The effect of size on business net change during crises: a multifactor partitioning analysis of Italian regions during 2007-2010

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Abstract This paper discusses the effects of size on business net change at the local unit level in Italy during the crisis started in 2008. The multifactor partitioning (MFP) approach is proposed for the analysis. The results suggest that units employing 10 to 49 employees benefit from moderating effect due to size, while for micro units – those employing less than 10 persons – the crisis is exacerbated by size-related factors.

Keywords: Units size; Italy; Multifactor partitioning; size-region interaction; SMEs; resilience

JEL classification: D21, E32, L25

1 Introduction

The disproportionate contribution of small firms to employment growth first gained wide attention with the work in the United States of David Birch (1979), followed by studies including Britain (Keeble, 1997), Europe (Carree and Thurik 1998), and Canada (Ray 1990 and 1996). However, the impact of economic shock on the performance of small firms during economic recessions has been largely neglected. Not much is known about this topic especially during the recent economic crisis and only a few studies have been presented.
Theoretical and empirical evidence suggests that small firms may experience different effects from larger ones during crises. Some papers find evidence that small and medium-sized enterprises (SMEs) are better able to weather crises than larger ones because of their greater flexibility (Tan and See 2004), others support the idea that SMEs may be affected by economic crises to a greater extent because of limited financial, technological and human resources and greater dependence on fewer customers (Narjoko and Hill 2007). Micheal and Robbins (1998) report that small firms tend to reduce employment during recessions. Recently, Varum and Rocha (2012) find that large firms suffer a greater increase in exit hazard during downturns than smaller firms do, although small firms remain generally more likely to exit.
The focus of this paper is on the analysis of net change in the size distribution of local units. The internal dynamics of change (births, deaths, and size class changes) is out of the scope of our paper. The aim is to assess whether firm size contributes or not in differentiating net change of businesses during crises. Moreover, another aim of the paper is to investigate whether the net change by size has a differential regional pattern. The study refers to the Italian case and the crisis started in 2008. In this period, all size classes of firms registered a reduction in the number of businesses. We try to measure the portions of change attributable to the general recession, the industrial composition, and the regional distribution, and

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separate them from the portion of change related to size factors. For this purpose, the use of the multifactor partitioning (MFP) approach is proposed (Ray 1990). MFP is essentially an extension of shift-share analysis, which allows to correctly compute components of change, by the use of standardized rates, and to include more than two factors in the model. The analysis is performed first at the national level and then at the regional level. Further evidence is provided by a confirmatory resilience analysis.

Almost all previous analyses of the effects of economic shock have been restricted to two-way analysis (Barbonne, 2003; Breathnach et al., 2015; Gardiner et al., 2013; Lagravinese, 2015; Lamarche et al., 2003; Ray et al., 2012), limiting them to identifying the intrinsic region and industry-mix effects only. Ray (1990) used four-way MFP analysis of employment growth by size class of establishment but for the entire 1978-1982 business cycle thus excluding any separate consideration of the severe 1982 recession. To the best of our knowledge, this is the first recorded study to partition the changing composition of establishments by size that take simultaneously account of the intrinsic effects of size, industry-mix by size class and regional distribution.

Overall, the contribution of this study is three fold. First, it provides results on the impact of firm size on business net change during crises, with reference to the period 2007-2010, and on the question if the impact presents regional differences. Second, the study allows a better understanding of the Italian case, which could be of interest for other contexts characterized, like Italy, by the prevalence of micro firms. Third, it proposes the use of the MFP approach for the analysis of this issue, shifting the focus from partitioning regional growth rates to partitioning growth by establishment size-class, and advancing from a concern with the main effects only to the identification of the size-related interaction effects. This is an innovative method in the context of business change since, as far as we know, up to now it has only been applied to study employment changes by firm size (Ray, 1990).

2 Data and methodology

The data source is the Italian Business Statistical Register of Local Units[†] (ASIA – Local units), for the years 2007 and 2010. This database is obtained by the integration of administrative and statistical sources and it is (annually) updated by the Italian National Statistical Institute (Istat). The register records all local units operating in the manufacturing and services sectors. We consider units classified according to economic activity (one-letter classification in Ateco 2007 -- Italian version of the European classification Nace Rev. 2), macro-regions (Northwest, Northeast, Centre, South, and Islands, corresponding to NUTS 1 areas), and size classes based on employment (0-9, 10-19, 20-49, 50 and more). For convenience, in the following size classes are referred to as micro, small, medium, and large local units, respectively. Notice that, since the unit of analysis is the establishment and not the firm, we decided not to use the standard size class breakdown (European Commission 2005). Further, it is important to remark that establishments are not tracked over the period 2007-2010. Instead, each establishment is allocated to a size class in a given year based on its employment in that year. This implies possible bias in the results on establishment performance.

[†] The definition of local units adopted by Istat complies with the Council Regulation (EEC) No 696/93 of 15 March 1993, according to which "the local unit is an enterprise or part thereof situated in a geographically identified place. At or from this place economic activity is carried out for which - save for certain exceptions - one or more persons work (even if only part-time) for one and the same enterprise". It is important to underline that data refer to individual establishments and not firms (which may have more than one establishment).

As for the sectoral classification, the analysis considers data classified according to six industry groups: Industry in the strict sense (including Mining and Quarrying - B, Manufacturing - C, Electricity, gas, steam and air conditioning supply - D, and Water supply, sewerage, waste management and remediation activities – E), Construction (F), Services G-I (including Wholesale and retail trade, and repair of vehicles and motorcycles - G, Transportation and Storage - H, and Accommodation and food service activities - I), Information and communication (J), Financial, insurance and real estate activities (K-L), Services M-N (including Professional, scientific and technical activities - M, and Administrative and support service activities - N).

In 2007, 4,358,033 local units were operating in Italy. Most of them (94.3%) were micro units, whereas 156,386 (3.5%) were small units, 64,669 (1.5%) were in the size class 20-49 and 29,520 units were employing 50 or more employees (Table 1).

Table 2 reports the net change (absolute and percentage values) occurred over the period 2007-2010 by size and region, jointly and separately. Differential changes are observed by size classes. Especially high reduction is observed for units with over 50 employees (-4.88%). As regards regions, Northeast and South show the highest relative loss of units (-2.59% and -2.11%, respectively). From the bivariate distribution it appears that changes are very different in the joint breakdown by regions and size.

Table 1 Local units distribution by size class and region, Italy 2007.

	Regional and size distribution - 2007									
	Micro 1-9		Small 10-19		Medium 20-49		Large over 50		Total	
Northwest	1,196,892	[94%]	49,276	[4%]	21,639	[2%]	11,274	[1%]	1,279,081	[100%]
Northeast	885,909	[93%]	40,613	[4%]	18,189	[2%]	7,955	[1%]	952,666	[100%]
Center	867,554	[94%]	32,804	[4%]	12,621	[1%]	5,501	[1%]	918,480	[100%]
South	801,581	[96%]	23,391	[3%]	8,710	[1%]	3,484	[0%]	837,166	[100%]
Islands	355,522	[96%]	10,302	[3%]	3,510	[1%]	1,306	[0%]	370,640	[100%]
Italy	**4,107,458**	**[94%]**	**156,386**	**[4%]**	**64,669**	**[1%]**	**29,520**	**[1%]**	**4,358,033**	**[100%]**

Table 2 Local units net change between 2007 and 2010 by size-class and region

NUTS 1 region	2007-2010 change									
	Nr. Local Units					Crude growth rates				
	Micro 1-9	Small 10-19	Medium 20-49	Large over 50	Total	Micro 1-9	Small 10-19	Medium 20-49	Large over 50	Total
Northwest	-19,814	-1,407	-338	-683	-22,242	-1.66	-2.86	-1.56	-6.06	-1.74
Northeast	-22,497	-1,193	-474	-504	-24,668	-2.54	-2.94	-2.61	-6.34	-2.59
Center	-13,992	-831	-192	-210	-15,225	-1.61	-2.53	-1.52	-3.82	-1.66
South	-18,071	62	407	-80	-17,682	-2.25	0.27	4.67	-2.30	-2.11
Islands	-7,554	398	273	37	-6,846	-2.12	3.86	7.78	2.83	-1.85
Italy	**-81,928**	**-2,971**	**-324**	**-1,440**	**-86,663**	**-1.99**	**-1.90**	**-0.50**	**-4.88**	**-1.99**

The observed changes are investigated by the MFP approach in order to understand factors affecting the characteristics of the trend. MFP was introduced by Ray (1990) and recently discussed by Lamarche et al. (2003) and Ray et al. (2012). Shift-share is a technique which decomposes the change in factors (Stimson et al. 2006). MFP is an extension of it and it differs from shift-share in two respects. First, it is based on standardized rates rather than crude rates, thus allowing to disentangle the compositional effects correctly. Second, it extends shift-share analysis to deal with more than two factors. This feature allows to apply the technique to the study of size class effect.

We adapt the MFP approach to study the growth rate at the size class level. The growth rate $r_{\bullet\bullet k}$ observed in each class is decomposed into five main effects and four interactions:

$$r_{\bullet\bullet k} = \underbrace{r_{\bullet\bullet\bullet}}_{\substack{\text{national}\\ \text{effect}}} + \underbrace{(\hat{r}_{\bullet\bullet\bullet} - r_{\bullet\bullet\bullet})}_{\text{allocation effect}} + \underbrace{(\hat{r}_{\bullet\bullet k} - \hat{r}_{\bullet\bullet\bullet})}_{\text{size effect}} + \underbrace{\sum_{ij} \frac{U_{ijk}}{U_{\bullet\bullet k}} (\hat{r}_{i\bullet\bullet} - \hat{r}_{\bullet\bullet\bullet})}_{\text{industry-mix effect}} + \underbrace{\sum_{ij} \frac{U_{ijk}}{U_{\bullet\bullet k}} (\hat{r}_{\bullet j\bullet} - \hat{r}_{\bullet\bullet\bullet})}_{\text{region-mix effect}} + \underbrace{INTERACTIONS_k}_{\text{interactions}}, \qquad (1)$$

where

$$INTERACTIONS_k = \underbrace{\sum_{ij} \frac{U_{ijk}}{U_{\bullet\bullet k}} (\hat{r}_{ij\bullet} - \hat{r}_{i\bullet\bullet} - \hat{r}_{\bullet j\bullet} + \hat{r}_{\bullet\bullet\bullet})}_{\text{industry-region interaction}} + \underbrace{\sum_{ij} \frac{U_{ijk}}{U_{\bullet\bullet k}} (\hat{r}_{i\bullet k} - \hat{r}_{i\bullet\bullet} - \hat{r}_{\bullet\bullet k} + \hat{r}_{\bullet\bullet\bullet})}_{\text{industry-size interaction}} + \underbrace{\sum_{ij} \frac{U_{ijk}}{U_{\bullet\bullet k}} (\hat{r}_{\bullet jk} - \hat{r}_{\bullet j\bullet} - \hat{r}_{\bullet\bullet k} + \hat{r}_{\bullet\bullet\bullet})}_{\text{size-region interaction}}$$

$$+ \underbrace{\sum_{ij} \frac{U_{ijk}}{U_{\bullet\bullet k}} (r_{ijk} - \hat{r}_{ij\bullet} - \hat{r}_{i\bullet k} - \hat{r}_{\bullet jk} + \hat{r}_{i\bullet\bullet} + \hat{r}_{\bullet j\bullet} + \hat{r}_{\bullet\bullet k} - \hat{r}_{\bullet\bullet\bullet})}_{\text{industry-size-region interaction}}.$$

$r_{\bullet\bullet k}$ ($\hat{r}_{\bullet\bullet k}$) is the crude (standardized) rate of size *k*, $r_{\bullet\bullet\bullet}$ ($\hat{r}_{\bullet\bullet\bullet}$) the overall crude (standardized) rate, $\hat{r}_{i\bullet\bullet}$ the standardized rate of industry *i*, $\hat{r}_{\bullet j\bullet}$ the standardized rate of region *j*, $\hat{r}_{ij\bullet}$, $\hat{r}_{i\bullet k}$, $\hat{r}_{\bullet jk}$ are the standardized rates by industry and region, industry and size, and region and size, respectively, r_{ijk} is the crude rate for industry *i*, region *j*, and size *k*, U_{ijk} the number of local units in industry *i*, region *j* and size *k* at time 0, $U_{\bullet\bullet k}$ the number of local units in size *k*. For the analytical definition of standardized rates, refer to Ray (1990).

The *national effect* is the change in a size class that would have occurred if the class had grown at the national rate. It measures the effects of macroeconomic fluctuations on change. The *allocation effect* measures the extent to which location of economic activity enhances national rates. The *size component* captures the pure effect attributable to size, freed from the effects of industry-mix, regional distribution and business cycle. This component reflects the size competitive position and can be attributed to size advantages or disadvantages. The *industry-mix effect* measures the proportion of change attributable to the industrial composition within each size class. A size class with a concentration of fast-growth industries will have a favourable industry-mix effect. The *region-mix effect* captures the proportion of change ascribed to the regional distribution of firms within each size class. Further, four interaction effects are identified: industry-region, industry-size, region-size and industry-size-region. Each region has specific resources and locational attributes that have a differential value for each industry according to its needs. The *industry-region interaction* is an aggregate measure of such specific advantages within each size class. The *industry-size interaction* reflects internal economies of scale, while the *region-size interaction* measures external economies of scale. Finally, the *industry-size-region interaction* is a very specific agglomeration economy measure.

Further, given that from a policy perspective it is important also to see which regions or which industry groups or interactions determine the overall results, we provide the explicit

MFP decomposition at the region-size group level. The growth rates $r_{\bullet jk}$ by region and size class are decomposed as

$$r_{\bullet jk} = \underbrace{r_{\bullet\bullet\bullet}}_{\substack{\text{national}\\ \text{effect}}} + \underbrace{(\hat{r}_{\bullet\bullet\bullet} - r_{\bullet\bullet\bullet})}_{\text{allocation effect}} + \underbrace{(\hat{r}_{\bullet\bullet k} - \hat{r}_{\bullet\bullet\bullet})}_{\text{size effect}} + \underbrace{\sum_i \frac{U_{ijk}}{U_{\bullet jk}}(\hat{r}_{i\bullet\bullet} - \hat{r}_{\bullet\bullet\bullet})}_{\text{industry-mix effect}} + \underbrace{\sum_i \frac{U_{ijk}}{U_{\bullet jk}}(\hat{r}_{\bullet j\bullet} - \hat{r}_{\bullet\bullet\bullet})}_{\text{region effect}} + \underbrace{INTERACTIONS_{jk}}_{\text{interactions}}, \quad (2)$$

where

$$INTERACTIONS_{jk} = \underbrace{\sum_i \frac{U_{ijk}}{U_{\bullet jk}}(\hat{r}_{ij\bullet} - \hat{r}_{i\bullet\bullet} - \hat{r}_{\bullet j\bullet} + \hat{r}_{\bullet\bullet\bullet})}_{\text{industry-region interaction}} + \underbrace{\sum_i \frac{U_{ijk}}{U_{\bullet jk}}(\hat{r}_{i\bullet k} - \hat{r}_{i\bullet\bullet} - \hat{r}_{\bullet\bullet k} + \hat{r}_{\bullet\bullet\bullet})}_{\text{industry-size interaction}} + \underbrace{\sum_i \frac{U_{ijk}}{U_{\bullet jk}}(\hat{r}_{\bullet jk} - \hat{r}_{\bullet j\bullet} - \hat{r}_{\bullet\bullet k} + \hat{r}_{\bullet\bullet\bullet})}_{\text{size-region interaction}}$$

$$+ \underbrace{\sum_i \frac{U_{ijk}}{U_{\bullet jk}}(r_{ijk} - \hat{r}_{ij\bullet} - \hat{r}_{i\bullet k} - \hat{r}_{\bullet jk} + \hat{r}_{i\bullet\bullet} + \hat{r}_{\bullet j\bullet} + \hat{r}_{\bullet\bullet k} - \hat{r}_{\bullet\bullet\bullet})}_{\text{industry-size-region interaction}}.$$

The interpretation of these components is similar to that outlined above. Notice that at this level of disaggregation, the regional-mix component becomes a regional component only.

3 Results

First, we consider the overall Italian situation. Results of the MFP decomposition (according to equation (1)) are summarized in Table 3 in relative form. Overall, changes in the size distribution of establishments are dominated by the size and industry-mix effects. The other effects are much smaller. One effect common to all size classes is the national effect (-1.99%). It captures the effect of the strong generalized recession undergoing the overall economy and affecting every size class in the same measure. The allocation effect (+0.18%) is quite small, meaning that the unit actual distribution is not so much different from the perfect proportional distribution.

Table 3 Partitioned rates (%) of business change in Italy by size class, 2007-2010

Effect	Micro 1-9	Small 10-19	Medium 20-49	Large over 50
National	-1.99	-1.99	-1.99	-1.99
Allocation	0.18	0.18	0.18	0.18
Size	-0.25	3.93	6.29	0.73
Industry-mix	0.17	-2.64	-3.06	-2.74
Region-mix	0.01	-0.08	-0.11	-0.14
Industry-size interaction	0	-0.98	-1.3	-0.61
Region-size interaction	0	-0.14	-0.61	-0.63
Other	-0.1	-0.18	0.11	0.32
Crude growth rate	-1.99	-1.90	-0.50	-4.88

Looking at micro units, the industry-mix effect is positive and small (+0.17%), meaning that micro units are slightly more concentrated in fast-growth industries (like Financial, insurance and real estate activities (K-L) and Services M-N - including Professional, scientific and technical activities - M, and Administrative and support service activities - N). The effect of micro size is negative, corresponding to a loss of 0.25%. This negative component shows the

existence of size disadvantages related to micro local units. Other effects and interactions are of small entity.
The decomposition is very much different for units with 10-19 and 20-49 employed persons. These two classes present similar patterns. The negative national effects are exacerbated by their industrial composition, which causes a decline of 2.64% and 3.06%, respectively. These negative effects are mitigated by size effects (+3.93% and +6.29%, respectively). Industry-size as well as region-size interactions are negative, denoting diseconomies of scale.
Turning to large units – those employing more than 50 persons – the negative national effect is exacerbated by the industrial composition (-2.74%). Size only provides a small mitigation (+0.73%). Negative industry-size and region-size interactions are observed, denoting internal as well as external diseconomies of scale.
It is worth noting that as the micro firms make up more than 90% of all establishments in Italy, it is their growth rate, and partitioned effects, which largely determine the norm against which the other size classes are measured. As a consequence, the effects for the micro firms are all very small and attention can be turned to a comparison of the other small and medium size classes with the large establishments. In this regard, the very high size effect for small and medium sized establishments compared with the much smaller size effect for large establishments is a finding of great interest.
Further, given the level of regional disparities in Italy, the weakness of the region effect may be rather striking at a first sight. The MFP results suggest that there are no great regional disparities in size class. The regional effect does not help explaining the differences in establishments changes by size class, due to the lack of disproportionalities in regional distribution.
So far, results show that at the national level the industrial composition and size were in general the factors mostly affecting units change. As for the size effect, this was highly important especially for small and medium units, which appeared to present structural characteristics more favourable in resisting to difficulties arising in crises periods. How regional economies have been reacting to the crisis and identifying if and how different factors were affecting the reaction to shocks of the crisis at the regional level is a relevant and complex question. To throw some light on these aspects, we apply MFP at the Italian NUTS 1 region level (equation (2)). Results are summarized in Figure 1. Detailed results can be found in Table 5 in the Appendix. At this level of analysis, an interesting indicator is the pure regional effect, which captures specific regional characteristics that influence all the industries in the region equally. It ranges between -0,17 in the Northwest and +0,97 in the Islands. Values are in general rather low. In the Centre, the effect is positive close to 0, in both Northern regions it is negative, whereas it is positive in the South (+0,62) and in the Islands (+0,97).
The industry-region interaction effect impacts on individual sectors within a region. It captures the distinctive location advantages of a region for particular sectors which apply over and above the pure regional effect, as might be expected in the case of specialized industrial clusters. The industry-region effect is thus linked to the region as well. In every considered situation, this effect is rather low in value and it is generally in the direction of balancing the pure regional effect.
The industry-size interaction effect represents internal economies of scale. It is negative in every region (except for micro units where the effect is always close to zero either in positive or negative direction) and rather similar across the regions. A more evident pattern can be observed across size classes. Some higher negative effects are found for the small and medium units, probably due to the great negative effect of the industry in these classes.
The regional analysis highlights the importance of the size-region interaction effect at the regional level. To make this result more evident, we have represented this effect separately in

Figure 2. The size-region interaction effect measures external economies of scale. The value of the effect is quite small only for microunits. As for the other size classes, it is negative in Northern regions, with the only exception of a small positive value in the 10-19 class in the Northeast. This is a typical dynamic area, especially for small firms. Thus, it looks like external economies of scale have been supporting the survival of small firms in the Northeast in this first part of the crisis. What is rather striking is the positive and rather high values registered for every class size (except microunits) in the South (range from 1.22 in the 10-19 class to 5.30 for the 20-49) and in the Islands (range from 3.46 in the 10-19 class to 6.03 in the 20-49). These results suggest that positive externalities were acting supporting the resilience of the industrial structure in these regions in the first period of the recent economic crisis.

Fig. 1 Partitioned rates (%) of business change in Italy by size class and region, 2007-2010

- Figure 1 about here -

Fig. 2 Size-region interaction effect from MFP decomposition

- Figure 2 about here -

To add an extra information to the results of the MFP analysis, we consider some proxy indicator of resilience or resistance. Recently the concept of resilience has attracted attention from regional analysts, spatial economists and economic geographers. Martin (2012) raises the possibility that certain regions may be little affected by external shocks due to their ability to resist the impact of the shocks. He defines regional resistance as the vulnerability or sensitivity of a regional economy to disturbances or disruptions such as recessions. The author provides an extended framework of the complexity of the concept and the phases of the regional resilience. We refer to Martin and Sunley (2014) for an extended debate about this issue. In this study, we compute a simple indicator in order to evaluate if and how it supports the MFP results.
Adapting the computation of the resilience indicator, as defined in Martin (2012), to local units change, we obtain the following indicator:

$$\text{Resistance Index}=\left[\left(\Delta U_{\bullet j \bullet}/U_{\bullet j \bullet}\right)-\left(\Delta U_{\bullet\bullet\bullet}/U_{\bullet\bullet\bullet}\right)\right]/\left|\Delta U_{\bullet\bullet\bullet}/U_{\bullet\bullet\bullet}\right|,$$

where $U_{\bullet j \bullet}$ and $U_{\bullet\bullet\bullet}$ are the total number of units in region *j* and in the nation, respectively, and $\Delta U_{\bullet j \bullet}$ and $\Delta U_{\bullet\bullet\bullet}$ represent their variation over the considered period. A zero value of the indicator means no difference with respect to the expected effect (at the national level), a positive value suggests that the region is more resistant that expected as regards the phenomenon under study. A negative value implies that a region is less resistant than expected. Results are shown in Table 4.

Table 4 Resistance index for local units in Italy by region and size class, 2007-2010

Resistance Index					
	Micro	Small	Medium	Large	Total

	1-9	10-19	20-49	over 50	
Northwest	0.2	-0.5	-2.1	-0.2	0.1
Northeast	-0.3	-0.5	-4.2	-0.3	-0.3
Centre	0.2	-0.3	-2.0	0.2	0.2
South	-0.1	1.1	10.3	0.5	-0.1
Islands	-0.1	3.0	16.5	1.6	0.1

Empirical evidence shows that the impact of the economic downturn in the Italian NUTS 1 regions is different with respect to the local units size structure of the industrial system. South and Islands appear to be more resistant especially in some size classes. The resistance index is positive in classes 10-19, 20-49 and 50 or more employees. The index for the other classes is negative, but small, close to 0 in most of the cases.

The resistance analysis confirms MFP findings, i.e. local units size classes were affected in different measure across regions by the recent economic crisis. A positive effect is registered in the South and the Islands, whose industrial system is characterized by a structure based primarily on micro and small units, with a minor role of large units, which were mostly exposed to critical performance during the economic downturn. Overall, these results are in agreement with those in Bianchi and Biffignandi (2015) and Espa et al. (2014). In Bianchi and Biffignandi (2015), a similar analysis is considered to study the dynamics of employment over the same period. Employment is classified according to the spatial and sectoral dimension only, while size dimension is not considered. Also Espa et al. (2014) consider businesses classified according to two dimensions (spatial and sectoral). Their study refers to the period 2004-2009 and a different method of analysis is used, which takes into account possible neighbourhood influences.

We emphasize however that our analysis refers to the years 2007-2010, i.e. to the first period of the long lasting recent crisis. It would be interesting to investigate the entire crisis period as well. This is left for future research.

4 Conclusion

This paper analyzes the effect of size on the net change of local units in Italy during the crisis started in 2008. Net change does not give evidence of entry-exit process. This implies that, if establishments reduce employment during recessions, it follows that any given establishment may be reclassified to a smaller size category in 2010 than it was in 2007. That is, there may be an upward bias in the reporting of small establishment performance. Nevertheless, net change provides valuable information about the trend in the dimensional structure of the industrial system. Given data availability, it would be useful to study the entry-exit process as well. Anyway, findings on net change decomposition is a key step towards understanding the contribution of different factors to the structural change.

Results show that differential patterns contribute to the observed negative changes in each size class. While for micro units the negative performance is mainly due to the national effect, for units with 10-19 and 20-49 employed persons the negative national effects are exacerbated by their industrial composition and largely mitigated by size effects. For larger units, the negative national and industry-mix effects are only mildly mitigated by size. Generally speaking, findings suggest that size effect played – at least in Italy in the period 2007-2010 – an important positive role for small (10-19 employees) and medium (20-49) units. Entry effects due to upsizing and downsizing were surely contributing to the growth of these size classes. From the structural viewpoint, either type of entries (from the same class size, from downsizing or upsizing) is contributing to the important message that size of small

and medium units is a driving positive factor in contrast with sectoral factors and the general (national) situation. Further, the analysis conducted at the regional level shows that NUTS 1 regions were reshaping their size structure in a different way, with especially high positive effects in the South and the Islands.

Findings about South and Islands are very interesting. At this stage of the study, it is not possible to provide an articulated interpretation of the factors intervening during the crisis and of the impact on employment, value added and other economic factors. Nevertheless, the analysis highlights the presence of positive external effects that have been contrasting the decrease of units. Results are further confirmed by the resilience analysis, which highlights that South and Islands were more resistant during the crisis.

An interesting development of this study, which will be the topic for another paper, will be to repeat the three-MFP analysis for the growth periods immediately preceding and following the crisis. A comparison of the results will be very informative toward a better understanding of the regional resilience to economic shocks.

From the methodological point of view, the MFP approach is shown to be a useful tool in identifying size effects on the observed changes. Even though the method does not allow to detect the causes of such changes, in a second stage, the size component (at a more disaggregated level) can be regressed against factors related to size, in order to investigate the causes of size advantages or disadvantages. Further, it is worth noting that at a more disaggregated spatial level, it would be necessary to include the spatial structure into the MFP decomposition, in the spirit of Nazara and Hewings (2004). This would call for a methodological development of MFP. This is also left for future research.

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References

[1] Barbonne, R.: Partition multifactorielle de la croissance de l'emploi des poles de la region de Quebec-Chaudiere-Appalaches: 1981-1996. Cahiers de geographie du Quebec: 47(131), 243-262 (2003)

[2] Bianchi, A., Biffignandi, S.: Decomposing employment change in a crisis period in Italy: a multifactor partitioning approach, Italian Journal of Applied Statistics: 24(2), 195-214 (2015)

[3] Birch, D.L.: The Job Generation Process. Cambridge, Mass.: Programme on Neighborhood and Regional Change (1979)

[4] Breathnach P., van Egeraat, C., Curran, D.: Regional economic resilience in Ireland: the roles of industrial structure and foreign inward investment. Regional Studies, Regional Science: 2(1), 497-517 (2015)

[5] Carree, M.A., Thurik, A.R.: Small firms and economic growth in Europe. Atlantic Economic Journal: 26(2), 137-146 (1998)

[6] Espa, G., Filipponi, D., Giuliani, D., Piacentino, D.: Decomposing regional business change at plant level in Italy: A novel spatial shift-share approach. Pap. Reg. Sci. 93: S113-S135 (2014)

[7] European Commission: The New SME Definition. User guide and model declaration. European Commission Publications, Enterprise and Industry (2005)

[8] Gardiner, B., Martin, R., Sunley, P.: Spatially unbalanced growth in the British economy. Journal of Economic Geography: 13(6), 889-928 (2013)
[9] Keeble D. 1976. The Impact of Industrial Structure in Industrial Location and Planning in the United Kingdom. pp. 31-45. London, Methuen.
[10] Lagravinese, R.: Economic crisis and rising gaps North-South: evidence from the Italian regions. Cambridge Journal of Regions, Economy and Society: 8, 331-342 (2015)
[11] Lamarche, R.H., Srinath, K.P., Ray, D.M.: Correct Partitioning of Regional Growth Rates: Improvements in Shift-Share Theory. Can. J. Reg. Sci. XXVI, 121–141 (2003)
[12] Martin, R.L.: Regional economic resilience, hysteresis and recessionary shocks. Journal of Economic Geography 12, 1-32 (2012)
[13] Martin, R.L., Sunley, P.J.: On the notion of regional economic resilience: conceptualization and explanation, Journal of Economic Geography (2014). doi: 10.1093/jeg/lbu015
[14] Narjoko, D., Hill, H.: Winners and losers during a deep economic crisis: Firm-level evidence from Indonesian Manufacturing. Asian Econ. J. 21, 343–368 (2007)
[15] Nazara, S., Hewings, G.J.D., Spatial structure and taxonomy of decomposition in shift-share analysis, Growth and Change: 35(4), 476-490 (2004)
[16] Ray, D.M.: Standardizing employment growth rates of foreign multinationals and domestic firms in Canada: From shift-share to multifactor partitioning. WP 62, International Labour Office, Multinational Enterprises Programme, Geneva (1990)
[17] Ray, D.M.: Employment creation by small firms. In: Britton J. N. H. (ed.) Canada and the global economy: The geography of structural and technological change. McGill-Queen's, Montreal, pp. 175-194 (1996)
[18] Ray, D.M., Lamarche R.H., Beaudin M.: Economic growth and restructuring in Canada's heartland and hinterland: From shift-share to multifactor partitioning. The Canadian Geographer 56, 296–317 (2012)
[19] Stimson, R., Stough, R., Roberts, B.: Regional economic development: analysis and planning strategy. Springer, Berlin (2006)
[20] Tan, H., See, H.: Strategic reorientation and responses to the Asian financial crisis: the case of the manufacturing industry in Singapore. Asia Pac. J. Manag. 21, 189–211 (2004)
[21] Varum, C.A., Rocha, V.C.: The effect of crises on firm exit and the moderating effect of firm size. Econ. Lett. 114, 94–97 (2012)

Appendix

Table 5 Partitioned rates (%) of business change in Italy by size class and region, 2007-2010

Growth Effect	Micro 1-9	Small 10-19	Medium 20-49	Large over 50
		Northwest		
Industry-mix	0.51	-2.61	-2.92	-2.54
Size	-0.25	3.93	6.29	0.73
Industry-size interaction	0.03	-1.13	-1.42	-0.80
Industry-region interaction	-0.07	0.24	0.25	0.24
Size-region interaction	0.11	-1.45	-2.96	-1.76
Other	0.00	0.15	1.18	0.06
Regional	-0.17	-0.17	-0.17	-0.17
		Northeast		

Industry-mix	0.29	-3.04	-3.68	-3.56
Size	-0.25	3.93	6.29	0.73
Industry-size interaction	0.03	-0.78	-1.56	-0.44
Industry-region interaction	-0.08	0.12	0.22	0.34
Size-region interaction	0.01	0.30	-0.64	-1.77
Other	-0.02	-0.95	-0.72	0.88
Regional	-0.71	-0.71	-0.71	-0.71
		Centre		
Industry-mix	0.35	-2.50	-2.66	-2.07
Size-mix	-0.25	3.93	6.29	0.73
Industry-size interaction	0.00	-0.90	-1.01	-0.73
Industry-region interaction	0.02	-0.10	-0.10	-0.04
Size-region interaction	0.07	-0.80	-2.47	0.03
Other	0.00	-0.37	0.23	0.05
Regional	0.02	0.02	0.02	0.02
		South		
Industry-mix	-0.41	-2.56	-2.99	-2.89
Size	-0.25	3.93	6.29	0.73
Industry-size interaction	-0.07	-1.19	-1.11	-0.33
Industry-region interaction	-0.15	-0.23	-0.47	-0.67
Size-region interaction	-0.15	1.22	5.30	2.39
Other	-0.04	0.28	-1.16	-0.33
Regional	0.62	0.62	0.62	0.62
		Islands		
Industry-mix	-0.43	-1.91	-2.25	-1.82
Size	-0.25	3.93	6.29	0.73
Industry-size interaction	-0.07	-0.81	-0.71	-0.25
Industry-region interaction	-0.21	0.08	0.01	-0.15
Size-region interactio	-0.26	3.46	6.03	5.15
Other	-0.06	-0.05	-0.76	0.01
Regional	0.97	0.97	0.97	0.97