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ABSTRACT

We test whether and how the adoption of the euro, narrowly defined as the end of competitive devaluations, has affected member states' productive structures, distinguishing between within and across sector reallocation. We find evidence that the euro has been accompanied by a reallocation of activity within rather than across sectors. Since its adoption, productivity growth has been relatively stronger in country-sectors that once relied more on competitive devaluations to regain price competitiveness. This effect is robust to potential omitted-variable bias and correlated effects. Firm-level evidence from Italian manufacturing confirms that low-tech businesses, which arguably benefitted most from devaluations, have been restructuring more since the adoption of the euro. Restructuring has entailed a shift of business focus from production to upstream and downstream activities, such as product design, advertising, marketing and distribution, and a corresponding reduction in the share of blue collar workers.

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1 Introduction

One of the main drivers of European integration was the idea that a more integrated European economy would promote economic efficiency, allowing countries to fully exploit their competitive advantages, fostering factor mobility and increasing allocational efficiency (European Commission 1993). The euro was a crucial milestone along this path. Ten years after its launch, we can start to assess the effects of such a radical institutional change. In this paper, we focus on whether the introduction of the euro – narrowly defined as the end of competitive devaluations – has induced significant changes in the productive structure of the euro area (EA) member states.[1]

When the euro was introduced in 1999, the European productive structure was sharply differentiated across member states, with a group of southern countries specialized in traditional, low-human-capital activities. Firms in these countries took advantage of recurrent devaluations to cope with international competition, especially from the low wage economies. The basic idea underlying our analysis is that the end of competitive devaluations should have had differential effects by country and sector. For one thing, before the introduction of the euro, countries had adopted different strategies in terms of devaluation vis-a-vis the Deutsche mark (Giavazzi & Giovannini 1989). Second, in some sectors competition is mainly in prices, so changes in the terms of trade are a fundamental determinant of performance; in other sectors, product differentiation is more pronounced, so prices are just one factor of competitiveness, alongside product quality, brand name, technological content, etc. Our initial hypothesis is that the euro should have been a greater shock for the sectors competing mostly in prices and the countries that made a more intense use of competitive devaluations. We therefore expect that restructuring has been more intense in these country-sectors.

We analyze restructuring along two dimensions. First, we consider whwther there has been a reallocation of factors away from the sectors that presumably had relied more heavily on devaluations (between sectoral reallocation process). Second, we consider to what extent

[1] Competitive devaluations are in principle a possible option even in the post-euro era. Nevertheless, the euro has put an end to the possibility of trade advantages with respect to the rest of the EA, which accounts for a significant fraction of exports for all members. Further, as the euro is a stronger currency, the risk of sharp devaluations is lower.

the reallocation has occurred within sectors. As the recent body of literature on trade and productivity has shown (Melitz 2003, Bernard, Jensen & Schott 2006*a*), most of the productivity gains from trade opening are achieved via the reallocation of production from less to more efficient firms within the same sector.

The between sectoral analysis is based on standard techniques of convergence/divergence of productive structures. We find very weak support for the proposition that the euro has induced a reallocation of activities between sectors. Specifically, Krugman dissimilarity indices show that intersectoral reallocation in the post-euro era has been almost nil for most of the EA countries and modest for the rest. Although a finer sectoral classification might give a somewhat different picture, we think it is plausible that a substantial process of reallocation should be visible even using the 22 two-digit manufacturing sectors of the NACE rev. 3 classification system.[2]

We then move on to consider whether there is evidence of within sectoral reallocation. Ideally, one would like to test this hypothesis directly with firm-level data. Unfortunately, such data are not available at the cross-country level. Our analysis is therefore based on sectoral data and on indirect measures of restructuring, in particular productivity growth. We follow the approach introduced by Rajan & Zingales (1998). We rank countries by how heavily they relied on devaluations, considering both nominal and real devaluation vis-a-vis the DM over the 1980-98 period. We classify sectors according to how important devaluations were for competitiveness using a series of indicators of the sectoral skill content, with the idea that low skill content implies more price competition. An alternative ranking is to look directly at the importance of emerging economies in world trade in each sector. The variable we track is China's export share. The interaction between the country-level devaluation measure and the sectoral skill content measure constitutes the indicator of how much a country-sector should have been affected by the euro.

We find clear support for the hypothesis that the euro has induced relatively strong

[2]The 'end of competitive devaluation' is not the only channel through which the euro could have stimulated factor reallocation. A 'trade integration' channel within the EA countries must be also acknowledged. The benefits from the use of a common currency - lower transaction costs, no exchange rate risk, better price and cost transparency - are expected to enhance openness to trade and investment, as well as to foster competition. Indeed, since the launch of the euro, bilateral trade among EA members has expanded far more rapidly than trade with other EU countries (European Commission 2008, Baldwin 2006, de Nardis, De Santis & Vicarelli 2008). Our results suggest that these channels too have had little impact on sectoral reallocation.

intrasectoral restructuring. Productivity growth has been fastest in the sectors with low skill content and the countries that had relied more on competitive devaluations. This result is robust to a series of checks. In particular, to address potential omitted-variable bias we not only include country and sector dummies but also a control group of countries that are broadly similar to the EA countries except for adoption of the euro, namely Denmark, Sweden and the UK. We also show that our results are not driven by some underlying autocorrelated process, independent of the euro. Moreover, restructuring seems to have had little negative effect on employment. The exception is when we rank sectors according to the Chinese export share, in which case a clear negative effect on employment emerges.

To obtain direct evidence on the restructuring process, we then turn to firm-level evidence from Italian manufacturing. We first review a series of 40 in-depth interviews with entrepreneurs conducted by researchers of the Bank of Italy in 2007, in the spirit of the NBER/Sloan "Pin factory" project (Borenstein, Farrell & Jaffe 1998). The interviews offer "soft" evidence on the restructuring process. They suggest that, since the adoption of the euro firms have shifted their business focus from production to upstream and downstream activities, such as R&D, product design, marketing and distribution. These activities, in fact, can procure a certain degree of market power and enable firms to escape the pure cost competition. Moreover, the shift is more dramatic in traditional, low-tech activities, in line with the aggregate evidence. Finally, it emerges that restructuring is an ongoing process, not a single episode with a beginning and an end.

The insights from the interviews are corroborated by the "hard", quantitative evidence provided by a database of manufacturing firms representative of the population of firms with at least 50 employees. First, the cross-sectional dispersion in both productivity and profitability has increased steadily since 1999, as one would expext during restructuring episodes. And there is a marked decline in the share of blue-collar workers, consistent with the thesis that firms are shifting the focus away from production. The decline is sharper, the lower the technological content of the sector. Interestingly, in the pre-euro era the opposite was the case: low-tech firms used devaluations to recoup price competitiveness and intensified their reliance on low-skilled workers. We do not find that job flows intensified after the introduction of the euro; the restructuring process seems to entail a reallocation

of workers within rather than between firms.

To close the circle, finally we consider whether the restructuring firms actually perform better than the others, regressing value added and productivity growth on indicators of restructuring at the firm level derived from ad hoc questions on the importance of trade marks and of changes in the mix of goods produced. We also include the share of blue-collar workers. The results confirm that the firms that undertook restructuring recorded higher growth rates both in value added and in productivity.

Our work is related to the growing body of literature that considers the effects of international competition on national productive structure (Chen, Imbs & Scott 2007). The paper closest to our sectoral analysis is Auer & Fischer (2008), on the effects on US industry of import penetration from emerging economies. They also find that the US sectors most exposed to competition from emerging countries recorded higher productivity growth, as well as lower price inflation. The same result on productivity is found by Bugamelli & Rosolia (2006) on Italian data. Using US firm-level data, Bernard et al. (2006*a*) find that industries' exposure to imports from low-wage countries is correlated positively with the probability of plant death and negatively with employment growth. In a companion paper, Bernard, Jensen & Schott (2006*b*) show that a reduction of inbound trade costs is positively associated with industry productivity (TFP), the probability of plant death, the probability of entry of new exporters, and export growth by incumbent exporters. For Italy, Bugamelli, Fabiani & Sette (2008) show that greater exposure to Chinese export penetration has diminished the pace of firms' output price increases.

The rest of the paper is organized as follows. In section 2 we describe the data and perform the between sector analysis. Section 3 explains the econometric approach to test for within sector reallocation and discusses the results. Section 4 deals with the firm-level evidence for Italian manufacturing firms and Section 5 concludes.

2 Cross-sectoral reallocation

In this section we analyze the productive structure of the European Union (EU) member countries and its evolution over time; given the need for a sufficiently long period after the introduction of the euro and data availability, we focus on the EU15 countries, i.e. the

11 that adopted the euro on its inception (Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain) plus Greece (entering the EA in 2002) and Denmark, Sweden and the UK, which have not adopted the euro. Following Bertola (2007), the three non-EA countries constitute the control group.[3] Despite its evident shortcomings, this is the best control group available.[4] We assess whether the introduction of the euro has induced a reallocation of production between sectors and, if so, whether the intersectoral change has been more dramatic in the countries that had previously made greater use of competitive devaluations. The main data source we rely upon in this and the next section is the March 2008 release of the EU KLEMS database (Timmer, O'Mahony & van Ark 2007). Figure 1 illustrates the manufacturing sector's share of value added in the economy for each of the EU15 countries in 1998 and 2005. In 2005 this share stood at around 20% for most countries, with lower values in France, Denmark, Greece and Luxembourg. Following the secular decline in manufacturing, the share decreased somewhat between 1998 and 2005 in most countries; Ireland and the UK experienced the most pronounced downsizing of the sector.

From now on, we concentrate on manufacturing, as the effects we are considering work through the terms of trade and so are important mostly for tradeable goods. Data on value added, employment and capital stock for the manufacturing sector are available for all EU15 countries with a breakdown into 22 industries corresponding as a rule to the two-digit NACE classification. As shown in Table A.1 in Appendix A, there is a clear north-south divide. Southern countries, like Italy, Greece and Portugal, still have a large share of their value added in traditional sectors like textiles, apparel, leather goods and footwear. The other countries concentrate their production in more technologically advanced sectors: machinery

[3] Bertola (2007) uses a diff-in-diff approach to test the effects of the euro on income dispersion.

[4] Ideally, the control group should have more than three countries, to avoid that idiosyncratic country patterns affect the results. However, what is really crucial is that the control group (non-EA members) is comparable with the treatment group (EA members). As EU membership involves many factors not available to the econometrician (laws, regulation, etc.), a control group with only EU countries should provide the best guarantees in terms of similarity (Baldwin 2006), whereas including non-EU countries seems more problematic. One could also object that the treatment is not fully exogenous, as in principle the three non-euro members could have deliberately opted-out in order not to preclude future competitive devaluations. This does not seem to be the case, however. For example, in the context of the assessment made by HM Treasury on the case for the UK to join the eurozone, Buiter & Grafe (2003) conclude that monetary independence has not been instrumental to maintain (or regain) competitiveness; indeed, "the UK exchange rate during the 1990s and until well into 2002 has been a source of competitive misalignment" (page 35).

in Germany (but in Italy, too), chemicals in a host of countries (Belgium, France, Germany, the Netherlands, Ireland and the UK), radio, television and communication equipment in the Nordic countries (Finland and Sweden in particular).

In order to facilitate the comparison of productive structures among countries and over time, we first characterize sectors by their skill, R&D and ICT intensity and then group them into intensity classes. Figures are computed from US data, which we use in the regression analysis to avoid problems of endogeneity. Skill intensity is proxied by hours worked by high-skilled persons, defined as those with at least a college degree, as a share in total hours; R&D intensity is R&D expenditure over value added; ICT intensity is the ratio of ICT capital stock to the total capital stock, both in real terms.[5]

As Table 1 shows, the machinery and the electrical and optical equipment sectors exhibit the highest ICT content; together with "other transport equipment", they spend a relatively higher fraction of their value added on R&D and employ relatively more skilled persons. As a rule, traditional sectors (producing food, textiles, leather and wood products) are characterized by low values of the three indicators. Intensity classes (low, medium-low, medium-high, high) are then defined according to quartiles in the distribution of each indicator (see Table A.2 in Appendix A for the matching of sectors into skill, ICT and R&D categories). A glance at the value added shares broken down by skill content in 1998 and 2005 (Figure 2) suggests that sectoral modifications were modest in the period. Only in Finland and Sweden reallocation towards high-skill activities has been substantial; Ireland stands out as the country where high-skill activities are prominent; if anything, Italy and Spain have increased their share in low-intensity activities.

To address sectoral modification in a more synthetic way, we apply standard techniques of convergence/divergence of productive structures. In particular, we calculate bilateral dissimilarity indices based on value added shares broken down by industry and by skill, R&D and ICT intensity according to the classification in Table A.2. Dissimilarity between country A and country B is captured by the following index á la Krugman:

$$\text{Dis}_{AB} = \left(\frac{1}{2} \sum_i |a_i - b_i| \right) \tag{1}$$

[5]ICT and skill intensity have been derived from EU KLEMS, R&D intensity comes from the OECD STAN database.

where a and b are the corresponding shares. The index ranges from 0 (perfect similarity) to 1 (perfect dissimilarity). The productive structure of each country is compared with that of the EA, net of the country's own economy for EA members only; indices are calculated for 1998 and 2005. Table 2 shows that, within the EA, the most highly dissimilar countries are, apart from Ireland and Luxembourg, which are exceptionally small, the southern countries still specialized in low-skill activities. There is no sign of a uniform tendency either towards convergence or divergence: some countries increased and others decreased their similarity with the rest of the area. This is clear from Figure 3, where we take an average of the indicators and plot the value for 2005 against that for 1998. Countries above (below) the 45-degree line are those diverging from (converging to) the EA average sectoral structure. In line with previous evidence of very limited sectoral modification for almost all countries, we find little convergence/divergence; if anything, there is a slight tendency toward heterogeneity.

We also evaluate, for each country, the dissimilarity index between 1998 and 2005 to assess the extent of intersectoral change over the period. Irrespective of the sectoral breakdown, the extent of sectoral reallocation proves to be fairly modest (Table 3). The dissimilarity index never goes beyond the first half of its range. The countries that changed their structure most are Sweden and Finland, followed by Greece.

It is interesting to see whether the degree of intersectoral reallocation, though mild, is related to competitive devaluations. We construct two measures of devaluation, nominal and real (DEVNOM and DEVREAL, respectively), calculated as the cumulated difference between January 1980 and December 1998 of the logarithm of each country's nominal/real effective exchange rate as a deviation from that of Germany. In principle, a negative sign indicates a depreciation relative to the DM; the absolute number refers to the intensity of the cumulative depreciation or appreciation. But for ease of interpretation we invert the signs, so that a higher value of the indicator reflects more intensive resort to competitive devaluations. Table 4 reports the values for DEVNOM and DEVREAL. The difference between the two (ΔP) is the cumulated change in relative producer prices. Both the nominal and the real indicators have been computed with respect to 62 countries, including the main emerging and developing economies. Both their exchange rates and their producer

prices have entered the indicator with a weight computed on the basis of trade flows (see Finicelli, Liccardi & Sbracia (2005) for the methodology).

We find that, when devaluation is measured in nominal terms (Figure 4), the countries relying most heavily on devaluations are those most specialized in low-skill activities. This positive relationship vanishes when we consider devaluation in real terms (Figure 5). We also find some weak evidence that countries relying more heavily on devaluations exhibit relatively more pronounced signs of intersectoral reallocation, as shown by Figure 6, where we plot the dissimilarity index between 1998 and 2005 (reported in the first column of Table 3) against real devaluation; this evidence does not depend on the choice of the indicator (nominal versus real and different sectoral breakdowns).

On the whole, we can conclude that the euro has not induced a structural break in member countries' specialization patterns. Let us now move on to assess whether a process of within sectoral restructuring characterized EA firms in the first part of this decade, and in particular whether this process was driven by the introduction of the euro, which eliminated competitive devaluations.

3 Within sectoral reallocation

In this section we use sectoral data to test the hypothesis that the end of competitive devaluations has induced a restructuring process in the EA firms. We begin by describing the empirical approach and the data, then move on to the results and finally perform a series of extensions and robustness checks.

3.1 The empirical approach and the data

We test the effects of the euro on within sectoral restructuring using sectoral data from different countries. Ideally, one would like to use direct measures of reallocation, such as job creation and destruction, entry, exit, etc.. Unfortunately, such measures can only be constructed from firm-level data and so are not available for a cross section of countries.[6] Accordingly, we use an outcome variable that should be closely related to reallocation, i.e.

[6]See Davis, Haltiwanger & Schu (1996) for an overview of a large body of literature developed in the nineties regarding sectoral reallocation. Bartelsmann, Scarpetta & Schivardi (2005) compute sectoral statistics of reallocation for 9 OECD countries, but their time span stops at the end of the nineties at best.

productivity growth. In fact, if reallocation and restructuring bring about productivity increases,[7] then the country-sectors that restructured more should have recorded a higher growth rate of productivity. We measure productivity as real value added per hour worked. We also consider growth in employment (more precisely, number of hours worked) growth: in fact, productivity increases might have been due simply to a reduction in the employment level, connected with the exit of the less productive plants and workers, the reorganization of production and offshoring. Descriptive statistics by country for the outcome variables are provided in Table A.3 in Appendix A.

We follow the approach introduced by Rajan & Zingales (1998) in their paper on the effects of financial development on growth. The idea is to exploit both cross-country and cross-sectoral variability to test the effects of the euro on productivity growth. First, we determine how heavily the various countries had relied on devaluations (DEV_i): we expect that the greater this reliance, the stronger the effects of the euro. Second, we propose a measure S_j of how important devaluations were for sectoral competitiveness before the euro: in some sectors competition is mainly price competition, so movements in the terms of trade are a fundamental determinant of performance; for others, product differentiation may be more pronounced, so that prices could be just one in a series of other factors in competitiveness, such as product quality, brand name and technological content. If the euro has had any effect in terms of restructuring, we expect it to be strongest in the country-sectors that relied more intensively on competitive devaluations, as measured by the interaction between the country and the sectoral indicators, $DEV_i * S_j$. We can test our argument through the following regression:

$$\Delta \ln y_{ij9805} = \alpha_0 + \alpha_1 DEV_i * S_j + \alpha_{\mathbf{2}}' \mathbf{X_{ij}} + DC_i + DS_j + u_{ij} \tag{2}$$

where $\Delta \ln y_{ij9805}$ is average yearly productivity growth in country i and sector j between 1998 and 2005, $\mathbf{X_{ij}}$ are additional controls and DC_i and DS_j are country and sector dummies respectively. Our prediction concerns the coefficient α_1: if $\alpha_1 > 0$, the higher the country-sector reliance on devaluations, the stronger the effects of the euro on productivity: $\alpha_1 =$

[7] The literature on productivity growth decomposition has identified various sources of productivity increases related to reallocation and restructuring; see Foster, Haltiwanger & Krizan (2001) for a survey.

$\partial^2 \Delta \ln y_{ij} / \partial DEV_i \partial S_j$.

One important feature of this approach is the inclusion of both country and sector dummies. Country dummies ensure that the results are not driven by specific country characteristics that might potentially be related to the devaluation measure: rather, we use within country differences in sectoral growth rates to identify the parameters of interest. The same applies to sectors: we do not compare different growth rates of productivity across sectors, as these might be dictated by sectoral characteristics potentially related to the variables we use to classify them. As such, this approach is robust to the main criticisms of the cross-country regressions with aggregate data, such as omitted-variable bias and reverse causality.[8]

Although the inclusion of country and sector dummies controls for the most likely omitted variable problems, one could still argue that we might just be capturing an underlying process that would have occurred even without the euro. For example, the intensifying competition from emerging countries might have forced restructuring regardless. Such a process might have been more pronounced precisely in those countries and sectors that relied more on competitive devaluations, potentially more vulnerable to such competition. This is indeed a very serious concern. To address it, we take the three countries that did not adopt the euro as a control group and compute the effect of the interaction for the EA in deviation from non-EA countries. Formally, our regression framework is represented by:

$$\begin{aligned} \Delta \ln y_{ij9805} = \beta_0 + \beta_1 DEV_i * S_j + \beta_2 EA_i * DEV_i * S_j + \\ + \beta_{\mathbf{3}}' \mathbf{X_{ij}} + DC_i + DS_j + u_{ij} \end{aligned} \tag{3}$$

where EA_i is a dummy equal to 1 for the EA countries. In this specification, the coefficient β_2 measures the deviation of the EA effect from that of the non EA countries, β_1. The idea is that the latter countries did not give up the possibility of devaluing, but are similar to the EA countries from an economic point of view, because as members of the EU they are subject to identical foreign trade rules, with the exception of the exchange rate. Differences

[8]Reverse causality could occur if productivity growth were persistent and low-productivity-growth sectors were determining the devaluation pattern before the euro. In this case, the correlation would actually be because productivity growth causes DEV. However, if anything, this should bias our estimates downward, inducing a negative correlation between DEV and productivity growth.

in the degree of restructuring according to the interaction term can therefore be attributed to the euro. As discussed above (see footnote 4), this control group is probably the best available, although it can be criticized both for its small size and its not necessarily random selection. To make sure that our results are not totally dependent on the control group, we also estimate equation (2) on EA members only, that is considering the absolute effect rather than the deviation from the control group. In this case, we are not controlling for potential confounding factors. However, we still control for fixed country and sectoral attributes, so that these estimates allow us to assess the extent to which our results depend on the control group.

In terms of the country-level indicator, we want to capture the reliance on competitive devaluations. From the theoretical standpoint, it is unclear whether real or nominal devaluation is the relevant variable. Consider a country that kept a fixed nominal exchange rate with the DM but gained competitiveness by curbing price rises. For it, the euro should not represent much of a change, as the exchange rate was already stable, and using real devaluation might overstate its reliance on devaluations. On the other side, consider a country with relatively rapid price inflation, that used devaluations to limit the effects on competitiveness. For such a country, appreciation was already under way before the euro, and using the nominal exchange rate would overstate the reliance on devaluations. These examples suggest that the ideal indicator should consider real devaluations that were due to changes in the nominal exchange rate. To capture this, in our basic specification we introduce both the nominal exchange rate and the degree of relative producer price inflation, to allow for potentially different dynamics of the two components of the real exchange rate. We test whether the coefficients of the two variables are opposite in sign and equal in absolute value, in which case the real exchange rate can be used directly.

For the sectoral indicators, we assume that price competition is more relevant in activities with a low human capital content, i.e. in which low-skilled workers are prevalent. The products of low-skill activities are likely to compete more in price than quality, relative to high-skill products. For a sector with low human capital content, the end of devaluations should have represented a stronger incentive to restructure; other things being equal, these sectors should have recorded higher productivity increases. Our main indicator is thus the

skill content at the sectoral level. Following Rajan & Zingales (1998), to avoid endogeneity problems we use the US measure, on the assumption that skill content is largely a technological characteristic, so that the measure computed for the US also applies to other countries. This assumption is particularly suitable for the EA countries, whose level of development is comparable to the US. In accordance with our interpretation, we use sectoral low-skill intensity, that is (1-skill intensity). This makes it easier to read the regression results.

We also experiment with other measures of sectoral dependence on devaluation. Following the same reasoning as above, high-R&D activities should also compete less on price and more on quality and technological content, reducing the price sensitivity of demand and hence the effects of exchange rate movements. Low-R&D activities should be characterized by greater price elasticity of demand, intensifying the response to- terms of trade movements. We also use ICT intensity, on the assumption that this is related to technological content. As before, we define sectors in terms of low R&D and ICT intensity: (1-R&D content) and (1-ICT intensity), again computed for US sectors.

Underlying our approach is the idea that in low-human-capital activities, the end to competitive devaluations has deprived EA countries of an instrument for meeting the competition from low-wage emerging economies. An alternative way to rank sectors, then, is to look directly at the importance of those economies in world trade. We take the most important of them, China, and compute its share of world exports in 1998. In this case, we are testing whether restructuring has been more intensive in countries that had relied on devaluations more heavily and in sectors where China's export share was larger.

The bottom part of Table 1 reports the correlation coefficients between the sectoral indicators. As expected, the correlation between the first three indicators is high, ranging from 0.6 to 0.8.. That between the China's world market share and the others is negative. That is, the Chinese share is inversely related to the human capital content of production, but correlation is low in absolute terms: -0.3 with ICT and skill intensity and -0.1 with R&D intensity, suggesting that to see China simply as a low-human-capital good exporter might be to miss some important features of its economy.

We also run the same regression for EA countries in the period before the introduction of the euro. The assumption is that at that time the competitive pressures were mitigated

by competitive devaluations. In this case, we expect no particular difference between the study and the control group. In the language of the policy evaluation literature, we make sure that we are not simply capturing pre-existing trends, and that the euro did indeed induce a structural break.

3.2 Results

Our main regression is based on equation (3), where the outcome is average annual productivity growth for the period 1998-2005. In addition to sectoral and country dummies, we include the log of the initial value of the dependent variable and, to control for any country-sector trend, its growth rate in the period 1995-98. Moreover, unless otherwise stated, to avoid endogeneity problems we weight observations according to sectoral employment in 1998. We run weighted regressions for two reasons. First, accounting for the importance of the sector gives an estimated coefficient representative of the population effect. Second, sectoral data could suffer from measurement error, which is likely to be negatively correlated with the size of the sector itself. In particular, mis-measurement of employment or value added in some small sectors might have a powerful impact on the estimates.[9] Finally, all standard errors are computed using the White robust correction.

Table 5 reports the results of estimating equation (3) when the sectoral dependence on devaluations is gauged by low-skill intensity. Panel A shows the estimates for productivity growth. The first column includes the interaction of skill intensity both with nominal devaluation (DEVNOM) and with relative producer price inflation (ΔP). The estimates for the control group are not significantly different from zero, in line with the idea that for these countries the euro has not brought a structural break. Relative to the control group, the EA countries that had devalued more before the euro show relatively sharper productivity growth in low-skill-intensive sectors, while the reverse holds for the interaction with producer price inflation. The two coefficients are opposite in sign and very similar in absolute value (1.17 vs. -1.05) and we fail to reject the hypothesis that one is equal to the negative of the other. We interpret this as an indication that, while our earlier questions

[9]For example, in 1998 the 'Office, accounting and computing machinery' sector only had 1,500 employees in Austria, 800 in Belgium and 300 in Greece; the 'Leather, leather products and footwear' sector only 1,300 in Ireland.

concerning the best measure of devaluation may be important in principle, in practice real devaluation is a sufficient statistic for our purposes. We therefore concentrate on it in the other columns.

In column 2 we give the basic specification, with the interaction term constructed with the real exchange rate (DEVREAL). For the three non-EA countries we find a negative coefficient, significant at 10%. This implies that productivity in sectors with less skill intensity grew relatively less the greater the real devaluation vis-a-vis the DM in the 1980-98 period. The interaction with the EA dummy gives a positive coefficient (1.01), significant at 5% (standard error equal to 0.40): compared to the control group, among the EA countries productivity growth has been stronger, the greater real devaluation in the 1980-98 period and the lower the sectoral skill intensity. The other controls have the expected sign; in particular, productivity growth is positively serially correlated and displays mean reversion.

To evaluate the magnitude of the effects, we use the growth differential, defined as:

$$GD \equiv \beta_2 * (DEV_{75} - DEV_{25}) * (S_{75} - S_{25})$$

where DEV_{75} is the value of DEV for the country at the 75^{th} percentile of the distribution (Spain) and DEV_{25} at the 25^{th} percentile (France), S_{75} is the sector at the 75^{th} percentile of the skill distribution (other non metallic mineral products) and S_{25} at the 25^{th} percentile (other transport equipment). GD measures how much more productivity grew in a low-skill sector (namely, at the 75^{th} percentile of the skill distribution) compared to a high-skill one (at the 25^{th} percentile) in a country that relied heavily on devaluations (at the 75^{th} percentile) compared to one that did not (at the 25^{th} percentile). For $\beta_2 = 1.01$, the growth differential is 1.7%, a sizeable effect, equal to the median yearly productivity growth and just below the mean (2.1%). It is important to note that this is only a within country and sector comparison, so it does not allow to draw conclusions on growth differential between the countries or the sectors. For example, it might well be that average productivity growth in Spain has been lower than in France: this would be captured by the country dummy. Similarly, average productivity growth in low-skill intensity sectors might have been lower than in high intensity ones. All we can say is that, *relatively to the country and sector averages*, the productivity growth differential between low- and high-skill sectors was higher

in Spain than in France.

We then perform a series of robustness checks of this basic result. In column 3 we repeat the exercise without weights. The estimate of the coefficient drops to 0.7 and the standard error increases slightly, so that the p-value is equal to 0.16. This indicates that the weighting scheme is important to obtain a significant coefficient, suggesting that the results have to be taken with due caution. Still, the value is positive and the p-stat reasonably low.

One could argue that firms require some time to adjust to the change of regime brought about by the euro. Moreover, even if restructuring started early on, such processes might take some time to result in productivity gains. According to this interpretation, one should find that the effects of restructuring are more visible in the latter part of the post-euro period, so we repeat the exercise calculating productivity growth for the 2002-05 period.[10] The coefficient does increase substantially, to 1.5, and is significant at 1%, lending support to the view that the effects of the euro on European firms did take some time to become appreciable. In fact, if we run the exercise for the 1998-2002 period (unreported), we get a substantially lower coefficient (0.36) not significantly different from 0 (standard error equal to 0.26).

As argued above, a possible criticism relates to the control group, only made up of three countries. In column 5 we run regression (2) only for the EA countries. In this case, we are not controlling for potential confounding factors; still, given that both sector and country dummies are included, we are controlling for fixed attributes on both levels. We find a positive and significant coefficient, although smaller, in accordance with the fact that the effect was negative for the control group. According to this estimate, the growth differential is 0.96%. This allows us to exclude the possibility that our results are simply driven by some idiosyncratic characteristics of the control group: within the EA countries, productivity grew faster exactly in those country-sectors that are most likely to be hit by the introduction of the fixed exchange rate regime.

As observed earlier, one might expect that productivity growth has been achieved through downsizing and offshoring, in which case it should go hand in hand with a re-

[10] To maximize comparability with the other regressions, we use the same initial value and pre-euro growth rate as for the other columns. Results are unchanged if we use the log of productivity in 2002 and the growth rate in the 1998-2002 period.

duction in employment. In Panel B we repeat the exercise using employment growth as the dependent variable. Contrary to this proposition, we find no clear relation between our interaction measure and employment growth. The coefficient of the interaction is generally negative, but is small in absolute value and not significantly different from zero. According to this finding, restructuring does not seem to have had a downside in terms of job losses.

These basic patterns are confirmed when using R&D and ICT intensity as sectoral indicators of the importance of devaluations.[11] In Table 6 we report the results for the R&D indicator. As before, the coefficient of the interaction is positive and significant, again with the exception of the unweighted regression. The effect increases in the second sub-period and still holds when computed on the EA countries only. The growth differential implied by the estimate in column 1 is similar in magnitude to that using skill intensity (1.6% productivity growth increase per year). Again, no clear effect on employment emerge - if anything, there is some evidence of a positive impact.

Similar results hold for ICT intensity, although the estimates tend to be less precise. The growth differential is 1.2% per year (Table 7). With this indicator, we get a significant coefficient also in the unweighted case, while no evidence of a stronger effect in the second sub-period emerges. The employment regressions again suggest no effect of the interaction term.

Findings are somewhat different when the sectoral indicator is the export share of China (Table 8). In this case, the productivity estimates tend to be less clear-cut. First, they are only significant for the baseline specification and for the unweighted one. The effect disappears when we exclude the control group, suggesting that these results are to be treated with even more caution than the others. In any case, according to the baseline specification, the growth differential is 0.5% where the sectors at the 25^{th} and 75^{th} percentiles are, respectively, chemicals and chemical products and rubber and plastic products. More interestingly, a negative effect on employment emerges. In the basic specification we get a coefficient of -1.77, significant at 5%. The implied growth differential is -0.6%.

As a final check, we run the same regressions as above for the period over which we computed the devaluation indicators, 1980-98. This is to make sure that we are not just

[11] As for skill intensity, the specification with DEVNOM and ΔP confirms that DEVREAL is a sufficient statistic for our purposes. According, that specification is not reported.

capturing some underlying autocorrelated process that was already operating before the euro.[12] To save on space, we report only the main specification, with DEVREAL. There is no support for this hypothesis (Table 9). Neither the effect for the control group nor the deviation for the EA countries is significant for productivity or for employment for any of the sectoral indicators. This further substantiates the argument that our results really are capturing a specific effect of the euro, not some other concomitant factor.

All in all, these regressions suggest that the end of competitive devaluations has had a positive impact on productivity growth in those countries and sectors that had presumably relied more on them. Moreover, there does not appear to be any downside in terms of jobs: reallocation does not seem to have come at the expenses of employment growth. A clear exception to this is the regression using the Chinese export share. This analysis begs the question of how productivity growth was achieved, i.e. how restructuring occurred. We tackle this issue in the next section.

4 Firm-level evidence of restructuring: the case of Italian manufacturing

In this section we turn to firm-level evidence on the response to the euro, drawn mostly from a survey of Italian manufacturing firms run by the Bank of Italy (INVIND). Restricting attention to Italy clearly limits the generality of the results, but Italy is an interesting case, as it had relied heavily on competitive devaluations and is specialized in traditional, low-tech activities, which according to the evidence set out above should have been most severely affected by the introduction of the common currency. We first review some insights from a series of case studies, then consider the time-series evolution of various measures of reallocation activities and, finally, study the correlation between restructuring and performance at the level of the firm.

[12] The inclusion of lagged growth in the regressions should already account for this.

4.1 Case studies

In the spring of 2007, the Bank of Italy conducted in-depth interviews with entrepreneurs and CEOs of some 40 Italian firms, mostly in the manufacturing sector. Like the NBER/Sloan "Pin factory" project (Borenstein et al. 1998), the survey involved long interviews (between 2 and 4 hours). The interviewers, always researchers of the Bank of Italy, followed a set schema, but most of the interview was left for the entrepreneurs to elaborate freely. The main goal was to assess whether the firms were restructuring and in what forms. Of course, 40 interviews cannot be statistically representative. The aim was to understand what forces were driving the process and how firms were responding, in order among other things to guide subsequent quantitative analysis. The main findings were summarized in an internal report by Omiccioli & Schivardi (2007), on which this section is based; the report has not yet been made public for confidentiality reasons.

One clear insight from the interviews is that success stories are invariably based on some degree of market power. Entrepreneurs are generally very clear that, given the growing role of low-wage countries in the world trade, competition based on production costs is rapidly becoming unsustainable, so the production of homogeneous, undifferentiated goods is less and less viable. All the firms that were surviving or even prospering in the globalized economy offered products that had a certain degree of differentiation and thus escaped pure cost competition. The challenge is to build up and maintain such market power.

The experiences reviewed were highly differentiated in a number of dimensions; by product, firm size, and the entrepreneur's personal history. But all the cases of successful restructuring had one feature in common: the firms had invested in activities not directly involving production. These activities may be classed as:

- Upstream: product creation (R&D, design) and brand establishment (advertising, marketing).
- Auxiliary: organization of production, often partly or wholly outside the firm (through outsourcing and offshoring); generally based on intensive use of ICT.
- Downstream: sales network, post-sales assistance.

These activities are not important only for high-tech products. Rather, the importance of

each component varies with the particular business considered. For final goods producers, the crucial needs are the establishment of a brand, the organization of production and the creation of a sales network. For high-tech activities, the creation of the product, particularly through R&D, remains the main route to competitive advantage. For producers of intermediate goods, customers require constant assistance, particularly for firms producing industrial machineries.

We interviewed some firms operating in the traditional sectors of clothing and shoes. The success stories entailed a shift of the business focus away from production towards brand creation and product design, maintaining a coordinating role in production, which was mostly outsourced, often abroad.[13] Out of 800 workers of a firm producing machines for tile making, only 70 were employed in the plant, the rest divided between product design (200) and marketing and administration. The prototypes of successful firms suggest that competitive strength is built outside the factory, by workers not directly involved in the production process. We will use this insight in our subsequent empirical analysis: restructuring means a greater reliance on non-production workers and, consequently, entails a reduction of the share of blue-collar workers in the workforce.

In terms of cross-sectoral differences, the process seems to be most intensive for low-tech activities. Most of the high-tech firms did not perceive either the euro or the globalization as a discontinuity in the competitive landscape. For them, in fact, competition focuses mostly on innovation and R&D. For example, an entrepreneur producing electrical machinery said that his firm had a 3-year lead over its Chinese competitors in technology and contended that was the key competitive edge to be maintained, rather than lowering production costs. Another firm in the medical and precision instrument field saw its main competitors as located in Germany and Japan; the strong euro had created the opportunity for an important acquisition in the US.

For low-tech firms, particularly those operating in the traditional sectors such as clothing and leather, the change was much more profound. All the entrepreneurs in these sectors stressed that a dramatic change in the competitive environment had occurred with the

[13] An entrepreneur in the shoe sector defined his firm as "a services firm that collects information from the market, elaborates it, designs products and dictates instructions to the other firms on how to produce them." Until 1999 this firm, which now employs 260 workers and produces only the models internally, was a traditional shoe-maker that produced for other brands.

introduction of the euro. Some had changed their business model radically (see footnote 13); those who had not were clearly struggling. This anecdotical evidence squares with the results of the previous section: the euro was a greater shock for activities of low skill content. It also suggests that the lower the technological content of the activity, the sharper the shift away from production is likely to be.

Further, the entrepreneurs do not think that the restructuring process is over. They all believed that the international landscape will keep changing fast in the coming years. Also, changes in the business model depend crucially on the individual histories of the firms. In particular, for family firms (almost all those interviewed could be classified as such) radical change tends to coincide with generational succession. Finally, restructuring itself is an ongoing, sequential activity, not a zero/one event. For example, many firms had been introducing business software, particularly some form of Enterprise Resource Planning (ERP), but this was mostly done in steps, first digitalizing accounting, then BtoB transactions, then production and so on. In fact, we interviewed firms with very different degrees of penetration of business software. All in all, therefore, we expect restructuring to be a smooth, ongoing process rather than concentrated in a short period of time.

4.2 Quantitative evidence from manufacturing firms[14]

The increasing availability of datasets with firm-level information has spurred a vast literature on restructuring (Davis et al. 1996). The basic idea, following the seminal work of Lilien (1982), is that periods of restructuring are characterized by intense factor reallocation and increased dispersion of firms' performance. In fact, when a shock hits the economy, some firms adapt and some do not, so that their performance diverges and factors are reallocated to successful restructurers. In this section we use the insights from this literature and the case studies reviewed above to assess the degree of restructuring of the Italian manufacturing sector following the introduction of the euro.

The data come from the Bank of Italy's annual survey of manufacturing firms (INVIND). INVIND is an open panel of around 1,200 firms per year representative of manufacturing firms with at least 50 employees. It contains detailed information on firms' characteristics,

[14]This subsection draws on the M.A. dissertation of Daniela Puggioni (2008) at the University of Cagliari.

including industrial sector, nationality, year of creation, number of employees, value of shipments, value of exports and investment. The questionnaire contains a fixed part and a rotating part used to investigate topics of special interest in the year. The resulting database has been used extensively (for a description of the database see, among others, Fabiani, Schivardi & Trento 2005, Guiso & Parigi 1999, Iranzo, Schivardi & Tosetti 2008).

If not all firms are equally successful at restructuring, performance should become more highly dispersed. Following up on the aggregate analysis, we consider productivity, measured as log of sales per worker,[15] and check whether its dispersion increased after the introduction of the euro. Figure 7 shows that in fact it did: the cross-firm dispersion of sales per worker goes from around 0.64 in the first part of the nineties to around 0.70 in the euro period.[16] Moreover, the dispersion increases almost monotonically up to the last available year (2007), suggesting that the process is still very much under way: in fact, if the restructuring wave were over, we would expect dispersion to revert to "business as usual" levels. We have also computed the dispersion of gross operating profits (EBITDA, earnings before interest, taxes, depreciation and amortization) over value added, drawn from the Cerved dataset.[17] In fact, Foster, Haltiwanger & Syverson (2008) show that selection and reallocation are due more to differences in profitability than in productivity. In Figure 7 we therefore also plot the standard deviation of profits, finding that they follow a similar pattern to productivity.

We next consider reallocation measures based on job flows.[18] The job creation rate (JC) is defined as

$$JC_t = \frac{\sum_{f \in E^+} \Delta E_{ft}}{\frac{1}{2}(E_t + E_{t-1})}$$

where ΔE_{ft} is the change in employment for firm f at time t, E^+ is the set of firms that

[15] Usually productivity is measured as value added per worker, but this is not available for a sufficiently long time span. However, given that part of the restructuring activity might entail the offshoring of some part of the production process, sales per worker might capture such reorganization of the production chain better.

[16] To make sure that results are not driven by outliers, we have also computed various interquartile ranges, finding exactly the same pattern.

[17] INVIND does not allow computation of profitability measures. We have therefore used Cerved, a database with balance-sheet information for almost all Italian limited liability companies, available since 1996. Cerved has no information on employment and therefore cannot be used for the other analysis in this section.

[18] See Davis et al. (1996) for a detailed explanation of job flow measures.

expand employment and E_t is aggregate employment.[19] The job destruction rate (JD) is defined similarly:

$$JD_t = \frac{\sum_{f \in E^-} |\Delta E_{ft}|}{\frac{1}{2}(E_t + E_{t-1})}$$

where E^- is the set of firms that reduce employment; net employment growth is $EG_t = JC_t - JD_t$; job reallocation is the sum of job creation and destruction, $JR_t = JC_t + JD_t$. Finally we also construct a measure of excess job reallocation, $ER_t = JR_t - |EG_t|$ which measures the job reallocation in excess of that required to reach a given change in net employment; for example, a sector might be constantly expanding employment and at the same time reallocating production among existing units: ER measures the job flow rate net of that due to sectoral employment expansion.

In Figure 8 we report JC, JD and EG. Job destruction peaks in 1993, when employment in the sample contracted by more than 5%. After that, both JC and JD remain fairly stable at values between 2 and 4%. Consistent with the downward trend in manufacturing employment, EG is negative in most years. Job reallocation also peaks in 1993 (Figure 9), then reverts to a fairly stable level of around 6%. ER shows a modest upward trend since 1998, with a peak in 2000 but again with fairly modest variations. Thus the traditional measures of restructuring offer little support to the hypothesis of an increase in restructuring after the euro. All the indicators of job reallocation (with the exception of ER) peak in the recession of the early nineties and then level off. This occurs at the same time as the increase in productivity and profitability dispersion which suggests two things. First, the reallocation process induced by the euro has a smooth, ongoing character, especially when compared to that related to the deep recession of 1993; in particular, it seems to have little effect on the reallocation of factors across firms – possibly because of the degree of flexibility of the factor markets. Second, and strictly related, the post-euro restructuring might be of a different type from that of the early nineties and require different indicators: in particular, rather than showing up in job flows across firms, it might have induced more within firm changes in workforce composition.[20]

[19] The normalization by $\frac{1}{2}(E_t + E_{t-1})$ rather than E_{t-1} constraints JC between -2 and 2 rather than -1 and ∞. The distribution is symmetric around 0 and easier to interpret graphically.

[20] Unfortunately, due to the lack of information on entry and exit, we can not compute the decomposition of productivity growth into the within firm, between firm and net entry components.

The case studies suggest that the firms that did well tended to shift from production to upstream and downstream activities, such as R&D, design, marketing and distribution chains. In terms of workforce composition, this implies that we should see a decrease in the share of blue-collar workers. Their average share decreased from 0.69 in 1990 to 0.62 in 2007 (Figure 10). This pattern reflects a secular trend, common to all developed economies, but with a clear break around the 1992 devaluation: from 1992 to 1998, the share stays roughly constant at around 0.67. It starts declining rapidly in 1999, falling to 0.62 in 2007. This evidence is consistent with the thesis that the devaluation of 1992 allowed firms to gain cost competitiveness, boosting the relative importance of production. With the euro, this possibility is ruled out and firms had to adapt their strategy, shifting away from production and therefore reducing the share of blue-collar workers. This interpretation is further corroborated by the analysis of the cross-firm variance in the share of blue-collar. Up to 1998 there is no clear trend in the cross sectional dispersion of this share.[21] Consistent with the hypothesis that the euro has forced a shift away from low-skill activities, and that the process has not been uniform across firms, starting in 1999 the standard deviation of the share of blue-collar workers increases steadily, from around 0.18 to 0.21.

According to the insights of the cross-country analysis of the previous section, the shift away from low-skill workers should have been stronger in low-tech activities, which had relied more on competitive devaluations. To check whether this is indeed the case, we have grouped firms according to the OECD classification system (OECD 2003), dividing them into 4 classes: low, medium-low, medium-high and high tech. Figure 11 reports the time series for the share of blue-collar workers for the 4 groups of firms. In general, the paths are similar to the aggregate, with a pause in the decrease after the 1992 devaluation and an acceleration starting in 1999. A clear exception is the group of high-tech firms, for which no clear pattern emerges, while the decrease is sharpest among the low-tech firms, which reduced the share of blue-collar workers by around 8 percentage points between 1999 and 2007. A similar picture emerges when considering the cross-firm dispersion in the share of blue-collar workers (Figure 12): again the largest increases are recorded by low and

[21] This graphical evidence is supported by the more formal analysis of Iranzo et al. (2008), who study the within and between firm skill dispersion using the same sample for the period 1980-97, finding a very stable time series pattern for the cross-firm component of skill dispersion, i.e. no evidence of an increase in dispersion.

medium-low tech firms.

To corroborate the graphical analysis, we have run some diff-in-diff regressions of the following form:

$$\text{ShBlue}_{ft} = \alpha_0 + \alpha_1 * \text{LOW}_f * \text{POST}_t + \alpha_2 \text{LOW}_f + \alpha_3 X_{ft} + \text{YEAR}_t + \varepsilon_{ft}, \qquad (4)$$

where ShBlue_{ft} is the share of blue-collar workers in firm f at time t, LOW is a dummy equal to 1 if the firm belongs to the low-tech group, POST is a dummy equal to 1 for the years 1999-2007, YEAR is a full set of year dummies and X_{ft} includes firm size (log of total employment) and 4 regional dummies (north-west, north-east, center and south). The LOW dummy controls for fixed group attributes, in particular for the fact that low-tech firms have a higher share of blue-collar workers than other firms; the year dummies control for possible time trends. The coefficient α_1 therefore measures the change in the share of blue-collar workers for the firms in the LOW group before and after the euro, as a deviation from the change for firms in the control group (firms not in the LOW group). As such, it can be interpreted as the extra effect of the euro on the LOW firms, compared to the control group. The results reported in Table 10 clearly confirm the graphical analysis. The first column applies only the dummy for the low-tech firms; the control group therefore comprises all other firms. The coefficient indicates the decrease in the share of blue-collar workers has been 3 percentage points greater among low-tech firms than among other since 1999, with a strong statistical significance. In the second column we also include a MEDIUM-LOW*POST dummy, so that now the control group consists of medium-high and high-tech firms. Again, we find that low and medium-low-tech firms decreased the share of blue-collar workers more substantially; and the same occurs when we include a dummy for medium-high-tech firms as well (column 3). The intensity of the decrease is inversely related to the technological content. Consistent with the findings of the previous section, the effect of the euro on workforce composition decreases monotonically with technological intensity. These results are very robust to changes in the specification. To control for selection effects, we have run the regressions with firm fixed effects; again the results hold. We have also included additional firm controls, such as indicators of productivity, export propensity and sales (as an alternative measure of size), finding no significant differences in the results.

One important objection to this exercise is that we might be capturing differences in trends in the occupational mix. That is, it might simply be that low-tech firms were already reducing blue-collar workers more intensively before the euro launch. For a limited number of firms, we can reconstruct the technological classification since 1984. To check whether we are picking up differences in trends, we have re-run regression (4) for the period 1984-90, with the POST dummy equal to 1 for 1988-90 and 0 before (this splits the sample approximately equally). If we are simply capturing differences in underlying trends, we should then find that α_1 is negative also in the eighties, when competitive devaluations were still possible. But columns (4-6) of Table 10 show that, if anything, in the eighties low-tech firms were actually increasing the blue-collar intensity of the workforce compared to the high-tech ones. These findings are robust to changes in the year of definition of the post-period and to including years up to 1998. We can conclude that before the euro low-tech firms used devaluations to regain price competitiveness and intensified their reliance on low-skilled workers; on the contrary, high-tech firms competed mostly in other dimensions and so were increasing the relative skill content of their workforce.

4.3 Restructuring and firm performance

Was restructuring effective in terms of firms performance? We measure performance in terms of growth of value added and productivity and rely on a simple cross-sectional empirical specification of the following form:

$$g_{i,t_0t} = \beta_0 + \beta_1 * \mathrm{RES}_{i,t_0} + \beta_2' X_{i,t_0} + \beta_3' \mathrm{YEAR}_{t_0} + \varepsilon_i, \tag{5}$$

where g_{i,t_0t} is the firms average growth rate of real value added or productivity (value added per employee) in the period t_0t and t_0 is the first available year for a firm in the sample, starting in 2000. To maximize the number of firms, we do not limit the sample to those that are surveyed both in 2000 and 2005, but also include firms sampled for at least a pair of consecutive years during the period. To net out cyclical effects, we compute the growth rate as the residual of a preliminary regression of the raw growth rate data on year dummies and the initial value of value added or productivity. The starting year is 2000 instead of 1999 because some of our proxies for restructuring take 2000 as the reference year (the results

do not change using 1999). YEAR_{t_0} is a set of dummies for the first year in which a firm is in the dataset; X_{it_0} includes firm size (log of total employment), sectoral dummies at two digits of the NACE rev. 1 classification and the usual 4 regional dummies, all computed at t_0. We focus on the coefficient of RES, a measure of restructuring activity, for which we use different proxies. The first comes directly from the previous analysis and refers to the share of blue-collar workers: here we check both the initial level of the share (ShBlue) and its average annual change in 2000-06 ($\Delta ShBlue$). If the reduced reliance on low-skilled workers has indeed been one of the dominant strategies to regain competitiveness after the introduction of the euro, we should find a negative relationship between this variable and firm performance. There is a clear negative effect of the initial share of blue-collar workers on value added and productivity growth (Table 11, columns 2 and 5), while the coefficient of the contemporaneous change in that share is not significantly different from zero (columns 1 and 4). The former result confirms the idea that if we control for sectoral differences in technology firms that focused more on non-production activities, through a larger share of white-collar workers, have performed better. Given the likely smooth and ongoing nature of the restructuring process, it is not surprising that our contemporaneous indicator is not able to fully capture the impact of restructuring on performance.

We then search for a heterogeneous effect of restructuring across sectors. As pointed out in the previous section, we might expect that, controlling for average sectoral differences in the blue-collar share, firm heterogeneity in performance is more strongly linked to the share in low-tech sectors. The data do not supported this thesis, possibly because of lack of sufficient statistical power (the coefficient is negative but statistically insignificant).

We check whether the effect of the blue-collar share on performance is indeed related to the euro by running similar regressions for the period 1990-95, when Italian firms could rely on devaluation to gain international competitiveness. Over this period we would expect no role for restructuring and the results (columns 3 and 6) show that this is indeed the case.

In the INVIND questionnaire referring to 2006, firms were asked about their business strategies, in particular about significant changes since 2000. The changes refer to significant renewals of the product menu and to greater reliance on branding strategies. [22] We exploit

[22]More precisely, firms were asked the following question: "Which of the following statements better describe your strategic behavior during the 2000-06 period? 1=the firm has not changed strategy; 2=the

this information in two steps. First, we construct a dummy variable NEWSTRAT which is equal to 1 when a firm claims to have been either changing the product menu or investing more resources in product branding, and 0 otherwise. As shown in columns 1 and 5 of Table 12, the dummy variable does have a significantly positive effect on performance; the effect also survives the introduction of the share of blue-collar workers (columns 2 and 6), which indicates that the performance improvement following the new strategy is realized on the top of that coming from the workforce composition. More detailed information on the intensity of the product change is then used to distinguish firms that renewed products within the same sectoral grouping (SMALLCH) from those that started producing products so new as actually changed productive sector (LARGECH)[23]. The control group here consists of firms that between 2000 and 2006 kept on producing almost the same products. As shown in columns 3 and 4 for value added growth and 7 and 8 for productivity growth, the strongest boost to performance has come from significant changes in the product menu. As for the blue-collar share, again we find no sectoral heterogeneity in the effect of product change and branding on performance (not reported).

All in all, the evidence of this section indicates that firms that undertook restructuring activities recorded a higher growth of both value added and productivity growth. Although more work will be required to establish a clear causal relation between restructuring and performance, this evidence squares with and complements the results previously discussed in the paper.

5 Conclusion

We have shown that the euro has been accompanied by a process of within sector reallocation, consistent with the hypothesis that the end of devaluations has forced restructuring in the countries and sectors that had depended most heavily on them. We used productivity growth as an indirect indicator of reallocation. This begs the question of how restructuring

firm has changed strategy, mostly by introducing relevant changes in the product menu; 3=the firm has changed strategy, mostly by investing more resources on its own brand; 4=the firm has changed strategy mostly by internationalizing its activity".

[23]The exact question asked to the firms is as follows: "With respect to your product menu in 2000, now you produce mostly: 1=the same products; 2= slightly different products that fall into a similar sectoral category; 3= products that are so different to fall into a completely different sectoral category".

actually took place. We therefore use firm-level data for Italy with detailed information on restructuring activity. A series of interviews with entrepreneurs suggested that since the adoption of the euro firms have shifted their business focus from production to upstream and downstream activites related to R&D, product design, marketing, distribution and post sale assistance. This search for market power has been stronger in the traditional, low-tech industries. Hard quantitative evidence on a sample of Italian manufacturing firms showed that the process has entailed a reallocation of workers mainly within rather than across firms, with a decrease in the share of blue-collar workers. Finally, we found that restructuring has improved performance.

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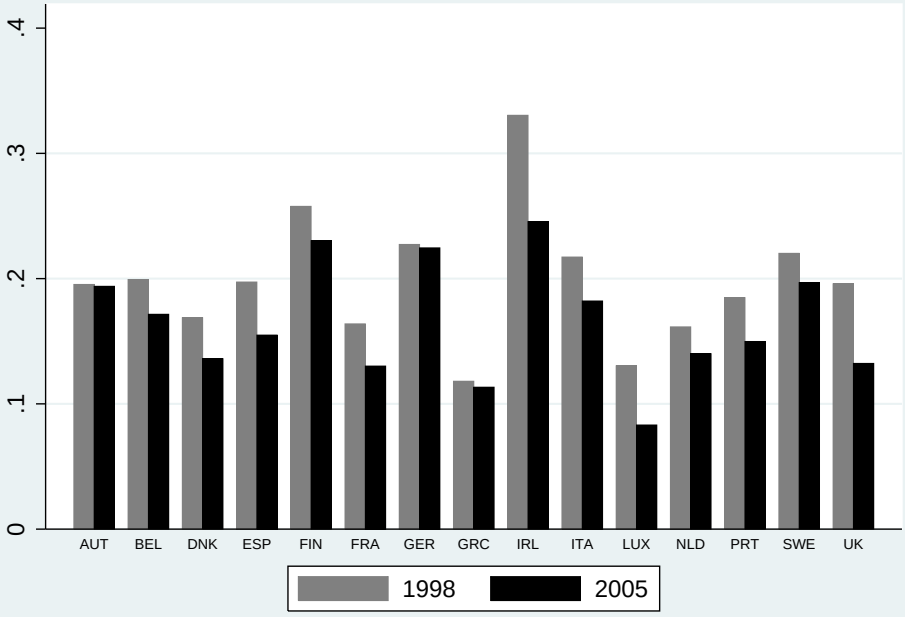
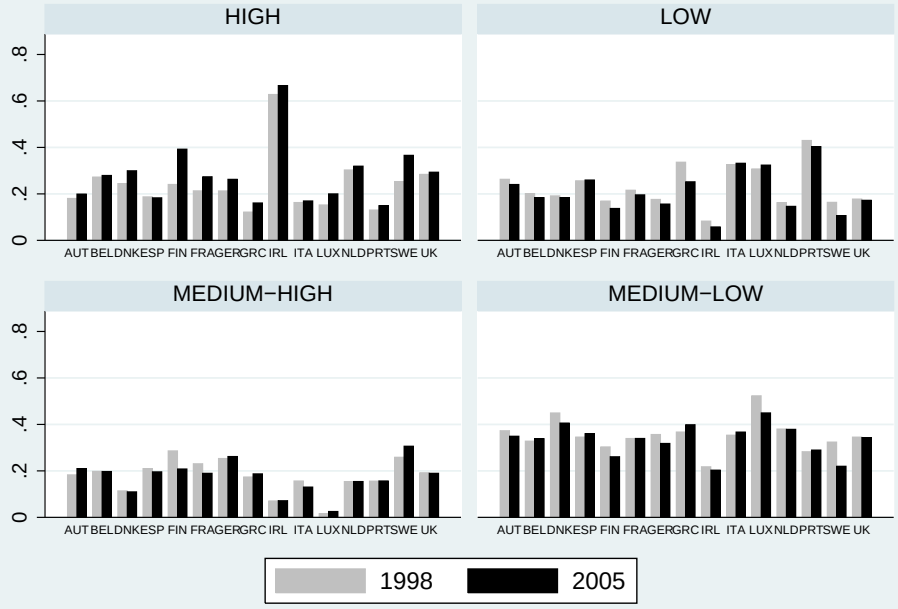
Figure 1: Manufacturing sector's share of value added



Source: our elaborations on EU KLEMS data.

Figure 2: Share of value added by skill content



Source: our elaborations on EU KLEMS data.

Figure 3: Dissimilarity index with respect to euro area average: 1998 and 2005

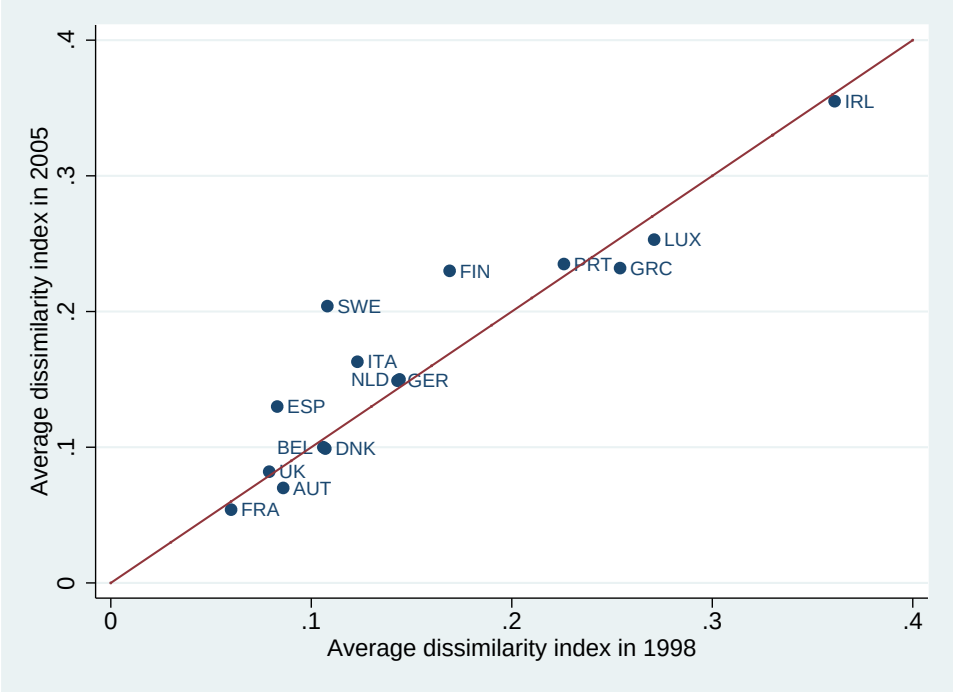


Figure 4: Size of low-skill activities and devaluation in nominal terms

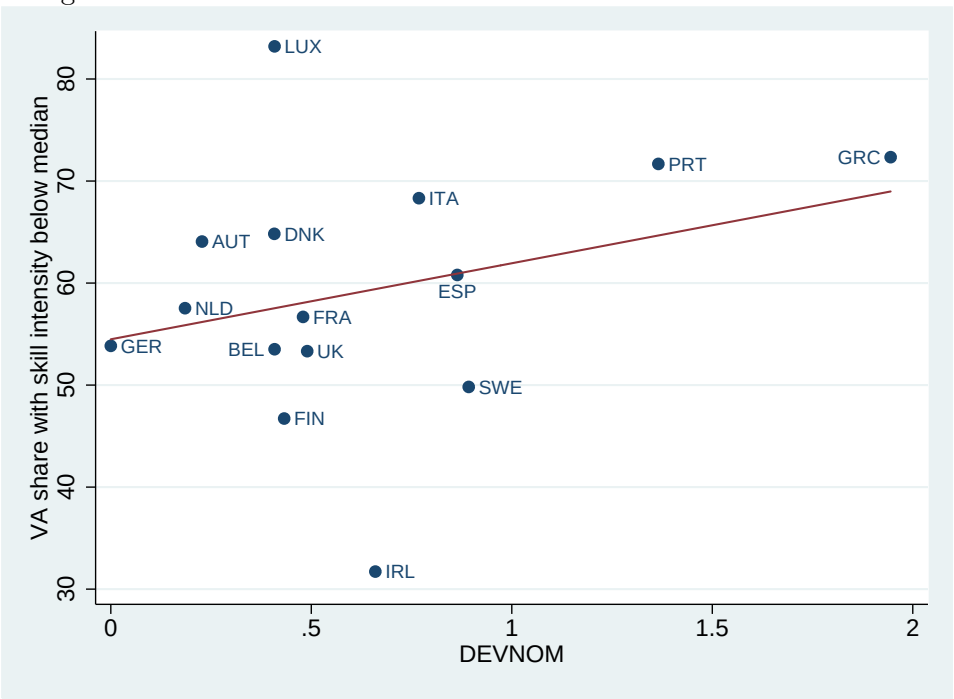


Figure 5: Relative importance of low-skill activities in 1998 and devaluation in real terms

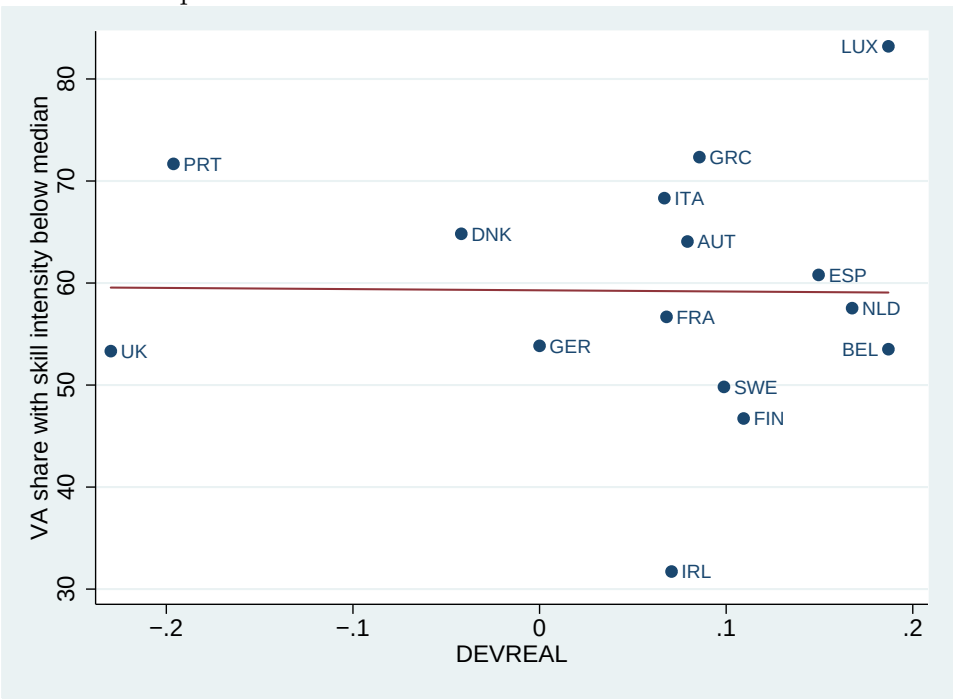


Figure 6: Dissimilarity index (by skill intensity) and real devaluation

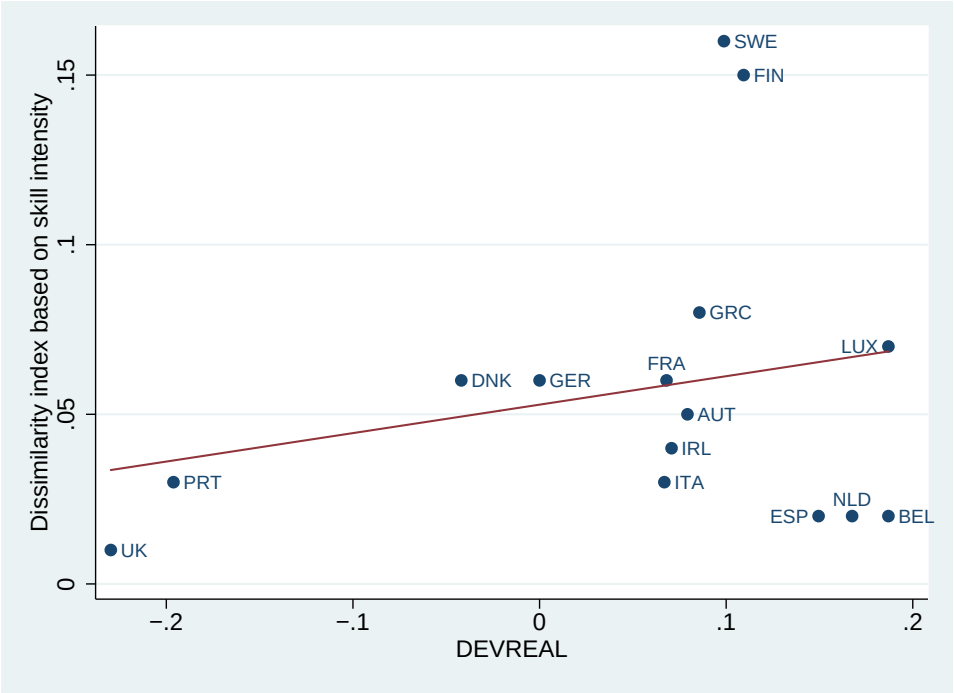
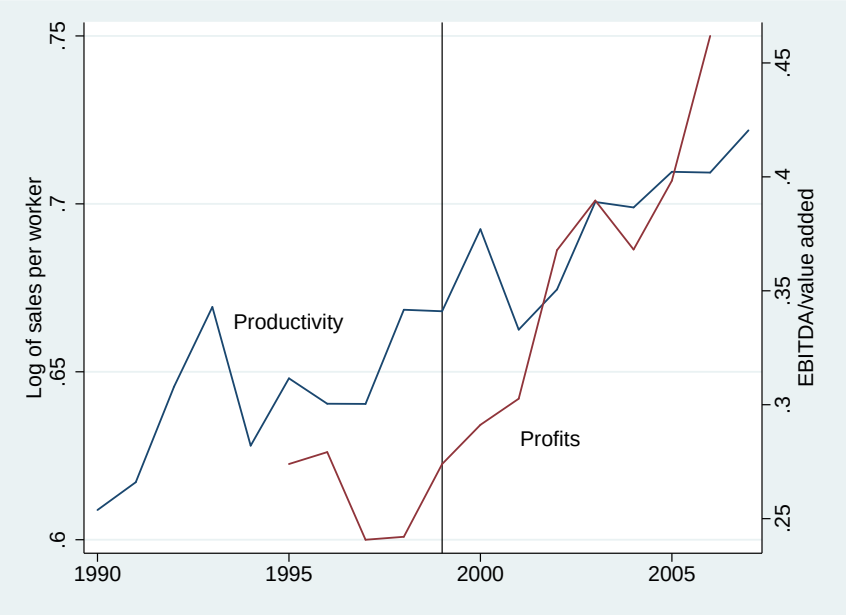
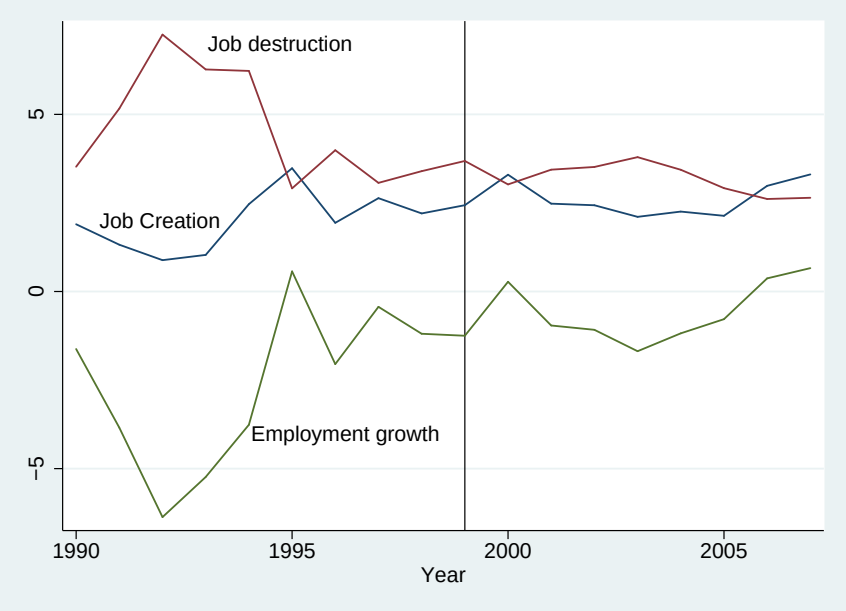


Figure 7: Standard deviation of productivity and profits



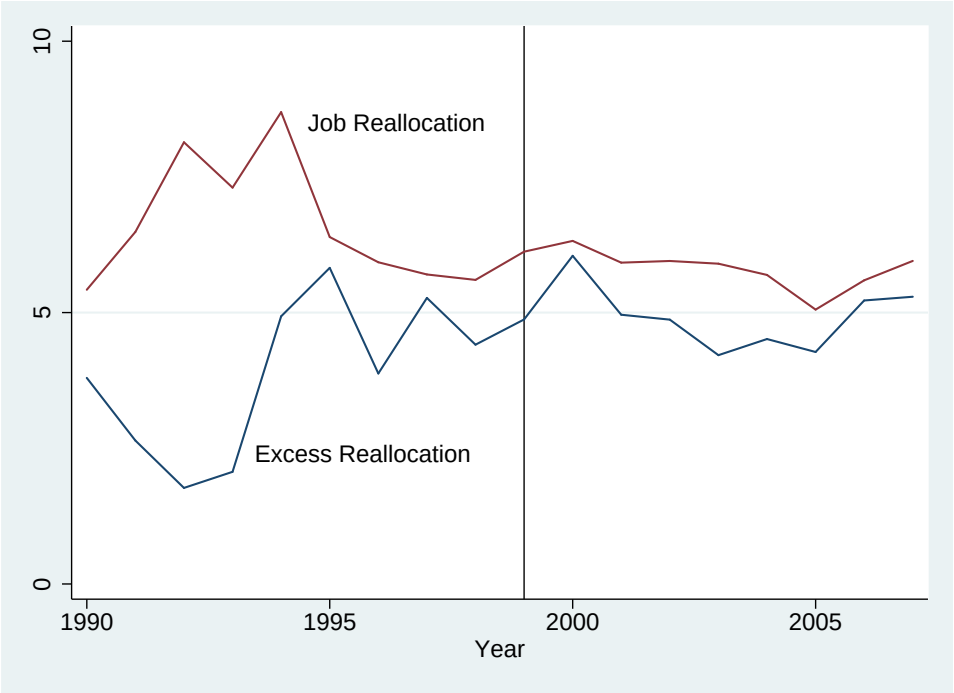
Note: productivity is measured as log of sales per workers (left scale) in the INVIND database. Profitability is EBITDA/value added (right scale) in the Cerved database. In this and the following graphs a vertical bar is drawn corresponding to 1999, year of the euro introduction.

Figure 8: Job creation, job destruction and net employment growth



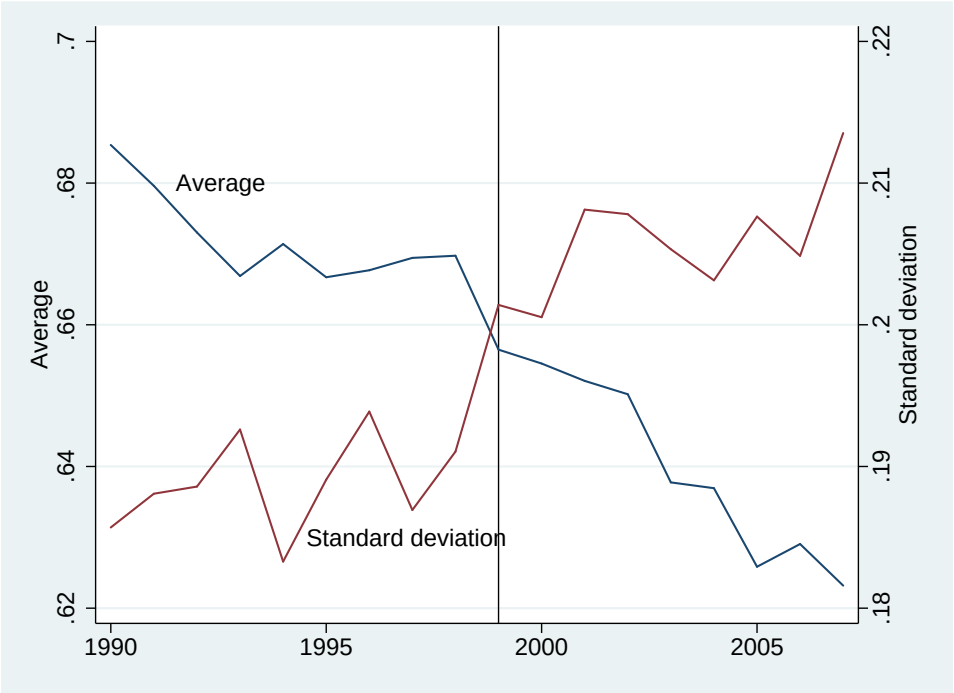
Source: Based on INVIND database.

Figure 9: Job reallocation and excess job reallocation



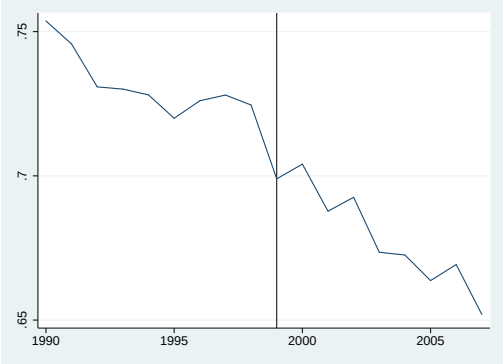
Source: Based on INVIND database.

Figure 10: Cross-firm average and standard deviation of the share of blue-collar workers

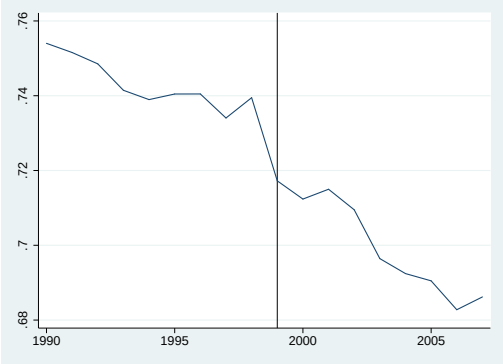


Source: Based on INVIND database.

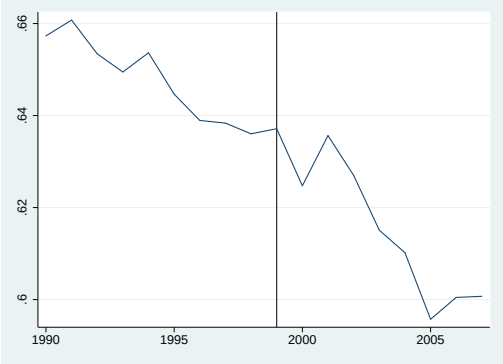
Figure 11: Share of blue-collar workers by technological intensity



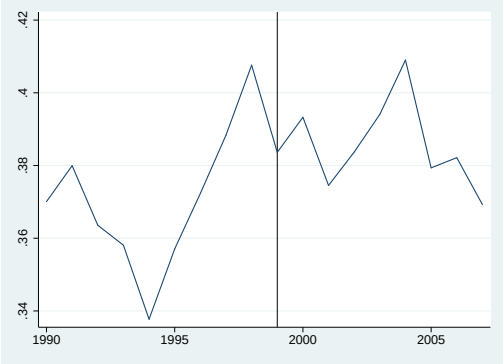
(a) low tech



(b) medium-low tech



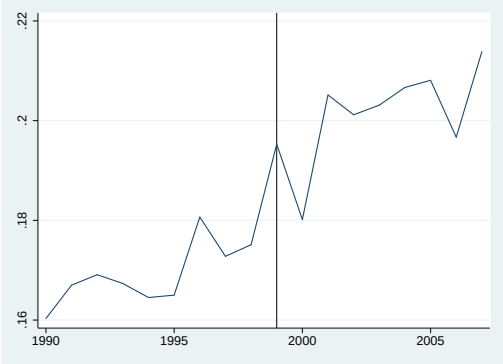
(c) medium-high tech



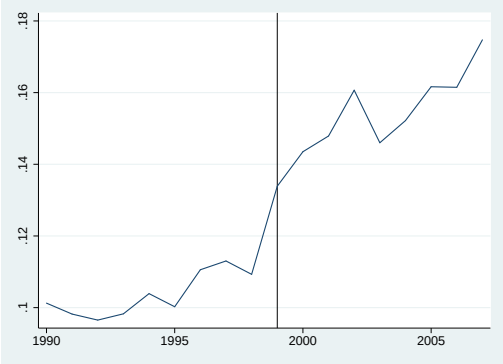
(d) high tech

Source: our elaborations on INVIND database.

Figure 12: Standard deviation of blue-collar workers by technological intensity



(a) low tech



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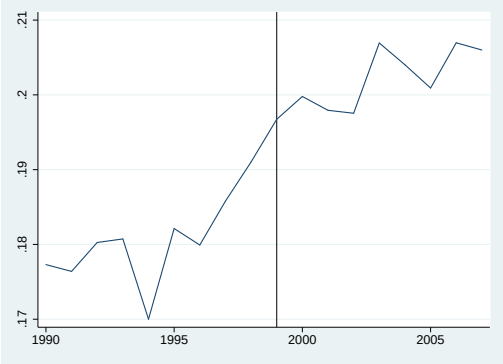

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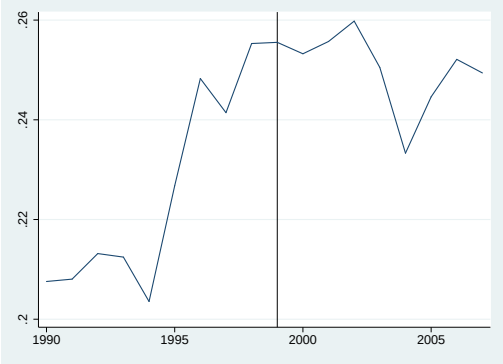

(d) high tech

Source: our elaborations on INVIND database.

Table 1: ICT, R&D, and skill intensities in the US and China's world market share by sector of economic activity

Sector (NACE code in parenthesis)	**ICT intensity**	**R&D intensity**	**Skill intensity**	**Chinese share**
Food products and beverages (15)	0.06	0.01	0.16	0.03
Tobacco products (16)	0.06	0.01	0.27	0.02
Textiles (17)	0.05	0.01	0.10	0.09
Wearing apparel, dressing (18)	0.05	0.01	0.14	0.16
Leather, leather products and footwear (19)	0.05	0.01	0.09	0.20
Wood and products of wood and cork (20)	0.04	0.01	0.08	0.03
Pulp, paper and paper products (21)	0.10	0.02	0.17	0.01
Printing, publishing and reproduction (22)	0.10	0.02	0.34	0.01
Coke, refined petroleum products and nuclear fuel (23)	0.05	0.06	0.31	0.05
Chemicals and chemical products (24)	0.12	0.14	0.41	0.02
Rubber and plastics products (25)	0.04	0.03	0.15	0.06
Other non-metallic mineral products (26)	0.07	0.02	0.14	0.05
Basic metals (27)	0.06	0.02	0.14	0.03
Fabricated metal products (28)	0.06	0.02	0.12	0.05
Machinery, n.e.c. (29)	0.18	0.06	0.16	0.02
Office, accounting and computing machinery (30)	0.16	0.42	0.49	0.03
Electrical machinery (31)	0.16	0.12	0.21	0.04
Radio, television and communication equipment (32)	0.16	0.22	0.36	0.05
Medical, precision and optical instruments (33)	0.16	0.36	0.38	0.03
Motor vehicles, trailers and semi-trailers (34)	0.14	0.13	0.20	0.00
Other transport equipment (35)	0.14	0.24	0.33	0.12
Manufacturing n.e.c.; recycling (36, 37)	0.09	-	0.16	0.09
Correlation matrix				
ICT intensity	1.0	0.7	0.6	-0.3
R&D intensity		1.0	0.8	-0.1
Skill intensity			1.0	-0.3
Chinese share				1.0

Source: Based on EU KLEMS, OECD STAN and United Nations data. Year 1998.

Table 2: Krugman dissimilarity indices vis-a-vis the euro area

	Skill intensity		*ICT intensity*		*R&D intensity*		*NACE*	
	1998	*2005*	*1998*	*2005*	*1998*	*2005*	*1998*	*2005*
Euro area								
Austria	0.06	0.06	0.07	0.04	0.06	0.07	0.15	0.11
Belgium	0.06	0.03	0.10	0.13	0.07	0.06	0.20	0.19
Finland	0.10	0.15	0.11	0.20	0.16	0.19	0.31	0.39
France	0.02	0.03	0.05	0.03	0.06	0.05	0.11	0.11
Germany	0.08	0.10	0.14	0.14	0.16	0.17	0.20	0.19
Greece	0.13	0.11	0.26	0.21	0.27	0.24	0.36	0.37
Ireland	0.42	0.42	0.21	0.18	0.35	0.34	0.47	0.47
Italy	0.13	0.19	0.11	0.12	0.09	0.13	0.16	0.21
Luxembourg	0.26	0.23	0.30	0.27	0.18	0.17	0.34	0.34
Netherlands	0.13	0.11	0.12	0.14	0.12	0.11	0.21	0.24
Portugal	0.21	0.20	0.18	0.19	0.24	0.26	0.28	0.29
Spain	0.03	0.09	0.09	0.13	0.08	0.14	0.12	0.15
Non-euro area								
Denmark	0.13	0.11	0.07	0.03	0.06	0.06	0.18	0.19
Sweden	0.09	0.21	0.10	0.18	0.09	0.15	0.15	0.28
United Kingdom	0.07	0.05	0.05	0.07	0.06	0.06	0.14	0.15

Source: Based on EU KLEMS and STAN OECD data. Note: dissimilarity indices are calculated for each country with respect to the EA, net of the country itself for EA members.

Table 3: Krugman dissimilarity indices, 1998-2005

	Skill intensity	*ICT intensity*	*R&D intensity*	*NACE*
United Kingdom	0.01	0.02	0.02	0.06
Netherlands	0.02	0.02	0.04	0.06
Belgium	0.02	0.02	0.02	0.04
Spain	0.02	0.03	0.05	0.07
Italy	0.03	0.05	0.04	0.07
Portugal	0.03	0.04	0.03	0.06
Ireland	0.04	0.09	0.04	0.11
Austria	0.05	0.04	0.04	0.07
Denmark	0.06	0.04	0.04	0.09
Germany	0.06	0.03	0.07	0.07
France	0.06	0.06	0.06	0.10
Luxembourg	0.07	0.06	0.05	0.10
Greece	0.08	0.09	0.13	0.14
Finland	0.15	0.16	0.16	0.20
Sweden	0.16	0.19	0.18	0.27

Source: Based on EU KLEMS and STAN OECD data. Note: countries are ordered according to the indices based on skill intensity.

Table 4: Nominal and real measures of devaluation and price changes

	DEVNOM	*DEVREAL*	ΔP
Austria	0.227	0.079	0.148
Belgium	0.408	0.187	0.222
Denmark	0.408	-0.042	0.450
Finland	0.432	0.109	0.323
France	0.479	0.068	0.411
Germany	0.000	0.000	0.000
Greece	1.945	0.086	1.859
Ireland	0.660	0.071	0.589
Italy	0.768	0.067	0.701
Luxembourg	0.408	0.187	0.222
Netherlands	0.185	0.167	0.018
Portugal	1.366	-0.196	1.562
Spain	0.864	0.150	0.715
Sweden	0.893	0.099	0.794
United Kingdom	0.490	-0.230	0.720

Source: Bank of Italy's calculations (see Finicelli et al. (2005))

Table 5: Low skill intensity and devaluations

	Panel A: productivity growth				
	(1)	(2)	(3)	(4)	(5)
$DEV * SK * EA$	1.17**	1.01**	0.71	1.50***	0.55**
	(0.56)	(0.40)	(0.50)	(0.53)	(0.26)
$DEV * SK$	-0.64	-0.41*	-0.23	-0.66**	
	(0.50)	(0.23)	(0.37)	(0.31)	
$\Delta P * SK * EA$	-1.05**				
	(0.45)				
$\Delta P * SK$	0.58				
	(0.37)				
$\ln(prod_{98})$	-0.05***	-0.05***	-0.05***	-0.05***	-0.05***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
$\Delta prod_{9598}$	0.16**	0.16**	0.07	0.09	0.11*
	(0.07)	(0.08)	(0.08)	(0.11)	(0.06)
Observations	321	321	321	321	256
R^2	0.54	0.53	0.37	0.43	0.51
	Panel B: employment growth				
$DEV * SK * EA$	-0.19	-0.06	-0.06	-0.11	0.07
	(0.23)	(0.24)	(0.27)	(0.31)	(0.13)
$DEV * SK$	0.24	0.07	0.10	-0.03	
	(0.19)	(0.19)	(0.21)	(0.25)	
$\Delta P * SK * EA$	0.12				
	(0.23)				
$\Delta P * SK$	-0.16				
	(0.19)				
$\ln(emp_{98})$	0.01***	0.01***	-0.01**	0.01*	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Δemp_{9598}	0.21***	0.20***	0.29***	0.16*	0.17**
	(0.07)	(0.07)	(0.10)	(0.08)	(0.07)
Observations	323	323	323	323	258
R^2	0.71	0.71	0.50	0.63	0.65

DEV is the indicator of nominal devaluation (DEVNOM) in column 1 and of real devaluation (DEVREAL) in all other columns, computed over the period 1980-1998; SK is low-skill intensity; EA is a dummy equal to 1 for the euro area countries; ΔP is the relative growth rate in producer prices (see the main text for details); $\ln(prod_{98})$ ($\ln(emp_{98})$) is initial productivity (employment) and $\Delta prod_{9598}$ (Δemp_{9598}) is productivity (employment) growth in the 1995-98 period. Outcome growth rates are computed for 1998-2005 in all columns except column 4, where it is computed for 2002-05. All regressions are weighted with the sectoral employment apart from that in column 3, which is unweighted. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Low R&D intensity and devaluation

	Panel A: productivity growth			
	(1)	(2)	(3)	(4)
$DEV * RD * EA$	1.51**	0.62	1.63**	1.01***
	(0.59)	(0.52)	(0.73)	(0.36)
$DEV * RD$	-0.43	-0.08	-0.52	
	(0.34)	(0.39)	(0.37)	
$\ln(prod_{98})$	-0.06***	-0.06***	-0.06***	-0.05***
	(0.01)	(0.01)	(0.02)	(0.01)
$\Delta prod_{9598}$	0.16**	0.07	0.10	0.11*
	(0.08)	(0.08)	(0.11)	(0.06)
Observations	306	306	306	244
R^2	0.56	0.38	0.46	0.54
	Panel B: employment growth			
$DEV * RD * EA$	0.36	0.05	0.48	0.18
	(0.30)	(0.24)	(0.43)	(0.19)
$DEV * RD$	-0.27	-0.09	-0.43	
	(0.20)	(0.17)	(0.31)	
$\ln(emp_{98})$	0.01***	-0.01**	0.01**	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Δemp_{9598}	0.22***	0.29***	0.19**	0.17**
	(0.07)	(0.10)	(0.09)	(0.07)
Observations	308	308	308	246
R^2	0.71	0.50	0.64	0.65

DEV is the indicator of real devaluation (DEVREAL), computed over the period 1980-1998; RD is low R&D intensity; EA is a dummy equal to 1 for the EA countries; $\ln(prod_{98})$ ($\ln(emp_{98})$) is initial productivity (employment) and $\Delta prod_{9598}$ (Δemp_{9598}) is productivity (employment) growth in the 1995-98 period. Outcome growth rates are computed for 1998-2005 in all columns except column 3, where it is computed for 2002-05. All regressions are weighted with the sectoral employment apart from that in column 2, which is unweighted. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Low ICT intensity and devaluation

	Panel A: productivity growth			
	(1)	(2)	(3)	(4)
$DEV * ICT * EA$	1.64*	2.78**	1.35	0.83
	(0.91)	(1.34)	(1.37)	(0.51)
$DEV * ICT$	-0.66	-1.24	-0.68	
	(0.58)	(0.99)	(0.95)	
$\ln(prod_{98})$	-0.06***	-0.05***	-0.06***	-0.05***
	(0.01)	(0.01)	(0.02)	(0.01)
$\Delta prod_{9598}$	0.16*	0.07	0.09	0.10*
	(0.08)	(0.07)	(0.12)	(0.06)
Observations	321	321	321	256
R^2	0.53	0.37	0.42	0.50
	Panel B: employment growth			
$DEV * ICT * EA$	0.29	-0.38	0.49	0.06
	(0.57)	(0.64)	(0.65)	(0.35)
$DEV * ICT$	-0.32	0.01	-0.56	
	(0.39)	(0.46)	(0.48)	
$\ln(emp_{98})$	0.01***	-0.01**	0.01*	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Δemp_{9598}	0.21***	0.30***	0.16**	0.17**
	(0.06)	(0.10)	(0.08)	(0.07)
Observations	323	323	323	258
R^2	0.71	0.50	0.63	0.65

DEV is the indicator of real devaluation (DEVREAL), computed over the period 1980-1998; ICT is low ICT intensity; EA is a dummy equal to 1 for the EA countries; $\ln(prod_{98})$ ($\ln(emp_{98})$) is initial productivity (employment) and $\Delta prod_{9598}$ (Δemp_{9598}) is productivity (employment) growth in the 1995-98 period. Outcome growth rates are computed for 1998-2005 in all columns except column 3, where it is computed for 2002-05. All regressions are weighted with the sectoral employment apart from that in column 2, which is unweighted. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Chinese export share and devaluation

	Panel A: productivity growth			
	(1)	(2)	(3)	(4)
$DEV * CH * EA$	1.34**	1.52**	0.98	0.27
	(0.67)	(0.70)	(1.19)	(0.38)
$DEV * CH$	-1.06**	-0.82	-0.97	
	(0.48)	(0.52)	(1.10)	
$\ln(prod_{98})$	-0.06***	-0.05***	-0.06***	-0.05***
	(0.01)	(0.01)	(0.02)	(0.01)
$\Delta prod_{9598}$	0.16*	0.07	0.09	0.11*
	(0.09)	(0.08)	(0.12)	(0.06)
Observations	321	321	321	256
R^2	0.53	0.36	0.42	0.49
	Panel B: employment growth			
$DEV * CH * EA$	-1.77**	-1.01	-1.75**	-0.39*
	(0.69)	(0.67)	(0.77)	(0.23)
$DEV * CH$	1.38**	1.11***	1.22*	
	(0.64)	(0.41)	(0.71)	
$\ln(emp_{98})$	0.01***	-0.01**	0.01*	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Δemp_{9598}	0.21***	0.29***	0.16**	0.19***
	(0.06)	(0.10)	(0.08)	(0.07)
Observations	323	323	323	258
R^2	0.73	0.51	0.64	0.65

DEV is the indicator of real devaluation (DEVREAL), computed for the period 1980-1998; CH is China's world export share; EA is a dummy equal to 1 for the EA countries; $\ln(prod_{98})$ ($\ln(emp_{98})$) is initial productivity (employment) and $\Delta prod_{9598}$ (Δemp_{9598}) is productivity (employment) growth in the 1995-98 period. Outcome growth rates are computed for 1998-2005 in all columns except column 3, where it is computed for 2002-05. All regressions are weighted with the sectoral employment apart from that in column 2, which is unweighted. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Pre-regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	SKILLS		R&D		ICT		CHINA	
	PROD	EMP	PROD	EMP	PROD	EMP	PROD	EMP
$DEV * SECT * EA$	-0.11	-0.13	0.05	0.00	0.29	0.09	0.20	0.08
	(0.09)	(0.10)	(0.10)	(0.12)	(0.19)	(0.19)	(0.19)	(0.42)
$DEV * SECT$	0.07	0.08	-0.01	0.02	-0.10	-0.04	-0.11	-0.12
	(0.05)	(0.06)	(0.05)	(0.07)	(0.10)	(0.10)	(0.11)	(0.18)
$\ln(prod_{80})$	-0.03***		-0.03***		-0.03***		-0.03***	
	(0.00)		(0.00)		(0.00)		(0.00)	
$\Delta prod_{7080}$	0.40***		0.40***		0.40***		0.40***	
	(0.02)		(0.03)		(0.02)		(0.02)	
$\ln(emp_{80})$		-0.00***		-0.00***		-0.00***		-0.00***
		(0.00)		(0.00)		(0.00)		(0.00)
Δemp_{7080}		0.69***		0.69***		0.69***		0.69***
		(0.06)		(0.06)		(0.06)		(0.05)
Observations	293	302	278	287	293	302	293	302
R^2	0.96	0.85	0.96	0.85	0.96	0.85	0.96	0.85

DEV is the indicator of real devaluation (DEVREAL), computed for the period 1980-1998; $SECT$ is the sectoral indicator, indicating low-skill intensity in columns 1 and 2, low-R&D intensity in columns 3 and 4, low-ICT intensity in columns 5 and 6 and China's world export share in columns 7 and 8; EA is a dummy equal to 1 for the EA countries; $\ln(prod_{80})$ ($\ln(emp_{80})$) is initial productivity (employment) and $\Delta prod_{7080}$ (Δemp_{7080}) is productivity (employment) growth in the 1970-80 period. Outcome growth rates are computed for 1980-1998. All regressions are weighted with sectoral employment. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Share of blue-collar workers

	(1)	(2)	(3)	(4)	(5)	(6)
	Period: 1990-2007			Period: 1984-1990		
$LOW * POST$	-0.031***	-0.031***	-0.072***	0.003	0.004	0.038*
	(0.005)	(0.006)	(0.013)	(0.009)	(0.011)	(0.021)
$MED - LOW * POST$		-0.019***	-0.059***		-0.006	0.029
		(0.006)	(0.013)		(0.010)	(0.021)
$MED - HIGH * POST$			-0.050***			0.036*
			(0.013)			(0.021)
LOW	0.076***	0.132***	0.336***	0.073***	0.127***	0.304***
	(0.004)	(0.005)	(0.010)	(0.007)	(0.008)	(0.015)
$MED - LOW$		0.135***	0.339***		0.135***	0.310***
		(0.004)	(0.010)		(0.007)	(0.014)
$MED - HIGH$			0.242***			0.215***
			(0.010)			(0.015)
$\ln(emp)$	-0.030***	-0.024***	-0.018***	-0.035***	-0.029***	-0.021***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Observations	24143	24143	24143	5142	5142	5142
R^2	0.09	0.15	0.20	0.14	0.22	0.32

The dependent variable is the share of blue-collar workers at the level of the firm. Ln(emp) is the log of total employment. LOW is a dummy equal to 1 for low-tech firms, and similarly for MED-LOW and MED-HIGH. POST is a dummy equal to 1 for the post 1998 years. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 11: Firm performance and share of blue-collar workers

	(1)	(2)	(3)	(4)	(5)	(6)
	Value added growth			Productivity growth		
ln(emp)	0.013***	0.016***	-0.001	0.012***	0.017***	0.002
	(0.004)	(0.004)	(0.006)	(0.004)	(0.004)	(0.006)
$\Delta ShBlue$	-0.022			0.017		
	(0.072)			(0.052)		
ShBlue		-0.055**	-0.055	-0.094***	-0.035	
		(0.023)	(0.036)	(0.020)	(0.035)	
Observations	3042	3178	1008	3044	3181	1009
R^2	0.030	0.044	0.063	0.034	0.053	0.076

Regressions are run over the period 2000-06 except for columns 3 and 6, where the period is 1990-95. The dependent variable is the annual average real growth rate of value added/labor productivity in the two periods. Ln(emp) is the log of total employment as of 2000. ShBlue is the share of blue-collar workers over the total number of employees as of 2000. $\Delta ShBlue$ is the average annual change in the share of blue-collar workers between 2000 and 2006. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 12: Firm performance and restructuring

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Value added growth				Productivity growth			
ln(*emp*)	0.017***	0.018***	0.016***	0.016***	0.017***	0.018***	0.016***	0.016***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
NEWSTRAT	0.016*	0.015*			0.013*	0.011		
	(0.009)	(0.009)			(0.008)	(0.007)		
ShBlue		-0.099***		-0.080***		-0.138***		-0.107***
		(0.027)		(0.027)		(0.023)		(0.022)
SMALLCH			-0.004	-0.004			0.001	0.001
			(0.013)	(0.013)			(0.014)	(0.013)
LARGECH			0.119**	0.112**			0.066*	0.057*
			(0.050)	(0.049)			(0.036)	(0.032)
Observations	1989	1989	2159	2159	1987	1987	2157	2157
R^2	0.043	0.060	0.058	0.067	0.050	0.087	0.060	0.081

The dependent variable is the annual average real growth rate of value added/labor productivity over the period 2000-06. Ln(emp) is the log of total employment as of 2000. ShBlue is the share of blue-collar workers over the total number of employees as of 2000. NEWSTRAT is a dummy variable equal to 1 if a firm has claimed to have significantly changed its strategy over the 2000-06 period mostly by changing the product menu or investing more resources in product branding, and 0 otherwise. SMALLCH is a dummy variable equal to 1 if a firm's product menu in 2006 results to be slightly (i.e,, still falling in a similar sectoral grouping) renewed with respect to what it was in 2000 and 0 otherwise. LARGECH is a dummy variable equal to 1 if a firm's product menu in 2006 results to be significantly (i.e,, falling in a different sectoral grouping) renewed with respect to what it was in 2000 and 0 otherwise. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

A Appendix

Table A.1: Value added shares by sector of economic activity

		AUT	BEL	DNK	FIN	FRA	GER	GRC	IRL	ITA	LUX	NLD	PRT	ESP	SWE	UK
Food products and beverages	1998	9.6	13.3	16.0	6.9	14.0	7.9	20.2	14.6	9.6	11.3	15.4	13.4	13.6	8.8	12.9
	2005	8.9	13.3	14.3	6.7	12.7	7.2	17.8	14.8	9.3	9.5	14.8	13.7	12.6	5.2	13.9
Tobacco products	1998	0.4	0.6	1.0	0.1	0.3	0.4	1.9	0.9	0.3	0.0	2.6	0.4	0.5	0.0	0.9
	2005	0.4	0.4	0.9	0.0	0.2	0.3	1.3	0.6	0.2	0.0	2.5	0.7	0.4	0.0	0.8
Textiles	1998	3.0	5.1	1.8	1.0	2.5	1.5	5.9	0.7	5.6	10.2	1.7	10.2	2.9	0.9	2.6
	2005	2.1	3.6	1.4	0.7	1.6	1.1	2.8	0.4	4.4	8.8	1.3	8.9	2.3	0.4	1.9
Wearing apparel, dressing	1998	1.0	1.1	0.9	0.9	1.7	0.9	11.0	1.1	4.5	0.0	0.5	6.8	3.0	0.3	1.8
	2005	1.1	0.7	0.5	0.4	1.6	0.6	5.7	0.4	3.6	0.0	0.3	5.8	2.0	0.1	1.0
Leather, leather products and footwear	1998	0.7	0.3	0.3	0.4	0.9	0.3	2.3	0.1	3.2	0.0	0.3	4.9	1.8	0.2	0.6
	2005	0.5	0.2	0.1	0.2	0.4	0.2	1.1	0.1	2.7	0.0	0.2	3.5	1.1	0.1	0.3
Wood and products of wood and cork	1998	5.3	1.3	3.0	4.9	1.6	2.0	2.5	1.0	2.4	1.5	1.7	4.3	2.3	3.8	1.6
	2005	4.7	1.8	3.4	3.9	2.0	1.6	2.3	1.1	2.6	2.1	1.4	4.4	2.3	2.8	1.6
Pulp, paper and paper products	1998	4.7	2.5	2.3	20.2	2.9	2.4	1.9	2.1	2.3	0.0	2.7	4.8	2.7	10.3	3.0
	2005	4.9	3.1	1.9	13.5	2.5	2.3	2.1	0.8	2.7	0.0	2.9	5.8	2.9	6.9	2.3
Printing, publishing and reproduction	1998	4.3	5.6	8.4	6.1	5.6	5.8	5.1	11.6	3.8	6.8	10.5	5.5	5.4	6.8	10.8
	2005	5.0	5.6	8.9	4.2	5.3	4.8	7.8	11.9	3.7	8.3	8.6	4.7	6.4	3.2	10.7
Coke, refined petroleum products and nuclear fuel	1998	2.0	4.0	0.5	1.8	2.8	0.4	7.0	0.1	2.5	0.0	2.4	0.0	2.9	1.3	1.7
	2005	2.4	3.2	0.1	1.6	2.1	0.7	9.0	0.2	0.4	0.0	3.0	0.0	2.1	2.0	1.6
Chemicals and chemical products	1998	5.6	18.3	9.3	5.3	9.5	9.5	5.5	36.7	7.7	5.8	14.2	5.3	9.5	10.7	9.5
	2005	7.3	19.0	13.0	4.5	10.2	11.0	6.2	32.0	8.0	5.8	18.5	5.2	9.2	9.9	10.8
Rubber and plastics products	1998	4.2	3.5	4.9	3.3	4.2	4.8	3.1	1.7	4.6	16.1	3.3	2.8	4.3	3.1	5.2
	2005	3.7	4.7	5.3	2.5	5.9	5.0	2.0	1.4	4.6	16.0	3.2	3.1	4.6	1.9	4.7
Other non-metallic mineral products	1998	6.2	5.4	4.7	3.4	3.9	3.9	7.3	3.2	5.0	9.8	3.7	9.7	7.1	2.0	3.3
	2005	5.7	4.9	4.3	3.0	3.6	3.3	7.2	2.1	6.1	12.0	3.6	9.7	8.3	1.5	3.8
Basic metals	1998	5.5	7.1	2.3	4.8	4.2	4.2	4.0	1.0	3.6	16.3	3.7	2.3	5.5	4.7	3.1
	2005	5.1	6.9	1.4	4.6	3.3	3.3	6.1	0.7	3.3	10.1	4.0	2.0	6.4	3.7	2.2
Fabricated metal products	1998	10.0	6.9	8.5	6.4	11.0	9.1	4.5	2.2	11.9	9.2	8.4	7.2	8.6	9.3	7.9
	2005	10.0	7.2	8.8	5.5	10.4	8.8	6.1	1.8	13.9	9.6	7.9	8.0	10.1	5.7	8.7
Machinery, n.e.c.	1998	11.7	6.2	15.5	13.0	8.1	15.5	3.5	2.8	12.6	7.0	8.2	5.0	6.5	13.0	8.9
	2005	12.3	6.4	14.0	10.5	9.2	14.1	4.2	2.2	14.1	7.8	9.0	5.6	7.4	9.4	9.0
Office, accounting and computing machinery	1998	0.3	0.3	0.3	0.1	0.3	0.8	0.1	6.7	0.5	0.0	0.9	0.2	1.1	0.7	1.7
	2005	0.5	0.2	0.5	0.0	2.5	1.1	0.0	12.7	0.3	0.0	0.6	0.3	0.6	0.3	1.9
Electrical machinery	1998	5.2	3.6	3.7	3.3	4.8	7.1	1.7	2.4	4.5	1.0	2.0	3.3	3.4	2.6	2.8
	2005	4.3	3.8	5.8	3.6	3.5	6.9	2.0	4.3	4.7	1.2	1.8	2.8	3.4	9.4	2.9
Radio, television and communication equipment	1998	5.8	2.3	2.5	9.7	2.7	1.7	1.1	3.8	2.1	0.1	2.4	1.4	1.7	3.1	3.9
	2005	4.6	2.1	3.1	29.0	5.4	5.2	1.5	5.0	2.4	0.1	1.6	3.8	1.1	20.8	2.4
Medical, precision and optical instruments	1998	2.1	0.8	4.0	2.8	3.2	3.5	0.4	4.1	2.3	2.7	2.3	0.7	1.0	4.0	2.4
	2005	2.5	1.0	4.5	1.6	4.0	4.1	0.7	5.0	2.5	5.8	2.7	1.0	1.0	2.4	3.6
Motor vehicles, trailers and semi-trailers	1998	4.9	8.0	1.6	1.2	7.0	13.4	0.7	0.6	3.9	0.0	3.3	4.8	9.3	8.9	6.3
	2005	6.9	7.9	1.4	1.0	7.6	13.4	0.6	0.5	3.3	0.0	3.2	4.9	8.4	10.5	6.1
Other transport equipment	1998	1.1	1.2	2.2	2.1	5.3	1.7	4.1	1.0	2.2	0.6	2.3	2.3	2.1	2.8	4.5
	2005	2.0	1.3	1.1	1.3	3.1	2.5	3.8	0.9	1.7	1.3	2.1	1.5	2.4	1.8	5.3
Manufacturing n.e.c.; recycling	1998	6.2	2.7	6.3	2.3	3.5	3.3	6.0	1.6	5.0	1.7	7.4	4.8	4.7	2.9	4.4
	2005	5.0	2.7	5.6	1.8	2.9	2.2	9.7	1.1	5.4	1.6	6.9	4.6	5.0	1.8	4.5

Source: Based on EU KLEMS data.

Table A.2: Classification of NACE sectors into skill, ICT and R&D intensity classes

Sector (NACE code in parenthesis)	**Skill content**	**ICT content**	**R&D content**
Food products and beverages (15)	MEDIUM-LOW	MEDIUM-LOW	LOW
Tobacco products (16)	MEDIUM-HIGH	MEDIUM-LOW	LOW
Textiles (17)	LOW	LOW	LOW
Wearing apparel, dressing (18)	LOW	LOW	LOW
Leather, leather products and footwear (19)	LOW	LOW	LOW
Wood and products of wood and cork (20)	LOW	LOW	LOW
Pulp, paper and paper products (21)	MEDIUM-HIGH	MEDIUM-HIGH	MEDIUM-LOW
Printing, publishing and reproduction (22)	HIGH	MEDIUM-HIGH	MEDIUM-LOW
Coke, refined petroleum products and nuclear fuel (23)	MEDIUM-HIGH	LOW	MEDIUM-HIGH
Chemicals and chemical products (24)	HIGH	MEDIUM-HIGH	HIGH
Rubber and plastics products (25)	MEDIUM-LOW	LOW	MEDIUM-HIGH
Other non-metallic mineral products (26)	LOW	MEDIUM-LOW	MEDIUM-LOW
Basic metals (27)	MEDIUM-LOW	MEDIUM-LOW	MEDIUM-LOW
Fabricated metal products (28)	LOW	MEDIUM-LOW	MEDIUM-LOW
Machinery, n.e.c. (29)	MEDIUM-LOW	HIGH	MEDIUM-HIGH
Office, accounting and computing machinery (30)	HIGH	HIGH	HIGH
Electrical machinery (31)	MEDIUM-HIGH	HIGH	MEDIUM-HIGH
Radio, television and communication equipment (32)	HIGH	HIGH	HIGH
Medical, precision and optical instruments (33)	HIGH	HIGH	HIGH
Motor vehicles, trailers and semi-trailers (34)	MEDIUM-HIGH	MEDIUM-HIGH	MEDIUM-HIGH
Other transport equipment (35)	MEDIUM-HIGH	MEDIUM-HIGH	HIGH
Manufacturing n.e.c.; recycling (36, 37)	MEDIUM-LOW	MEDIUM-HIGH	not allocated

Source: Based on EU KLEMS data.

Table A.3: Descriptive statistics, dependent variables (percentage points)

	Productivity growth			Employment growth		
Country	mean	median	st. dev.	mean	median	st. dev.
Austria	4.2	3.9	2.3	-1.1	-0.9	2.5
Belgium	2.2	1.9	1.5	-1.4	-1.2	1.9
Denmark	1.9	1.2	2.4	-2.9	-2.4	2.9
Finland	4.5	3.2	4.9	-0.5	-0.4	2.8
France	3.6	2.8	4.2	-1.4	-0.9	2.5
Germany	2.6	1.7	3.2	-1.2	-0.6	1.8
Greece	1.7	0.2	4.8	-1.8	-1.0	2.4
Ireland	7.5	6.0	6.2	-1.2	-0.2	4.3
Italy	0.1	0.1	2.2	-0.4	-0.2	1.5
Luxembourg	2.6	1.9	3.9	-0.5	0.6	3.2
Netherlands	3.1	2.6	2.1	-1.7	-1.2	1.8
Portugal	1.1	0.9	2.1	-1.8	-1.5	1.7
Spain	1.0	0.4	1.3	1.4	1.7	2.6
Sweden	6.6	3.4	10.1	-1.5	-1.3	1.7
United Kingdom	4.4	3.8	2.1	-4.6	-3.5	3.7

Source: Based on EU KLEMS data. Note: manufacturing sector. Average growth across sector, weighted with sectoral employment, calculated over the period 1998-2005.