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Title: Trade and Wages: Evidence from Matched Employer-Employee Data

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1 Motivation and Project Outline

1.1 Motivation

The effect of trade on wages is one of the most crucial topics in international economics, and has been the subject of a vast and important literature. Understanding whether greater openness has a causal effect on wages is important for a number of reasons, and it is an issue of interest to a broad audience, including scholars, workers, employers, and policymakers. In the past decades, the distribution of wages became more unequal in a number of countries, and the increased openness of international markets has been identified as one potential explanation (see, e.g., Feenstra and Hanson, 1999) for this phenomenon. Further, the fear that trade openness might destroy jobs and lower wages domestically leads workers (and labor unions) to resist changes in trade policies that would likely be beneficial for society as a whole.

While the early studies have typically used countries or industries as the unit of observation (e.g. Katz and Summers, 1989), the focus in recent years has shifted toward the analysis of firms. A number of empirical studies have, in fact, documented substantial heterogeneity across firms in relation to their exposure to and participation in the international markets. Firms that trade differ substantially from firms that do not trade, under a number of dimensions. In particular, firms that engage in international transactions are a small fraction of the total, and tend to be significantly larger, more productive, and pay higher wages compared

to firms that only operate in the domestic market, even within narrowly defined industries (Melitz, 2008).

The "wage premium" paid by firms that export, in particular, has been the subject of a number of studies. Bernard, Jensen, Redding and Schott (2006), for instance, report that in the US, wages are 17 percent higher in exporting firms (6 percent higher when controlling for industry and size) than in non-exporting firms. The same pattern has been found in other countries (see Bernard et al., 2006 for further references).

The stylized fact just described has prompted scholars to conduct empirical studies to address the issue of causality. Most existing empirical papers treat labor as homogeneous and just look at industry-level or firm-level average wages, or average wages by education or occupation groups. This is to a large extent due to data limitations. In fact, most available firm- or plant-level datasets only provide average wages at the firm/plant level, and, typically, labor force survey-type data, which contain detailed information at the level of the individual worker, do not include firm-level information, in particular related to a firm's engagement in international markets. These data limitations have so far severely limited the researchers' ability to address the issue of causality. That is, they have prevented economists from determining whether the observed wage premium associated with exporting is due to workforce composition (i.e., exporting firms pay higher wages because they employ workers with greater skills) or rather to exporting firms paying workers of any given skill level a wage premium *beyond* what they could earn elsewhere. Because different models of exporting behavior with firm heterogeneity make different predictions about what should happen to wages, resolving this issue empirically would be informative to theorists as well.[1]

Further, all that researchers have been able to do so far is concentrate on differences between exporting and non-exporting firms, while neglecting the question of whether the impact of entering the export market is differentiated across workers *within the same firm*. We know that trade does not affect all firms equally, but are workers in the same firm affected by trade in the same way? In other words, does trade also change the shape of the wage distribution, for example increasing wage inequality within the firm? This is an important fact to establish. In fact, the overall effect of trade on wage inequality will depend not just on the *between-firm* effect (exporting versus non-exporting firms) but also on the *within-firm* impact, something we know almost nothing about.

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[1]In Melitz (2003) and Helpman and Itskhoki (2008b), for instance, wages and workforce composition are the same across firms. In the framework of Helpman and Itskhoki (2008a), in contrast, exporters pay higher wages, and these higher wages are explained in part by differences in workforce composition, and in part by an exporting wage premium.

1.2   Project Outline

In this project, we plan to use a unique, matched employer-employee database including *the entire workforce* of a sample of 1,500 Italian firms in the manufacturing sector observed from 1980 to 1997 to study the effects of exporting on wages at the firm level. Specifically, we will examine (1) whether there is a causal effect of exporting on wages, i.e. whether the observed wage differentials between exporting and non-exporting firms are due to differences in workforce composition or to exporting firms paying a wage premium to their workers, and (2) whether workers with different observable and unobservable characteristics are affected differently by trade, both *across* firms and, especially, *within* firms. We will use the sudden and large devaluation of the Italian Lira in 1992 as a source of exogenous variation, within industries, in the incentive of Italian firms to export. Because the devaluation has been differentiated by currency, in addition to looking at exporting vs. non-exporting firms differences over time, we will exploit pre-existing differences in destination markets as an additional source of identification.

The unique features of our data, i.e. the fact that we have longitudinal information on the entire workforce of a large sample of firms *matched with* detailed information on exporting behavior at the firm level, put us in an ideal position to address issues (1) and (2). Because data limitations prevented researchers from answering these questions so far, this project would result in a significant contribution to the existing research in international economics on the effects of trade on wages at the micro level.

In what follows, we describe in greater detail the data and the methodology we will adopt. We conclude by describing the proposed timeline for the project.

2   Project Details

2.1   Data

The data we will use in this project were constructed from the Bank of Italy's annual 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, nationality, year of creation, average number of employees during the year, value of shipments, value of investment, and, most important for our purposes, value of exports. The Social Security Institute (INPS) was asked to provide the complete work histories of all workers that ever transited in an INVIND firm for the period 1981-1997, including spells of employment in which they were employed in firms not listed in the INVIND survey. As we explain below, this feature of the data will allow us to separately identify and estimate firm effects and worker effects. Overall, we have information on about a million workers per year. The

information on workers include age, gender, area where the employee works, occupational status (production, clerical, manager), annual gross earnings (including irregular payments such as overtime, shift work and bonuses), number of weeks worked and the firm identifier. This database has been used by Iranzo, Schivardi and Tosetti (2008) and Macis (2008).

2.2 Methodology

First, we will begin by taking a descriptive approach to document, for the first time, the differences between exporting and non-exporting firms across the whole wage distribution, as opposed to just average wages. The matched employer-employee nature of our data will enable us to compare not just the distributions of "raw" wages, but also the distributions of workers' "talent" or "ability". This is an important exercise, motivated by recent theoretical papers on international trade with firm and worker heterogeneity. The general equilibrium model of Helpman and Itskhoki (2008a), in particular, predicts that exporting firms hire "better" workers than non-exporting firms. In particular, it predicts that there is a "jump" in worker's ability (and wage) associated with the exporting status, so the distribution of ability (and that of wages) is shifted to the right (first-order stochastic dominance) in firms that export. This is a very sharp prediction which can only be tested with matched employer-employee data. To do so, we will adopt the methodology developed by Abowd, Kramarz and Margolis (1999). According to Abowd et al. (1999), wages can be decomposed into a component due to time-variant observable individual characteristics, a pure worker effect, a pure firm effect and a statistical residual, as follows:

$$w_{it} = X_{it}\beta + \theta_i + \psi J_{(i,t)} + \varepsilon_{it} \tag{1}$$

where the subscript i denotes the worker, t denotes time, $J(i,t)$ is the firm where worker i works at time t. The worker fixed effect, μ, is the component of wages due to the worker's pure ability, irrespective of the characteristics of the particular firm, and net of the personal time-variant characteristics included in the controls X. Likewise, the firm effect, ψ, is interpreted as the component of wages specific to the firm where the employee works, and might respond to particular compensation policies, such as efficiency wages or rent-sharing. In our database, workers are followed even when they change firm, which allows us to apply the Abowd et al. (1999) methodology and identify firm and worker effects. We will thus be able to examine the distribution of skills θ (and wages w) and compare the distributions in exporting firms with the distributions in non-exporting firms.

Next, we will tackle the issue of causality in the relationship between exporting and wages. As mentioned above, we will exploit the sudden and substantial devaluation of the Italian lira which occurred in 1992 as an exogenous shock to the incentive of Italian firms to export. We will essentially implement a difference-in-differences methodology, comparing outcomes in

exporting firms vs. non-exporting firms over time, as well as a triple-difference methodology, exploiting pre-existing variation in firms' destination markets, and the fact that the 1992 Lira devaluation has been uneven across currencies. We are interested in understanding whether changes in average wages are due to changes in workforce composition or to exporting firms paying a wage premium to their workers. The issue is of relevance because different models of exporting behavior with firm heterogeneity make different predictions. In Melitz (2003) and Helpman and Itskhoki (2008b), for instance, wages and workforce composition are the same across firms. In the framework of Helpman and Itskhoki (2008a), in contrast, exporters pay higher wages, and these higher wages are explained in part by differences in workforce composition, and in part by an exporting wage premium.

The first step in this part of the paper will be to estimate an extended version of (1) as follows:

$$w_{it} = X_{it}\beta + \theta_i + \psi_t J_{(i,t)} + \varepsilon_{it} \tag{2}$$

where the difference between (1) and (2) is that in (2) the firm effects are year-specific. Because the year-specific firm effects ψ_t are obtained after taking into account worker effects, they can be interpreted as firm-and-year-specific wage premia.[2] Thus, for each firm and each year, we will have the entire distribution of workers' ability and an estimate of the wage premium. At this point, we will be able to run difference-in-differences (D-in-D) regressions of the following form:

$$Y_{jt} = \mu + \chi_{jt}\gamma + D_t\lambda + (\chi_{jt} * D_t)\delta + Z\pi + \varepsilon_j \tag{3}$$

where j indexes firms, Y_{jt} is the change in an outcome variable of interest, χ_{jt} is an indicator variable equal to 1 if firm j is an exporter and equal to 0 if firm j only serves the domestic market in year t, D_t is an indicator variable equal to 1 if year t is a post-devaluation year and 0 otherwise, and Z is a vector of firm characteristics such as industry and region. The outcome variables we will focus on are (a) average wages at the firm-year level, $\overline{w}_{jt} = \sum_{i\epsilon j} w_{it}$, (b) the firm-and-year specific wage premium, ψ_{jt}, and (c) the average ability of the firm's workforce, $\overline{s}_{jt} = \sum_{i\epsilon j} \theta_i$. The coefficient of interest in these regressions is δ, which captures a differential change in the outcome variables between exporting and non-exporting firms in the post-devaluation compared to the pre-devaluation period. Because the devaluation has been differentiated by currency, in addition to looking at exporting vs. non-exporting firms differences over time, we can exploit pre-existing differences in destination markets as an additional source of identification, and we can estimate difference-in-differences-in-differences (D-in-D-in-D) models as follows:

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[2]This is similar to Kaplan and Verhoogen (2006). However, our project differs from their paper in a number of ways, as we explain below.

$$Y_{jt} = \mu + \chi_{jt}\gamma + D_t\lambda + [(\chi_{jt} * D_t) * H_j]\delta + Z\pi + \varepsilon_j \tag{4}$$

where H_j is an indicator variable equal to 1 if firm j was predominantly trading with countries with respect to which the Italian Lira experienced a large devaluation, and 0 otherwise.

By comparing the estimated δ for outcome variables (a), (b) and (c), we will be able to assess whether changes in wages associated with exporting were determined by changes in workforce composition (e.g. exporting firms attracting workers with higher levels of skills) or rather by exporting firms paying a wage premium, for given skill, beyond what workers could get elsewhere.

We are also interested in examining whether exporting leads to greater wage inequality within the firm. We will answer this question by running models (3) and (4) with outcome variables that capture various aspects of within-firm wage dispersion, such as the year-specific standard deviation (or coefficient of variation) of wages, the 90-10 log wages differential, and the 90-50 and 50-10 log wage differentials, to explore whether inequality changed at the top or rather at the bottom of the wage distribution.

Our project substantially improves upon the existing literature. Kaplan and Verhoogen (2006) is the closest paper to our project. Building upon Verhoogen (2008), these authors use "linked" employer-employee data, and the Mexican devaluation of 1993 as an exogenous shock to the incentive to export. Albeit interesting, this paper presents a number of limitations. First, it only focuses on between-firms effects, while completely neglect the potential within-firm effects of exporting. Second, these authors do not have truly matched data: they have a dataset with information on firms (including export behavior) and another with workers, where the only information on firms is the number of employees. What they do to "match" the datasets is they use firm size as a proxy of export behavior. In our view, these are serious limitations. In contrast, our database is a genuine, matched employer-employee dataset, with detailed information on both the worker's and the firm's side, including precise information on exporting behavior (which does vary even among firms of the same size). Moreover, for each of our 1,500 firms, we have information on the entire workforce, which allows us to study within-firm effects in addition to between-firm effects.

References

[1] Abowd, J. M., Kramarz, F. & Margolis, D. N. (1999), "High Wage Workers and High Wage Firms," *Econometrica*, 67 (March), 251-333.

[2] Feenstra, R.C., and Gordon, H. H. (1997), "The Impact of Outsourcing and High-Technology Capital on Wages: Estimates for the United States, 1979-1999", *Quarterly Journal of Economics*, Vol. 114 (1999): 907-940.

[3] Helpman, E. & Itskhoki, O. annd Redding, S. (2008a), Inequality and Unemployment in a Global Economy. Mimeo, Harvard University.

[4] Helpman, E. & Itskhoki, O. annd Redding, S. (2008b), Wages, unemployment and inequality with heterogeneous rms and workers. Mimeo, Harvard University.

[5] Iranzo, S., Schivardi, F. and Tosetti, E. (2008): "Skill Dispersion and Firm Productivity: an Analysis with Employer-Employee Matched Data", *Journal of Labor Economics*, Volume 26, pp. 247-285.

[6] Kaplan, D. & Verhoogen, E. (2006), 'Exporting and Individual Wage Premia: Evidence from Mexican Employer-Employee Data'. Mimeo, Columbia University and ITAM.

[7] Katz, L. F., and Summers, L.H. (1989), "Can Interindustry Wage Differentials Justify Strategic Trade Policy?" In Robert C. Feenstra, ed., Trade Policies for International Competitiveness, 85-124. University of Chicago Press.

[8] Macis, M. (2008): "Wage Dynamics and Insurance", Mimeo, University of Michigan.

[9] Melitz, M. (2003), 'The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity', *Econometrica*, 71, 1695-1725.

[10] Melitz, M. (2008), "International Trade and Heterogeneous Firms", The New Palgrave Dictionary of Economics, Second Edition.

[11] Verhoogen, E. (2008), 'Trade, quality upgrading, and wage inequality in the mexican manufacturing sector', *Quarterly Journal of Economics*, 123, 489-530.