Global Value Chains and the Great Recession: Evidence from Italian and German Firms

Antonio Accetturo, Banca d'Italia*

Anna Giunta, Università Roma Tre

Abstract

During the last two decades, profound changes in the international division of labour among firms have occurred, with impressive growth in outsourcing, off-shoring of some stages of production and the globalization of intermediates goods markets. This new model of the international division of labour has both initiated an increasing variety of relationships among producers and spurred the development of Global Value Chains. According to some recent research, Global Value Chains have been one of the main transmission mechanisms of the Great Trade Collapse that severely and simultaneously hit all OECD countries in 2009.

Pervasive as it has been, it also appears that the impact of the crisis on firms involved in Global Value Chains has been highly heterogeneous. Our paper intends to contribute to this very recent and ongoing debate, providing a description of the effects of the crisis from a perspective that is both country-comparative, Germany and Italy being the countries taken into consideration, and on firm level, as we pay particular attention to the positioning of the firms along Global Value Chains, i.e., whether intermediate or final firms- and to their strategies. Three are the main conclusions: *i*) intermediate firms were hit by the crisis more than final firms; *ii*) among intermediate firms, the ones that carried out innovation activities in the previous period (before 2008) were somewhat sheltered by the effect of crisis; *iii*) firms' positioning in GVCs and their strategies may help to explain the Italy-Germany performance gap.

Key words: Global Value Chains, Germany, Italy, Industrial Firms, Firm Organization
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Contact Author: antonio.accetturo@bancaditalia.it

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1. Introduction

A growing body of literature over the past twenty years considers that a structural change in the productive economy has occurred as a further consequence of the ICT revolution, the steady lowering of trade barriers and transport costs (Feenstra, 1998), and the changing nature of multinational enterprises (Saliola and Zanfei, 2009). The outcome is a new international division of labour in which the production of final products is fragmented in Global Value Chains (GVCs henceforth). Under this interpretation, one may consider the production process for any given good as a continuum of tasks assigned to the various productive units; these tasks can be performed in several different places around the world. The organization of production varies continually, with each task offshored to the country where the production and international transaction costs are lowest. According to Miroudot and Ragoussis (2009), trade in intermediate inputs represents a share of between 56% and 73% of overall trade flows in goods and services for developed economies.

In the face of the 2008-09 great recession, the systemic importance of GVC proved to be significant. According to several studies, GVCs acted as a channel for the rapid transmission of real and financial shocks, thus amplifying the national fluctuations of demand for final goods. Baldwin (2009) holds that the synchrony of the collapse in world trade was precisely caused by the input-output linkages in GVCs. Moreover, recent research shows that the impact of the crisis on firms' performance is sensibly different according to the organizational mode of global transactions (Altomonte *et al*., 2012) as well as by firms' positioning in the GVCs (whether outsourcer or intermediate, Bekes *et al*., 2011).

The aim of this paper is to contribute to this recent debate by analyzing the microeconomic organizational characteristics and performances of firms involved in GVCs using the EU-EFIGE/Bruegel-UniCredit survey (henceforth Efige). We first make an account

of the differences between final and intermediate firms in terms of numerosity, size, productivity and dynamics in sales during the 2008-09 crisis. We then use a principal components analysis with the aim to detect firms' strategies in terms of internationalization, innovation and human capital accumulation. Then, in the econometric part of the paper, we compare the dynamics of sales during the 2008-09 crisis by distinguishing between intermediate and final firms and, within each group, according to the company's strategies.

We exploit the cross-national nature of the Efige dataset by comparing German and Italian industrial firms, paying particular attention to their positioning in GVCs. Germany and Italy are somewhat paradigmatic countries and provide to be an interesting area of application as: *i*) they are both highly industrialized countries and leaders in EU manufacturing exports; *ii*) industrial firms of both countries are substantially involved in and affected by globalization; *iii*) a large share of firms (higher in the Italian industry) work exclusively as intermediate firms , a key factor in our analyses to explain heterogeneous resilience to the crisis.

The 2008-09 crisis is a particularly interesting case for many reasons. First, it was quite unexpected and originated from the US financial crisis of the summer of 2007. This implies that it can be considered exogenous to the German and Italian economic conditions. Second, the downturn was particularly severe. German and Italian GDP fell by, respectively, 4 and 7 per cent in two year; the crisis can be considered as a serious "stress test" for firm's strategic decisions. Third, as pointed out before (Baldwin, 2009; Altomonte *et al*., 2012), GVCs had a primary role in transmitting the crisis worldwide; this implies that firms' involvement in the crisis can be considered first rate.

Our results show that intermediate firms are on average smaller, less productive than final firms. Their strategies are also somewhat less ambitious in terms of human capital accumulation, innovation and internationalization. The econometric part shows that being

an intermediate firm is generally associated with a more severe contraction of sales during the 2008-09 crisis. However, heterogeneity among firms matters. The contraction of turnover for firms with high human capital was smaller; innovative intermediate firms also experienced a slighter reduction.

All in all, the positioning within the GVC and their strategies explains a relevant portion of the difference in performance between German and Italian firms.

A methodological disclaimer is worth making. This is basically a descriptive paper that aims at establishing some stylized facts on the microeconomics of GVCs; this implies that, in regression analyses, we cannot make any serious claim of causality between firm organizational characteristics (e.g. intermediate vs. final) and their performance during the crisis due to the presence of serious endogeneity problems (self-selection into the "intermediate" group or omitted variable biases). Keeping this in mind, we deem to make a relevant step forward in the growing body of empirical literature on GVCs (that we review in the next section) under three main aspects. First, we make a cross-country analysis for two developed and highly industrialized economies; this is an important issue since most of the existing literature focuses on emerging markets firms and their chances to access GVCs. Second, unlike developing countries in which intermediate firms prevail, advanced economies are characterized by the coexistence of both final and intermediate firms; this implies that they are on the verge to become either a "headquarter" or a "factory economy" (Baldwin, 2011). By analyzing firm performance during a great economic shock, we are able to understand which is the "best" specialization of a country under "extreme" economic conditions. Third, as heterogeneity matters, the analysis of the micro dynamics at firm level is particularly relevant in terms of strategies and their ability to face a major macroeconomic shock.

The structure of the paper is as follows. Sections 2.1 reviews the most relevant theoretical and applied literature concerning behavior and performance of firms involved in GVCs,

while Section 2.1 makes a comparison between Italy and Germany in terms of involvement in GVCs; Section 2.3 analyzes the very recent debate on the role of GVCs as transmission mechanisms of the 2008-9 financial crisis. Section 3 presents the data. Section 4.1 shows some descriptive statistics in terms of participation to GVCs and performance; while Section 4.2 presents the principal component analysis to detect heterogeneous strategies among firms. Section 5 analyzes the performance of the firms during the crisis by setting up the estimation methods and presenting the main results. Section 6 concludes.

2. Firms in the GVCs

2.1 A brief literature review

Organization and performance of firms involved in GVCs have been under scrutiny by two very different streams of literature. To the first one, based on the theory of the firm, belong the models by Melitz (2003); Antras and Helpman (2004); Helpman *et al*. (2004); Helpman (2006). They have analyzed which sourcing strategy (i.e., the "make-or-buy" and "where-to-make-or-buy" organizational choices) firms choose in order to internationally organize their production. Based on the hypothesis of firms' heterogeneity, this stream of literature links firms' organizational choices with the various forms of internationalization. The main predictions (Antras and Helpman, 2004) are that there exists a productivity ordering such that the most productive firms engage in Foreign Direct Investments, while less productive firms choose international outsourcing and domestic firms vertically integrate at home.

Empirical support to the theoretical prediction of Antras and Helpman models come from several studies, such as: Tomiura (2005 and 2007); Anderson *et al*.; (2008); Federico (2009); Kohler and Smolka (2009).

In such analyses (both theoretical and empirical), the missing element is the "other side of the coin", the complementary agent of the global operation, i.e. the firm that produces as supplier to other firms rather than as manufacturer of the final product. Here we come to the other stream of the literature that has analyzed organization and performance of firms involved in GVCs, paying more attention to the role and the upgrading processes of supplier firms.

This stream of literature was initiated by Gereffi (1994) and subsequently enhanced by contributions of Gereffi and Korzeniewicz (1994), Gereffi (1999), Henderson *et al*. (2002) and Humphrey and Schmitz (2002). Most applications are based on clusters of firms operating in developing countries, that join the GVCs has a partial substitute for full home based industrialization processes, following a new path for industrialization. Differently from the empirical studies before reviewed, most empirical analyses, based upon the Global Value Chain Approach predictions, are made of descriptive case-studies, rather than based on econometric investigations of representative samples.[1]

The distinctive feature of the Global Value Chain Approach, relevant to our investigation, is essentially how participation in GVCs may affect the performance of an intermediate firm, thus enhancing the probability "to move up" the value chain. In particular, scholars focus on factors contributing to the improved firm performance or "upgrading" of firms in the GVCs. At least four distinct channels of upgrading are envisioned: (a) product innovation (increasing the ability of supplier firms to satisfy higher value added, more sophisticated products – Dolan and Humphrey, 2000; Bair and Gereffi, 2001; Bazan and Navas-Aleman, 2004; Giuliani *et al*., 2005 – or enlarging product lines); (b) process innovation (increasing the technical efficiency of the production process); (c) functional upgrading (improving the quality of supplier's operations along the GVCs, or moving to higher quality functions, e.g., from production to design); and (d) inter-chain upgrading

[1] The absence of good quality firm level data (Sturgeon and Gereffi, 2009) may explain why most of such empirical analyses have been based on detailed case-studies, surveys and anecdotal evidence rather than on statistical investigations.

(applying the competence acquired in a particular function so as to move into a new chain).

Thus, according to the Global Value Chain Approach, firms' technical and relational abilities can be determinants of suppliers' performance. In particular, the propensity to penetrate foreign markets, on the one hand, and the ability to introduce process and product innovations, on the other, are often viewed as important determinants of a firm's ability to exploit the opportunities offered by participation in GVCs.

The predictions of the Global Value Chain Approach have been tested in recent articles (Accetturo *et al*. 2011; Accetturo et al., 2012; Giunta *et al*., 2012) for the case of Italian industrial supplier firms. All found that, to some extent, suppliers able to penetrate foreign markets and to carry out innovation (organizational, product and process) exhibit labour productivity performance similar to final firms, whereas "traditional" (i.e. non-exporting and non-innovating) suppliers have lower productivity than final firms.[2]

2.2 Italian and German firms in the GVCs

From a static point of view, Germany and Italy are similar under many respects. Manufacturing is prominent in both countries: in 2010, in Germany equals to 25,3% of total value added and in Italy 23,3**%** (Eurostat, XX). The production structure is quite similar: family-owned German firms represent 90% of total firms, 86% in Italy (Bugamelli *et al*., 2012). Foreign markets penetration of manufacturing products is high in both countries: share of exports to German GDP is 39.9%, in Italy 23.4%. A starker difference is, instead, represented by the size of the firms: the average number of employees in Italian firms was 9 in 2009, while in Germany was 37.

Both countries share a great involvement in GVCs. Largely as outward processing trade, the global operation of firms started quite early in Germany (Helg and Tajoli, 2005) and accelerated around the 1990's, after the unification process, with the increasing

[2] On the contrary, Kimura (2002), for Japanese firms, and Razzolini and Vannoni (2011) for Italian ones, investigating the relative performance of suppliers, have documented a profitability and productivity gap in which suppliers are disadvantaged relative to other producers.

commercial integration with Poland, Slovakia, Czech Republic, and Hungary. Foreign outsourcing started somewhat later in Italy (in the second half of the '90s) as a firms' reaction strategy to shocks such as stronger competitive pressure from Eastern European and Asian producers; exchange rate constraints before the introduction of the single European currency; and the development and spread of ICTs.

As underlined by Breda and Cappariello (2012), if the direct and indirect import content of the production of goods and services is taken as an indicator of international outsourcing, we will appreciate another similarity between the two countries. In 2007, such indicator was around 17% for both the Italian and the German economies: "on this basis and from a static viewpoint, also Italy could be defined as a «bazaar economy»"[3] (Breda and Cappariello, 2012, 133).

2.3 Firms in GVCs, facing the great recession

"World trade experienced a sudden, severe, and synchronized collapse in late 2008 – the sharpest in recorded history and deepest since WWII" (Baldwin, 2009). World trade in manufactures fell by about 30% between the first half of 2008 and the first half of 2009 (WTO, 2009). The fall in trade during the crisis has also been quite homogeneous across all countries: more than 90% of OECD countries have exhibited simultaneously a decline in exports and imports exceeding 10% (Martins and Araújo, 2009).

According to the recent work of several researchers,[4] GVCs had a leading role in the transmission of the shocks in the 2008-09 crisis, causing the Great Trade Collapse. Why were GCVs regarded as the main propagation of the global downturn? Which were the transmission mechanisms? The main idea is that because of the vertical specialization and links among firms, reduction of the final demand will be amplified more than it would be implied by the "standard trade channel" (Bems *et al*., 2010). In Yi (2009) this will happen

[3] The label "bazaar economy" comes from Sinn (2003), suggesting that Germany sells products that were not produced in the country.

[4] For a lively debate on these issues see also Voxeu http://www.voxeu.org/

because the same component might be exchanged several times (and crosses several national borders) before it is finally incorporated in the final product.

Alessandria *et al*. (2011) test another likely channel of transmission based on the inventory adjustments firms adopt to face the demand reduction. As a consequence of a reduction in the final demand, final firms decreased orders across GVCs firms. On the other hand, Escaith *et al*. (2010) agree only partially on the role played by the "inventory effect".

In the same spirit, but pursuing a somewhat different line of analysis, is the work of Altomonte *et al*. (2012). The latter do recognize that magnitude of the drop is caused by the exceptionally negative growth rates of both intermediates and capital goods, which are originated by the emergence of GVCs. The novelty of their approach concerns the introduction of the peculiar modes of organization of inter-firm linkages as a key factor to explain firms' different resilience during the crisis, for both imports and exports. In their analyses, based on a representative sample of French firms, they single out two organizational modes: the first one pursued by multinational firms that entail trade among related parties; while, according to the second one, the relationship between buyer and supplier is carried out by arm's length trade. They found that trade originated within hierarchies of firms (i.e. transactions among firms belonging to a group) reacted faster to the negative demand shock but also recovered faster in the following months than arm's length trade: "our explanatory hypothesis is that the internalization of activities within the boundary of a group allows for a better management of information flows coming from the bottom of the value chain so that production and inventories can be more swiftly adjusted to demand shocks" (Altomonte *et al*., 2012, 22).

Békés *et al*. (2011) shed some more light on the link between GVCs and different impacts they had on firms, highlighting that firm's positioning in GVCs do matter. On the basis of a survey over 14,000 manufacturing firms operating in Europe: Germany, France, Italy,

Spain, Austria, Hungary, and the UK, they show that in 2009 outsourcers registered 1.8 percentage points smaller reduction in sales, while suppliers' sale contracted more.

3. Data

For the comparative analysis of firms in the GVCs between Germany and Italy we use the Efige survey. The data have been collected within the EFIGE project – European firms in a global economy: internal policies for external competitiveness – supported by the Research Directorate General of the European Commission. The sample includes around 3,000 firms for France, Germany, Italy and Spain, more than 2,200 firms for UK, and 500 firms for Austria and Hungary.

Sampling design follows a stratification by sector and firm size, that induces an oversampling for large firms. The sample is representative for the local population of firms, as shown by Barba Navaretti *et al*. (2011).

The survey questionnaire contains both qualitative and quantitative data on firms' characteristics and activities, split into six sections providing different pieces of information on: structure of the firm; workforce; investment; technological innovation and R&D; internationalisation; finance; market and pricing.[5] Data from the survey was then matched with balance sheet information from Amadeus (Bureau Van Dijk).[6]

As this paper focuses on the two major industrial economies of the Euro area, we make use of the Italian and German firm data. This should leave us with slightly less than 6,000 observations. However, the number of firms actually used in the analysis is much lower (slightly more than 3,000: 2,000 for Italy and 1,000 for Germany) due to the presence of several missing values in the balance sheet data.

Descriptive statistics are reported in table 1.

[5] The questionnaire can be found at the website www.efige.org

[6] We consider all the manufacturing firms, food and beverages excluded, due to the countercyclical nature of these industries.

We use the share of total turnover made up by sales of produced-to-order goods to other firms (Share of produced-to-order, SPTO henceforth) as a proxy for the sales of an intermediate firm in a GVC. Indeed, produced-to-order strategies allow customers to purchase products that are specific to their needs. This is likely to approximate in the best way the strict relationships that are usually established in a GVC. The higher this share, the more "intermediate" a firm, i.e. the lower its access to final consumers.

Table 1 shows that SPTO is quite large. On average, more than three-fourth of a firm's sales is made up of selling of intermediate goods to other firms. The standard deviation is also quite high and it hints at the existence of a "polarized" world in which fully intermediate firms coexist with final ones.[7]

4. Descriptive analysis

4.1 Participation to GVCs and performance

Table 2 reports the average SPTO for Italy and Germany by sector, and, for comparison, the share purchases over sales. There is a stark difference between the two countries. Italian SPTO is on average 18 percentage points higher than the German one, and it is larger for all sectors. Purchases of Italian firms also seem quite high compared with the German one, thus indicating a lower value added in the production process. All in all ,Italian firms seem more intermediate and fragmented than the German ones.

Italian firms' fragmentation is confirmed by fig. 1 that depicts the evolution between 2001 and 2008 of the median Vertical Integration Index. The Vertical Integration Index is computed as the ratio between value added and sales and it proxies the share of turnover internally produced by the firm. The higher the share, the more vertically integrated the firm. The line for Germany (solid red) is always above the one for Italy (blue dashed). This confirms the larger fragmentation of Italian firms in comparison with the German ones.

[7] As the average number of employees is 48, the Efige dataset is, as already mentioned, representative of medium and large firms.

However, the fact that the trend over time is decreasing for Germany also confirms the transformation of that economy into a "Bazaar economy" (Sinn, 2003).

Italy's prevalence of intermediate firms is also proved by table 3. In this table we define "intermediate" a firms with a SPTO equal to 100 per cent. Almost two-thirds of Italian firms can be defined as intermediate whereas this share is equal to 42 per cent in Germany. As in table 2, the pervasiveness of intermediate firms is confirmed in all sectors.

Table 4 reports some descriptive statistics of firms' characteristics and performance. Intermediate firms in the dataset are smaller in terms of both sales and employment and less productive. In the period 2008-09, they also accumulated a larger decrease in total sales compared with final companies.

These differences are also confirmed within each country, as the ranking between final and intermediate firms is preserved. The cross-country comparison also highlights the weaknesses of the Italian productive structure and its disappointing performance in the crisis period. The gap is particularly wide in terms of employees while the labour productivity discount for Italian firms is larger for final firms. In our dataset the differential in the 2008-09 performance is also huge.[8]

4.2 Detecting heterogeneity

So far, the Efige dataset has confirmed a well-known fact: intermediate firms are usually "worse" than the final ones under many aspects ranging from size to productivity; moreover, during the recent crisis, they also experienced a more dramatic fall in sales.

However, a recent stream of literature has highlighted the heterogeneous nature of both suppliers and final firms. Companies tend to differ from each other in terms of strategic choices to compete in the markets.

[8] According to Eurostat, Industry and Trade Statistics, between 2007 and 2009, industrial production fell by 22.2 per cent in Italy and 16.9 per cent in Germany. This hints that the Efige dataset for Germany is skewed toward more successful firms.

In order to deduce the adopted strategies, we start by analyzing firm's choices in terms of innovation, internationalization and human capital accumulation. As most of these variables are generally highly correlated,[9] we resort to the principal component analysis; The primary purpose of this technique is the reduction of a set of correlated covariates in some latent variables (feature reduction).

We consider the following variables:

- share of employees with a university degree;
- share of employees in training activities;
- dummy for the introduction of product innovation;
- dummy for the introduction of process innovation;
- exports share over total turnover.

Our components of interest are those with the eigenvalue greater than one.

Table 5 reports the factor loadings for the first two components.

The first component, that we call *Innovation&Trade*, is highly correlated with the actions aimed at strengthening the innovative potential (process and product innovation) and the access to foreign markets (share of exports); in other words, it denotes firms that expand the range of products and the number of served markets.

The second component, *Human capital*, is instead highly correlated with the share of employees with a university degree and involved in training activities. It denotes a strategy aimed at improving the quality of their products by rising the educational levels of the workforce.

Table 6 shows that intermediate firms are less involved in both *Innovation&Trade* and *Human Capital* strategies. By analyzing these characteristics according to the country of localization, interesting patters emerge.

[9] The relationship between skill intensity, trade and innovation is well established in the empirical literature. See Bernard and Jensen (1999) and Griliches (2000).

The *Innovation&Trade* strategy in Italian and German firms is not particularly different within each group. For each type of firms, the point estimate in one country is not statistically different from the one in the other. In other words, although in each nation the ranking between final and intermediate firm is preserved, the behaviour of each kind of company is not statistically different from one country to the other.

The picture is totally different when we look at the *Human Capital* strategy. This is definitely more widespread in Germany than in Italy, although, even in this case, the ranking between final and intermediate is confirmed within each country.

5. Performance during the crisis

We now look at the relationship between firm performance and its positioning in GVCs and strategy. To do so, we estimate the following equation:

$$(1) \qquad \Delta y_i = \alpha + \beta_1 SPTO_i + \beta_2 Strat_i + \beta_3 SPTO_i * Strat_i + \gamma X_i + \phi_1 D_s + \phi_2 D_c + \varepsilon_i$$

Where Δy_i is the cumulated growth rate of sales between 2007 and 2009 for firm *i*. $SPTO_i$ is its share of produced-to-order sales. $Strat_i$ is a set of dummies of the firm's chosen strategy that emerges from the principal component analysis. X_i is a set of covariates aimed at capturing firms' heterogeneity; it includes a control for the initial (log) level of sales and the number of employees both measured in 2007. D_s and D_c are sets of, respectively, sector and country dummies.

The coefficients of interest are β_1, β_2 and β_3. β_1 capture the correlation between the performance during the crisis and the firm's positioning in the GVC. β_2 indicates the influence of firms' strategies on the dynamics of sales in the period 2008-09. β_3 denotes the possible heterogeneous effects of those strategies according to the firm's position in the GVC.

Equation (1) is estimated by OLS, standard errors are robust to take into account the heteroskedasticity concerns. We also exclude from the regressions the first and the 99th percentile of the dependent variable to minimize the impact of outliers. As pointed out in the introduction, coefficients β_1, β_2 and β_3 cannot be interpreted in causal way but, rather, as conditioned statistical associations. This is due to the presence of serious endogeneity problems: there can be a number of omitted variables (such as firm's productivity, entrepreneur's ability.) that affect both the firm's decisions (intermediate vs. final or its strategies) and its performance during a period of crisis. Unfortunately, this problem cannot be easily solved; there are not obvious instruments that correlate with companies' choices but not with its performance. For this reason, we should consider the estimates of equation (1) as multivariate stylized facts on the microeconomics of GVCs.

Results are shown in table 7.

Column (1) reports a simple specification with just the SPTO variable and country and sector dummies. The coefficient of SPTO is negative and significant, thus confirming that being intermediate is associated with a negative performance during the crisis. The effect is quite small but persistent over specifications. A standard deviation increase in the SPTO (37.7 points) is associated to an additional fall in sales by 1.3 percentage points, that amounts to the 6 per cent of the average decline in turnover during the crisis (-21.9 per cent) (table 1 reports the values of the standard deviations).

Column (2) adds firm-level controls such as the initial period (log) levels of sales and employment. The coefficient for 2007 turnover is negative and significant thus showing a process of mean reversion. Larger firms (measured in employment) attenuated instead the fall in sales during the crisis. The SPTO coefficient is still negative and significant, with a point estimate quite close to the previous regression.

In column (3) we insert controls for firm strategies. Both *Innovation&Trade* and *Human Capital* are positive and significant. This implies that, controlling for sector, country, firms'

characteristics and positioning in the GVC, the adoption of one of those strategies attenuates the negative effect of the crisis. In particular, a rise by standard deviation (1.0) of the *Human Capital* indicator increases the growth of sales by 2.2 percentage points; the same expansion for the *Innovation&Trade* index determines a rise by 0.9 percentage points. The smaller effect for the *Innovation&Trade* component can be rationalized by the "Trade" component of this indicator; as the crisis was originally trade-induced, exporting firms were more exposed to the severe drop in international demand, thus attenuating the possible positive effects of such strategy.

In column (4) we investigate the hypothesis that firm strategies can have different effects according to the positioning in the GVC. This is done by interacting *Innovation&Trade* and *Human Capital* variables with SPTO. Results show that while the *Human Capital* coefficient is still positive and significant, its interaction with SPTO is not statistically different from zero; this implies that this strategy has the same positive effect on both final and intermediate firms.

The positive average effect of the *Innovation&Trade* strategy (column 3) hides instead a huge heterogeneity between final and intermediate firms as the latter benefit much more from this strategy than the former.

Before interpreting this result, it is interesting to understand the real magnitudes of these coefficients by some back-of-the-envelope calculations. Consider a representative firm with sales and employment equal to the mean and belonging to the textile industry; if its SPTO is equal to zero (a final firm) and its *Innovation&Trade* indicator is at the 25^{th} percentile of the distribution (-0.925), its expected growth in the crisis period is 2.0 per cent; if the same firm were at the 75^{th} percentile of the *Innovation&Trade* index its expected growth would be negative (-2.1 per cent). Consider now the same exercise for a fully intermediate firm (SPTO=100) with the same characteristics. The expected growth if

Innovation&Trade indicator is at the 25th percentile is -5.4 per cent; the one for a firm at the 75th percentile is -2.0 per cent.

This suggests that an *Innovation&Trade* strategy attenuates, for the intermediate firms, the negative effects of being exposed to a major international demand contraction. This can be rationalized by the fact that innovative intermediate firms may more likely establish longer term relationships in the GVCs, due to the higher quality of their products.

5.1 Do GVCs explain the Italy-Germany performance gap?

We finally analyze whether the positioning within a GVC and the firm strategies may help to explain the Italy-Germany performance gap. As clearly shown in table 4, during the 2008-09 crisis Italian and German firms in the Efige dataset presented divergent dynamics in terms of sales.

The Italian structural problems are well known (see Brandolini and Bugamelli, 2009, for a comprehensive review) and they range from the small size of the firms to backward labour market institutions and include inefficiencies of public administration as well as rigidities in the service markets.

In the descriptive statistics of the paper, we have also shown how Italian industry is characterized by a very large number of fully intermediate firms that performed very badly during the crisis.

In this section, we try to understand whether the high number of intermediate firms in Italy did contributed to this relevant performance gap. To do so, fig. 2 reports the absolute value of the dummy Italy across several specifications. As the dummy is always negative, the higher the bar, the worse the performance of Italian firms.

The first bar (No controls) is the simple difference in mean between Italian and German firms' sales in the period 2008-09, that is quite huge (22.5 percentage points).

In the second bar (Sectors), we report the modulus of the dummy Italy when we add controls for industries. This is aimed at taking into account composition effects due to the different sectoral specializations. The dummy Italy is basically unchanged, thus confirming that the Italian structural problems are only weakly related to the industry composition.

In the third bar (firm characteristics), we add covariates at firm level (initial employment and sales) in order to capture microeconomic differences in terms of size and productivity. In this case, the dummy Italy registers a drop; this implies that the Italian endowment of small and less productive firms had a negative effect on the average national performance during the crisis.

In the fourth and the fifth bars we include controls for, respectively, position in the GVC (SPTO) and strategies interacted with SPTO. In both cases, the bars register a fall thus confirming that the position in GVCs and firms' choices have a relevant role in shaping a country's performance.

The comparison between columns (3) and (5) shows that GVCs and firms' strategies accounted for 2.2 percentage points. As the overall difference in performance is 22.5 percentage points, this implies that these features account for almost 10 per cent of the total difference between German and Italian firms. This is not a small number, considering that this kind of explanation of the Italy-Germany gap has been overlooked by analysts and policy makers.

6. Concluding remarks

According to recent papers (Alessandria *et al*., 2011; Altomonte *et al*., 2012; Baldwin, 2009; Bekes *et al*., 2011, Bems *et al*., 2010; Yi ,2009), GVCs have been one of the main transmission mechanisms of the Great Trade Collapse that severely and simultaneously hit all OECD countries in 2009, thus amplifying the national fluctuations of demand for final goods.

The aim of this paper is to contribute to this recent debate by looking at the impact of the crisis on firms' performance. To the best of our knowledge, this is one of the few papers that investigates the micro impact of the crisis on firms involved in GVCs.

Our research hypothesis is that firms' positioning along the GVCs – whether intermediate or final firms - as well as some firms' strategies –to increase the level of human capital; innovation propensity and foreign markets penetration- play a significant role in their performance in 2008-09. We compare German and Italian industrial firms; these two countries provide to be an interesting area of application as: *i*) they are both highly industrialized countries and leaders in Europe manufacturing exports; *ii*) industrial firms of both countries are substantially involved in and affected by globalization; *iii*) a large share of firms (higher in the Italian industry) work exclusively as intermediate firms , a key factor in our analyses to explain heterogeneous resilience to the crisis.

In our analyses we use the Efige dataset, a unique database that contains both qualitative and quantitative data on firms' characteristics and activities; the data have been matched with balance sheet information from Amadeus (Bureau Van Dijk).

Our descriptive analysis shows that, within each country, intermediate firms are smaller than final ones (in terms of both sales and employment) and less productive. In the 2008-09 period, they also accumulated a larger decrease in total sales compared with final companies. As shown by Altomonte *et al*. (2012), the result is somewhat expected as the impacts of a shock on final demand are amplified for firms participating in GVCs which are located further from the final customer: "when global demand fell towards the end of 2008 – in parallel with heightened financial uncertainty – upstream firms were able to satisfy lower demand mostly by drawing from the large inventories they were holding. This however caused orders across global value chains to decrease substantially and more than proportionally with respect to the initial downstream drop in demand, but in line with lower future expectations" (Altomonte *et al*., 2012)

The cross-country analysis shows that, in comparison with German firms, a higher percentage of Italian industrial firms are fully intermediate (they sell 100% of their turnover to other firms); moreover, the differential in performance in 2008-09 is quite remarkable, as the Italian intermediate firms decreased their turnover by 30% versus a 7% fall of sales of German intermediate firms.

The aggregate figures may mask firms' heterogeneous resilience to the crisis. In order to dissect such heterogeneity, we carry out a principal component analysis, that distinguishes among two main firms' strategies, respectively labeled "Innovation and Trade" and "Human Capital". The results shed some more light on the differences between Italian and German firms, the latter being significantly more involved in a strategy aimed at raising the educational levels and training of the workforce.

The main results of our regressions confirm the findings of the descriptive analysis: being an intermediate firm is generally associated with a more severe contraction of sales during the 2008-09 crisis. However, heterogeneity among firms matters. The contraction of turnover for final firms with previously pursued a strategy of increasing the human capital level was smaller; on the other hand, innovative intermediate firms also experienced a slighter reduction of turnover. Finally, the cross-country comparison shows how the well-known weaknesses of the Italian industry in terms of average firms' size and strategies severely undermine a successful participation in the GVCs, thus casting a shadow over Italy's role in the current and future international division of labour as Italy risks to become a "factory country", to use Baldwin (2011) taxonomy. On the contrary, the higher share of final firms, the larger firms' size, the higher firms' labour productivity partly explain German firms' capacity to face the crisis and to fastly recover.

While some limitations in the methodology of this paper have to be addressed in our future research agenda, the correlation we found between firms' positioning in the GVCs,

their strategy and the ability to face the crisis have relevant implications, that seem, so far, overlooked by policy makers.

References

Accetturo A., Giunta A. and Rossi S. (2011), Le imprese italiane tra crisi e nuova globalizzazione, *L'Industria*, 1, 145-164, also available in Questioni di Economia e Finanza, n. 86, Banca d'Italia, Rome,http://www.bancaditalia.it/pubblicazioni/econo/quest_ecofin_2/QF_86/QEF_86.pdf

Accetturo A., Giunta A. and Rossi S. (2012), Being in a Global Value Chain: Hell or Heaven?, Voxeu, 15 Dicember

Alessandria G, Kaboski J.P. and Midrigan V. (2011) US Trade and Inventory Dynamics, *American Economic Review*, vol. 101(3), pages 303-07, May.

Altomonte C., Di Mauro F., Ottaviano G., Rungi A., Vicard V. (2012), *Global Value Chains During the Great Trade Collapse. A Bullwhip Effect?* European Central Bank, Working Paper Series, n. 1412

Andersson,M.,. Lööf H and Johansson S., (2008) Productivity and International Trade: Firm Level Evidence from a Small Open Economy, *Review of World Economics* 144 (4), 774-801

Antras P., Helpman E. (2004), Global Sourcing, *Journal of Political Economy*, 112, 552-580

Bair J. and Gereffi G. (2001), Local Clusters in Global Chains: the Causes and Consequences of Export Dynamism in Torreon's Blue Jeans Industry, *World Development*, 29, 1885-1903

Baldwin R. (2011), *Trade and Industrialisation After Globalisation's 2nd Unbudling: How Building and Joining a Supply Chain Are Different and Why It Matters*. Working Paper 17716, NBER Working Paper Series

Baldwin, R. (ed.) (2009), *The Great Trade Collapse: Causes, Consequences and Prospects*, VoxEU.org

Barba Navaretti G., Bugamelli M., Schivardi F., Altomonte C., Horgos D.and Maggioni D. (2011) *The Global Operations of European firms. The Second EFIGE PolicyRreport*, BRUEGEL BLUEPRINT SERIES, Volume XII

Bazan L., Navas-Aleman L. (2004), The Underground Revolution in the Sinos Valley: a Comparison of Upgrading in Global and National Value-Chains, in Schmitz H. (ed.), *Local Enterprises in the Global Economy: Issues of Governance and Upgrading*. Cheltenham, Edward Elgar

Békés, G, Halpern L., Koren M., Muraközy B. (2011), *Still Standing: How European Firms Weathered the Crisis*, The third EFIGE policy report", Bruegel, 22 December

Bems, R., Johnson R.C., Yi K-M. (2010) The Role of Vertical Linkages in the Propagation of the Global Downturn of 2008, Federal Reserve Bank of Philadelphia, January 18 (to be completed)

Bernard and Jensen (1999), Exceptional Exporter Performance: Cause, Effect, or Both?" *Journal of International Economics*, 47, 1-25.

Brandolini A.. M. Bugamelli (2009), *Rapporto sulle tendenze del sistema produttivo italiano*, Quaderni di Economia e Finanza n. 45, Bank of Italy, Rome.

Breda E., Cappariello R., (2012) A Tale of Two Bazaar Economies: An Input-Output Analysis of Germany and Italy, *Economia e Politica Industriale*, vol. 39 (2), 111-137

Bugamelli M., Cannari L., Lotti F. and Magri S., (2012) *Il gap innovativo del sistema produttivo italiano: radici e possibili rimedi*, Questioni di Economia e Finanza, n. 121, Bank of Italy, Rome

Dolan C. and Humphrey J. (2000), Governance and Trade in Fresh Vegetables: the Impact of UK Supermarkets on the African Horticulture Industry, *Journal of Development Studies*, 37, 147-176

Feenstra R. (1998), Integration of Trade and Disintegration of Production in the Global Economy, *Journal of Economic Perspectives*, 12, 31-50

Federico, S. (2009 Online Publication Data: 2009/12/10),Outsourcing Versus Integration at Home or Abroad and Firm heterogeneity', *Empirica* (DOI?)

Gereffi G. (1999), International Trade and Industrial Upgrading in the Apparel Commodity Chain, *Journal of International Economics,* 48, 37-70

Gereffi, G. (1994), The Organization of Buyer-Driven Global Commodity Chains: How U.S. Retailers Shape Overseas Production Networks, in Gereffi G., Korzeniewicz M. (eds.), *Commodity Chains and Global Capitalism*, Westport, Connecticut, Praeger

Gereffi G., Korzeniewicz M. (eds.) (1994), *Commodity Chains and Global Capitalism*. Westport, Connecticut, Praeger

Giuliani E., Pietrobelli C. and Rabellotti R. (2005), Upgrading in Global Value Chains: Lessons from Latin American Clusters, *World Development*, 33, 549-573

Giunta A., Nifo A., Scalera D., (2012)"Subcontracting in Italian Industry. Labour Division, Firm Growth and the North-South Divide", *Regional Studies*, vol. 46, 8, 1067 – 1083.

Griliches, Z. (2000). R & D, education, and productivity. Loeb classical library. Harvard University Press.

Escaith H., Lindenberg N. and Miroudot S., (2010) *International Supply Chains and Trade Elasticity In Times of Global Crisis*, World Trade Organization (Economic Research and Statistics Division) Staff Working Paper ERSD-2010-08

Helg R., Tajoli L., (2005), Patterns of International Fragmentation of Production and the Relative Demand for Labor, *North American Journal of Economics and Finance* 16, 233–254

Helpman, E. (2006.) Trade, FDI, and the Organization of Firms, *Journal of Economic Literature*, vol. 44(3), 589-630, September

Helpman E., Melitz M.J. and Yeaple S.R. (2004), Export versus FDI with Heterogeneous Firms, *American Economic Review*, 94, 300-316

Henderson J., Dicken P., Hess M., Coe N. and Yeung H.W. (2002), Global Production Networks and the Analysis of Economic Development, *Review of International Political Economy*, 9, 436-64

Humphrey J. and Schmitz H. (2002), How Does Insertion in Global Value Chains Affect Upgrading in Industrial Clusters? *Regional Studies*, 36, 1017-1027

Kimura F. (2002), Subcontracting and the Performance of Small and Medium firms in Japan, *Small Business Economics*, 18, 163-175

Kohler, W. Smolka M. (2009), *Global Sourcing Decisions and Firm Productivity: Evidence fromSpain*, *CESifo Working Paper* No. 2903

Martins J.O., Araújo S. (2009), The Great Syncronization: the Trade Crisis of 2008-09, 8 Jul, *Voxeu.org*.

Melitz M. (2003), The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity, *Econometrica*, 71, 1695-1725

Miroudot, S. and Ragoussis, A. (2009) *Vertical Trade, Trade Costs and FDI*, OECD Trade Policy Working Papers 89, OECD, Trade Directorate

Razzolini T. and Vannoni D. (2011), Export Premia and Subcontracting Discount: Passive Strategies and Performance in Domestic and Foreign markets, *World Economy*, 34, 984-1013

Saliola F. and Zanfei A. (2009), Multinational Firms, Global Value Chains and the Organization of Knowledge Transfer, *Research Policy*, 38, 369-381

Sinn H.W. (2003) *Bazaar economy*. Ifo-Viewpoint, 50: 28

Sturgeon T.J., Gereffi G. (2009), Measuring Success in the Global Economy: International Trade, Industrial Upgrading, and Business Function Outsourcing in Global Value Chains, *Transnational Corporations,* Vol. 18, No. 2, August, 1-36

Tomiura E. (2005), Foreign Outsourcing and Firm-Level Characteristics: Evidence from Japanese Manufacturers, *Journal of the Japanese and International Economies*, vol. 19(2), June

Tomiura E. (2007), Effects of R&D and Networking on the Export Decision of Japanese firms, *Research Policy*, vol. 36(5), 758-767, June

Yi K-M, (2009) The Collapse of Global Trade: The Role of Vertical Specialisation, In Baldwin R. and Evenett S. (ed.) *The Collapse of Global Trade, Murky Protectionism, and the Crisis: Recommendations for the G20*, 45-48. VoxEU.org.

Table 1

DESCRIPTIVE STATISTICS

	No. Obs.	Mean	Standard Deviation
SPTO	3,253	75.6	37.7
Share of purchases over sales	3,224	29.2	24.7
Sales in 2007 (1)	3,253	11,364	97,889
Employees in 2007	3,253	48.5	179.6
Labour productivity in 2007 (2)	2,394	53.2	48.9
Percentage change of sales 2008-09	3,253	-21.9	34.7

Source: Authors' calculations on Efige dataset.
Weighted averages according to the sample design.
(1) Thousands of euros. (2) Value added (in thousands of euros) per employee.

Table 2

ITALIAN AND GERMAN FIRMS IN GVC

	Italy		Germany	
	Share of produced to order sales	Share of purchases over sales	Share of produced to order sales	Share of purchases over sales
Traditional	82.1	32.3	53.8	17.7
Chemical	76.9	38.0	65.6	17.0
Metals	84.7	34.1	69.5	16.9
Mechanics	81.1	33.5	62.7	21.7
Advanced mechanics	70.3	29.9	50.9	19.5
Automotive	78.9	36.8	60.8	22.1
Other	78.2	33.2	62.2	15.9
Total	**80.9**	**33.7**	**62.9**	**18.2**

Source: Authors' calculations on Efige dataset.
Weighted averages according to the sample design.
Traditional sectors include: Manufacture of textiles, leather and furniture; Chemical includes: Manufacture of chemical products, rubber and plastic products; Metals includes: Manufacture of basic metals and fabricated metal products, except machinery and equipment; Mechanics includes: Manufacture of machinery, equipment, office machinery, computers and electrical machinery; Advanced Mechanics includes: Manufacture of radio, television, communication equipment, medical, precision and optical instruments, watches and clocks; Automotive includes: Manufacture of motor vehicles, trailers semi-trailers and other transport equipment. Other includes: Manufacture of wood and wood products, pulp, paper and paper products, publishing and printing, coke, refined petroleum products and nuclear fuel and Recycling.

Table 3

INTERMEDIATE AND FINAL FIRMS IN ITALY AND GERMANY

	Italy		Germany	
	Total number of firms	% of intermediate	Total number of firms	% of intermediate
Traditional	487	69.4	94	31.1
Chemical	229	59.9	127	40.7
Metals	557	70.3	250	50.0
Mechanics	427	60.0	243	43.5
Advanced mechanics	92	51.4	95	32.1
Automotive	52	55.6	18	35.1
Other	358	63.4	204	37.3
Total	**2222**	**65.1**	**1031**	**41.6**

Source: Authors' calculations on Efige dataset.
Weighted averages according to the sample design. Firms are defined "intermediate" if their share of produced-to-order sales is equal to 100%.

Table 4

CHARACTERISTICS OF THE FIRMS

	Intermediate	Final
Sales in 2007 (1)	8,251	15,708
Employees in 2007	41.1	58.9
Labour productivity in 2007 (2)	50.4	58.0
Percentage change of sales 2008-09	-25.4	-17.0

	Italy			Germany		
	Intermediate (3)	Final	Total	Intermediate (3)	Final	Total
Sales in 2007 (1)	8,005	14,798	10,377	9,191	17,038	13,777
Employees in 2007	35.6	43.6	38.3	62.4	81.4	73.5
Labour productivity in 2007 (2)	50.2	52.9	51.1	56.6	99.5	82.1
Percentage change of sales 2008-09	-30.2	-25.3	-28.4	-7.5	-4.9	-5.9

Source: Authors' calculations on Efige dataset.
Weighted averages according to the sample design. (1) Thousands of euros. (2) Value added (in thousands of euros) per employee. (3) Firms are defined "intermediate" if their share of produced-to-order sales is equal to 100%.

Table 5

PRINCIPAL COMPONENT ANALYSIS

	Component 1 *Innovation&Trade*	Component 2 *Human Capital*
Share w/ university degree	0.402	0.420
Share in training	0.246	0.733
Product innovation	0.627	-0.212
Process innovation	0.370	0.065
Export share	0.495	-0.486
Eigenvalues	1.442	1.103

Source: Authors' calculations on Efige dataset.
Weighted averages according to the sample design. Innovation&Trade and Human Capital are the first two components of a Principal Component Analysis including: (i) share of employees with a university degree, (ii) share of employees in training activities, (iii) a dummy for the introduction of product innovation, (iv) a dummy for the introduction of process innovation, (v) export share over total sales. The first two components have all the eigenvalue larger than one and explain half of total variability. Innovation&Trade is highly correlated with variables (iii), (iv) and (v); Human Capital is highly correlated with (i) and (ii).

Table 6

HETEROGENEITY ACROSS FIRMS

	Intermediate			Final		
Innovation&Trade	-0.083			0.116		
Human Capital	-0.073			0.103		
	Italy			Germany		
	Intermediate	Final	Total	Intermediate	Final	Total
Innovation&Trade	-0.075	0.133	-0.002	-0.113	0.092	0.006
Human Capital	-0.216	-0.188	-0.206	0.471	0.529	0.505

Source: Authors' calculations on Efige dataset.
Weighted averages according to the sample design. Innovation&Trade and Human Capital are the first two components of a Principal Component Analysis including: (i) share of employees with a university degree, (ii) share of employees in training activities, (iii) a dummy for the introduction of product innovation, (iv) a dummy for the introduction of process innovation, (v) export share over total sales. The first two components have all the eigenvalue larger than one and explain half of total variability. Innovation&Trade is highly correlated with variables (iii), (iv) and (v); Human Capital is highly correlated with (i) and (ii).

Table 7

FIRMS PERFORMANCE IN 2008-09

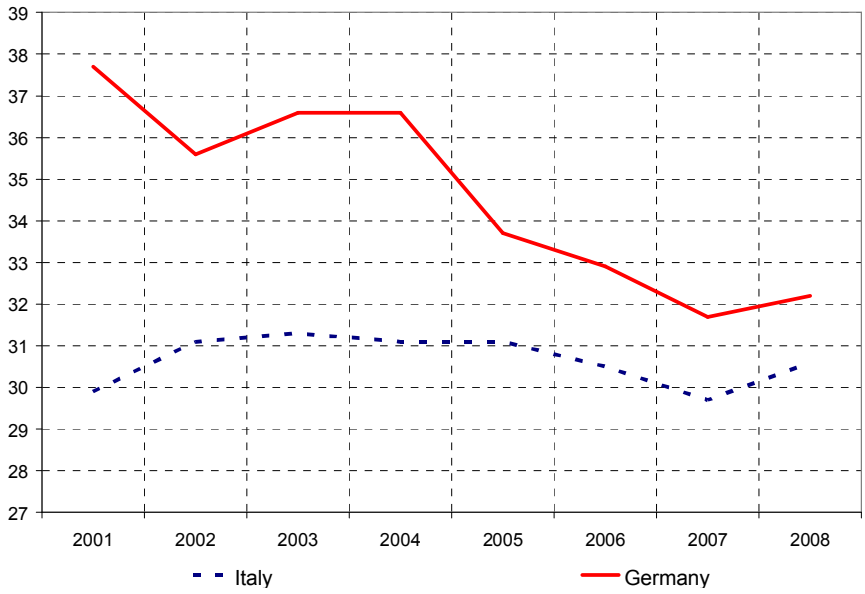
	(1)	(2)	(3)	(4)
Share of produced-to-order sales (SPTO)	-0.034**	-0.038**	-0.035**	-0.036**
	(0.016)	(0.016)	(0.016)	(0.016)
Log(employment)-2007	-	3.504**	3.449**	3.477**
		(1.421)	(1.420)	(1.417)
Log(sales)-2007	-	-4.074***	-4.245***	-4.170***
		(1.104)	(1.165)	(1.162)
Innovation&Trade	-	-	0.923*	-2.282**
			(0.564)	(0.996)
Human Capital	-	-	2.205***	3.555**
			(0.601)	(1.124)
Innovation&Trade*SPTO	-	-	-	0.042**
				(0.012)
Human Capital*SPTO	-	-	-	-0.016
				(0.014)
No. industry dummies	20	20	20	20
Country dummy: Italy	-21.776***	-20.328***	-19.072***	-18.894***
	(1.178)	(1.309)	(1.346)	(1.340)
Constant	-2.593	18.619	20.075**	19.307**
	(2.726)	(6.142)	(6.563)	(6.570)
R^2	0.13	0.14	0.15	0.15
No. Obs.	3,253	3,253	3,253	3,253

Source: Authors' calculations on Efige dataset.

OLS weighted estimates according to sample design. Dependent variable: percentage change in sales in the period 2008-09. All estimates exclude the 1st and the 99th percentile of the dependent variable. White-robust standard errors in parenthesis. * significant at 10%, ** significant at 5%, *** significant at 1%.

Fig. 1

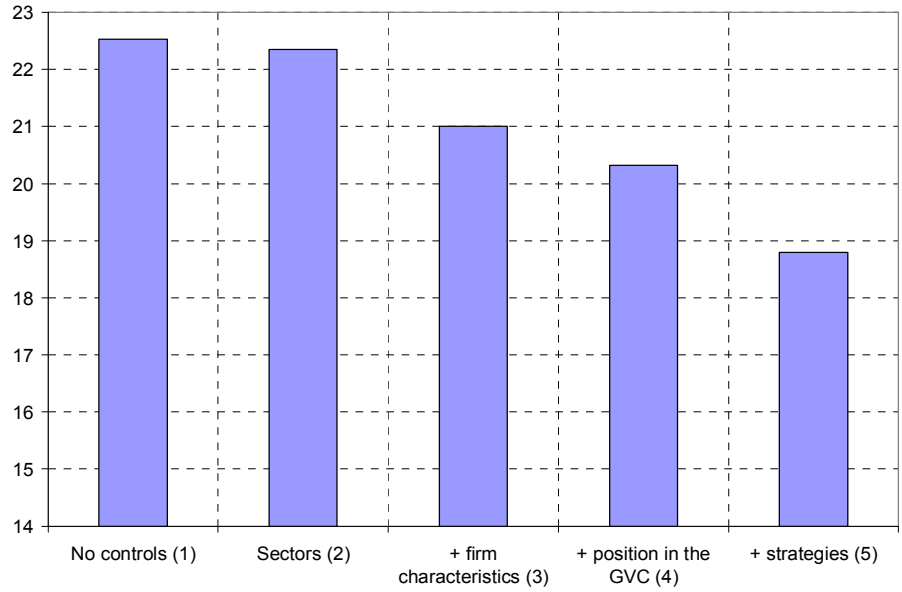
VERTICAL INTEGRATION INDEX



Source: Authors' calculations on the Efige dataset.
Evolution over time of the weighted median Vertical Integration Index (VII). VII is computed as the percentage of value added over total sales.

Fig. 2

DO GVC MATTER FOR 2008-09 COUNTRY PERFORMANCE?



Source: Authors' calculations on the Efige dataset.
The figure shows the value of the "Dummy Italy" (in absolute value). The higher the bar, the more negative the average performance for Italian firms during the crisis. *No controls* is a simple mean difference between Germany and Italy. *Sectors* shows the "Dummy Italy" controlling for 20 industry dummies. *+ firm characteristics* inserts controls for the log level of sales and employment in 2007. *+ position in the GVC* adds controls for the share of produced-to-order sales. *+ strategies* adds controls for firms' strategies and their interaction with the share of produced to order sales.