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Diverse twins: the impact of China on Italian and German manufacturing exports

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Abstract

Germany and Italy are two major manufacturing producers and export a substantial part of their products – over 70 per cent- to OECD countries. While they share many characteristics, in term of specialization and destination markets, they are also "diverse twins". Italy has a productive structure still largely based on so-called "traditional" sectors, while Germany specialized mainly in high tech goods. Italy is therefore more likely to be more vulnerable to the competitive pressure by emerging economies, and especially China, which experienced a strong increase in its export market share during the last decades. This paper addresses the issue of the impact of China on the export performance of Italy and Germany to their main trading partners to assess how well they withstood competition. Using data for the period 1995-2009, we implement a longitudinal multilevel model on quantiles to take into account two very important data characteristics: their hierarchical hidden structure (captured by a multilevel model) and the heterogeneity of the export shares (captured by a quantile approach). This innovative estimation method, together with the introduction of Chinese export shares as explanatory variable to account for the potential Chinese competition, allows us to estimate the impact of China on Italy and Germany's market shares. Results show that China has affected Italy's and Germany's market shares in different ways, in different sectors, characterized by different market shares. However, Italy does not seem to have been "more at risk". These results are relevant also for their policy implications and for an ex post analysis of the "response" to the Chinese competition.

JEL Classification: F-10; F-14

Keywords: China; Longitudinal multilevel, Quantile analysis, Market Shares, export competition

1. Introduction

China has recently become the first exporter worldwide of manufacturing goods, impressively increasing its export shares in all sectors and markets, including the more technologically advanced ones. Data for the past decades show that many countries have been losing export market share to its advantage. These losses have been large also for the euro area countries, which at first seemed (or were thought) "sheltered" from China's competition, because of a specialization on different segments of products (Tiffin, 2014).

Within Europe, Germany and Italy are two of the world main manufacturing producers and export a substantial part of their products – over 70 per cent – to other OECD markets. The two countries are an useful benchmark to understand how the recent changes in the global trade landscape have affected the productive structure of advanced economies. While they share many characteristics, in term of specialization and destination markets, they are also inherently diverse. Italy, has a productive structure largely based on so-called "traditional" sectors, i.e. those at lower technological content, which made the country immediately more vulnerable to the competitive pressure from emerging economies, especially China after its access to WTO in 2001. Germany, on the other hand, more focussed on higher technology sectors and specialized intermediate exports, has often been considered less at risk, but it has lost its leadership as world's main manufacturing exporter in more recent years.

The rapid growth and international integration of China has modified the power balance of world trade. Having gone through a rapid process of structural transformation as well as international integration, while increasing its export shares, China has also been upgrading the quality of its production and exports, becoming a very strong competitor worldwide (Ferrarini and Scaramozzino, 2015). These changes in the structure of Chinese exports and their consequences have been object of recent research, aiming at understanding, on the one hand, whether they can be considered exceptional for a country still at an "early stage" of economic development and, on the other, which factors have triggered them and whether and to what extent this has affected the competitiveness of other main exporters.

A still relatively understudied issue related to this line of research is whether the competitive threat from China is affecting not only developing but also developed countries and not only labour intensive but also capital-intensive goods, as suggested by looking at the developments of world market shares and the reshaping of the international production networks.

Since its early opening to international markets in 1978, China has been characterized by its capacity to supply large quantities of low cost manufactures. Over time, the range of products exported has however substantially increased, covering as well a larger share of more sophisticated ones (Ferrarini and Scaramozzino, 2015). Analyses based on highly disaggregated statistics on trade (at the 6-digit of the Harmonized System) show that China exports as many products as Germany, the country exporting the greatest number of products worldwide (Schott, 2004). Beside the range of exported products, also destination markets of Chinese exports have changed in the last decade. In 2009, China was already serving roughly 70% of markets also served by individual EU members (Benkovskis, et al, 2013), triggering fears of a potential displacement also for EU countries.

Against this background, this paper analyses the impact of China on the market performance of two of the most relevant manufacturing exporters of the Euro area, Italy and Germany, direct competitors of China in several markets. To test the competitive effect of China on Italy and Germany using the high-income OECD markets as destination markets, and the main manufacturing sectors as playing field, we propose an innovative econometric technique (multilevel quantile regression). This methodology seems to fit well the structure of our data, since it allows us to account on the one hand for the hierarchical hidden structure of the data (the multilevel part) and, on the other hand, for the heterogeneity of the export shares (captured by the quantile approach). Such innovative estimation method, together with the use of Chinese export shares as explanatory variable to account for the potential competition, allows us to directly estimate the impact of China on Italy and Germany's market shares. Results show that China has affected Italy's and Germany's market shares in different ways, in different sectors, characterized by different market shares, product composition and quality. However, contrary to our expectations, the results show a mixed picture, where some sectors are potentially displaced by Chinese exports, but others have resisted much better. Furthermore, they suggest that – compared to Germany - Italy does not seem to have been "more at risk", contrary to priors. These results are relevant also for their policy implications and for an ex post analysis of the "response" of advanced economies with different structural characteristics to Chinese competition.

The paper proceeds as follows. Section 2 sets the scene reviewing the recent export performance of Italy, Germany and China and the impact of China on other countries' export performance. Section 3 specifies the econometric model, Section 4 describes data, methodology and results. Section 5 concludes.

2. Chinese export performances and the possible competition effect on EU countries

China's structural transformation and resulting sustained pattern of economic growth over the last three decades has influenced other economies in the world through a number of different channels, with trade being one of the most significant (Arora and Vamvakidis, 2010). According to Lin and Yang (2014) the structural transformation of China and the resulting 'moving up' on the value chain consisted of three main steps. The first in 1986 "when exports of textiles and clothing exceeded crude oil (…). The second (…) in 1995, when China's export of machineries and electronics exceeded textiles and clothing. The third after China's accession to the World Trade Organization (WTO) in 2001, when high and new tech exports grew rapidly, and the level of product sophistication increased. (…) Some exporters have become integral parts of the global supply chains of multinationals in automobiles, computers, cell phones, and airplane parts. " (Lin and Yang, 2014: 4).

As a consequence of these developments, an extensive literature has investigated their possible impact on trade performance of different groups of countries, mainly concentrating on the post –WTO accession period (Shafaeddin, 2002; Yang, 2006). At first studies focused on East Asia, given the crucial role of China in the re-organization of regional production networks that resulted in China specializing on assembling intermediate products from the neighbor countries (Gaulier et al., 2006; Eichengreen et al., 2004). More recently, some contributions analyzed the impact of China on other developing countries in Latin America (Jenkins et al., 2008) and Africa (Giovannetti and Sanfilippo, 2009, Lin and Yang, 2014). Less attention has been given so far to the possible impact of Chinese export on developed countries, whose productive structures were considered less at risk due to their relatively more sophisticated production[1]. However, more recently, the increasing evidence on a fast catching-up and the rise of "sophistication" of Chinese production[2], stimulated a new attention on the impact on developed countries. In line with the international trade literature of heterogeneous firms a la Melitz, most existing studies looked at how EU domestic firms react to an increase of Chinese competition, showing the impact on upgrading (Mion and Zhu, 2013; Martin and Mejean, 2014), employment (Autor et al., 2014), exit from the market (Colantone et al., 2014) and other relevant dimensions.

Less evidence, on the other hand, has been produced at the macroeconomic level, and by looking specifically at the implication of China's entry on the export performance of advanced economies.

[1] See the recent discussion paper by Benkovskis, et al (2013) for a study on the impact on EU countries.
[2] The so-called "China is special" argument proposed by Rodrik (2006) has been confirmed in two studies by Schott (2008) and Fontagné et al. (2008), both claiming that Chinese exports are becoming increasingly similar to those of OECD countries. Pula and Santàbarbara (2011) add also that, despite their lower unit values, the quality of Chinese exports is higher compared to other developing countries.

However the macro patterns are very interesting and may tell a convincing story. As mentioned above, when the share of Chinese exports started to increase at very high rates, the share in world exports of manufactured goods of the most industrialized countries started exhibiting a downward trend. However, the share of manufactured goods in total exports and the pace of de-industrialization vary largely among advanced economies. Countries with lower shares of manufactured goods in total exports (such as the UK) followed a sharper trend of de-industrialization, whereas Germany and Italy, which have higher shares of manufactured goods in total exports, experienced a slower declining tendency (Vu, 2014).

Still, as reported by Benkovski et al. (2013), despite well-grounded raising concerns over Chinese competition, there is only limited evidence of crowding-out for advanced economies and especially a highly heterogeneity in individual country's responses. Abraham and van Hove's (2011) working on intra-OECD trade find that Chinese competition is reducing market shares of many OECD countries and that such competitive pressure is felt in labor-intensive sectors but also in a growing number of industries with high capital-intensity and/or higher value added. A study looking at the impact on the export performance of the G7 countries also finds similar results (Vu, 2014). However all these studies highlight the heterogeneity among the different exporters. Cheptea et al (2010) show the heterogeneity of developments within industrial countries (EU, US and Japan) and among sectors against the rise of Chinese market shares and maintain that, on average, EU countries have performed better than US and Japan. A similar conclusion has been reached by Husted and Nishioka (2010), who evaluate the extent of Chinese competition by means of a constant market shares analysis. Cheptea et al. (2010) also show that, within EU, market shares have been characterized by different behaviors: while German market shares have been more or less constant, Italian ones have dropped substantially, even though with differences across sectors and products[3].

We enter this debate by addressing the issue of China's competition to the two main manufacturers producers in Europe, Germany and Italy. The interest of comparing these two countries is due to a number of reasons, since two countries with similarly competitive exporting firms may be characterized by different performances, if one has a more favourable mix of products, or if it exports to a particularly dynamic set of destinations markets. In aggregate terms, both Italy and Germany have experienced a slowdown in terms of their shares in OECD markets, in a period in which Chinese exports rose at impressive rates (Figure 1). Italy underwent a strong decline; Germany, on the other hand, after a decrease seems to have recovered its share. These developments might be a consequence of Italy's specialization in low technology production, whose world demand has been growing less that the world average in the last decades, as pointed out to explain the country's loss of world's market shares over the last twenty years (Barba Navaretti et al, 2008). If this is the case, Italy has a higher risk of being crowded out by Chinese competition. As a matter of fact, the overlap between Chinese and Italian trade specializations has been growing considerably, even in the period preceding the entry to WTO, especially in low skilled but also in some skill intensive sectors (Amighini and Chiarlone, 2005). A recent analysis based on export similarity indexes shows how, outside the Asian region, Italy is the country with the most similar export structure to China, followed by Germany (ICE-Prometeia, 2011). The same study shows that, in the case of Germany, an interesting and somewhat unexpected issue is that its similarity with China increased substantially over the last decade.

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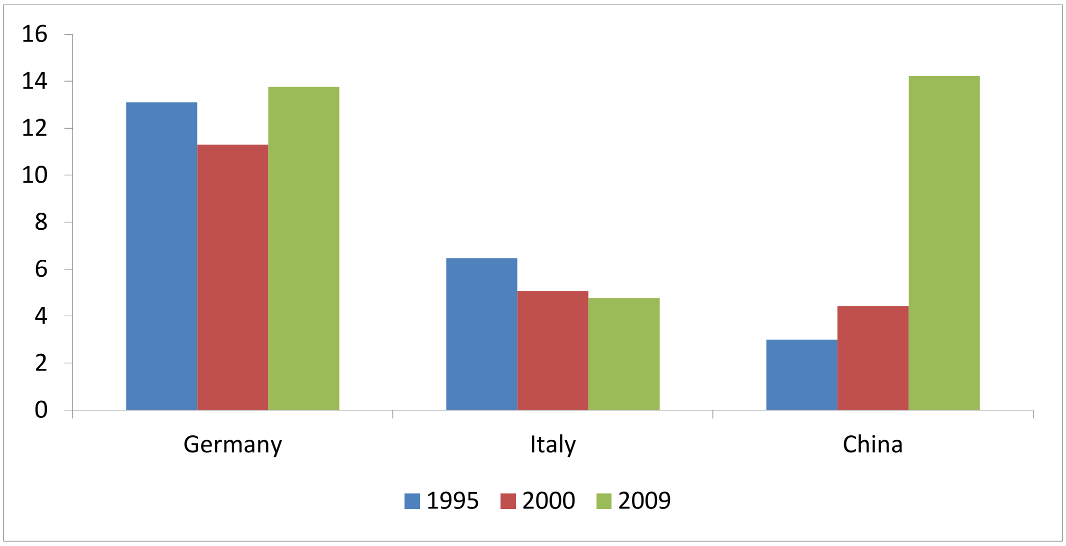
[3] Such finding seems to be supported as well in the empirical investigation by Vu (2014), who – differently from our paper – looks at exports to the world market and shows that Germany is the only G7 country not significantly affected by Chinese competition.

Figure 1. Manufacturing Export shares (%) of selected countries in OECD markets



Source: Authors' elaboration on UN Comtrade data accessed via WITS

3. Methodology and Data

In this paper, to address the still controversial issue of the possible crowding out of Italy and Germany's export from China, we propose an econometric approach which allows us to fit better the structure of our data with respect to the traditional models used so far (i.e. traditionally a modified gravity model). We use a quantile longitudinal multilevel model to take into account two very important characteristics of data, likely to affect estimates and forecasts: on the one hand, data hierarchical hidden structure (units nested in sectors, time, geographical areas, captured by a multilevel model) and, on the other, the heterogeneity of the dependent variable, export shares in our case (very different export shares levels in different sectors, captured by a quantile approach).

The proposed approach allows us to account for the fact that internationalization data are likely to have a hierarchical structure: for instance, export behavior is not only influenced by firms' or countries' goals and characteristics, but is also shaped by the social and economic environment (competitiveness) and clustered on economic sectors. Standard regression models (such as the Generalized Linear Models) are inadequate when a complex structure of data exists, since they do not allow to account for this data (hidden) hierarchical structure. Furthermore, it is difficult to properly account for the heterogeneity of the export shares if we do not disentangle it at a quantile level; this adds a further characteristic to the hierarchical structure of data and requires a composite approach to be fully investigated.

We propose a model to analyze measurements repeated on the units (recipients) over time and economic sectors, so a basic three hierarchical structure regression model can be arranged with export shares at the destination market as first level, economic sectors as second level and the time as third level. This allows us to analyze the recipients export shares over time as well as the variation of this pattern across economic sectors, taking into account the hierarchical structure hidden in the data (Rabe-Hesketh, Skrondal, 2012; Snijders, 2014). This longitudinal hierarchical model is run on quantiles, using the Koenker and Bassett's (1978) classic approach. In particular, since our dependent variable (export shares) is skewed and we do not know the distribution of the underlying population, the quantile multilevel approach seems the right approach to disentangle the evidence of heterogeneity in the data.

In particular, a longitudinal quantile regression model, generalizing Koenker and Bassett's (1978) seminal paper, can be written as

$$y_{it} = x'_{it}\beta_\theta + u_{\theta it}$$

With $Quant_\theta(y_{it} \mid x_{it}) = x'_{it}\beta_\theta$

where y is the dependent variable, x is a vector of regressors, β is the vector of parameters to be estimated, and u is a vector of residuals. $Quant_\theta(y_{it} \mid x_{it})$ denotes the θ-th conditional quantile of y given x . The θ-th regression quantile, 0 < θ < 1, solves the following problem:

$$\min_\beta \frac{1}{n}\left\{ \sum_{i,t:y_{it}\geq x'_{it}\beta} \theta\left|y_{it} - x'_{it}\beta\right| + \sum_{i,t:y_{it}<x'_{it}\beta} (1-\theta)\left|y_{it} - x'_{it}\beta\right| \right\} = \min_\beta \frac{1}{n}\sum_{i:1}^{n} \rho_\theta u_{\theta it}$$

Where $\rho\theta(\cdot)$, which is known as the 'check function', is defined as

$$\rho_\theta(u_{\theta it}) = \begin{cases} \theta u_{\theta it} & if\ u_{\theta it} \geq 0 \\ (\theta - 1)u_{\theta it} & if\ u_{\theta it} < 0 \end{cases}$$

which is then solved by linear programming methods. As θ increases from 0 to 1, we can trace the entire conditional distribution of y, conditional on x (Buchinsky, 1998)[4]. In this paper the classic quantile longitudinal model is modified due to the hierarchical hidden structure of the data, specifying the vector of residuals according to a longitudinal multilevel approach; thus, it becomes a longitudinal three-level models with random intercept and random slope (Yang, Goldstein, 1996; Skrondal, Rabe-Hesketh, 2004). The model includes all variables described below in the fixed part, a random slope and three level variances to be estimated.

[4] More on quantile regression techniques can be found in the surveys by Buchinsky (1998) and Koenker and Hallock (2001) while a set of sufficient conditions that identify a panel quantile regression model with fixed effects can be found in Canay (2011).

So the model to be estimated in a quantile regression context is the following: let the i-th occasion (it corresponds to the Italian or German export shares to the m-th country of destination) in the j-th economic sector (2 DIGITS)of the t-the be expressed by a three level model as follows:

$$y_{tij} = \underbrace{\beta_0 + \beta_1 a_{1tij} + \beta_2 a_{2tij}^2 + \sum_{l=3}^{L} \beta_l x_{ltij} + \sum_{p=1}^{P} \zeta_p s_{ptj} + \sum_{h=1}^{H} \alpha_h d_{htj} + \sum_{q=1}^{Q} \gamma_q t_{qtij} + \delta_1 e_{1tj}}_{\text{fixed part}} \qquad \underbrace{+ u_{tj} + v_t + \varepsilon_{tij}}_{\text{random part}}$$

where $u_{tj} \approx iid - N(0, \tau_u^{\ 2})$, $v_t \approx iid - N(0, \tau_v^{\ 2})$, $\varepsilon_{tij} \approx iid - N(0, \tau_\varepsilon^{\ 2})$

where

y_{ijt} = response variable (export shares to the m-th country of destination);

i=1,2,…,T is the unit (German or Italian export share per country of destination);

j=1,2,…,n is the sector (economic sector at 2 DIGITS);

t=1,2,…,T is the year (time).

Control variables included in the fixed part are those typically employed in standard gravity models (Anderson and van Wincoop, 2004). This is the case of the per capita GDP of the host country, which is a proxy for the demand, and the bilateral distance between the importer and the exporter, which is a proxy for the trade costs and other barriers. Additionally, since we use export shares, rather than total flows, as dependent variable, we account for potential persistency adding its first lag. The competition effect from China is measured by including the corresponding shares of China to the same market and sector, as common in the empirical literature on the topic (Autor et al., 2014). In the light of this structure, our contextual variables are sectors and distance.

3.1 Data and descriptive statistics

The dataset covers the period 1995-2009; high-income OECD countries are the importers. All monetary variables are in natural logarithm. Data on market shares are computed on bilateral trade flows classified according to the harmonized system (1992) at 6-digit level and come from the BACI dataset published by CEPII (cf. Gaulier and Zignago, 2010). Keeping the high level of disaggregation to account for product specific characteristics, we run the model adopting the grouping structure of the Standard International Trade Classification (SITC) revision 3. Bilateral distances, measured as simple distance (in Km) between the two most populated cities, comes from the CEPII (Mayer and Zignago, 2011). Data on GDPs of the exporter and the importers are from the World Bank World Development Indicators.

Table 1 reports descriptive statistics for the variables considered in the model.

Table 1. Summary Statistics

Italy

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Export Shares	43611	0.119	0.138	0.000	1.000
GDP (recipient country, per capita)	41240	8448.089	12973.010	69.314	94908.010
distance	43611	5798.495	3898.916	492.343	18572.150
Chinese Export Shares	43611	0.148	0.145	0.000	0.991

Germany

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Export Shares	45477	0.139	0.145	0.000	1.000
GDP (recipient country, per capita)	42806	8259.301	12829.500	69.314	94908.010
distance (km)	45477	6140.269	3817.704	173.524	18824.750
Chinese Export Shares	45477	0.142	0.144	0.000	0.991

Table 2 reports the average export shares (in Italy and Germany) and the corresponding size (i.e. number of positive observations) for different quantiles and for the whole sample. As expected, German shares and the number of units within each quantile are always above the Italian ones. For both countries, export shares to other advanced markets are quite significant, with median values of 3.3% for Italy and 4.4% for Germany. In addition, the number of sectors where the two countries enjoy higher shares (the top 5 and 10 per cent) is relevant (about 5-10% of the total), and it is likely to catch their high specialization in specific productions, where the two countries still lead the markets.

Table 2: Italian and German export shares by quantile

Quantiles	Italian Shares	Size (Italy)	German Shares	Size (Germany)
5	0.0019022	2181	0.0029089	2273
10	0.0048151	4362	0.0062621	4548
25	0.0145556	10902	0.0191204	11370
50	0.0336912	21806	0.0445776	22739
75	0.0595038	32709	0.0761936	34107
90	0.0831829	39250	0.1024219	40929
95	0.0951938	41430	0.1147213	43204
99	0.1108353	43174	0.1307142	45022
top 10	0.4392739	4361	0.4667202	4548

top 5	0.5670441	2181	0.5975578	2273

This becomes even clearer when we analyze the average shares for all sectors (2 digits) considered. This disaggregated analysis is used to highlight the sectors in which each country reports the higher shares (in bold in the table). It also shows that, despite overall lower levels of market shares (Table 3), there are some sectors in which Italy has a higher share than Germany (on average, in italics); these not surprisingly, include all the traditional specializations (clothing, apparel, footwear) of the "made in Italy" (from 81 to 85).

Table 3. Mean of Italian and German shares and size of different sectors

Sectors	Italian Shares	Size (Italy)	German Shares	Size (Germany)
71	0.124729	2645	0.164967	2779
72	**0.198553**	2722	**0.2162051**	2773
73	**0.185263**	2510	**0.2014911**	2622
74	0.135063	2753	0.1745163	2818
75	0.04424	2489	0.0996754	2697
76	0.046008	2559	0.0905934	2708
77	0.103942	2727	0.1538245	2806
78	0.0773	2675	0.1330409	2765
79	0.160658	2154	**0.2065598**	2348
81	*0.106442*	2559	0.1044963	2623
82	*0.150856*	2652	0.0688497	2607
83	*0.111728*	2294	0.0704372	2495
84	*0.137027*	2624	0.0912279	2687
85	*0.158162*	2543	0.0549303	2506
87	0.086135	2623	**0.2087672**	2801
88	0.107727	2346	**0.1937508**	2626
89	0.087751	2736	0.1180012	2816

Note: See appendix A for the full names of sectors. For simplicity we report here the content of some sector: 71: power generated machinery; 73: metalworking mach.; 82: Furniture; 83: Travel goods, handbags; 84:apparel and clothing; 85: Footwear; 87: professional instruments

Table 4. Mean of Italian and German shares and size for different sectors and quantiles

sector/quantile	Export share (IT)	N (IT)	Export Share (DE)	N (DE)	Export share (IT)	N (IT)	Export Share (DE)	N (DE)
	25				**50**			
71	0.017	385	0.024	176	0.041	1105	0.064	913
72	0.016	91	0.026	89	0.047	348	0.067	440
73	0.015	213	0.022	263	0.040	580	0.056	825
74	0.020	188	0.029	91	0.047	861	0.071	763
75	0.011	1567	0.020	903	0.021	2132	0.043	1681
76	0.012	1606	0.020	1079	0.022	2182	0.040	1867
77	0.019	562	0.029	213	0.040	1489	0.064	1186
78	0.015	905	0.023	579	0.033	1772	0.049	1295
79	0.013	538	0.019	366	0.030	964	0.045	744
81	0.014	683	0.021	921	0.033	1320	0.042	1671
82	0.015	401	0.018	1347	*0.038*	1006	0.035	2064
83	0.012	605	0.016	1475	*0.033*	1210	0.031	2067
84	0.015	436	0.017	1324	*0.039*	1101	0.033	1962
85	0.013	426	0.014	1667	*0.034*	829	0.026	2164
87	0.018	840	0.025	49	0.035	1743	0.074	540
88	0.016	744	0.026	299	0.034	1482	0.057	964
89	0.018	712	0.028	529	0.037	1682	0.053	1593
	75				**95**			
71	0.072	1999	0.104	1892	0.106	2541	0.147	2656
72	0.097	1293	0.120	1439	0.162	2455	0.182	2531
73	0.083	1316	0.096	1552	0.144	2264	0.154	2350
74	0.083	1966	0.111	1886	0.118	2651	0.155	2677
75	0.029	2338	0.069	2335	0.039	2465	0.092	2651
76	0.030	2415	0.062	2417	0.039	2526	0.079	2662
77	0.064	2265	0.095	2026	0.086	2625	0.132	2665
78	0.051	2355	0.083	2044	0.068	2624	0.125	2709
79	0.057	1437	0.088	1338	0.102	1914	0.152	2069
81	0.059	1970	0.066	2229	*0.093*	2477	0.088	2540
82	*0.067*	1648	0.049	2414	*0.121*	2441	0.060	2558
83	*0.057*	1751	0.040	2284	*0.091*	2199	0.054	2428
84	*0.068*	1854	0.049	2331	*0.108*	2454	0.071	2587
85	*0.070*	1492	0.035	2352	*0.131*	2365	0.045	2469
87	0.052	2300	0.117	1527	0.069	2536	0.175	2562
88	0.052	1942	0.094	1694	0.075	2219	0.141	2353
89	0.058	2368	0.081	2347	0.077	2674	0.105	2737

Also dividing by quantiles and sectors (Table 4), results seem to be confirmed and, in particular, the Italian superiority in traditional sectors (from 81 to 85, Made in Italy sectors) is especially evident in higher quantiles (from the 50th quantile), confirming that Italy has higher shares than Germany in those traditional sectors in which it is particularly specialized (in italics). The latter group of results can lead already to some interesting implications when coupled with mirror information on the behavior of Chinese corresponding market shares across the different sectors and quantiles. Table 5 reports information on those sectors where the share of China is larger (defined arbitrarily as above 15% of the market), showing two main facts.

Table 5. Economic sectors in which both German and Italian export shares are higher than 0.15 across quantiles

	quantiles and countries							
economic sectors	25 DE	25 IT	50 DE	50 IT	75 DE	75 IT	95 DE	95 IT
76	0.185	0.183	0.172	0.176	0.163	0.17	0.157	0.167
81	0.201	0.206	0.182	0.186	0.164	0.17	0.154	0.156
83	0.322	0.333	0.311	0.325	0.303	0.315	0.296	0.3
84	0.328	0.391	0.3	0.35	0.283	0.308	0.271	0.272
85	0.282	0.286	0.265	0.29	0.257	0.276	0.253	0.248
88	0.215	0.207	0.19	0.184	0.171	0.183	0.155	0.181
89	0.255	0.255	0.23	0.234	0.21	0.216	0.2	0.208

First, when compared with Table 4, it is shown here that almost all the sectors included are the same in which Italy is most specialized, and a larger exporter compared to Germany. Second, the weight of the Chinese presence in these sectors tends to reduce as we move from lower to higher quantiles[5]. Looking back to the descriptive statistics by sector and quantile, the latter is a more general finding. The number of sectors in which the Chinese share is prevalent reduces proportionally as we move from the 25th percentile (where 15 out of 17 sectors have a large share of Chinese exports) to the 95th (where the number drops to 10). Itself, this can be roughly interpreted as the tendency of Chinese competition to diminish as it moves towards higher value added specializations still dominated by traditional exporters, such as Italy and Germany, from advanced markets.

4 Results

The main results of the multilevel quantile regression estimation are reported in Tables 6 and 7 (results at each quantile are reported in the Appendix). First, to confirm that a multilevel approach is recommended in such context, we run a Likelihood Ratio Test on the existence of a hierarchical structure in the data. The results strongly reject the null (absence of a second/third level in the data, LR chi2 = 173.53 with a p-value<0.001), suggesting that the multilevel model is appropriate.

Focusing on the general results, all signs are as expected (significant coefficients in bold). When considering the statistical significance and the numerical values of the coefficient of "Chinese share", we observe two main things. The first is that Italy has been affected by Chinese competition along basically all the distribution of its shares, with the exception of the very low ones (i.e. the 5th quantile), meaning that China could have eroded the presence of Italian exporters when their scale was not substantial. The second main finding is that the coefficients of Germany are always higher than those of Italy. As quantiles grow (shares grow) this effect is even more evident and magnified. This same result holds also in the whole sample (last row, Table 6), with a similar effect (the numerical value is 0.13 for Germany and 0.10 for Italy, i.e. a 1% raise of Chinese market shares results in a reduction of German and Italian shares by 0.13 and 0.1%, respectively). This result comes

[5] To a certain extent, this is coherent with the findings of the empirical work by Ferrarini and Scaramuzzino (2015), who find that the higher the sophistication of the products, the lower the share of China.

a bit of a surprise if we follow the general remarks on the capacity of Germany to keep its export shares despite raising Chinese competition. There are, however, some explanations for this. First, one can be found by looking at the distribution of the competitive effect across the different sectors. When looking at the descriptive statistics provided by Tables 2-4, it is clear that Germany has an overall higher level of market shares in both the different sectors and quantiles. Hence, one could argue that the probability that the entry of Chinese competitors may affect German (relatively higher) market shares more than the Italian (relatively lower) ones is high. Related to this, is also the fact that higher coefficients may hinder sector heterogeneity, with some sectors in which both countries experience declining specialization being those more severely hit by Chinese competition. The latter seems an hypothesis more likely to fit to the case of Germany. As observed from Table 5, in fact, the pressure from Chinese competition is especially strong in those sectors in which Italy has a consolidate specialization, and that are less relevant for Germany. So, while a more specific assessment of the welfare implications for domestic producers is out of the scope of this paper, one could still argue that, despite the magnitude of the competitive effect is higher for Germany than for Italy, the "quality" of such competitive effect is more relevant to Italy, which sees a stronger negative effect on its major sectors of specialization.

Moving to the other variables, when we look at the coefficient of the distance, as expected from a standard "gravity" interpretation, all signs are negative and significant (not significant only for the lowest quantiles in Germany), confirming that the farer the destination the lower the export shares on average, since the more the distance the more risky and complex the exporting, resulting in higher trade costs. The coefficients are however quite low, and this could be due to the fact that transaction and transportation costs are generally low amongst OECD countries. Interestingly enough, when it comes to the coefficients for the top 5 and 10 quantiles, the coefficient of the distance turns positive (and significant) for both Italy and Germany. This stands as a relevant finding, which leads to two different, but related, explanations. The first is the scale effect. With high market shares, and in presence of large volumes, the negative effect of the physical distance is more likely to be offset. The second could be a quality effect. If top performing sectors are, as we expect, those where the two countries have high specialization and a reputation of high quality/value of their manufactures, the demand would be sustained, independently on the distance to the final destination.

Table 6. Chinese Shares estimated effect on Germany and Italy and corresponding distances

Quantiles	Chinese share on Germany	Chinese share on Italy	Distance Germany	Distance Italy
5	-0.0000777	-0.0005342	-0.0000106	**-0.0004508**
10	-0.0000453	**-0.0015015**	-0.0002261	**-0.0011009**
25	0.0002474	**-0.0052483**	**-0.0010034**	**-0.0039536**
50	**-0.0205097**	**-0.0119869**	**-0.0151221**	**-0.0094808**
75	**-0.0471835**	**-0.0289698**	**-0.0227761**	**-0.0155938**
90	**-0.0680817**	**-0.0462765**	**-0.0279063**	**-0.0188169**
95	**-0.0784098**	**-0.0555281**	**-0.0278912**	**-0.019211**
99	**-0.1106498**	**-0.0769632**	**-0.0213854**	**-0.0166017**
top 10	**-0.4567923**	**-0.3513537**	**0.0622206**	**0.0337083**
top 5	**-0.5366606**	**-0.43835**	**0.0713893**	**0.0512402**
Tot	**-0.1303854**	**-0.1036476**	**-0.0169577**	**-0.0129088**

Statistically significant coefficients in bold

Table 7 reports the role of destination countries' GDP on the Italian and German shares. We introduced a quadratic effect (GPD and GDP squared) to highlight the existence of a composite effect of the richness of destination country on Italy and Germany, if any. Specifically, the quadratic form allows us to capture decreasing or increasing marginal effects of destination countries GDP on German/Italian export shares (Wooldridge, 2008). Since Italy is well known for its "made in Italy", luxury goods, exported all around the world, it is interesting to verify whether and how the Italian (or German) market shares are influenced by the GDP of the destination countries. The introduction of a squared term on a regression model allows us to show the existence of a parabolic effect of the GDP on the dependent variable. When it exists, it shows a change on the sign of the estimated coefficients of the GDP on the country export shares and allows us to identify a threshold (a minimum or a maximum) corresponding to the GDP coefficient change. Our results show that this composite effect exists and it is different in the two countries.

Table 7. Destination countries GDP on Germany and Italy (estimated coefficients) and their estimated thresholds (in $).

quantiles	GDP on German Shares	GDP on German Shares (squared)	GDP on Italian shares	GDP on Italian shares (squared)	Threshold GDP On Germany	Threshold GDP on Italy
5	**-0.00034**	**0.0000251**	-1.59E-06	3.63E-06	**923.975**	1.245
10	**-0.00085**	**0.0000747**	-0.00029	0.000033	**289.844**	85.627
25	**-0.00143**	**0.0001254**	0.001404	-5.8E-05	**303.963**	196319.753
50	**-0.00546**	**0.0003685**	**0.004764**	**-0.00024**	**1643.772**	**17221.093**
75	**-0.00875**	**0.0005353**	**0.010334**	**-0.00064**	**3549.878**	**3148.117**
90	**-0.0146**	**0.0008278**	**0.011025**	**-0.00077**	**6751.965**	**1266.467**
95	**-0.02322**	**0.0013074**	**0.006929**	**-0.00058**	**7175.465**	**384.317**
99	**-0.043**	**0.0024463**	**-0.00807**	0.000226	**6559.842**	58509556.93
top 10	**-0.04103**	**0.0028568**	-0.01812	0.000113	**1315.496**	6.2018E+34
top 5	0.013934	-0.000633	0.000435	-0.00092	60568.961	1.265979318
total	**-0.04242**	**0.0023954**	**-0.01705**	**0.000727**	**7006.665**	**124497.341**

Note: **Maximum**: positive sign on levels, negative sign on squared; **Minimum**: negative sign on levels, positive sign on squared.For a detailded description see Wooldridge (2008). Statistically significant coefficients in bold.

For Germany a minimum exists in all quantiles (except for the top 5% highest shares) with an estimated threshold that grows as the export shares grow[6]. In other words, this means that as destination market's per capita GDP grows, German export shares grow constantly, since the non linear effect exists but its magnitude is quite low. German export shares decrease (up to the threshold) only in those countries with a very low per capita GDP (923$ to 7000$, on average, all else equal). In general, the composite effect shows a very low threshold (7006$): the propulsive effect of destination country's per capita GDP on German export shares is evident only in middle and high GDP countries (with a per capita GDP greater than 7006$, on average, all else equal).

[6] When represented in a graph with destination market's per capita GDP on x-axis and German export shares on y-axis, this would be a set of U-shape parabolas that shift to the right as GDP grows. This means that there's a negative effect of destination market's per capita GDP on German shares as its shares grow (as quantiles grow).

Also for Italy, a threshold exists but, contrary to Germany, it turns out to be a maximum only in higher quantiles (from 50% to 95%) and it tends to decrease as quantiles increase[7]. This means that Italy loses competitiveness (in terms of export shares) in higher GDP countries, where Italy is expected to have also higher shares thanks to its specialization on "made in Italy", luxury goods. Or, as destination country's per capita GDP grows, its effect on Italian export shares tends to decrease, leaving Italy weaker in the international markets that count more for its high quality products (on average, all else equal). In general, the two extreme quantiles (lowest and highest) are not significant and the composite net effect shows a very high threshold (a minimum) , so the non linearity effect is not very meaningful (destination country's per capita GDP greater than 124000$).

The multilevel component of the model, that can be read in the full tables reported in Appendix B, disentangles the effects of the economic sectors and allows us to estimate the percentage of variance explained by each level (sector and time) at each quantile. It shows how the role of sectors is very heterogeneous across quantiles and between Italy and Germany: sectors from 81-84, for instance, represent a big boost for Italian export share (the opposite effect can be noticed in Germany), confirming the preliminary analysis done on the descriptive statistics and the results on the quantiles and the percentage of variance explained by levels (especially by sectors) is very heterogeneous. On average, indeed, along the quantiles and on the whole sample the variance (heterogeneity) explained by time is higher than that explained by sectors in both the countries, suggesting that the sectors heterogeneity is more difficult to be fully captured in a single model (detailed results are available from authors upon request).

5. Conclusions

Over the last decades, the success of Chinese exports has come at the expense of a large number of countries. Recent research has emphasized, on the one hand, the changes in Chinese specialization and, on the other hand, the competitive impact of Chinese manufacturing exports on many developing and emerging countries; European countries were at first considered sheltered, because of their different segments of specialization and destination markets for exports, resulting in the creation of niche markets However, other studies show a displacement of developed countries exports and highlight important heterogeneity in individual countries exports shares at sectoral and product level.

This paper contributes to the literature on the effect of China on exports of developed countries, using an innovative econometric model and showing that Chinese competition has affected Italy's and Germany's market shares in different ways, in different sectors and market segments . Contrary to our expectations, the results present a mixed picture, where some sectors and segments are potentially displaced while others have resisted much better. We generally show that the two countries have been largely affected by the Chinese competition, but also that the sectorial composition of such competitive pressure is shifted towards not specialized segments of the markets, or those with a marginal role in the exporters basket. On the other hand, the overall assessment of the China effect seems to highlight once again the role of quality and specialization as effective barriers from developing countries competition.

These results are rooted on a novel econometric approach. We estimate a quantile longitudinal multilevel model which allows us to take into account two very important characteristics of our data:

[7] If we plot this result on a graph with destination market per capita GDP on x-axis and export shares on y-axis, the net effect can be represented as inverted U-shaped parabolas shifting to the left as export shares grow. In other words, this means that the positive effect from GDP is more evident for lower export shares quantiles while this effect becomes negative as the shares grow.

their hierarchical hidden structure (captured by a multilevel model) and the heterogeneity of the export shares (captured by a quantile approach). The model proposed is very flexible and we can disentangle the GDP effect on export shares to show how heterogeneous this effect is across the distribution. Our results, on the whole and at a quantile and multilevel level, confirm the flexibility and characteristics of the model proposed.

A standard model without the specification on quantiles and without taking into account the hierarchical hidden structure of the model, could have showed, for instance, a negative effect of destination country's per capita GDP on export shares. By focusing on quantiles, disentangling the hierarchical structure of data, taking into account the heterogeneity within each quantile and adding non linearities, we can claim that this result is strongly influenced by the patterns of the top 4-5% units. By disentangling the GDP effect on export shares, we are able to show how heterogeneous this effect is across the distribution, increasing the information on the relationships studied.

These results are relevant also for their policy implications. If China is a competitor only for certain market segments, or in certain markets, it is useful to identify those segments and markets and especially to understand the underlying dynamics. Tiffin (2014) in a study on Italian competitiveness, for instance, suggests that Italy, penalized as mentioned above by its product composition, which is biased towards low tech- traditional products which growth has recently been less dynamic, has however been able to re-orient its exports to markets with a rapidly expanding demand for imports, and therefore its market shares' losses, at a disaggregated level, have not be as critical as feared. Our results, obtained in a different context and using a totally different methodology, support the same view.

The results are also potentially useful for an ex post analysis of the country "response" to the Chinese competition, for instance a quality upgrading of some low tech traditional products, calling for further research on the topic.

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APPENDIX A

Classification Used

- 7 - Machinery and transport equipment
    - 71 - Power-generating machinery and equipment
    - 72 - Machinery specialized for particular industries
    - 73 - Metalworking machinery
    - 74 - General industrial machinery and equipment, n.e.s., and machine parts, n.e.s.
    - 75 - Office machines and automatic data-processing machines
    - 76 - Telecommunications and sound-recording and reproducing apparatus and equipment
    - 77 - Electrical machinery, apparatus and appliances, n.e.s., and electrical parts thereof (including non-electrical counterparts, n.e.s., of electrical household-type equipment)
    - 78 - Road vehicles (including air-cushion vehicles)
    - 79 - Other transport equipment
- 8 - Miscellaneous manufactured articles
    - 81 - Prefabricated buildings; sanitary, plumbing, heating and lighting fixtures and fittings, n.e.s.
    - 82 - Furniture, and parts thereof; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings
    - 83 - Travel goods, handbags and similar containers
    - 84 - Articles of apparel and clothing accessories
    - 85 - Footwear
    - 87 - Professional, scientific and controlling instruments and apparatus, n.e.s.
    - 88 - Photographic apparatus, equipment and supplies and optical goods, n.e.s.; watches and clocks
    - 89 - Miscellaneous manufactured articles, n.e.s.

Disaggregation at 3 digits:

Sector 7:

- 711 - Steam or other vapour-generating boilers, superheated water boilers, and auxiliary plant for use therewith; parts thereof
- 712 - Steam turbines and other vapour turbines, and parts thereof, n.e.s.
- 713 - Internal combustion piston engines, and parts thereof, n.e.s.
- 714 - Engines and motors, non-electric (other than those of groups 712, 713 and 718); parts, n.e.s., of these engines and motors
- 716 - Rotating electric plant, and parts thereof, n.e.s.
- 718 - Power-generating machinery, and parts thereof, n.e.s.
- 721 - Agricultural machinery (excluding tractors), and parts thereof
- 722 - Tractors (other than those of headings 744.14 and 744.15)
- 723 - Civil engineering and contractors' plant and equipment; parts thereof
- 724 - Textile and leather machinery, and parts thereof, n.e.s.
- 725 - Paper mill and pulp mill machinery, paper-cutting machines and other machinery for the manufacture of paper articles; parts thereof
- 726 - Printing and bookbinding machinery, and parts thereof
- 727 - Food-processing machines (excluding domestic); parts thereof
- 728 - Other machinery and equipment specialized for particular industries; parts thereof, n.e.s.
- 731 - Machine tools working by removing metal or other material

- 733 - Machine tools for working metal, sintered metal carbides or cermets, without removing material
- 735 - Parts, n.e.s., and accessories suitable for use solely or principally with the machines falling within groups 731 and 733 (including work or tool holders, self-opening die-heads, dividing heads and other special attachments for machine tools); tool holders for any type of tool for working in the hand
- 737 - Metalworking machinery (other than machine tools), and parts thereof, n.e.s.
- 741 - Heating and cooling equipment, and parts thereof, n.e.s.
- 742 - Pumps for liquids, whether or not fitted with a measuring device; liquid elevators; parts for such pumps and liquid elevators
- 743 - Pumps (other than pumps for liquids), air or other gas compressors and fans; ventilating or recycling hoods incorporating a fan, whether or not fitted with filters; centrifuges; filtering or purifying apparatus; parts thereof
- 744 - Mechanical handling equipment, and parts thereof, n.e.s.
- 745 - Non-electrical machinery, tools and mechanical apparatus, and parts thereof, n.e.s.
- 746 - Ball- or roller bearings
- 747 - Taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, including pressure-reducing valves and thermostatically controlled valves
- 748 - Transmission shafts (including camshafts and crankshafts) and cranks; bearing housings and plain shaft bearings; gears and gearing; ball screws; gearboxes and other speed changers (including torque converters); flywheels and pulleys (including pulley blocks); clutches and shaft couplings (including universal joints); articulated link chain; parts thereof
- 749 - Non-electric parts and accessories of machinery, n.e.s.
- 751 - Office machines
- 752 - Automatic data-processing machines and units thereof; magnetic or optical readers, machines for transcribing data onto data media in coded form and machines for processing such data, n.e.s.
- 759 - Parts and accessories (other than covers, carrying cases and the like) suitable for use solely or principally with machines falling within groups 751 and 752
- 761 - Television receivers (including video monitors and video projectors), whether or not incorporating radio-broadcast receivers or sound- or video-recording or reproducing apparatus
- 762 - Radio-broadcast receivers, whether or not incorporating sound-recording or reproducing apparatus or a clock
- 763 - Sound recorders or reproducers; television image and sound recorders or reproducers; prepared unrecorded media
- 764 - Telecommunications equipment, n.e.s., and parts, n.e.s., and accessories of apparatus falling within division 76
- 771 - Electric power machinery (other than rotating electric plant of group 716), and parts thereof
- 772 - Electrical apparatus for switching or protecting electrical circuits or for making connections to or in electrical circuits (e.g., switches, relays, fuses, lightning arresters, voltage limiters, surge suppressors, plugs and sockets, lamp-holders and junction boxes); electrical resistors (including rheostats and potentiometers), other than heating resistors; printed circuits; boards, panels (including numerical control panels), consoles, desks, cabinets and other bases, equipped with two or more apparatus for switching, protecting or for making connections to or in electrical circuits, for electric control or the distribution of electricity (excluding switching apparatus of subgroup 764.1)
- 773 - Equipment for distributing electricity, n.e.s.
- 774 - Electrodiagnostic apparatus for medical, surgical, dental or veterinary purposes, and radiological apparatus
- 775 - Household-type electrical and non-electrical equipment, n.e.s.
- 776 - Thermionic, cold cathode or photo-cathode valves and tubes (e.g., vacuum or vapour or gas-filled valves and tubes, mercury arc rectifying valves and tubes, cathode-ray tubes, television camera tubes); diodes, transistors and similar semiconductor devices;

photosensitive semiconductor devices; light-emitting diodes; mounted piezoelectric crystals; electronic integrated circuits and microassemblies; parts thereof

- 778 - Electrical machinery and apparatus, n.e.s.
- 781 - Motor cars and other motor vehicles principally designed for the transport of persons (other than motor vehicles for the transport of ten or more persons, including the driver), including station-wagons and racing cars
- 782 - Motor vehicles for the transport of goods and special-purpose motor vehicles
- 783 - Road motor vehicles, n.e.s.
- 784 - Parts and accessories of the motor vehicles of groups 722, 781, 782 and 783
- 785 - Motor cycles (including mopeds) and cycles, motorized and non-motorized; invalid carriages
- 786 - Trailers and semi-trailers; other vehicles, not mechanically-propelled; specially designed and equipped transport containers
- 791 - Railway vehicles (including hovertrains) and associated equipment
- 792 - Aircraft and associated equipment; spacecraft (including satellites) and spacecraft launch vehicles; parts thereof
- 793 - Ships, boats (including hovercraft) and floating structures

Sector 8:

- 811 - Prefabricated buildings
- 812 - Sanitary, plumbing and heating fixtures and fittings, n.e.s.
- 813 - Lighting fixtures and fittings, n.e.s.
- 821 - Furniture and parts thereof; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings
- 831 - Trunks, suitcases, vanity cases, executive cases, briefcases, school satchels, binocular cases, camera cases, musical instrument cases, spectacle cases, gun cases, holsters and similar containers; travelling bags, toilet bags, rucksacks, handbags, shopping bags, wallets, purses, map cases, cigarette cases, tobacco pouches, tool bags, sports bags, bottle cases, jewellery boxes, powder boxes, cutlery cases and similar containers, of leather or of composition leather, of sheeting of plastics, of textile materials, of vulcanized fibre or of paperboard, or wholly or mainly covered with such materials or with paper; travel sets for personal toilet, sewing or shoe or clothes cleaning
- 841 - Men's or boys' coats, capes, jackets, suits, blazers, trousers, shorts, shirts, underwear, nightwear and similar articles of textile fabrics, not knitted or crocheted (other than those of subgroup 845.2)
- 842 - Women's or girls' coats, capes, jackets, suits, trousers, shorts, shirts, dresses and skirts, underwear, nightwear and similar articles of textile fabrics, not knitted or crocheted (other than those of subgroup 842.2)
- 843 - Men's or boys' coats, capes, jackets, suits, blazers, trousers, shorts, shirts, underwear, nightwear and similar articles of textile fabrics, knitted or crocheted (other than those of subgroup 845.2)
- 844 - Women's or girls' coats, capes, jackets, suits, trousers, shorts, shirts, dresses and skirts, underwear, nightwear and similar articles of textile fabrics, knitted or crocheted (other than those of subgroup 845.2)
- 845 - Articles of apparel, of textile fabrics, whether or not knitted or crocheted, n.e.s.
- 846 - Clothing accessories, of textile fabrics, whether or not knitted or crocheted (other than those for babies)
- 848 - Articles of apparel and clothing accessories of other than textile fabrics; headgear of all materials
- 851 - Footwear
- 871 - Optical instruments and apparatus, n.e.s.
- 872 - Instruments and appliances, n.e.s., for medical, surgical, dental or veterinary purposes
- 873 - Meters and counters, n.e.s.

- 874 - Measuring, checking, analysing and controlling instruments and apparatus, n.e.s.
- 881 - Photographic apparatus and equipment, n.e.s.
- 882 - Photographic and cinematographic supplies
- 883 - Cinematographic film, exposed and developed, whether or not incorporating soundtrack or consisting only of soundtrack
- 884 - Optical goods, n.e.s.
- 885 - Watches and clocks
- 891 - Arms and ammunition
- 892 - Printed matter
- 893 - Articles, n.e.s., of plastics
- 894 - Baby carriages, toys, games and sporting goods
- 895 - Office and stationery supplies, n.e.s.
- 896 - Works of art, collectors' pieces and antiques
- 897 - Jewellery, goldsmiths' and silversmiths' wares, and other articles of precious or semiprecious materials, n.e.s.
- 898 - Musical instruments and parts and accessories thereof; records, tapes and other sound or similar recordings (excluding goods of groups 763 and 883)
- 899 - Miscellaneous manufactured articles, n.e.s.

APPENDIX B

Model Results for selected quantiles:

Italy

Quantile 25%

```
                                                Wald chi2(5)       =         .
Log pseudolikelihood =  32034.705               Prob > chi2        =         .

                              (Std. Err. adjusted for 17 clusters in sitc_2digit)
```

share_it_2digit	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
l1_share_it_2digit	.0085996	.0056808	1.51	0.130	-.0025345	.0197336
lgdp_pc	.001404	.0013365	1.05	0.294	-.0012156	.0040235
lgdp_pc_sq	-.0000576	.000095	-0.61	0.544	-.0002438	.0001286
ldist	-.0039536	.000359	-11.01	0.000	-.0046573	-.0032499
_Isitc_2dig_2	.0013232	.0003451	3.83	0.000	.0006469	.0019995
_Isitc_2dig_3	-.0005639	.0003153	-1.79	0.074	-.0011819	.0000542
_Isitc_2dig_4	.0037375	.0001336	27.97	0.000	.0034756	.0039994
_Isitc_2dig_5	-.0076338	.0001552	-49.19	0.000	-.007938	-.0073296
_Isitc_2dig_6	-.0065097	.0001365	-47.70	0.000	-.0067771	-.0062422
_Isitc_2dig_7	.0020205	.0002142	9.43	0.000	.0016007	.0024402
_Isitc_2dig_8	-.0025376	.0001175	-21.60	0.000	-.0027679	-.0023073
_Isitc_2dig_9	-.0060766	.0002325	-26.14	0.000	-.0065323	-.0056209
_Isitc_2dig_10	-.0027063	.0001226	-22.07	0.000	-.0029466	-.002466
_Isitc_2dig_11	-.0015981	.0001234	-12.95	0.000	-.0018399	-.0013563
_Isitc_2dig_12	-.004669	.0002899	-16.11	0.000	-.0052371	-.0041008
_Isitc_2dig_13	-.0017684	.0003829	-4.62	0.000	-.0025188	-.001018
_Isitc_2dig_14	-.003403	.0002336	-14.57	0.000	-.0038609	-.0029452
_Isitc_2dig_15	.0000196	.000239	0.08	0.935	-.0004489	.000488
_Isitc_2dig_16	-.0014366	.0001788	-8.03	0.000	-.0017871	-.0010861
_Isitc_2dig_17	.0013009	.0001932	6.73	0.000	.0009222	.0016795
share_ch_2digit	-.0052483	.0018502	-2.84	0.005	-.0088747	-.0016219
_cons	.0461273	.004739	9.73	0.000	.0368391	.0554156

Random-effects Parameters	Estimate	Robust Std. Err.	[95% Conf.	Interval]
sitc_2digit: Identity				
sd(_cons)	2.87e-10	1.88e-08	5.98e-66	1.38e+46
t: Identity				
sd(_cons)	.0005867	.0003604	.000176	.0019558
sd(Residual)	.0086161	.0002076	.0082188	.0090327

.
.

Quantile 50%

```
                                                Wald chi2(5)       =          .
Log pseudolikelihood =  49807.971               Prob > chi2        =          .

                               (Std. Err. adjusted for 17 clusters in sitc_2digit)
```

share_it_2digit	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
l1_share_it_2digit	.0822402	.0216572	3.80	0.000	.0397929	.1246875
lgdp_pc	.0047638	.0020586	2.31	0.021	.0007291	.0087985
lgdp_pc_sq	-.0002442	.0001446	-1.69	0.091	-.0005275	.0000392
ldist	-.0094808	.0005748	-16.49	0.000	-.0106074	-.0083543
_Isitc_2dig_2	.0100839	.0007742	13.03	0.000	.0085666	.0116012
_Isitc_2dig_3	.001816	.0006264	2.90	0.004	.0005883	.0030436
_Isitc_2dig_4	.0095102	.0001982	47.98	0.000	.0091217	.0098987
_Isitc_2dig_5	-.0202216	.000722	-28.01	0.000	-.0216366	-.0188066
_Isitc_2dig_6	-.019282	.0006922	-27.86	0.000	-.0206387	-.0179252
_Isitc_2dig_7	.0001542	.0003928	0.39	0.695	-.0006156	.0009241
_Isitc_2dig_8	-.0071526	.0004771	-14.99	0.000	-.0080878	-.0062175
_Isitc_2dig_9	-.015126	.000544	-27.80	0.000	-.0161923	-.0140598
_Isitc_2dig_10	-.0058431	.0004296	-13.60	0.000	-.0066852	-.0050011
_Isitc_2dig_11	.0008328	.0004273	1.95	0.051	-4.65e-06	.0016703
_Isitc_2dig_12	-.0045721	.0008769	-5.21	0.000	-.0062907	-.0028535
_Isitc_2dig_13	.0019325	.0009405	2.05	0.040	.0000892	.0037759
_Isitc_2dig_14	-.0021415	.0007009	-3.06	0.002	-.0035152	-.0007678
_Isitc_2dig_15	-.0068568	.0004207	-16.30	0.000	-.0076813	-.0060322
_Isitc_2dig_16	-.0076522	.0005188	-14.75	0.000	-.0086689	-.0066354
_Isitc_2dig_17	-.0010324	.0006001	-1.72	0.085	-.0022086	.0001437
share_ch_2digit	-.0119869	.0044504	-2.69	0.007	-.0207096	-.0032643
_cons	.0986792	.0104854	9.41	0.000	.0781282	.1192303

Random-effects Parameters	Estimate	Robust Std. Err.	[95% Conf.	Interval]
sitc_2digit: Identity				
sd(_cons)	1.06e-11	4.91e-10	5.20e-51	2.17e+28
t: Identity				
sd(_cons)	.0021258	.0003596	.001526	.0029614
sd(Residual)	.0187337	.0005936	.0176056	.0199341

Quantile 75%

```
                                                  Wald chi2(5)       =          .
Log pseudolikelihood =  59758.904                 Prob > chi2        =          .

                                  (Std. Err. adjusted for 17 clusters in sitc_2digit)
```

share_it_2digit	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
l1_share_it_2digit	.2225228	.036911	6.03	0.000	.1501785	.294867
lgdp_pc	.010334	.0029602	3.49	0.000	.004532	.016136
lgdp_pc_sq	-.0006415	.0001766	-3.63	0.000	-.0009877	-.0002953
ldist	-.0155938	.0009504	-16.41	0.000	-.0174565	-.013731
_Isitc_2dig_2	.0234979	.0013403	17.53	0.000	.0208709	.0261249
_Isitc_2dig_3	.0087812	.0011511	7.63	0.000	.0065251	.0110374
_Isitc_2dig_4	.0111969	.0002384	46.97	0.000	.0107297	.0116642
_Isitc_2dig_5	-.033696	.0018675	-18.04	0.000	-.0373561	-.0300358
_Isitc_2dig_6	-.0314751	.0017511	-17.97	0.000	-.0349072	-.028043
_Isitc_2dig_7	-.0052173	.0005525	-9.44	0.000	-.0063001	-.0041344
_Isitc_2dig_8	-.0155239	.0010246	-15.15	0.000	-.017532	-.0135158
_Isitc_2dig_9	-.0190143	.0006491	-29.29	0.000	-.0202865	-.0177421
_Isitc_2dig_10	-.0060563	.0006973	-8.69	0.000	-.007423	-.0046896
_Isitc_2dig_11	.0017059	.0005203	3.28	0.001	.0006861	.0027257
_Isitc_2dig_12	-.0042776	.0016044	-2.67	0.008	-.0074221	-.0011331
_Isitc_2dig_13	.0042423	.0015211	2.79	0.005	.0012609	.0072237
_Isitc_2dig_14	.0084879	.001292	6.57	0.000	.0059556	.0110202
_Isitc_2dig_15	-.0173501	.000915	-18.96	0.000	-.0191434	-.0155567
_Isitc_2dig_16	-.0159998	.000943	-16.97	0.000	-.0178482	-.0141515
_Isitc_2dig_17	-.0063911	.0009932	-6.44	0.000	-.0083377	-.0044445
share_ch_2digit	-.0289698	.0072065	-4.02	0.000	-.0430943	-.0148452
_cons	.1485692	.015291	9.72	0.000	.1185994	.178539

Random-effects Parameters	Estimate	Robust Std. Err.	[95% Conf.	Interval]
sitc_2digit: Identity				
sd(_cons)	1.42e-11	9.98e-10	2.18e-71	9.26e+48
t: Identity				
sd(_cons)	.0034303	.0004864	.0025979	.0045294
sd(Residual)	.0313475	.0013644	.0287841	.0341391

General Longitudinal Multilevel Model

```
                                              Wald chi2(5)       =         .
Log pseudolikelihood =   43355.72             Prob > chi2        =         .

                                 (Std. Err. adjusted for 17 clusters in sitc_2digit)
```

share_it_2digit	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
l1_share_it_2digit	.606208	.0310229	19.54	0.000	.5454042	.6670119
lgdp_pc	-.017049	.004203	-4.06	0.000	-.0252867	-.0088113
lgdp_pc_sq	.0007266	.0002106	3.45	0.001	.0003137	.0011394
ldist	-.0129088	.0010812	-11.94	0.000	-.0150278	-.0107897
_Isitc_2dig_2	.0305591	.0024888	12.28	0.000	.0256813	.035437
_Isitc_2dig_3	.0274037	.0022731	12.06	0.000	.0229485	.0318589
_Isitc_2dig_4	.0069761	.0004564	15.29	0.000	.0060816	.0078705
_Isitc_2dig_5	-.023137	.0020631	-11.21	0.000	-.0271805	-.0190934
_Isitc_2dig_6	-.0171363	.0018684	-9.17	0.000	-.0207983	-.0134743
_Isitc_2dig_7	-.0040989	.000591	-6.94	0.000	-.0052572	-.0029407
_Isitc_2dig_8	-.0126877	.0011423	-11.11	0.000	-.0149266	-.0104488
_Isitc_2dig_9	.0122246	.0012757	9.58	0.000	.0097243	.0147248
_Isitc_2dig_10	.0048865	.0009692	5.04	0.000	.0029868	.0067861
_Isitc_2dig_11	.0168217	.0017046	9.87	0.000	.0134807	.0201627
_Isitc_2dig_12	.02158	.0031593	6.83	0.000	.0153878	.0277721
_Isitc_2dig_13	.0242833	.0029988	8.10	0.000	.0184058	.0301608
_Isitc_2dig_14	.033741	.0032083	10.52	0.000	.0274527	.0400292
_Isitc_2dig_15	-.0120324	.0011281	-10.67	0.000	-.0142435	-.0098214
_Isitc_2dig_16	.0038525	.0012793	3.01	0.003	.0013451	.00636
_Isitc_2dig_17	.0011194	.0015183	0.74	0.461	-.0018563	.0040952
share_ch_2digit	-.1036476	.0140213	-7.39	0.000	-.1311288	-.0761663
_cons	.2455411	.0251575	9.76	0.000	.1962332	.2948489

Random-effects Parameters	Estimate	Robust Std. Err.	[95% Conf.	Interval]
sitc_2digit: Identity				
sd(_cons)	2.39e-11	1.43e-09	2.98e-62	1.92e+40
t: Identity				
sd(_cons)	.0060017	.0005548	.0050072	.0071938
sd(Residual)	.0776216	.00618	.0664069	.0907303

Germany

Quantile 25%

```
                                                Wald chi2(5)       =          .
Log pseudolikelihood =  15893.022               Prob > chi2        =          .

                                 (Std. Err. adjusted for 17 clusters in sitc_2digit)
```

share_de_2digit	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
l1_share_de_2digit	.0009999	.0016346	0.61	0.541	-.0022038	.0042036
lgdp_pc	-.0014338	.0007363	-1.95	0.052	-.0028769	9.39e-06
lgdp_pc_sq	.0001254	.0000497	2.52	0.012	.000028	.0002228
ldist	-.0010034	.0003052	-3.29	0.001	-.0016016	-.0004052
_Isitc_2dig_2	-.0000436	.0001936	-0.23	0.822	-.0004231	.0003359
_Isitc_2dig_3	-.0005291	.0000961	-5.50	0.000	-.0007176	-.0003407
_Isitc_2dig_4	-.0013216	.0002574	-5.13	0.000	-.0018261	-.0008171
_Isitc_2dig_5	-.0013708	.0001284	-10.68	0.000	-.0016224	-.0011191
_Isitc_2dig_6	-.0002878	.0001262	-2.28	0.023	-.0005352	-.0000403
_Isitc_2dig_7	-.0000364	.0001538	-0.24	0.813	-.0003377	.000265
_Isitc_2dig_8	-.0000624	.0001026	-0.61	0.543	-.0002636	.0001387
_Isitc_2dig_9	-.0007047	.0001597	-4.41	0.000	-.0010178	-.0003917
_Isitc_2dig_10	-.0009692	.0000952	-10.18	0.000	-.0011558	-.0007827
_Isitc_2dig_11	-.0005322	.0001492	-3.57	0.000	-.0008246	-.0002397
_Isitc_2dig_12	-.0008351	.0001294	-6.45	0.000	-.0010888	-.0005814
_Isitc_2dig_13	-.0005625	.0001254	-4.49	0.000	-.0008083	-.0003168
_Isitc_2dig_14	-.0020107	.0001443	-13.93	0.000	-.0022935	-.0017278
_Isitc_2dig_15	-.0013023	.0002582	-5.04	0.000	-.0018084	-.0007962
_Isitc_2dig_16	-.0006176	.000052	-11.88	0.000	-.0007196	-.0005157
_Isitc_2dig_17	.0005835	.0001614	3.62	0.000	.0002672	.0008998
share_ch_2digit	.0002474	.0006212	0.40	0.690	-.0009702	.001465
_cons	.0195762	.0050922	3.84	0.000	.0095956	.0295568

Random-effects Parameters	Estimate	Robust Std. Err.	[95% Conf.	Interval]
sitc_2digit: Identity				
sd(_cons)	6.89e-09	4.04e-07	9.18e-59	5.17e+41
t: Identity				
sd(_cons)	.0002039	.0006462	4.09e-07	.101569
sd(Residual)	.0037162	.0001577	.0034196	.0040386

Quantile 50%

```
                                                Wald chi2(5)       =          .
Log pseudolikelihood =  47122.105               Prob > chi2        =          .

                                 (Std. Err. adjusted for 17 clusters in sitc_2digit)
```

share_de_2digit	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
l1_share_de_2digit	.0694194	.022562	3.08	0.002	.0251986	.1136402
lgdp_pc	-.0054573	.0026427	-2.07	0.039	-.0106369	-.0002777
lgdp_pc_sq	.0003685	.0001678	2.20	0.028	.0000397	.0006972
ldist	-.0151221	.0007553	-20.02	0.000	-.0166025	-.0136416
_Isitc_2dig_2	.004626	.0005708	8.11	0.000	.0035073	.0057446
_Isitc_2dig_3	-.0073132	.0003831	-19.09	0.000	-.008064	-.0065623
_Isitc_2dig_4	.0079847	.0002693	29.65	0.000	.0074569	.0085125
_Isitc_2dig_5	-.0216776	.000884	-24.52	0.000	-.0234101	-.0199451
_Isitc_2dig_6	-.024913	.0010473	-23.79	0.000	-.0269657	-.0228603
_Isitc_2dig_7	.000844	.0004801	1.76	0.079	-.000097	.0017849
_Isitc_2dig_8	-.0122673	.000709	-17.30	0.000	-.013657	-.0108776
_Isitc_2dig_9	-.02343	.0009251	-25.33	0.000	-.0252431	-.0216168
_Isitc_2dig_10	-.0223986	.000869	-25.77	0.000	-.0241018	-.0206953
_Isitc_2dig_11	-.0316645	.0012287	-25.77	0.000	-.0340727	-.0292564
_Isitc_2dig_12	-.0341091	.0015027	-22.70	0.000	-.0370543	-.0311639
_Isitc_2dig_13	-.0316822	.0013613	-23.27	0.000	-.0343503	-.0290141
_Isitc_2dig_14	-.040534	.0015777	-25.69	0.000	-.0436262	-.0374419
_Isitc_2dig_15	.0093036	.0001022	91.07	0.000	.0091033	.0095038
_Isitc_2dig_16	-.0057137	.0004937	-11.57	0.000	-.0066814	-.004746
_Isitc_2dig_17	-.0085845	.0008055	-10.66	0.000	-.0101633	-.0070058
share_ch_2digit	-.0205097	.0041232	-4.97	0.000	-.0285911	-.0124283
_cons	.2156529	.0120718	17.86	0.000	.1919926	.2393132

Random-effects Parameters	Estimate	Robust Std. Err.	[95% Conf.	Interval]
sitc_2digit: Identity				
sd(_cons)	9.46e-12	4.86e-10	1.88e-55	4.76e+32
t: Identity				
sd(_cons)	.0017117	.0008262	.0006646	.0044082
sd(Residual)	.0227011	.000771	.0212391	.0242637

Quantile 75%

```
                                             Wald chi2(5)       =          .
Log pseudolikelihood =  57171.329            Prob > chi2        =          .

                                  (Std. Err. adjusted for 17 clusters in sitc_2digit)
```

share_de_2digit	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
l1_share_de_2digit	.2025349	.0343132	5.90	0.000	.1352822	.2697877
lgdp_pc	-.0087518	.0034216	-2.56	0.011	-.0154579	-.0020456
lgdp_pc_sq	.0005353	.0002339	2.29	0.022	.0000768	.0009938
ldist	-.0227761	.0016405	-13.88	0.000	-.0259914	-.0195608
_Isitc_2dig_2	.0194871	.0009678	20.13	0.000	.0175902	.021384
_Isitc_2dig_3	-.0025431	.0005133	-4.95	0.000	-.0035492	-.0015371
_Isitc_2dig_4	.0100402	.0002333	43.03	0.000	.0095829	.0104976
_Isitc_2dig_5	-.0275493	.0016455	-16.74	0.000	-.0307744	-.0243242
_Isitc_2dig_6	-.0319142	.0019667	-16.23	0.000	-.0357688	-.0280596
_Isitc_2dig_7	-.0034477	.0006999	-4.93	0.000	-.0048196	-.0020758
_Isitc_2dig_8	-.0112185	.0010266	-10.93	0.000	-.0132305	-.0092065
_Isitc_2dig_9	-.0184497	.0009225	-20.00	0.000	-.0202577	-.0166416
_Isitc_2dig_10	-.0276765	.0017248	-16.05	0.000	-.031057	-.0242961
_Isitc_2dig_11	-.0437564	.0024839	-17.62	0.000	-.0486247	-.0388881
_Isitc_2dig_12	-.0445011	.0029138	-15.27	0.000	-.0502119	-.0387902
_Isitc_2dig_13	-.0391452	.0025527	-15.33	0.000	-.0441484	-.034142
_Isitc_2dig_14	-.051809	.0031371	-16.51	0.000	-.0579576	-.0456603
_Isitc_2dig_15	.0141875	.0003729	38.04	0.000	.0134565	.0149185
_Isitc_2dig_16	-.0061042	.0007044	-8.67	0.000	-.0074847	-.0047237
_Isitc_2dig_17	-.0135538	.0014382	-9.42	0.000	-.0163727	-.0107349
share_ch_2digit	-.0471835	.0075552	-6.25	0.000	-.0619914	-.0323756
_cons	.3147553	.0202367	15.55	0.000	.2750921	.3544185

Random-effects Parameters	Estimate	Robust Std. Err.	[95% Conf.	Interval]
sitc_2digit: Identity				
sd(_cons)	1.64e-11	9.48e-10	8.27e-61	3.24e+38
t: Identity				
sd(_cons)	.0032484	.0005103	.0023874	.0044197
sd(Residual)	.035784	.0015532	.0328657	.0389614

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General Longitudinal Multilevel Model

```
                                             Wald chi2(5)       =          .
Log pseudolikelihood =  43421.103            Prob > chi2        =          .

                                  (Std. Err. adjusted for 17 clusters in sitc_2digit)
```

share_de_2digit	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
l1_share_de_2digit	.572896	.0369599	15.50	0.000	.500456	.645336
lgdp_pc	-.0424207	.0064097	-6.62	0.000	-.0549834	-.0298579
lgdp_pc_sq	.0023954	.0003501	6.84	0.000	.0017092	.0030815
ldist	-.0169577	.0021293	-7.96	0.000	-.021131	-.0127844
_Isitc_2dig_2	.0213675	.002149	9.94	0.000	.0171555	.0255795
_Isitc_2dig_3	.0157039	.0016512	9.51	0.000	.0124677	.0189401
_Isitc_2dig_4	.0050361	.0004656	10.82	0.000	.0041234	.0059487
_Isitc_2dig_5	-.0202372	.0023527	-8.60	0.000	-.0248485	-.015626
_Isitc_2dig_6	-.0200033	.0030556	-6.55	0.000	-.0259921	-.0140145
_Isitc_2dig_7	-.000163	.0008568	-0.19	0.849	-.0018422	.0015163
_Isitc_2dig_8	-.0070734	.0012041	-5.87	0.000	-.0094334	-.0047135
_Isitc_2dig_9	.0141205	.0016755	8.43	0.000	.0108366	.0174045
_Isitc_2dig_10	-.0133618	.0025301	-5.28	0.000	-.0183206	-.0084029
_Isitc_2dig_11	-.0305409	.0034219	-8.93	0.000	-.0372477	-.0238342
_Isitc_2dig_12	-.0096852	.0054113	-1.79	0.073	-.0202911	.0009207
_Isitc_2dig_13	-.0058193	.0043727	-1.33	0.183	-.0143896	.0027511
_Isitc_2dig_14	-.0212619	.0050081	-4.25	0.000	-.0310776	-.0114462
_Isitc_2dig_15	.0178562	.001382	12.92	0.000	.0151475	.0205648
_Isitc_2dig_16	.0163183	.0020725	7.87	0.000	.0122562	.0203804
_Isitc_2dig_17	-.0030931	.0028173	-1.10	0.272	-.008615	.0024287
share_ch_2digit	-.1303854	.0210226	-6.20	0.000	-.171589	-.0891818
_cons	.3947944	.0430861	9.16	0.000	.3103472	.4792416

Random-effects Parameters	Estimate	Robust Std. Err.	[95% Conf.	Interval]
sitc_2digit: Identity				
sd(_cons)	2.86e-11	1.66e-09	1.65e-60	4.96e+38
t: Identity				
sd(_cons)	.0074438	.0006387	.0062915	.0088071
sd(Residual)	.0793868	.0067532	.0671954	.0937902