



The effects of exporting on wages: An evaluation using the 1999 Brazilian exchange rate devaluation



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ABSTRACT

The impact of international trade on wages has received substantial attention in recent decades; but only recently the specific effects of exporting on wage inequality have been investigated in detail. This paper employs the unexpected 1999 Brazilian exchange rate devaluation to identify the effects of exporting on Brazilian manufacturing firm-level wages using employer–employee linked data. We find that this export shock increased the average wage gap between the high and low productivity firms. Most of this wage increase took the form of a larger wage premium, but increased sorting of workers also played a significant role. Further scrutiny at the occupation–firm level indicates that the wage increases of managerial white-collar occupations came solely from wage premium variations. Skilled blue-collar workers also exhibited wage gains, but these gains came in equal shares from increased wage premium and worker sorting; the remaining occupational categories saw no wage increase.

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1. Introduction

The prospect of a dramatic increase in wage inequality has been an important argument used against further international trade integration. Indeed, such concerns have given rise to a substantial body of research about the effects of trade on wage inequality. Surprisingly, according to the literature reviews conducted by Goldberg and Pavcnik (2007) and Harrison, McLaren and McMillan (2011), several studies that are based on the classical trade models, which focus on between-industry and between-skill wage differences, find only a modest effect of trade on wage inequality over the last few decades.

This puzzling result has been challenged by the recent findings of Helpman et al. (2012) for Brazil and by Akerman et al. (2013) for Sweden, among others. These studies find that a large part of overall wage inequality occurs *within* industries and *within* occupations rather than *between* industries and *between* skills. More precisely, after controlling for workers' observable characteristics, Helpman et al. (2012) find that between-firm wage variation accounts for 40% of the within-industry wage inequality in Brazil. Most important, a major part of this is explained by firm engagement in international trade, since exporters pay on average higher wages for workers with ex ante identical observable characteristics.

The significance of these findings is that globalization by means of increasing access to foreign markets promotes current exporters' sales abroad. In turn, profits and wages rise, which increases within-industry wage inequality. Nevertheless, the increase in market access also unleashes a countervailing force: an increase in employment by exporting firms, which reduces wage inequality. Thus, the effect of exporting on within-industry wage inequality is theoretically ambiguous. In light of developing countries' recently increased access to the markets of developed countries—e.g., the trade agreements signed by the United States with Peru and Colombia in 2006—it is of considerable interest and potentially of great concern for policymakers to understand the mechanisms underlying the effects of an export shock on wages, in order to better predict its impact on wage inequality and better design public policies.

This paper exploits the large and unexpected 1999 Brazilian real exchange rate depreciation to identify the effects of an exogenous increase in exports on the wages of manufacturing firms. This identification strategy overcomes the difficulty posed by the fact that exporting status and wages are simultaneously determined, which is a major impediment to establish causality between them. The first contribution of this paper is to decompose such impact on firm-level wages into those changes that arise because of changes in workforce composition and those that are inherent to the firm's wage policies (i.e., the firm-level *wage premium*). These estimates give us the opportunity to evaluate predictions from several competing international trade models that are based upon different wage-setting mechanisms and labor market

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assumptions, and therefore lead to different policy prescriptions for altering wage inequality. As discussed in detail in the next section, models featuring a perfectly competitive labor market predict no wage premium, and therefore average wages should only be impacted by changes in workforce composition. In contrast, models that relax the competitive labor market assumption predict that the wage premium should be affected by an export shock.

Our second and most substantial contribution is to deepen the abovementioned analysis by examining the effects of an export shock at the occupational level within firms. This is the first paper, to the best of our knowledge, to infer whether the export shock-induced wage variation at the occupation–firm level arises due to changes in the wage premium or in the workforce composition. The paramount reason for such analysis resides in evaluating theoretical models that feature trade-induced workforce skill upgrade—e.g., Matsuyama (2007), Verhoogen (2008), and Brambilla, Lederman and Porto (2012)—across different occupations. Interestingly, the predictions from these models have not been thoroughly examined at the occupational level because the two extant empirical studies—namely, Verhoogen (2008) and Brambilla et al. (2012)—were hampered by data restrictions.

Moreover, occupational changes seem to be an important ingredient in wage inequality evolution in both developed and developing countries, as demonstrated by Kambourov and Manovskii (2008, 2009a, 2009b) for the United States, by Torres et al. (2013) for Portugal, and by Helpman et al. (2012) for Brazil. These findings imply that a within-industry analysis may not be sufficiently disaggregated to uncover channels at the occupation level capable of accounting for a significant part of the changes in wage inequality.

The rich Brazilian longitudinal employer–employee linked data used in this paper allow us to follow workers across different employers and to control for unobservable characteristics of workers and firms. Most important, these data contain detailed information about the worker's observable characteristics and occupation that is not available in the data used by earlier studies. The empirical methodology developed here is based upon Frías et al. (2009), but we improve upon it by using worker–firm match effects that are revealed to be very important in the recent studies of Woodcock (2010) and Krishna et al. (2014).

The between-firm wage inequality measured as the natural logarithm of the ratio of average wages between the largest firms (upper quartile in terms of employment) and the smallest firms (lower quartile in terms of employment) increased by approximately 15% in the 1995–2004 period. Our empirical estimates at the firm level using the 1999 Brazilian exchange rate devaluation account for almost two thirds of such increase. Most of the estimated wage increase took the form of a larger firm-level wage premium, though increased sorting of workers into more productive firms also played a role. These results support models featuring both export-led skill upgrade and non-neoclassical labor markets.

Applying the same wage inequality measure at the occupation–firm level reveals a heterogeneous pattern. More precisely, wage inequality increased for professional and managerial white-collar and skilled blue collar workers by 16 and 19% respectively, whereas inequality changed by less than 5% for the remaining white- and blue-collar occupations. Most important, the results indicate that the wage increases for white-collar occupations arise solely for professional and managerial occupations and due to wage premium variation. Thus, the export shock did not promote skill upgrading in white-collar occupations, which is in stark contrast with some of the skill upgrade models mentioned earlier. Interestingly, the skilled blue-collar occupations presented an increase in wage due in equal parts to wage premium and workforce composition improvement, while the unskilled blue-collar workers exhibited no wage gain, which resulted from a lack of variation in either workforce composition or wage premium.

Besides suggesting that firms' wage policies are heterogeneous across occupations and that unskilled blue-collar, skilled white-collar, and unskilled white-collar workers receive no wage gains from the

export shock, these results support the theoretical models which prescribe that exported goods are of better quality than those for domestic markets, and the increase in quality takes place by means of a more intensive use of skilled production workers. Finally, such heterogeneity at the occupational level implies a widening in the skill–unskilled wage gap, whereas the white collar–blue collar wage gap is shrinking due to the larger increase in the wage premium experienced by skilled blue-collar occupations.

This paper is connected to a growing body of work that examines the nexus between exporting and wages. The closest paper is Frías et al. (2009), which found that the Mexican 1994 peso devaluation-induced export shock increased wages in more productive firms, and that a large part of such increase occurred via wage premium. Given the proximity of our research to their paper, their work is discussed further in Section 3. The second closest paper is by Helpman et al. (2012), who investigated wage inequality within industries and occupations using Brazilian employer–employee linked data for 1986–1998. They estimated a structural model to conduct counterfactual simulations regarding the impact of trade openness on wage inequality. Although we also examine wage changes at the occupation level, this paper departs from their research by using more recent data and a different identification strategy, and goes a step further by estimating the effects of export shock on the components of the wage variation at the occupation–firm level.

Our paper is also related to the empirical literature on the exporter wage premium that grew significantly after the seminal works of Bernard and Jensen (1995, 1997), which revealed that exporters in the United States paid higher wages on average than non-exporters in the same industry. The survey by Schank, Schnable and Wagner (2007) points out that further studies confirmed the existence of such wage premium in several developed and developing countries.¹ From a different perspective, Krishna et al. (2014) and Davidson et al. (2012) empirically evaluated the effects of trade openness on the firm–worker match quality for Brazil and Sweden using within-industry tariff variation and between-industry export orientation variation, respectively. Both studies found that trade exposure affected both workforce composition and the quality of firm–worker match.

Another connection is with the heterogeneous firm models that exhibit heterogeneous wages for ex ante identical workers, such as Egger and Kreckemeier (2009, 2010, 2012), Helpman et al. (2010), Davis and Harrigan (2011), and Amiti and Davis (2012). Lastly, this paper is also connected to the literature that investigates export-induced skill upgrading, such as Verhoogen (2008) for Mexico, Fajnzylber and Fernandes (2009) and Molina and Muendler (2013) for Brazil, Alvarez and López (2009) for Chile, and Bustos (2011) and Brambilla et al. (2012) for Argentina, who found that firms which engage in exporting increase their demand for skilled workers relative to unskilled workers.

The remainder of the paper is organized as follows. Section 2 presents a brief review of related theoretical models and their testable predictions. In Section 3, we discuss the econometric methodology. Section 4 describes the data used. Empirical results and several robustness checks are presented in Section 5, and conclusions are drawn in Section 6.

2. Theoretical background

The development of several theoretical heterogeneous-firm international trade models was motivated by Bernard and Jensen's (1995, 1997) finding that firms within the same industry exhibited substantial heterogeneity in terms of productivity, employment level, wages, and even markets served. The most popular of these models is the one proposed by Melitz (2003). It consists of a multi-country economy where consumers have Dixit–Stiglitz preferences with a constant elasticity of

¹ For Latin America, in particular, the exporter wage premium was investigated by Alvarez and López (2005) for Chile and Krishna et al. (2014) for Brazil.

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