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by
Mario Macis
(Johns Hopkins University and IZA)
Fabiano Schivardi
(University of Cagliari, EIEF and CEPR)

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Mario Macis
Johns Hopkins University and IZA

Fabiano Schivardi
University of Cagliari, EIEF and CEPR

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Abstract

We use linked employer-employee data from Italy to explore the relationship between exports and wages. Our empirical strategy exploits the 1992 devaluation of the Italian Lira, which represented a large and unforeseen shock to Italian firms' incentives to export. The results indicate that the export wage premium is due to exporting firms both (1) paying a wage premium above what their workers would earn in the outside labor market – the "rent-sharing" effect, and (2) employing workers whose skills command a higher price after the devaluation – the "skill composition" effect. The latter effect only emerges once we allow for the value of individual skills to differ in the pre- and post-devaluation periods. In fact, using a fixed measure of skills, as typically done in the literature, we would attribute the wage increase only to rent sharing. We also document that the export wage premium is larger for workers with more export-related experience. This indicates that the devaluation increased the demand for skills more useful for exporting, driving their relative price up.

JEL classification: F16, J31

Key words: Export wage premium, linked employer employee data

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1 Introduction

Since the seminal paper of Bernard, Jensen & Lawrence (1995), a growing body of empirical work has shown that exporting firms pay higher wages, even after controlling for firm-level characteristics such as industry and size.[1] The ensuing theoretical literature has proposed two possible mechanisms. On one side, exporting firms might employ workers with higher skills, so that the exporting wage premium is a reflection of observable and unobservable workers' characteristics – the "skill composition" effect (Yeaple 2005, Verhoogen 2008, Bustos 2011, Kugler & Verhoogen 2012). On the other, the presence of frictions in the labor market might lead exporting firms to pay higher wages than non-exporting firms for identical workers, because exporting generates rents that are shared with the employees – the "rent sharing" effect (Cosar, Guner & Tybout 2009, Helpman & Itskhoki 2010, Helpman, Itskhoki & Redding 2010).[2] While these theoretical mechanisms are well understood, identifying their relative importance empirically has proven difficult. Traditional studies using average wages at the firm level cannot fully control for workers' skills and therefore cannot distinguish between composition or rent-sharing factors. In the last few years, the literature has taken advantage of the growing availability of matched employer-employee data to address these issues, but the evidence is still not conclusive.[3]

In this paper, we use a unique matched employer-employee database including *the entire workforce* of a large sample of Italian manufacturing firms to study the effects of exporting on wages at the firm level. We add to the literature along at least three dimensions. First, as done by Frías et al. (2009) for Mexico, we exploit the sudden and large devaluation of the Italian Lira in 1992 as a source of exogenous variation, within industries, in the firms' incentive to export. Second, we propose an empirical framework that allows the market value of individual workers' observable and unobservable skills to vary before and after the devaluation. As we show, this is a crucial step in correctly disentangling rent sharing from skill composition effects. Third, we document the heterogeneous effects of exporting on wages based on a measure of workers' export-specific experience.

[1] For comprehensive surveys, see Schank, Schnabel & Wagner (2007) and (Frías, Kaplan & Verhoogen 2009).

[2] Besides specificities and frictions, there are at least two other mechanisms that could imply that the firm shares the rents from exporting with their workers: efficiency wages (Frías et al. 2009, Davis & Harrigan 2011) and fair-wage considerations (Egger & Kreickemeier 2009, Amiti & Davis 2011). See Frías et al. (2009) for a more detailed survey of the various theoretical mechanisms behind export wage effects.

[3] See, among others, Frías et al. (2009) and Frias, Kaplan & Verhoogen (2012) for Mexico; Schank et al. (2007) and Baumgarten (2011) for Germany; Helpman, Itskhoki, Muendler & Redding (2012) and Krishna, Poole & Senses (2010) for Brazil. We discuss how our results compare with those of the existing literature below.

The linked employer-employee nature of our data allows us to apply the methodology developed by Abowd, Kramarz & Margolis (1999) to decompose individual wages into a component due to observable worker and firm characteristics, a component due to unobservable worker characteristics ("worker effects") and a component due to firm-level, unobservable characteristics ("firm effects"). We take the worker effects to measure the market value of workers' unobservable (to the econometrician) skills, independent of the characteristics of the particular firms where they are employed at a given point in time. As in Frías et al. (2009) and Helpman et al. (2012), the firm effect, our measure of rent sharing, is estimated separately for each firm-year, so that it can vary according to the degree of the firm's export activity. We estimate worker and firm effects under two alternative assumptions. First, as typically done in the literature, we assume that the worker effects are fixed throughout the entire period. Second, we allow the individual worker effects to vary in the pre- and post-devaluation periods. In fact, the devaluation represented a major shock to the incentives to Italian firms to export. If workers' skills are heterogeneous in terms of their contribution to the export activity, then their market value might be plausibly affected by the devaluation. By estimating separate worker effects pre and post devaluation, we are able to account for any change in the market value of skills at the individual level–something that, to the best of our knowledge, is new to the literature.

Our empirical framework is based on regressing workers' wage, and its components (skill composition and rent sharing), on the share of export at the firm level in the post-devaluation period, accounting for the potential endogeneity of the export share (we discuss this issue in more detail below). Our results indicate that the increased export activity that followed the unexpected and large devaluation of the Italian currency in 1992 led to higher wages. Our estimates imply that, other things equal, wages rose by 1.5 percent (on average) at a firm recording the median increase in the export share (15 percent). In terms of rent sharing or skill composition, we find that, when skills are assumed to be fixed throughout the period, the whole effect of the increase in exports is due to the rent-sharing component. This indicates that the characteristics of the workforce have not changed systematically in relation to the export activity that firms undertook after the devaluation. In fact, when the worker effects are fixed, only changes in the workforce composition can change the skill composition at the firm level. However, when we allow the worker effects to vary before and after the devaluation, we find that the higher wages are roughly equally due to an increased firm effect, common to the entire firm workforce, and to an increase in the workers' effect, with the latter being more robust and, in some specifications, more sizable than the former.

Given that we found no evidence of changes in the skill composition when keeping the worker effects fixed, the increased worker effects in exporting firms must reflect an increase in the the market value of skills of the workers they employ. We conclude that exporting firms do share rents with their workers, which is consistent with recent models that emphasize firm heterogeneity and labor market frictions (Helpman & Itskhoki 2010, Helpman et al. 2010), but also that the market value of the unobservable workers' skills they employ increases after the devaluation. Failure to take this change into account would lead one to overestimate the rent-sharing component.

To corroborate our interpretation of the results, we explore whether the export wage premium associated with the devaluation can be linked to a measure of export-specific workers' skills. We assume that past experience in exporting firms increases the level of a worker's export-specific skill, and find that, indeed, the export effect is significantly stronger for workers with greater past cumulated export experience. This result, which was robust to including an extensive set of tenure controls in the regressions, indicates that there is heterogeneity across workers in the distribution of skills in terms of how useful they are for the export activity, and that the devaluation increased the demand for export specific skills, driving their relative price up.

One crucial concern when attempting to estimate the effect of exporting on wages, even in the context of an exogenous change in the incentive to export, is that the most productive firms might also be those that are better equipped to take advantage of the devaluation. If this is the case, then a measured "effect" of increased export activity on wages might simply reflect the underlying heterogeneity, which generated both greater exports and higher wages. We have taken several approaches to lessen this concern: First, we argue that in the Italian case the concern that exporters are primarily the most productive firms is much less relevant than in other contexts. In fact, the existing evidence on the exporting activities of Italian firms indicates that the firms that benefited the most from the 1992 devaluation of the Italian Lira were not the most advanced firms (across industries) or the most productive ones (within industries). Crinò & Epifani (2009) document that there is only a weak relationship between exports and TFP across Italian firms. As a matter of fact, in contrast to other developed economies, the bulk of the Italian production structure specializes in medium- and low-tech activities, such as textiles, furniture, and tiles. Bugamelli, Schivardi & Zizza (2010) show that firms engaged in low-tech activities have benefited the most from the 1992 devaluation. In this paper, we test directly whether "better" firms experienced greater increases in the share of sales exported in the devaluation period. We find that the change in the export share of sales was unrelated to firm size (employment), investment intensity (measured as the investment to workers ratio), and domestic sales.[4] Second, in our empirical specification, we explicitly control for pre-determined conditions at the firm level. More specifically, our proposed specification allows for wages in the devaluation period to be correlated with the pre-devaluation export intensity. This allows us to establish whether the changes in wages (or wage components) that took place in the devaluation period were due to the increased export activity or simply to pre-existing heterogeneity. Further, our analysis is very robust to inclusion of firm fixed effects, which control for unobservable, time-invariant firm heterogeneity. Third, the analysis is corroborated by an instrumental variables strategy. Our instrument is a foreign demand index based on GDP growth in destination countries defined at the geographical-sectoral level. We use the export destination at the level of province-three digit sectors before the devaluation to construct a weighted average of GDP growth, which proxies demand growth, in the destination countries for each province-sector.

The paper that is most closely related to ours is Frías et al. (2009), who use matched employer-employee data from Mexico and exploit the 1994 devaluation of the Peso as an exogenous shock to the incentive Mexican firms' incentives to export. Combining this shock with a theoretical framework that predicts that more productive, larger firms take better advantage of the devaluation, they contrast outcomes of firms of different sizes during the devaluation period and afterwards, finding that most of the effect of exporting on wages comes from rent sharing. Our paper, too, uses matched employer-employee data and a large and unexpected devaluation as a source of identification. In contrast to Frías et al. (2009), however, we do not focus on differences based on firm size or other indicators of productivity; rather, we look directly at how wages relate to changes in export shares in the devaluation period compared to the earlier years. For the reasons explained above, we argue that in the Italian context this provides a more appropriate estimation strategy. Most important, our paper differs from theirs in that we allow the individual worker effects to differ in the pre- and post-devaluation periods. In fact, when we constrain the worker effects to be fixed over time, we also obtain that rent sharing explains the bulk of the export wage premium. Krishna et al. (2010) use matched employer-employee data from Brazil, and find that when firm-worker match controls are included in the regressions, the effect of trade openness on wages at exporting firms compared to domestic firms vanishes.

[4]This contrasts with the Mexican experience as described in Verhoogen (2008) and Frías et al. (2009). In Mexico, better, larger firms took more advantage of the peso devaluation of 1993. This is because the Mexican exports were directed to a large extent towards the US, so that exported goods were on average of a higher quality than domestically sold ones.

In their paper, however, the firm-worker match is also fixed over time, and it is not allowed to vary with export activity. Helpman et al. (2012) also use linked employer-employee data from Brazil. They estimate firm-occupation-year effects which include both wage premia and unobserved worker heterogeneity. This paper builds a structural model of trade with heterogeneous firms to estimate the role of trade in determining wage dispersion within occupation; by contrast, in our paper we focus on disentangling skill composition from rent sharing effects. Another paper related to our approach is that of Park, Yang, Shi & Jiang (2010), which exploits the Asian financial crisis of 1997 as an exogenous shock to the incentive to Chinese firms to export. Compared to our paper, they do not focus on wages specifically but, rather, on a large set of performance indicators at the firm level. As far as (firm-level average) wages are concerned, they find that firms that increase exports also pay higher wages; moreover, using an instrumentation approach similar to ours, they find that the IV effects are substantially larger than the OLS ones, something that we obtain as well.

Finally, our work includes a novel exploration of the heterogeneous effects of trade. Much of the existing literature has focused on the differential effects of trade across groups of workers, typically defined by education, occupation (blue collar, white collar, managers), and industry. However, these traditional categories are very broad, and potentially mask substantial within-group heterogeneity. A recent exception is represented by Hummels, Jorgensen, Munch, & Xiang (2011), who document the heterogeneous effects of trade on workers who perform different sets of tasks (e.g., creative vs. routine tasks), or whose occupations employ different sets of knowledge (e.g., mathematics, social science, engineering, etc.). Frias et al. (2012) also contribute to the analysis of the heterogeneous effects of trade by looking at different percentiles of the within-firm wage distribution. In our paper, we document heterogeneous wage effects of exporting based on an explicit measure of export-related skills rather than using occupational categories or wage levels. To the best of our knowledge, the only other paper that considers workers' export experience explicitly is Mion & Opromolla (2011), who find that managers with previous export experience receive a wage premium and increase the likelihood that a firm engages in export activity.

The paper proceeds as follows. In Section 2 we describe the data and perform the estimation of worker effects and firm effects. In section 3 we present our main econometric analysis of the effect of exporting on wages, workforce composition, and firm-level wage premia, and in Section 4 we perform the robustness exercises. In Section 5 we explore the heterogeneity of the export wage premia across workers, emphasizing the role of workers' past export experience. Finally, in Section 6 we conclude and offer directions for future research.

2 Data and descriptive evidence

2.1 Data description

The data used in this paper were constructed from the Bank of Italy's INVIND survey of manufacturing firms. 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, including industrial sector, year of creation, average number of employees during the year, sales, investment, and, most important for our purposes, exports. The Italian Social Security Institute (Istituto Nazionale Previdenza Sociale, INPS) provided the complete work histories of all workers who ever transited in an INVIND firm in the period 1980-1997, including spells of employment in which they were employed in firms not listed in the INVIND survey. Overall, we have information on about one million workers per year, more than half of whom are employed in INVIND firms in any given year. The rest are employed in about 500,000 other firms of which we only know the unit identifier.[5]

The information on workers includes age, gender, the province where the employee works, occupational status (production, non-production, manager), annual gross earnings (including irregular payments such as overtime, shift work, and bonuses), number of weeks worked, and the firm identifier. We have deleted records with missing entries on either the firm or the worker identifier, those corresponding to workers younger than 15 and older than 65, those who have worked less than 4 weeks in a year, and those in the first and last percentiles of the weekly earnings distribution.

In Table 1 we report summary statistics on workers' characteristics for the entire sample (column [1]), which, as explained in Section 2.2 below, we use to estimate worker and firm effects, as well as for workers employed in INVIND firms (columns [2] and [3]), on which we base our main analysis. Because precise information on exporting behavior for a representative sample of firms is available only for INVIND firms after 1987, we will restrict our attention to INVIND firms in the period 1987-1997. For the entire sample, average gross weekly earnings at 1995 constant prices are about 378 euros, and the average age of workers is 37 years. Almost 80% of the observations pertain to males, 66% to production

[5] This is the same database used by Iranzo, Schivardi & Tosetti (2008), to which the reader is referred to for further details.

workers, and 33% to non-production workers. The INVIND sample in years 1987 through 1997 consists of about 4.1 million observations. The descriptive statistics for the INVIND sample are quite similar to those of the total sample; this was expected, because this sample includes the same workers but only observations of those who were employed by an INVIND firm in the period 1987-1997.

Table 2 reports statistics on the firm-level data used in our main regression analyses. A total of 1,218 unique firms are included in the INVIND sample in the period considered. The sample is unbalanced. The median INVIND firm employs about 230 workers, and it reports sales of over 31 million euros. Eighty-nine percent of the firms in the sample were exporters in the period considered. Conditional on exporting, the median firm exports 30 percent of their sales. These figures are in line with those reported in other studies on Italian firms (Crinò & Epifani 2009, Castellani, Serti & Tomasi 2008) and are substantially higher than those found in other countries. In the United States (Bernard et al. 1995) or Mexico (Frías et al. 2009), for instance, only a small proportion of firms do export. This difference is explained by two factors. First, Italy's main commercial partners are countries within the European Union (EU), which are located in relative geographic proximity. Second, the INVIND sample excludes firms with fewer than 50 employees, and it is a well-known fact that small firms have a much lower propensity to export compared to larger firms. In fact, Table 2 confirms that, even within the 50+ employee firms, exporters are substantially larger than non-exporters, both in terms of employment and sales volume.

The devaluation of 1992 was substantial and had a strong impact on exports. Figure 1, Panel (a) reports the multilateral real exchange rate of the lira (Finicelli, Liccardi & Sbracia 2005). This is the best indicator for our purposes, because it represents a measure of competitiveness of manufacturing goods. After the initial sharp drop, the exchange rate kept devaluating (with the exception of an appreciation in the second quarter of 1993) until mid-1995, when the depreciation compared to January 1992 was of the order of 30 percent. After that, the currency recorded a stable appreciation, which by the end of the decade brought the multilateral exchange rate back to around 85 percent of the January 1992 level. Figure 1, Panel (b) shows that the exporting behavior of the INVIND firms changed after 1992–the year of the Lira devaluation. The median (mean) share of sales exported increased sharply from around 18 percent (26 percent) in the 1987-1991 period to 30 percent (34 percent) in 1997. Interestingly, the share starts decreasing in 1997, arguably indicating the fading away of the competitive advantage. Indeed, this decrease further supports the view that the sharp rise in exports was linked to the devaluation itself and not to some other concomitant factor, such as the European single market, whose effects should have been permanent.

2.2 Decomposing wages into returns to skills and rent sharing

Our goal is to establish whether export intensity leads to higher wages, and, if this is the case, if the higher wages simply reflect the skill composition of the workforce, including unobservable skills, or also rent sharing, defined as the excess wage that a worker obtains from working in a given firm compared to the market value of her skills. We exploit the matched employer-employee nature of our data to perform a decomposition of wages into two terms that capture the two potential sources of the positive correlation between exports and wages. Following Abowd et al. (1999), we decompose wages into a component due to time-variant observable individual characteristics, a "pure" worker effect, a "pure" firm effect and a statistical residual, using the following equation:

$$w_{it} = X'_{it}\beta + \theta_i^{\mathrm{F}} + \sum_j d_{ijt}\psi_{jt}^{\mathrm{F}} + \varepsilon_{it} \tag{1}$$

where the subscript i denotes the worker, j denotes the firm, t denotes time, X'_{it} is a vector of individual time-varying controls, θ_i^{F} is the worker effect, d_{ijt} is a dummy equal to 1 if worker i is in firm j at time t, and ψ_{jt}^{F} is the firm-year effect. We use the superscript F to indicate that the worker effect is fixed over time. Abowd et al. (1999) show that, under the assumption of random workers' mobility across firms (conditional on the observables), equation (1) can be estimated and firm and worker effects separately identified. The identification of firm effects and worker effects is guaranteed by the substantial mobility of workers in the sample: 63 percent of the workers in the sample have been employed by at least two different firms in the period 1982-1997, and between 8 and 15 percent of workers change employer from one year to the next.

We use the estimated worker effect $\hat{\theta}_i^{\mathrm{F}}$ as our measure of the unobserved skill component of wages. In fact, the worker effect represents the component of wages that reflects the market value of the workers' unobservable skills, independent of the characteristics of the particular firm that the individual works for, and net of the workers' personal time-varying characteristics included in the controls. The firm-year effect ψ_{jt}^{F} represents the firm-specific contribution to wages, after controlling for individual workers' characteristics. As such, it can be interpreted in terms of rent sharing. Because we are interested in relating rent sharing to the firm's export behavior, which changes over time (specifically, after the devaluation), we modified the original Abowd et al. (1999) procedure, which imposes a time-invariant firm effect, and estimate a time-varying firm effect $\hat{\psi}^{\mathrm{F}}_{jt}$. Note that, thanks to the 50-employee minimum restriction, and because we observe the complete workforce of all INVIND firms, for each firm-year we have at least 50 observations (672 on average – see Table 2), which guarantees a reasonably high precision of the estimates of the firm-year effects.[6]

The above procedure allows for the firm effect to vary over time while keeping the worker effect fixed. Although assuming that the worker effect does not vary over time sis the standard approach in the literature (Abowd et al. 1999, Frías et al. 2009, Krishna, Poole & Senses 2011), it might be too restrictive for the question that we are addressing. As shown in Figure 1, the average increase in the export share of Italian manufacturing firms was very large. Such a shift might have induced a change in the market value of different skills.[7] In particular, some workers might be endowed with skills that are more valuable in export markets: for example, human capital specific to products that were particularly favored by the devaluation. It is indeed possible that the returns to such skills have increased after the devaluation. If a firm employs workers with export-valuable skills, it might export more, and pay higher wages because the market value of such skills has increased. By keeping the worker effects fixed, however, one would exclude this possibility a priori, forcing the higher wages to be picked up by the firm-year effect, thus attributing the higher wages to rent sharing. To account for changes in the market value of skills, we therefore allow the worker effects to take different values before and after the devaluation, estimating an extended version of equation (1) as follows:

$$\begin{aligned} w_{it} &= X'_{it}\beta + \theta^{\mathrm{V}}_{it} + \sum_j d_{jit}\psi^{\mathrm{V}}_{jt} + \varepsilon_{it} \\ \theta^{\mathrm{V}}_{it} &= (1 - DV_t)\theta^{\mathrm{PRE}}_i + DV_t\theta^{\mathrm{POST}}_i \end{aligned} \tag{2}$$

where $DV_t = 1$ for $t > 1992$ and 0 otherwise, and θ^{PRE}_i and θ^{POST}_i are worker i's effects computed separately for the pre and post 1992 periods. Given that we have data up to 1997, θ^{POST}_i is estimated on a maximum of 5 observations per individual. The average number

[6] We estimate equations (1) and (2) using all available observations, and not only those of INVIND firms because this improves the precision of the estimate of the workers' effects. However, for non-INVIND firms, for which we have on average 2.5 workers per year, we impose that the firm effect is fixed throughout the period. Note that these firms do not enter the subsequent analysis because for non INVIND firms we have no export information, so there is no advantage in recovering a time-varying measure that can be interpreted in terms of rent sharing for these firms.

[7] Indeed, there is evidence that the devaluation has impacted the demand for observable skills. In Figure 2, we plot the time series evolution of the share of production workers in the INVIND firms. It decreases regularly from .71 in 1986 to .67 in 1993, following the secular decline common to all advanced economies. When the devaluation hits, the fall stops and the share of production workers remains stable until 1998, after which it starts falling again. This is exactly the period in which the devaluation has boosted the export activity (see Figure 1) and, possibly, the demand for production workers.

of individual-year observations in the post period is 4.1 and the median is 5.

Prior to the estimation, we identified the groups of "connected" workers and firms. A connected group includes all of the workers ever employed by any firm in the group, and all the firms that any worker in the group has ever worked for. It is only within connected groups that worker- and firm-effects can be identified (Abowd, Creecy & Kramarz 2002). By design, our sample consists of essentially one large, connected group, with 99.6% of the sample forming a single connected group.[8] Thus, in our estimation, we focus on the largest connected group and disregard the remaining observations. In Table 3, we present the results from estimation of equations (1) and (2).[9] The dependent variable w_{it} is the natural logarithm of weekly wages. The vector X_{it} includes age and age squared (proxying for labor market experience), a dummy variable for non-production workers and a dummy for managers (occupational status changes over time for a considerable number of workers), as well as interactions of these terms with a female dummy variable.

The estimated coefficients on the workers' observable characteristics, shown in Panel A of Table 3, deliver unsurprising results: wages appear to exhibit a concave age profile, and a substantial wage premium is associated with white collar jobs and, especially, with executive positions. Panel B of Table 3 presents the standard deviations of and the correlations between log wages (w_{it}) and the different components of wages (θ_i^{F}, θ_{it}^{V}, ψ_{jt}^{F}, ψ_{jt}^{V}). Similar to Abowd et al. (1999) and Iranzo et al. (2008), a substantial portion of the variation in earnings is due to heterogeneity in worker effects (the correlation between wages and worker effects is 0.43 when the worker effects are time-invariant and 0.36 when they are allowed to vary before and after the devaluation). Firm effects also play an important role (the correlation between wages and ψ_{jt}^{F} is equal to 0.45 and that with ψ_{jt}^{V} is 0.25). The two measures of worker effects (θ_i^{F} and θ_{it}^{V}) are strongly positively correlated with each other (the correlation between θ_i^{F} and θ_i^{PRE} is 0.81 and that between θ_i^{F} and θ_i^{POST} is 0.68), and so are the two measures of firm-year effects (correlation = 0.54). The correlation between the worker and the firm effects is zero when the worker effects are time-invariant, and turns

[8]Note that the this conclusion holds despite the fact that we allow for firm-year effects and, in equation (2), for different worker effects in the pre- and post-devaluation periods. In fact, even if we treat each firm-year as a separate effect, a firm in year t employs to a large extent the same workers it was employing at $t-1$, which makes the year-firm observations automatically connected over time. When we estimate the workers' effects separately for the pre-post devaluation periods, connectiveness is guaranteed by the fact that, for non INVIND firms, we estimate non-time-varying firm effects. Such effects supply the connection between the pre and post devaluation periods. We have also repeated all of the regressions below estimating the θ_{it}^{V} and ψ_{jt}^{V} effects running two separate regressions for the pre and post devaluation period, and the results, available upon request, are qualitatively similar.

[9]The estimation was carried out using the conjugate gradient algorithm proposed by Abowd et al. (2002) and implemented by the Stata routine "a2reg" developed by Ouazad (2008).

negative when the worker effects are time-variant. Finally, the pre- and post-devaluation worker effects (θ_i^{PRE} and θ_i^{POST}) are positively correlated with each other (correlation = 0.44), which was expected; in fact, even though the devaluation might have changed the returns to skills, workers who commanded a high wage before the devaluation on average do the same after it. Still, the correlation is substantially below 1, indicating that returns to (unobservable) skills have changed in the two periods.

2.3 Exports and wages: Descriptive evidence

Before moving to the effects of the devaluation, we first analyze the correlation between wages and export activity and offer some suggestive evidence on the respective roles of skill composition and rent sharing in determining the export wage premium. Of course, at this stage we cannot interpret this in any causal sense. As a measure of export activity, we use the share of export sales in total sales. Indeed, most firms in our sample are exporters, but they do differ considerably in their export intensity (see Table 2).

In Panel A of Table 4, we report the wage regressions. Column [1] uses the individual log wage as the dependent variable, controlling for worker-level characteristics (gender, age, age squared, white collar dummy, manager dummy), firm characteristics (log employment, log of domestic sales, fourteen industry dummies), as well as a set of four geographic area dummies and ten year dummies.[10] We find a strong, positive association between the export share ($EXSH$) and log wages. Other things equal, a one-standard-deviation higher export share is associated with 2.6% higher wages. In column [2], we repeat the same regression using average wage at the firm-year level as the dependent variable, controlling for firm-year-level workforce characteristics (average age, percentage of females in the workforce, percentage of white collar employees, fraction managers), time-varying firm characteristics (log of employment, log of domestic sales) as well as year dummies. We do so because the firm-year component, used as the dependent variable below, is measured at the firm-year level. To keep comparability in the specifications, therefore, we will use averages at the firm-year level as our preferred regressions. We find that the results are similar, although the coefficient increases somewhat, from 0.095 to 0.119, arguably because the workers' controls aggregated at the firm level are less precise than those at the individual level. Finally, in column [3] we include firm fixed effects in the regression, to control for unobserved time-invariant firm heterogeneity. The estimated coefficient is equal to 0.075, which indicates that a robust association exists between within-firm changes in exports and changes in

[10] We consider Italy's four main geographic regions: the Northeast, the Northwest, the Center and the South-Islands.

wages.

To disentangle the effect of the skill composition from that of rent sharing, we resort to the wage decomposition described in Section 2.2 (similar to Frías et al. (2009)). We define a skill composition (SC) term as the average worker effect at the firm-year level,

$$SC_{jt} \equiv \frac{1}{n_{jt}} \sum_i d_{ijt}\theta_{it} \tag{3}$$

where, as before, d_{ijt} is a dummy equal to 1 if worker i is in firm j at time t and n_{jt} is the number of workers in firm j at time t. We measure rent sharing (RS) as the firm-year effect:

$$RS_{jt} = \psi_{jt} \tag{4}$$

As before, the superscripts F and V will be used to denote the case in which the worker and firm effects were obtained from specification (1) (with time-invariant worker effects), and specification (2) (when the worker effects are allowed to vary before and after the devaluation), respectively.

Next, we explore the relationship between export intensity and SC and RS, and report the results in Panels B and C, respectively, of Table 4. Specifically, in the first two columns, the dependent variables are SC^F and RS^F (i.e., the measures of skills and rent sharing obtained with time-invariant worker effects, respectively) and the last two SC^V and RS^V (i.e., the measures of skills and rent sharing obtained with time-varying worker effects). The OLS results reported in column [1] of the two panels indicate that the wage premium is explained by both workforce composition and rent sharing: the coefficient on the export share is positive and significant in both panels. However, the elasticity of RS^F is five times larger than that of SC^F (0.093 vs. 0.021). This finding is reinforced in the fixed effects (FE) specifications of column [2], in which case the coefficient is essentially zero for SC^F and remains positive and significant, albeit smaller, for RS^F. These results suggest that some firms employ higher-skilled workers and export more (OLS results), but that changes of the export share over time are not reflected, on average, in changes in the skill composition. On the contrary, the fixed effects results indicate that there is a positive correlation between export intensity and RS^F within firms over time.

The picture changes somewhat when we use SC^V and RS^V (column [3], OLS and column [4], FE). In this case, the coefficient in the SC^V regression increases considerably and, more importantly, it remains significant also when we control for firm fixed effects. Symmetrically, the coefficient for RS^V decreases but remains highly significant in both specifications. The fact that we do find a positive association between within-firm changes in export shares SC^V (i.e., worker effects that were allowed to differ before and after the devaluation) is consistent with the idea that changes in export intensity associated with the devaluation might have changed the market values of workers' skills. Once this is taken into account, the correlation between export intensity and the skill composition component of wages increases, and that with rent sharing decreases. Thus, imposing a fixed skill level pre- and post-devaluation might be too restrictive, and might lead one to attribute to RS part of the effect that is instead due to a change in the market value of workers' unobserved skills. Of course, at this stage no claims of causality can be made. We will return to this point in the next section, after describing our identification strategy.

3 Evidence from the 1992 Devaluation Episode

In this section we tackle the issue of causality in the relationship between exporting and wages. As mentioned above, we exploit the sudden and substantial devaluation of the Italian lira that occurred in September 1992 as an exogenous shock to the incentives of Italian firms to export.

3.1 An unexpected shock to the exchange rate

The currency devaluation of September 1992 was largely unpredicted. The speculative attacks that led to the devaluation started after the Danish referendum of June 2, 1992 that, quite unexpectedly, rejected the Maastricht Treaty by a small margin (0.7 percent). The Danish referendum represented a big blow to the process of European integration. One consequence was diminished credibility of the exchange rate mechanism (ERM), which immediately led to speculative attacks against the weak currencies. The monetary authorities resisted the attacks until the end of the summer. The Italian lira devaluated by 7 percent during the weekend of September 12-13. On September 16, the British pound left the ERM; the lira and the Spanish peseta suspended their exchange rate agreements immediately after. Italy rejoined the ERM only on November 25, 1996. During the four ensuing years, the exchange rate of the lira fluctuated substantially.

Even though the depreciation was unexpected, one might argue that its effects were differentiated according to some firm characteristics, which in turn might be correlated with subsequent wage changes. For Mexico, Verhoogen (2008) shows that larger, more productive firms took greater advantage of the peso devaluation of 1993. This is because the Mexican exports were directed to a large extent towards the US, so that exported goods were on average of a higher quality than domestically sold ones. Firms that increased exports to the US were therefore those already producing high-quality goods before the devaluation. They undertook further quality upgrading, which led to an increased gap with respect to non-exporting firms.

It is not clear, however, whether the same patterns characterize the Italian case. In terms of classical indicators of development, such as income per capita or labor costs, Italy is a developed economy. However, its production structure was (and still is) specialized in medium and low-tech activities, such as textiles, furniture, and tiles. Bugamelli et al. (2010) argue that firms in these sectors were those that benefitted most from the devaluation. Their argument is based on the assumption that pure price competition is relatively more important in low-tech activities. The price advantage of a devaluation should have been therefore more pronounced for firms not at the top of the quality or technology ladder. The same type of reasoning applies within industries. For example, in the textiles sector, firms that produce low-quality shirts co-exist with luxury fashion producers. The argument is that the former might have benefited more from the devaluation because the demand elasticity for such goods is higher, given the production of close substitutes in low-wage countries. It is therefore unclear ex-ante which type of firms benefited most from the lira devaluation. In fact, such benefits might have depended on a series of factors, such as export destination, relative importance of price competition, product composition, etc., that are not easily linked to any specific firm characteristic.

To probe the hypothesis that changes in the export share following the devaluation were to a large extent exogenous with respect to pre-devaluation firm characteristics, we run a set of regressions similar to those of Verhoogen (2008):

$$\Delta EXSH_{i,t_1t_0} = \alpha + \rho X_{i,t_0} + \text{Dummies} + \eta_i \tag{5}$$

where $\Delta EXSH_{i,t_1t_0}$ is the change in the firm level share of export over total sales between t_0 and t_1, X_{i,t_0} is a firm characteristic measured at t_0 and Dummies are sector and area dummies. In the Mexican case, Verhoogen (2008) and Frías et al. (2009) use employment, sales per worker, and TFP as proxies for plant heterogeneity , and find that the estimate of ρ for the devaluation period are substantially larger than in other periods. This is interpreted as showing that "better" firms took greater advantage of the devaluation. We run the same type of regressions and report the results in Table 5. We consider three periods, the devaluation period (1991-1995), and pre (1987-1991) and post (1995-1999) periods. Following Frías et al. (2009), we regress the change in the share of exports on the log of domestic sales, the log of employment, and on the ratio between investment and employment measured in the initial year. We find no significant differences in the coefficients between the devaluation period and the other two periods for any of the indicators. We conclude that there is no evidence that "better" firms disproportionately took advantage of the 1992 Lira devaluation.

3.2 Empirical Strategy

We are interested in singling out the effects of a change in the export share on wages and on its components, following the 1992 devaluation. For the dependent variable, we consider the wage, the firm-year average worker effect (which measures the skill composition), and the year-specific firm component (which measures rent sharing). The identifying assumption is that changes in export shares in the devaluation period are indeed attributable to the unforseen devaluation episode and were uncorrelated (as showed in the previous section) to pre-existing firm attributes commonly used in the literature as proxies for firm "quality." We take the years 1987-91 as the base period, before the devaluation occurred,[11] and define DV as a dummy for the years from 1992 onward. We specify our main regression as:

$$y_{jt} = \alpha + \beta EXSH_{jt} * (1 - \mathrm{DV}) + \gamma EXSH_{jPRE} * \mathrm{DV} + \delta EXSH_{jt} * \mathrm{DV} \ + \mathbf{X}'_{\mathbf{jt}} \boldsymbol{\theta} + \mu_j + \epsilon_{jt} \quad (6)$$

where j denotes firms and t years, y_{jt} is alternatively the wage w, SC and q as defined in equations (3) and (4), respectively, $EXSH_{jt}$ is the current export share, $EXSH_{j\mathrm{PRE}}$ is the average share in the pre-devaluation (1987-91) period, $\mathbf{X_{jt}}$ is a vector of additional controls of firm and workforce characteristics, and μ_j are firm fixed effects. In this specification, β measures the correlation between export share and the dependent variable in the pre-devaluation period, in the same way as in the basic OLS regressions that were described in the previous section. For the devaluation period ($DV = 1$), we control for pre-existing effects of export on worker compensation by including the share of export in the pre-devaluation period interacted with the DV dummy. By doing so, we control for the possibility that firms that were exporting more in the pre-devaluation period might have also been paying higher wages, which could persist in the post-devaluation period; moreover, this also accounts for the possibility that a higher initial export share might be correlated with higher wages in the devaluation period, if, as in Frías et al. (2009), "good firms" take greater advantage of the devaluation. The coefficient γ will therefore capture any of these effects, if indeed present. Thus, controlling for the pre-devaluation export propensity, the coefficient δ measures the effect of the current export share on wages. Despite its simplic-

[11] Figure 2 shows that the average and median export share in the INVIND sample was very stable during the pre-devaluation period. We have also run regressions for which we picked 1990 or 1991 as base years, obtaining very similar results.

ity, this specification encompasses many different regimes, according to the values of the estimated parameters. We discuss the most interesting ones next.

$\delta = 0, \gamma > 0$ In this case, the relation between wages and export activity is a fixed firm attribute. The pre-devaluation export share captures this attribute and constitutes a sufficient statistic to predict the effects of the devaluation on wages, while the actual share has no effect.

$\delta > 0, \gamma = 0$ This configuration would indicate that export propensity is not a fixed firm attribute: a devaluation might entail changes in export that cannot be predicted on the basis of pre-existing conditions. Moreover, controlling for the current propensity, pre-existing conditions play no role in determining the impact of export propensity on wages.

$\delta > 0, \gamma > 0$ In this case, there is a role for both a pre-determined, fixed component and for current conditions.

3.3 Main Results

We estimate equation (6) using log wages, SC and RS as dependent variables, and report the results in Table 6. In panel A we present OLS results, while in panel B we adopt a fixed effects specification, with the fixed effects defined at the level of the firm.

3.3.1 Assuming time-invariant worker skills

We begin by describing the OLS results. All regressions include firm-year-level workforce characteristics (average age, percentage of females in the workforce, percentage of white collar employees, fraction managers), time-varying firm characteristics (log of employment, log of domestic sales) as well as region, industry and year dummies. For wages, we find in column [1] that $\delta = 0.103$, statistically significant at the 1% level, and $\gamma = .033$, statistically significant at the 5% level. This implies that, controlling for the pre-devaluation export share, a high post-devaluation share is associated with higher wages. Moreover, given that γ is only one third of δ in magnitude, the current export share is what matters the most for wage determination, contrary to the idea that some pre-determined condition, captured by the pre-devaluation share, is the main driver of the post-devaluation outcomes. In terms of magnitude, the effect is not negligible: given that the median export share has increased by approximately 15 percentage points during the devaluation episode, workers in the median firm recorded a wage 1.5 percent higher following the devaluation. Finally, the coefficient on the export share in the pre-devaluation period, β, is 0.105, highly significant, not too dissimilar to what we found in the OLS regressions of Table 4, and essentially identical to δ. Columns [2] and [3] report the results for SC^F and RS^F (that is, the worker and firm effects estimated while assuming the worker effects are constant over time) as the dependent variables. For SC^F, we obtain an estimated δ essentially equal to zero (0.003). The coefficient on the pre-share value γ is instead positive (0.019) and statistically significant at the 5% level. This suggests that the workforce composition is indeed a quasi-fixed attribute, so that, controlling for the pre-devaluation export share, changes in the share after the devaluation do not affect the firms' skill composition. Stated differently, the higher post-devaluation wages do not seem to be due to a workforce composition effect. The relationship between export intensity and workers' skills is confirmed by the estimate of β, similar in magnitude to that of γ (0.027): "normal" (pre-devaluation) export activity is associated with higher skills. For RS^F, our measure of firm-year wage premia, the estimated δ is positive, statistically significant at the 1% level, and large in magnitude (0.091), while the estimated γ is small (0.015) and not statistically significant. This indicates that the higher wages related to increases in the export shares are mostly due to a time-varying firm effect, which is common to all workers in the firm. This is consistent with the idea that the firm and the workers share the surplus deriving from the increase in export following the devaluation. Moreover, the rent-sharing component does not seem to be a fixed firm attribute in that it is not related to the average export share in the pre-devaluation period. The coefficient estimate on the export share in the pre-devaluation period, β, is instead large and significant (0.080), and its magnitude is comparable to that of δ, indicating that the rent sharing component of wages reflects export intensity similarly before and during the devaluation period.

We now turn to the fixed effects specifications (Panel B of Table 6). This exploits only within-firm variation, and it ensures that we are controlling for any firm-specific, time-invariant unobservable characteristics. In fact, one could argue that controlling for the pre-devaluation average export share and other firm-level controls such as log employment and log of domestic sales is not enough to account for potential firm heterogeneity. Once we do that, we obtain slightly smaller estimates of δ for wages (0.083) in column [1], still highly statistically significant, which indicates that the effects of export on wages do not simply reflect a fixed firm attribute. We also still obtain that all of the wage effect is attributable to changes in wage premia rather than changes in workforce composition. In fact, when the dependent variable is SC^F (column [2]), the export share exerts very little effect: the only marginally statistically significant coefficient is the export share in the pre-devaluation period, but with a small magnitude (0.013). This is consistent with the view that the skill composition is a rather fixed attribute so that, once we control for firm fixed effects, the within-firm variation in exports has very little effect on the skill composition. Instead, when the dependent variable is the rent-sharing component RS^F (column [3]), the estimated coefficient δ remains positive and strongly significant, although reduced in magnitude (0.050). This reduction indicates that there is a fixed firm component in the propensity to export that is passed on to wages. Still, the coefficient remains sizable and statistically significant, which means that within-firm variations in the share of exports over time are also reflected in the rent-sharing component of wages.

3.3.2 Allowing worker skills to vary pre- and post-devaluation

The picture that emerged from columns [1], [2], and [3] of Table 6 Panels A and B is that the export activity stimulated by the devaluation of the lira led to higher wages, and the increased wages were entirely due to rent sharing with no evidence of changes in skill composition. SC^F and RS^F, however, were estimated under the assumption that the worker effect is fixed over time. Such an effect captures the combination of two elements in the wage determination: the worker's unobservable skills and the price that the labor market assigns to such skills. Although it seems plausible that there is a fixed component of workers' skills, such as education and other cognitive skills, and non-cognitive ability, it is less obvious that the market value of these skills is unchanged following such a strong shock as the devaluation that we are analyzing. In fact, workers might be heterogeneous in terms of export-specific skills. For example, the devaluation might have been particularly advantageous for some products, more traded on international markets. Then, if part of the human capital is product-specific, workers with the skills that are more useful for the exporting activity might observe an increase in the market value of their skills. Consider now the case of a firm with abundant export-specific skills that, after the devaluation, increases its export share substantially. If the market value of its workers' skills has increased, the firm will increase compensation accordingly, not to share rents but, rather, to meet the higher market value of its workers' skills. Failure to allow the worker effects to change over time would imply that the increased market value of those skills would be absorbed by the time-varying firm component of wages (RS^F), thus overestimating the rent sharing component of the correlation between export and wages.

This conjecture is confirmed by the results reported in columns [4] and [5] of Table 6, where we report the results for SC^V and RS^V: that is, the average firm-year worker effect and rent-sharing component estimated while allowing the individual worker effects to take different values in the pre- and post-devaluation periods (model (2)). In fact, when SC^V is the dependent variable, the estimated δ is positive and statistically significant, in both the OLS (column [4] of Panel A) and fixed effects (column [4] of Panel B) specifications (0.026 and 0.031, respectively, compared to zero when using SC^F). The estimated δ remains large and significant also for RS^V (column [5] of Panels A and B) although its magnitude is reduced compared to when RS^F was used (0.079 vs. 0.091 in the OLS specification and 0.033 vs. 0.050 in the fixed effects specification). Thus, it appears that the increased wage associated with exporting is due to both a firm-level component, plausibly related to rent sharing, and a component attributable to a change in the market value of workers' unobservable skills. Specifically, the results from the specifications with firm fixed effects (Panel B, columns [4] and[5]) indicate that the two components contribute equally to explaining the effect of export intensity on wages. Not allowing the worker effects to vary over time would have led to incorrectly concluding that the wage premium was entirely explained by rent sharing, with workers' skills not playing any role. We will provide further corroboration to this interpretation in section 5.3 below, where we will relate the export wage premium to a measure of export-specific worker experience.

4 Robustness analysis

In this section, we perform a series of robustness exercises to corroborate our results.

4.1 Accounting for effort and productivity

We address two potential concerns that one might have with the analysis above and our interpretation of the results: the estimated coefficient δ might be reflecting increased worker effort in response to the extra demand or increased productivity that is related both to higher wages and to higher exports.

The first concern arises because our wage measure is total weekly earnings and we have no information on hours worked at the individual level in the social security data. If employees in firms that increase the export share after the devaluation are working more hours per week to meet the extra demand, we would be capturing an effect on hours and not directly on the wage rate. Fortunately, the INVIND firm survey does report the total hours worked at the firm level, from which we can recover a measure of average per capita hours. The results from including this additional control in the regressions are reported in

Panel A of Table 7.[12] The table presents results from fixed effects specifications, for which the fixed effects are defined at the level of the firm. As can be seen in columns [1], [3] and [5], hours worked are positively and significantly correlated with wages as well as with the firm effects (both RS^F and RS^V). However, our main coefficient of interest, δ, is still positive, sizable, and statistically significant, and its magnitude is only slightly reduced. The estimates for the worker effects (both SC^F and SC^V) are essentially unaffected. This indicates that the effects on the total compensation is not just due to an increase in the number of hours worked.

The second possible issue is that the firm might become more productive as a consequence of expanding its export activities due to "learning by exporting" (De Loecker 2011). Indeed, evidence from other contexts does suggest that labor productivity and TFP increase when firms begin exporting or when they expand their exports (Park et al. 2010). Thus, this would be a different mechanism for export to affect wages other than skill composition and rent sharing. To account for this possibility, we include TFP in the regression, computed using the Olley & Pakes (1996) procedure (see Iranzo et al. (2008) for the details). Because computing TFP requires further data, available only for a subset of firms, when we include TFP in the regressions (Panel B of Table 7), our sample size is reduced to 3,858 firm-year observations. In spite of this, our results are very robust to the inclusion of TFP in the controls. The estimated coefficient δ remains sizable and strongly statistically significant, and both workers' skills and rent sharing contribute to the export wage premium. TFP shows a strong positive correlation with wages.

4.2 Instrumenting the export share

Although we have shown that the post-devaluation performance is not related to pre-devaluation firm "quality," one could still argue that time-varying firm shocks are driving both the export performance and wage changes. To further account for this possibility, we propose an IV estimation. We illustrate the IV procedure concisely in the main text and report a full discussion in the Appendix. We follow Park et al. (2010) to construct a measure of foreign demand at the local-sectoral level. To do so, we use data on export by country of destination at the provincial[13] and 3-digit sectoral level and compute the share of exports ω_{psc} to each country c in the first quarter of 1992 for each province-sector ps.

[12] Note that because of some missing values in hours worked, our estimation sample is reduced from 6,334 to 6,225 observations.

[13] A province is an administrative unit roughly comparable to US counties. The Italian territory comprises 103 provinces.

We then use these shares to construct a weighted average of foreign demand growth at the province-sector-year level as

$$DEMAND_{pst} = \sum_{c} \Delta y_{ct} * \omega_{psc} \tag{7}$$

where $\Delta y_{ct} = ln(\text{GDP}_{ct}) - ln(\text{GDP}_{c92})$ is the percentage change in real GDP in country c between t and 1992. We argue that this is a valid instrument for the change in the export share of a firm in a given province and a given industrial sector. In fact, the province-sector subdivision is very narrow, and therefore export composition at the firm level is likely to be correlated with that at the province-sector level.[14] At the same time, firms' unobserved characteristics are unlikely to be correlated with the export destination at the province level and with GDP growth in the destination countries. We discuss the validity of the instrument in more detail in the appendix.

Panel C of Table 7 reports the IV estimates. In all of the regressions, we adopt a firm fixed effects specification. The results, discussed more at length in the appendix, confirm our main findings. In general, the absolute magnitude of the estimates increases (similar to what was found in Park et al. (2010) and Frias et al. (2012)). As before, we find that when we use SC^F and RS^F, all of the increase in the wage is attributable to rent sharing–in this case, the export share has a negative effect on the skill composition (in accordance with the idea that the devaluation might have favored more low-skill firms). However, when we allow for variable workers' effects and use SC^V and RS^V as dependent variables, we find that the skill composition is strongly positively affected by the export share in the devaluation period. The rent sharing component is also positively affected although in this case the estimated coefficient fails to attain conventional levels of statistical significance. Although these results should be taken with a grain of salt, as the diagnostic tests give ambiguous answers on the validity of the instruments (see the appendix and the table), overall the IV estimates further corroborate our results and interpretation.

5 Export wage premium and workers' past export experience

Our results imply that workers enjoy higher wages when their firm increases its exports. The export wage premium is explained both by a firm-year factor, RS, which we interpret as rent sharing, and by a skill composition effect, SC, that emerges only if we allow the

[14] In particular, Guiso & Schivardi (2007) have shown that Italian firms in the same sector and location are characterized by a high degree of social interaction, which should induce correlation in export destinations within each province-industry.

returns to (unobservable) skills to differ in the pre- and post-devaluation periods. The latter result can be explained if: a) there is heterogeneity in the distribution of skills in terms of usefulness for the export activity; and b) the devaluation increases the demand for those skills, driving their relative price up. In this section, we corroborate this interpretation by testing whether the export wage premium associated with the devaluation can be linked to a measure of export-specific workers' skills. Measures of such skills are typically unobservable in administrative data or labor force surveys. Our data, however, allow us to construct a measure of export-related skills: workers' past experience in exporting activities. If producing for foreign markets requires a certain degree of specificity, then it seems plausible that a worker employed by an exporting firm can actually accumulate export-specific human capital. Mion & Opromolla (2011) find evidence of this mechanism for managers in Portuguese firms. We therefore construct a cumulated export experience variable as follows:

$$EXPER5Y_{it} = \sum_{k=1}^{5} EXSH_{j(i,t-k)} \tag{8}$$

where i denotes workers, t denotes time, $j(i,t)$ denotes the firm where worker i was employed at time t, and $EXSH_{j(i,t)}$ is firm j's export share at time t. The index $EXPER5Y_{it}$ can take values between 0 (if a worker was employed in firms that produced only for the domestic market in the previous five years) and 5 i(f the worker was employed in firms that exported its entire output in the previous five years). Given that we are interested in the effects of an individual characteristic (export experience) on wages, we perform this analysis on the individual workers' data rather than on firm-year averages. Because we have information on exports for INVIND firms only, the export experience index can be computed only for workers who have been employed at INVIND firms throughout the 1987-1997 period. This subsample consists of 58 percent of the total INVIND workers' sample. As shown in column [4] of Table 1, the characteristics of these workers are very similar to those in the full sample. Because export data are available only starting in 1984, a five-year export experience index can be computed only starting in 1989. Thus, the sample is reduced to slightly less than 1,200,000 person-year observations. In 1991, the year before the devaluation, the mean (standard deviation) $EXPER5Y$ was equal to 1.23 (1.06).[15]

[15] We have also performed all the regressions with $EXPER3Y_{it}$, defined in an analogous way but considering only the previous 3 years of employment, which allows us to use the entire 1987-1997 period. We obtained very similar results (available upon request). In 1991, the mean (median) $EXPER3Y$ was equal to 0.80 (0.67).

In Table 8 we present results from estimating the following equation:

$$
\begin{aligned}
w_{it} &= \alpha + \beta EXSH_{j(i,t)} * (1 - DV) + \gamma EXSH_{j(i,t)PRE} * \text{DV} \\
&+ \delta_0 EXSH_{j(i,t)} * DV + \zeta EXPER5Y_{it} + \xi EXPER5Y_{it} * DV \\
&+ \delta_1 EXSH_{j(i,t)} * EXPER5Y_{it} * DV + \boldsymbol{\theta}' \mathbf{X_{ij(i,t)}} + \mu_j + \epsilon_{it}
\end{aligned} \tag{9}
$$

which is a version of equation (6) augmented with $EXPER5Y_{it}$ and its interaction with DV and $EXSH_{j(i,t)} * DV$. In equation (9), the coefficient δ_0 captures the baseline effect of post-devaluation contemporaneous export on wages for workers with no past cumulated export experience, and δ_1 measures whether the effect is related to past export experience. By interacting past experience with the export share, we allow for exports to have heterogeneous effects across workers according to their export experience: in the post-devaluation period, $\partial w_{it}/\partial EXSH_{j(i,t)} = \delta_0 + \delta_1 * EXPER5Y_{it}$.

In Panel A of Table 8, we present OLS results, and in Panel B results from fixed effects regressions, with the fixed effects defined at the firm level. In all cases, the control vector $\mathbf{X_{ij(i,t)}}$ includes worker characteristics (gender, age, age squared, white collar dummy, manager dummy), firm characteristics (log employment, log of domestic sales, fourteen industry dummies), as well as a set of four geographic area dummies and eight year dummies; we cluster the standard errors at the firm-year level. Column [1] in both Panels A (OLS) and B (firm fixed effects) shows that our main coefficient of interest, δ_1, is positive and statistically significant, indicating that the export wage premium increases with a worker's past export experience. Using the estimates from column [1], Panel A, we obtain that a one-standard deviation increase in $EXPER5Y_{it}$ increases the wage by 1.7 percent for a worker in a firm with an export share equal to the sample mean. The direct effect of export experience and its interaction with the devaluation dummy are instead slightly negative or zero, which indicates that having export experience bears no premium in a firm that does not export.

Within firms, $EXPER5Y_{it}$ varies both cross-sectionally (because workers vary in their tenure at the firm) and longitudinally for workers with the same tenure but who were hired in different years. Nevertheless, it is possible that $EXPER5Y_{it}$ is picking up a tenure effect. In particular, for workers at their first job, $EXPER5Y_{it}$ will grow with tenure (unless the firm has zero export). Thus, it might then be the case that workers with longer tenure receive a larger share of the extra rent generated by the increased exports during the devaluation period. To account for this possibility, in column [2], we include controls for tenure. Specifically, we include a full set of tenure dummies, and interactions of each of these dummies with $EXSH_{j(i,t)} * DV$; that is, we allow for the post-devaluation export share to affect workers with different seniority at the firm differently. The estimates of δ_1 are virtually unchanged in both the OLS and firm fixed effects regressions. In the INPS-INVIND data, tenure is measured precisely for workers who joined their firm in 1981 or subsequent years, but it is subject to right censoring for those who were in the firm's workforce as of 1980, the first year in the data set.[16] In column [3], we report results from the same specification as in column [2] but for which the sample has been limited to the cohorts of workers who joined their current employer after 1980, for whom tenure is precisely measured, and we obtain very similar results.

Thus, we find that the export wage premium is larger for workers with higher cumulated past export experience. This finding, and its robustness to controlling for tenure and isolating the employer switchers, corroborates our interpretation of the previous results that part of the export wage premium is due to an increase in the market value of workers' skills specifically related to export activity.

6 Conclusions

We exploited the large and unexpected devaluation of the Italian lira in 1992 to study the effect of firms' exporting activity on wages. We documented that because of the structure of Italian exports, there was no systematic relationship between pre-determined measures of firm "quality" (employment, sales, investment) and the extent to which firms benefited from the devaluation in terms of increased exports, which considerably lessens endogeneity concerns that are paramount in other contexts (see, e.g., Verhoogen (2008), Frías et al. (2009) and Park et al. (2010)). Our matched employer-employee data allowed us to distinguish between workforce composition effects, changes in the market value of workers' unobservable skills, and an actual export wage premium enjoyed by workers above and beyond what they would get in non-exporting firms. The results indicate that the increase in the export share of sales induced by the 1992 devaluation did cause wages to be higher, and that this effect was due to both exporting firms paying a wage premium and to changes in the market value of workers' unobservable skills. A novel contribution of this paper is to show that this result depends crucially on whether one allows the returns to individual workers' unobservable skills to vary over time. We argued that it is plausible to expect that a large shock such as the 1992 lira devaluation would have an impact on the market

[16] In column [2], we included a dummy variable for workers who were already in the data set as of 1980.

value of workers' unobservable skills, especially if these are export-specific. In fact, we have shown that imposing that the market value of workers' unobservable skills is fixed over time (as typically done in the literature) would have led one to erroneously attribute all of the export premium to a firm-year component, common to all workers in the firm.

The "rent-sharing" effect is consistent with theoretical models that emphasize the role of firm heterogeneity and frictions, and that predict an effect of trade on wage dispersion across occupations, industries, and firms (Helpman & Itskhoki 2010). The "skill composition" effect, together with our finding that the workers who benefited the most were those with more export-related past experience, documents the importance of export-specific skills, which are typically not observed in traditional datasets. This is in fact another novel contribution of this paper, and the result that the change in the export share in the devaluation period had a significantly stronger effect on workers with more past cumulated export experience further supports a causal interpretation of the effects of export on wages.

In addition to providing new evidence on the relationship between exporting and wages, our paper has implications for both future empirical and theoretical analysis. On the empirical front, researchers have only recently started exploring the heterogeneous effects of export shocks within industries and occupations and within firms (Helpman et al. 2012, Frias et al. 2012, Hummels et al. 2011); future research should aim at obtaining more precise measures of export-specific skills. On the theoretical side, our findings suggest that labor market frictions and export-specific skills should be essential ingredients in models of the effects of international trade on wages.

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A Detailed discussion of the IV analysis

Our instrument is based on foreign demand growth defined at the local-sectoral level. The Italian manufacturing sector is characterized by a number of industrial "districts," defined as small geographical areas highly specialized in specific productions. Guiso & Schivardi (2007) show that industrial districts defined along these two dimensions (geography and sector) are characterized by a high degree of information spillovers, according to which "firms actions convey useful information about a common problem." According to this view, being located in an area-sector characterized by a high share of export toward a country reduces the costs of exporting toward that country for the individual firms. Thus, if demand in that country grows, the firms located in that area-sector will benefit relatively more from the devaluation episode. Accordingly, one can compute a measure of foreign demand growth for an area-sector as a weighted average of GDP growth (a natural proxy for demand at the country level) in the country of destination, with the weights constructed from the area-sector export shares before the devaluation. The National Institute of Statistics collects export data by country of destination on a quarterly basis for the Italian provinces at the sectoral level, based on the 3-digit ateco91 classification system. We can therefore construct the province-sector export share by country of destination before the devaluation, in the first quarter of 1992, as $\omega_{psc} = \frac{EXPORT_{psc}}{EXPORT_{ps}}$, where p is the province, s the sector and c the country of destination and $EXPORT_{ps} = \sum_c EXPORT_{ps}$ is the total sectoral-province export. Given this shares, we define the province-sector demand growth index as:

$$DEMAND_{pst} = \sum_c \Delta y_{ct} * \omega_{psc} \tag{10}$$

where $\Delta y_{ct} = ln(\text{GDP}_{ct}) - ln(\text{GDP}_{c92})$ is the percentage change in real GDP in country c between 1992 and t. We interacted DEMAND_{pst} with a set of thirteen 2-digit sector dummies. In fact, as seen above, different sectors have different export propensities and respond differently to demand changes.

This approach is similar to Park et al. (2010), who construct firm level instruments for the export of Chinese firms. Unlike us, they have information on export destination at the firm level, although only for the top two destinations. Moreover, instead of using GDP growth in destination countries, they use the bilateral exchange rate changes following the currencies' devaluation of the east Asian countries during the crisis of 1997. We have also experimented with an instrument based on bilateral exchange rates, which does not perform as well as the GDP-based one.

This variable is arguably a valid instrument for the change in the export share of a firm in province p and sector s. A high level of $DEMAND_{pst}$ signals that the demand relevant for a specific province-sector increased substantially. It seems natural that such demand has a positive impact on export propensity, and therefore on the change in the share of exports over total sales. The exclusion restriction requires that the residual in the wage equation 6 is uncorrelated with DEMAND_{pst}. If the ω's where measured at the firm level, trade shares might in principle be correlated with firm "quality": high quality firms will tend to export more to countries with high income per capita, possibly related to growth potential. This is not likely to be an issue in our setting: in fact, it is well know from the growth literature that growth experiences differ greatly across countries of similar development levels, and that unconditional convergence does not hold: there is no systematic relation between the level of GDP and its growth rate. Using data from the Penn World Table (Heston, Summers & Aten 2006), we have regressed the growth rate of GDP over the period 91-97 on GDP per capital in 1991, finding a small and insignificant coefficient (p-value=0.69). Moreover, we consider trade shares at the province-sector level. This reduces the likelihood that individual firm characteristics are systematically related to the sector-province trade shares. The mean value of the instrument is 0.17; similarly for the median, the standard deviation is 0.085.

The IV results are reported in Table 7, Panel C. For log wages (column [1]), we find that the effect of export share in the post-devaluation period increases substantially with respect to the OLS and fixed effects estimates, from about 0.10 (Table 6, column [1]) to 0.39. Taken at face value, these estimates imply a substantially larger impact of exports on wages: for the median increase in the export share, the wage increase is 6%. Conversely, the estimate of γ (not reported in Table 7 to save space) becomes negative (-0.17), implying that a large export share before the devaluation is associated with a lower wage after 1992. This result is in line with the interpretation of the devaluation as having been more beneficial to low-quality, low-wage firms that, before the devaluation, tended to have a smaller export share.

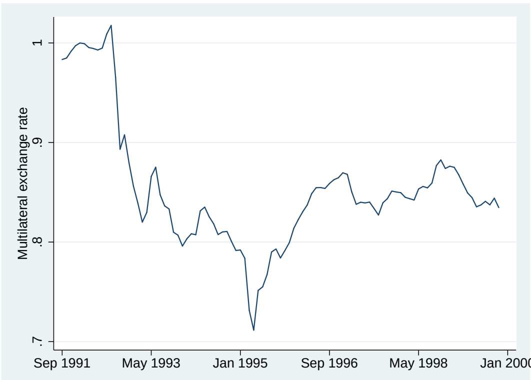
The diagnostic tests give ambiguous results on the validity of the instruments. The F-statistic on the excluded instruments is 6.5, which is below the commonly used threshold value of 10. The Anderson-Rubin test for the null hypothesis that the coefficient on the export share is statistically not different from zero strongly rejects the null (p-value=0.000). This test is robust to potentially weak instruments. Instead, the Hansen J statistics for the over-identification test rejects the null of exogeneity of the instruments (p-value=0.000).

When we turn to SC (workers' skills) and RS (rent sharing) (columns [2] and [3], respectively), we obtain a picture that is very similar to the one described in our main analyses above. When the market value of workers' unobservable skills is not allowed to vary over time (i.e., when we use SC^F and RS^F as dependent variables), we obtain that the positive effect of exporting on wages is entirely due to the RS component, while the contribution of SC is actually negative; and when we allow workers' unobservable skills to take different values pre- and post-devaluation (i.e., when we use SC^V and RS^V as dependent variables; columns [4] and [5], respectively), the estimated contribution of RS drops substantially (also losing statistical significance), and the contribution of SC becomes positive and strongly significant. Again, we find a substantial increase in the δ coefficient with respect to the OLS and fixed effects estimates (the estimated δ goes from 0.031 [Table 6, Panel B, column [4]] to around 0.31 in the case of SC^V, and from 0.033 [Table 6, Panel

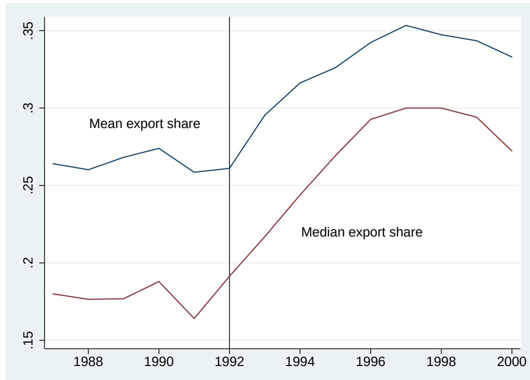
B, column [5]] to 0.05 for RS^V).

The larger coefficients can be due to several factors. First, there might be some measurement error in our indicator of exporting activity. While measurement error in the export share is likely to be negligible, given the quality of the INVIND survey, the share of export over total sales is in any case a partial indicator of export activity. The higher effects are compatible with the argument that the devaluation was more beneficial to "bad" firms. According to this interpretation, such firms would have increased relatively more their export share, compared to "good" firms. Moreover, other things equal, such firms should pay lower wages. This reasoning implies a negative correlation between the export share and the residual term in equation (6), which leads to a downward bias in the uninstrumented fixed effects estimates. Interestingly, the only exercise that we are aware of that is comparable to ours obtains similar results. In fact, Park et al. (2010) find that when regressing the average wage on changes in export for Chinese firms, the coefficient goes from 0.06 in the OLS regressions to 0.29 with IV, which is an increase in magnitude similar to the one that we find in our paper. This suggests that, whatever its source, the bias is not a specificity of the Italian context.

Figure 1: Real exchange rate and export share

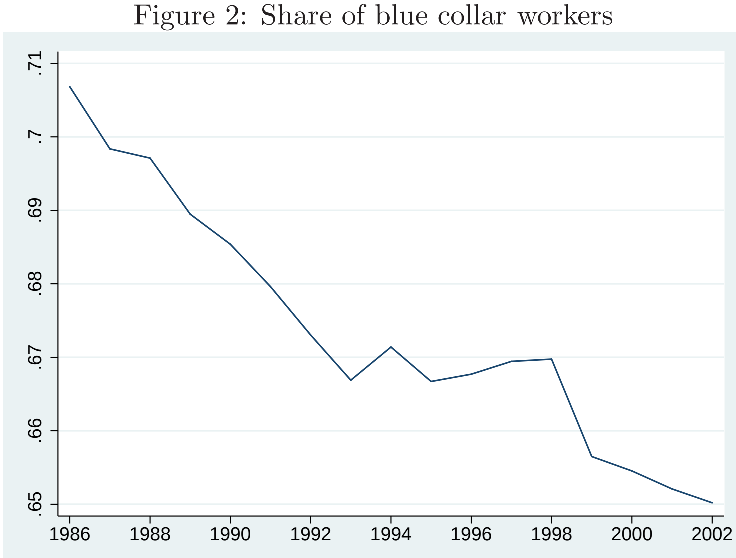


(a) Real exchange rate (Jan. 1992=1). Source: Finicelli at al, 2005.



(b) Mean and median export share. Source: INVIND.

Figure 2: Share of blue collar workers



Source: INVIND.

Table 1: Descriptive statistics, workers

	[1] Entire sample 1980-1997 mean (st.dev.)	[2] Entire sample 1987-1997 mean (st.dev.)	[3] INVIND sample 1987-1997 mean (st.dev.)	[4] INVIND stayers 1987-1997 mean (st.dev.)
Weekly wage	377.6	401.1	404.2	400.1
	(160.2)	(182.0)	(168.5)	(166.7)
Age	36.9	37.6	38.8	40.1
	(10.0)	(10.1)	(9.9)	(10.2)
Males	0.79	0.79	0.78	0.75
Production workers	0.66	0.64	0.67	0.68
Non-prod. workers	0.33	0.35	0.32	0.31
N. Observations	18,635,710	11,042,916	4,076,375	2,372,173

Notes: Entire sample refers to all workers in the data set; INVIND sample only includes workers who are currently employed by a firm that belongs to the Bank of Italy-INVIND survey. See Section 2.1 for a description of the data.

Table 2: Descriptive statistics, firms

INVIND firms, 1987-1997			
	[1]	[2]	[3]
	All firms-year	Exporters	Non-Exporters
Employment			
Mean	672.0	720.5	287.4
(st.dev.)	(3,206.7)	(3,395.9)	(473.9)
Median	229	245	147
Sales			
Mean	112,785.1	120,726.2	49,891.3
(st.dev.)	(539,758.5)	(570,468.8)	(130,019.8)
Median	31,240.6	33692.61	16,500.3
Export (0/1)	0.89	1	0
Export Share of Sales			
Mean	0.31	0.34	0
(st.dev.)	(0.27)	(0.27)	0
Median	0.25	0.30	0
N. Obs.	7,591	6,740	851

Notes: The sample includes firms in the INVIND sample in the period 1987-1997. Sales are expressed in thousands of euros (in constant 1995 prices).

Table 3: Estimating worker effects and firm effects: Two-way fixed effects regressions

Panel A: AKM Regressions Results	[1]	[2]
	θ_i^{F}, ψ_{it}^{F}	θ_{it}^{V}, ψ_{it}^{V}
Number of Observations	18,552,604	18,552,604
Number of Individual FEs	1,711,543	2,757,403
Number of Firm FEs	444,853	444,853
F	39.71	38.71
Prob > F	0.000	0.000
Adj. R-squared	0.84	0.87
Coeffs. on worker characteristics:		
Age	0.0341	0.0389
Age squared	-0.0002	-0.0002
Age * Female	-0.0159	-0.0175
Age squared * Female	0.0001	0.0001
White collar	0.0709	0.0545
Executives	0.5174	0.4320
White collar * Female	-0.0079	-0.0034
Executives * Female	0.0221	-0.0001

Notes: The sample includes all firms and all workers in the largest connected group. The estimation was performed using the conjugate gradient algorithm proposed by Abowd et al. (2002) and implemented by the Stata code "a2reg" written by Ouazad (2008). See Section 2.2 for details.

Panel B: Variance-covariance matrix of workers' and firms' effects

	w_{it}	θ_i^{F}	θ_{it}^{V}	ψ_{it}^{F}	ψ_{it}^{V}
w_{it}	0.343				
θ_i^{F}	0.428	0.253			
θ_{it}^{V}	0.358	0.845	0.328		
ψ_{it}^{F}	0.446	-0.032	0.032	0.127	
ψ_{it}^{V}	0.245	-0.002	-0.382	0.544	0.193

Notes: The diagonal entry reports the standard deviation and the other entries are correlations.

Table 4: Export Intensity and Wages, Skill composition and Rent sharing: Cross-Sectional and Within-Firm Patterns

	[1]	[2]	[3]	[4]
	Panel A: Wages			
	Log wage			
EXSH	0.095***	0.118***	0.075***	
	(0.010)	(0.007)	(0.011)	
Specification	OLS	OLS	FE	
Observations	4,075,745	7,585	7,585	
R-squared	0.59	0.82	0.96	
	Panel B: Skill Composition			
	SC^F		SC^V	
Export share of sales	0.021***	0.001	0.039***	0.022***
	(0.003)	(0.004)	(0.006)	(0.007)
Specification	OLS	FE	OLS	FE
Observations	7,585	7,579	7,585	7,585
R-squared	0.76	0.96	0.65	0.93
	Panel C: Rent Sharing			
	RS^F		RS^V	
EXSH	0.093***	0.042***	0.078***	0.031***
	(0.006)	(0.008)	(0.007)	(0.007)
Specification	OLS	FE	OLS	FE
Observations	7,585	7,585	7,585	7,585
R-squared	0.55	0.92	0.47	0.93

Notes : The sample includes INVIND firms, years 1987-1997. OLS denotes Ordinary Least Squares and FE firm fixed effects specifications. Robust standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent confidence levels, respectively. **Panel A.** An observation is a worker-year in [1] and a firm-year in [2] and [3]. The dependent variable is the log of individual weekly earnings in [1] and the average of log weekly earnings in the firm-year in [2] and [3]. All regressions include controls for worker gender, age, age squared, white collar, manager, log employment, log of domestic sales, industry dummies (14), geographic area dummies (4) and year dummies (10). **Panel B.** SC^F are firm-year averages of the time-invariant worker effects (AKM regression of Table 3, column [1]), and SC^V are firm-year averages of the worker effects that were allowed to vary before and after the devaluation (Table 3, column [2]). See section 3.2 and Table 3 for details. **Panel C.** RS^F are firm-year effects obtained from AKM regressions where the worker effects were time-invariant (Table 3, column [1]), and RS^V are firm-year effects obtained from AKM regressions where the worker effects were allowed to vary before and after the devaluation (Table 3, column [2]). See section 3.2 and Table 3 for details.

Table 5: Changes in export and initial conditions

Dependent variable:	Δ EXSH		
	Periods		
	91-87	95-91	99-95
	[1]	[2]	[3]
Dom. sales	0.011**	0.016***	0.011*
	(0.005)	(0.004)	(0.006)
	[0.45]		[0.46]
Employment	-0.004	0.005	0.002
	(0.004)	(0.005)	(0.005)
	[0.16]		[0.71]
Inv./workers	-0.000	0.000	-0.003
	(0.006)	(0.005)	(0.005)
	[0.95]		[0.67]

Notes : Each coefficient comes from a separate regression. The dependent variable is the change in the share of export over total sales over the relevant interval. Dom. sales is the log of real domestic sales, employment the log of the number of employees, and Inv/workers the log of real investment over the number of employees. The regressors are measured at the initial year of the relevant interval (i.e., Dom. Sales in column [1] is the log of real domestic sales in 1987, in columns [2] in 1991 and so on). Standard errors in round brackets. In square brackets, we report the p-value of a test of equality of the coefficient with the corresponding coefficient for the 95-91 regression. All regressions include 17 sector and 4 area dummies. *, **, and *** denote statistical significance at the 10, 5, and 1 percent confidence levels, respectively.

Table 6: Devaluation Regressions

	[1]	[2]	[3]	[4]	[5]
Dependent variable:	Log W	SC^F	RS^F	SC^V	RS^V
			Panel A: OLS		
$\delta: EXSH * DV$	0.103***	0.003	0.091***	0.026**	0.079***
	(0.014)	(0.008)	(0.013)	(0.012)	(0.014)
$\gamma: EXSH_{PRE} * DV$	0.033**	0.019**	0.015	0.021	0.009
	(0.015)	(0.008)	(0.014)	(0.013)	(0.014)
$\beta: EXSH * (1 - DV)$	0.105***	0.027***	0.080***	0.018***	0.086***
	(0.008)	(0.005)	(0.006)	(0.005)	(0.006)
Observations	6,334	6,334	6,334	6,334	6,334
R-squared	0.83	0.78	0.55	0.75	0.54
			Panel B: Firm F.E.		
$\delta: EXSH * DV$	0.083***	-0.007	0.050***	0.031***	0.033***
	(0.012)	(0.005)	(0.010)	(0.008)	(0.009)
$\gamma: EXSH_{PRE} * DV$	0.036**	0.008	0.022*	0.014	0.008
	(0.016)	(0.006)	(0.013)	(0.010)	(0.012)
$\beta: EXSH * (1 - DV)$	0.095***	0.013*	0.048***	0.022**	0.042***
	(0.016)	(0.005)	(0.012)	(0.009)	(0.011)
Observations	6,334	6,334	6,334	6,334	6,334
R-squared	0.96	0.96	0.91	0.92	0.91

Notes : The sample includes INVIND firms, years 1987-1997. One observation is a firm-year. $EXSH$ is the share of sales that is exported. $EXSH_{PRE}$ is the average export share in the pre-devaluation period. DV is a dummy variable equal to 1 after 1992 (devaluation period). Controls include firm-year-level workforce characteristics (average age, percentage of females in the workforce, percentage of white collar employees, percentage of managers), time-varying firm characteristics (log of employment, log of domestic sales) as well as year, industry, and region dummies. SK^F and RS^F are firm-year level worker effects and firm effects obtained from the AKM regressions described in Table 3, Column [1] where the worker effect is time-invariant, and SK^V and RS^V were obtained from the AKM regressions described in Table 3, Column [2] where the worker effects were allowed to take different values in the pre- and post-devaluation periods. See Section 3.2 and Table 3 for more details. OLS results are reported in Panel A and firm fixed effects results in Panel B. Robust standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent confidence levels, respectively.

Table 7: Robustness tests

	[1]	[2]	[3]	[4]	[5]
Dependent variable:	Log W	SC^F	RS^F	SC^V	RS^V
	Panel A: Controlling for hours worked				
$\delta : EXSH * DV$	0.068***	-0.008	0.043***	0.026***	0.026***
	(0.012)	(0.005)	(0.010)	(0.008)	(0.009)
Hours worked	0.059***	0.001	0.023***	0.011**	0.026***
	(0.009)	(0.003)	(0.005)	(0.005)	(0.005)
Observations	6,225	6,225	6,225	6,225	6,225
R-squared	0.96	0.96	0.91	0.92	0.91
	Panel B: Controlling for hours worked and TFP				
$\delta : EXSH * DV$	0.073***	-0.017***	0.069***	0.036***	0.038***
	(0.014)	(0.006)	(0.013)	(0.012)	(0.012)
Hours worked	0.064***	-0.003	0.017***	0.008	0.025***
	(0.009)	(0.002)	(0.006)	(0.006)	(0.007)
TFP	0.030***	0.002	0.011***	0.008**	0.009***
	(0.005)	(0.002)	(0.003)	(0.003)	(0.003)
Observations	3,858	3,858	3,858	3,858	3,858
R-squared	0.96	0.98	0.93	0.92	0.92
	Panel C: Instrumenting for Export shares				
$\delta : EXSH * DV$	0.393***	-0.159***	0.428***	0.308***	0.050
	(0.093)	(0.041)	(0.094)	(0.071)	(0.069)
Observations	6,169	6,169	6,169	6,169	6,169
	First stage statistics				
Kleibergen-Paap F stat	6.5	6.5	6.5	6.5	6.5
	Second stage statistics				
Anderson-Rubin (Ho: d=0)	11.7	10.63	14.36	12.87	5.77
p-value	0.000	0.000	0.000	0.000	0.000
Hansen J-stat	95.8	61.24	107.5	92.5	61.4
p-value	0.000	0.000	0.000	0.000	0.000

Notes : The sample includes INVIND firms, years 1987-1997. One observation is a firm-year. All results are from fixed effects regressions, where the fixed effect is defined at the level of the firm. See the Notes to Table 6 for the definitions of the dependent variables, the explanatory variables, and the list of control variables. **Panel A**: The controls include average hours worked (total house/employees) at the firm-year level. **Panel B**: The controls include average hours worked and TFP. See section 4.4.1 for details. **Panel C**: See the appendix for details on our IV strategy. Robust standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent confidence levels, respectively.

Table 8: Export wage premium and workers' export experience

Dependent variable:	Log W		
	[1]	[2]	[3]
	Panel A: OLS		
$\delta_0 : EXSH * DV$	0.089***	0.133***	-0.018
	(0.026)	(0.047)	(0.043)
$\delta_1 : EXSH * DV * EXPER5Y$	0.052***	0.051***	0.065***
	(0.009)	(0.009)	(0.011)
$EXPER5Y$	-0.013	-0.022**	-0.033***
	(0.008)	(0.011)	(0.010)
$EXPER5Y * DV$	-0.011*	-0.015**	0.002
	(0.006)	(0.006)	(0.005)
Tenure Dummies & Interactions	No	Yes	Yes
Observations	1,176,993	1,176,993	267,407
R-squared	0.603	0.604	0.617
	Panel B: Firm F.E.		
$\delta_0 : EXSH * DV$	0.147***	0.220***	0.100**
	(0.021)	(0.041)	(0.040)
$\delta_1 : EXSH * DV * EXPER5Y$	0.024***	0.021***	0.020***
	(0.006)	(0.006)	(0.007)
$EXPER5Y$	0.007	0.005	0.005
	(0.006)	(0.008)	(0.007)
$EXPER5Y * DV$	-0.002	-0.008**	-0.005*
	(0.003)	(0.004)	(0.003)
Tenure Dummies & Interactions	No	Yes	Yes
Observations	1,176,993	1,176,993	267,407
R-squared	0.645	0.646	0.669

Notes : INVIND panel, years 1989-1997. One observation is a worker-year. $EXPER5Y_{it}$ measures five-year cumulated past export experience for worker i in year t. See section 4.5 for details. Additional controls include age and age squared, gender, white collar indicator, manager indicator, log employment, log of domestic sales, and indicators for year, industry, and region. Standard errors, clustered by firm-year, are reported in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent confidence levels, respectively.