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BATTLE SCARS.
NEW FIRMS' CAPITAL, LABOR, AND REVENUE GROWTH DURING THE DOUBLE-DIP RECESSION

by Francesco Manaresi* and Filippo Scoccianti*

Abstract

We study the growth dynamics of firms before and during the financial crisis. We find that firms born during the recession display lower growth over time in capital, employment and revenue, despite being more productive at entry than those born in normal times. We show that this pattern can be explained by credit market tightening, as measured by sector-level financial dependence and pre-crisis exposure to the interbank market. We argue that there may be two non-competing mechanisms that affect newborn firms during a financial crisis: firms enter with less capital and thus face tighter collateral constraints; and banks select projects that are less risky, at the expense of their future growth potential. We provide some evidence that both elements may play a role in explaining the observed pattern of firm dynamics.

JEL Classification: D22, D24.
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Contents

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1. Introduction

The financial crisis and the sovereign debt crisis induced a double-dip recession in several European countries between 2007 and 2013 (hencefort, "crisis period"). The slow recovery experienced by many countries in the aftermath of the recession renewed interest by scholars in the possible persistent effects of financial crises. Firm dynamics is one of the key channels that has been considered on this regard, particularly on its extensive margin: firm entry and exit. Fort et al. (2013) show how entry and exit dynamics are important to understand business-cycle fluctuations. Clementi and Palazzo (2016) argue that entry and exit amplify and propagate the effects of business-cycle fluctuations. Siemer (2014) show how large negative financial shocks may affect firm entry and, thus, result in a long-lasting recession caused by a "missing generation" of entrants.
While the evidence on the extensive margin is now considerably large (see Manaresi (2015) for evidence on the Italian case), very little is known regarding the post-entry dynamics of firms born during recessions. One notable exception is the work of Moreira (2016), who study the growth dynamics of cohorts born during non-financial U.S. recessions (from 1979 to 2003). She finds that these firms remain significantly smaller over their lifetime with respect to those born in boom periods. She argues that this persistent effect of recessions may be explained by demand frictions that must be overcome by firms in the early stages of their life (e.g., via reputation building, the creation of customer relationships, fidelization, etc.): recessionary firms have lower demand in their early years of life and, thus, will face stronger demand frictions over their life.

In this paper, we provide new evidence on the role of entry, exit, and cohort effects in explaining capital, employment, and revenues dynamics during the recent double-dip recession of Italy. For this purpose, we combine administrative data from several sources to obtain detailed information on all incorporated firms in Italy over the period 1993-2013. We start by providing graphical evidence that shows how entry and exit play a significant role in explaining aggregate drops in capital, employment, and revenues during the crisis period. We also show that young firms (that is, firms operating by less than 5 years) contribute significantly to the decline in input accumulation and production. This latter effect may signal the presence of a cohort effect similar to the one identified by Moreira (2016). To test for this hypothesis, we perform a regression analysis that identifies cohort effects controlling for year and age (using Deaton (1998) methodology), as well as for sector heterogeneity. Results confirm the presence of a significant cohort effect: firms born during the crisis period display significantly lower capital, employment, and revenues growth, relative both to other cohorts of the same age, and to other firms observed in the same year.[1]

We look for explanations of this persistent effect: first we check whether cohorts born during the crisis period are different at entry. Consistently with most of the existing evidence, we find that *at entry* these firms are both smaller and positively selected: that is, they display higher productivity than firms born during boom periods. Thus, selection at entry is unlikely to explain slower growth *after entry*.

[1] While our analysis ends in 2013, an increase in the productivity of new firms born in 2014 have been found using a dataset from the National Statistical Institute, which collects information on revenues, value added, and employment for all Italian firms, both incorporated and unincorporated (see Figure 15.4 of the Bank of Italy's Annual Report (2017)).

We then check the role of different alternative explanations that may account for this phenomenon. For this purpose, we construct sector-level measures of various frictions (computed before the recession) and we observe whether they can explain the cohort effects during the crisis period. We start with demand frictions, along the mechanism identified by Moreira (2016). Following her paper, we consider the sector-level average share of advertisement costs, and the index of product differentiation developed by Gollop and Monahan (1991). Surprisingly, we find an opposite result with respect to her study. The negative cohort effect during the crisis period is attenuated in sectors characterized by higher advertisement cost, or larger product differentiation (thus, where firms are likely to face stronger demand frictions). The difference between our results and Moreira's may stem from the type of recession that the two papers study: our analysis focuses on a recession triggered by a financial crisis, while Moreira (2016) looks at non-financial recessions. In a financial recession, when credit dries-up, firms need to rely on internal sources of finance. Product differentiation and advertisements generally allow firms to charge larger mark-ups on their goods: thus, firms facing larger demand frictions may also be the ones that are more able to hoard cash and, through it, better insulate from tighter credit conditions.

To understand whether access to credit is indeed driving the negative cohort effects, we consider two sector-level proxies of credit market frictions: the index of external finance dependence (De Serres et al. 2006), and the pre-crisis average exposure to the interbank market of banks lending to the sector (Cingano et al. 2015). We find that these proxies are significantly related to cohort effects.

In principle, credit market frictions may induce cohort effects for two non-competing reasons. First, because they may reduce new entrants initial capital level, which would result in less pledgeable collateral, lower access to credit, and, thus, slower growth afterwards (at least until these firms are able to save their way out of the credit constraints (Moll 2014)). Second, during the financial crisis banks may want to reduce their risk exposure by financing safer projects, despite their lower growth potential. Identifying these two different channels is relevant both from a scientific and a policy point of view. Indeed, if firms born during the crisis have inherently lower growth potential, policy support in their favor should be avoided; conversely, if these firms are just facing credit constraints, several policy tools (such as public guarantees) may foster their growth. We provide some preliminary evidence that both channels may be at work in explaining our results.

2. Facts about net employment, net capital and revenue growth

To perform our analysis we combine data from three sources. Data on average yearly employees for all Italian firms come from the National Social Security Institute. Revenues for all incorporated firms in Italy, as well as many other balance-sheet data, are collected by CERVEDGroup.[2] Finally, end-of-year capital stock for all

[2] Incorporated firms represent a large share of total firms in Italy: in 2013 they around 75 per cent of value added, 68 per cent of employees, and 72 per cent of total wage bill accrued to this group of firms. Their role in the economy has been growing steadily in the last 20 years: in 1993, they represented around 45 per cent of total employees. In our regression analysis, this trend is taken into consideration by the inclusion of year fixed effects.

incorporated firms in Italy has been calculated by Lenzu and Manaresi (2016) using the perpetual-inventory method, combining CERVEDGroup and National Accounts data.[3]

We focus on the private sector, excluding agriculture, finance, and utilities. The resulting dataset covers the period 1993-2013 and is composed of 6,888,246 observations (953,038 individual firms). Table 1 reports basic descriptive statistics for the variable of interests.

Table 1. Descriptive Statistics

	Mean	Std.Dev.	Median	Min	Max
Capital (000)	1544.749	42937.35	135.052	0	3.51e+07
Employees	17.729	159.26	5	0	57977.08
Revenues (000)	4579.739	84199.41	751	1	5.90e+07
Manufacturing (%)	28.02	44.9	0	0	1
Services (%)	58.46	49.3	1	0	1

Figures 1, 2 and 3 show the evolution of revenue, net employment and net capital growth for the entire economy from 2001 to 2013. For each year, the figures provide also the relative contributions to aggregate changes by four different types of firms: entrants, young incumbent (firms with up to 5 years of existence), old incumbents (firms with more than 5 years of existence) and exiters. Figure 1 shows that positive capital growth is generally driven by entrant firms (extensive margin) and capital accumulation among old firms (intensive margin). Conversely, in these years, the contribution of entrants and young firms is typically negative: in Section 7.1, we show that this is explained by a long-term decline in capital growth rates of new cohorts of manufacturing firms (which dates back to the second half of the 1990s). More interestingly for the goals of this analysis, the contribution of young firms to the negative capital growth experienced since 2010 by the economy is generally large, reaching 117 per cent of the decrease in 2012.Qualitative evidence that sectoral recomposition does not explain the drop in lower capital growth of young firms during the crisis can also be appreciated from Figure A1 and A2 in the Appendix, where we split firms between manufacturing and service sectors and we still observe such drop.

Also, Figure 1 shows how exiters have a relatively important role in explaining the drop in capital growth during the crisis which ranges from 14 per cent in 2010 to 30 per cent in 2013.[4]

Figure 2 provides the result of applying the same decomposition to net employment growth. Young incumbent firms and entrants together account for around 30 per cent of aggregate drop in net employment during the crisis. Yet, old incumbents have a very large role too, particularly in the first part of the crisis.

[3] In particular, sector-specific capital depreciation rates comes from National Accounts; while the firm-level age of capital is computed from CERVED data using amortizations and net fixed-assets. See the technical appendix in Lenzu and Manaresi (2016) for additional details.

[4] The finding that exiters start playing a role in the second part of the crisis is also remarkably consistent with evidence on firm demography from the Chamber of Commerce database (Telemaco). Telemaco shows a steady increase in exit rates since the second half of 2010, which has reverted only at the end of 2013.

Finally, Figure 3 shows results of the decomposition of net revenues growth. Being a flow variables, net revenues display much larger variability during the crisis, ranging from -15 per cent in 2009 to 10 per cent in 2010. Contrary to capital and, to a lesser extent, employment growth rates, all aggregate changes in revenues, both positive and negative, are mainly driven by old incumbent firms: their contribution to revenues growth almost always exceeds 75 per cent. Yet, notice how the relatively small contribution of entrants and young firms increases during slowdowns (such as years 2008-2009, and 2012-2013).[5]

According to the graphical evidence provided so far, young and entrant firms appear to be much more flexible in adjusting their inputs when faced with changing economic conditions, while older firms are less responsive and use revenues as their main margin of adjustment. This behavior is confirmed both in growing and in recessionary periods.

The strong procyclicality of inputs accumulation by entrants suggests the presence of a positive selection effect during the crisis in terms of measured productivity (both labor and Solow-residuals). Indeed, entrants in the aftermath of the crisis have been characterized by a considerably smaller amount of both labor and capital accumulation while their revenues proven more stable.

In addition, the fact that lower input accumulation persists also among younger cohorts, may imply that the crisis has negatively affected the growth prospects of entrant firms (despite their initial selection at entry): that is, the crisis entails significant "cohort effects".

3. Decomposition by cohorts and age

We start looking at visual evidence of cohort effects; i.e., whether firms born during the double-dip recession recorded persistently lower growth rates than firms born in previous periods. Figures 4, 5, and 6 plot (log) levels of capital, employment, and revenues by age for five cohorts of firms: those born before the crisis (2001, 2003, and 2005) and those born during it (2007, 2009, and 2011). A careful inspection of each of these figures, and a comparison between them, provides several intriguing results. First, and more generally, comparing Figure 4 and 5 we see that capital-to-labor ratios are increasing in firm age. Indeed, initially employment grows much more rapidly (by around 100 per cent, in terms of log-differences, in the first 2 years of life) than capital (which grows by around 60-70 per cent over the same period). The slower pace of capital accumulation may be attributed to credit market frictions that prevent firms from rapidly attaining their optimal capital-to-labor ratio.

Second, Figure 4 shows that cohorts born during the crisis are smaller at entry (age = 0) in terms of initial capital, while they are similar to firms born before the crisis in terms of initial employment and revenues – with the exception of the 2011 cohort.

Third, there seems to be a general downward trend in firm growth by age overtime. This decline is particularly strong for capital, and to a smaller degree also for employment and revenues.

Fourth, and most importantly for our analysis, the decline in life-time growth of capital, employment, and revenues is significantly stronger for cohorts born during the crisis. For instance, comparing the 2005 and 2007

[5] See Figures A5 and A6 for similar results obtained for manufacturing and service sectors.

cohorts, we can observe that the two were born with almost the same level of employment and revenues, but the 2007 cohort displayed at birth 5 per cent more capital than the 2005 one. At age 6 (the last year available), firms born in 2007 have around 20 per cent less capital, 10 per cent less employees, and 20 per cent less revenues than those born in 2005. This evidence is indeed suggestive of a possible cohort effect induced by the crisis.

These results may be driven by several confounding factors. For instance, sectoral recomposition could be driving both the long-term downward trend in firm growth and the effect of the crisis period. Also, the comparison of age profiles of different cohorts may be affected by specific year effects affecting different cohorts at different ages. To identify the cohort effects, simultaneously disentangling them from year, age, and sector effects, we have to resort to a regression-based cohort analysis.

4. Empirical Strategy

The study of the behavior of cohorts has a long-lasting tradition in sociology and human demography, where they are considered fundamental drivers of structural transformation of societies (Ryder 1965). The economic literature used cohort analysis in studies of inequality, health, and consumption behavior (Deaton and Paxson 1998,). The fundamental goal of a cohort analysis is to identify a cohort-specific effect, net of any age-specific and year-specific factor (Glenn 2005). A fundamental identification problem emerges because of the identity:

$$Age = Period - Cohort$$

Thus, the econometrician cannot simply regress a dependent variable *DV* measured in year *t* for cohort *c* of age *a* on a set of age dummies *A*, cohort dummies *C*, and time dummies *T*. That is, the model:

$$DV_{ct} = A\gamma + C\lambda + T\delta + \epsilon_{ct} \qquad (1)$$

does not allow to identify the cohort effects λ, because the design matrix is singular with 1 less the full rank.

Many methods have been developed in the past decades to solve this problem (see Glenn 2005 for a review). In this paper, we exploit the methodology discussed in Deaton (1998) based on a normalization of one of the three dimensions. To understand it, consider the identification problem in matrix formula:

$$As_y = Ts_t - Cs_c$$

where the *s* vectors are sequences {0,1,2,3,…} of length given by the corresponding matrix that premultiplies them. To solve the identification problem, we can replace the vector of year effects in (1) with $\tilde{\delta} = \delta + \kappa s_t$, where κ is a constant scalar. The normalization imposes $\sum_{c=1}^{C} \delta_c = 0$ and $\sum_{t=1}^{T} t\delta_t = 0$, so that year effects identify cyclical fluctuations, while long-term changes in the dependent variable are captured by age and cohort effects.[6]

In our final empirical model, we also control for sector effects, as changes sector composition may in principle confound cohort effects. We do so, by including a set of 2-digits NACE rev. 1.1 sector dummies *S*.

We thus estimate

$$DV_{sct} = A\gamma + C\lambda + T\tilde{\delta} + S\theta + \epsilon_{sct} \qquad (2)$$

As dependent variables, we consider the post-entry growth rates in input accumulation (capital and employment), output (revenues), and in labor productivity (value-added over employment).[7] We allow the error term to display serial correlation at the sector level.

[6] Practically, normalization is accomplished by transforming any δ_t with$t \in [3, \ldots, T]$ into $\tilde{\delta}_t = \delta_t - [(t-1)\delta_2 - (t-2)\delta_1]$ (see Deaton 1998, Section 2.7). Moreira (2015) chooses to normalize cohort effects, rather than year ones, because she is interested in identifying the role of cohorts in explaining business cycles. Nonetheless, results provided in Figure A7 in the Appendix shows that all result are confirmed using Moreira (2015) approach. Finally, notice that normalization of age effects should *not* be performed in general, as age-specific growth rates clearly do not reverse to the mean overtime (see section 7.2).

[7] Year-on-year growth rates are approximated by log-differences.

5. Baseline results

Figure 7 plots the cohort fixed effects ($\boldsymbol{\lambda}$) estimated from model (2) on capital, employment, and revenue growths. Our aim is to compare the growth behavior of firms born before and after the crisis, hence in what follows we focus on cohorts born in between 2001 and 2012, normalizing the fixed effect of the last cohort to zero. All the patterns that we will comment in the text are statistically significant at p<0.01, unless differently specified.

In the years leading up to the crisis revenues and employment growth was rather stable, while capital growth was already slowing down (see Section 7.1 for a discussion of the long-term trends). Figure 7 shows that capital accumulation kept declining during the crisis, except for a partial recovery in 2009-10, which coincided with the temporary improvement in overall economic conditions experienced in those two years. The decline accelerated from 2011 onwards: capital growth rates of the 2012 cohort are estimated to be more than 6 p.p. lower than the one of the 2006 cohort. Also revenues and employment growth declined for cohorts born during the crisis, even if to a smaller degree than for capital. For the 2012 cohort, for instance, year-on-year revenue and employment growth rates are around 5 p.p. and 4 p.p. smaller than for the 2006 cohort. In sum, model (2) provides evidence of the presence of a rather strong cohort effect on both inputs accumulation and revenues growth during the crisis. Notice how the growth rate of labor productivity remained substantially stable during the period. Actually, the slight improvement in input accumulation for cohorts born in 2009 and 2010 resulted in a significantly lower productivity growth.

Figures 8 and 9 show results for manufacturing and services sectors, respectively. A significant drop in cohort-specific growth rates can be appreciated in both sectors. In manufacturing, in particular, the drop seems more marked: around 6-8 p.p. from 2006 to 2012 for capital, employment, and revenues.

These results, obtained controlling for age, year, and sector fixed-effects, are broadly in line with the graphical results obtained in Section 2 without controls, expect for a somewhat stronger decline in net employment growth for the 2007 cohort: the drop in factor accumulation and revenues observed during the double-dip recession accrues mostly to cohorts born in this period. Comparatively, previously born firms have suffered less during the same period.

6. Possible channels

One crucial question is whether growth rates of cohorts born in recession will remain lower *after* the recession or, conversely, whether they will “catch-up” during the recovery period. To answer this question it is crucial to understand which economic mechanisms may explain a lower factor accumulation over as much as 6 years (for the 2007 cohort). In the following paragraph we test for alternative explanations as of why, during the crisis, firms that started their lifetime being more efficient, at least in a static term, ended up growing less.

First of all, firms born during the crisis may be different at entry with respect to those born before it. They may be smaller and/or less productive and, thus, display lower growth later on in their life. To study how cohorts born during the double-dip recession differ at entry, we regress their size in the year of birth (in terms of (log) employment, capital, and revenues) over a set of cohort dummies, controlling for sector fixed effects. More formally, for all firms, observed in their year of entry *c*, we estimate:

$$Size_{ic} = C\pi + S\kappa + \epsilon_{ic}$$

where *C* and *S* are, respectively, a vector of cohort and sector fixed effects, and π and κ are their corresponding vectors of coefficients.

Figure 10 plots the fixed effects estimated for cohorts 2001-2012, where cohort 2012 has been normalized to 0. In the first part of the recessionary period (2007-2009), employment at entry remained substantially stable at levels comparable to the pre-crisis period. Still in 2010, employment at birth was in between the levels of 2005 and 2006. Similarly, changes in revenues at entry remained substantially stable at least until 2010. Also value-added displays a similar trend: as a result, labor productivity (value-added over employees) has remained unchanged over the period. Conversely, average capital at entry has been reducing steadily since 2007. Firms starting their business in 2012 had a level of capital at entry around 60 per cent smaller than their counterparts born before the crisis. Combining together these facts, we can infer that total factor productivity of entrants has significantly increased since 2009. This increase in firms' efficiency at entry is a common finding in the literature (e.g., Ataf and Saffie 2015), often interpreted as a positive selection effect during downturns or, as in the Italian case, a prolonged period of crisis. However, as discussed in the previous Section, this measured increase in static efficiency at entry didn't translate into a higher growth of inputs or revenues over firms' lifetime.

Since measured productivity at entry of cohorts born during the crisis cannot account for their slower growth afterward, we have tested the relevance of alternative channels. One of these relates to the factthat younger firms may have faced severe and protracted demand constraints during the crisis. As Foster et al. (2015) show, one of the reason for which new businesses start operating with a small scale is that their demand is relatively low at entry due to informational, reputational, or other demand-side frictions. Firms overcome such frictions overtime, through a process of "learning about demand", based on repeated customer interactions, marketing, etc. During a recession, though, demand is lower and it may be harder for firms to learn and grow. Indeed, demand-side constraints are found by Moreira (2015) to explain the lower growth of cohorts born in past U.S. recessions (those from early 1980s to 2001). To test whether demand played a significant role in explaining cohort effects in the Italian crisis, we follow Moreira and identify two different proxies for the relevance of these demand frictions: the share of advertising expenditure on total revenues (averaged at the 2-digit sector level over the period 1985-2006),[8] and the generalized index of product diversification of Gollop and Monahan (1991). The latter is a synthetic index that takes into account product number, distribution of production shares, and dissimilarity of products (as measured by input shares) and was computed at the 2-digit sector level for manufacturing firms only by Gollop and Monahan using historical U.S. data. Both indicators should proxy for the importance of reputation and product market substitutability across sectors (Moreira 2015).

[8] This information is available only for a subsample of around 50K CERVED firms (the Company Account Data-System Sample, so-called CEBIL). We implicitly assume that sample selection of CEBIL is not correlated with the sectoral distribution of advertising shares.

We consider biannual cohort dummies, and we interact each of these dummies with a dummy = 1 if a firm belongs to a sector with higher-than-median level of the proxy for demand friction.[9] We thus estimate:

$$DV_{sct} = A\gamma + T\delta + S\theta + \alpha F + \bar{C}\lambda + \bar{C}F\sigma + \epsilon_{sct} \qquad (3)$$

where *A*, *T*, and *S*, are age, year, and sector dummies; *F* is a dummy if sector *s* has higher-than-median level of the demand friction, and $\bar{C}$ is a biannual cohort dummy. Notice that, because we are averaging cohorts over two years, we no longer need to normalize year fixed-effects as in (2). We are interested in coefficients λ (the cohort effects for firms facing less demand friction) and $(\lambda + \sigma)$ (the cohort effects in sectors with larger demand frictions). In the rest of the analysis, to ease the discussion, we focus on revenues as a single measure of firm size. Results for capital and employment are substantially similar and available from the authors upon request.[10]

Figure 11 plots the results, focusing on cohorts 2001-2012. First, it is reassuring that, using both proxies, the pre-crisis pattern is similar among firms facing more and less frictions. Secondly, during the crisis, sectors facing *lower* demand frictions had stronger cohort effects. This result is in striking contrast to what Moreira (2015) finds for historical U.S. recessions. One important distinction of our study, is that we focus on a financial crisis, while Moreira studied non-financial recessions. This has important implications: product differentiation and advertisement allow firms to charge higher mark-ups. Now, if the double-dip crisis reduced firm access to external finance, firms that were better able to raise cash-flow from their products may have also be less vulnerable to the credit tightening that occurred during the crisis.

This considerations induce us to look at the role of credit market frictions. Notably, we focus on financial dependence and the severity of the credit crunch, and we identify 2-digit sector-level proxies for both. For financial dependence, we use the index developed by De Serres et al. (2006); while for the severity of the credit crunch we compute the average exposure to the interbank market of banks lending to the sector in 2006 (i.e., before the crisis). The index of De Serres et al. (2006) is based on the Rajan and Zingales (1998) methodology and is computed on U.S. data for both manufacturing and service sectors.[11] The proxy for the severity of credit crunch is based on Cingano et al. (2015), who show that bank exposure to the interbank market significantly affected the ability of banks to lend during the crisis, inducing a significant drop in firm investments.

Figure 12 shows the result of estimating model (3) using, alternatively, the two indicators of credit market frictions. The top panel shows that sectors characterized by higher-than-median financial dependence reported bigger negative cohort effects, particularly for firms born in the later part of the crisis (2009 to 2012). The bottom panel shows that sectors more strongly affected by the credit crunch had a significantly stronger cohort effect since 2007. Both panels also show that, before the crisis, cohort effects did not differ much on the basis of the proxies of credit market frictions.

[9] Biannual grouping of firms is done solely to obtain less noisy estimates, and to ease the presentation of results. All results are robust to using yearly cohort dummies as in model (2).

[10] Demand frictions are, if anything, less relevant for capital and employment than for revenues. Credit market frictions explain sector-level heterogeneity in the drop of both capital and employment growth similarly to revenues.

[11] To compute the dependence of a sector, De Serres et al. (2006) use data on U.S. listed firms. A firm's dependence on external finance is defined as its capital expenditure minus internal funds (cash flow from operations) divided by capital expenditure.

To sum up, results so far show that credit market frictions are likely to induce a persistent lower growth of firms born during the financial crisis. But how exactly this can be possible? We argue that there are two non-competing potential mechanisms that may explain this persistency.

A first one is the "*pledgeability channel*". Because of lower credit availability, firms start with lower capital levels (as depicted in Figure 8). This results in lower collateral to pledge for additional credit: firms may, thus, face tighter credit constraints and slower growth in subsequent years (Bassetto et al. 2015).

A second mechanism is the "*flight-to-safety channel*". Because of the impact of the financial shock on bank balance-sheets, banks may become more risk-averse in their lending. Projects that have lower variability in returns would thus be more likely to get financed relative to the pre-crisis period, even at the expenses of forgiving higher average returns from riskier firms. As a result of this, businesses started during the crisis would display, coeteris paribus, lower growth rates overtime.

Identifying the relative role of the pledgeability and the flight-to-safety channels is not just a scientific question: the two mechanisms have different implications both in terms of policy and in terms of the potential recovery after the crisis. If firms born during the crisis don't grow just because they lack collateral, specific policies aimed at providing public guarantees for young firms may help them. Even in the absence of such policies, the most productive of them may be able to "save their way out of credit constraints" (Moll 2014) during the recovery, though this process may be possibly long. Conversely, changes in banks attitude towards risk-taking affect the type of entrepreneurial projects that are implemented by each cohort. Policy interventions in favor of these less-profitable firms may thus be highly inefficient. Also, their recovery potential after the crisis may be considerably lower with respect to other cohorts of firms.

However, disentangling the relative role of risk and pledgeability channels is a daunting empirical task. At least two identification problems are present: the first is that pledgeability of assets and riskiness of investment are in fact two intertwined elements; the second is that the analysis relies on identifying something which is very hard to observe, that is the "growth potential" of new entrepreneurial projects. Although fully addressing these identification issues goes well beyond the scope of the present paper, we provide here some suggestive evidence that both channels may have being at play.

Using firm balance-sheet data, we compute a sector-level proxy of pledgeability: the average share of tangible assets over total assets. We also compute a sector-level proxy of investment riskiness: the average yearly coefficient of variation of revenue growth. Both proxies are measured over the period 1993-2006 (i.e., from the first year of availability to the last year before the financial crisis). We then distinguish four groups of firms, defined according to whether they belong to sectors with above-/below-median pledgeability and riskiness. We then estimate biannual cohort dummies for these four groups using model (3). Results, plotted in Figure 13, show that most of the negative cohort effect during the crisis accrues to firms having *both* low pledgeability and high riskiness.

In search for additional evidence of the presence of the risk channel, we also estimate model (2) using the coefficient of variation of revenues growth as the dependent variable. Indeed, if banks financed less risky new projects during the crisis, we would expect the coefficient of variation to be smaller for cohorts born during the crisis period.[12] Indeed, Figure A8 identifies such a decline at least for cohorts born from 2010 onwards. Notice however, that this is a necessary but not sufficient condition for the risk channel to be present. Indeed, it is not a priori clear whether (and how) the pledgeability channel would also impact the distribution of revenues growth.

7. Age Effects

So far, our discussion has been mostly focused on cohort effects. However, model (2) also allows us to identify how input accumulation and revenue growth change over the age distribution of firms. For what concerns employment growth, there is ample evidence in the literature of a concave and steep decline in employment growth by age (see Haltiwanger et al. (2014), Geurts and Van Biesebrock (2014), Manaresi (2015)); on the contrary, the patterns for capital and revenue growth rates have never been studied before. Figures 14 reports the age profile of input accumulation and revenue growth for the whole economy (Figures A12 and A13 show similar patterns for manufacturing and services, respectively). The Figure shows how employment growth is much larger during the first two-three years of age, while it remains substantially smaller afterwards. Conversely, capital displays a much more prolonged growth, which last at least up to eight years of age. The slower pace at which capital reaches its optimal level can be considered evidence of credit market frictions (possibly linked to the fact that younger firms are more opaque) and adjustment costs. Revenue growth over the age distribution is positioned somehow in between employment and capital: it does not have the sudden increase at age 1 of employment, while it is ultimately flatter than capital.

8. Conclusion

In this paper, we studied firm dynamics during the recent Italian double-dip recession. We have depicted the relative contribution of entry, exit, and incumbents (distinguishing between young and old ones) to aggregate changes in input accumulation and output growth. Results points to the presence of a significant “cohort effect”, in that firms born during the recession display low growth rates of capital, employment, and revenues. Results of a regression that controls for confounding age, year, and sector effects confirm this result.

The cohort effect of the recession cannot be explained by demand frictions, such as those that have been recently found to play a role in cohort effects during U.S. historical recessions. Conversely, they seem to be linked to the tightening of credit market frictions during the recent financial crisis. In principle, two channels may link a credit market tightening with a negative cohort effect: reduced pledgeability of assets for newborn firms, or bank selection of less risky projects (which have also lower growth potential). Preliminary evidence seem to point to both channels being present during the financial crisis.

[12] We thank Francesca Lotti for this suggestion.

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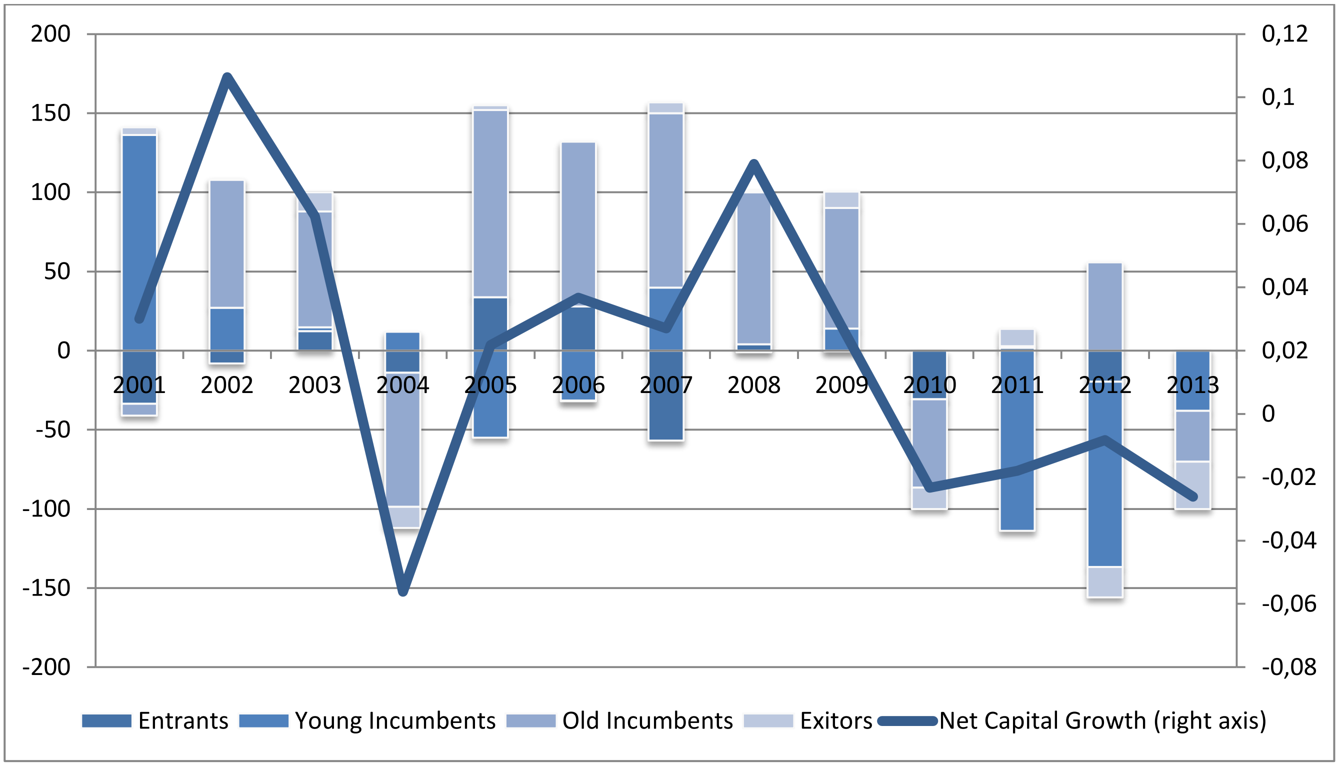
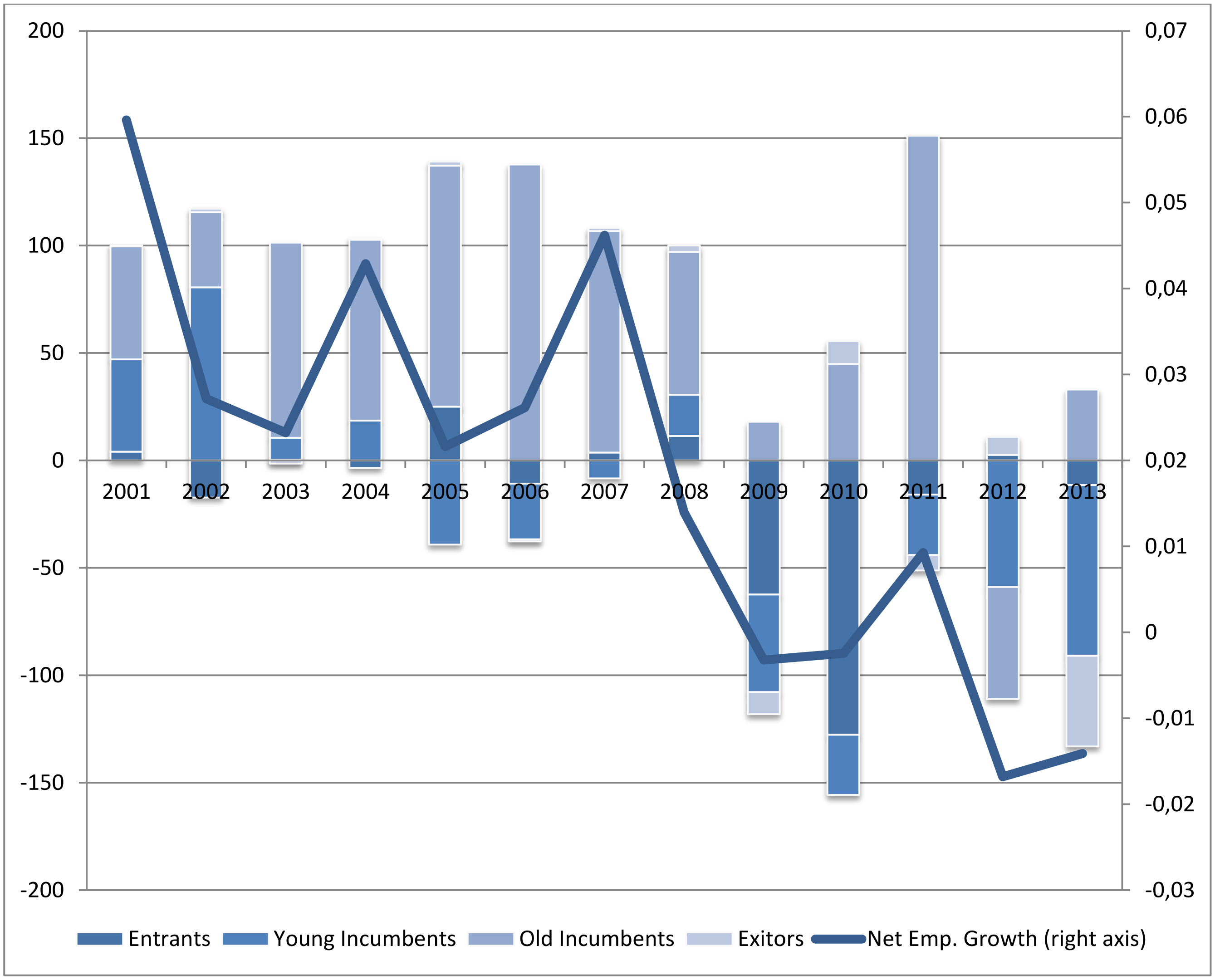
Figures

Figure 1 – Net Capital Growth and Its Contributors – All Economy – 2001-2013



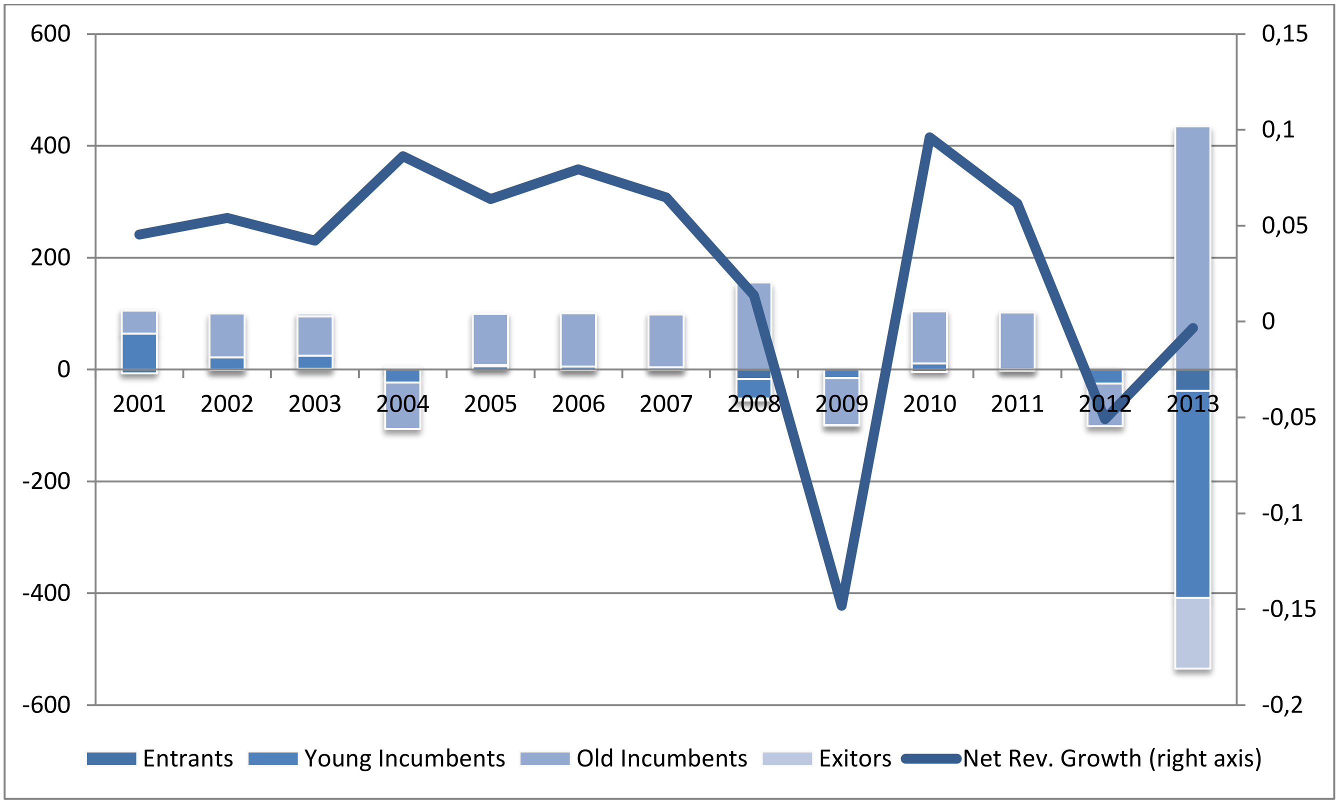
Source: Authors' elaborations on CERVED and INPS data.

Figure 2 – Net Employment Growth and Its Contributors – All Economy – 2001-2013



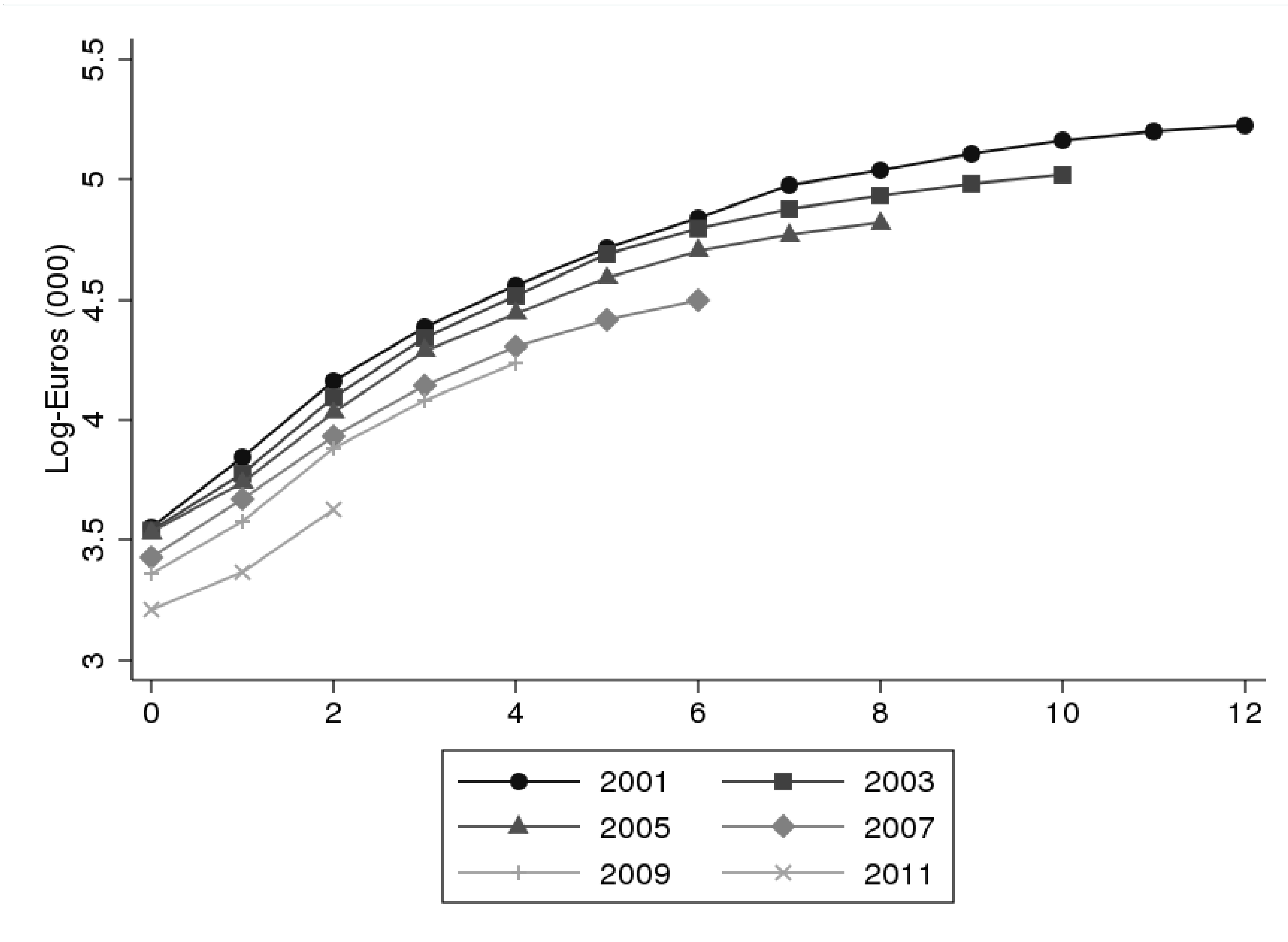
Source: Authors' elaborations on CERVED and INPS data.

Figure 3 – Net Revenues Growth and Its Contributors – All Economy – 2001-2013



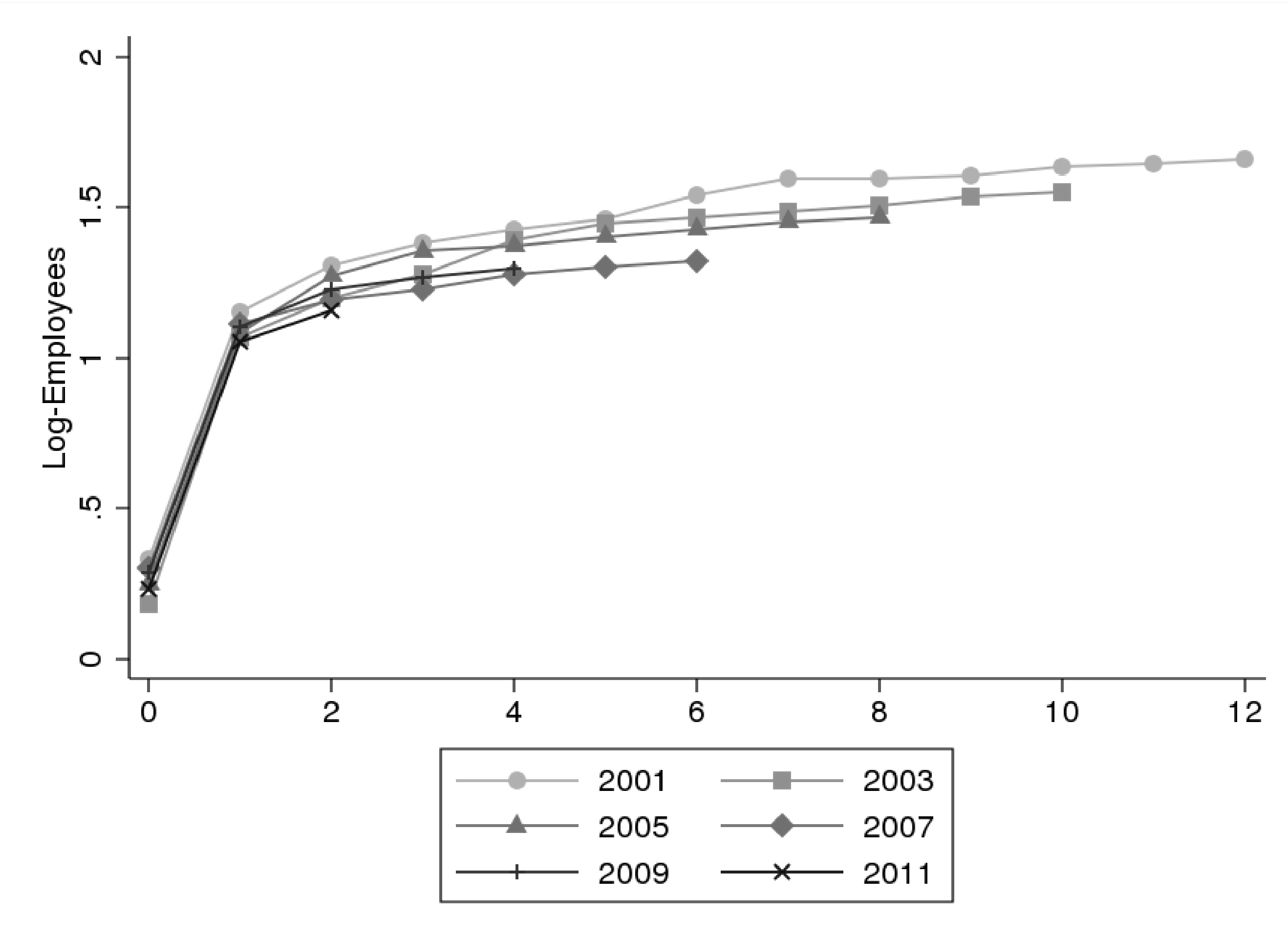
Source: Authors' elaborations on CERVED and INPS data.

Figure 4 – Evolution of (log) Capital by Cohorts



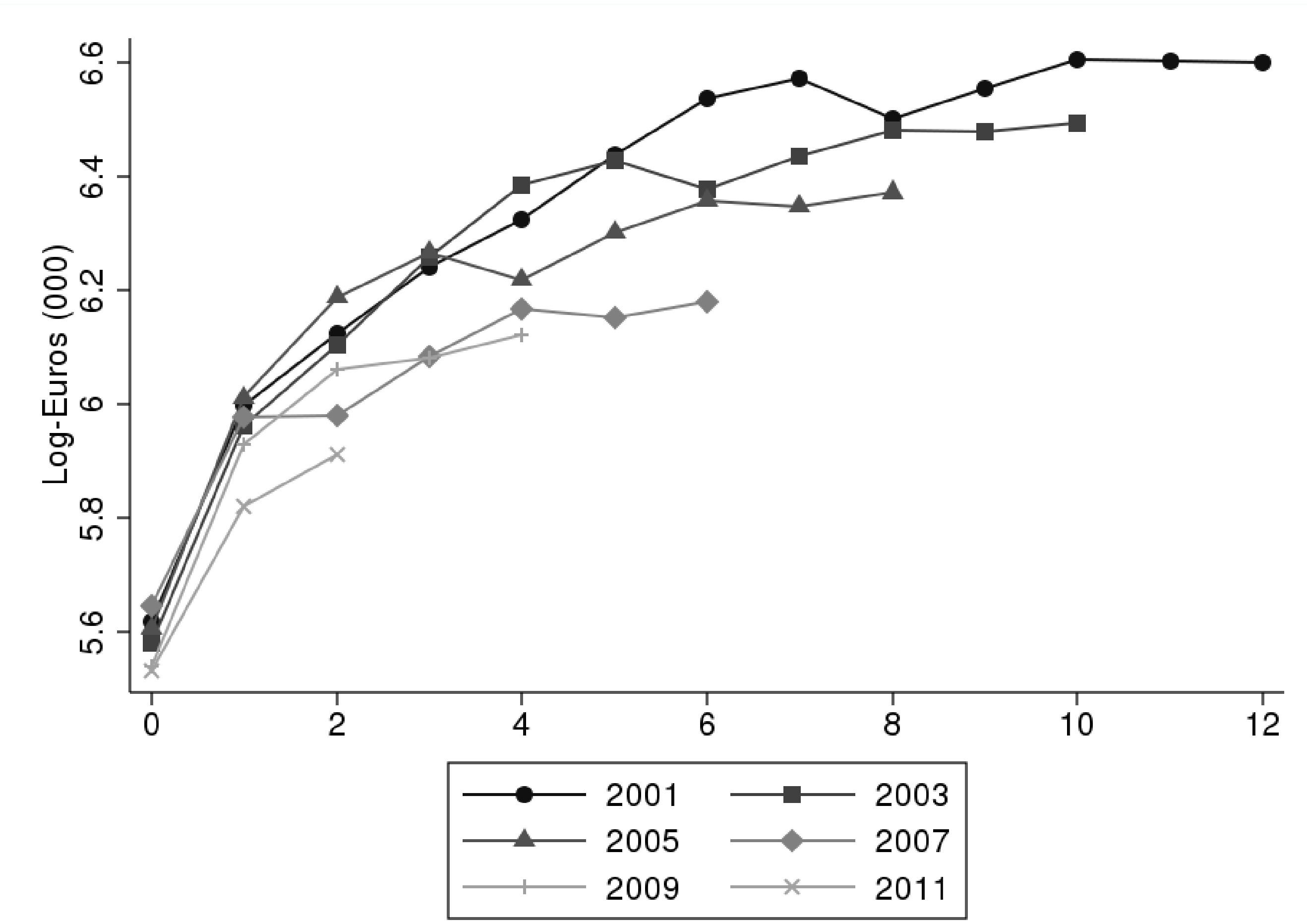
Source: Authors' elaborations on CERVED and INPS data.

Figure 5 – Evolution of (log) Employment by Cohorts



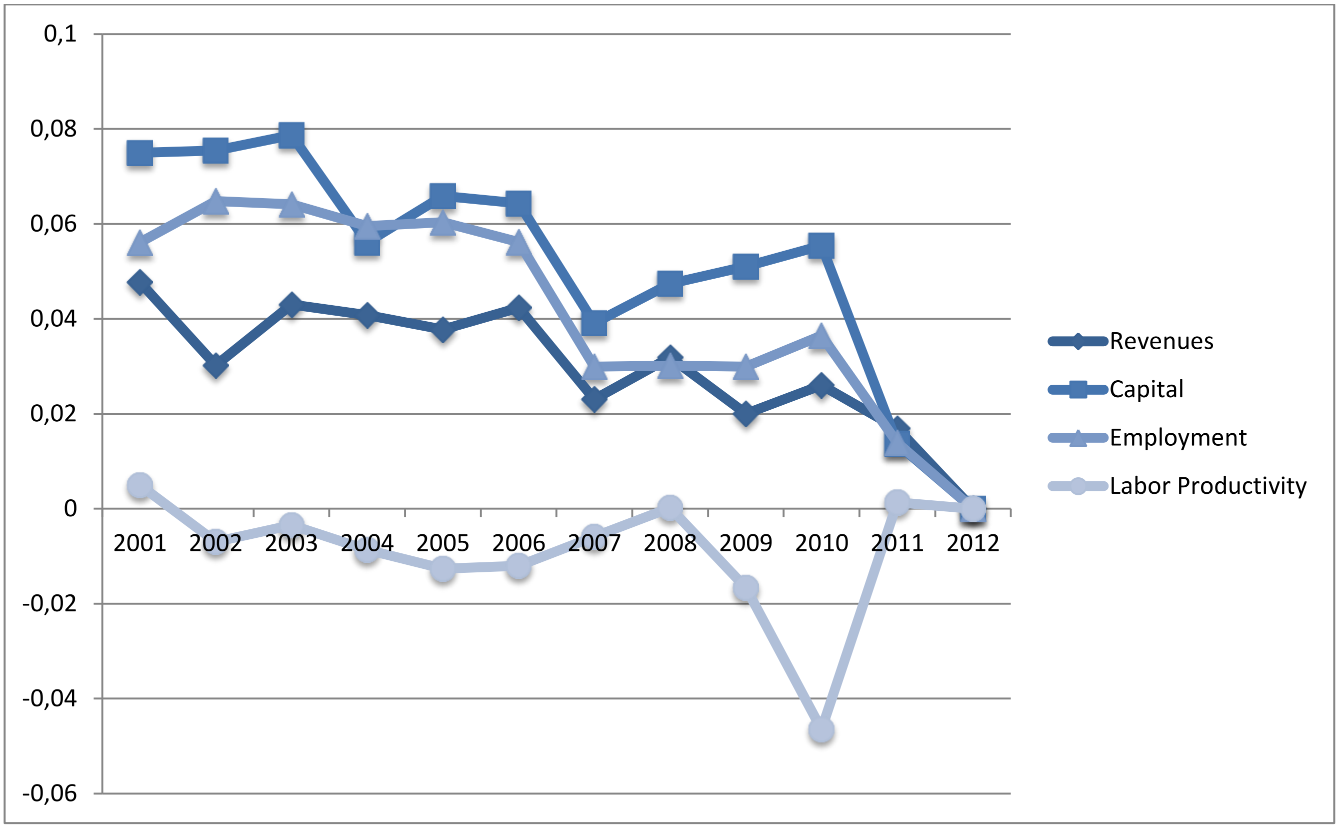
Source: Authors' elaborations on CERVED and INPS data.

<u>Figure 6 – Evolution of (log) Revenues by Cohorts</u>



Source: Authors' elaborations on CERVED and INPS data.

Figure 7 – Cohort Effects on Revenues, Capital, and Employment Growth – All Economy – 2001-2012

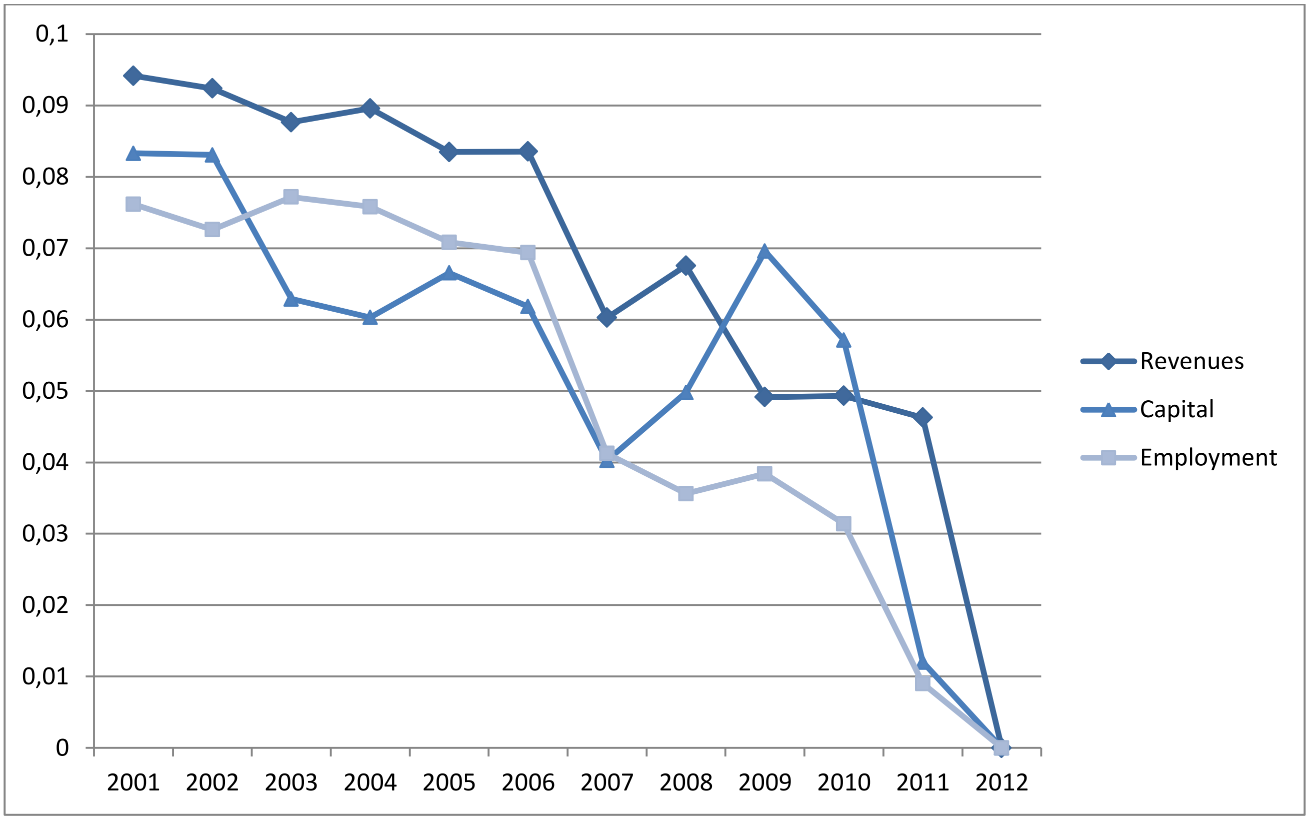


Source: Authors' elaborations on CERVED and INPS data. The figure plots cohort coefficients obtained by estimating model:

$$DV_{sct} = A\gamma + C\lambda + T\tilde{\delta} + S\theta + \epsilon_{sct}$$

Where DV is, alternatively, year-on-year revenue, capital, employment, or productivity growth rates. The 2012 cohort is normalized to zero.

Figure 8 – Cohort Effects on Revenues, Capital, and Employment Growth – Manufacturing – 2001-2012

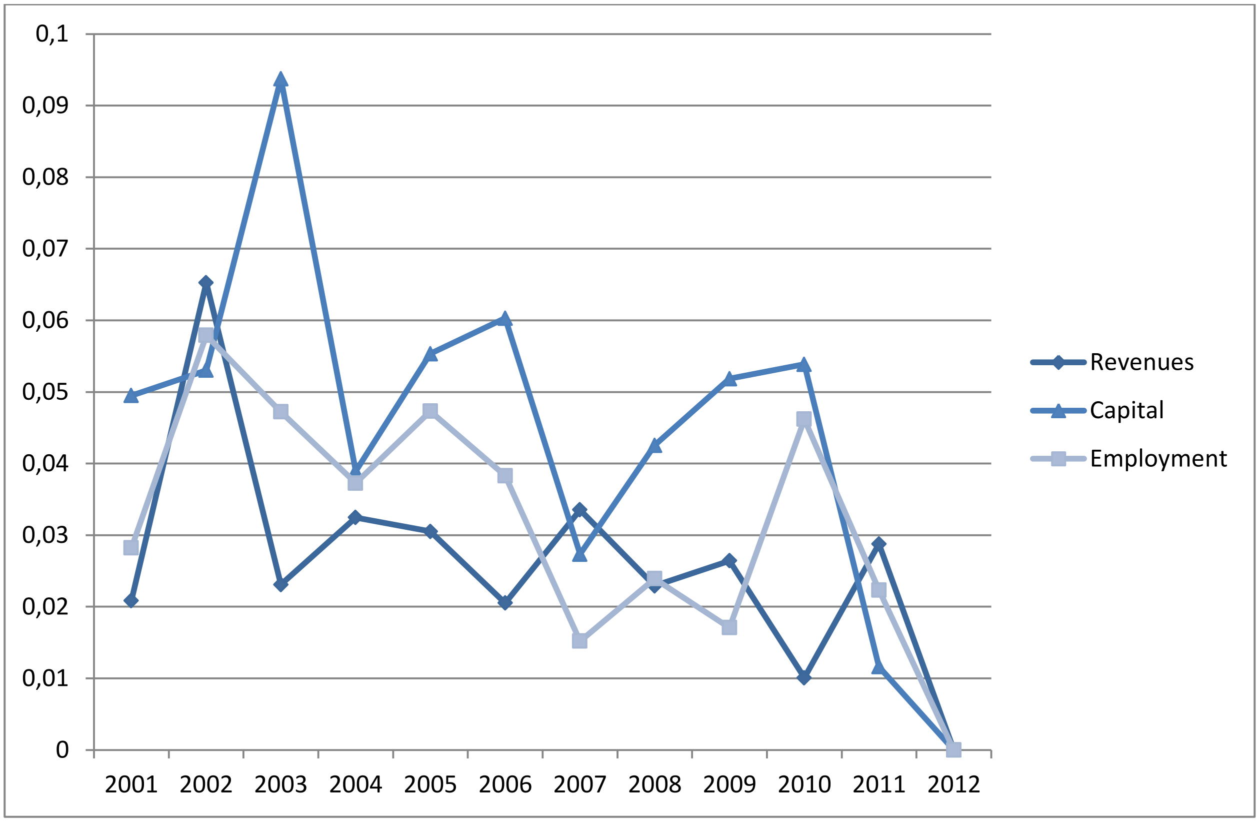


Source: Authors' elaborations on CERVED and INPS data. The figure plots cohort coefficients obtained by estimating model:

$$DV_{sct} = A\gamma + C\lambda + T\tilde{\delta} + S\theta + \epsilon_{sct}$$

Where DV is, alternatively, year-on-year revenue, capital, or employment growth rates. The 2012 cohort is normalized to zero.

Figure 9 – Cohort Effects on Revenues, Capital, and Employment Growth – Services – 2001-2012

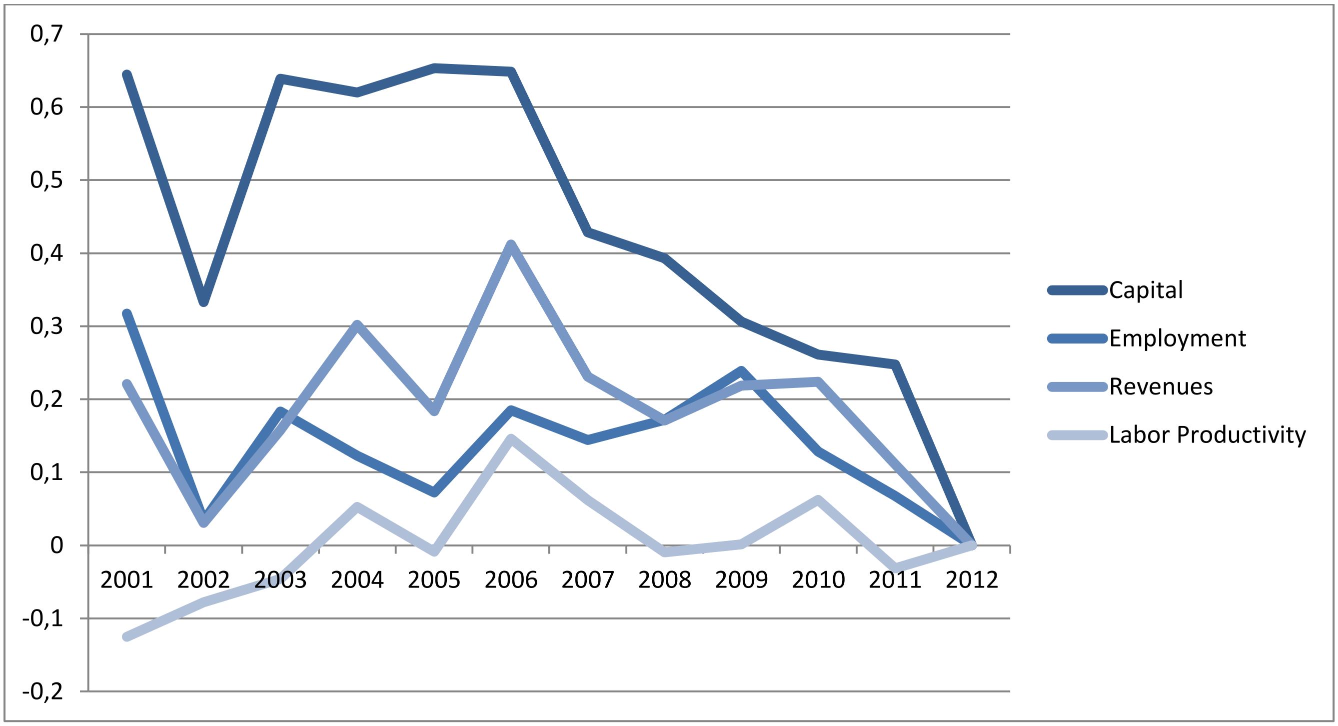


Source: Authors' elaborations on CERVED and INPS data. The figure plots cohort coefficients obtained by estimating model:

$$DV_{sct} = A\gamma + C\lambda + T\tilde{\delta} + S\theta + \epsilon_{sct}$$

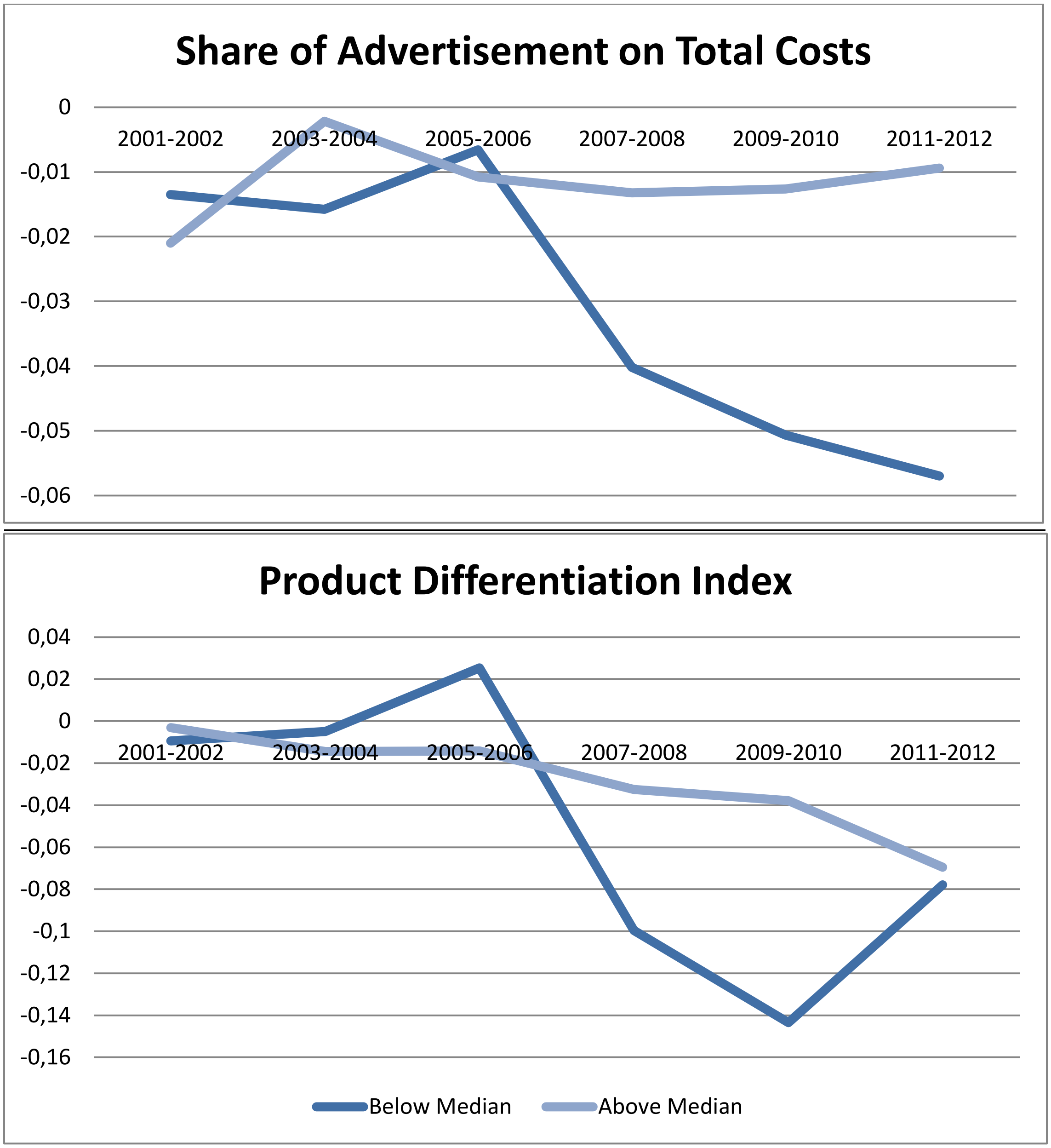
Where DV is, alternatively, year-on-year revenue, capital, or employment growth rates. The 2012 cohort is normalized to zero.

Figure 10 – Size at Entry of Cohorts – (log) Capital, Employment, and Labor Productivity – 2001-2012



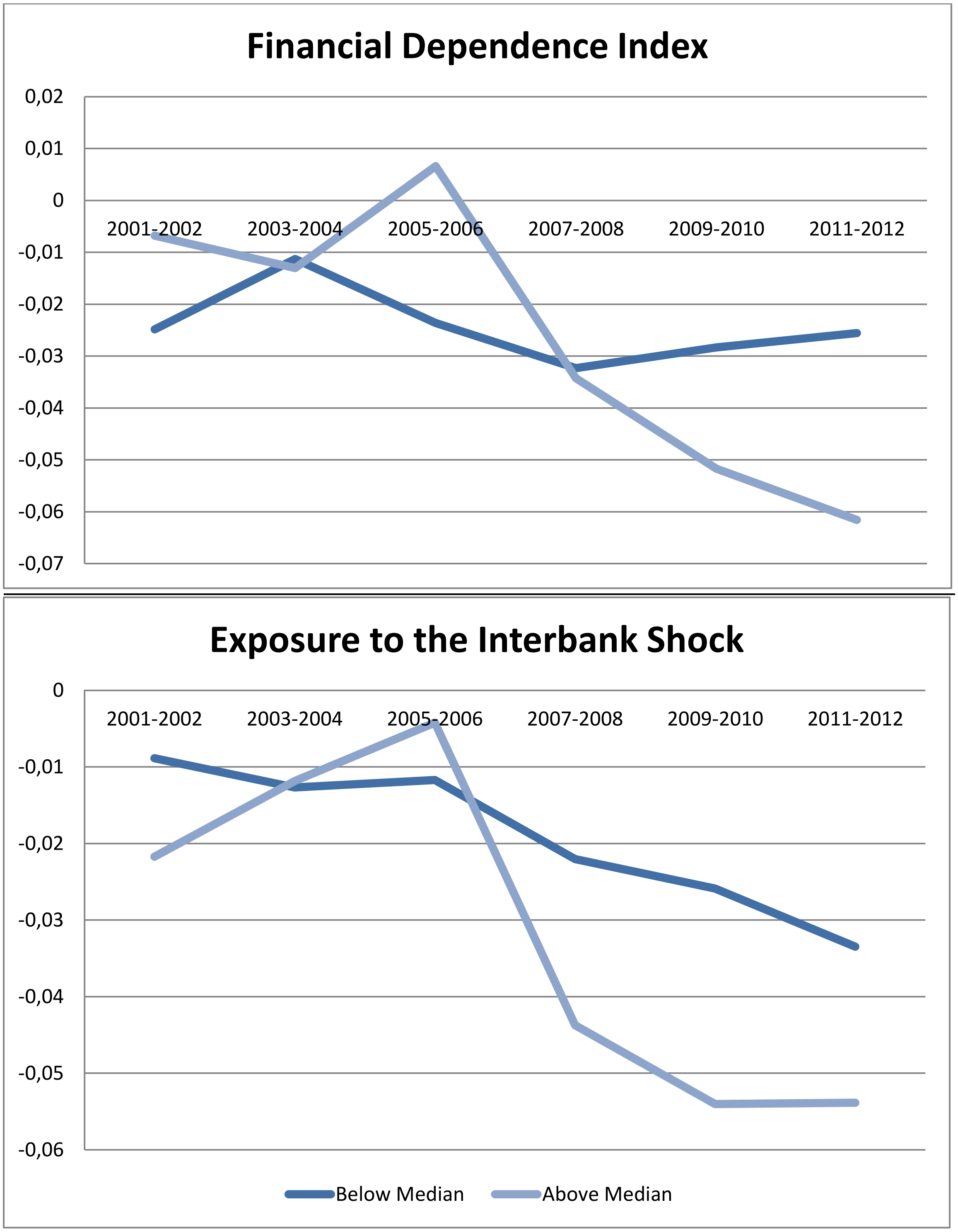
Source: Authors' elaborations on CERVED and INPS data. The figure plots cohort coefficients obtained by regressing capital, employment, revenues, or labor productivity at entry on year dummies. The 2012 cohort is normalized to zero.

Figure 11 – Cohort Effects on Revenues Growth, by Proxies of Demand Frictions – 2001-2012



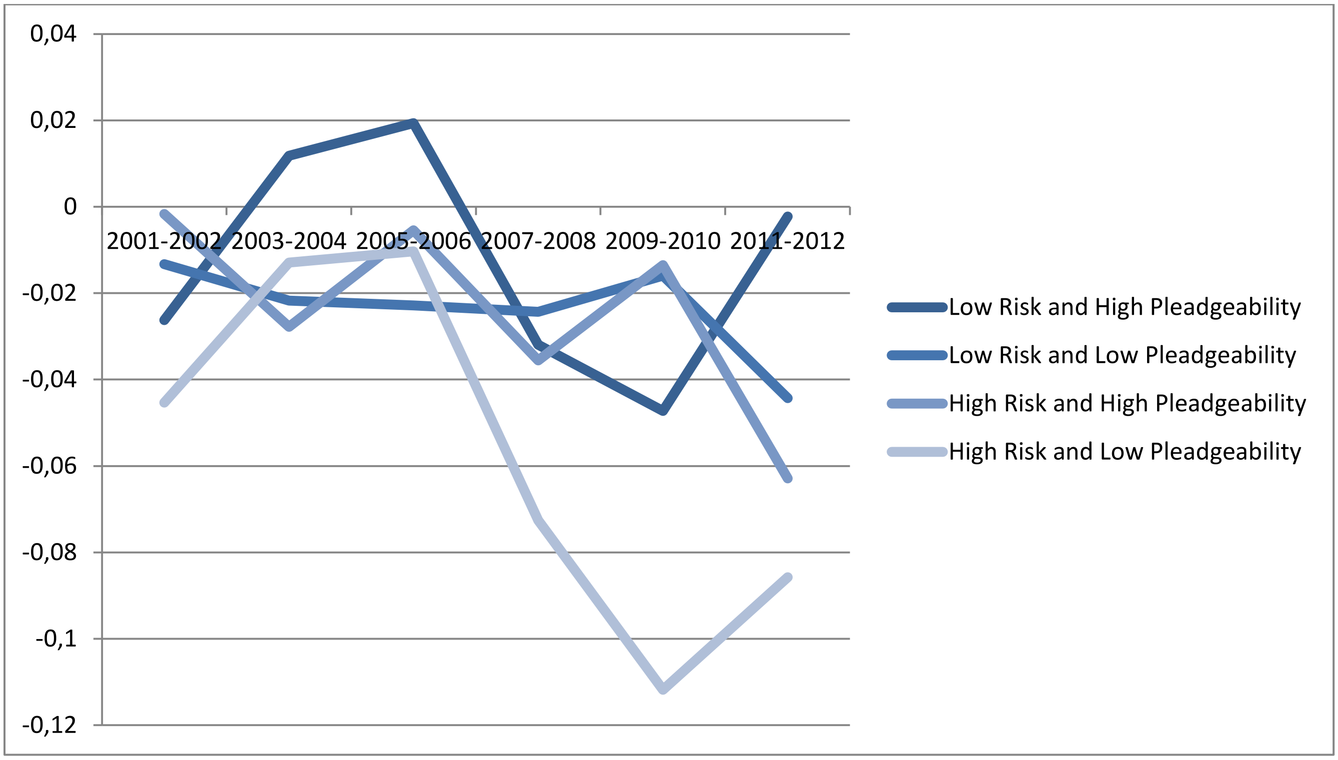
Source: The figure plots cohort coefficients obtained by estimating model (3) in the paper on revenues growth.

Figure 12 – Cohort Effects on Revenues Growth, by Proxies of Credit Frictions – 2001-2012



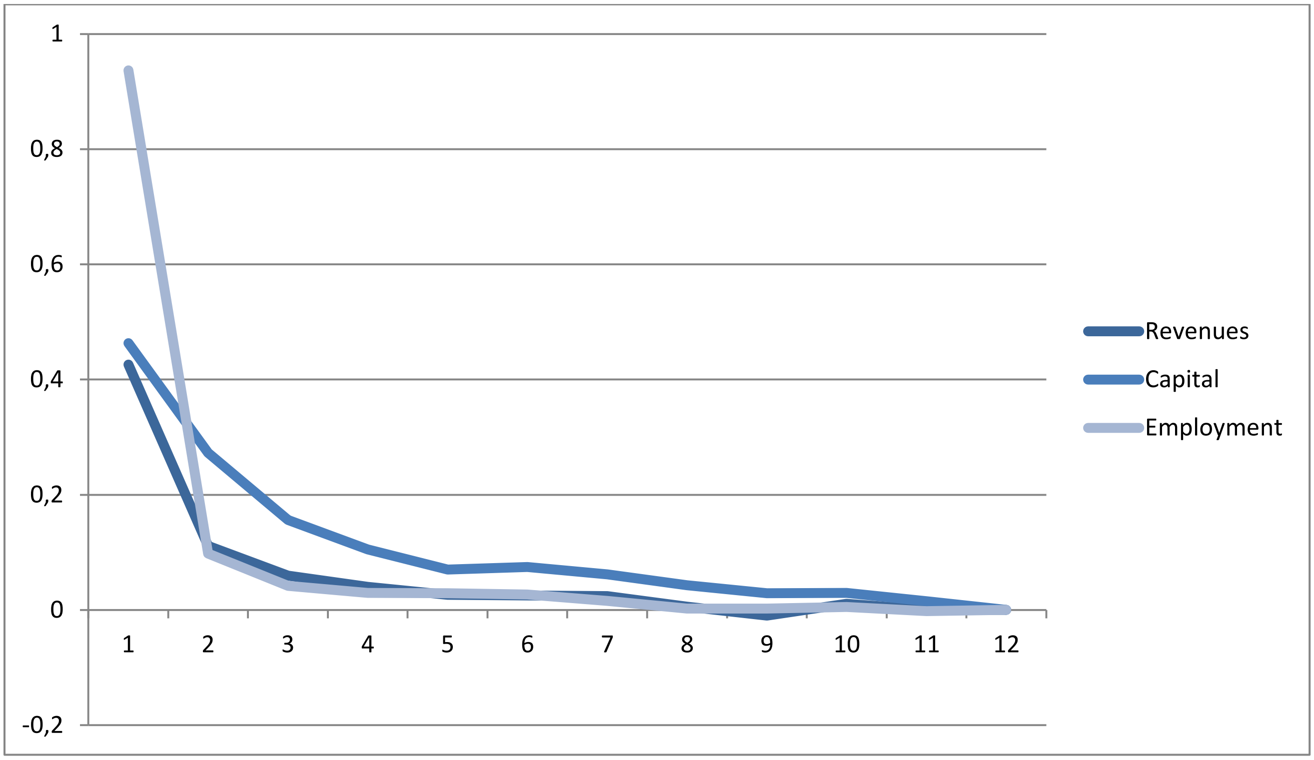
Source: The figure plots cohort coefficients obtained by estimating model (3) in the paper on revenues growth.

Figure 13 – Cohort Effects on Revenues Growth, by Proxies of Pleadgeability of Assets and Riskiness of Projects



Source: The figure plots cohort coefficients obtained by estimating model (3) in the paper on revenues growth.

Figure 14 – Age Effects on Revenues, Capital, Employment Yearly Growth Rates – All Economy

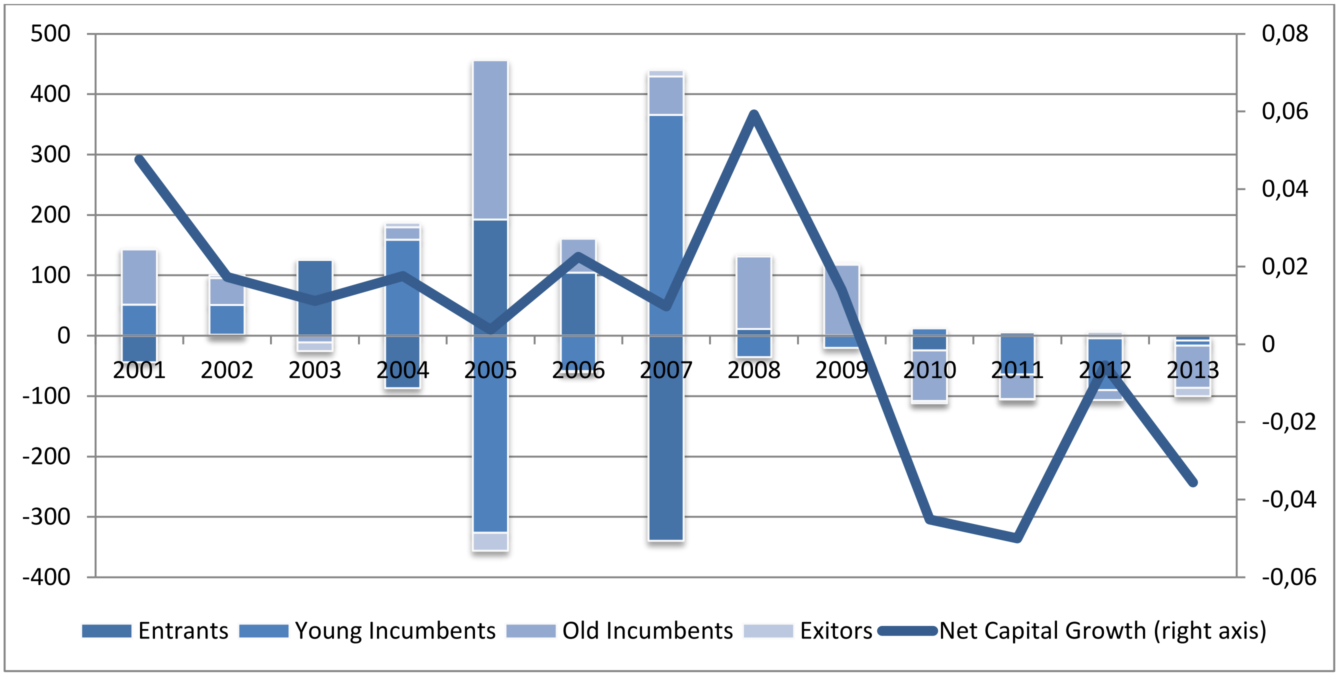


Source: Authors' elaborations on CERVED and INPS data. The figure plots age coefficients obtained by estimating model:

$$DV_{sct} = A\gamma + C\lambda + T\tilde{\delta} + S\theta + \epsilon_{sct}$$

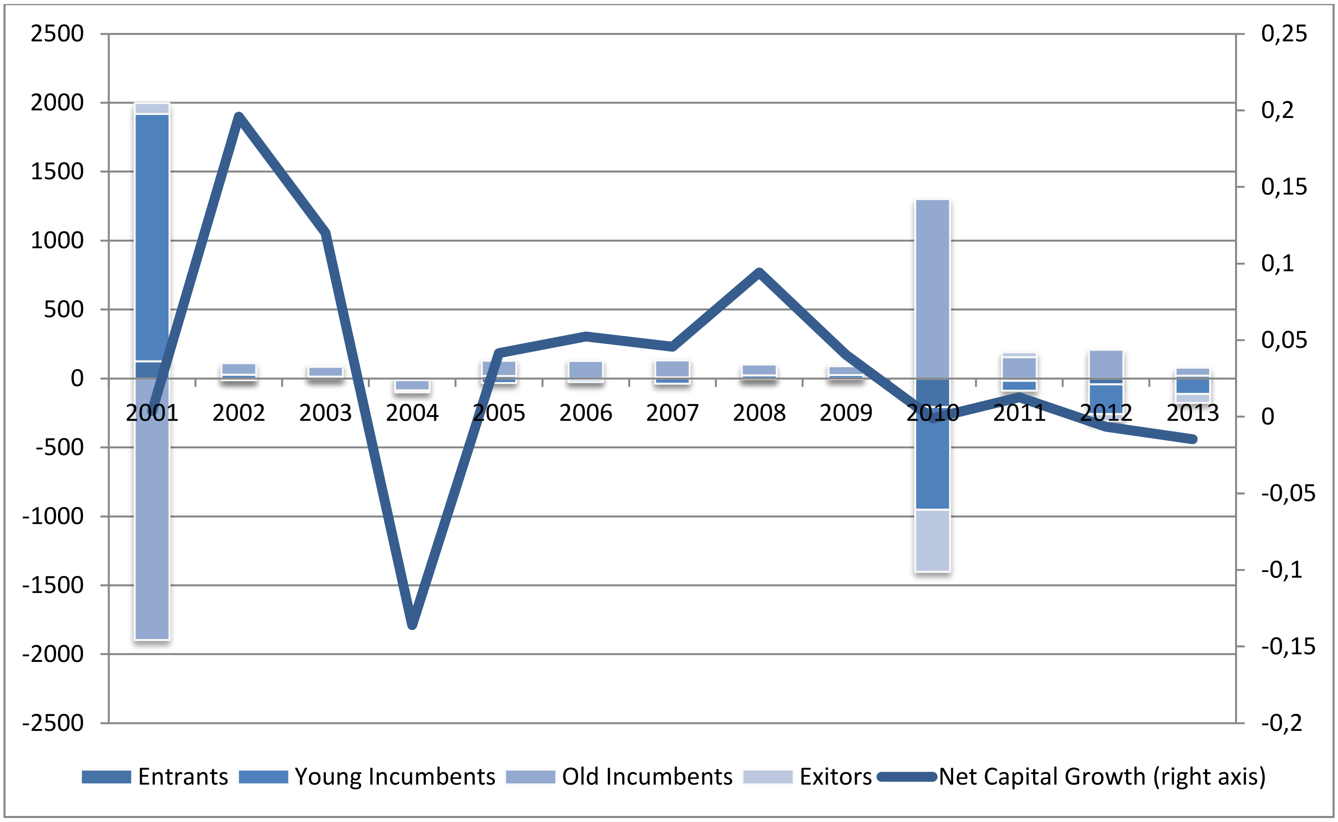
Where DV is, alternatively, year-on-year revenue, capital, or employment growth rates. Age group 12+ is normalized to zero.

Figure A1 – Net Capital Growth and Its Contributors – Manufacturing Sector – 2001-2013



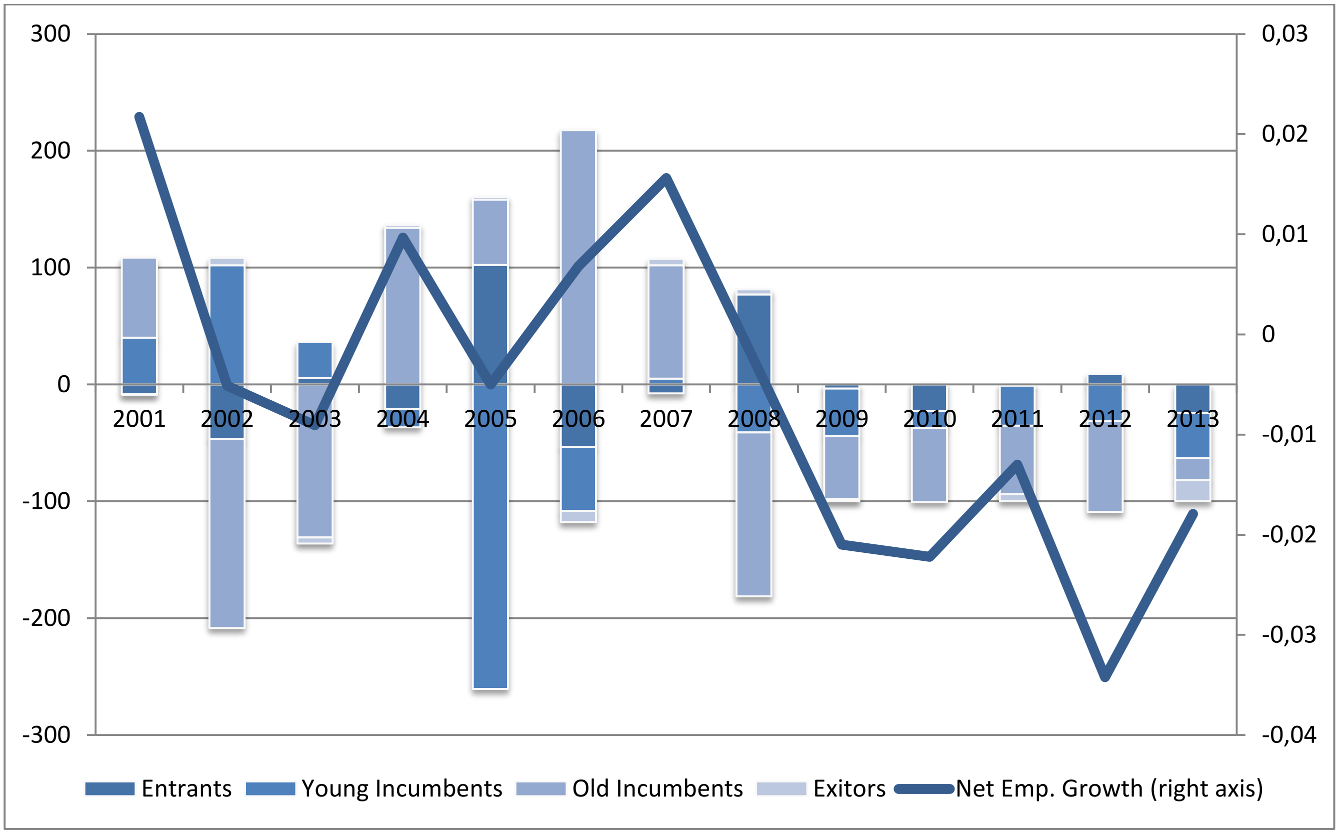
Source: Authors' elaborations on CERVED and INPS data.

Figure A2 – Net Capital Growth and Its Contributors – Services – 2001-2013



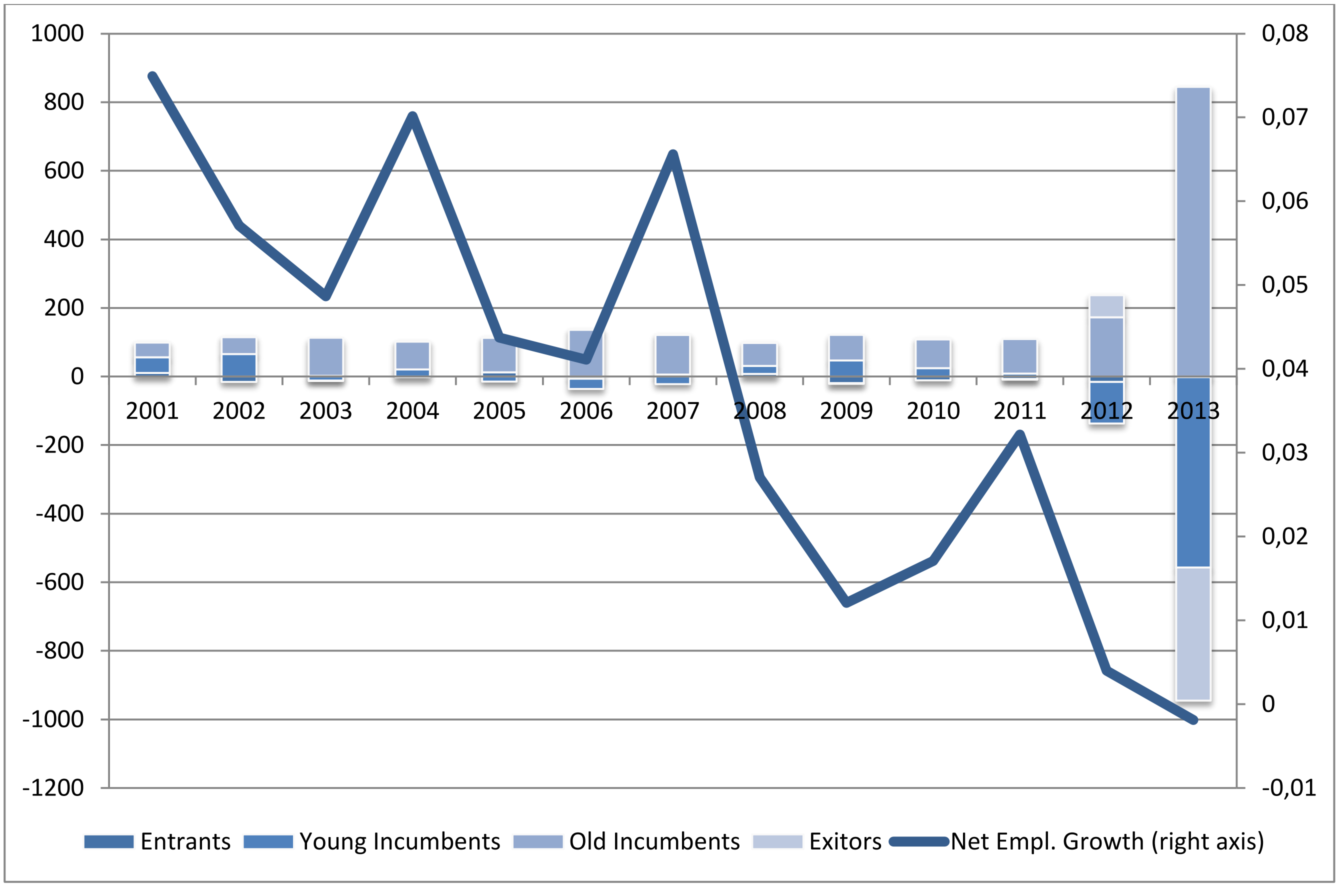
Source: Authors' elaborations on CERVED and INPS data.

Figure A3 – Net Employment Growth and Its Contributors – Manufacturing Sector – 2001-2013



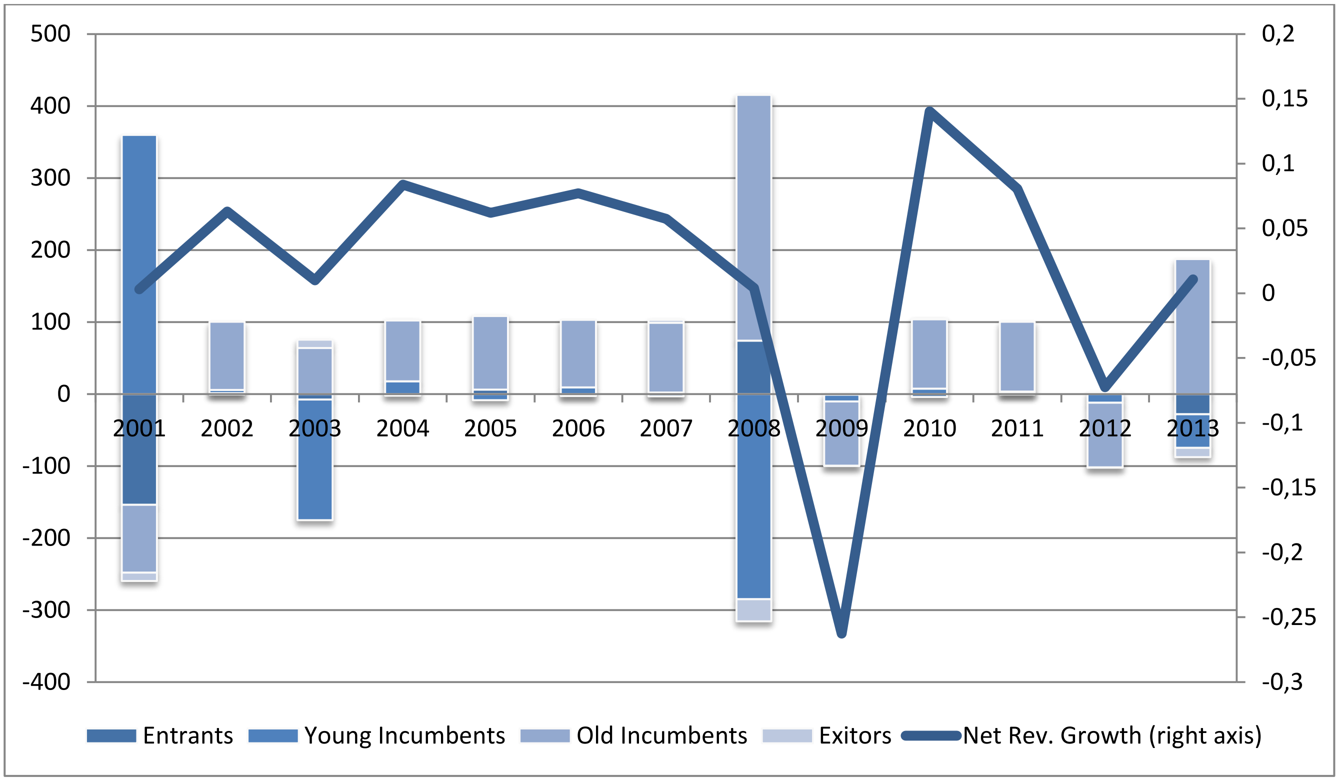
Source: Authors' elaborations on CERVED and INPS data.

Figure A4 – Net Employment Growth and Its Contributors – Services – 2001-2013



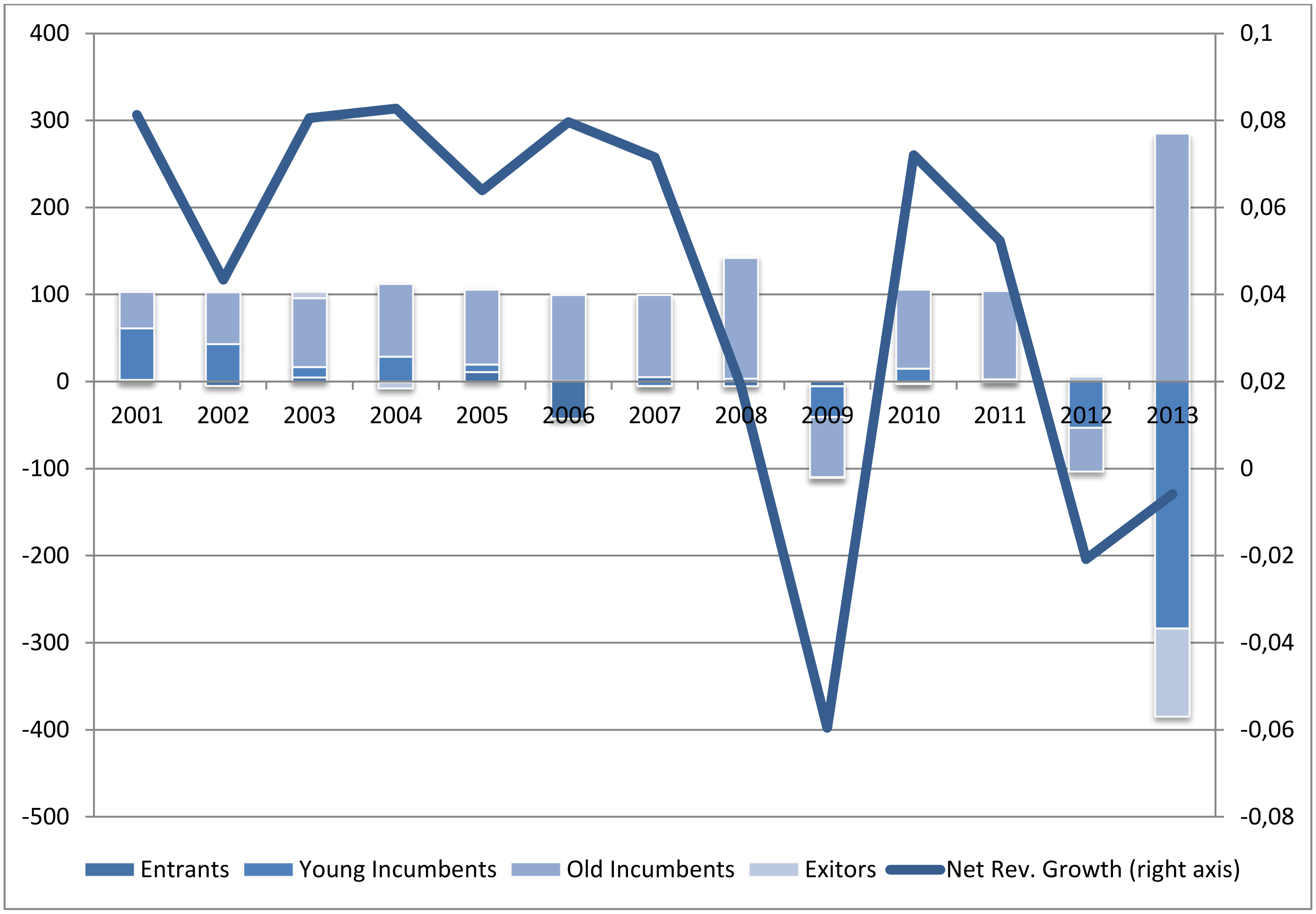
Source: Authors' elaborations on CERVED and INPS data.

Figure A5 – Net Revenues Growth and Its Contributors – Manufacturing Sector – 2001-2013



Source: Authors' elaborations on CERVED and INPS data.

Figure A6 – Net Revenues Growth and Its Contributors – Services – 2001-2013



Source: Authors' elaborations on CERVED and INPS data.

Figure A7 – Cohort effects for revenue, capital, and employment growth – normalizing cohort dummies

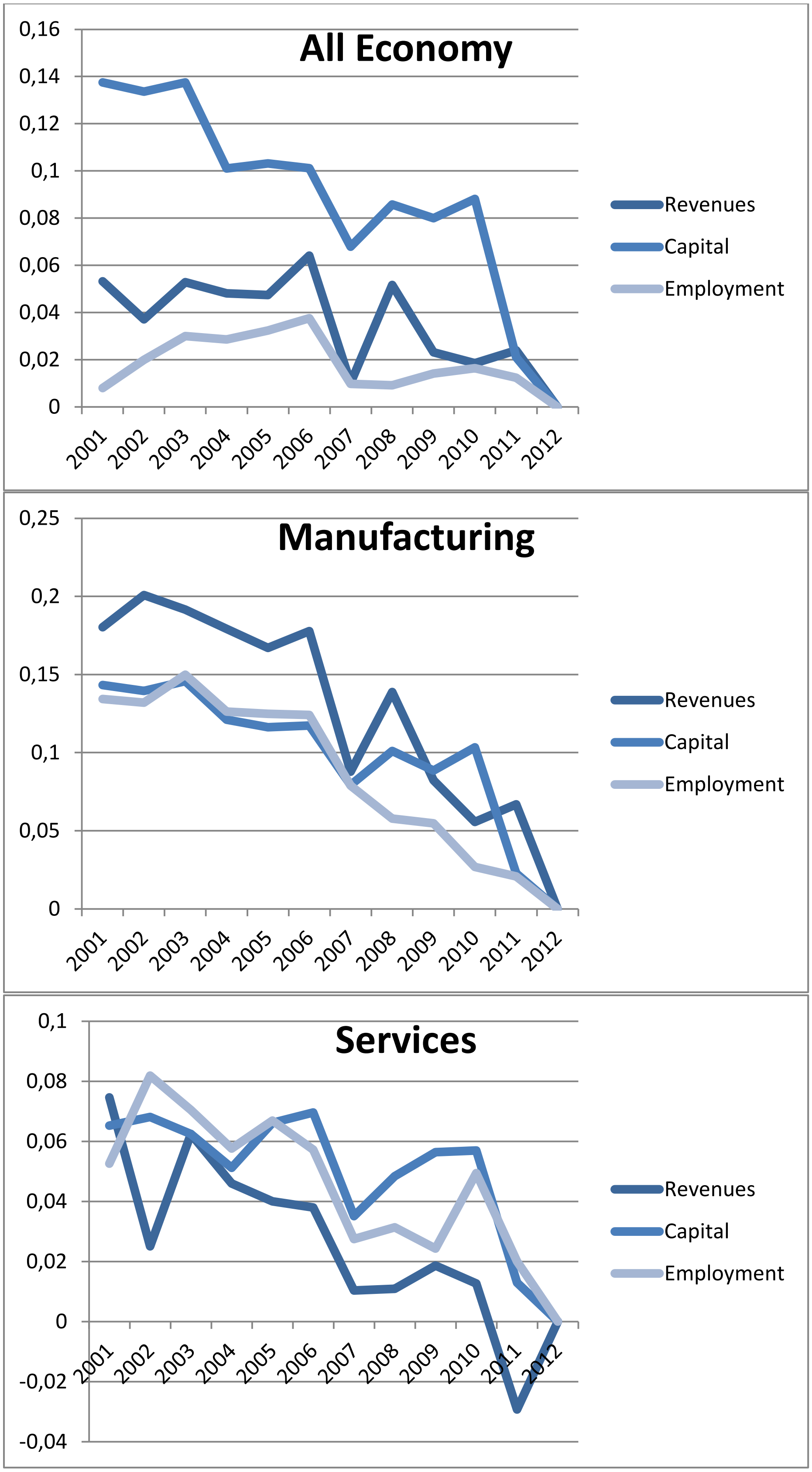
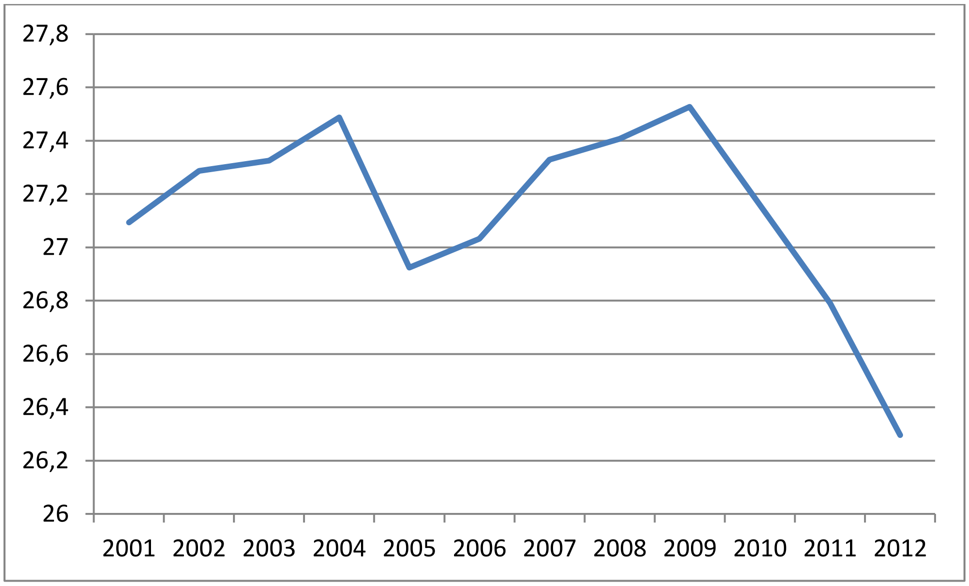


Figure A8 – Evolution of the Coefficient of Variation of Revenue Growth by Cohort – 2001-2012

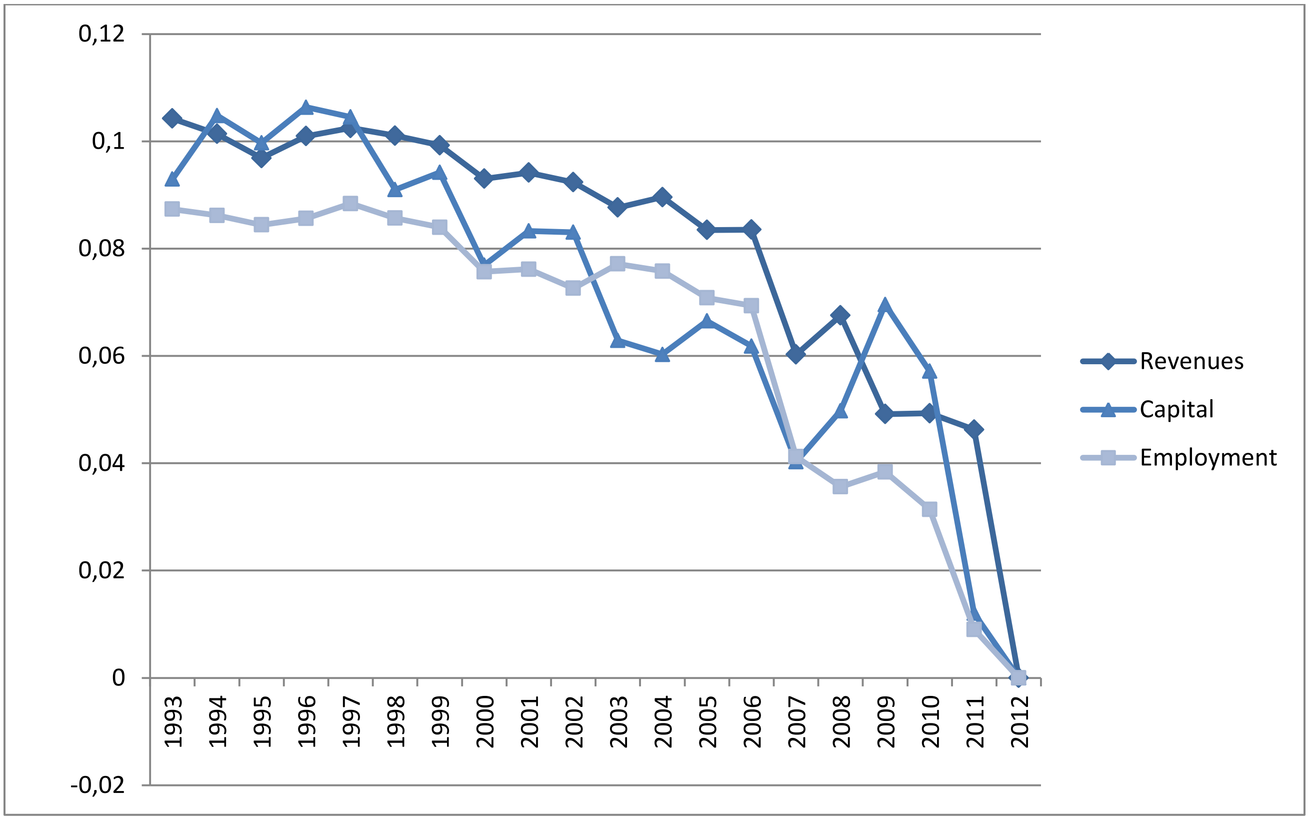


Source: Authors’ elaborations on CERVED and INPS data. The figure plots cohort coefficients obtained by estimating model:

$$DV_{sct} = A\gamma + C\lambda + T\tilde{\delta} + S\theta + \epsilon_{sct}$$

Where DV is the coefficient of variation of revenue growth.

Figure A9 – Long-term trends in input accumulation, revenue and productivity growth – manufacturing

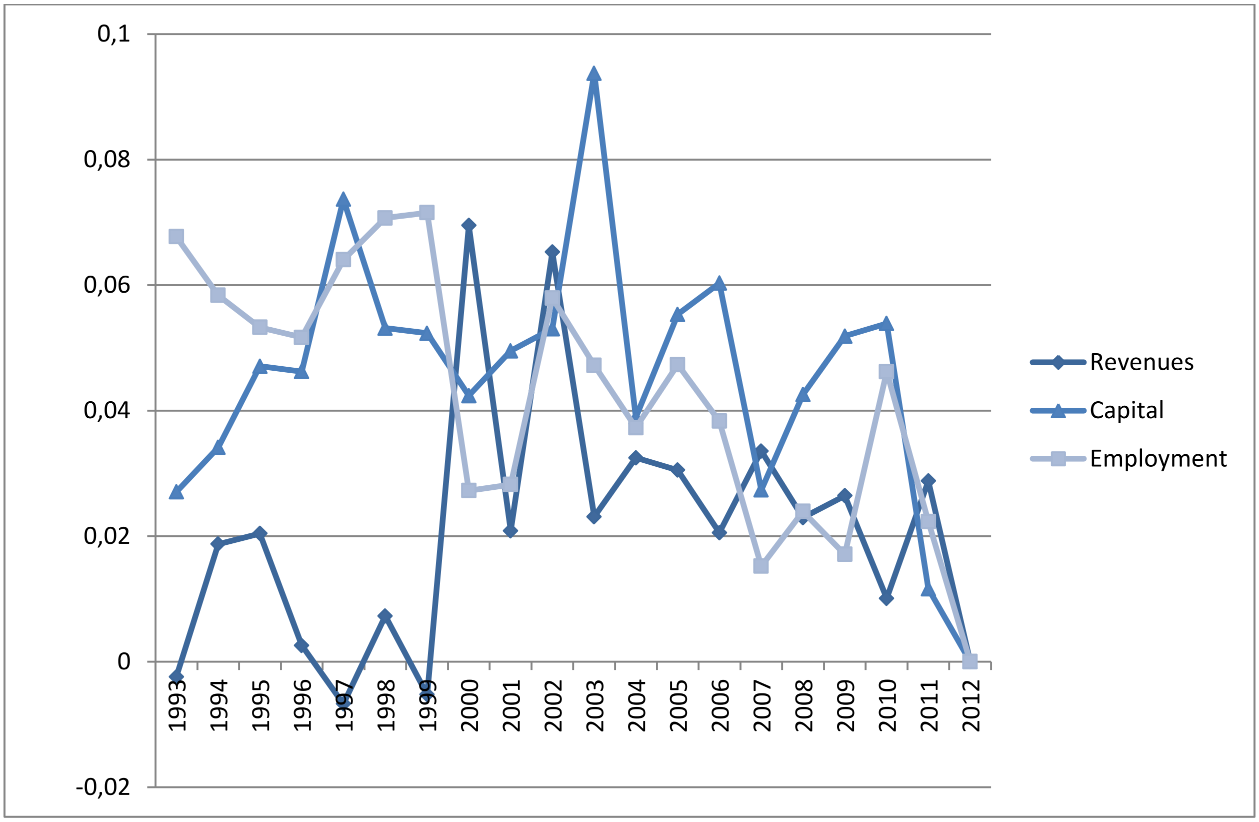


Source: Authors' elaborations on CERVED and INPS data. The figure plots cohort coefficients obtained by estimating model:

$$DV_{sct} = A\gamma + C\lambda + T\tilde{\delta} + S\theta + \epsilon_{sct}$$

Where DV is, alternatively, year-on-year revenue, capital, or employment growth rates. The 2012 cohort is normalized to zero.

Figure A10 – Long-term trends in input accumulation, revenue and productivity growth – services

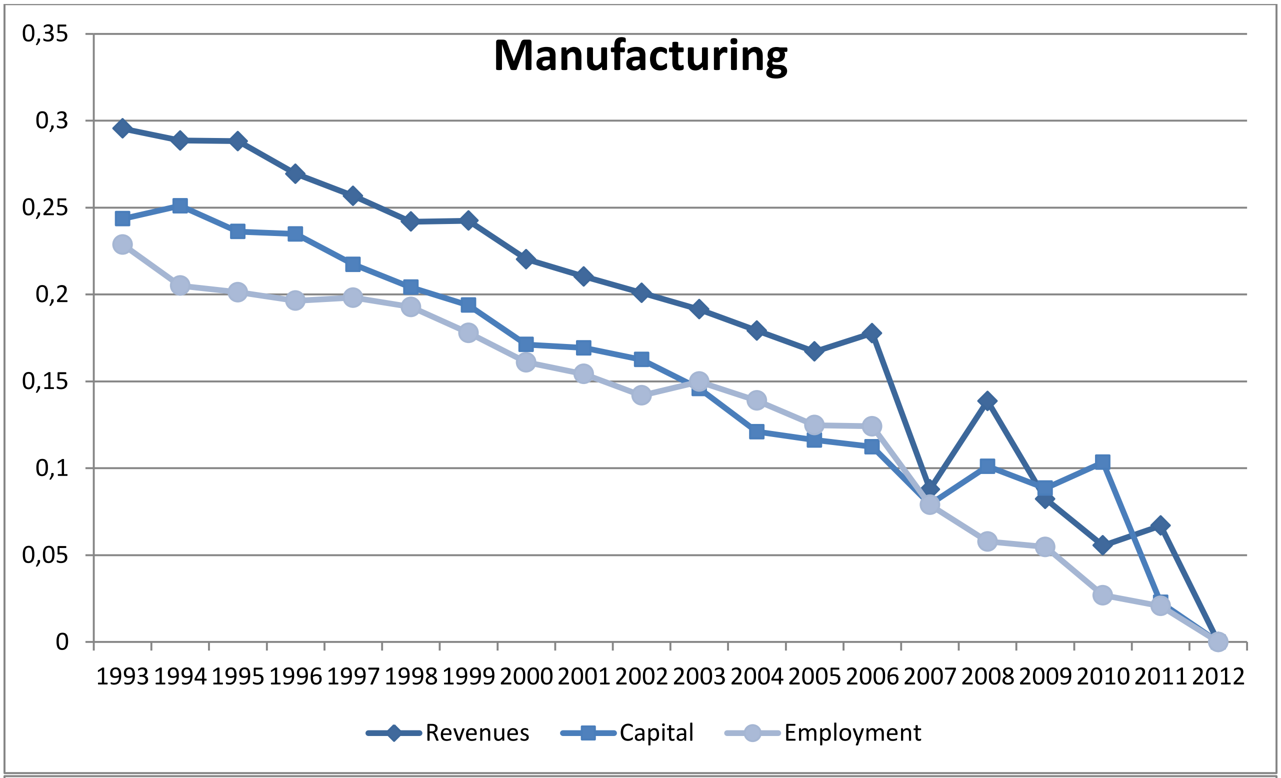


Source: Authors' elaborations on CERVED and INPS data. The figure plots cohort coefficients obtained by estimating model:

$$DV_{sct} = A\gamma + C\lambda + T\tilde{\delta} + S\theta + \epsilon_{sct}$$

Where DV is, alternatively, year-on-year revenue, capital, or employment growth rates. The 2012 cohort is normalized to zero.

Figure A11 – Long term trends in input accumulation and revenue growth – normalized cohort effects



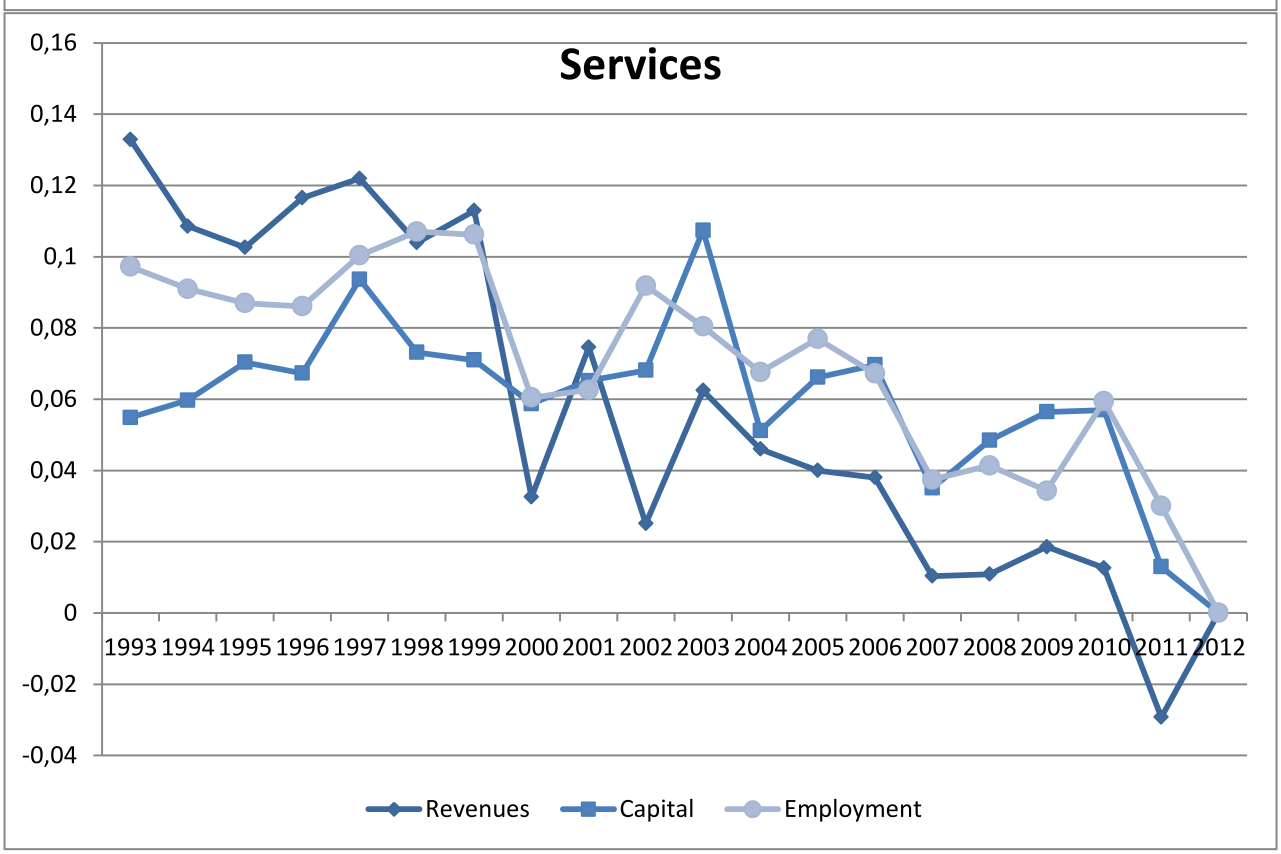
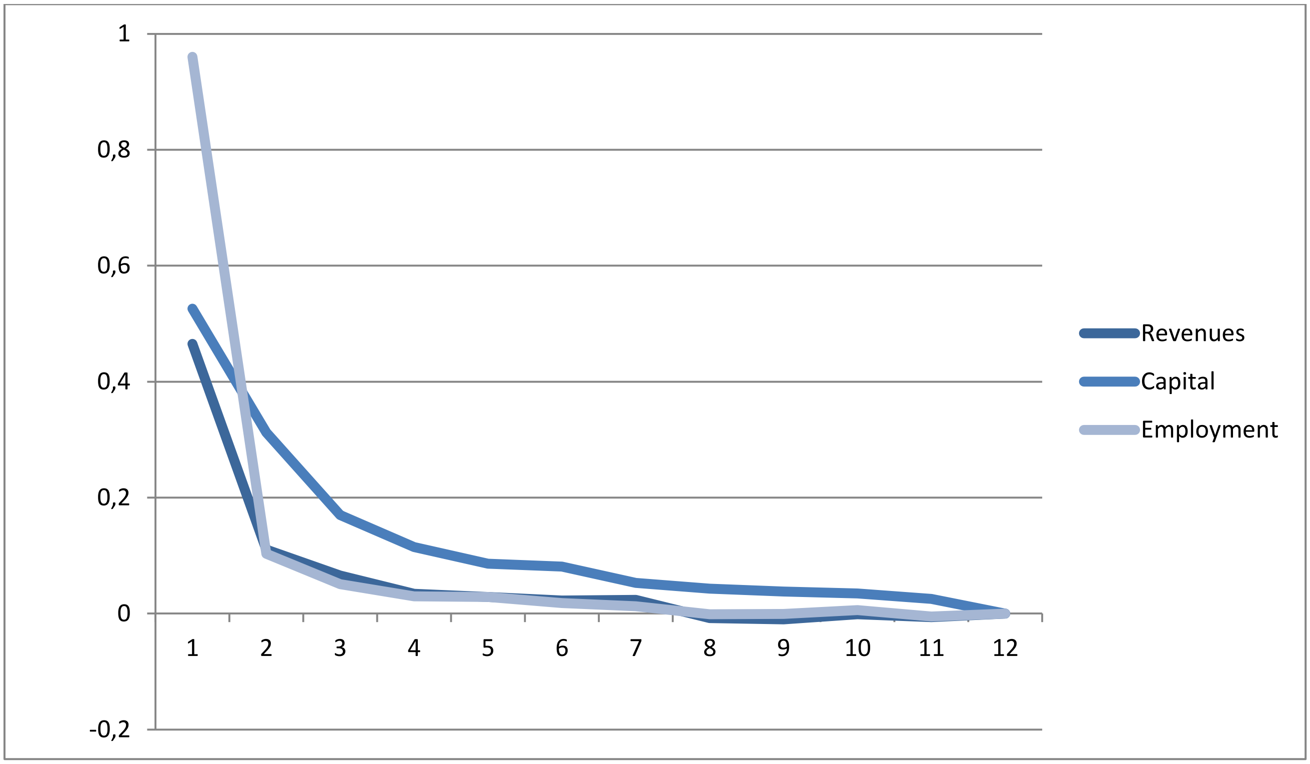


Figure A12 – Age Effects on Revenues, Capital, Employment Yearly Growth Rates – Manufacturing

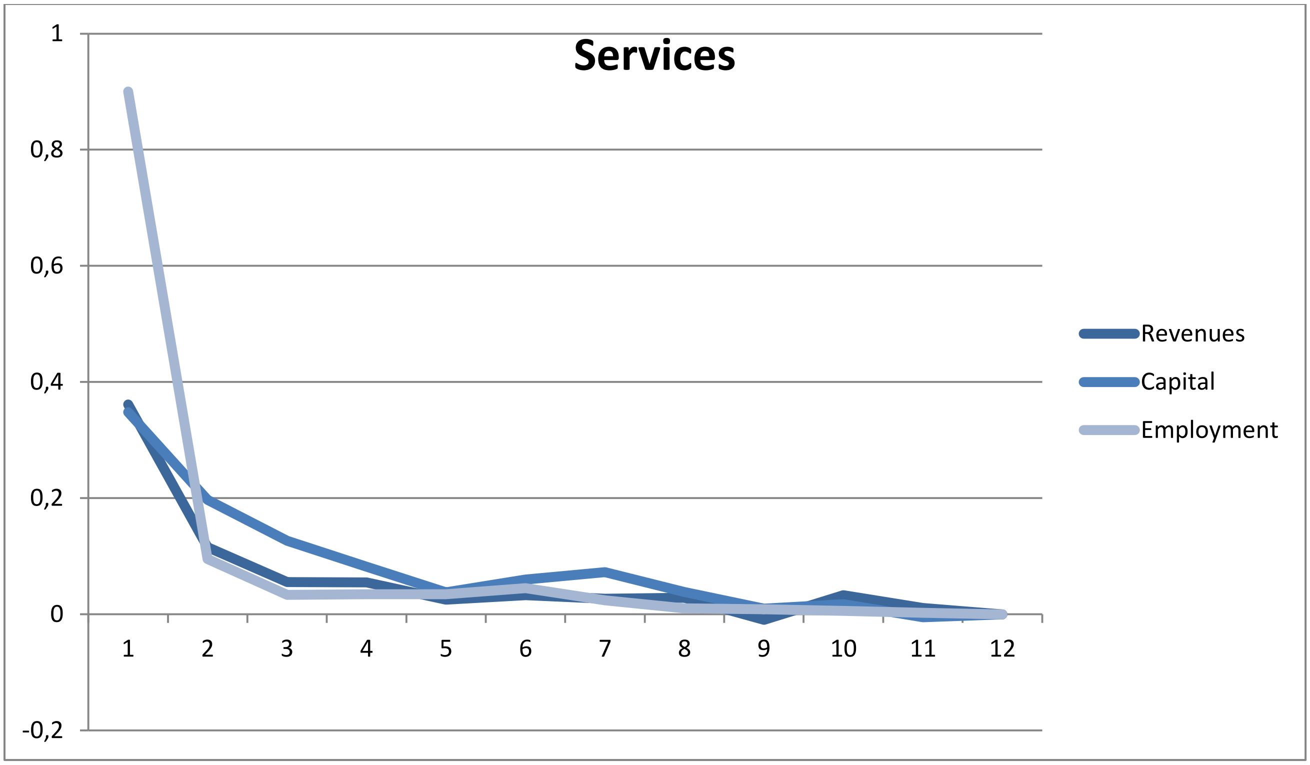


Source: Authors' elaborations on CERVED and INPS data. The figure plots age coefficients obtained by estimating model:

$$DV_{sct} = A\gamma + C\lambda + T\tilde{\delta} + S\theta + \epsilon_{sct}$$

Where DV is, alternatively, year-on-year revenue, capital, or employment growth rates. The 2012 cohort is normalized to zero.

Figure A13 – Age Effects on Revenues, Capital, Employment Yearly Growth Rates – Services



Source: Authors' elaborations on CERVED and INPS data. The figure plots cohort coefficients obtained by estimating model:

$$DV_{sct} = A\gamma + C\lambda + T\tilde{\delta} + S\theta + \epsilon_{sct}$$

Where DV is, alternatively, year-on-year revenue, capital, or employment growth rates. The 2012 cohort is normalized to zero.