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SKILL UPGRADING AND EXPORTS

by Antonio Accetturo,* Matteo Bugamelli* and Andrea Lamorgese*

Abstract

This paper analyzes the effects of international trade on the relative demand for skilled workers in Italian local labor markets. We find that exports cause a sizable skill upgrading in the labor force by increasing the average level of education of the workforce and the share of white-collars workers.

JEL Classification: F12, J23, J24.
Keywords: international trade, labor demand, schooling, skill composition.

Contents

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* Bank of Italy, Economic Research and International Relations.

1 Introduction[1]

Since the mid-90s, the intense globalization of real and financial markets has led to heated policy debate on the impact of trade on labor market outcomes. The vast empirical economic literature has focused on the effects of increased import competition from developing low skill abundant countries on advanced economies' labor markets (Lawrence and Slaughter, 1993; Sachs and Shatz, 1994; Wood, 1995).

Most recent theoretical developments in the international trade literature have added a new margin: an effect of exports on labor outcomes. In a neoclassical labor market, Yeaple (2005) and Bustos (2011b) show that increased export opportunities make the adoption of new technologies more profitable, thus raising aggregate demand for skilled workers. A similar mechanism, focusing on product quality, is described by Verhoogen (2008). Helpman et al. (2010) provide a very general model with heterogeneous firms, heterogeneous workers and imperfectly functioning labor markets in which trade liberalizations provide greater incentives to (costly) select better workers on the part of more productive and profitable firms; this is likely to tilt the firm's labor demand toward more qualified individuals. A positive relationship between trade and wage premia also emerges from models of efficiency wages (Amiti and Davis, 2008; Davis and Harrigan, 2007; Egger and Kreickemeier, 2009).

Empirical evidence on the impact of exports on labor market outcomes is scant

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and focuses mainly on developing economies (Bustos, 2011a; Frias et al., 2011, 2012; Verhoogen, 2008). The aim of this paper is to fill this gap and estimate the causal impact of exports on the skill content of employment in Italian local labor markets over the period 2000-06.[2] By using an instrumental variable approach that exploits world demand as a pull factor, we show that an increase in exports generates a sizable process of quality upgrading in the labor force, as captured by the increase in the average schooling level of employed workers and in the share of white-collar workers.[3]

For the sake of clarity, it is important to note that, in this study, skill content is measured in terms of the level of competence attained by workers at school and of occupational status (white- or blue-collar). We do not investigate, however, on-

[2]Other papers deal with the trade impact on Italian wage and employment by skill. Contrary to our results Manasse et al. (2004) conclude that exports have a negative effect on white-collar employment shares, while Falzoni et al. (2011) find a positive effect on low-skilled workers' wages. Matano and Naticchioni (2010) find, instead, that sales to developing countries raise white-collar workers' employment share and wage premium. These papers cannot be easily compared to ours for two reasons: they do not deal with the endogeneity of exports; they all refer mostly to the 1990s, a period when the European institutional framework (pre-euro), the Italian labor market institutions, and the intensity and patterns of worldwide trade flows were totally different from those underlying our analysis. Macis and Schivardi (2012) use a linked employer-employee dataset and exploit the 1992 lira devaluation to show that the export wage premium is due to exporting firms paying a wage premium to all its workers and employing workers whose skills command a higher price following devaluation.

[3]A possible explanation for the rise of skilled labor demand as a reaction to increased exports rests on the traditional Heckscher-Ohlin-Samuelson (HOS) framework based on comparative advantages. Under the HOS mechanism, skill intensity should increase (decrease) when skill-abundant countries increase their export flows to less (more) skill-abundant markets. However, empirical evidence, available upon request, shows that the entire effect is driven by exports from skill-abundant sector-provinces to advanced economies and, to a lesser extent, to emerging markets, thus contradicting the HOS predictions.

the-job human capital accumulation which, in any case, appears to be a negligible phenomenon in Italy.[4] This implies that the effect of exports on skill intensity can be due either to the reallocation of workers across provinces or sectors or to the turnover (hiring/firing) of individuals with different skill levels. Unfortunately, our data do not allow us to disentangle these two mechanisms, and this endeavor is beyond the scope of the present analysis.

This paper contributes to the literature under three main aspects. Firstly, from an empirical perspective, the cited studies focusing on trade liberalizations or dramatic devaluations are very robust but they are lacking in terms of external validity. Our instrumental variable approach, that can be used even for countries that have not experienced path-breaking trade shocks in recent years, represents an important step forward in terms of generalizing the results. Secondly, although theoretical models are usually solved in general equilibrium, all past empirical validations have a firm-level (partial equilibrium) perspective: we focus instead on local labor markets, which allows us to estimate general equilibrium effects by tracking labor market outcomes for the entire population and by appraising the possible reallocations.[5] Thirdly, unlike most of the existing empirical papers we use a richer definition of skill intensity that includes not only occupational status (white- or blue-collar workers) but also level of education.

To sum up, this is the first paper to analyze the causal effects of exports on skill upgrading with a general equilibrium perspective. Doing so we complement Autor

[4]Our data (based on the Italian Labor Force Survey; see section 3) shows that the on-the-job human capital accumulation is really rare: the one per cent only of employed individuals were enrolled at school over the period 2000-06.

[5]This obviously comes at a cost: this paper cannot be considered a direct test of the different mechanisms highlighted in the theoretical models that are based on firm's behavior and highlight heterogeneous effects among firms.

et al. (2013) who tackle a different line of research in a similar setting. While they study the causal impact of imports from China on a number of labor market outcomes (employment, wages, unemployment, transfers, etc.) of US commuting zones, we provide evidence of the causal impact of exports of Italian firms on the skill content of the local labor force.[6]

2 Empirical specification and identification

We estimate the following equation:

$$SI_{pst} = \alpha_{ps} + \beta \ln X_{pst} + \gamma_1 D_t + \gamma_2 D_s * D_t + \varepsilon_{pst} \tag{1}$$

where SI_{pst} is the average skill intensity of workers in sector s, province p and year t. Skill intensity is proxied by either the log of average schooling or the share of white-collar workers. X_{pst} are export flows from sector s and province p at time t. α_{ps} is a set of fixed effects by sector and province: they capture time-invariant differences in skill intensity across sectors and provinces, like, for example, the presence of universities (that are likely to increase the local supply of skilled individuals) or the existence of highly productive firms (that employ both qualified individuals and record large flows of exports). D_t is a set of year dummies. The interaction terms between sector and time dummies ($D_s * D_t$) control for a sector-specific year effect due, for example, to technological changes or import competition. All regressions are weighted according to the size of the observational cell in terms of the number of individuals interviewed within the Labor Force Survey (see section 3 for more details); standard errors are

[6] A similar identification strategy ensures the causal interpretation of results in both studies — Autor et al. (2013) uses the growth of imports from China in a set of advanced economies (excluding US) as an exogenous supply shock.

clustered at the sector-province level.

We concentrate our analysis on the 2000-2006 period. We focus on the period after the introduction of the euro and before the 2008-09 crisis to rule out confounding factors like large exchange rate fluctuations or the collapse of world trade in 2008.

The coefficient of interest is β which captures the relationship between exports and skill intensity. Its estimation by a fixed effect model (FE) like (1) is potentially biased in at least two respects. First, there could be an omitted variable bias: skill-biased technical change could affect both exports and demand for skilled labor, inducing an upward bias in the FE estimates. A second issue of concern is reverse causality: for example, firms getting prepared for exports could increase their share of skilled workers before starting to export, so that the FE estimates would be downward biased. To address these concerns we resort to an instrumental variable-fixed effect estimation (IV-FE) where we instrument province/sector exports with a demand pull variable constructed as follows:

$$\hat{X}_{pst} = \sum_{c} X_{psct_0} \frac{M_{sct}}{M_{sct_0}} \tag{2}$$

where X_{psct_0} is the export flow from province p, sector s to country c in an initial period t_0 (1995 in our data), M_{sct} and M_{sct_0} are the imports of country c from the world (excluding Italy) in a sector s at time, respectively, t and t_0. In words, the instrument $\hat{X}_{pst}$ is constructed by appending the dynamics of the destination country's total sectoral imports to the initial sector-province level of exports to that country.

The exclusion restriction is based on the hypothesis that foreign demand in a certain sector is sufficiently exogenous to local exporting performance. This requires that all sector-province exports toward each country are small enough not to influence the trading partners' demand (i.e. X_{psct_0}/M_{sct_0} is low). We deem this is guaranteed by the fact that the 99-th percentile of X_{psct_0}/M_{sct_0} distribution is 0.0008. These *abnormal* trade flows account for the 0.26 per cent of total Italian exports in 1995 and their exclusion does not affect our final result. This supports our idea that even the relatively largest sector-province export flows are negligible in comparison with world trade.

3 Data

The key dataset is the microdata of the Italian Labor Force survey (henceforth LFS): each quarter the Italian National Institute of Statistics asks a rotating sample of roughly 400,000 individuals about their current and past working conditions, their working position and level of education. In our analysis we include all workers (employed and self-employed, nationals and foreign-born) between 15 and 65 years old, restricted to the manufacturing sector where we distinguish 21 sectors (two digits of the Nace Rev. 1 classification).

From the LFS we compute the two dependent variables of equation (1). The first is the (log of the) average level of education of employed workers in sector s, province p at time t. This is measured in years by attributing to each individual the lowest number of years necessary to obtain their higher degree (as is usual in the estimates of Mincerian equations for Italy); that is: zero years for no formal education (uncompleted elementary school); 5 years for completed elementary school; 8 years for completed lower secondary school; 13 years for completed upper secondary school; 18 years for completed university degree; 21 years for completed graduate school degree. The second measure is the share of white-collar workers in the same $\{p, s, t\}$ cell.

Italian export data, in current values, disaggregated by province of origin (95

Table 1: Statistics: average 2000-06

	No. Obs.	Mean	Standard Deviation
Log(Average level of education)	12,171	2.283	0.118
Average level of education	12,171	9.879	1.184
Share of white-collar workers	12,171	0.274	0.159
Log(Exports)	12,171	4.975	2.216
Exports	12,171	669.1	1,264.60

Source: Authors' calculations.

Note: Weighted averages according to the size of each cell (in terms of interviewed individuals).

provinces),[7] sector and country of destination are collected and published by the Italian National Institute of Statistics.[8] Since sectors are classified according to Nace Rev.1, they are perfectly matched to LFS data. The instrumental variable is built on the basis of the BACI-CEPII dataset on world trade flows.[9]

The combination of the three datasets yields information on trade and skills level for 7 years (2000-06), 95 Italian provinces and 21 manufacturing sectors, i.e. some 14,000 observations. However, considering gaps in both LFS and provincial trade flows, our baseline sample contains slightly more than 12,000 observations.

Table 1 reports some descriptive statistics. In the manufacturing sector the average number of years of schooling (over the sample period) is quite low (9.8 years, a figure between lower and upper secondary school), the share of white-collar workers

[7]During the period 1995-2006, the total number of provinces rose from 95 to 103. In order to have constant units of observation, we keep the geography constant and reassign the newly-created provinces to the old ones.

[8]Contrasting once again our work with Autor et al. (2013), it should be noted that our data provides us with sector-province information about exports, whereas Autor et al. (2013) do not have measures of Chinese imports at local level.

[9]We mapped the H6 product classification of BACI-CEPII data into the Nace Rev. 1 classification using concordance tables between HS6 and CPA from Eurostat (see `http://ec.europa.eu/eurostat/ramon/relations/index.cfm?TargetUrl=LST_REL`).

is less than 30 per cent. The average level of exports at the province/sector cell is around 669 millions of euros. Both variables of interest – level of education and exports – have increased during the sample period: average level of education has risen by 6 per cent in 7 years, the share of white-collar workers by almost 1 percentage point, exports by 4.7 per cent.

4 Results

The results from the estimation of equation (1) are reported in Table 2: FE estimates are in the top panel, IV-FE in the bottom panel. In both panels, the first two columns show the estimates of a more parsimonious specification than (1), obtained by dropping the set of dummies $D_s * D_t$; the last two columns show the estimate of the full model.

In the FE estimates the correlation between skill intensity and exports is quite weak: the coefficient of the share of white-collar workers is positive and significant at 10 per cent, while that of the average level of education is not statistically different from zero. In the IV-FE estimation we get different results: the coefficient of the log of exports is now positive and significant in all specifications. Quantitatively, an increase by a (within) standard deviation of the log of exports (0.325) leads to growth in average level of education by 2 per cent,[10] that is, slightly more than a quarter of its standard deviation (0.078). The same rise in exports determines an increase in the share of white-collar workers by 3-4 percentage points (depending on the specification), that is, more than a quarter of its standard deviation (12.5 per cent).

[10] Within standard deviations are computed by subtracting sector-province averages from each observation.

Table 2: Baseline results

FE estimates				
	Average level of education	Share of white-collar workers	Average level of education	Share of white-collar workers
Log(Exports)	0.000	0.007*	0.000	0.006*
	(0.003)	(0.004)	(0.003)	(0.004)
Year dummies	YES	YES	YES	YES
Year*Industry dummies	NO	NO	YES	YES
No. Obs.	12,138	12,138	12,138	12,138

IV-FE estimates				
	Average level of education	Share of white-collar workers	Average level of education	Share of white-collar workers
Log(Exports)	0.063*	0.120**	0.069*	0.099*
	(0.034)	(0.050)	(0.038)	(0.051)
Year dummies	YES	YES	YES	YES
Year*Industry dummies	NO	NO	YES	YES
No. Obs.	12,138	12,138	12,138	12,138
First stage				
F of excluded instruments	11.9	11.9	8.65	8.65
Log(Instrument)	0.078**	0.078**	0.074**	0.074**
	(0.023)	(0.023)	(0.025)	(0.025)

Source: Authors' calculations.

Note: Regression weighted according to the size of each cell (in terms of interviewed individuals). Robust standard clustered at sector-province level in parenthesis. Significance: * 10%, ** 5%, *** 1%.

Diagnostic for the IV estimation is satisfying. The marginal effect of the instrument is positive and highly significant and, for the first two specifications, the F-statistics is above the rule-of-thumb value of 10 (Angrist and Pischke, 2009; Bound et al., 1995).[11] The comparison between the two panels suggests that the FE esti-

[11] The fact that the F-statistic falls below 10 in the full specification is not particularly worrisome. As Angrist and Pischke (2009) point out, just-identified IV estimates are median-unbiased and they are unlikely to be subject to the weak-instrument critique. Note moreover that our instrument is not to be considered weak, since the marginal effect of the first stage is always positive and significant (and fairly constant over specifications). Even reduced form regressions support this idea,

mates are plagued by a downward bias, that could be due to the "prepare to export" argument described in section 2.

5 Conclusions

This paper shows that exports have a sizable effect on the labor market outcomes. We find that in Italian provinces and sectors where exports flows increased over the period 2000-06, the skill intensity of the workforce also increased. Through an IV-FE specification that uses the evolution of imports in the destination markets as an exogenous pull factor for Italian exports, we show that the estimated effect is causal and quite large. This implies that international demand induces a tilt in labor demand in favour of more qualified individuals.

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since regressions of the dependent variables on the instruments (in the full specification) deliver a coefficient of 0.005 (s.e. 0.002) for the average level of education and 0.007 (s.e. 0.003) for the share of white-collar workers.

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