

Structural change and human capital in the Italian productive system^{*}

Fabiano Schivardi (Università di Cagliari and EIEF)

and

Roberto Torrini (Banca d'Italia)

Abstract

We study the role of human capital in the restructuring process of the Italian economy. Italy displays a large and persistent gap in the share of college graduates in the population (12% in 2007) with respect to the rest of Europe (24%). The introduction of the 3+2 reform has significantly increased the supply of college graduates, mostly absorbed by the private sector. Firm level evidence indicates that the growth in graduate employment is due almost entirely to a “within” firm component rather than to a shift of the productive structure from low to high human capital activities. We also find that a higher share of college graduates at the local level is positively associated with restructuring activities and with productivity growth. This indicates that increasing the educational attainments of the workforce is key to overcome the phase of stagnating productivity growth that characterizes the Italian economy since the mid nineties.

JEL classification system: J24.

Keywords: human capital, tertiary education, firm restructuring, growth.

* We thank Giuseppe Bertola and Daniele Checchi for useful discussions and suggestion, as well as the participants to the workshop held at Fondazione Agnelli on the research project “Riforma dell’Università dieci anni dopo. Scelte degli atenei e delle famiglie ed esiti sul mercato del lavoro” (Turin, January 2010). We are solely responsible for any mistake. The opinions expressed in this paper are our own and do not necessarily reflect those of the Bank of Italy.

1. Introduction

The growth performance of the Italian economy since the mid nineties has been very disappointing, even compared to other European countries. The average growth rate of GDP over the period 1995-2008 has been 1.2 per cent, compared to 1.5 for Germany, 2.1 for France, 2.7 for the UK. While employment has grown substantially, the productivity performance has been particularly negative. GDP per hour worked increased by 0.4 per cent per year as compared to 1.5 in Germany, 1.6 in France, 2.1 in the UK. A crucial question is then what can explain the low growth of productivity. One view, put forward by many scholars, is that the productive structure that had work well during the previous two decades, based on small firms operating mostly in low and medium tech activities, has not been able to cope with the adoption of the euro and with the increase in competition from producers from developing economies (the so called globalization). There is evidence that the system has indeed undertaken a process of restructuring, based on climbing the ladder of production in terms of technological content, quality, branding etc. (Rossi, 2006; Bugamelli, Schivardi and Zizza 2010; De Nardis, 2010). However, the disappointing aggregate performance indicates that the transition is far from being successfully concluded. It is then crucial to investigate potential barriers to firm restructuring.

The goal of this paper is to study the role of tertiary education in the process of restructuring of the Italian economy since the beginning of the decade. Shifting production towards high human capital activities naturally requires human capital itself. In fact, it is well known that human capital is essential not only for creating new technologies but also for absorbing existing technologies produced elsewhere (Nelson and Phelps, 1966; Benhabib and Spiegel, 2005; Ciccone and Papaioannou, 2009). We will consider if the low share of college graduates of the Italian workforce, when compared to the other European economies, has represented a constraint to the restructuring process and, through this, to growth. Moreover, we will try to understand if the reform of the tertiary education system, that has contributed to increase the supply of college graduates, has eased such constraint. The major challenge of this exercise is to separate demand and supply effects of human capital. For example, the low level of education of the Italian workforce might be due to the fact that Italian firms specialize in low-tech activities, which require little human capital. If entrepreneurs are not capable of shifting towards higher human capital activities, then increasing the educational attainments of the workforce might be of no help, because there is little demand for workers with higher education. Similarly, small firms, that account for a large share of employment in Italy, tend to hire less graduates than large firms. On the other hand, it might be that firms are constrained in restructuring activities by the scarcity of

workers with college education. Our goal is to identify the effects of the supply of high skill workers on restructuring.

We start by documenting the Italian delay in terms of higher education of the workforce compared to other developed economies. According to the European Labor Force Survey, in 2007 the share of college graduates in the population was 12% in Italy, exactly half of the average of the other EU countries. This overall difference also emerges when considering different groups, both in terms of workers characteristics (by age and sex) and sector of employment. Moreover, we also show that sectoral composition and firm size structure explain only a small part of the difference: mostly, Italian workers have a lower degree of education independently from the sector they work in.¹ This indicates that the low human capital content of the labor force is not simply explained by the characteristics of the productive structure.

In terms of dynamics, the share of graduates in the workforce has almost doubled between 1993 and 2007. The increase is even stronger among the younger cohorts, such as 25-35, particularly for women, where the share triples. In terms of field of study, there has been an increase in economics, political science, psychology and engineering and a decrease in literature, law and medicine. However, this raising trend has not been enough to reduce the gap with the rest of Europe: rather, the difference with the average of the other European countries has increased from 11 percentage points in 1997 (the first year for which comparable data are available) to 13 in 2004. Since then, it has been slightly decreasing, arguably following the introduction of the 3-year degree system, indicating a non negligible role of the reform to increase the supply of college graduates. Finally, a decomposition exercise shows that, for all European countries, the growth in the share of college graduates is only marginally due to sectoral reallocation, as most of it comes from an increase within sectors.

Having established that Italy still lags behind in terms of educational attainments of the workforce, and that such lag is not simply due to the structure and composition of the productive system, in the rest of the paper we move on to a firm level analysis. We use the Bank of Italy survey of firms with at least 20 employees. We first consider the firm level determinants of skill demand: what are the characteristics of firms that hire more college graduates? We find that large firms have a higher share of college graduates, although the difference becomes substantial only for very large firms (with more than 1,000 employees). The sectoral component plays an important role: the share of college graduates in low-tech firms (identified according to the OECD 2003 classification system)

¹ We stress that the sectoral composition analysis on Eurostat labor force data should be taken with a grain of salt, as the sectoral disaggregation is fairly coarse: activities are divided in 17 sectors. In particular, there is no subdivision within the manufacturing sector.

is one-fourth of that in high tech firms. In terms of evolution over time, neither sectoral nor firm size reallocation play any significant role in accounting for the almost doubling in the share of college graduates from 2000 to 2006: all the increase occurs within firm. This indicates that firm characteristics are the fundamental determinants of the increase in graduate employment. So we move on to considering these determinants more thoroughly.

In 2006 the survey enquired the characteristics of college graduates that are considered as more important for recruiting. Work experience and individual attitudes are the most important determinants, while both the reputation of the university and degree level (3 or 3+2) are on average not very important. This suggests that the Italian productive system has little capacity to detect differences in the quality of college education.² The reputation of the university and the level of the degree are more important for high-tech firms and for firms run by a boss with a college degree. This confirms that some characteristics of the production system, namely the low-tech content of many productions and, less predictably, the low degree of education of firm owners, might actually restrain the demand for college graduates.

The survey in 2006 also asked firms about restructuring activities carried out in the previous five years in terms of product upgrade, branding and internationalization. We find that restructuring is positively related to the share of graduate employment in the firm. Of course, this correlation cannot be interpreted as causal. In particular, the same firm level characteristics that, as we have seen, influence the demand for college graduate might also determine restructuring. For example, a firm boss with a college degree might be more able to undertake restructuring and also hire more college graduates independently from restructuring. To overcome this problem, we instrument the share of college graduates at the firm level with the share of college graduate in technical degrees in the population at the provincial level. The idea is that a larger share of college graduates at the local level facilitates their recruiting. This assumption is justified by the low mobility of Italian workers. At the same time, such share can be thought of as exogenous from the firm's perspective. The IV estimates confirm that having more graduates in the workforce increases the probability of undertaking restructuring. Finally, to determine if this process affects growth, we resort to a larger sample of firms, for which we can compute value added and TFP growth over the period 2000-2007. We regress them on the indicators of college graduates supply at the local level. The results, although statistically imprecise and therefore to be interpreted cautiously, are in line with the previous evidence that a higher local supply of college graduates increases growth.

² It might also be that, for university reputation, there is little variability in the quality of the graduates of different university, so that firms do not take that much into account when recruiting.

All in all, our analysis indicates that both demand and supply effects explain the low degree of education of the Italian workforce. On the demand side, a higher degree of education of firm owners and a shift towards more sophisticated products would increase the demand for college graduates. At the same time, supply also plays a role: a more educated workforce facilitates restructuring and is more conducive to growth of both value added and productivity. Taken together, our results suggest a positive effects of the reform of the Italian university on the restructuring process. In fact, the increase in the supply of college graduates following the reform might jump-start a virtuous circle: firm owners with a college degree would increase the demand for college graduates and foster restructuring activities, which in turn would further increase the demand for college graduates. This hypothesis finds tentative support in our data but more work is needed to confirm or disprove it. This will require to monitor closely the evolution in the supply of college graduates and the restructuring process over the next years. However, at the moment we cannot dismiss the claim that the reform of the system has contributed to ease an important constraint on firm restructuring, that is the availability of workers with tertiary education.

2. The Italian gap in tertiary education

Italy, when compared with the other European countries, stands out for its remarkably low education achievements. According to the Labour force survey in 2007, only 12 per cent of the working age population and 16 per cent of employed workforce had a tertiary education degree, as opposed to 24.0 and 29.4 per cent in the other countries of the European Union (EU15)³ (Table 1). The gap was of similar magnitude for the 25-35 age cohort.

In the business sector the gap is stark (Table 2): in 2007 only 10.9 per cent of the labor force had a college degree, against 23.4 for the other EU countries. The difference is less marked in the public sector⁴ (36.2 against 46.3), which absorbs a larger than average share of the total number of college graduates (45.3 per cent against 41.0), even if this sector employs a lower share of workers than in the rest of the EU (19.9 per cent against 26.1, Table 3).

In Italy college graduates have a higher employment rate than less educated people (Tables 4 and 5). However, their employment rate is lower than in the rest of the EU. This mainly reflects a

³ In the rest of the paper when we talk about the European Union we mean EU15 if not otherwise specified.

⁴ We define as Public sector workers, all workers in the Public administration, School and Health systems, although part of them actually work in private businesses. In fact, the Labour force survey does not distinguish between market and non-market activities. Our choice was dictated by the fact that in most EU countries the public sector plays a predominant role in both the Education and Health care activities.

comparatively low participation to the labor market and a comparatively high unemployment rate of the Italian female college graduates.

Supply factors are likely to play a predominant role in explaining the low degree of education of the Italian workforce. At the same time, a low demand for qualified workers in the business sector may have also played a role in perpetuating such a wide and persistent gap. In fact, a weak demand may reduce economic incentives to acquire tertiary education, thus explaining the comparatively low levels of education attainments of the Italian population.

The sectoral specialization (traditional manufacturing plays a much more important role in Italy than in the EU) and the small average firm size contribute to a low demand for highly educated workers.⁵ Unfortunately, comparable statistics do not provide information on education and firm-size with a very detailed breakdown. The Labour force survey only allows a broad assessment of this issue. The dataset provides information on workers education, sector of activity (17 branches, 14 for the business sector), and production-unit size, broken-down in 4 classes: “less than 10 workers”, “between 10 and 49”, “50 or more”, “unknown but greater than 10”. We can therefore undertake some counterfactual exercises, to assess to which extent differences in industry composition and firm-size can lead to sizeable differences in the demand for high-skilled workers. The main limitation of this analysis is the broad industry break-down (for instance manufacturing activities are grouped together) and the classification of production-unit size, which does not allow to assess cross-country differences in the weight of medium and large size firms, as they are all lumped together in the 50+ class size (as well as the unknown, but greater than 10). These limitations should be kept in mind when interpreting the results.

In the first exercise we assume that each country has the EU15 industry composition, while maintaining in each sector the observed incidence of college graduates of the country. In the Italian case this would entail a reduction in manufacturing and a rise in the incidence of some service sector branches, which in turn would translate into a small increase in the share of workers with tertiary education (0.4 percentage points). Sector composition proves to be more relevant for younger workers (25-35 year-old): by assuming the EU15 industry composition the share of graduated workers in Italy would be 1.2 percentage points higher (Table 6). When maintaining the observed industry composition and assuming in each sector the average EU firm size composition⁶,

⁵ It is well known that large firms have a workforce with a higher average education (Oi and Idson, 2005). Moreover, Italian firms are small when compared to other comparable economies (Bertelsmann, Scarpetta and Schivardi, 2005). According to the Labour force survey more than 50 per cent of business sector workers are employed in business unit with less than 10 employees (35 per cent in the other EU countries).

⁶ We excluded the category “unknown but greater than 10”.

in Italy the share of workers employed in productive units with less than 10 workers would decline from 54 to 41 per cent (the EU average). Notwithstanding such a marked change, the college graduate share would raise by just 0.3 percentage points (0.7 for younger workers). This can be explained by the little difference observed in Italy between small and larger production units, as far as the incidence of college graduates is concerned. On average in Europe production units with 50 or more workers have a share of college graduated workers 8 percentage points higher than small units with less than 10, whereas in Italy the gap between the two amounts to just 3 percentage points. More marked differences would likely emerge with a finer size classification. Finally, if we assume the EU15 employment composition as defined both by the production unit size and the sector, the impact on the Italian share of college graduates would be slightly larger: the share would increase by 0.7 percentage points for the whole workforce and by 1.9 percentage points for younger workers.

Although these results go in the expected direction, it seems that the employment composition cannot by itself explain the low incidence of tertiary education. The analysis suggests that the Italian productive system employs less college graduates even controlling for compositional effects. Still, one needs to keep in mind the coarse sectoral and size subdivision. These shortcomings make our results a lower bound for the relevance of the sectoral and size composition in explaining the Italian education gap.

3. Persistence of the education gap and structural dynamics since the 1990s.

Between 1993 (first year for which the Labour force survey is available) and 2007, the college graduates' share of Italian working-age population has increased from 5,5 to 12,0 per cent (from 8.7 to 16.9 for employed workers), thanks to the higher education achievements of younger cohorts (Table. 7). Among younger people (25-35 year-old), the incidence of college graduates increased from 7.1 to 18.9 per cent (from 8,0 to 19.2 for employed workers).

The rise in college graduates supply was strongly driven by the female component. While the male share moved up from 6.1 to 10.9, the share of women with a tertiary degree increased from 4.9 to 13.2 per cent of the total female population in 2007. The female share of total college graduates increased from 44.8 to 54.7 per cent; among employed workers the share moved from 40.6 to 51 per cent (from 24.3 to 42.4 in the business sector, from 51.4 to 61.4 in the public sector). The growth differential is starker among the 25-35 cohort: males and females, moving from the same college graduates' share in 1993 (7 and 7.2 for men and women, respectively), in 2007 showed quite different achievements. The incidence among males doubled to 14.8 per cent, while

among the female population component it reached 22.9 per cent, more than three times the starting level.

As to the composition of college graduates, the incidence of Economics and management, political and social sciences, pedagogy, psychology and engineering has increased; on the contrary literature, law and medicine had a sizeable decline; scientific degrees, other than engineering, also recorded a decline, although less marked. Among younger workers the share of literature remained stable, while even sharper than for the total was the fall in medicine, law, foreign languages and scientific degrees other than engineering. The largest increase was in pedagogy, political and social sciences, and engineering (Table 8).

The increase in the educational attainments was not enough to reduce the gap with respect to the rest of the EU countries (Table 7). In fact, the distance kept growing until the beginning of this decade. Only in recent years, especially after the university reform which introduced the so called 3+2, the gap has started to decline. The standard duration of a tertiary education course is now 3 years, instead of 4 or 5 as in previous arrangements, possibly followed by two years course to achieve a further specialization.

Comparable statistics are not available for Germany until 2002, therefore we compare the Italian developments with EU15 excluding Germany. Between 1997 and 2004 Italy lost ground: the gap in terms of the incidence of tertiary educated population increased from 11 to 13 percentage points. Since 2004 the distance has slightly declined, to 12.7 percentage point in 2007. For 25-35 year-old population the delay increased from 16.8 points in 1997 to 20.3 in 2004, moving back to 18,1 in 2007. The performance of the youths between 25 and 30 year-old, which were directly affected by the 3+2 reform, is remarkable: since 2003 the gap has fallen from 23.2 per cent in 2003 to 17.5.

The increase in the supply of college graduates in Italy was mainly absorbed by the business sector, since the public sector shrank from 26.9 per cent of the labor force in 1993 to 19.9 in 2007, mostly by curtailing hiring. This entailed a rise in the number of college graduates of 183 per cent in the business sector and by 53 per cent in the public sector.⁷ The share of graduates employed in the business sector jumped from 40 to 55 per cent; graduates moved from 4.4 to 10.9 per cent of total business sector employment. Among younger workers, (25-35 year-old) the share of business sector increased form 51.4 to 69.4, from 5 to 15 per cent as a percentage of young business sector workers.

⁷ This is likely an overestimation of the public sector increase, considering that according to official statistics public employment has increased by only 1 per cent in the period we analyse, against 11 per cent in our data set, where, as explained before, public sector employment cannot be exactly identified.

In order to assess if the rise in college graduates supply and the decline of the share of public sector employment worsen the job opportunities of highly educated workers, we analyze the unemployment rate dynamics, separately for male and female workers, by education level (Figure 1). The trend in college graduates' unemployment rate seems less favorable than the development observed for other education groups. However, this mainly reflects the growing education level of newcomers, which tilts the age distribution of graduated workers towards younger cohorts. Once we focus on young workers (25-35), the unemployment rate of college graduated women follows the general female trend, while the unemployment rate of graduated males increased more than that of the other workers in the 1990s, but converged to the average male unemployment rate in more recent years. We can thus conclude that in relative terms the college graduates' performance in the labor market remained stable when compared to less educated workers.

College graduates display an higher than average employment rate and a lower than average unemployment rate both in Italy and in the other EU countries (Table 7). However, as shown by the unemployment rate of the 25-35 year-old workers, it is harder for Italian younger graduates to access the labor market. Contrary to what observed in the other EU countries, the male unemployment rate of college graduates between 25 and 35 is higher than that of less educated workers; the female graduates unemployment rate is similar to the rest of the female population, and higher than for women with secondary education. This reflects the fact that on average it takes more time to get a degree in Italy and that the youth unemployment rate, both for graduates and non graduates, is in Italy higher than in most other countries.

In terms of the dynamics of the employment rate of young workers, in the second half of this decade a decline in the employment rate of college graduates between 25 and 35 year old took place. This, however, is entirely due to the reform of the degree system, as most students, instead of entering the labor market, after having obtained the 3 year diploma went on to a 2 year specialist course.

The rise in college graduate employment can be driven by both a general rise in the education level at all workplaces and a reallocation of employment toward high skill-intensive activities. To assess the relative importance of such structural changes we undertake a shift-and-share analysis for the period 1997-2007. Observations are grouped in cells and the overall increase in the college graduate share is broken down in a component which depends on the reallocation of workers between cells, the so called "between" component, in a component measuring the impact of the rise of graduates' share inside each cell, the "within" component, and a component which depends on the interaction between the within and between components. We first define the classification

cells according to the sole sector of activity (17 branches); then we define the classification cells according to both the industry and the size class (3 classes, 1-9, 10-49, 50 and more).

By defining h_i the share of college graduates in cell i and w_i the share of total workers employed in cell i , the rise in the share of college graduated workers between 1997 and 2007 can be broken down in the following way:

$$h^{07}-h^{97}=\sum_i(w_i^{07}-w_i^{97})h_i^{97}+\sum_i(h_i^{07}-h_i^{97})w_i^{97}+\sum_i(w_i^{07}-w_i^{97})(h_i^{07}-h_i^{97})=\Delta_w+\Delta_h+\Delta_{wh}$$

where Δw is the change of graduates' share due to the reallocation of workers between cells (between component) given the incidence of graduates in 1997 in each cell i , Δh is the contribution of the rise in college graduates' share in each cell (within component), taken as given the weight of each cell on total workers in 1997. The last component considers the additional contribution of a rise (decline) in the weight on total employment of cells which also had a rise (decline) in the share of graduates (cross component).

In Italy the reallocation of workers between sectors explains 0.9 percentage points out of the 5.5 points increase in the share of graduates in the whole economy, compared to one percentage points out of 7.2 in the EU⁸ (Table 9). In the business sector, the contribution of the between component has been only slightly higher. For younger workers the reallocation process was even less relevant. If we jointly consider the reallocation of workers between *both sectors and size* classes, the relevance of the between component is slightly higher, especially in the more recent period (between 2002 and 2007, Table 10). In all cases the within component explains most of the increase in the graduates' share, both in Italy and in the EU, while the structural change plays a minor role both in Italy and in the other European countries.

Taken together, this evidence indicates that, in spite of progress made in the last 15 years in “producing” college graduates, the Italian delay with respect to the rest of Europe has kept growing until recent years. In coincidence with the reform of the degree system, a convergence process seems to have started for younger cohorts. Moreover, the share of college graduates has increased substantially and the Italian economy has been able to absorb new graduates, in spite of a decline in the weight of the public sector, where most of them used to find a job until the beginning of the last decade. Given that sectoral and size reallocation do not play a central role in the absorption process, we next move on to the firm level, analyzing what type of firms hire college graduates and what are the determinant of college graduates demand at the firm level.

⁸ EU is defined as the European Union at 15 countries excluding Germany, as the relevant information for Germany is only available since 2002.

4. The demand for college graduates at the firm level

The Bank of Italy runs an annual survey of a representative sample of Italian firms with at least 20 employees. The sample refers to the whole private sector, excluding the financial sector. The survey consists of fixed part, repeated every year, and monographic sections that change from year to year, that are used to investigate specific questions of interest.⁹ In 2006 a monographic section was devoted to graduate employment recruiting.

We first consider the relationship between college graduates and firms characteristics. On average, 8.1% of the employees had a college degree (Table 11), in line with the values for the private sector from the LFS (Table 2). In terms of firm size, the share of college graduates is fairly constant for firms with less than 200 employees, while it grows with size above this threshold, reaching a maximum of 15.6% for firms with more than 1,000 employees¹⁰. Some geographical differences also emerge, with southern firm employing less college graduates. In manufacturing, the technological content of the sector of operation, classified according to the OECD system (OECD, 2003), strongly correlates with graduate employment: in high tech firms the share of college graduates is 17%, compared to less than 5% in medium and low tech firms. Business services firms also employ a large share of college graduates.

The survey also reports information on the ownership structure, which allows us to classify firms as owned by a family or individual vs. a financial or foreign institution. Family firms tend to have a lower share of college graduates than other firms (6.6% vs. 10.9%). We also know the educational attainments of the firm's "boss" (the owner for family firms or the CEO for non family firms). Firms whose boss holds a college degree have almost three times as many graduates as other firms (12.5% vs. 4.8%). To control for spurious correlations, in column 1 of Table 14 we regress the share of college graduates on firm characteristics. Size and geographical area play a very marginal role, while sectoral effects are important. Moreover, the relevance of having a boss with a graduate degree is confirmed by the regressions, while the role of family ownership is reduced when accounting for the former variables. In fact, family firms are substantially less likely to be run by a college graduate; once we control for this, the effect of family ownership becomes statistically insignificant, although still negative.

Another important fact is that the cross-firm dispersion in the share of college graduates is fairly high, with a standard deviation between 1.5 and 2 times the mean (Table 11). This means that the

⁹ The survey has been extensively used to study Italian firms. For a description of the dataset and of its characteristics, see for example Fabiani, Schivardi and Trento (2005) or Iranzo, Schivardi and Tosetti (2008).

¹⁰ This might explain why the analysis of the previous section, based on a 50+ employees maximum threshold, did not display any significant role for firm size.

“occupational models” differ substantially across firms, even within the same size or sectoral class. The cross-firm, within class dispersion is therefore very important to explain the differences in the occupational structure of Italian firms.

We now turn to changes in the labor force composition, to begin to address the issue of structural change. Unfortunately, in the survey the share of college graduates is not reported every year. The other year for which this information is available is 2000, when the survey was restricted to *manufacturing firms with at least 50 employees*. For this category, we can compare the composition of the labor force in 2000 and 2006. Of course, one should keep this limitation in mind, as the data exclude a large share of Italian firms (small and all the non manufacturing). The average share of college graduate grew from 4.6 to 7.7, almost doubling in only 6 years (Table 11). The increase has been larger for small firms. A possible explanation is that these firms were more reliant on a model based on low-skill labor. As argued by Bugamelli et al. (2010), this model has been challenged by globalization and the euro, so that for these firms the necessity to restructure, and therefore to increase the skill content of their labor force, has been stronger. A similar reasoning can be applied also in terms of technological content: the percentage increase in college graduates has been larger for low-tech firms. In absolute terms, also the increase in the share of college graduates in high-tech firms has been substantial. In terms of geographical area, firms located in the Center have increased the share of college graduates more than firms in the South and North-West.

We have seen in the previous sections that the increase in the share of college graduates occurred mostly within sector and firm size class, rather than through sectoral reallocation. However, that analysis was based on a very coarse sectoral disaggregation. We therefore perform a “shift-and-share” decomposition exercise, using sector, size and their interaction to define the classes. Specifically, we use:

- a) 5 size classes, in terms of employment: 50-99, 100-199, 200-499, 500-999, 1000+;
- b) 4 sectoral classes, in terms of technological contents (results are very similar when using 14 two-digit sectors);
- c) The interaction between the two categories.

The results, reported in Table 12, indicate that the increase in the share of college graduates is completely explained by the within class component. The contribution of the “between” and “cross” terms is negative and small in absolute value. This means that the sectoral and size structure of manufacturing firms with at least 50 employees has not changed significantly in the 6 years considered. Again, this is in line with Bugamelli et al. (2010), who use national accounts data

to study the sectoral composition, finding that it has changed very little between 1998 and 2005. This shows that the determinants of the increase in the share of college graduates are within-firm effects, rather than due to reallocation. Next, therefore, we consider the firm-level determinants of the demand for skilled work.

In 2006 the survey investigated the importance of some applicants' characteristics for the recruitment of college graduates at their first or second job experience. The characteristics are: a) geographical area of the applicant; b) personality traits; c) work experience; d) post-graduate degrees (ie., after the 3 year basic degree, including pre-reform degrees, masters, Ph.D., etc.) e) reputation of the degree-granting university. Answers range from 1 (not important) to 4 (very important).

The Table 13 reports the average value of the answer for the whole sample and for various subsamples, while Figure 2 reports pie graphs for the frequencies of each answer. The most important factors are personality traits (average grade 3.37), followed by work experience (3.16). The factors related to college education are less relevant: 2,34 for post-graduate degrees and 2,15 for the reputation of the university. The fact that the reputation of the university is not important shows that the employers do not seem to perceive marked differences in the quality of education granted by the universities. These might depend both on the fact that entrepreneurs are not capable to appreciate such differences (a demand factor) and that the quality of the education has little variation across universities (supply effects), something that we cannot tell apart. Finally, the geographical area of the applicant bears little importance.

In Table 14, columns 2-6, we report the results of a regression of the importance of each factor on firm characteristics. For the geographical area and personality traits there is basically no effects of firms characteristics. Work experience is slightly more important for firms located in the South, possibly signaling a lower quality of formal education there, substituted for by on-the-job training.

Some more interesting insights emerge for the other two categories. Interpreting the relevance of post-graduate education is not simple. The 3+2 reform aims at supplying the labor market with workers with different levels of education, to better suit the firms' vacancies. Therefore, one cannot simply interpret in a negative sense the fact that firms do not deem as very important post graduate degrees. If all firms claimed that they are important, we would conclude that the reform was a failure: it would have been better to maintain the old system. In general, therefore, the fact that such degrees are not that important signals that firms are often happy with 3-year degrees. Additional insights can be obtained from the firm characteristics. The relevance of post-graduate degrees increases monotonically with technological intensity, exactly as we would expect, in line

with the idea that different firms require different levels of education. Also firms in the Center and South puts more weight on post graduate education, possibly again reflecting a lower quality of basic education there. Finally, firm bosses with a graduate degree themselves also put significantly more weights on post-graduate education. This suggests that one important determinant of the demand of college graduates might be the fact that the entrepreneurs are also college graduates. In this case, they are better endowed to appreciate differences in the educational attainments of job applicants. This interpretation is supported by the reputation of the university. Also in this case, a firm boss with a college degree puts more emphasis on this factor, as do firms with a higher technological intensity.

Summing up, we found that sectoral and size reallocation have played no role in explaining the increase in the share of college graduates: rather, the increase occurred within firms. In general, firms are not particularly concerned with the reputation of the degree granting university. At the same time, the importance of post-graduate education grows with technological intensity, suggesting that the reform has indeed contributed to meet a differentiated demand for skills. Finally, an important determinant is the fact that the boss herself holds a college degree: in this case, both the reputation of the university and post-graduate education are deemed more important. The same occurs when considering technological intensity. Entrepreneurs with better education and firms with a higher technological content can therefore contribute to increase the quality of the demand for higher education. As we have seen, the sector specialization pattern is very resilient and there is no reason to expect substantial reallocation towards high tech activities in the near future. More positive news come from the educational attainments of the firm bosses. From 2002 to 2006 the share of bosses with a college degree (again, for manufacturing firms with at least 50 employees) has grown from 23 to 39 percent. Firm bosses with graduate education are becoming widespread in all sectors, including the low-tech ones, possibly in relation to the generational change occurring in many family firms. More educated entrepreneurs are therefore likely to be the most relevant source of an increase in both the quantity and the quality of graduate labor force demand in the near future.

5. Human capital and firm restructuring

Having discussed the determinants of the demand for college graduates, we now move on to investigate the relationship between college graduate in the workforce and firm restructuring. In addition to the characteristics of college graduates sought for by firms, the 2006 survey also contains a section on firm restructuring and on changes in the firm strategy, compared to the strategy the firm was following in 2000. In particular, firms are asked if they changed business

mode by: a) introducing new products; b) investing in branding; c) becoming more oriented to foreign markets through export, FDI and international outsourcing (see Bugamelli et al. 2010 for details). For each category, we create a dummy equal to 1 if the firm has answered “yes”; we also create a “summary” dummy equal to 1 if the firm has answered yes to at least one category, the alternative being “The firm did not change strategy”. Another question is about the self-assessed competitive strength of the firm (1=very weak, 5=very strong). Finally, the firm reports the share of turnover coming from products with own brand. Firms with more own products should be investing more in branding, advertising etc, all activities that require more skilled labor.

We begin by analyzing the correlation between these restructuring indicators and the share of college graduates in the firm. We run the following regressions:

$$restructure_i = a_0 + a_1 share\ graduates_i + a_2 other\ controls_i + u_i$$

where *restructure* are the restructuring indicators discussed above and the other controls are the firm characteristics discussed in the previous section: dummies for boss with a graduate degree, family firms, size classes, sectors and area. For simplicity, and to maximize comparability with the following instrumental variables analysis, we run OLS regressions even for the categorical variables (results are qualitatively the same with probit and ordered probit regressions). We report the results in Panel A of Table 15. Although we control for many firm characteristics, including sectoral dummies, we still find that the share of college graduates strongly correlates with the indicators of restructuring/competitive strength, with the exception of a strategy more based on branding. To give a sense of the strength of the correlation, increasing the share of college graduates by one standard deviation (.14) would increase the probability of an overall change in strategy of 6.3 percent, against an average value of the dummy for the change in strategy of .49. This indicates that restructuring/competitive strength goes together with graduate workforce.

Of course, this simple correlation cannot inform us on the causal relation between graduate workforce and restructuring. It might simply be that an unobserved variable, such as the ability of the entrepreneur, jointly determines both restructuring and the workforce composition. Although we can already claim that restructuring requires more qualified workforce, it might be that the scarce resource is entrepreneurial ability, in which case increasing the educational attainment of the workforce might be of little help for restructuring. To address this problem, we need exogenous variations in the share of college graduates at the firm level. We use the share of college graduates in the workforce with scientific degrees for the years 2001-2005 in the province where the firm is

located,¹¹ obtained from the labor force survey. Using data for multiple years increases the degrees of freedom and allows for lagged potential effects of the reform. The identifying assumption is that this share is correlated with that at the firm level: changes in the supply of college graduates at the local level are reflected in changes in college graduates hired by firms. This assumption seems particularly appropriate for Italy. There is a widespread consensus that geographical mobility in Italy is low because of high moving costs. For example, according to a 1995 survey of the National Institute of Statistics, more than 40% of unemployed workers were unwilling to take a job outside the municipality of residence and only 22% were ready to move anywhere (Faini, Galli and Rossi 1996). The exclusion restriction requires that the share of college graduates at the provincial level influences firm restructuring only by facilitating the hiring of college graduates. One possible objection to this assumption relates to human capital spillovers. Being localized in an area with many college graduates might facilitate restructuring in itself. In any case, we will report the overidentification tests to check for potential endogeneity concerns.

In panel B of Table 15 we report the IV results. The estimates are in line with the OLS ones, but with substantially stronger effects. For example, the coefficient in the overall change in strategy regression goes from .41 to 1.18. Tests statistics are generally satisfactory, with the exception of the share of turnover coming from own-brand products, where both the F-statistics and the Sargan statistics signal that the instruments are inadequate. One possible interpretation of the stronger effects is in terms of “local average treatment effects” (LATE). The IV estimates are based on variations of the share of college graduates at the firm level that can be attributed to changes in the share of college graduates in the workforce at the provincial level. It might be that provinces in which firms respond more to such changes are also those in which the effects of college graduates on restructuring are strongest.

The evidence so far supports a causality effect of college graduate employment on restructuring. The final question we want to address is more directly the relation between the share of graduates from the 3+2 system and firm performance. This is clearly a difficult question, as the reform is fairly recent and, in general, assessing its effects on the productive system is complicated. As an attempt to directly tackle this question, we will check if firm growth is related to the share of college graduates from the 3+2 system at the regional level, for which we have time series data. The chain of causality can be summarized as follows: 1) the reform increases the supply of college graduates; b) college graduates facilitates restructuring; 3) this leads to firm growth. There is evidence supporting each step of this chain separately. Above we have supplied evidence that supports point b). Point a) can be tested by considering the correlation between the share of college

¹¹ For multi-plant firm, we use the location of the headquarters, arguably in charge of hiring most of college graduates.

graduates from the 3+2 system and the growth rate of the total number of college graduate. This is shown in Figure 3, which reports the partial correlation coefficient between these two variables at the year-region level for the years 2001-2007, where we also control for year and region dummies. The correlation is strong, positive and statistically significant. Finally, Bugamelli et al. (2010) supply evidence that firms that undertook restructuring activities registered higher growth rates of value added and of value added per worker over the period 2000-2006, compared to firms that did not restructure. We test this causality chain by regressing some indicators of firm performance on the growth rate of college graduates at the local level. As dependent variables, we use the firm level growth rate of value added, of value added per worker and of TFP.¹² Given that for this regressions balance sheets data are all what is needed, we use the “Centrale dei Bilanci” database, that contains information on a sample of around 50,000 firms per year, a much larger number than INVIND (see Cingano and Schivardi 2004 for a description). We run the regression:

$$Performance\ growth_{it}=a_0+a_1growth\ rate\ of\ graduates_{it}+a_2performance_{it-1}+dummies_{it}+u_{it}$$

where *Performance growth_{it}* is the delta log of, respectively, value added, value added per worker and TFP between *t* and *t-1* for firm *i*, *growth rate of graduates* is the delta log of the number of graduates in the resident population at the regional level, *performance_{it-1}* is the lagged log value of the performance indicator and *dummies_{it}* are region, two digit sector and area dummies. To address endogeneity concerns, we use the share of graduates in 3+2 courses in total graduates as an instrument for the growth rate of college graduates. As argued by Bosio and Leonardi (2010), the pace of diffusion of the reform has been dissimilar across universities, arguably for exogenous reasons, so that changes in such shares should be exogenous to the determinants of the productive structure, while correlated with the growth rate of graduates, as shown in Figure 3. The results are reported in Table 16. The growth rate of value added is positively related to that of college graduates and the IV estimates are substantially larger than the OLS ones. The effects are less precise for the productivity indicators, with significance levels always around 10%. Overall, the evidence supports the claim that an increase in the graduate workforce has a positive impact on firm performance. To get a rough gauge of the size of the effects, the estimate in Column (6) for TFP implies that TFP would increase by 0.7% following an increase in college graduates of 10%.

The regressions in Table 16 use the share of graduates in the 3+2 system as instruments. Indeed, such share might have an impact on firm performance beyond its contribution to the growth of

¹² TFP is computed using the book value of physical capital. The capital and labor coefficients are obtained from a simple OLS regression of log value added over log capital and log labor, including year and sector dummies. The resulting coefficients are 0.18 for capital and 0.70 for labor. Although this regression is subject to endogeneity concerns, in practice TFP computations tends to be fairly robust with respect to the estimation method (see Cingano and Schivardi 2004 for some comparisons). We leave the use of more sophisticated estimation methods to future work.

college graduates. For example, graduates in the 3+2 system are typically young; moreover, as argued before the reform has increased the variety of college graduates achievements, possibly implying better matches. If this were the case, it would be more appropriate to use directly the share in the performance regression rather than as an instrument. We therefore directly analyze the effects of the reforms by regressing firm's growth over the regional share of college graduates due to the 3+2 system. Although endogeneity should not be a major concern, we address this possibility following Bosio and Leonardi (2011) and instrument the share of 3+2 graduates in year t with the share of 3+2 courses and the share of enrolled students in the 3+2 courses three years before, separately for males and females. The assumption is that the share of new courses opened in the same region three years before should be exogenous with respect to growth opportunities three years down the road. The other controls are the same as in the previous regression. The results are reported in Table 17. They support the claim that the reform is having a beneficial effects on firm growth. For value added, we find a coefficient of .04, significant at 1%. It implies that an increase of one standard deviation in the share of 3+2 graduates (.27) would increase value added growth by 1%. The IV estimates are approximately twice as large, arguably because of measurement error in the share of 3+2 graduates. As for the previous regression, the effects are smaller, and somehow less significant, for the productivity measures, but the positive effects emerge also in this case. The estimated coefficients imply an increase in growth between .05 and 1.5% when increasing the share of 3+2 graduates by one standard deviation.

All in all, these regressions support the view that the reform of the university system has eased a constraint for firm restructuring. Needless to say, the evidence is indirect and therefore only suggestive. More work will be needed to confirm or, possibly, contradict these results. However, so far the data do not reject the hypothesis that the supply of college graduates at the local level is an important determinant of firm restructuring and growth.

6. Conclusion

This paper has studied the interaction between human capital and structural change in the Italian productive system. We have shown that Italy records a substantial lower level of college graduates in the workforce than the rest of Europe and that this gap was not reduced over time. Only in the very last years, arguably following the introduction of the 3+2 system, there is some evidence that a catching up process might be starting to kick in. In terms of time changes, the share of college graduates did increase substantially over the last fifteen years. Most of the increase occurred within sector and firm size classes, rather than following sectoral reallocation from low to high human capital activities. Firm level evidence indicates that firms do benefits from a labor force with high

education attainments when undertaking restructuring. In fact, the increase of college graduates at the local level induces more restructuring and higher productivity growth. In this respect, the 3+2 reform might have helped by increasing the supply of college graduates.

All in all, our evidence support the assertion that education pays off, particularly in a period in which the system is undergoing a process of difficult and costly restructuring. This conclusion is in line with that reached by Ciccone, Cingano and Cipollone (2006), who found that the investment in education has high private and social returns. At the same time, more work will be needed in the near future, as the effects of the reform kicks in, to confirm or disprove these results. Due to data limitation and to the short time period since the reform, in fact, our analysis leaves open a series of issues that will have to be tackled in future research. At the moment, in any case, the evidence suggests that increasing the supply of college graduates will help the Italian productive system to restructure and that the 3+2 reform might help along these lines. And if it is too early to claim that the reform was successful, it is equally too early to deem it a failure: more evaluation efforts will be required before embarking in further reforms (or counter-reforms).

Tables

Table 1

Employment rates, unemployment rates and college graduate shares, by country

15-64 year-old						
	Employment rate		Unemployment rate		College graduate share	
	Total	Graduates	Total	Graduates	Population	Labour force
AT	71.1	86.4	4.5	2.5	14.7	17.9
BE	62.0	83.7	7.5	3.8	28.1	37.9
DE	69.3	86.0	8.7	3.5	20.5	25.4
DK	77.9	87.6	3.7	3.0	27.1	30.5
ES	66.3	82.7	8.3	5.4	27.0	33.7
FI	69.9	85.2	6.9	3.4	29.4	35.8
FR	64.4	79.8	8.1	5.5	24.3	30.0
GR	61.4	81.9	8.4	7.1	19.2	25.7
IE	68.7	86.1	4.6	2.6	28.1	35.2
IT	58.7	77.7	6.2	4.5	12.0	15.9
LU	64.2	83.4	4.1	3.2	22.7	29.5
NL	75.2	86.9	3.6	2.0	26.7	30.9
PT	67.8	84.2	8.5	7.6	12.0	15.0
SE	76.8	87.6	6.0	3.6	27.0	30.8
UK	74.7	87.3	5.3	2.3	28.2	32.9
EU15 excluding Italy	69.1	84.5	7.2	4.0	24.0	29.4
UE15	67.5	83.9	7.1	4.0	22.2	27.6

25-35 year-old						
	Employment rate		Unemployment rate		College graduate share	
	Total	Graduates	Total	Graduates	Population	Labour force
AT	82.0	88.7	4.7	3.0	18.9	20.5
BE	80.6	90.3	8.8	4.4	41.3	46.3
DE	77.7	90.2	8.7	3.3	23.7	27.5
DK	85.6	89.2	3.9	4.1	40.1	41.8
ES	79.2	84.8	8.3	6.6	40.2	43.1
FI	80.3	86.6	6.2	3.7	38.8	41.8
FR	79.9	86.4	9.7	6.3	39.6	42.8
GR	74.9	80.1	11.7	12.4	27.1	29.0
IE	81.9	89.9	4.6	2.4	43.6	47.8
IT	70.1	71.3	8.3	9.5	18.9	19.2
LU	83.9	87.3	5.2	4.5	35.7	37.2
NL	87.7	93.8	2.3	1.3	36.7	39.3
PT	80.9	85.1	9.8	10.4	21.4	22.5
SE	83.9	87.3	5.8	4.6	39.9	41.6
UK	80.5	90.5	4.5	2.1	37.6	42.3
EU15 excluding Italy	79.9	87.9	7.6	4.8	34.1	37.6
UE15	78.4	86.4	7.7	5.2	31.7	35.0

Source: Eurostat, European Labour force Survey

Table 2

Employment composition by education level in the business and the public sector

15-64 year-old						
	Business sector			Public sector		
	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
AT	19.9	65.9	14.2	12.4	55.8	31.8
BE	26.0	43.5	30.5	15.2	30.3	54.5
DE	16.5	62.7	20.8	10.9	50.3	38.8
DK	29.9	48.4	21.7	16.2	34.5	49.3
ES	47.8	25.3	26.9	15.7	20.6	63.8
FI	20.0	50.7	29.2	7.9	38.1	54.0
FR	26.9	47.6	25.5	19.6	39.9	40.5
GR	41.8	41.8	16.4	9.7	30.2	60.1
IE	27.6	43.3	29.1	15.0	28.3	56.7
IT	43.9	45.3	10.9	17.2	46.5	36.2
LU	33.0	40.1	26.9	22.6	41.5	35.8
NL	31.1	45.5	23.4	11.6	40.9	47.5
PT	75.5	15.3	9.2	43.2	18.5	38.3
SE	17.8	60.7	21.5	7.2	43.1	49.7
UK	24.7	48.9	26.3	14.8	35.5	49.7
EU15 excluding Italy	28.8	47.8	23.4	14.8	38.9	46.3
UE15	30.9	47.4	21.7	15.1	39.7	45.2
25-35 year-old						
	Business sector			Public sector		
	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
AT	11.8	71.3	16.9	7.0	57.1	35.9
BE	15.3	46.0	38.7	7.8	26.9	65.3
DE	10.6	66.7	22.7	6.9	52.0	41.1
DK	15.0	52.4	32.6	8.0	31.1	60.9
ES	35.5	26.7	37.8	8.0	18.5	73.5
FI	8.7	55.7	35.6	2.9	36.2	60.9
FR	16.3	44.5	39.2	8.7	38.6	52.7
GR	28.2	50.7	21.1	4.1	33.3	62.6
IE	14.5	43.3	42.2	5.8	23.0	71.2
IT	32.4	52.3	15.3	7.7	47.0	45.3
LU	25.7	40.3	34.1	13.8	41.6	44.6
NL	19.0	48.5	32.5	5.8	38.7	55.5
PT	61.4	22.1	16.5	26.7	23.2	50.1
SE	8.3	57.9	33.8	3.5	36.3	60.2
UK	17.9	45.5	36.6	7.8	33.6	58.6
EU15 excluding Italy	20.9	46.8	32.2	7.9	37.5	54.6
UE15	22.7	47.7	29.6	7.8	38.3	53.9

Source: Eurostat, European Labour force Survey

Table 3

Public sector employment share and share of graduates employed in the public sector

	15-64 year-old		25-35 year-old	
	Public sector employment share	Share of graduates employed in the public sector	Public sector employment share	Share of graduates employed in the public sector
AT	20.9	37.2	18.8	33.0
BE	30.8	44.3	28.5	40.2
DE	25.5	39.0	25.8	38.6
DK	31.8	51.4	32.6	47.5
ES	18.4	34.8	14.8	25.2
FI	26.6	40.1	24.4	35.6
FR	29.5	40.0	27.6	33.9
GR	21.3	49.8	19.1	41.2
IE	22.5	36.2	19.3	28.7
IT	19.9	45.3	13.0	30.6
LU	28.8	35.0	29.2	35.0
NL	30.6	47.2	29.1	41.2
PT	19.9	50.9	18.0	40.0
SE	32.8	53.1	29.5	42.7
UK	28.3	42.7	26.0	36.0
EU15 excluding Italy	26.1	41.0	23.9	34.7
UE15	25.3	41.4	22.3	34.4

Source: Eurostat, European Labour force Survey

Table 4

Employment and unemployment rates by country and education level

	Males 25-35 year-old							
	Employment rate				Unemployment rate			
	Primary	Secondary	Tertiary	Total	Primary	Secondary	Tertiary	Total
AT	79.5	90.5	93.1	89.8	10.8	3.5	2.7	5.0
BE	69.4	88.2	91.5	85.7	18.5	7.1	4.9	12.8
DE	66.9	80.9	94.1	82.2	25.5	8.4	2.5	12.2
DK	83.9	90.6	91.7	90.0	5.6	2.2	3.8	5.1
ES	84.6	86.5	88.6	86.5	8.4	5.2	5.7	10.0
FI	70.6	85.4	93.4	86.2	12.1	5.9	2.8	8.1
FR	76.4	87.7	89.8	86.2	16.8	8.8	6.3	14.1
GR	88.8	86.5	83.9	86.6	6.8	7.6	10.4	10.3
IE	73.7	90.1	92.4	87.6	11.0	4.7	2.9	8.2
IT	81.2	82.6	75.2	81.0	8.0	5.3	8.3	7.7
LU	90.0	87.6	89.4	88.7	7.2	4.4	3.3	6.8
NL	86.0	94.3	95.8	93.2	4.6	1.6	1.3	3.2
PT	87.2	80.2	87.3	85.6	7.5	5.9	8.0	8.5
SE	75.0	89.1	89.5	87.8	11.3	4.6	4.5	7.7
UK	78.6	89.8	93.9	89.0	8.7	4.7	1.9	6.9
EU15 excluding Italy	79.8	86.2	91.4	86.3	12.0	6.6	4.2	10.1
UE15	80.1	85.6	90.1	85.5	11.1	6.4	4.5	9.7
	Males 15-64 year-old							
	Employment rate				Unemployment rate			
	Primary	Secondary	Tertiary	Total	Primary	Secondary	Tertiary	Total
AT	58.5	80.8	89.8	77.8	8.9	3.3	2.0	4.9
BE	49.6	73.8	86.8	68.7	11.4	6.1	3.7	9.7
DE	50.4	77.7	89.2	74.5	18.4	8.3	3.1	11.5
DK	69.9	84.5	90.1	81.5	5.4	2.5	2.9	4.6
EE	71.7	78.2	87.2	77.3	7.9	6.0	4.4	8.9
FI	49.2	76.3	86.9	71.4	11.4	6.6	3.3	9.2
FR	53.0	74.4	82.1	69.1	12.1	6.6	5.4	10.3
GR	69.8	74.3	87.1	74.9	5.1	5.9	4.5	6.7
IE	61.2	84.1	90.3	77.0	7.8	4.2	2.8	6.8
IT	62.5	77.3	84.0	70.7	6.0	4.4	3.2	5.7
LU	58.9	75.8	87.2	72.3	5.7	2.6	2.7	4.9
NL	70.4	84.2	89.2	81.4	5.3	2.9	1.9	4.6
PT	73.3	68.1	87.8	73.8	7.2	6.9	5.6	7.8
SE	58.3	83.9	88.4	79.2	11.3	4.9	3.9	7.6
UK	64.9	80.0	88.9	78.6	10.6	5.3	2.5	8.0
EU15 excluding Italy	61.9	78.0	87.5	75.1	10.4	6.4	3.6	9.1
UE15	62.0	77.9	87.2	74.4	9.5	6.1	3.5	8.5

Source: Eurostat, European Labour force Survey

Table 5

Employment and unemployment rates by education level and country

	Females 25-35 year-old							
	Employment rate				Unemployment rate			
	Primary	Secondary	Tertiary	Total	Primary	Secondary	Tertiary	Total
AT	56.5	75.5	84.4	74.2	12.9	4.7	3.4	6.9
BE	43.9	72.2	89.4	75.4	26.6	11.2	4.1	18.9
DE	43.0	75.1	86.2	73.3	23.4	7.6	4.2	11.1
DK	61.2	81.8	87.1	81.2	7.8	3.9	4.4	8.3
ES	58.2	68.2	81.7	71.3	15.6	11.3	7.4	19.4
FI	47.4	70.8	81.8	74.2	17.4	8.5	4.4	13.4
FR	47.6	72.7	83.7	73.6	23.4	10.4	6.4	18.4
GR	43.0	61.6	77.0	62.6	21.1	16.8	14.2	23.8
IE	42.7	72.5	87.9	76.1	13.2	4.7	2.0	8.8
IT	42.3	64.0	68.7	59.0	14.5	8.9	10.3	13.8
LU	71.2	76.9	85.6	79.1	8.1	4.4	5.5	9.5
NL	58.0	82.7	92.0	82.2	7.4	2.6	1.3	4.6
PT	71.4	76.8	83.8	76.1	14.2	9.9	11.7	16.9
SE	51.9	78.9	85.6	79.8	21.5	6.4	4.7	12.1
UK	44.1	70.7	87.4	72.0	12.4	5.1	2.2	8.6
EU15 excluding Italy	51.6	73.1	85.0	73.3	17.3	8.1	5.3	13.7
UE15	49.7	71.6	83.3	71.1	16.8	8.2	5.7	13.7
	Females 15-64 year-old							
	Unemployment rate				Unemployment rate			
	Primary	Secondary	Tertiary	Total	Primary	Secondary	Tertiary	Total
AT	47.2	69.5	81.8	64.4	8.8	4.1	3.3	6.0
BE	31.1	57.3	80.9	55.3	15.5	9.7	3.9	14.1
DE	40.8	68.7	81.7	64.1	16.6	8.4	4.0	11.2
DK	58.5	78.5	85.5	74.3	6.1	3.6	3.1	6.0
ES	40.2	58.4	78.4	55.1	15.5	10.8	6.4	16.8
FI	41.9	70.4	83.9	68.4	14.7	8.1	3.4	11.9
FR	41.8	63.8	77.8	59.9	12.3	8.5	5.6	12.3
GR	33.8	48.3	76.5	47.9	13.1	14.8	9.9	17.5
IE	34.2	64.0	82.5	60.2	7.6	4.7	2.4	7.2
IT	29.8	58.4	72.4	46.6	10.5	7.3	5.6	9.8
LU	41.6	58.3	79.4	56.1	6.0	4.4	3.9	6.7
NL	50.4	74.1	84.3	68.8	7.1	3.7	2.0	5.8
PT	57.6	61.8	81.9	61.9	10.7	9.5	8.9	12.2
SE	47.4	76.6	87.0	74.3	16.0	5.8	3.3	9.6
UK	54.6	71.7	85.6	70.6	8.3	5.1	2.2	7.3
EU15 excluding Italy	44.4	67.1	81.5	62.9	12.5	7.6	4.4	11.0
UE15	41.4	65.9	80.7	60.4	12.2	7.6	4.5	10.9

Source: Eurostat, European Labour force Survey

Table 6

Changes in the college graduates' share of the labour force, when assuming the EU average composition, by sector or by sector and size class

15-64 year-old			
	College graduates' share	Change in graduates' share by assuming EU15 sector composition	Change in graduates' share by assuming the EU sector and size class composition
AT	14.2	0.5	0.7
BE	30.5	-1.1	-1.2
DE	20.8	-0.5	-0.4
DK	21.2	-0.2	-0.9
EE	26.9	2.6	3.9
FI	29.2	-0.2	0.0
FR	25.5	0.0	-0.2
GR	16.4	4.6	6.6
IT	10.9	0.4	0.7
LU	26.9	-7.5	-7.8
NL	23.3	-1.3	-1.8
PT	9.2	3.9	6.1
SE	21.3	-1.9	-2.1
UK	26.1	-0.7	-1.0
25-35 year-old			
	College graduates' share	Change in graduates' share by assuming EU15 sector composition	Change in graduates' share by assuming the EU sector and size class composition
AT	16.9	0.6	0.5
BE	38.7	-1.5	-1.5
DE	22.7	-0.8	-1.3
DK	31.6	-0.2	-1.9
EE	37.8	3.5	4.6
FI	35.6	-0.7	-1.2
FR	39.2	-0.4	-0.9
GR	21.1	4.2	6.6
IT	15.3	1.2	1.9
LU	34.1	-10.8	-12.4
NL	32.3	-2.2	-3.2
PT	16.5	4.1	6.4
SE	33.6	-2.7	-3.5
UK	36.3	-1.6	-2.5

Source: Eurostat, European Labour force Survey

Table 7

College graduates' share, employment and unemployment rates

15-64 years-old							
	Graduates' share of population (Italy)	Graduates' share of labour force (Italy)	Graduates' employment rate (Italy)	Graduates' unemployment rate (Italy)	Emp. rate (Italy)	Unemp. rate (Italy)	Graduates' share of population (EU excluding Germany)
Males							
1993	6.1	7.9	89.2	3.3	68.2	7.7	-
1997	7.1	9.2	85.9	5.6	65.7	9.5	18.2
2000	8.2	10.6	87.0	4.1	67.5	8.3	20.2
2004	9.3	11.6	87.0	3.8	69.8	9.3	22.5
2007	10.9	13.0	84.0	3.2	70.7	5.0	24.0
Females							
1993	4.9	10.3	75.1	7.7	35.7	14.9	-
1997	6.3	12.6	72.8	9.8	36.5	16.5	17.1
2000	7.9	14.6	74.2	8.6	40.2	14.9	19.8
2004	10.2	17.3	76.3	6.7	45.2	10.2	24.2
2007	13.2	20.4	72.4	5.6	46.6	7.9	25.5
Total							
1993	5.5	8.7	82.9	5.1	51.9	10.3	-
1997	6.7	10.4	79.7	7.4	51.1	12.1	17.6
2000	8.1	12.1	80.7	6.2	54.0	10.9	20.0
2004	9.8	13.8	81.4	5.2	57.5	8.0	22.8
2007	12.0	15.9	77.7	4.5	58.7	6.2	24.7
25-35 year-old							
Males							
1993	7.0	6.7	78.6	10.2	81.7	8.8	-
1997	8.0	7.3	70.6	18.0	77.4	12.3	24.5
2000	9.4	9.4	77.6	12.5	77.8	10.7	27.8
2004	12.1	11.4	75.7	11.0	80.9	8.4	32.2
2007	14.8	13.8	75.2	8.3	81.0	6.7	33.3
Females							
1993	7.2	10.2	69.5	17.5	48.9	16.3	-
1997	9.2	12.2	65.5	20.7	49.5	18.7	26.4
2000	11.7	15.4	68.9	18.0	52.2	17.9	30.8
2004	17.1	20.1	70.3	12.7	59.7	11.9	37.6
2007	22.9	26.7	68.7	10.3	59.0	10.5	40.8
Total							
1993	7.1	8.0	74.0	13.8	65.4	11.7	-
1997	8.6	9.2	67.9	19.4	63.6	14.9	25.4
2000	10.5	11.8	72.8	15.5	65.2	13.7	29.3
2004	14.6	15.0	72.6	12.0	70.4	9.9	34.9
2007	18.9	19.2	71.3	9.5	70.1	8.3	37.0

Source: Eurostat, European Labour force Survey

Table 8**College graduates' composition**

	15-64 year-old				25-35 year-old			
	1993	2000	2008	Change	1993	2000	2008	Change
Psychology	1.2	1.4	2.5	1.3	1.5	1.7	3.4	1.9
Agronomy	2.9	2.5	2.2	-0.7	3.8	2.1	1.9	-1.9
Pedagogy	3.0	3.5	6.2	3.2	2.8	2.8	5.6	2.8
Political and social studies	3.7	5.3	7.0	3.3	3.7	6.5	9.7	5.9
Architecture	4.4	5.2	4.5	0.1	4.7	5.2	3.9	-0.8
Chemistry	4.5	4.3	3.4	-1.1	3.7	4.0	3.8	0.0
Sciences	4.8	4.6	4.0	-0.8	4.5	4.5	3.4	-1.2
Natural sciences and geology	5.0	5.2	4.5	-0.5	5.5	4.3	3.3	-2.2
Languages	6.5	6.7	5.8	-0.7	7.6	6.8	5.4	-2.1
Engineering	8.9	8.8	10.3	1.4	8.7	9.4	12.3	3.6
Economics and management	11.2	13.3	14.1	2.8	14.9	19.2	16.7	1.8
Law	12.8	13.0	10.4	-2.4	14.5	15.5	10.8	-3.7
Medicine	14.8	12.4	12.7	-2.1	14.1	7.3	9.7	-4.4
Literature	16.2	14.0	12.3	-3.9	9.9	10.7	10.2	0.3

Source: Istat, Labour force Survey

Table 9

Shift-share analysis, cells defined by the sector of activity

Total economy								
	15-64				25-35			
	Within	Between	Interaction	Total	Within	Between	Interaction	Total
1997-2007					1997-2007			
Italy	4.6	0.9	0.0	5.5	9.7	0.7	-0.4	10.0
EU15 excluding Germany	6.3	1.0	-0.1	7.2	11.1	1.0	-0.2	11.9
1997-2002					1997-2002			
Italy	2.1	0.4	0.0	2.5	4.3	0.3	0.1	4.7
EU15 excluding Germany	2.7	0.5	0.0	3.2	5.7	0.5	0.0	6.2
2002-2007					2002-2007			
Italy	2.5	0.5	-0.1	3.0	5.3	0.3	-0.3	5.3
EU15 excluding Germany	3.5	0.5	-0.1	4.0	5.3	0.5	-0.1	5.7
Business sector								
	15-64				25-35			
	Within	Between	Interaction	Total	Within	Between	Interaction	Total
1997-2007					1997-2007			
Italy	3.7	1.4	0.0	5.1	7.4	1.2	0.0	8.6
EU15 excluding Germany	6.2	1.0	-0.1	7.1	10.3	1.1	-0.2	11.2
1997-2002					1997-2002			
Italy	2.0	0.6	0.0	2.6	3.6	0.6	0.1	4.3
EU15 excluding Germany	2.7	0.6	0.0	3.3	5.4	0.7	0.0	6.1
2002-2007					2002-2007			
Italy	1.6	0.8	0.0	2.5	3.8	0.7	-0.2	4.3
EU15 excluding Germany	3.4	0.4	0.0	3.8	4.8	0.3	-0.1	5.0

Source: Eurostat, European Labour force Survey

Table 10

Shift-share analysis, cells defined by sector of activity and size class

Total economy									
	15-64				25-35				
	Within	Between	Interaction	Total	Within	Between	Interaction	Total	
1997-2007				1997-2007					
Italy	4.3	1.2	0.0	5.5	9.7	0.8	-0.5	10.0	
EU15 excluding Germany	5.6	1.7	-0.1	7.1	10.5	1.8	-0.2	12.0	
1997-2002				1997-2002					
Italy	2.2	0.4	0.0	2.6	4.2	0.3	0.2	4.7	
EU15 excluding Germany	2.6	0.2	-0.1	2.8	5.4	0.1	-0.1	5.5	
2002-2007				2002-2007					
Italy	2.1	1.0	-0.2	3.0	5.2	0.6	-0.5	5.3	
EU15 excluding Germany	2.9	1.5	-0.1	4.4	5.0	1.6	-0.1	6.6	
Business sector									
	15-64				25-35				
	Within	Between	Interaction	Total	Within	Between	Interaction	Total	
1997-2007				1997-2007					
Italy	3.5	1.3	0.2	5.1	7.2	1.3	0.2	8.6	
EU15 excluding Germany	5.8	1.5	0.0	7.3	10.0	1.7	-0.1	11.6	
1997-2002				1997-2002					
Italy	2.0	0.5	0.1	2.6	3.5	0.5	0.2	4.3	
EU15 excluding Germany	2.5	0.5	0.0	3.0	4.9	0.6	0.1	5.6	
2002-2007				2002-2007					
Italy	1.5	1.0	0.0	2.5	3.5	1.1	-0.3	4.3	
EU15 excluding Germany	3.2	1.0	0.0	4.3	5.0	1.2	-0.1	6.0	

Source: Eurostat, European Labour force Survey

Table 11

College graduates' share in Italian firms

	Total sample, 2006		Manufacturing, 50+ employee firms			
	Mean	Stand. dev.	2006		2000	
			Mean	Stand. dev.	Mean	Stand. dev.
Total	8.1	13.9	7.7	10.1	4.6	6.6
Size (employment):						
20-49	7.6	14.0				
50-99	8.9	13.9	7.1	10.1	3.8	5.6
100-199	8.1	12.0	7.7	9.3	4.8	6.6
200-499	10.1	13.9	9.4	10.1	6.0	7.5
500-999	11.4	14.5	10.8	11.4	9.4	10.3
1000+	15.6	20.8	13.4	12.3	11.7	11.5
Geographical Area						
North-West	8.4	14.0	6.6	7.4	4.4	6.0
North-East	8.3	13.9	8.7	11.3	5.2	7.2
Centre	7.8	13.0	9.2	12.4	4.2	6.4
South	7.2	14.5	6.8	10.4	4.2	7.2
Sector						
Manufacturing	6.2	9.2	7.7	10.1	4.6	6.6
Technological intensity:						
Low	4.7	7.6	5.7	8.6	2.9	4.9
Med-Low	4.1	5.4	5.1	5.0	3.7	4.3
Med-High	9.8	11.5	11.1	11.9	6.3	7.2
High	17.2	18.5	21.0	18.7	13.8	14.0
Services	10.6	18.1				
of which:						
Trade	4.9	8.7				
Business services	16.2	22.7				

Source: INVIND survey, year 2000 and 2006.

Table 12

Shift and share decomposition

Cells	$h^{06}-h^{00}$ (%)	Δ_w	Δ_h	Δ_{wh}
Size	3.098	-0.004	3.104	-0.001
Sector	3.050	-0.070	3.197	-0.076
Size and sector	3.072	-0.018	3.196	-0.107

Source: INVIND survey, year 2000 and 2006. We use 5 size classes (20-49, 50-99, 100-199, 200-499, 500-999, 1000+) and the four technological intensity classes. The slight differences in the average values is due to the fact that not all firms can be attributable to the technological classes, so that the three sample differ marginally

Table 13

Relevance of individual characteristics in graduate employment recruiting

	<i>Geographic area</i>	<i>Personality traits</i>	<i>Work experience</i>	<i>Post-graduate degree</i>	<i>University reputation</i>
Total	1,99	3,37	3,16	2,34	2,15
Size:					
less than 50 employees	1,99	3,38	3,16	2,32	2,17
50 employees or more	1,98	3,36	3,15	2,38	2,10
Area:					
North-West	1,96	3,41	3,15	2,23	2,10
North-East	2,06	3,35	3,13	2,30	2,10
Centre	1,90	3,38	3,10	2,47	2,34
South	2,02	3,32	3,30	2,53	2,12
Industry:					
Manufacturing	2,04	3,36	3,14	2,33	2,11
of which:					
Low tech.	2,01	3,31	3,10	2,27	2,08
Medium-tech.	1,96	3,36	3,17	2,32	2,13
Medium-high tech.	2,16	3,42	3,14	2,36	2,09
High tech.	2,05	3,39	3,23	2,81	2,41
Services	1,92	3,39	3,19	2,36	2,20
of which					
Trade	1,94	3,40	3,30	2,32	2,15
Other services	1,89	3,38	3,09	2,40	2,25

Source: INVIND survey, year 2006. Each column reports average values for one characteristics. Answers go from 1 (not important) to 4 (very important). All values are weighted with sampling weights.

Table 14

Firm level determinants of demand for graduate workers

	(1)	(2)	(3)	(4)	(5)	(6)
	Graduates' share	Area	Personality traits	Work experience	Post-graduate degree	University reputation
Graduate boss	0.067 (0.011)***	0.003 (0.063)	0.100 (0.055)*	-0.093 (0.054)*	0.175 (0.054)***	0.183 (0.056)***
Family firm	-0.012 (0.013)	0.002 (0.081)	0.056 (0.063)	-0.124 (0.066)*	-0.090 (0.067)	0.022 (0.066)
Size dummy						
50-99	-0.000 (0.010)	0.047 (0.069)	-0.052 (0.056)	0.037 (0.056)	0.013 (0.060)	-0.032 (0.062)
100-199	-0.014 (0.011)	-0.046 (0.072)	-0.033 (0.063)	0.032 (0.060)	-0.076 (0.064)	-0.014 (0.068)
200-499	-0.018 (0.012)	0.073 (0.080)	0.122 (0.066)*	0.100 (0.066)	0.045 (0.074)	0.063 (0.073)
500+	0.007 (0.020)	0.021 (0.097)	0.136 (0.071)*	0.008 (0.086)	0.327 (0.095)***	0.243 (0.086)***
Geography dummy						
North-East	-0.000 (0.013)	0.096 (0.088)	-0.056 (0.076)	-0.015 (0.076)	-0.021 (0.075)	-0.049 (0.077)
Center	-0.006 (0.014)	-0.002 (0.081)	0.053 (0.079)	-0.021 (0.073)	0.227 (0.073)***	0.065 (0.073)
South	-0.011 (0.014)	0.066 (0.079)	-0.070 (0.076)	0.174 (0.066)***	0.371 (0.073)***	0.046 (0.075)
Sector dummy						
Medium-low tec	-0.008 (0.005)*	0.047 (0.078)	0.120 (0.080)	0.154 (0.084)*	0.198 (0.074)***	0.163 (0.075)**
Medium-high tec	0.043 (0.008)***	0.223 (0.088)**	0.125 (0.080)	0.115 (0.087)	0.276 (0.078)***	0.163 (0.079)**
High tec	0.096 (0.031)***	0.002 (0.201)	0.164 (0.185)	0.215 (0.129)*	0.570 (0.168)***	0.352 (0.208)*
Trade	0.002 (0.007)	0.067 (0.098)	0.113 (0.089)	0.223 (0.090)**	0.080 (0.080)	0.018 (0.077)
Business serv.	0.099 (0.023)***	-0.039 (0.103)	0.105 (0.104)	0.048 (0.094)	0.157 (0.098)	0.071 (0.103)
Other	0.005 (0.008)	-0.160 (0.114)	-0.036 (0.135)	-0.040 (0.136)	0.051 (0.107)	-0.003 (0.107)
Constant	0.041 (0.015)***	1.776 (0.118)***	3.139 (0.106)***	3.072 (0.119)***	1.945 (0.108)***	1.743 (0.106)***
Observations	2908	2328	2359	2365	2283	2138

Source: INVIND survey, year 2006. Share grad. is the firm-level share of college graduates. The dependent variable in columns 2-6 is the importance of each factor for graduate workforce recruiting. Answers go from 1 (not important) to 4 (very important). Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions are weighted with sampling weights.

Table 15

Firm restructuring and graduate employment

Panel A: OLS						
	(1)	(2)	(3)	(4)	(5)	(6)
COEFFICIENT	New strategy	New products	Branding	International	Competitive strength	Share brand
Share graduates	0.41*** (0.078)	0.33*** (0.070)	0.020 (0.057)	0.061* (0.035)	0.45*** (0.11)	58.4*** (11.7)
Constant	0.57*** (0.035)	0.32*** (0.032)	0.18*** (0.026)	0.071*** (0.016)	2.99*** (0.049)	57.7*** (3.38)
Observations	2596	2596	2596	2596	2780	1959
Panel B: IV						
COEFFICIENT	New strategy	New products	Branding	International	Competitive strength	Share brand
Share graduates	1.18** (0.50)	1.06** (0.46)	0.032 (0.36)	0.084 (0.22)	2.09*** (0.76)	237** (112)
Constant	0.54*** (0.042)	0.29*** (0.038)	0.18*** (0.030)	0.070*** (0.019)	2.92*** (0.060)	50.3*** (5.82)
Observations	2596	2596	2596	2596	2780	1959
Cragg-Donald F-statistic	13.05	13.05	13.05	13.05	12.10	4.87
Sargan (p-value)	0.26	0.03	0.04	0.30	0.89	0.001

Source: INVIND survey, year 2006. "New strat" is a dummy=1 if the firm changed strategy with respect to 2000; "New prod." if it changed strategy by introducing new products, "Branding" if it changed strategy by increasing investment in branding, "International" if it changed strategy by becoming more oriented towards foreign markets; "Competstrength" is the self assessed competitive strength, taking values from 1 (very low) to 5 (very strong); "Share brand" is the share of products sold under the firm's own brand. Instruments in panel B are the shares of college graduates in scientific, economics and management and political and social sciences degrees over the total workforce at the provincial level separately for each year 2001-2005. All regressions include dummies for boss with graduate degree, family firms, size, sector and area. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions are weighted with sampling weights.

Table 16

Firm performance (yearly growth rate) and growth rate of college graduates at the regional level

Dependent variable:	Value added		Value added per worker		TFP	
	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV
VARIABLES						
Growth rate of college graduates	0.0230* (0.0123)	0.131*** (0.0470)	0.0199* (0.0120)	0.0616 (0.0453)	0.0194* (0.0114)	0.0746* (0.0429)
Inrealvalag	-0.0241*** (0.000768)	-0.0217*** (0.000850)				
Invawlag			-0.132*** (0.00191)	-0.132*** (0.00219)		
tfplag					-0.133*** (0.00193)	-0.132*** (0.00219)
Constant	0.0981 (1,233)	1.006*** (0.0121)	0.360 (1,467)	0.581*** (0.0360)	0.285 (1,094)	0.525*** (0.0359)
Observations	167,575	127,005	167,575	127,005	167,575	127,005
R-squared	0.018	0.018	0.063	0.065	0.061	0.062

Robust standard errors in parentheses

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

Source: Centrale dei bilanci database. The dependent variable is year-to-year growth rate of value added, value added per worker and TFP at the firm level for the years 2001-2007. The yearly growth rate of college graduates is computed at the regional level. The IV regressions use the share of college graduate from the 3+2 system over the total number of graduates at the regional level as instrument. All regressions include dummies for year, sector and area. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1.

Table 17

Firm performance (yearly growth rate) and share of college graduates from the 3+2 system at the regional level

Dependent variable:	Value added		Value added per worker		TFP	
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	IV	OLS	IV	OLS	IV
Share 3+2	0.0442*** (0.0158)	0.0852*** (0.0241)	0.0208 (0.0153)	0.0639*** (0.0241)	0.0251* (0.0145)	0.0523** (0.0226)
Lagged dep. var.	-0.0217*** (0.000849)	-0.0217*** (0.000849)	-0.132*** (0.00219)	-0.132*** (0.00219)	-0.132*** (0.00219)	-0.132*** (0.00219)
Constant	0.170 (102.0)	0.257*** (0.0410)	0.502 (155.6)	1.449*** (0.0207)	0.465 (60.55)	0.497*** (0.0359)
Observations	127,005	127,005	127,005	127,005	127,005	127,005

Robust standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

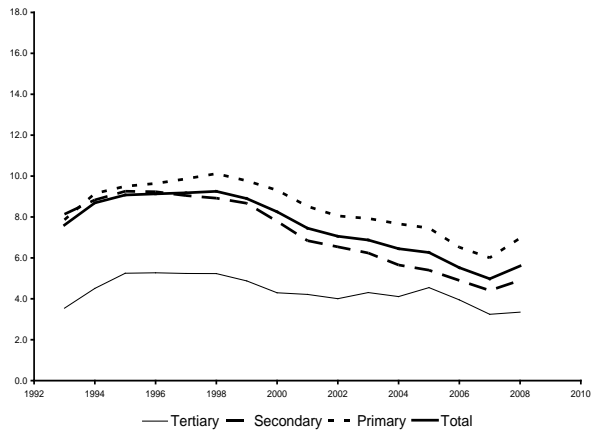
Source: Centrale dei bilanci database. The dependent variable is year-to-year growth rate of value added, value added per worker and TFP at the firm level for the years 2001-2007. Share 3+2 is the share of college graduate from the 3+2 system over the total number of graduates at the regional level. Instruments columns (2), (4) and (6) are the share of 3+2 courses over the total number of courses offered by the university in the region three years before and the share of enrolled students in the 3+2 courses over the total number of college students in the region three years before, separately for males and females. All regressions include dummies for year, sector and area. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1.

Figures

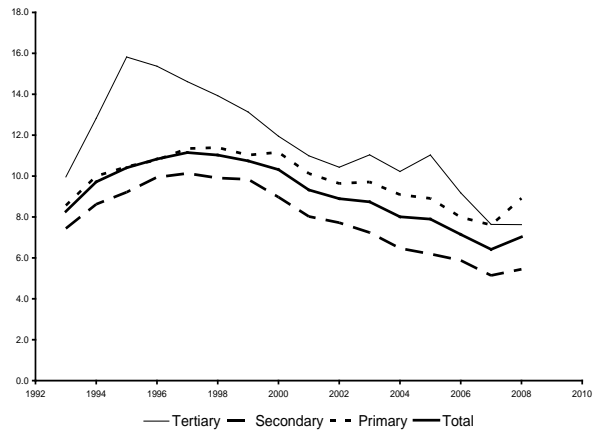
Figure 1

Unemployment rate by education, males

15-64 year-old

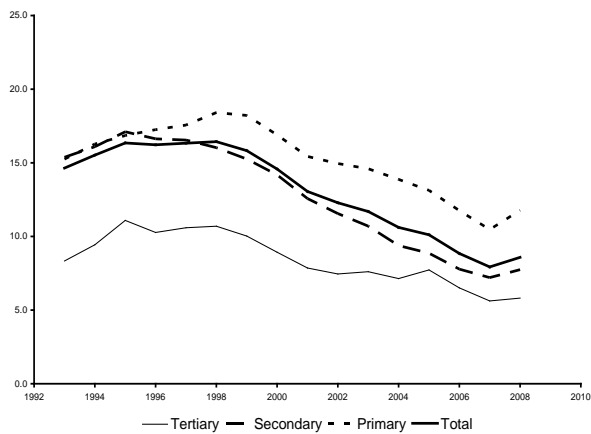


25-35 year-old



Unemployment rate by education, females

15-64 year-old



25-35 year-old

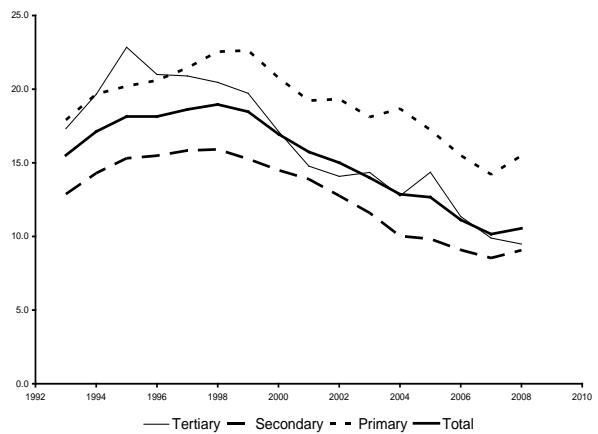
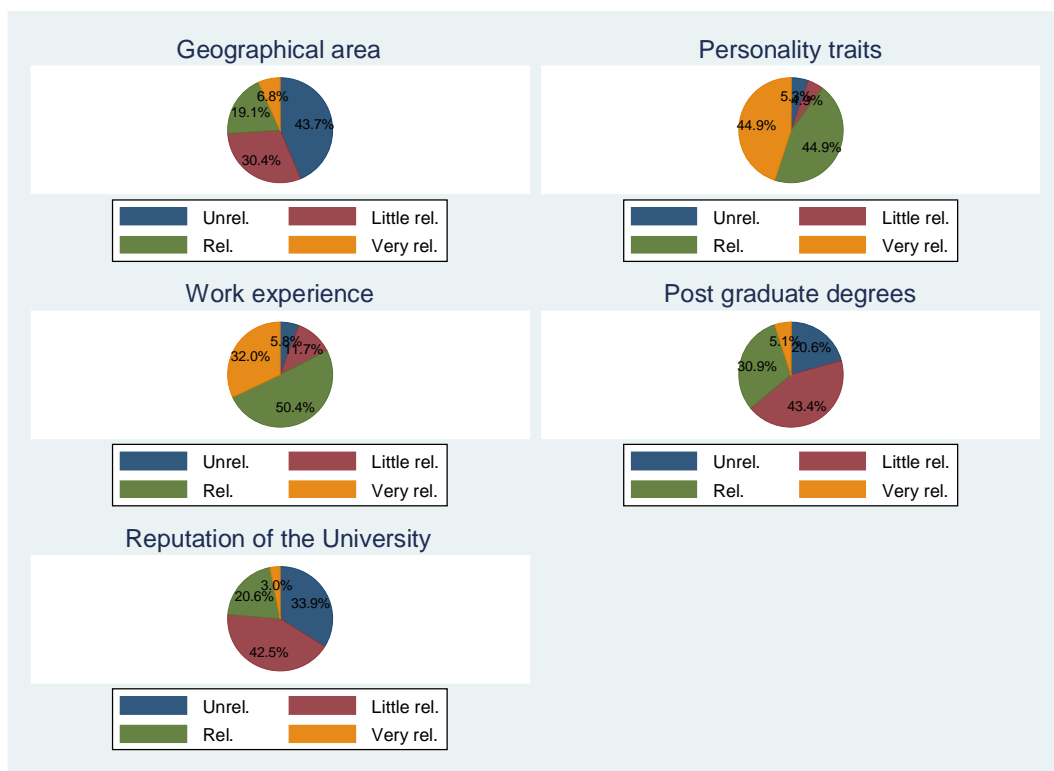


Figure 2

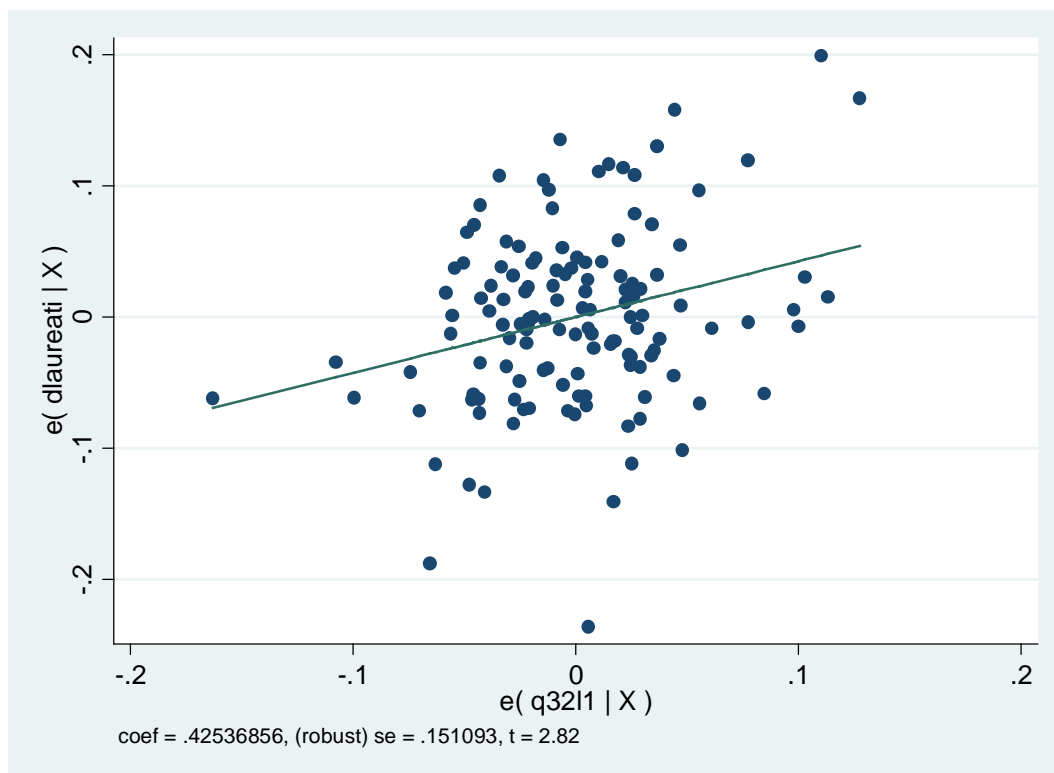
Factors in graduate employment recruiting, share of each answer



Source: INVIND survey, year 2006. Answers go from 1 (not important) to 4 (very important). All values are weighted with sampling weights.

Figure 3

Partial correlation between the growth rate of college graduates at the regional level and the share of college graduates from the 3+2 system over total college graduates in the population, 2001-2007



Note: the graph reports the residuals of the growth rate of college graduates and of the share of college graduates from the 3+2 system at the regional level over controls for year and region dummies. Each point is a year-region observation. The regression line is also reported.

References

- Bartelsman, E., Scarpetta, S. and Schivardi, F. (2005), Comparative Analysis of Firm Demographics and Survival: Micro-Level Evidence for the OECD Countries, in *Industrial and Corporate Change*, vol. 14, n. 3, pp. 365-391.
- Benhabib, J. and Spiegel, M.M. (2005), Human Capital and Technology Diffusion, in Aghion and Durlauf, editors, *The Handbook of Economic Growth*, vol. I, pp. 935-66, Elsevier, NorthHolland.
- Bosio, G.M. and Leonardi, M. (2010), “The effect of 3+2 on the graduate labor market: demand and supply” mimeo, FGA.
- Bugamelli, M., Schivardi, F. and Zizza, R. (2010), The Euro and Firm Restructuring, in Alesina and Giavazzi, editors, *Europe and the Euro*, pp. 99-138, University of Chicago Press, Chicago.
- Ciccone, A., Cingano, F. and Cipollone, P. (2004), The Private and Social Return to Schooling in Italy, in *Giornale degli Economisti e Annali di Economia*, vol. 63 n. 3-4, pp. 413-444.
- Ciccone, A. and Papaioannou, E. (2009), Human Capital, the Structure of Production and Growth, in *The Review of Economics and Statistics*, vol. 91, pp. 66-82.
- Cingano, F. and Schivardi, F. (2004), Identifying the sources of local productivity growth, in *Journal of the European Economic Association*, vol. 2, n. 4, pp. 720-742.
- De Nardis, S. (2010), editor, *Imprese italiane nella competizione internazionale*, Isae, Roma.
- Fabiani, S., Schivardi, F. and Trento, S. (2005), ICT Adoption in Italian Manufacturing: Firm-Level Evidence, in *Industrial and Corporate Change*, vol. 14, n. 2, pp. 225-249.
- Faini, R., Galli, G. and Rossi, F. (1996), Mobilità e disoccupazione in Italia: un’analisi dell’offerta di lavoro, in G. Galli, editors, *La mobilità della società italiana*, SIPI, Roma.
- Iranzo, S., Schivardi, F. and Tosetti, E. (2008), Skill Dispersion and Firm Productivity: An Analysis with Employer-Employee Matched Data, in *Journal of Labor Economics*, vol. 26, n. 2, pp. 247-285.
- Nelson, R. and Phelps, E.S. (1966), Investment in Humans, Technical Diffusion, and Economic Growth, *American Economic Review*, n. 56, pp. 69-75.
- OCSE (2003), *Science, Technology and Industry Scoreboard*, Annex , OECD, Parigi.
- Oi, W.Y. and Idson, T.L. (1999), Firm Size and Wages, in *Handbook of Labor Economics*, vol. 3, pp. 2165-2214, Elsevier, North Holland.
- Rossi, S. (2006), *La regina e il cavallo. Quattro mosse contro il declino*, La Terza, Bari.

