE* and the *DIICE* indices, as defined in [5] and in [6], are then:

$$ICE = u' \, {}_mA \, Y \, [u' \, X]^{-1} \quad [A5]$$

and:

$$DIICE = [u' \, {}_mA \, (I-{}_dA)^{-1} \, Y] \, [u'X]^{-1} \quad [A6]$$

where *X* is the *n*-vector of exports.

Finally, the matrix notation for the VAP index, as defined in [6], is:

$$ICP = u' \, V \, [u' \, V]^{-1} \quad [A7]$$

with *V* as the *n*-vector of value added.