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

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Abstract

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 characteristics. Three are the main conclusions: *i*) intermediate firms were hit by the crisis more than final firms; *ii*) among intermediate firms, the ones that invested in human capital and carried out product 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 part of the performance gap between Italian and German firms.

Key words: Global Value Chains, Germany, Italy, Industrial Firms, Firm Organization
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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 labor 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 size, productivity and

sales' dynamics during the 2008-09 crisis. We then focus on firms' characteristics in terms of internationalization, innovation and human capital accumulation to detect possible systematic heterogeneities between final and intermediate firms. 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 characteristics.

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 and innovation, while their involvement in export activities does not seem particularly different. The econometric part shows that the crisis hit firms in GVC in an

asymmetric way. Intermediate firm observed a more severe contraction of sales, while firms in a more downstream position (i.e. purchasers of specialized intermediaries) registered a less critical turnover reduction. However, heterogeneity among firms matters. The contraction of turnover was smaller for high human capital intermediate firms.

All in all, the positioning within the GVC and their characteristics help in explaining part 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 in the face of the great recession; this implies that, in regression analyses, we cannot make any serious claim of causality between firm 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 analysis to detect heterogeneous characteristics 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; Agostino et al., 2014) 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**%**. 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

[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.

accelerated around the 1990's, after the unification process, with the increasing 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

[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/

implied by the "standard trade channel" (Bems *et al*., 2010). In Yi (2009) this will happen 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

3.1 The Efige dataset

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 4,000, roughly 2,000 for each country) due to the presence of several missing values in the balance sheet data.

[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.

3.2 Variables and descriptive statistics

The aim of the paper is to analyze the impact of the participation to a GVC on firm performance during the crisis.

Finding a firm-level proxy for the participation to a GVC is not an easy task. In principle we should find a dataset that contains information on all firm-to-firms linkages including the type of products bought and sold by each firm. At the best of our knowledge, these kind of data are not available; for this reason we proxy the participation to a GVC with two variables.

The first indicates whether a firm participates to a GVC as a supplier (i.e. in an upstream position). We use a variable that is the share of total turnover made up by sales of produced-to-order goods to other firms (Share of produced-to-order, SPTO henceforth). 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.

The second signals whether a firm participates to a GVC as a purchaser (i.e. in a downstream position). We use a dummy equal to one if the firm buys customized intermediate goods (Customized purchases of intermediaries, CPI henceforth), that is components which are exclusively manufactured for the firm.

Descriptive statistics are reported in table 1.

First of all it should be noted that the average number of employees is 55; this means that the Efige dataset is, as already mentioned, representative of medium and large firms. Table 1 also 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. The purchase of customized intermediaries is

limited to a small portion of firms (10.4 per cent), meaning that the actual number of firms in a downstream position is very limited in the dataset.

4. Descriptive analysis

4.1 Participation to GVCs and performance

Table 2 reports the average SPTO and CPI for Italy and Germany by sector. 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. German CPI is instead generally higher, with the only exception of the Advanced Mechanics sector.[7] All in all, from a GVC perspective, Italian firms are more "intermediate" than the German ones.

Italy's prevalence of intermediate firms is also proved by table 3. In this table we define "intermediate" (INT, henceforth) 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; they also tend to buy less frequently customized intermediaries. 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 only exception is the CPI indicator that assumes similar values for German intermediate and final firms. This confirms the idea that German economy has transformed into a "Bazaar economy" (Sinn, 2003) and that many firms (regardless their positioning in GVC) have organized their own production chain.

[7] Advanced Mechanics includes: Manufacture of radio, television, communication equipment, medical, precision and optical instruments, watches and clocks.

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 labor 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 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.

In order to deduce different characteristics, we start by analyzing firm's choices in terms of innovation, internationalization and human capital accumulation.

We consider five 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.

Table 5 presents some descriptive statistics according to the positioning in the GVC. Intermediate firms have less human capital and tend to be engaged more frequently in process rather than product innovations. Instead, international exposure is quite similar for the two types of firms.

[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.

By analysing these characteristics according to the country of localization, interesting patters emerge. Innovative activities are not particularly different for Italian and German firms 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 accumulation. The latter is definitely more widespread in Germany than in Italy, although, even in this case, the ranking between final and intermediate is preserved within each country.

5. Econometric analysis

5.1 Performance during the crisis

We now look at the relationship between firm performance and its positioning in GVCs and strategy. We first estimate the following equation:

(1) $$\Delta y_i = \alpha + \beta_1 INT_i + \beta_2 CPI_i + \gamma X_i + \phi_1 D_s + \phi_2 D_c + \phi_3 D_g + \varepsilon_i$$

Where Δy_i is the cumulated growth rate (in log scale) of sales between 2007 and 2009 for firm *i*. INT_i is a dummy variable equal to one if the share of produced-to-order sales is 100 per cent.[9] CPI_i is a dummy equal to one if the firm purchased customized intermediaries. 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; it also includes the variables described in section 4.2 (human capital, innovation and export share) aimed at detecting heterogeneous strategies of the firms. D_s and D_c are sets of, respectively, sector and country dummies. D_g are set of dummies equal to one if the firm belongs to a national or foreign group.

[9] The use of a continuous variable for SPTO delivers very similar results. This is due to the fact that the SPTO distribution is actually bimodal, with a peak at zero per cent, another peak at 100 per cent and very few intermediate values.

The coefficients of interest are β_1 and β_2. β_1 captures the correlation between the performance during the crisis and the intermediate status of a firm in a GVC. β_2 indicates the influence of the downstream positioning in a GVC of a firm on the dynamics of sales in the period 2008-09.

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 and β_2 cannot be interpreted in causal way but, rather, as conditioned statistical associations. This is due to the possible 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 6.

Column (1) reports a simple specification with just INT, CPI, country and sector dummies. The coefficient of INT is negative and significant, thus confirming that being intermediate is associated with a negative performance during the crisis. Intermediate firms witnessed, on average, an additional fall in sales by 2.8 percentage point (in log scale). The coefficient of CPI is, instead, positive and significant. Its point estimate indicates that firms engaged in the purchase of customized intermediaries (i.e. in a downstream position in a GVC) succeeded in limiting the drop in sales during the crisis by 3.4 percentage points (in log scale).

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 coefficients of INT and CPI are now slightly larger in modulus although the confidence intervals greatly overlap.

In column (3) we insert controls for firm strategies and characteristics. While the coefficients of INT and CPI confirm the previous results, human capital and product innovation variables turn out to be positive and significant. This implies that, controlling for sector, country, firms' characteristics and positioning in the GVC, having a qualified workforce or introducing new products attenuated the negative effect of the crisis. The effects of process innovation, international exposure or group membership are instead not statistically different from zero.

5.2 Heterogeneous effects

We now investigate whether firm characteristics may have different effects according to the positioning in the GVC. This is done by estimating a fully interacted version of equation (1). In particular we run the following regression:

$$\Delta y_i = \alpha + \gamma_1\left(X_i + D_s + D_g\right) + \beta_3 INT_i + \gamma_2 INT_i * \left(X_i + D_s + D_g\right) + \beta_3 CPI_i + \gamma_3 CPI_i * \left(X_i + D_s + D_g\right) + \phi_4 D_c + \varepsilon_i \quad (2)$$

Results are displayed in table 7.

The first column reports the coefficients for final, non CPI firms. The second and the third contain the coefficients for the interaction terms of each variable with, respectively, the dummy INT and CPI.

Results show that human Capital accumulation mostly benefitted intermediate firms as the interaction term between INT and the share of workforce with a tertiary education or in training is positive and significant. Large intermediate firms were also particularly sheltered during the crisis, while international exposure, that hit final or CPI firms, did not seem to have harmed intermediate firms.

5.3 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 performance gap between Italian and German firms. As clearly shown in table 4, during the 2008-09 crisis Italian and German firms 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 labor 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, while the share of firms engaged in the purchase of customized intermediaries is comparatively small.

In this section, we try to understand whether the high number of intermediate firms in Italy did contributed to the relevant performance gap.

To do so, we proceed as follows. We calculate how much of the Italy-Germany firms' performance gap is explained by our econometric models and then we compute the contribution of each set of regressors to the explained gap.

In practice we run following six regressions:

$$\Delta y_i = \alpha + \kappa_1 D_{Italy} + \varepsilon_i$$

$$\Delta y_i = \alpha + \kappa_2 D_{Italy} + \text{Sectors} + \varepsilon_i$$

$$\Delta y_i = \alpha + \kappa_3 D_{Italy} + \text{Sectors} + \text{Firm characteristics} + \varepsilon_i$$

$$\Delta y_i = \alpha + \kappa_4 D_{Italy} + \text{Sectors} + \text{Firm characteristics} + \text{Strategies} + \varepsilon_i$$

$$\Delta y_i = \alpha + \kappa_5 D_{Italy} + \text{Sectors} + \text{Firm characteristics} + \text{Strategies} + \text{Positioning} + \varepsilon_i$$

$$\Delta y_i = \alpha + \kappa_6 D_{Italy} + \text{Fully interacted model} + \varepsilon_i$$

The total explained performance gap between German and Italian firms is given by $\kappa_6 - \kappa_1$.

The accounting is made by comparing κ_j with κ_{j+1}, with j=1,…,6. If $\kappa_{j+1} - \kappa_j$ is positive, part of the performance gap between Germany and Italy is explained by the variables added in the *j+1th* regression. Percentage contributions to the total explained gap is computed as $\frac{\kappa_{j+1} - \kappa_j}{\kappa_6 - \kappa_1}$.

Table 8 reports the results for these estimates.

Most of the total explained performance gap (70 per cent) is attributable to firm characteristics such as size, human capital or innovative activity. However, different positioning in the GVC and (less relevantly) their interactions with firm characteristics have an important role as it explains almost one-fourth of the gap. This is not a small number, considering that this kind of explanation of the Italy-Germany firms' 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); German firms are instead more frequently in the purchase of customized intermediaries, thus hinting at the fact that those companies are usually located in a downstream position in the GVC.

The aggregate figures may mask firms' heterogeneous resilience to the crisis. In order to dissect such heterogeneity, we analyze firms according to their human capital accumulation, innovation strategies or international projection. 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, while purchasing specialized intermediaries (i.e. organizing own value chains) somehow sheltered firms during the crisis. However, heterogeneity among firms matters. The contraction of turnover for intermediate firms with previously pursued a strategy of increasing the human capital level was smaller. 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 labor 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' labor productivity partly explain German firms' capacity to face the crisis and to 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.

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Table 1

DESCRIPTIVE STATISTICS

	No. Obs.	Mean	Standard Deviation
SPTO	4,117	73.2	38.9
Customized purchases of intermediaries	4,117	0.104	0.306
Sales in 2007 (1)	4,117	11,282	87,288
Employees in 2007	4,117	55.2	194.1
Labour productivity in 2007 (2)	4,117	189.8	282.4
Percentage change of sales 2008-09	4,117	-17.9	34.5

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

Table 2

ITALIAN AND GERMAN FIRMS IN GVC

	Italy		Germany	
	Share of produced to order sales	Customized purchases of intermediaries	Share of produced to order sales	Customized purchases of intermediaries
Traditional	80.9	0.067	59.9	0.210
Chemical	76.7	0.055	63.5	0.112
Metals	84.2	0.061	70.7	0.112
Mechanics	81.3	0.151	63.0	0.200
Advanced mechanics	69.2	0.203	52.5	0.188
Automotive	77.3	0.144	64.2	0.261
Other	78.1	0.037	55.3	0.046
Total	**80.4**	**0.082**	**62.2**	**0.139**

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	534	66.9	185	37.7
Chemical	230	59.7	201	42.4
Metals	586	69.6	415	50.8
Mechanics	446	59.6	447	43.0
Advanced mechanics	99	49.7	174	31.8
Automotive	54	55.2	41	42.8
Other	364	63.5	341	34.1
Total	**2,313**	**64.1**	**1,804**	**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)	8,545	14,648
Customized purchases of intermediaries	0.087	0.126
Employees in 2007	46.1	66.4
Labour productivity in 2007 (2)	180.2	201.5
Percentage change of sales 2008-09	-21.9	-12.9

	Italy			Germany		
	Intermediate (3)	Final	Total	Intermediate (3)	Final	Total
Sales in 2007 (1)	7,924	14,486	10,277	9,985	14,797	12,794
Customized purchases of intermediaries	0.065	0.112	0.082	0.139	0.139	0.139
Employees in 2007	35.7	44.9	39.0	70.0	86.2	79.5
Labour productivity in 2007 (2)	192.5	201.5	51.1	151.5	186.7	172.1
Percentage change of sales 2008-09	-29.1	-27.5	-28.4	-5.0	-2.1	-3.3

Source: Authors' calculations on Efige dataset.
Weighted averages according to the sample design. (1) Thousands of euros. (2) Sales (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

HETEROGENEITY ACROSS FIRMS

	Intermediate	Final
Share w/ university degree	6.579	10.6
Share in training	14.2	18.2
Product innovation	43.6	53.2
Process innovation	44.5	39.6
Export share	20.1	20.0

	Italy			Germany		
	Intermediate	Final	Total	Intermediate	Final	Total
Share w/ university degree	5.2	7.6	6.1	9.5	13.3	11.7
Share in training	10.6	11.6	10.9	22.7	24.4	23.7
Product innovation	43.6	53.3	47.1	43.8	53.0	49.2
Process innovation	44.5	40.9	43.2	44.6	38.4	41.0
Export share	22.2	25.0	23.2	15.2	15.3	15.3

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 6

POSITIONING IN THE GVC AND FIRMS PERFORMANCE IN 2008-09

	(1)	(2)	(3)
Intermediate (INT)	-2.772**	-3.149**	-2.725**
	(1.041)	(1.045)	(1.046)
Customized purchases of intermediaries (CPI)	3.400**	4.332**	4.070**
	(1.712)	(1.722)	(1.744)
I*CPI	-	-	-
Log(employment)-2007	-	4.468***	4.583***
		(1.097)	(1.083)
Log(sales)-2007	-	-4.768***	-4.838***
		(0.843)	(0.912)
Share w/ university degree	-	-	0.118**
			(0.040)
Share in training	-	-	0.068**
			(0.020)
Product innovation	-	-	2.132**
			(1.068)
Process innovation	-	-	-0.425
			(1.048)
Export share	-	-	-0.034
			(0.024)
National Group	-	-	-1.330
			(2.047)
Foreign Group	-	-	-1.927
			(2.545)
No. industry dummies	21	21	21
Country dummy: Italy	-23.247***	-21.929***	-20.438***
	(1.721)	(1.131)	(1.159)
Constant	-1.526	22.136***	19.866***
	(2.218)	(4.898)	(5.225)
R^2	0.16	0.17	0.17
No. Obs.	4,117	4,117	4,117

Source: Authors' calculations on Efige dataset.
OLS weighted estimates according to sample design. See eq. (1). 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%.

Table 7

FIRMS' CHARACTERISTICS AND THE CRISIS: FINAL VS. INTERMEDIATE

	Final, no CPI firms	Interaction with INT	Interaction with CPI
Log(employment)-2007	3.243**	4.099**	2.159
	(1.592)	(2.041)	(3.036)
Log(sales)-2007	-4.098**	-2.229	-3.370
	(1.436)	(1.768)	(3.419)
Share w/ university degree	-0.022	0.297**	0.234
	(0.048)	(0.090)	(0.164)
Share in training	0.048*	0.069*	-0.149
	(0.029)	(0.039)	(0.660)
Product innovation	1.055	2.006	-2.810
	(1.505)	(2.137)	(3.871)
Process innovation	-1.359	2.114	-3.435
	(1.520)	(2.075)	(3.448)
Export share	-0.106**	0.127**	-0.008
	(0.038)	(0.048)	(0.074)
INT	-	-0.315	-
		(10.253)	
CPI	-	-	-5.697
			(20.144)
Group dummies (w/interactions)		YES	
Industry dummies (w/ interactions)		YES	
Country dummy: Italy		-20.178***	
		(1.159)	
R^2		0.19	
No. Obs.		4,117	

Source: Authors' calculations on Efige dataset.
OLS weighted estimates according to sample design. See eq. (2). 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%.

Table 8

DECOMPOSITION OF ITALIAN-GERMAN FIRMS' PERFORMANCE

	Dummy Italy	Total performance gap explained (in %)
Overall difference	-24.25	
Sectors	-24.02	6%
Characteristics	-22.79	30%
Strategies	-21.16	40%
Positioning	-20.44	18%
Positioning*Characteristics (see eq. 2)	-20.18	6%

Source: Authors' calculations on the Efige dataset.
The column "Dummy Italy" reports the point estimate of the country dummy for Italy in each regression after inserting each set of variables. 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. List of regressors. *Overall difference*: Dummy Italy. *Sectors*: Dummy Italy, Sector dummies. *Characteristics*: Dummy Italy, Sector dummies, log employment and log sales in 2007. *Strategies*: Dummy Italy, Sector dummies, log employment and log sales in 2007, share of workers with tertiary education, share of workers in training programs, dummy for process and product innovation, export share. *Positioning*: Dummy Italy, Sector dummies, log employment and log sales in 2007, share of workers with tertiary education, share of workers in training programs, dummy for process and product innovation, export share, INT, CPI. *Positioning*Characteristics*: see equation (2).