

# Heterogeneous Fall of Productive Capacity in the Italian Industry during the 2008-2013 Great Recession: A Descriptive Analysis<sup>1</sup>

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## **Abstract**

*Between 2008 and 2013 economic activity in the Italian manufacturing sector declined substantially; productive capacity was largely downsized. Monteforte and Zevi (2014) estimate that potential output declined by about 15% in the manufacturing sector as a whole, with sizeable differences across sectors; in some of them activity had been declining even before 2008. This paper analyses the micro-data collected for the Survey of industrial and service firms to identify the main factors that contributed to the reduction of firms' productive capacity in A) the whole 2007-13 period and B) in four sub-periods (pre-crisis 2001-07, first phase of the crisis 2008-09, recovery 2010-11, second phase of the crisis 2012-13).*

*Our main findings are that: i) productive capacity losses were widely heterogeneous across sectors of manufacturing activity in all phases of the crisis; differences in pre-crisis trends tended to persist in the course of the crisis; ii) larger firms were more successful in avoiding major capacity losses, especially so in the first phase of the crisis; iii) the share of sales in foreign markets was negatively correlated with performance in 2008-09 but the correlation turned positive in 2012-13; iv) among the Italian macro-regions, the Centre weathered relatively better the long recession, especially in 2008-09; v) in 2012-13 subsidiaries underperformed firms not belonging to any group, this helped the performance of parent companies, that was in line with the average; vi) the negative effects on productive capacity of credit constraints, which discouraged investments, were felt by Italian firms especially in 2012-13.*

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<sup>1</sup> The views expressed in this paper are those of the authors and do not necessarily represent those of the Bank of Italy.

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## 1. Introduction and motivation

In this work we analyze the trend of productive potential of Italian manufacturing firms during the 2008-2013 period using individual data from the Bank of Italy Survey of Industrial and Service Firms (henceforth SIF). In particular we compute a measure of the capacity change at the firm level and explore which firm's characteristics (size, share of foreign turnover, sector of activity and macro-region) were associated with that change. We further investigate the role played by credit constraints and whether or not being part of a group mattered.

In the last few years several studies have assessed the impact of the prolonged economic crisis on the productive potential of the Italian economy as a whole. In particular, Aprigliano and Conti (2014), using a quarterly Bayesian VAR model, find a cumulated loss of about 2.0% of the Italian potential GDP in 2013 with respect to 2007, mainly concentrated between 2007 Q3 and 2009 Q3; Gerali *et al.* (2014) estimate, by means of a dynamic general equilibrium model, that potential GDP declined by about 2 percentage points (in short, pp) in 2011-13; Ball (2014) find a cumulated decline of potential output of more than 10pp in 2015 with respect to the real time forecasts of late 2007.

Focusing on the manufacturing sector, Monteforte and Zevi (2014) estimate a loss of productive potential between 11 and 17% in 2008-13, depending on the data source adopted; the contraction reaches almost 20% compared to the counterfactual "no crisis" scenario. A similar methodology was exploited in Banca d'Italia (2014) to compute the fall in manufacturing capacity in the Italian macro-regions, pointing to a decline of about 15% in the South and 9% in the rest of the country. Nomisma (2015) estimates a loss of almost 18% between 2007 and 2014.

All aforementioned studies employ macro data; the key contribution of this paper is that it is, to our knowledge, the first one to date that uses firm-level data to address this issue.

As in most previous studies we draw a distinction between the effects of: (1) the global financial crisis that followed the bankruptcy of Lehman Brothers and hit the Italian economy – as well as most countries in the world – mainly through the sharp decline in foreign demand between 2008 and 2009 ("first phase of the crisis"), and (2) the second recession, triggered by the sovereign debt crisis, which resulted in a deep slump of

domestic demand in 2012 and 2013 (“second phase of the crisis”). In between these two contractions the Italian economy experienced a short-lived recovery (“recovery”).

Our main findings are the following: i) productive capacity losses were widely heterogeneous across sectors of manufacturing activity in all phases of the crisis; differences in pre-crisis trends tended to persist in the course of the crisis; ii) larger firms were more successful in avoiding major capacity losses, especially so in the first phase of the crisis; iii) the share of sales in foreign markets was negatively correlated with performance in 2008-09 but the correlation turned positive in 2012-13; iv) among the Italian macro-regions, the Centre weathered relatively better the long recession, especially in 2008-09; v) in 2012-13 subsidiaries underperformed firms not belonging to any group, this helped the performance of parent companies, that was in line with the average; vi) the negative effects on productive capacity of credit constraints, which discouraged investments, were felt by Italian firms especially in 2012-13.

In Section 2 we describe our data set and explain the statistical treatments; in Section 3 we show the heterogeneous loss of productive capacity along a number of firm dimensions (foreign trade exposure, size, sector of activity, location, credit constraints); in Section 4 we conduct an econometric analysis to estimate to what extent those firm-level characteristics are associated with the decline in productive capacity, controlling for other observables.

## **2. Data definitions and statistical treatments**

As productive capacity (henceforth PC) is unobservable by its own nature, following Malgarini and Paradiso (2010) and Monteforte and Zevi (2014; MZ henceforth), we define it as:

$$c_{i,t} = \frac{y_{i,t}}{u_{i,t}} \quad (1)$$

where  $y_{i,t}$  is the production level of firm  $i$  at time  $t$  and  $u_{i,t}$  stands for its contemporaneous rate of capacity utilization (henceforth CU). We are interested in the percentage change of  $c_{i,t}$  from time  $t - 1$  to time  $t$ . In order to carry out micro level analyses, estimation of PC requires firm-level data on production and CU. As Istat provides only aggregate measures of industrial production, we resort to the Bank of Italy SIF dataset, which collects firm-level data on CU and useful information to build a proxy for production at the annual frequency.

We use the SIF subsample of manufacturing firms with 50 or more employees, which are asked to report their CU in each wave. This leaves us with about 1,700 observations per year as shown in Table a1 in the Appendix. We restrict the time horizon to years after 2000.

We approximate the firm's production changes by deflating the nominal turnover by the price variations recorded in the sample stratum to which the firm belongs

(identified according to the macro-region where a firm is located and its main sector of activity). This approach is supported by the evidence that the proxy is closely correlated with the index of industrial production (Fig. 1).<sup>4</sup>

The second component that is needed to estimate potential output is a measure of CU. In SIF, firms are regularly asked to report their CU and in most cases the average individual records are in line with Istat aggregate data for the respective sector of activity and size of firms. However, as a share of firms do not report their CU. In case of missing values, we adopt an imputation procedure that uses the firm's history and the sample stratum. Table a2 details the number of imputed values by year, geographic area, firm size and sector of activity. Between 2000 and 2013, about 17 per cent of the values were imputed, with the share growing until 2010-11 and declining in the last two years<sup>5</sup>.

A statistical issue arises from the evidence that firms have reported rounded values for CU. The distribution of actual answers (excluding imputed values) shows a clear preference

**Figure 1**  
Industrial production and real turnover in Istat data



Source: our computation on Istat data.  
Notes: series are seasonally adjusted. 2010=100

<sup>4</sup> A potentially misleading factor is firm's sales of third party products, which could be relevant for firm analysis even if not necessarily in the aggregate. We are able to control for this as in the 2007 and 2012 SIF waves firms were asked to which extent their turnover was influenced by sales of third party products. Similar shares were reported by the same firms in the two waves: in 2012 41% of firms sold third-party products, explaining 20.7% of their total turnover, or about 8% of turnover of total industry. We kept note of these firms in the estimations conducted in Section 4. A more detailed analysis of sales of third-party products as described in the SIF survey can be found in Di Nino (2015).

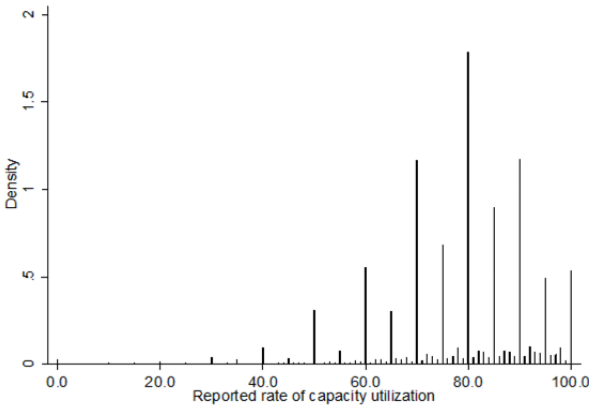
<sup>5</sup> The highest share of imputed values was recorded in the North West of the country (where it amounts to 24.2% on average ) and among firms with higher number of employees.

for figures that end in five or zero: in fact, 82.5% of the answers are heaped around multiples of five (Fig. 2).

This may result in an attenuation bias to the extent that firms do not revise their reported estimates of CU when the changes in the latter from one period to the next are small. We pay special attention to this problem, as CU is a key driver of our estimate for PC. In order to correct heaped reported values we estimate the distribution of CU, as a function of firm-level observables.<sup>6</sup> We then use the predicted values to smooth the distribution of CU rates around the answer provided.<sup>7</sup> We leave for future work a full procedure of Multiple Imputation for missing data, however we notice that all the main descriptive statistics are similar whether one uses the original SIF data or those including our correction.

**Figure 2**

Distribution of reported CU rates



Source: our computation on SIF data.

Both production and CU, constructed as above mentioned, closely track the corresponding aggregate Istat series.

Our analysis is based on the unbalanced panel of firms that participated in the SIF survey between 2001 and 2013; we do not use the balanced panel, as only 324 firms (out of a total of about 1800 firms per year) were reported in all waves. Table a3 reports the number of observations per firms. The variation in PC can only be computed when firm *i* is observed for two consecutive waves. This leaves us with 17,326 observations between 2002-2013 for which we can compute the outcome of interest (about 75% out of a total of

<sup>6</sup> The model includes the following firm-level observables: the natural logarithm of the number of employees at time *t* and *t*-1; the natural logarithm of the inflation-adjusted income and investments at time *t* and *t*-1; and a set of fixed effects for its sector of economic activity, geographic macro-region, export share, legal form and years.

<sup>7</sup> We subtract (add) 2 percentage points when the predicted value lies in the bottom (top) quintile of the distribution, 1 point when it lies in the second quintile and we leave provided values unchanged when they are not multiples of five. The use of an independent variable predicted on a set of controls in a regression which includes the same controls does not bias coefficient estimates yet may induce downward bias in the estimated standard errors.

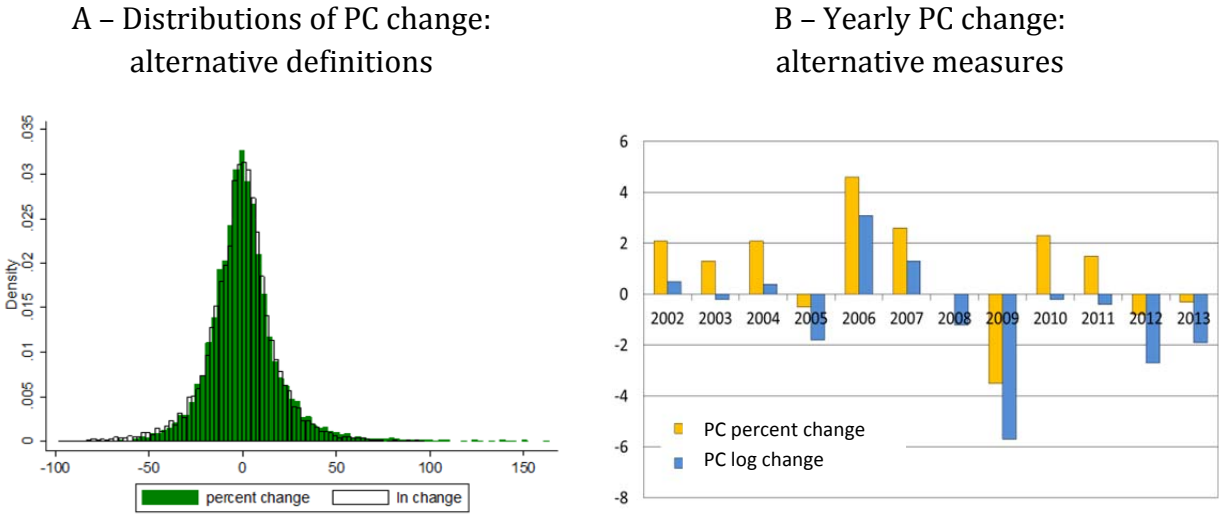
23,138 observations). At this stage of the research project, we do not take a stand on the reasons why firms entry to and exit from our sample. In principle a firm can exit for a variety of reasons, e.g.: it may simply be the case that a firm drops out of the market; a firm may reduce its labor force to less than 50 employees, in which case it is no longer asked to report its CU in SIF; a firm in financial distress may chose not to participate in one or more waves, as SIF participation is not compulsory; further reasons are also possible. Although there is at this stage no evidence of sample-selection, we plan to investigate this issue further in the future.

We approximate the percentage change of PC from time t-1 to time t by its log-difference:

$$\delta_{it} = \frac{c_{i,t}}{c_{i,t-1}} \approx \ln(c_{i,t}) - \ln(c_{i,t-1}) \equiv \delta'_{it} \quad (2)$$

The distributions of  $\delta_{it}$  and  $\delta'_{it}$  are similar; however, the former has a longer upper tail while the latter has a longer lower tail (Fig. 3.A).

**Figure 3**



Source: our computations on SIF data.  
 Note: all distributions are weighted with the number of firms .

For both measures  $\delta_{it}$  and  $\delta'_{it}$  we computed average yearly PC variation in the economy. Fig. 3.B shows that average percentage variation is lower for the log-differences, pointing to the presence of a significant number of large yearly negative changes at the firm level (the larger is the change, the bigger is the downward bias induced by the log-difference). All in all, we prefer to use the logarithmic measure as it helps to correct the upward bias

displayed by the aggregate firm-level data with respect to the macro series (already pointed out in MZ with reference to the SIF dataset).<sup>8</sup> In fact, cumulating the firms' percentage variations does not result in a large PC loss over the whole crisis period, whereas using the measure in log-differences, with a 1-99% trimming, results in a cumulated decline of 11.6%, in line with aggregate evidence.

As a robustness check, we also compute PC changes by trimming the top and bottom decile and quintile and the resulting estimates are roughly similar; from this we conclude that the dynamics of the log-difference measure is not overly affected by what goes on in the tails of the distribution. The cumulated PC decline between 2007-2013 amounts to 7.5% and 6.4% if the extreme deciles and quintiles are trimmed, respectively. Based on these findings, in the following we adopt the measure of PC variation in log-differences with the 1-99% trimming.

Before proceeding, several remarks are in order.

First, we did not expect to find in our micro data as large a PC decline as in MZ and Nomisma (2015). On the one hand, firms in more pronounced hardship during the crisis may be more likely to leave the sample, given the voluntary nature of participation to the survey. On the other hand (and far more importantly), the sample we analyze consists of firms with at least 50 employees; these firms, according to the latest available data, accounted for 52% of the employees in manufacturing, 60% of fixed capital investments, 61% in value added and 66% of total turnover, in the average of 2008-12. As already mentioned, they consistently over-performed smaller firms along all of those dimensions. If we assume that the PC adjustment was concentrated on the *intensive* margin, a 11.6% decrease in PC for the firms in our sample would imply a 22.0% PC decrease for smaller firms, given the decline for the total manufacturing sector estimated with macro data by previous works (around 15%). However, a substantial share of the fall in PC came from adjustments in the *extensive* margin. Mistretta and Monteforte (2015) estimate it at about 7-8%. In light of this estimate, consistency with the aggregate figure requires a PC loss for firms with less than 50 employees in line with the estimate (15.3%) for firms in the lowest dimensional class in our sample (50-99 employees).

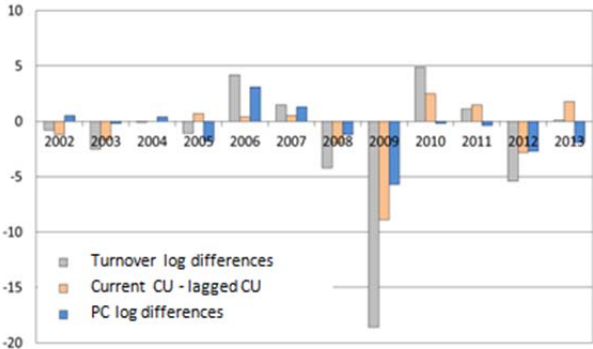
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<sup>8</sup> MZ find a generalized upward bias in firms' own assessment of own PC change, of a magnitude broadly stable in time and across sectors.

A final note of caution on the interpretation of our quantitative results: by construction, our variable of interest is very sensible to shocks to the turnover in real terms, which in turn immediately reacts to demand shocks (Fig. 4).<sup>9</sup> Therefore, annual changes of PC may tend to overemphasize high frequency volatility. However, our estimates of PC are arguably reliable if one looks at its evolution over a longer period.

**Figure 4**

Yearly variation of firms’ turnover, CU and PC



Source: our computations on SIF data.  
 Note: distributions are weighted with the number of firms

**2.1 Computed vs. self-declared capacity changes**

In the SIF survey firms are asked to report the change of their Technical Productivity Capacity (henceforth TPC), defined as the “maximum possible production attainable with full plant capacity utilization with no changes in labor shifts”.<sup>10</sup> Aggregating the individual records we find, in line with MZ, that the resulting TPC change is consistently higher than both the change in PC computed in the previous section and the one derived from the aggregate Istat series.<sup>11</sup> Figure 5. However, Panel A shows that – with the notable exception of 2013 – the three series present remarkably similar dynamics; the similarity is more pronounced for the two measures based on SIF data.

The pattern of the responses by firms to the question on the change in their TPC is reported in Figure 5.B; relatively few firms report a decline (less than 10% in all years, with the sole exception of the peak of 13.5% in 2009). The share of firms reporting an

<sup>9</sup> The correlation between PC variation and contemporaneous turnover variation is equal to 0.85, whereas that between PC variation and contemporaneous CU change is equal to 0.73.  
<sup>10</sup> The wording of the question is: “Percent change in technical productive capacity between year T and T-1”. Technical productive capacity is defined as “The maximum possible production attainable with full plant capacity utilization with no changes in labor shifts”.  
<sup>11</sup> The features of the series derived from the Istat data are described in MZ 2014.

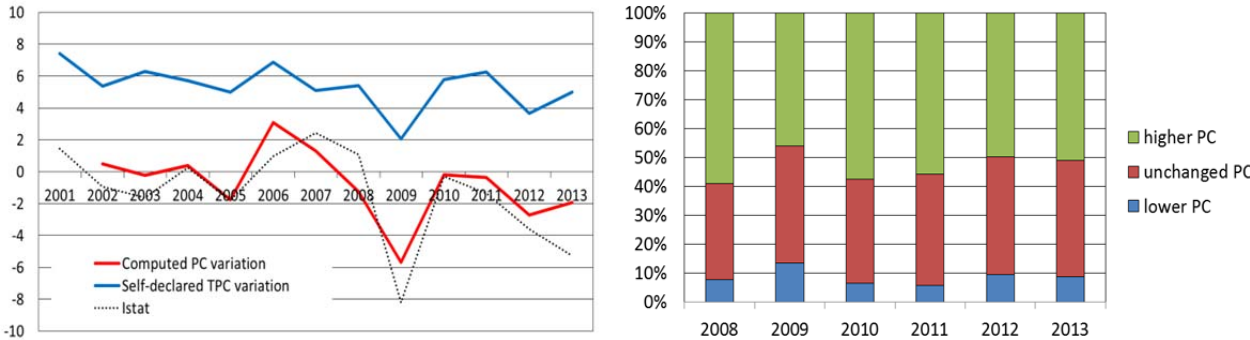


increase in their TPC is consistently higher than 50%; about one out of three respondents reports an unchanged TPC. Interestingly, a similar *ad hoc* survey conducted in November 2014 by Istat (2015) found that the self-declared increase in productive capital in 2014 is close to zero for 63% of the firms and positive for 27%, leaving just 10% of firms reporting a reduction.

**Figure 5**

**A - Different measures of capacity change**

**B - Self-reported TPC change**

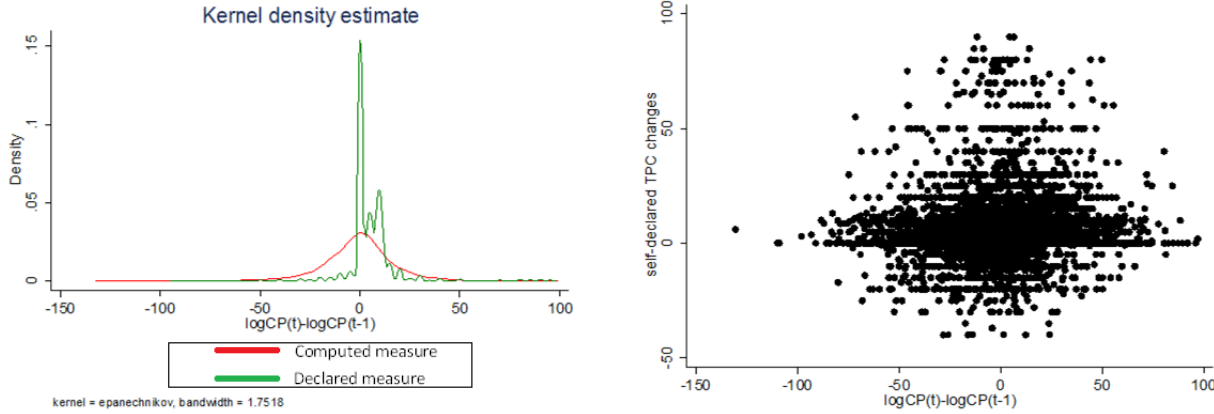


Source: Panel A: our computation on SIF data and Istat; Panel B: SIF 2008-2013  
 Note: distributions of variables based on SIF data are weighted with number of firms.

**Figure 6**

**A - Distributions of declared and computed capacity changes**

**B - Scatter plot between declared TPC changes and computed PC changes**



Source: our computation on SIF data.  
 Note: Panel A: distributions are weighted with the number of firms. The red line plots the kernel density estimate of the computed PC change. The green line plots the kernel density estimate of the self-declared TPC change.

In order to better understand how firms interpret the SIF question in TPC we estimate the following equation :

$$\Pr(\text{answer}_{it}) = \Phi \left( \delta n_{it} + \log \left( \frac{\text{inv}_{it}}{n_{i,t}} \right) + \text{controls} \right) \quad (3)$$

where  $\text{answer} \in$  (“higher PC”, “lower PC”, “unchanged PC”),  $\delta n_{it} = n_{it} - n_{it-1}$  is the change in the number of employees of firm  $i$  from  $t-1$  to  $t$ ,  $\text{inv}_{it}$  are contemporaneous investments, and  $\text{controls}$  include a set of year, sector, macro-region and size dummies.

As expected, the probability (Table a4) of reporting a positive TPC change increases when new employees are hired and investment expenses per employee increase; the same variables are negatively correlated to the probability of the firm reporting zero or negative TPC growth. Figure 6 compares the distribution of declared and our computed capacity changes (panel A) and presents a scatter plot of the two measures of capacity variation (panel B). The distribution of declared TPC clearly shows a dense mass around 0, with relatively few negative observations, whereas our computed PC change is more normally distributed around zero. The scatter plot, however, suggest that no linear relationship exists between the two measures of PC changes; indeed, the correlation between the two is 0.06.

### 3. Heterogeneous impact of the crisis

According to the computed PC, in the pre-crisis period (between 2001 and 2007) capacity increased on average by 0.5% per year (Table 1). PC started falling in 2008 and its decline became dramatic in 2009 (phase 1 of the crisis); in the subsequent two years it declined marginally (recovery); with the inception of the sovereign debt crisis, in 2012-13 PC was further reduced (phase 2 of the crisis).

**Table 1**

#### Sub-periods and average capacity changes

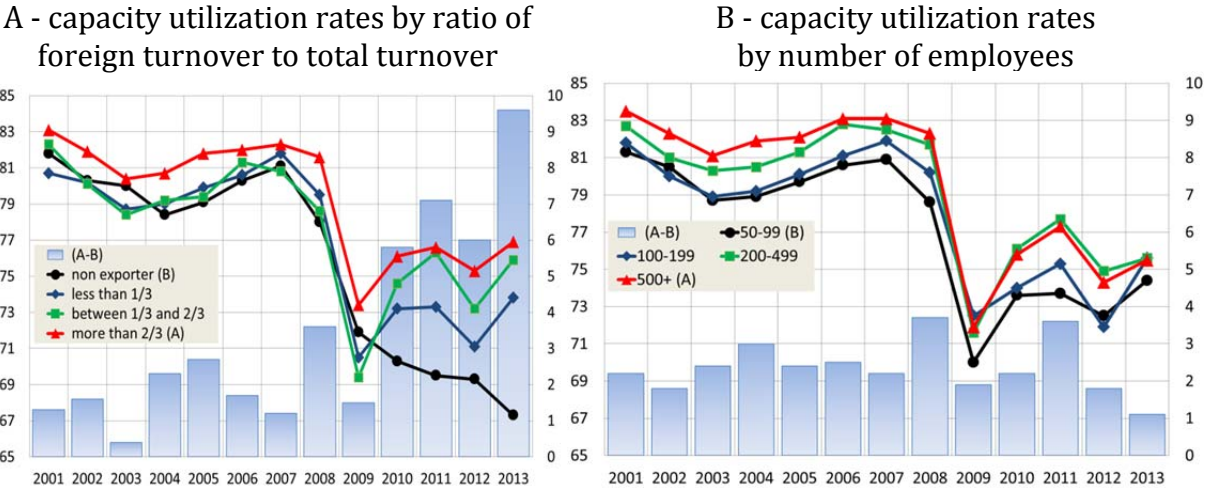
Periods	Years	Average yearly PC changes (%)
Pre-crisis	2001-2007	0.5
Phase 1 of the crisis	2008-2009	-3.4
Recovery	2010-2011	-0.3
Phase 2 of the crisis	2012-2013	-2.3

Table 2 further reports the computed yearly PC change across different dimensions, i.e., sectors of activity, share of foreign turnover, geographical macro-regions and firm size; the relevance of each of these factors is discussed in turn in the following sub-sections.

### 3.1 Heterogeneity by degree of foreign exposure

The international financial crisis of 2008-09 hit the Italian economy through the sharp decline of world trade, therefore firms more exposed to external markets were the most severely affected. The computed PC loss for phase 1 of the crisis spans between 3.0% among domestic-market-oriented firms to 12.4% for export-oriented-ones (Table 2). Between 2010 and 2011 the latter managed to recover some of the lost capacity (with PC increasing by 1.9%), while non-exporting firms witnessed a further decline (3% ).

Figure 7



Source: our computations on SIF data.  
 Note: observations are weighted with the number of firms. Firms are grouped according to the following categories: 1) firms that do not export at all; 2) exporting firms whose foreign turnover is up to 1/3 of total turnover; 3) exporting firms whose foreign turnover is between 1/3 and 2/3 of total turnover; 4) exporting firms whose foreign turnover is above 2/3 of total turnover. Histograms represent the difference in CU between categories 4 and 1.

The more recent sovereign debt crisis resulted in a decline of domestic demand, both public and private: the PC of non-exporting firms fell by more than 13%, while the decline was almost nil among export-oriented firms (1.2%). Interestingly, over the whole sample period the large fall in PC for non-exporting firms was the result of a huge contraction in sales (exceeding 30%), partially compensated by a quick fall in CU(Figure 7.A).

### **3.2 Heterogeneity by firm size**

Our sample includes only firms with at least 50 employees.<sup>12</sup> When the international financial crisis hit the economy, initially its impact was evenly spread among firms of all sizes. In 2009 the impact became more heterogeneous: while the PC of smaller firms in the sample (50-99 employees) declined by 7.2%, the reduction was about one half among firms with 200-499 employees and virtually nil among the largest ones (the evolution of CU did not play a major role in producing those differentiated effects, contrary to the case of exposure to foreign markets; Figure 7.B). Firms with 50-99 employees were also those that suffered the most during the sovereign debt crisis: their PC declined by over 6%, whereas it was less than half as large among the remaining firms. As a result, in 2007-2013 firms with employees between 50 and 99 units witnessed an overall PC reduction of 15.3%, while the fall was significantly lower for larger firms (between 4.9% and 7.9%).

### **3.3 Heterogeneity by sector of activity**

Looking at the overall crisis period, the largest decline in PC took place in manufacturing of non-metallic minerals which was likely affected by the deep crisis of the construction sector. The textile and leather goods sector suffered a similar decline during the first phase of the crisis, continuing the negative trend of previous years; however, a moderate recovery occurred between 2010 and 2011, before recording a further decline during the sovereign debt crisis. The sector producing means of transportation performed relatively well through 2012, but was severely affected by the sovereign debt crisis. The overall decrease in PC was moderate among firms producing machinery and appliances which, after being hit by the fall in foreign demand in 2008-09, subsequently managed to broadly stabilize their PC during the recovery phase and 2012-13. Finally, the PC of manufacturers of food products increased by 2.2% from 2007 to 2014; this is the combined result of an increase before 2010 and a fall thereafter.<sup>13</sup>

Focusing on the dynamics before the crisis, between 2001 and 2007 the PC of manufacturers of textile and leather goods declined by 1.5% per year; a less intense but qualitatively similar pattern is found for firms producing metal products. On the contrary, the top performing sectors were the manufacture of mechanical machinery, electric appliances, means of transportation and wood and paper products.

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<sup>12</sup> Smaller firms were not asked about their CU until 2013.

<sup>13</sup> Figure a5 compares the sectorial PC changes we have computed to those found in MZ.

**Table 2**  
**Computed PC change**

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Avg PC change before 2007	Cum PC change from 2007
Yearly average	0.5	-0.2	0.4	-1.8	3.1	1.3	-1.2	-5.7	-0.2	-0.4	-2.7	-1.9	<b>0.5</b>	<b>-11.6</b>
<b>Sectors (1)</b>														
Food	-0.6	1.3	-0.1	0.5	0.7	-1.3	-0.3	3.1	2.1	-0.1	-0.2	-2.3	<b>0.1</b>	<b>2.2</b>
Textile and leather	-0.9	-1.9	-0.6	-3.8	-1.8	-0.4	-3.1	-10.9	2.5	-0.9	-2.1	-5.5	<b>-1.5</b>	<b>-18.9</b>
Wood and paper	3.4	2.1	5.6	-0.9	1.8	2.1	-4.2	-0.7	-4.7	-1.9	-1.9	-4.8	<b>2.5</b>	<b>-16.9</b>
Coke, chemicals, rubber and plastic	1.7	-0.1	1.7	-6.6	3.5	2.0	-2.0	0.1	0.9	-3.3	-3.4	-1.9	<b>0.3</b>	<b>-9.3</b>
Non-metallic minerals	0.2	2.8	-1.4	-3.7	4.5	0.7	-1.6	-9.2	-3.7	-4.2	-0.4	-3.5	<b>0.5</b>	<b>-20.8</b>
Metals	0.2	1.1	-4.3	-4.3	2.1	1.3	-1.7	-2.8	-3.6	-0.3	-3.2	4.8	<b>-0.7</b>	<b>-6.8</b>
Machinery and mechanical appliances	2.4	-1.7	0.4	0.6	7.8	4.0	-0.2	-13.0	0.7	1.8	-0.5	-0.9	<b>2.3</b>	<b>-12.2</b>
Electrical machinery and appliances	0.3	-0.8	5.0	1.4	7.3	2.8	2.1	-10.2	4.9	1.7	-8.6	-1.6	<b>2.8</b>	<b>-12.0</b>
Means of transportation	1.2	3.3	0.5	5.9	2.0	1.5	1.9	-1.6	-2.1	1.4	-2.9	-15.3	<b>2.5</b>	<b>-18.1</b>
<i>Other</i>	-5.5	-3.3	3.7	1.4	0.6	-2.8	-0.4	-8.3	-0.1	0.9	-6.2	-5.4	<b>-1.0</b>	<b>-18.3</b>
<b>Share of foreign turnover</b>														
Nihil	0.4	0.3	-1.5	-0.7	4.4	-2	-0.4	-2.8	0.8	-4	-4.4	-9	<b>0.1</b>	<b>-18.5</b>
Between 0-1/3	0.4	-1	0.2	-3.1	1.8	-0.1	-1.1	-1.9	-0.9	-0.2	-4	-1.8	<b>-0.3</b>	<b>-9.5</b>
Between 1/3-2/3	0.8	-0.1	0.9	-2.2	2.9	2.9	-2.1	-6.3	-0.9	-0.2	-2.6	-2.0	<b>0.9</b>	<b>-13.4</b>
Over 2/3	0.4	0.9	0.9	0.6	4.7	2.4	-0.6	-11.9	1.5	0.4	-0.8	-0.4	<b>1.7</b>	<b>-11.8</b>
<b>Macro-region (2)</b>														
North West	0.4	-0.5	-0.3	-3.4	1.8	1.6	-1.7	-7.0	0.7	-0.4	-2.5	-2.1	<b>-0.1</b>	<b>-12.5</b>
North East	1.1	0.8	0.1	-0.5	3.8	1.4	-0.9	-6.2	-0.8	-0.1	-3.2	-2.1	<b>1.1</b>	<b>-12.7</b>
Centre	-0.2	-3.2	0.5	0.1	3.4	2.0	0.1	-4.1	0.3	0.0	-2.2	-1.3	<b>0.4</b>	<b>-7.1</b>
South and Islands	0.3	1.9	4.0	-1.4	5.3	-0.9	-2.3	-1.0	-2.7	-1.3	-2.8	-1.5	<b>1.6</b>	<b>-11.1</b>
<b>Number of employees</b>														
50-99	0.2	-0.6	0.0	-1.6	3.0	0.2	-1.3	-7.2	-0.5	-0.8	-4.4	-2.0	<b>0.2</b>	<b>-15.3</b>
100-199	0.6	-0.7	0.5	-3.1	3.8	2.3	-1.1	-4.5	1.5	0.4	-1.4	-1.4	<b>0.6</b>	<b>-6.4</b>
200-499	1.4	1.5	1.1	0.1	1.9	4.0	-1.1	-3.8	-1.4	-0.5	0.9	-2.2	<b>1.7</b>	<b>-7.9</b>
500+	1.5	2.0	1.4	-1.1	3.0	1.3	-1.2	-0.2	-2.6	1.7	0.5	-3.1	<b>1.4</b>	<b>-4.9</b>

Source: our computations on SIF data.

Note: The table presents average variation in productive capacity computed with equation 2. The extreme percentiles of the yearly distributions of the computed capacity were trimmed. Observations are weighted with the number of firms. - (1) The sectorial classification is based on Ateco 2002.- (2) Macro-region is where the administrative seat of the firm is located.

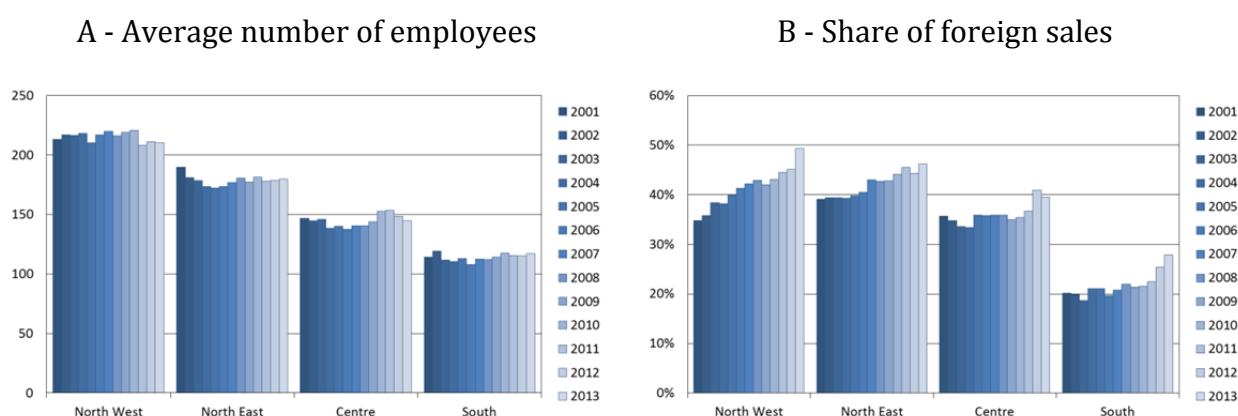
### 3.4 Heterogeneity by macro-region

The decline in PC was not evenly distributed across the Italian macro-regions.<sup>14</sup> The macro-regions more exposed to foreign demand were more severely hit by the global financial crisis, with the decline of PC amounting to 8.6% in the North West and 7.0% in the North East.

During the temporary recovery the South underperformed the rest of the country, losing 4.0% of its PC, while PC in the other macro-regions roughly stagnated. The sovereign debt crisis affected the entire country more evenly. As a result, between 2010 and 2013 the PC loss in the South (-8.0%) was roughly twice as large as that recorded in the rest of the country (-4.7%). These results are in line with the findings in Banca d'Italia (2014).

Such gap reflects the cross-country heterogeneity in firms characteristics described in Figure 8. Panel A shows that Southern Italy is characterized by a larger presence of small firms, with an average of 100 employees per firm in the sample (roughly constant during the double crisis). Average firm size is higher in the Centre, just below 150, and in the North East, around 180, and even more so in the North West (always above 200). Panel B shows that southern regions are characterized by lower export shares (about 20%), which are higher everywhere else (around 35% at the beginning of the sample); the export share show a positive trend in all macro-regions.

**Figure 8**



Source: SIF 2001-2013.

Note: observations are weighted by number of firms.

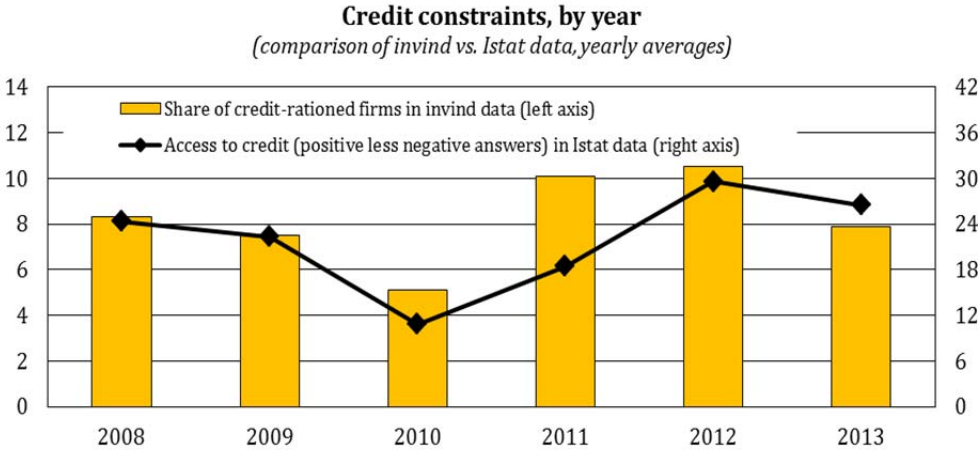
<sup>14</sup> In SIF firms are grouped according to the location of their administrative seat.

The degree of foreign exposure helps explain why the North suffered more during the global financial crisis. Also, the continuing decline of PC in the South since 2007 is consistent with the smaller firm size in that macro-area (see sub-section 3.2) and the larger relevance of weaker domestic demand there

### 3.5 The role of credit constraints

We define credit constraints as in Bugamelli, Gaiotti, Viviano (2014): firms are credit constrained if they report that they would like to receive more credit at current conditions or that they were not granted all or part of the additional credit, despite their willingness to pay more for it. Such definition results in an homogeneous series spanning the whole sample (in 2010 the section on firms financing was modified in the SIF survey) .<sup>15</sup> Credit constraints proved to be severe especially in 2011 and 2012.

Figure 9



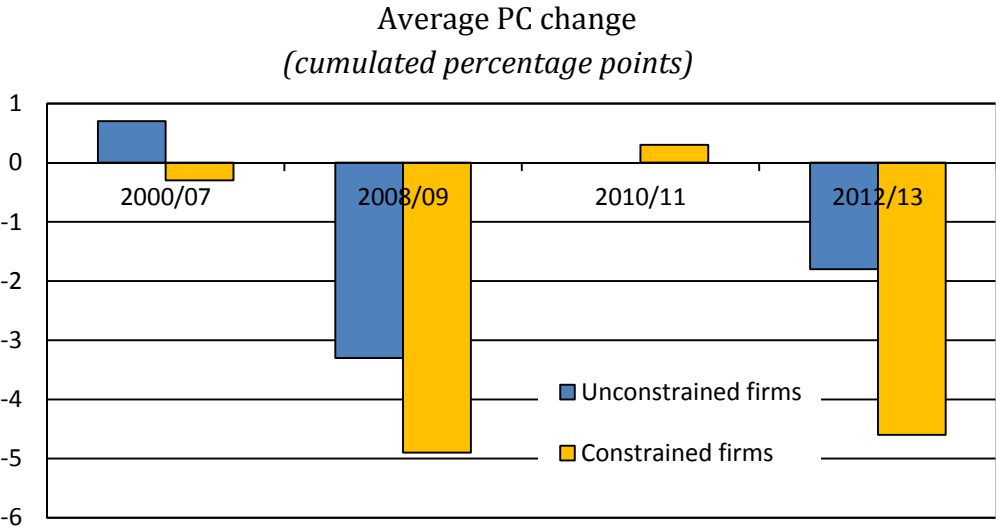
Source: our computation on SIF data.  
 Note: observations are weighted by number of firms. Until 2009 respondents were asked whether they would be interested in increasing their debit at the time of the survey, which takes place at the beginning of the 2<sup>nd</sup> quarter of each year; in case of a positive answer, a second question asked respondents whether they would be willing to incur an extra cost to receive more credit. Starting in 2010 the section of the questionnaire concerning the financing of the firm was revisited and questions were rephrased to make specific reference to the preceding calendar year; our assessment is that this rephrasing did not fundamentally alter the series and coherently with it we don't see a break in the series.

From 2008 the Istat business survey records firms' opinions on access to credit. Figure 9 shows the difference between the share of firms reporting an improvement in credit

<sup>15</sup> We explored an alternative definition according to which firms are credit constrained if they would like to receive more credit at current conditions, actually asked banks or other financial intermediaries for more credit, and credit was denied (even in part). The definition proposed by Bugamelli *et al.* (2014) seems more suitable to describe the phenomenon of interest, so we chose to follow their approach. The main results of our analysis are robust to both definition.

conditions vs. those reporting a deterioration in the Istat survey, together with the share of credit-rationed firms estimated on the basis of SIF data. The two series move very closely together and in the same direction. Further, figure a6 shows that, as expected, the share of firms that are credit rationed in one year and the contemporaneous average percentage change in PC are negatively correlated (-0.53). A notable exception is 2009, when firms' difficulties in accessing access credit played a relatively minor role (the correlation is -0.64 if we exclude that year).

**Figure 10**



Source: our computation on SIF data. Note: observations are weighted with the number of firms.

Figure 10 reports the PC change of credit constrained and unconstrained firms in the average of the three sub-periods in our sample. The evolution of PC was rather similar in the two groups before the crisis and in the recovery phase. By contrast, after the collapse of Lehman Brothers, PC declined marginally more for constrained firms. Throughout the sovereign debt crisis, the decline in PC was markedly stronger for constrained firms.

**4. Relative importance of factors impacting on productive capacity**

In Section 3 we described the average change in firms' PC during the main phases of the Great Recession along a number of dimensions. In this section we exploit the availability of micro-data to assess how the impact of the crisis on individual firms' PC depends on a



number of observable firms' characteristics.<sup>16</sup> Specifically, we estimate the following equation:

$$\delta'_{it} = \log\left(\frac{c_{i,t}}{c_{i,t-1}}\right) = \alpha + \beta X + \gamma Z + u_{it} \quad (4)$$

where  $X$  is a set of fixed effects for: macro-regions (with the North West as the comparison group), share of exported turnover (with non-exporters as the comparison group), sector of activity (with metallic and mechanical product as the comparison group) and size, and  $Z$  is a vector of additional controls. Estimates for the entire crisis period 2007-2013 are reported in Table 3, where our favorite specification is in column (8).<sup>17</sup>

The estimates broadly confirm the evidence of Section 3, with the differences related to the sector of activity and to size turning to be the most significant. The estimated impact of the crisis is statistically different across sectors: *ceteris paribus*, for producers of non-metallic minerals and of textile and leather goods the change in PC was about 2 percentage points lower than the one of the comparison group; the change was instead about 1.2 percentage points higher for producers of food and tobacco products.

The annual PC decline for firms located in the Centre was significantly smaller than in the rest of the country.

Larger firms (by number of employees) performed significantly better than others: the average annual PC change for firms with 100 or more employees was at least 1.7 percentage points higher than it was for smaller ones (50-99 employees); PC change among firms with 1,000 or more workers was 3.0 points higher.

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<sup>16</sup> At this stage we cannot identify causal relationships but we still deem the main estimated relations informative for policy making.

<sup>17</sup> For model 8 as a robustness check we present in column 9 the estimates we obtain using percentage PC change ( $\delta_{it}$ ) as the dependent variable in place of the log-differences ( $\delta'_{it}$ ).

**Table 3- Estimates of regression (4)**

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
SECTORS OF ACTIVITY	Log change	Log change	Log change	Log change	Log change	Log change	Log change	Log change	Percent variation	Log change	Log change	Log change
- Food and tobacco	1.077* (0.586)	1.051* (0.589)	1.121* (0.595)	1.266** (0.608)	1.143* (0.597)	1.186** (0.595)	1.175* (0.601)	1.187* (0.616)	0.471 (0.650)	1.435** (0.650)	1.100* (0.615)	1.360** (0.650)
- Textile and leather	-1.824*** (0.680)	-1.916*** (0.676)	-1.989*** (0.673)	-2.019*** (0.669)	-1.943*** (0.665)	-2.140*** (0.664)	-2.120*** (0.662)	-2.058*** (0.668)	-2.412*** (0.652)	-2.156*** (0.688)	-2.066*** (0.667)	-2.163*** (0.687)
- Coke, chemicals, rubber, plastic	0.323 (0.657)	0.330 (0.655)	0.350 (0.659)	0.372 (0.655)	0.299 (0.655)	0.379 (0.658)	0.327 (0.658)	0.281 (0.657)	-0.633 (0.721)	0.641 (0.682)	0.399 (0.662)	0.738 (0.687)
- Non-metallic minerals	-2.023** (0.812)	-2.073** (0.811)	-2.235*** (0.812)	-1.825** (0.828)	-1.978** (0.826)	-1.855** (0.850)	-1.861** (0.850)	-1.803** (0.853)	-2.199*** (0.841)	-1.883** (0.912)	-1.711** (0.857)	-1.803** (0.918)
- Other manufacturing	-1.709** (0.774)	-1.777** (0.780)	-1.897** (0.776)	-1.856** (0.762)	-1.810** (0.762)	-1.827** (0.753)	-1.819** (0.752)	-1.787** (0.756)	-2.312*** (0.700)	-1.257* (0.648)	-1.741** (0.756)	-1.213* (0.647)
MACRO-REGIONS												
- North East			0.104 (0.610)	0.0824 (0.604)	0.0262 (0.605)	-0.0398 (0.596)	-0.0466 (0.598)	-0.0422 (0.598)	-0.104 (0.590)	0.0289 (0.612)	-0.0415 (0.597)	0.0340 (0.610)
- Center			1.294** (0.557)	1.450** (0.565)	1.566*** (0.570)	1.469** (0.573)	1.326** (0.583)	1.342** (0.587)	1.496** (0.594)	1.084* (0.601)	1.380** (0.589)	1.124* (0.603)
- South and islands			-0.117 (0.579)	0.368 (0.644)	0.608 (1.125)	0.423 (1.117)	0.194 (1.122)	0.176 (1.110)	0.736 (1.207)	-0.137 (1.055)	0.162 (1.105)	-0.143 (1.050)
SHARE OF EXPORTED TURNOVER												
- 0<export share<1/3				1.594 (0.981)	1.439 (0.975)	1.308 (0.968)	1.338 (0.974)	1.403 (0.968)	0.591 (1.081)	0.479 (0.929)	1.407 (0.966)	0.488 (0.927)
- 1/3≤export share<2/3				1.638 (1.063)	1.426 (1.054)	1.537 (1.054)	1.561 (1.060)	1.612 (1.057)	0.561 (1.170)	0.705 (1.001)	1.634 (1.054)	0.722 (0.998)
- export share≥2/3				2.028* (1.120)	1.736 (1.125)	1.810 (1.117)	1.806 (1.122)	1.880* (1.110)	1.205 (1.207)	0.851 (1.055)	1.927* (1.105)	0.895 (1.050)
SIZE												
- 100-199 employees					1.464*** (0.548)	1.620*** (0.565)	1.636*** (0.565)	1.652*** (0.564)	1.788*** (0.562)	1.185** (0.580)	1.547*** (0.565)	1.095* (0.581)
- 200-499 employees					1.600*** (0.556)	2.051*** (0.635)	2.084*** (0.639)	2.110*** (0.644)	1.996*** (0.626)	2.136*** (0.666)	1.959*** (0.642)	2.009*** (0.663)
- 500-999 employees					0.983 (0.719)	1.642** (0.792)	1.667** (0.800)	1.706** (0.803)	1.554** (0.792)	2.025** (0.816)	1.614** (0.799)	1.945** (0.812)
- ≥1,000 employees					2.274*** (0.775)	2.889*** (0.868)	2.939*** (0.879)	2.967*** (0.885)	2.849*** (0.909)	2.916*** (0.900)	2.820*** (0.879)	2.797*** (0.897)
ADDITIONAL CONTROLS												
Belongs to a group						-1.222** (0.537)	-1.286** (0.545)	-1.214** (0.542)	-0.808 (0.538)	-1.326** (0.558)	-1.633*** (0.577)	-1.697*** (0.594)
Is credit rationed												
Is parent company											1.989** (0.794)	1.729** (0.831)
Year fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age and age squared	No	No	No	No	No	No	No	No	No	No	No	No
Legal form fixed effects	No	No	No	No	No	No	No	No	No	No	No	No
Constant	-1.001*** (0.378)	1.773*** (0.648)	1.590** (0.693)	-0.0738 (1.123)	-0.568 (1.151)	-0.0447 (1.146)	0.966 (1.299)	1.155 (1.361)	3.515*** (1.378)	2.321* (1.291)	1.326 (1.368)	2.465* (1.299)
Adj. R-Squared	0.00213	0.0138	0.0141	0.0144	0.0156	0.0164	0.0166	0.0173	0.0169	0.0175	0.0182	0.0182
Observations	9,720	9,720	9,720	9,720	9,720	9,656	9,656	9,656	9,660	9,069	9,656	9,069

Note: OLS estimates of  $\beta$  and  $\psi$  in equation 4. Sample restricted to years 2007-2013. In models 1-8 and 10-12 the dependent variable is PC change measured as the difference between its natural logarithm at time t and at time t-1. In model 9 the dependent variable is PC change measured as percentage change from time t-1 to time t. Extreme percentiles of the dependent variables were trimmed. The omitted sector is "firms producing metallic and mechanical products", the omitted macro-region is North West; the omitted share of exported turnover is "nihil"; the omitted size is "50-99 employees". Standard errors clustered at firm level in parentheses.  
\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

Our estimates on the full sample (2007-2013) do not point to systematically significant differences between exporters and non-exporters;<sup>18</sup> this finding presumably stems from the fact that foreign exposure, after impacting negatively in the first phase of the crisis, turned significantly favorable in the second. This aspect is discussed again below, when the performances are estimated for different sub-periods.<sup>19</sup>

Considering conglomerates, on average firms belonging to a group reduced their PC by 1.2 points per year more than firms not belonging to groups. Exploring this evidence further (models 11-12), we find that parent companies fared no differently from firms outside groups while subsidiaries' PC instead fell more.

Finally, we do not find evidence that in the overall crisis period 2007-2013 the average PC change of credit rationed firms was statistically differed from that of other firms (models 10 and 12).<sup>20</sup>

However, estimates for the whole 2007-2013 period could hide significant patterns: Table 4 reports estimates of our favorite specification (model 8) separately for each sub-period, including the pre-crisis years (2001-2007). We find that the reasons behind PC losses shifted in the course of the years. Considering first the sector of activity, the main vulnerability was the pre-existing trend: manufacturers of textile and leather products were already clearly suffering even before the onset of the crisis. In 2008-09 the global financial crisis hit all sectors evenly, with the exception of the food sector and the manufacturing of chemical products, with PC raising in both sectors. The decline in PC was instead particularly pronounced again in the textile and leather goods sector; this was the case in 2012-13 too.

As for firm size, its effects is statistically significant only in 2008-09, with big firms being much better at weathering the negative foreign demand shock. All other factors being equal, the Centre macro-region was less affected than the rest of country in 2008-09. Compared to non-exporting firms, those with a share of foreign turnover exceeding two

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<sup>18</sup> The difference in the PC dynamics of firms exporting at least two thirds of their production vis-à-vis non-exporters is only marginally significant; in addition, significance depends on the model specification.

<sup>19</sup> Running the simple following regression (4a) of PC change on a continuous (0-100%) export share variable with time varying coefficients yields that exporters increased their PC significantly more than the others in 2006-07 and reduced it more in 2009, while the variable was not relevant in the remaining years:

$$\delta'_{it} = \alpha + \beta * t_{year} * \frac{x_{it}}{y_{it}} + X + u_{it} \quad (4a)$$

where  $t_{year}$  is a set of year dummies and  $X$  is the usual set of control dummies.

<sup>20</sup> We also find suggestive evidence that in the overall period capacity decrease was larger among more mature firms; however this results is at best marginally significant.

thirds suffered a significantly larger (about 4 pp per year) PC loss in 2008-09 but had a much better performance in 2012-13 (recording a differential in PC change larger than 5 pp per year).

Finally, a focusing on the years 2012-2013 a major drag on PC came from the credit tightening: -3.5pp per year in credit constrained firms with respect to non-constrained ones. Also, in 2012-2013, the PC of subsidiaries fell more than the one of firms outside groups.

**Table 4 – Estimates of regression (4) by sub-period**

Sample restricted to years: Model:	2001-07		2008-09		2010-11		2012-13	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>SECTORS OF ACTIVITY</b>								
- Food and tobacco	-0.880 (0.742)	-0.778 (0.760)	3.823*** (1.294)	3.736*** (1.340)	1.250 (1.428)	2.370 (1.523)	1.093 (1.244)	0.723 (1.281)
- Textile and leather	-2.738*** (0.909)	-2.398*** (0.899)	-3.621** (1.535)	-3.089** (1.555)	0.167 (1.719)	-0.389 (1.881)	-2.353** (1.162)	-3.036** (1.240)
- Coke, chemicals, rubber, plastic	-0.599 (0.756)	-0.337 (0.779)	2.319* (1.311)	2.743** (1.329)	-1.320 (1.491)	-0.845 (1.542)	0.0961 (1.221)	0.648 (1.202)
- Non-metallic minerals	-0.386 (0.949)	0.396 (1.026)	-3.620 (2.444)	-3.339 (2.481)	-3.494 (2.423)	-3.299 (2.518)	0.878 (1.570)	1.108 (1.467)
- Other manufacturing	-0.382 (0.767)	-0.527 (0.774)	-0.502 (1.355)	-0.0349 (1.373)	-1.354 (1.612)	-1.325 (1.691)	-3.010* (1.702)	-1.022 (1.192)
<b>MACRO-REGIONS</b>								
- North East	1.119* (0.672)	1.037 (0.675)	0.910 (1.172)	0.897 (1.199)	-1.194 (1.494)	-1.430 (1.631)	-0.280 (1.070)	0.227 (0.998)
- Center	0.784 (0.721)	0.371 (0.736)	2.939** (1.341)	2.681* (1.370)	-0.289 (1.437)	-0.215 (1.507)	0.787 (1.198)	0.490 (1.191)
- South and islands	1.697** (0.776)	1.198 (0.795)	2.015 (1.523)	2.064 (1.537)	-2.606 (1.673)	-2.566 (1.749)	1.365 (1.320)	0.648 (1.275)
<b>SHARE OF EXPORTED TURNOVER</b>								
- 0<export share<1/3	-0.0555 (0.852)	-0.260 (0.868)	0.187 (1.785)	0.0707 (1.796)	0.452 (2.752)	0.0265 (2.876)	3.384 (2.141)	1.450 (2.007)
- 1/3≤export share<2/3	1.230 (0.911)	1.200 (0.921)	-1.741 (1.949)	-2.187 (1.950)	0.628 (2.990)	0.534 (3.119)	4.881** (2.306)	2.842 (2.083)
- export share≥2/3	1.871* (1.050)	1.734 (1.063)	-3.965** (1.993)	-4.264** (1.989)	2.020 (3.073)	1.580 (3.173)	6.729*** (2.327)	5.171** (2.121)
<b>SIZE</b>								
- 100-199 employees	0.594 (0.578)	0.354 (0.587)	1.948* (1.082)	1.652 (1.126)	1.705 (1.306)	1.902 (1.411)	1.311 (1.029)	-0.259 (1.027)
- 200-499 employees	2.012*** (0.666)	1.645** (0.672)	3.032** (1.264)	3.033** (1.323)	0.288 (1.445)	0.895 (1.532)	2.051* (1.100)	1.460 (1.116)
- 500-999 employees	2.031** (0.809)	1.558* (0.826)	3.513** (1.478)	4.189*** (1.506)	0.540 (1.799)	0.851 (1.866)	1.517 (1.445)	1.277 (1.481)
- ≥1,000 employees	1.312 (0.908)	1.177 (0.936)	6.876*** (2.032)	7.064*** (2.080)	1.229 (1.823)	1.013 (1.858)	0.760 (1.703)	-0.315 (1.677)
<b>ADDITIONAL CONTROLS</b>								
Belongs to a group	-0.975* (0.571)	-1.072* (0.601)	-0.917 (1.034)	-1.204 (1.068)	-1.682 (1.277)	-1.165 (1.355)	-1.344 (0.937)	-3.059*** (0.981)
Is credit rationed		-0.762 (1.868)		-1.862 (1.978)		0.297 (3.760)		-3.500** (1.706)
Is parent company		1.300 (0.902)		1.203 (1.837)		-0.897 (1.814)		3.844*** (1.202)
Constant	1.015 (1.454)	1.295 (1.470)	0.0747 (2.460)	0.587 (2.432)	1.348 (3.458)	1.250 (3.654)	-4.853 (2.986)	-1.096 (2.684)
Adj. R-Squared	0.0135	0.0125	0.0372	0.0372	0.00175	-0.00120	0.0141	0.0182
Observations	8,567	8,136	2,773	2,707	2,653	2,472	2,772	2,522

Note: OLS estimates of  $\beta$  and  $\gamma$  in equation 4. Sample restricted to years shown above. Models 1, 3, 5 and 7 include the same controls as model 8 of Table 3; models 2, 4, 6 and 8 include the same controls as model 12 of Table 3; all models include: year fixed effects, age, age squared, legal form fixed effects. The dependent variable is PC change measured as the difference between its natural logarithm at time t and at time t-1. Extreme percentiles of the dependent variables were trimmed. The omitted sector is “firms producing metallic and mechanical products”; the omitted macro-region is North West; the omitted share of exported turnover is “nihil”; the omitted size is “50-99 employees”. Standard errors clustered at firm level in parentheses.

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

## **5. Conclusions**

In this paper we use survey micro-data to investigate the drivers of the fall of production capacity in the Italian manufacturing sector during the long, double-dip recession of 2008-13. Looking at the whole sample period, the fall was particularly pronounced among smaller firms, especially those in the textile and leather sector (whose productive capacity was already declining before 2008), and in the non-metallic mineral sector (which was likely affected by the deep crisis of the construction sector). In 2012-13, productive capacity was significantly affected by both credit constraints and intra group dynamics (for firms belonging to groups). As expected, the impact of the 2008-09 recession was particularly severe for export-oriented firms, while the opposite occurred in 2012-13. Finally, the fall in productive capacity was broadly evenly distributed across Italian macro-regions, with a somewhat lower decline in the Centre.

## 6. Appendix

**Table a1 – SIF sample size**

	Number of observations	Observations for which PC can be computed
2001	1,713	0
2002	1,797	1,385
2003	1,848	1,393
2004	1,861	1,448
2005	1,890	1,481
2006	1,838	1,509
2007	1,785	1,461
2008	1,752	1,402
2009	1,706	1,379
2010	1,667	1,321
2011	1,749	1,353
2012	1,750	1,389
2013	1,782	1,418
<b>Total</b>	<b>23,138</b>	<b>16,939</b>

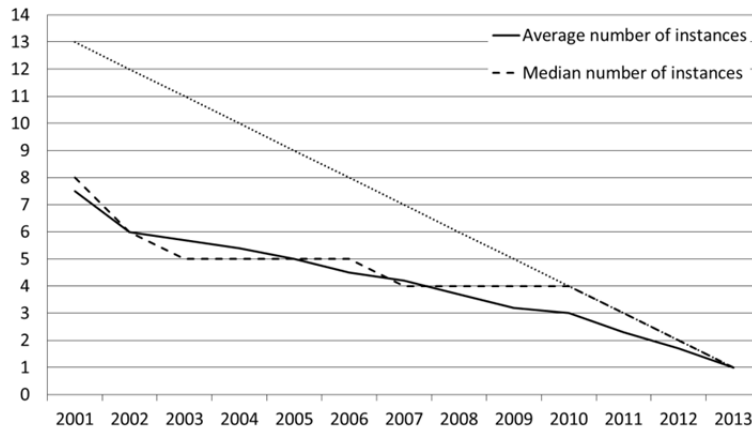
Source: SIF data.

**Table a2 - Provided and imputed values on the CU rates question in SIF**

	Number of answers provided	Number of imputed values	Total number of observations
<b>Reference year</b>			
2001	1,518	195	1,713
2002	1,531	266	1,797
2003	1,543	305	1,848
2004	1,548	313	1,861
2005	1,573	317	1,890
2006	1,529	309	1,838
2007	1,496	289	1,785
2008	1,412	340	1,752
2009	1,389	317	1,706
2010	1,342	325	1,667
2011	1,409	340	1,749
2012	1,437	313	1,750
2013	1,470	312	1,782
<b>Macro-region</b>			
North West	4,908	1,569	6,477
North East	4,358	902	5,260
Centre	4,481	618	5,099
South and Islands	5,450	852	6,302
<b>Number of employees (1)</b>			
50-99	6,810	1,312	8,122
100-199	5,574	933	6,507
200-499	4,176	877	5,053
500-999	1,503	406	1,909
1000 and above	1,134	413	1,547
<b>Sector of activity</b>			
Food, beverages and tobacco products	2,466	436	2,902
Textiles, wearing apparel and leather	2,498	554	3,052
Wood, paper products and printing	1,242	226	1,468
Coke, chemicals, rubber and plastic	2,229	528	2,757
Non-metallic mineral products	1,422	139	1,561
Metallurgy and metal products	3,054	557	3,611
Machinery and mechanical equipment	2,589	600	3,189
Electrical machinery and equipment	1,482	451	1,933
Transport vehicles	1,153	251	1,404
Other manufacturing	1,062	199	1,261
<b>Total</b>	<b>19,197</b>	<b>3,941</b>	<b>23,138</b>

Source: SIF data. (1) Information not available for firm with 20-49 employees.

**Table a3 – Panel structure: average and median number of instances,<sup>1</sup> by initial year in the data**



Source: SIF data

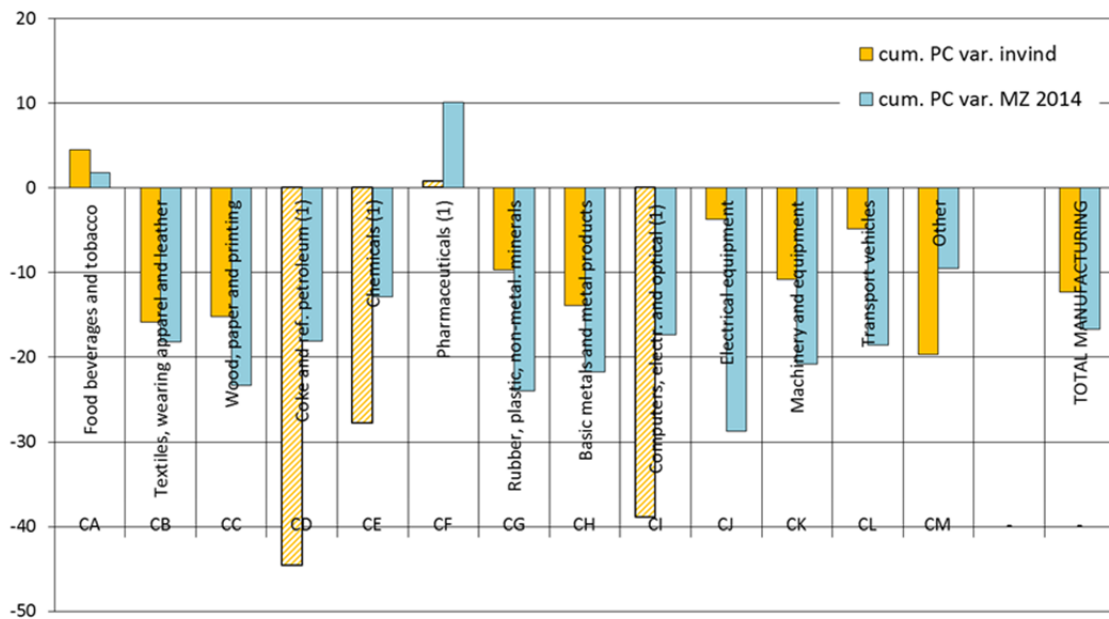
Note: (1) instances are the times (possibly non consecutive) that each firm is interviewed in the survey.

**Table a4 – Reported TPC change**

	self-reported PC increase	self-reported no PC change	self-reported PC decrease
$\Delta$ number of employees	0.0042*** (0.00045)	-0.0017*** (0.00044)	-0.0072*** (0.00061)
Log(investments/employee)	0.13*** (0.0089)	-0.11*** (0.0088)	-0.074*** (0.011)
Observations	22,678	22,678	22,678

Note: SIF data between 2001-2013. The table reports marginal effects from probit regressions (4); robust standard errors in parentheses, corrected for firm level clustering; controls include year, sector, macro-region and size dummies. \* p<.1, \*\*p<.05, \*\*\* p<.01.

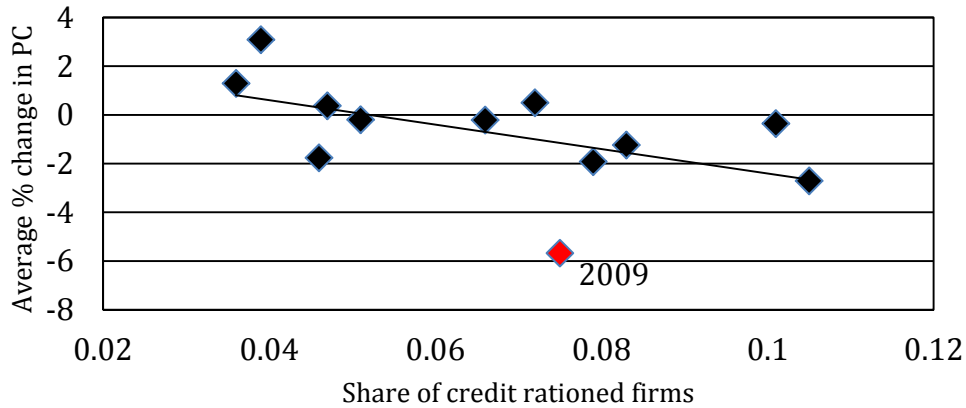
**Figure a5 – PC change by sector: computation on micro-data vs computation on macro series**



Source: our computation on SIF data for cumulated PC variation computed on micro-data; Monteforte and Zevi (2014) for cumulated PC variation computed on macro series.

Note: (1) Less than 50 observations for some or all years for those sectors. The correlation between the two series is 0.29; it increases to 0.33 ignoring sectors with very few observations.

**Figure a6 – share of credit rationed firms and average Pc change by year**



Source: our computation on SIF data.

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