World Development 170 (2023) 106319

Contents lists available at ScienceDirect

World Development

journal homepage: www.elsevier.com/locate/worlddev

Gender wage discrimination with employer prejudice and trade openness ☆

Sarra Ben Yahmed

ZEW – Leibniz Centre for European Economic Research, Mannheim, Germany

ARTICLE INFO

Article history:
Accepted 28 May 2023
Available online 5 July 2023

JEL codes:
F16
J31
J7
L13

Keyword:
Gender wage gap
Employer taste-based discrimination
International trade
Imperfect competition
Oligopoly
Uruguay

ABSTRACT

This paper studies the effect of trade liberalisation on gender wage inequality. A simple trade model with employer taste-based discrimination and imperfect competition provides an explanation for the heterogeneous effects of international trade on the gender wage gap within sectors. While import competition reduces rents and with them the gender wage gap, the effect of exports depends on the level of concentration of a sector. On the one hand, easier access to foreign markets has a competition effect through the selection of the low-cost firms in non-concentrated sectors. On the other hand, better export opportunities with easier access to foreign markets can increase profits of domestic firms' in concentrated sectors and thus enable discriminatory firms to maintain wage gaps. Evidence from Uruguay supports the empirical relevance of the taste-based discrimination mechanism at the sector level.

1. Introduction

Reducing gender inequality remains an essential dimension of sustainable and inclusive development policies. While integration into the international trading system plays a fundamental role in promoting job creation, and enhancing welfare, research shows that international trade tends to increase wage inequality, not only between different skill groups but also among workers with similar observable skills.[1] Research on the effects of international trade on gender inequality has been less common and has offered mixed results. A better understanding of the conditions under which trade openness can promote gender wage equality, or on the contrary contribute to maintaining gender gaps, is crucial to adapt policies and make trade integration better conductive to sustainable development goals.

In this paper, I investigate the effects of international trade on the wage gap between equally-skilled men and women. Trade liberalisation has been expected to help to drive out wage discrimination via foreign competition. Yet, empirical research has also found a positive association between export shares and the gender wage gap in concentrated sectors.[2] I argue here that international trade has not only a pro-competitive effect but also a market-size effect that impacts positively profits and thus the ability to discriminate. The first contribution of this paper is thus to provide a novel theoretical framework that explains otherwise puzzling empirical results. I develop a theoretical model of trade with imperfect competition, taste-based discrimination and endogenous sectoral gender wage gap. It is a partial-equilibrium model with a single international oligopoly à la Cournot, where two countries produce and trade a homogeneous good. Firm output and export decisions are determined by their relative costs of production, which in turn depend on the firm's position in the distribution of prejudice. To hire male workers, prej-

☆ Thank Carlos Casacuberta for precious help with the data. I am grateful to Pierre-Philippe Combes, Matthieu Crozet, Lionel Fontagné, Cecilia Garcia-Peñalosa, Peter Neary, Marcelo Olarreaga and Alain Trannoy for helpful comments and suggestions. This paper also benefited from comments received in seminars at the Aix-Marseille School of Economics and the University of Oxford, the EDGE PhD workshop, the Arnoldshain Seminar, the EUDN PhD meeting, the RIEF workshop, and the EALE, LAGV and RES annual conferences.

E-mail address: sarra.benyahmed@zew.de

[1] See Fontes and Pavcnik (2007) for a literature review and Brambilla, Dix-Carneiro, Lederman, and Porto (2012) for several Latin-American countries. See also Helpman, Itskhoki, Muendler, and Redding (2017), and references herein, who show that firms' trade orientation explains part of the wage inequality among Brazilian workers with similar observable characteristics, holding similar jobs in the same sector.

[2] Berik, Rodgers, and Zveglich (2004) and Menon and Rodgers (2009).

https://doi.org/10.1016/j.worlddev.2023.106319
0305-750X/

udiced employers are willing to use their rents and offer men a wage premium, as in Becker (1957). They employ women only if the gender wage gap compensates the utility loss due to their distaste for hiring women. Women are thus hired by the least prejudiced employers whose perceived unit labour cost equals the female wage plus the monetary equivalent of their prejudice. The equilibrium gender wage gap is determined by the prejudice of the last employer who employs women, the marginal discriminator. All firms with a prejudice higher than the one of the marginal discriminator employ men and their unit labour cost equals the female wage plus the gender wage gap. Different levels of prejudice against women thus lead to heterogeneity in firm's labour costs.

In this framework, the pro-competitive effect of import penetration on wage discrimination results from the selection of the most-competitive (least-discriminatory) firms. As discrimination is costly, discriminatory firms are less productive than non-discriminatory firms. Discriminatory firms can afford their labour cost disadvantage in markets sheltered from competition, but higher import penetration spurs discriminatory firms to align their costs to those of nondiscriminatory firms. As a result, demand for male labour dwindles while that for female labour increases, reducing the wage gap.

The market-size effect of export opportunities on wage discrimination is a novel finding of this paper. Trade integration offers new sales opportunities abroad and the selection of firms into the foreign market determines the effect of exports on the gender wage gap. In sectors with already high level of domestic competition, only the most-competitive (least-discriminatory) firms are able to export. Least discriminatory firms expand production more than other firms, and their demand for (female) labour increases. Women can thus be employed by firms with lower prejudice level and the gender wage gap is reduced. In sectors with low level of domestic competition, discriminatory firms may also be able to export and earn profits abroad. In this case, there is no selection of firm into the export markets and trade liberalisation does not help to reduce rents nor the wage gap in the domestic country.

The second contribution of this paper is to test these theoretical predictions using a novel empirical strategy. Market access, as defined in economic geography models, captures the effect of trade openness. Market access fits the theoretical framework as it influences firms' profits, and thus firm ability to discriminate.[3] Both the access to foreign markets (export potential) and the access to the domestic market by foreign firms (import potential) are used to disentangle the market-size and the pro-competitive effects. These market potentials are constructed using determinants of bilateral trade flows that are exogenous to local characteristics. I use data from Uruguay, which dramatically opened its economy to international trade in the 1990s through multilateral and regional trade agreements, in particular with the creation of the MERCOSUR. Over this decade, gender prejudices on labour market access and pay remained frequent among employers. The gender wage gaps are estimated for each sector and year using individual data from the household survey *Encuesta Continua de Hogares*. Lastly, a Herfindahl index of production concentration at the sector level captures the level of domestic competition. The empirical findings are consistent with the theory. First, I find that more concentrated sectors exhibit higher gender wage gaps. Second, I find evidence of the pro-competitive effect of trade. Greater market penetration by foreign competitors in a concentrated sector is negatively associated with the sectoral gender wage gap. Better access to foreign markets also reduces the gender wage gap in sectors that were already competitive (had a low concentration level) prior trade liberalisation. This is consistent with the selection of least discriminatory firms into export markets in sectors with a high number of firms. Finally, I also find evidence of the market-size (or profit-enhancing) effect of trade integration in concentrated sectors. The interaction of the export potential with the concentration index is associated with a positive effect on the gender wage gap, mitigating the competition effect of a greater export potential. For high levels of concentration, greater export potential actually increases the wage gap.

The work here is closely related, first, to papers that investigate the role of competition on gender inequality and whose empirical results are consistent with the taste-based discrimination theoretical framework. A few papers study the role of competition stemming from domestic forces (Black & Strahan, 2001; Hellerstein & Neumark, 2006; Heyman, Svaleryd, & Vlachos, 2013; Weber & Zulehner, 2014).

Another group of papers focus on the effect of a change in competition level brought by trade openness. Ederington, Minier, and Troske (2009) find that a fall in tariffs increases the female share within industries in Colombia. The paper here focuses on wages. The pro-competitive effect of import penetration that reduces gender wage gaps in concentrated sectors corroborates evidence by Black et al. (2004) for the United States, and Artecona and Cunningham (2002) for Mexico. The novelty of the paper here is to investigate not only the impact of greater import penetration but also the impact of greater export potential both theoretically and empirically. While better export opportunities reduce the gender wage gap in non-concentrated sectors, better export opportunities may, however, increase rents of discriminatory firms in concentrated sectors and hereby increase the gender wage gap. The latter finding is similar to what Berik et al. (2004) find for Taiwan and South Korea. I show in the theoretical part that this result is consistent with prejudiced employers as trade openness does not necessarily lower profits. This finding is new in the literature and explains otherwise puzzling results. Overall, the theory and the empirics show that both the pro-competitive effect via import competition and the profit-enhancing effect via export opportunities matter for gender wage inequality.

Second, the paper contributes to the broader literature that studies the impact of international trade on gender inequality through other channels than product market competition. One of the first approaches to the issue is based on traditional trade theories and sectoral specialization given comparative advantages in international trade (Busse & Spielmann, 2006; Wood, 1991; Wood, 1994; Sauré & Zoabi, 2014). The work here adopts a different approach as it investigates how trade affects gender inequality within sectors. Apart from sectoral specialization, trade can affect gender outcomes through technological change, and does so in different ways depending on the workers' skill level and the technology adopted (Juhn, Ujhelyi, & Villegas-Sanchez, 2014; Ben Yahmed, 2012; Bøler, Javorcik, & Ulltveit-Moe, 2018). Finally, wage inequality between workers with identical skills can also be generated in a framework with imperfect labour market competition instead of imperfect product market competition as in this paper (Black, 1995; Fanfani, 2022). Employers' monopsony power can be embedded in a model of trade to study the impact of international trade on wage inequality (e.g. Jha & Rodriguez-Lopez, 2021). But despite a large interest in the effect of international trade on (gender) wage inequality, understanding how discrimination and imperfect labour market competition jointly relate to this issue remains an open area for future research.

The remainder of the paper is organised as follows. In the next section I develop a model of oligopolistic competition and wage discrimination in an open-economy. In Section 3, I describe the empirical methodology, the data, and descriptive statistics on gender wage gaps and trade in Uruguay over the 1990s. The empirical results are presented in Section 4. Last, Section 5 concludes.

[3] See Fujita, Krugman, and Venables (1999) where the wages paid by a firm in a given region depend on regional access to other markets.

2. A theoretical framework

The next section first outlines a theoretical framework with taste-based discrimination and imperfect competition to then provide intuitions behind novel implications of international trade on gender wage gaps within sectors. The theoretical framework focuses on the product market competition mechanism. In a setting with prejudiced employers, an increase in competition pressure is expected to reduce the gender wage gaps due to unequal rent sharing between male and female employees. I explain below how international trade can have more than one effect on gender wage gaps. The model is developed in Appendix B.

2.1. The setting

Domestic firms produce hiring male and/or female employees who are equally productive. Employers, however, have heterogeneous prejudices against women. Employers' prejudice are, in Becker's words, a distaste for, or aversion to, cross-gender contact at work. This disutility is integrated in the production cost. The manager of firm i acts upon the *perceived* unit cost of production, which is the female wage plus the disutility cost $c_i = w_f + d_i$if firm i employs women and the male wage $c_i = w_m$ if firm i employs men. Employer i hires women if the gender wage gap compensates the utility loss d_i, i.e. $w_f + d_i < w_m$. The equilibrium gender wage gap is determined by the level of prejudice of the marginal firm N_f, i.e. the last firm which hires women and is indifferent between employing men and women.

This setting leads to gender segregation across firms except for the marginal firm. From here on, I denote "'female firms"' the firms that employ women, while "'male firms"' are those that employ men. As a result of the heterogeneity in perceived unit costs, firms have heterogeneous output levels. Female firms' unit cost increases and production level decreases with the employer's prejudice d_i. Yet, a female firm always produces more than a male firm given that their costs remain $w_f + d_i$ lower than the one of male firms, w_m.

Standard predictions of the Beckerian model can be derived here. First, an increase in the number of firms reduces the gender wage gap. The intuition behind this competition effect is as follows. The entry of firms reduces the level of output produced by each firm. Less-discriminatory firms have lower unit costs, so their market share falls less than that of more discriminatory firms. Thus the demand for female workers increases relative to that for male workers with firm entry, and the wage gap is reduced. This effect highlights the role of the number of firms in reducing the incidence of taste-based discrimination. Second, the wage gap increases as more women enter the labour market. Women are first hired by the least discriminatory firms. As more firms hire women to absorb the larger female labour supply, the marginal employer has stronger prejudices and requires a wider wage differential to hire female employees. As expected, the opposite holds if the male labour supply rises.

I incorporate this setting into a simple partial equilibrium model of intra-industry trade, which brings out a novel effect of trade liberalisation on the gender wage gap via the competition channel. Two countries D and F (for the domestic and foreign country) with heterogeneous firms trade a homogeneous good under oligopolistic competition. Firms in both countries engage in intra-industry trade to capture some of the rents that exist in the foreign market. To export to market D, foreign firms have to pay an iceberg trade cost τ_D, while domestic firms have to pay τ_F to export to market F.

To allow for firm entry/exit in a simple way, I assume that there is an exogenous fixed number of *potential* entrants, i.e. the maximal number of firms operating in a market.[4] They are denoted N_D at home and N_F abroad. A potential firm may or may not produce and does not incur additional fixed costs if it does. Even if a potential firm does not produce, it exerts a competitive pressure as other firms account for the total number of potential competitors.[5]

2.2. Trade liberalisation and the gender wage gap

What are the effects of international trade on the gender wage gap in this setting? The model shows that it is important to distinguish between (i) a fall in the trade costs to export to foreign markets τ_F and (ii) a fall in the trade costs to import to the domestic market τ_D.

A fall in the trade costs to enter the foreign market τ_F has opposing effects on the gender wage gap and it depends on the domestic market structure.

Proposition 1 (*The market-size effect of a reduction in export costs*). A fall in the costs to enter the foreign market τ_F increases the sectoral gender wage gap if the number domestic of firms is small.

First, lower trade costs make it easier for firms to sell in the foreign market. This is the market-size effect of trade liberalisation as domestic firms can access a larger market. This result is derived in section B.2.1 in the appendix, assuming that both female and male firms produce for the foreign market (abstracting from the extensive margin of production). The effect comes from variation in the relative costs and production levels of male firms relative to female firms, i.e. the intensive margin of production. This market-size effect of trade increases the gender wage gap and it is proportional to the cost disadvantage of discriminatory firms. As transport costs fall, their cost disadvantage represents less of a hindrance and male firms export relatively more. The next proposition highlight another effect of export costs via the extensive margin. The market-size effect of trade is more likely to dominate in a sector with a large cost disadvantage between male and female firms. This is the case when the number of firms at home is low, i.e. when domestic competition before trade liberalisation is low. This is a particularly interesting result, as it emphasizes the profit-enhancing effect of foreign-market access that has been overlooked in previous empirical analysis of the effect of trade openness on the gender wage gap.

Proposition 2 (*The competition effect of a reduction in export costs*). A fall in the costs to enter the foreign market τ_F reduces the sectoral gender wage gap if the number domestic of firms is large.

A fall in the costs to export to foreign markets has a second and opposite force on the gender wage gap. Indeed, it also enables firms that were already exporting to reduce their price and sell more abroad. As a result of firms' strategic interactions in the foreign market, the foreign price falls with a reduction in export costs.

[4] In as similar way as in chapter 5 Helpman and Krugman (1987).

[5] The assumption of a fixed number of potential firms is better suited to study countries with low entry rates that can be explained by characteristics such as stringent market regulations and high start-up costs acting as a deterrent. Fisman and Allende (2010) find that high entry regulation leads to the expansion of existing firms instead of entry of new firms, which results in higher concentration levels. Mitton (2008) shows that concentration of sales and employment is substantially higher in smaller and less developed countries and countries with higher entry costs for new firms, weaker antitrust policy and burdensome regulation. We later apply the theoretical framework to Uruguay, a small country with very low net entry rates in some industries, ranging from 0 to 25% in the manufacturing sector at the end of the 1980s, as shown in Fontes (1995). They further document that industries with highest barriers to entry had larger cohorts of older firms surviving from the period of strong market protection with import-substitution strategies. A decade later, Uruguay had entry costs above the world average according to the index developed by Djankov, La Porta, Lopez-de Silanes, and Shleifer (2002).

The fall in the price in the foreign market benefits relatively more low-cost less discriminatory firms. One can show in the model that the competition effect gets larger when the number of firms increases. For a high number of domestic firms N_D, it dominates the market size effect, trade liberalisation favours the low-cost non-discriminatory firms and this selection of firms in the export markets contributes to a reduction in the gender wage gap.

Proposition 3 (*The competition effect of a reduction in import costs*). A fall in import costs τ_D reduces the sectoral gender wage gap in the domestic market.

This is the result of two forces. First, foreign firms pay lower trade costs to enter country D's market so that the average cost of competitors falls. This puts a downward pressure on the domestic price. Second, as foreign firms sell now at lower cost they are able to sell more, this generates a fragmentation effect. Both effects reduce the rents that domestic employers used to pay men a premium, which reduces the gender wage gap.

Moreover, the reduction in the gender wage gap is larger if foreign competitors are more productive and if the number of foreign firms N_F entering the domestic market is large. The last effect also operates through the two mechanisms cited above: downward pressure on the average cost because of an increase in the number of firms, and the fragmentation effect as more firms sell in the domestic market.

2.3. Discussion of the theoretical framework

The theoretical framework brings out novel and policy-relevant implications of international trade on the wage gap. In particular, the results that exports have a market-size effect that dominates its competition effect in concentrated sectors is new, and helps explain previous empirical findings. For example, Menon and Rodgers (2009) find that the export share increases the gender wage gap of concentrated sectors in India. While in less concentrated sectors, higher export shares are associated with a lower gender wage gap. Berik et al. (2004) also find similar results for Korea and Taiwan. The fact that model helps explain results considered as puzzling so far support the value of theoretical framework. Before turning to testing the prediction of the model using data for Uruguay, I mentioned here limitations of the model and how the theoretical framework could be changed to study other aspects of the link between trade, competition and taste-based discrimination.

The model assumes an exogenous number of potential firms. Introducing more explicitly firm entry in a setting with imperfect competition could bring interesting effects through the change in the distribution of prejudices among employers. Using a dynamic model would also make it possible to test dynamic implications of the Beckarian predictions in a model of trade.

The literature on competition has shown that the link between competition and the concentration of market share depends on the characteristics of the market. For example, Ederington and Sandford (2016) show in a dynamic model with monopolistic competition that competition and the share of discriminatory employers depend not only on the sunk start-up cost, but also on the the fixed cost and the elasticity of substitution across varieties. This three elements have however different effect on the concentration level of a sector. Studying the role of other determinants of competition, in addition to the number of firms and their unit cost as done here, could uncover more complex links between international trade, competition and taste-based discrimination.

In the framework developed in this paper, the labour supply has been taken as exogenous. Ederington et al. (2009) develop a model with endogenous labour supply but keep the gender wage gap constant. Making the supply of female and male labour endogenous would add another mechanism through which the gender wage gap changes. Doing so while keeping the gender wage gap endogenous as in the model developed here is beyond the scope of this paper but would be a valuable extension.

3. An empirical investigation

The theoretical framework sets out how the sectoral gender wage gap is impacted by trade liberalisation and how it depends on the market structure of the sector. The model fits economies with at least some tradable sectors that are imperfectly competitive and enable firms to enjoy rents, and where some employers are prejudiced against female workers. I now proceed to test the model's predictions with data for Uruguay, an economy that experienced considerable trade liberalisation in the 1990s. At the end of 80s, several manufacturing industries had high concentration levels and very low or almost no entry Fontes (1995). Moreover, gender prejudices were strong at the time of trade liberalisation. According to the World Value Survey, in 1996, 49% of male mangers agreed that "when jobs are scarce, men should have more right to a job than women" and 38% of them agreed that "if a woman earns more money than her husband, it's almost certain to cause problems". The next section presents how sectoral gender wage gaps are estimated. Section 3.2 then discusses Uruguay's domestic market structure and presents the domestic competition variable, and Section 3.3 explains how market potentials are calculated to obtain measures of trade openness. The empirical specification implemented in the last step is described in Section 3.4.

3.1. Calculating the gender wage gaps

I use data from the Uruguayan longitudinal household survey (Encuesta Continua de Hogares, hereafter ECH) over the 1983–2003 period. The survey covers all urban areas in the country which represent about 90% of the population. Given the theoretical framework, I restrict the sample to employees (exposed to employer discrimination), aged from 18 to 65, and working in the manufacturing sector (most exposed to international trade). Table A1 in the appendix provides descriptive statistics on the sample.

To obtain a measure of the gender wage gap, I estimate a Mincer-type equation for each gender $g \in \{f, m\}$, year t and sector j separately:

$$\ln W_{igjt} = X'_{igjt}\beta_{gjt} + \epsilon_{igjt}$$

The vector of individual characteristics, X_i, includes the number of years of education, potential experience and its square, and a dummy for Montevideo to control for wage differences between the capital and other urban areas.[6] The returns to characteristics $\widehat{\beta}$s vary by sector and year. I use sectors for which there are enough female and male observations, namely the food and beverage industry, the machinery industry, the chemicals industry, the paper and printing industry, and the textile, apparel and leather industry. The decomposition of the total gender wage gap for each year t and sector j is, following Oaxaca (1973) and Blinder (1973):

[6] Arguments can be made for the inclusion or exclusion of occupational controls. I here consider that human-capital characteristics should determine the job position, hence I do not control for occupation. Controlling for occupation increases the gender wage gap, especially at the beginning of the period in the following industries: food, machinery, paper and printing, and chemicals. This comes from bigger differences in the returns to education within occupation as compared to the mean difference when occupation is not controlled for. Estimating the wage gap for private-sector employees only does not change the results.

$$\overline{\ln W}_{mjt} - \overline{\ln W}_{fjt} = \left(\overline{X}_{mjt} - \overline{X}_{fjt}\right)\widehat{\beta}_{mjt} + \overline{X}_{fjt}\left(\widehat{\beta}_{mjt} - \widehat{\beta}_{fjt}\right) \quad (1)$$

where $\overline{\ln W}_{gjt}$ denotes the mean log wage for group g in sector j and year t, $\overline{X}_{gjt}$ denotes the average level of characteristics of group g in sector j and year t. $\widehat{\beta}_{gjt}$ is the estimated parameter from the corresponding wage equation. The adjusted wage gap, subsequently used as a measure of wage discrimination, equals the difference in returns to similar characteristics:

$$\widehat{WG}_{jt} = \overline{X}_{fjt}\left(\widehat{\beta}_{mjt} - \widehat{\beta}_{fjt}\right)$$

The wage gap is computed for 2-digit manufacturing sectors for which there are enough male and female observations to estimate the gender wage gap.[7] This results in a panel of five 2-digit sectors over 20 years. The small sample size is a limitation of the study.

Table 1 shows the evolution of the total and adjusted gender wage gaps, together with the female share. In the whole economy, the wage gap fell steadily over the 90s, while the female share increased from 42 to 48%. In the manufacturing sector, which was directly affected by trade liberalisation, both the raw wage gap and the adjusted wage gap fell in the early 1990s when the Mercosur was first introduced, and fell further in the mid-1990s, corresponding to a period of consolidation of the trade agreement as shown in. The rise in the wage gap over the early 2000s is concomitant with the Uruguayan banking and currency crisis. The adjusted wage gap is always bigger than the raw wage gap. Differences in productive characteristics such as human capital between men and women do not help explain the raw wage gap. In fact, women have higher levels of education than that of men (Table A1 in the Appendix). The differences in the returns to characteristics are here the only source of gender differences in wages.

Looking at sectoral variation, both the raw wage gap and the adjusted wage gap are substantially larger in the manufacturing sector where the female share is lower compared to whole economy. At the beginning of the period, the wages of men were 50% higher than those of women (40 log points), with the gap being unexplained by differences in characteristics. During the first half of the 2000s, the raw wage gap was around 30% (27 log points) and remained unexplained by observable characteristics. Despite the fact that the wage gap has fallen in almost all manufacturing sectors, there remains substantial sectoral variation at the end of the period. Gaps are higher in the textile and garment industry, followed by the food, beverage and tobacco industry, where the female shares of employment are the highest. In the Machine and Equipment sector, the raw and the adjusted wage gaps are particularly low; this is also the sector for which the wage gap is less precisely estimated due to a small number of observations.

3.2. The measure of domestic competition

The model shows that the effect of trade liberalisation on the gender wage gap depends on both the direction of trade (exports vs. imports) and on the level of domestic competition of the sector. In the model, domestic competition is represented by the number of firms and their relative production costs. As proxy for industry competition, I use the Herfindahl index of production concentration, which is unambiguously reduced by the number of firms. In addition to the fact that the index depends on the variables present in the model, the Herfidhal index has been shown to be an appropriate proxy for domestic competition. Related to the issue under study here, Ederington and Sandford (2016) develop a dynamic model of a monopolistically competitive industry with sunk costs, sequential entry and discriminating and non-discriminating firms. Also in this setting, they show that market deregulation (an exogenous entry of firms) reduces levels of discrimination within an industry and that this effect is higher in the most concentrated industries. These findings support the use of concentration indexes to analyze empirically the heterogeneous effects of trade liberalisation on discrimination at the industry level. In the case of Uruguay, Fontes (1995) document that concentrated industries, such as beverages and paper industries, had older and bigger firms and indeed lower entry rates.

The Herfindahl index is calculated as $C_{jt} = \sum_i^N \frac{q_{ijt}}{Q_{jt}}^2$, where $\frac{q_{ijt}}{Q_{jt}}$ is firm i's share of production in industry j and year t. The index values range from 1, for a monopoly, to $\frac{1}{N}$ if firms have equal market shares. The concentration index is computed based on a firm surveys from the National Statistics Institute (INE), the *Encuesta Industrial Anual* for 1983–1996 and the *Encuesta de Actividad Económica* for 1998–2003. Data for 1997 are taken from the Economic Census.[8] Table 2 shows that even at the two-digit level, the index varies across sectors and over time. The most concentrated sector in the early 1980s was the paper industry, while in 2000, the food and beverages industry and the machinery industry were the most concentrated.

In the next section, the empirical analysis uses pre-liberalisation concentration indexes to make sure that they are not influenced by trade liberalisation. In the mid-80s, the average Herfindahl index for 2-digit industries varies from 0.19 in Textile & Garment to 0.39 in the Paper & Printing sector.

3.3. The measures of market potential

Uruguay experienced considerable trade liberalisation in the 1990s, at the regional level with the founding of Mercosur in 1991 and its amendment in December 1994, and at the multilateral level with the GATT and WTO. The level and the dispersion of Uruguay's MFN tariffs have fallen across all sectors (see Figure A1 in the appendix). In December 1997, Mercosur members agreed to increase temporarily their common external tariff by 3 percentage points. The reduction in tariffs resumed after 2000. Uruguay is a small open economy whose export and import shares have been rising (as depicted in Figure A1 in the appendix).

I use market potentials as defined in economic geography models to measure the market-size effect and the competition effect of trade integration on gender wage gaps. I prefer market potential measures over trade shares for two reasons. First, market potentials reflect information on the economic mechanism that the model presented in Section 2 intends to stress: firms' ability to make profits at home and abroad. Similarly, New Economic Geography (NEG) models formalize a causal relationship between wages and market potential as the latter determines the level of profit that can be shared with employees (Fujita et al., 1999). Second, it is possible to construct market potential measures that are exogenous to local characteristics, as explained below.

I compute the export and import potential measures for each year in the period 1983–2003 using bilateral trade and production data from the *TradeProd database* (Mayer et a., 2008; de Sousa, Mayer, & Zignago, 2012), the *Distances database* with bilateral distances and common official language from the CEPII (Mayer & Zignago, 2011). The Uruguayan MFN tariffs at the 2-digit sector level comes from the Latin American Integration Association (LAIA) and is available from 1991.[9]

[7] I only keep sector×year cells with at least 20 female or male observations. Sectors excluded from the analysis are Wood and Products of Wood, Non-Metallic Mineral Products and Basic Metal Industries. The median number of observations in a sector×year cell is 105 for women and 279 for men.

[8] I am grateful to Carlos Casacuberta for his help with the data on Herfindhal indexes.

[9] I am grateful to Carlos Casacuberta for sharing with me data on MFN tariffs.

Table 1
Gender Employment and Wage Gaps.

		1990	1992	1994	1996	1998	2000	2002
Whole economy	Female share	0.42	0.42	0.42	0.44	0.45	0.46	0.48
	Raw Wage Gap	0.23	0.19	0.18	0.14	0.14	0.11	0.04
	$\ln W_m - \ln W_f$	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
	Wage Gap	0.26	0.27	0.25	0.23	0.20	0.19	0.13
	$\overline{X}_f\left(\widehat{\beta}_m - \widehat{\beta}_f\right)$	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Manufacturing sector	Female share	0.33	0.33	0.30	0.30	0.31	0.32	0.31
	Raw Wage Gap	0.40	0.35	0.36	0.34	0.24	0.22	0.27
	$\ln W_m - \ln W_f$	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
	Wage Gap	0.44	0.40	0.41	0.40	0.26	0.29	0.30
	$\overline{X}_f\left(\widehat{\beta}_m - \widehat{\beta}_f\right)$	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
Food Beverage	Female share	0.25	0.26	0.26	0.26	0.31	0.31	0.28
	Raw Wage Gap	0.22	0.27	0.31	0.29	0.33	0.23	0.24
	$\ln W_m - \ln W_f$	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)
	Wage Gap	0.25	0.33	0.51	0.35	0.30	0.33	0.36
	$\overline{X}_f\left(\widehat{\beta}_m - \widehat{\beta}_f\right)$	(0.06)	(0.07)	(0.07)	(0.05)	(0.07)	(0.05)	(0.07)
Textile Garment	Female share	0.60	0.62	0.59	0.60	0.56	0.55	0.61
	Raw Wage Gap	0.67	0.54	0.54	0.58	0.40	0.41	0.60
	$\ln W_m - \ln W_f$	(0.04)	(0.04)	(0.05)	(0.06)	(0.05)	(0.07)	(0.08)
	Wage Gap	0.72	0.54	0.52	0.63	0.40	0.38	0.58
	$\overline{X}_f\left(\widehat{\beta}_m - \widehat{\beta}_f\right)$	(0.04)	(0.04)	(0.05)	(0.06)	(0.05)	(0.07)	(0.15)
Chemicals Plastic	Female share	0.25	0.27	0.28	0.29	0.31	0.30	0.34
	Raw Wage Gap	0.16	0.06	0.15	0.12	0.11	0.22	0.09
	$\ln W_m - \ln W_f$	(0.06)	(0.07)	(0.07)	(0.08)	(0.09)	(0.09)	(0.11)
	Wage Gap	0.28	0.15	0.24	0.22	0.09	0.29	0.18
	$\overline{X}_f\left(\widehat{\beta}_m - \widehat{\beta}_f\right)$	(0.10)	(0.13)	(0.10)	(0.09)	(0.11)	(0.08)	(0.11)
Machines	Female share	0.12	0.11	0.13	0.13	0.10	0.16	0.15
	Raw Wage Gap	0.01	0.06	−0.12	0.08	0.06	−0.02	0.16
	$\ln W_m - \ln W_f$	(0.10)	(0.10)	(0.09)	(0.10)	(0.11)	(0.12)	(0.21)
	Wage Gap	-0.03	0.01	−0.20	0.02	−0.11	0.04	0.27
	$\overline{X}_f\left(\widehat{\beta}_m - \widehat{\beta}_f\right)$	(0.14)	(0.31)	(0.18)	(0.10)	(0.28)	(0.12)	(0.37)
Paper Printing	Female share	0.26	0.27	0.27	0.31	0.24	0.38	0.30
	Raw Wage Gap	0.02	0.15	0.37	0.35	0.05	0.12	0.22
	$\ln W_m - \ln W_f$	(0.09)	(0.10)	(0.12)	(0.13)	(0.15)	(0.10)	(0.13)
	Wage Gap	0.21	0.17	0.41	0.31	0.20	0.19	0.40
	$\overline{X}_f\left(\widehat{\beta}_m - \widehat{\beta}_f\right)$	(0.16)	(0.12)	(0.14)	(0.23)	(0.19)	(0.11)	(0.19)

Source: Author's calculations based on the Encuesta Continua de Hogares, INE, Uruguay. Wages include bonuses. The wage gaps are expressed in logarithm. The wage difference in percentage points is $(exp(wage\ gap) - 1) \times 100$.

Table 2
The Herfindahl index of production concentration in manufacturing industries.

Year	1983–85	1990	1992	1994	1996	1998	2000
Textile & Garment	0.19	0.22	0.27	0.28	0.30	0.18	0.19
Chemicals & Plastics	0.26	0.24	0.27	0.29	0.31	0.35	0.41
Machines	0.29	0.14	0.14	0.16	0.25	0.27	0.34
Food & Beverages	0.32	0.22	0.24	0.29	0.27	0.29	0.30
Paper & Printing	0.39	0.32	0.31	0.41	0.48	0.40	0.32

Note: $C_{jt} = \sum_i^N s_{ejt}^2$, where s_{ijt} is firm i's share of production in industry j and year t.

The first step consists in estimating a gravity equation for each sector j and year t (as in Fally, Paillacar, & Terra, 2010; Hering & Poncet, 2010). Total sales from country D to country F are expressed as:

$$lnX_{DFjt} = \sum_{kt} \beta_{kjt} \tau_{k,DFjt} + FX_{Djt} + FM_{Fjt} + \epsilon_{DFjt} \quad (2)$$

where X_{DFjt} is the flow of good j from country D to country F in year t. The variable FX_{Djt} is an exporter fixed effect which is sector-country-year specific: this captures characteristics such as the number of firms and the average cost of production. Analogously, the importer fixed effect FM_{Fjt} captures characteristics particular to each sector of the importing country in a given year. The vector $\tau_{k,DFjt}$ includes k variables of the trade costs of entering market F. For the period 1983–2003, the set of trade costs include bilateral distance, contiguity, common language, past colonial relationship and common legal origine that vary across trade partners, and common currency and regional trade agreements, inlcuding the MERCOSUR trade agreement, that vary across trade partners and years. Starting from 1991, I have also access to tariff information at the sector level. Thus I construct two sets of market potential variables, one without tariffs for 1983–2003, and another with sectoral tariff for 1991–2003. Note however that the benchmark variables calculated for 1983–2003 without sectoral tariff do vary across sector and time even if distance and language do not. The gravity equation is estimated separately for each sector j and year t so that it allows the effect of distance and language to vary across sectors and time. For instance, distance represents a bigger trade barrier for perishable products than non-perishable ones but the effect of distance may be reduced over time as technological progress reduces transportation time.

In a second step, I use the estimated coefficients of Eq. (2) to compute Uruguay's access to foreign markets, its export potential (EP) and foreign competitors access to Uruguay, its import potential (IP), at the sector level. Uruguayan firms' access to foreign markets when exporting good j is denoted by $\widehat{EP}_{URY,jt}$. It captures the market-size effect of trade. It is the sum of the market accesses to all of Uruguay's trade partners F. In this case, Uruguay is the exporter country D and the trade partners are the importer countries F. Uruguayan firms' access to market F depends (i) on the costs to enter this market $\tau_{URY,Fjt}$, (ii) on the size of the demand in the foreign market F and (iii) the level of competition in the foreign market F both captured by the importer fixed-effects $\widehat{FM}_{Fjt}$.

$$EP_{URYjt} = \sum_F EP_{URY,Fjt} = \sum_F \left(\widehat{FM}_{Fjt} \prod_k (\tau_{k,URY,Fjt})^{\widehat{\beta}_{kjt}} \right)$$

Note that the characteristics of the Uruguayan sector are not included in the EP variable, but they are controlled for in the gravity Eq. (2). By excluding the sector-year-specific exporter fixed-effects $FX_{URY,jt}$, this measure is exogenous to domestic factors that affect the sector's export supply capacity, such as its competitive advantage or changes in the labour supply. In particular, this approach reduces the concern of reverse causality between a sector's gender wage gap and its export shares as it may be argued that maintaining low female wages, likely associated with a high gender wage gap, reduces (female) labour costs and thus increases competitiveness and exports.[10]

Foreign firms' access to Uruguay is denoted by IP_{jt}. It captures the pro-competitive effect of trade. It is the sum of all of trade partners' access to the Uruguayan market. In this case, Uruguay is the importer country F and the trade partners are the exporter countries D. The competitors' access depends on the costs to enter the Uruguayan market $\tau_{F,URY,jt}$ and on the competitive advantage of competitors captured by the exporter fixed-effects $\widehat{FX}_{Fjt}$.

$$IP_{URYjt} = \sum_F IP_{F,URYjt} = \sum_F \left(\widehat{FX}_{F,jt} \prod_k (\tau_{k,F,URYjt})^{\widehat{\beta}_{kjt}} \right)$$

Note that the characteristics of the Uruguayan sector are not included in the IP variable, but they are controlled for in the gravity Eq. (2). By excluding the sector-year-specific importer fixed-effect $FM_{URY,j,t}$, the IP measure does not capture (is exogenous to) domestic factors that affect import penetration. Thus, this approach limits the concerns of reverse causality between the gender wage gap of a sector and the import shares of that sector.

Fig. 1 depicts the evolution of the estimated market access variables IP and EP in five 2-digit manufacturing sectors for which there are enough male and female observations to estimate the gender wage gap. Both variables rose in the 1990s in the Food and Beverage industry, Chemicals Products industry, Machines and Equipments industry. In the Textile and Garment industry Uruguay's market access remained constant while IP slightly decreased. Most sectors suffered from a fall in EP in the late 1990s, reflecting the crisis and fall in demand in neighboring countries.

3.4. Empirical specification

To identify empirically the heterogeneous effects of trade openness, I employ the following specification:

$$\widehat{WG}_{jt} = \beta_0 + \beta_1 \ln EP_{jt-1} + \beta_2 \ln C_{j0} \ln EP_{jt-1} + \beta_3 \ln IP_{jt-1} + \beta_4 \times \ln C_{j0} \ln IP_{jt-1} + \theta_t + \mu_j + \epsilon_{jt} \quad (3)$$

where $\widehat{WG}_{jt}$ is the gender wage gap in sector j at time t.[11] The export potential EP_{jt-1} captures profit opportunities abroad in sector j and year $t-1$. The import potential IP_{jt-1} captures competition from foreign products. C_{j0} is the level of concentration of sector j at the beginning of the period. As industry concentration can respond to an import or export shock, the specification uses pre-liberalisation concentration levels from the mid-80s.

The year fixed-effects θ_t capture shocks or policies affecting labour market conditions equally across all manufacturing sectors. These include, for example, macroeconomic shocks such as the financial crisis in the early 2000s or government policies which influence female labour supply such as childcare or parental-leave reforms. The industry fixed-effects μ_j net out any impact of time-invariant industry-specific factors such as social norms regarding female employment (which may be less accepted in machinery or oil industries than in textile and garment). The effect of trade openness is thus identified from within-industry changes over time. Some specifications include in addition past concentration levels $C_{j,t-1}$ to capture differences in ability to discriminate across sectors with different market power, and share of women in a sector FLS_{jt-1} to control for the effect of female concentration on female relative wages. Section 4.2 addresses further endogeneity concerns.

4. Empirical results

4.1. The gender wage gap, export and import potentials

Table 3 shows the results from the estimation of Eq. (3) for the period 1984–2003 in columns (1) to (4) and for the period 1992–2003 in columns (5) to (8), which use sector-specific tariffs in the estimation of market potential variables. Given that all sectors exhibit two-way trade, and that export and import potential have opposing effects on the ability to discriminate, the preferred specifications include both IP and EP. In most columns, the effect of foreign competition in non-concentrated sectors $lnIP_{jt-1}$ is associated with a higher adjusted wage gap.[12] This result cannot be explained by a model of taste-based discrimination as the one presented in Section 2. We discuss in Section 4.3 potential reasons that the model fails to incorporate and could lead to such a result. In particular, this coefficient becomes insignificant when controlling for a proxy for other forms of discrimination.

The main coefficient of interest for the test of taste-based discrimination is the interaction of the import potential with domestic concentration $lnIP_{jt-1} \times ln\overline{C}_{j0}$. C_{j0} is the sector-specific Herfindahl index for the years just before the liberalisation episode and it is centered at the median value i.e. the index for the machinery and equipments sector. This interaction consistently has a negative estimated coefficient: higher levels of concentration reduces the coefficient of import competition on the wage gap. Figure A2 in the appendix gives the total effect of import potentials on the gender wage gap using the results of column (4). Sectors with a Herfindahl index higher than 0.35 experience a reduction in the gender wage gap with the entry of foreign products. In the sample

[10] See Seguino (1997), Blecker and Seguino (2002), Busse and Spielmann (2006) and references herein.

[11] Given that the dependent variable is estimated for each year and sector in the first stage, the point estimates are affected by sampling variation. To correct for heteroscedasticity, I estimate this specification by weighted least squares, where the weights are the inverse of the standard errors from the estimation of the gender wage gaps.

[12] A similar result pertains in Black and Brainerd (2004) in their regression of the gender wage gap on import penetration.

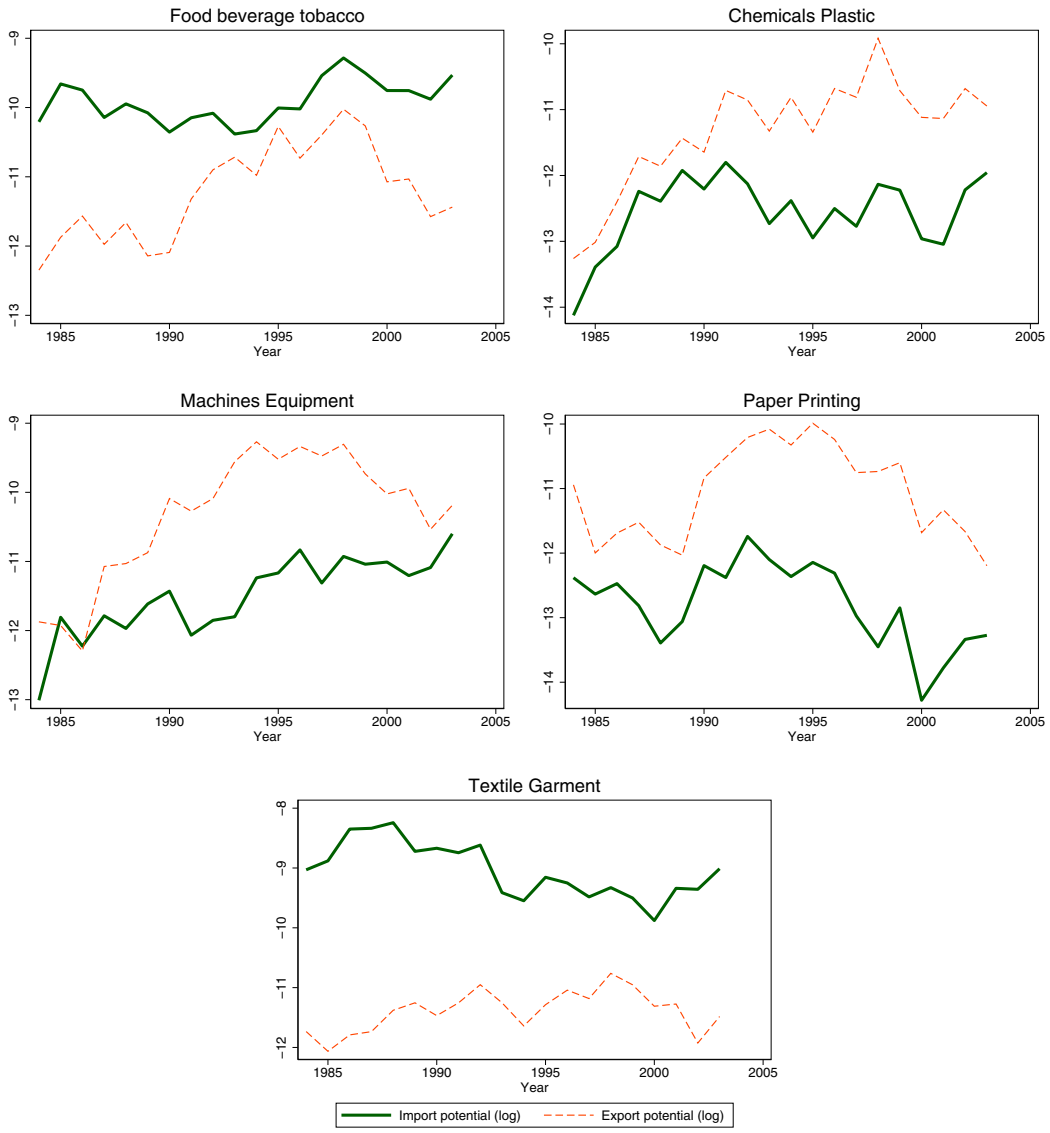

Fig. 1. Market Potentials. Source: Author's calculations based on the *TradeProd Database*, CEPII. Uruguyan firms' access to foreign markets (Export Potential) and foreign firms' access to the Uruguayan markets (Import Potential) shown here are calculated based on all of Uruguay's trade partners.

Table 3
Market Potentials and the Gender Wage Gap.

	Dependent variable: Adjusted gender wage gap							
	1985–2003				1992–2003			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\ln IP_{jt-1}$	0.052		0.125***	0.138***	0.161***		0.350***	0.316***
	(0.025)		(0.020)	(0.026)	(0.033)		(0.076)	(0.049)
$\ln IP_{jt-1} \times \ln \overline{C}_{j0}$	-0.231*		-0.436***	-0.529***	-0.236***		-0.474**	-0.443**
	(0.108)		(0.064)	(0.052)	(0.049)		(0.138)	(0.099)
$\ln EP_{jt-1}$		−0.005	−0.125***	−0.139***		−0.019	−0.209**	−0.205***
		(0.025)	(0.020)	(0.022)		(0.038)	(0.059)	(0.038)
$\ln EP_{jt-1} \times \ln \overline{C}_{j0}$		0.116	0.229***	0.232***		−0.003	0.248*	0.263**
		(0.057)	(0.024)	(0.018)		(0.029)	(0.093)	(0.075)
$\ln \overline{C}_{jt-1}$				0.215***				0.089
				(0.028)				(0.057)
$\ln FLS_{jt-1}$				0.061				−0.081
				(0.140)				(0.159)
Observations	91	91	91	91	60	60	60	60
R-squared	0.226	0.178	0.321	0.405	0.320	0.272	0.391	0.418

Note: All regressions include year and 2-digit sector fixed-effects. Weighted least squares regressions where the weights equal the inverse of the standard errors in the gender wage gap estimation. C_{j0} is the sector-specific Herfindahl index over 1983–1985 in (1) to (4), and over 1990–1991 in (5) to (8). It is centered at the median value i.e. the index for machinery and equipments. Standard errors in parentheses are clustered at the sector level. *** p<0.01, ** p<0.05, * p<0.1.

here, an increase in the import potential reduces the gender wage gap only the Paper & printing industry with a concentration level of 0.39. but it is not statistically significant. From the perspective of the theoretical framework, the negative coefficient of the interaction between imports and concentration can be interpreted as the result of a reduction in domestic rents, which employers previously used to discriminate against women.

The negative and significant coefficient on the export potential $lnEP_{jt-1}$ reveals that in sectors with low domestic concentration, a larger export potential helps reduce the gender wage gap. This is consistent with the model where only the most-productive non-discriminatory firms export if many firms produce at home. The expansion of these firms makes it harder for discriminatory firms to break even in their own domestic market, which explains the lower gender wage gap. This effect is larger when Uruguay's MFN tariffs are used to compute the export potential for 1991–2003 (columns (7) and (8)).

However, the positive and significant coefficient on $lnEP_{jt-1} \times ln\overline{C}_{j0}$ reveals that the competitive effect of the export potential is reduced in concentrated sectors. The mitigation effect of domestic concentration is consistent with the theory. As a higher export potential reduces the cost-threshold to enter foreign markets, it facilitates the entry of less-productive discriminatory firms into foreign markets. Discriminatory employers may use the export revenues to pay men a premium. This "market-size effect" of exports would dominate empirically in sectors with a concentration level above 0.39. Figure A2 in the appendix gives the total effect of the export potential on the gender wage gap using the results of column (4). The competition effect dominated during Uruguay's liberalisation episode in the 90s as changes in export potentials had a negative effect on the gender wage gap in all except one sector.

Finally, columns (4) and (8) additionally account for the sector-specific concentration level, centered at the median, $ln\overline{C}_{jt-1}$. As predicted by the theory, more concentrated sectors have higher gender wage gaps. The results are also robust to controlling for the sector-specific female labour share $lnFLS_{jt-1}$.

4.2. Exploring threats to identification

In this section, I explore threats to identification related to unobserved skills, changes in minimum wages as well as alternative channels that may be driving the results such as other forms of discrimination or imported inputs. Note that any alternative story would have to explain (i) the fall in the gender wage gap in concentrated sectors with an increase in import competition, (ii) the fall in the gender wage gap in competitive sectors with an increase in export potentials, and (iii) the increase in the gender wage gap in concentrated sectors with an increase in export potentials.

It is possible that trade liberalisation affects the returns to unobserved skills such as the field of study or foreign language skills. Unobserved skills may affect the gender wage gap and be correlated with trade liberalisation. However, there is a priori no reason that the effect of trade integration on their returns depends on the level of production concentration of a sector. Unobserved skills are thus unlikely to drive the results. Even so, to account for the potential differences in male and female unobserved skills across sectors, I adopt an approach used by Glaeser and Maré (2001) who argue that unmeasured ability is highly correlated with measured ability such as occupation and educational attainment. I control for the sector share of the female (male) workforce with a post-secondary degree $FSLS_{jt-1}$ ($MSLS_{jt-1}$). I also control for the share of skilled white-collar women (men) FWC_{jt-1} (MWC_{jt-1}). Table 4 shows that when I include these controls, in columns (1) and (2), the coefficients of market potential and its interaction with concentration are not affected, which adds confidence that gender differences in unobserved skills do not drive the results.

Minimum wages can reduce the gender wage gap at the bottom of the wage distribution as women are more likely to receive lower pay compared to men. Given that sectors have different shares of workers affected by minimum wage regulation, and that the minimum wage changes over time, the effect of the minimum wage on the gender wage gap could be correlated with changes in sectors' market potentials. Column (3) displays the results of a regression with controls for the share of employees earning the hourly minimum wage at the sector level and its interaction with the female labour share of the sector. Again, the effects of market potentials, and how they depend on the level of concentration of a sector, are robust to the addition of these controls.

I additionally test for an alternative source of gender wage differences. Uncertainty about labour market attachment is a common source of gender statistical discrimination as women work *on average* fewer hours than men and are more likely to interrupt their career. In fact, Goldin (2014) documents that the gender wage gap is the largest in jobs where the returns associated with working long hours are the largest. In a statistical discrimination setting, Ben Yahmed (2012) shows that trade liberalisation can increase the gender wage gap among skilled workers in tradable sectors. However, this mechanism would not explain why the effect of trade liberalisation differs across concentrated *vs.* non-concentrated sectors. Still, I control for the sector-specific share of male workers working more than 45 h a week to capture sectoral differences in the probability to discriminate because of the use of overtime. Note that the overall increase in female labour market attachment over the 1990s is netted out be year fixed-effects. Column (4) in Table 4 shows that a higher share of male employees working long hours in a sector is positively correlated with the gender wage gap in that sector, although not significantly so. In column (5), further interactions of the share of employees working long hours with the market potential measures are not significant. The effects of market potentials in sectors with low concentration levels lose significance but the effects in concentrated sectors remain significant with a larger magnitude.

Easier entry of foreign products into the Uruguayan market may also lead to productivity gains and changes in labour demand if they are used as inputs. Easier entry of foreign intermediate inputs may have different effects on gender gaps compared to that of foreign goods directly competing with domestic goods (Kis-Katos, Pieters, & Sparrow, 2018). I control for imported inputs and its interaction with sectors' concentration levels in column (6). The coefficient of import potential alone is not significant anymore. More importantly for this study, the results for the main variables of interest remain unchanged.

Finally, I use wild bootstrap with a six-point distribution developed in Webb (2014) to assess the robustness of the inference given the small number of sectors. Table A2 in the appendix shows that the coefficients of interest remain significant at the 5% level in all cases except three.

4.3. Discussion of caveats

The empirical analysis for Uruguay confirms the following essential predictions of the model: (i) it is important to differentiate imports from exports as they are not expected to affect the wage gap in the same way, and (ii) the effect of trade depends on the level of domestic competition at home. Moreover, the empirical findings are robust to controlling for several threats to identification.

However, the total effects of trade in the case of Uruguay do not illustrate the potential heterogeneity of the effects across concen-

Table 4
Market Potentials and the Gender Wage Gap. Additional controls.

	Dependent variable: Adjusted gender wage gap					
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln IP_{j,t-1}$	0.141***	0.141***	0.146**	0.138***	0.390	0.138**
	(0.023)	(0.023)	(0.035)	(0.026)	(0.444)	(0.036)
$\ln IP_{j,t-1} \times \ln \overline{C}_{j,0}$	−0.517***	−0.517***	−0.509***	−0.529***	−0.641**	−0.441**
	(0.046)	(0.046)	(0.040)	(0.052)	(0.201)	(0.112)
$\ln EP_{j,t-1}$	−0.147***	−0.147***	−0.146**	−0.138***	−0.364	−0.130***
	(0.021)	(0.021)	(0.035)	(0.022)	(0.214)	(0.019)
$\ln EP_{j,t-1} \times \ln \overline{C}_{j,0}$	0.215***	0.215***	0.233**	0.231***	0.333*	0.208***
	(0.024)	(0.024)	(0.062)	(0.020)	(0.121)	(0.032)
$\ln \overline{C}_{j,t-1}$	0.230***	0.230***	0.174***	0.214***	0.214***	0.205***
	(0.035)	(0.035)	(0.036)	(0.026)	(0.036)	(0.039)
$\ln FLS_{j,t-1}$	0.069	0.069	0.110	0.054	0.074	0.034
	(0.158)	(0.158)	(0.094)	(0.152)	(0.157)	(0.162)
$\ln MSLS_{j,t-1}$	0.116					
	(0.075)					
$\ln FSLS_{j,t-1}$	−0.043					
	(0.035)					
$\ln FWCS_{j,t-1}$		−0.043				
		(0.035)				
$\ln MWCS_{j,t-1}$		0.116				
		(0.075)				
Min $wage_{j,t-1}$			1.016			
			(0.956)			
$\ldots \times \ln FLS_{j,t-1}$			−1.089			
			(0.820)			
Long $hours_{j,t-1}$				0.062	0.179	
				(0.257)	(0.319)	
$\ln IP_{j,t-1} \times$ long $hours_{j,0}$					−0.474	
					(0.757)	
$\ln EP_{j,t-1} \times$ long $hours_{j,0}$					0.434	
					(0.354)	
Imported $inputs_{j,t-1}$						0.096
						(0.062)
$\ldots \times \ln \overline{C}_0$						0.102*
						(0.043)
Observations	91	91	91	91	91	91
R-squared	0.419	0.419	0.420	0.405	0.414	0.424

Note: All regressions include year and 2-digit sector fixed-effects. Weighted least squares regressions where the weights equal the inverse of the standard errors in the gender wage gap estimation. Export and import potentials are calculated using all trade partners, 1983–2013. $\overline{C}_0$ is the sector-specific Herfindahl index over 1983–1985 centered at the cross-section median. Standard errors in parentheses are clustered at the sector level. *** p<0.01, ** p<0.05, * p<0.1.

trated vs non-concentrated sectors. One likely reason is that the sectoral data is too aggregated with concentrated and non-concentrated sectors in the same 2-digit industry group. Another potential reason is that the Herfindahl index does not capture all aspects of changes in domestic competition levels. Exploring again the theoretical predictions using another country with more disaggregated data and more information on competition levels would be a valuable avenue for further research.

Moverover, the model presented in Section 2 cannot explain why more import competition would be positively associated with the wage gap in sectors with a large number of firms as we see in most columns of Table 3. [13] This might be due to other determinants of the gender wage gap that gain in importance with import penetration. Note, however, that the coefficient of the import potential becomes insignificant when controlling for a proxy of other forms of discrimination pointing towards the role of statistical discrimination as in Ben Yahmed (2012). Besides unequal rent sharing, sorting of women and men across different firms within sectors are important drivers of the gender wage gap (Card, Cardoso, & Kline, 2016). The role of sorting between firms within sectors that cannot be accounted for in this study. Related research at the firm level has focused on the export dimension, showing that it may increase the gender wage gap among high-skill workers or decrease it among blue-scholar workers. I am not aware of any paper studying also the role of import competition at the firm level.

5. Conclusion

International trade affects men's and women's opportunities in the labour market in different ways. Trade openness has been expected to reduce the gender wage gap due to taste-based discrimination as it has been associated with increased competition and thus a reduction of firms' ability to share rents unequally. This paper shows that trade openness can have opposing effects on the gender wage gap resulting from employers' prejudices. I highlight here how it depends on the direction of trade flows and the domestic sectors' competition levels. First, trade liberalisation makes it easier for foreign firms to enter the domestic market, reducing production by high-cost discriminatory firms. This selection of firms reduces the gender wage gap. Second, the liberalisation of trade partners' markets can have two opposite effects. If competition at home and abroad is not too fierce, a reduction in exporting cost enables discriminatory firms to make profits from exporting which increases the gender wage gap. This market-size effect dominates if the number of competitors is small enough. However, if discriminatory firms are not able to sustain their cost disadvantage abroad, better export opportunities benefit only the most-productive,

[13] A similar result pertains in Black and Brainerd (2004) in their regression of the gender wage gap on import penetration.

least-discriminatory domestic firms that increase their demand for labour, which reduces the wage gap. This selection effect dominates when the number of firms is large enough.

The findings for Uruguay over a period of significant trade liberalisation go in the direction of the theoretical predictions. The interaction of the import potential with the concentration index systematically attracts a significant and negative sign. Import competition may curb wage gaps in sectors highly concentrated before trade liberalisation. The export potential also reduces the gender wage gap, but this effect is largest in sectors where concentration is low before liberalisation. On the contrary, however, export opportunities may increase the gender wage gap when domestic concentration is high, as observed in other studies.

The paper provides insights for policies aiming at reducing gender inequality as it shows when and how international trade may help reduce gender wage gaps in the presence of discrimination. The reduction in gender wage gaps with export opportunities may seem to be a good news, but concentration of production limits its effect. It shows that, among many other important aspects, a country should pay attention to its domestic market structure and competition policies to ensure that trade integration is inclusive and favours gender equality.

Data availability

Data will be made available on request.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

I thank Carlos Casacuberta for precious help with the data. I am grateful to Pierre-Philippe Combes, Matthieu Crozet, Lionel Fontagné, Cecilia Garcia-Peñalosa, Peter Neary, Marcelo Olarreaga and Alain Trannoy for helpful comments and suggestions. This paper also benefited from comments received in seminars at the Aix-Marseille School of Economics and the University of Oxford, the EDGE PhD workshop, the Arnoldshain Seminar, the EUDN PhD meeting, the RIEF workshop, and the EALE, LAGV and RES annual conferences.

Appendix A. Empirical analysis

A.1. Data availability

The individual data used in this study to compute the gender wage gaps are openly available on the website of Uruguay's National Statistical Office INE athttp://www.ine.gub.uy/encuesta-continua-de-hogares1. The trade flows data come from the TradeProd database, the trade costs data come from the GeoDistances database. Both are available on the CEPII website:http://www.cepii.fr/cepii/en/bdd_modele/bdd.asp. The concentration index has been built using confidential firm surveys from Uruguay's National Statistics Institute (INE), the Encuesta Industrial Anual for 1983-1996 and the Encuesta de Actividad Económica for 1998-2003. Data for 1997 are taken from the Economic Census. I received the Herfindahl concentration indexes, already computed at the industry level, from Prof. Carlos Casacuberta (Universidad de la República, Uruguay). The datasets and further information are available from the author upon reasonable request.

A.2. Descriptive statistics

Table A.1 shows that between 67% and 75% of the working population are employees. Female employees receive on average lower hourly wages than male employees although the raw gender wage gap has decreased over the period. The manufacturing sector hires between 22.5% and 11.7% of all employees over the 1990s. Men have higher employment shares in the manufacturing sectors compared to women. Female employees earn less than men and the gender wage gap is higher in the manufacturing sector than in the overall economy. There is a slow convergence between male and female average wages. While the raw wage gap was 0.4 log points in 1990, it declined to 0.27 log points in 2002. Female employees are slightly younger than male employees but the difference has faded out over the period. However, women have on average a higher level of education than men. There has been an increase in the educational level for both men and women but the increase in the share of employees with some tertiary education has been stronger for females than for males.

Table A.1
Descriptive Statistics.

	Gender	1990	1992	1994	1996	1998	2000	2002
Share of employees	Male	25.9	25.1	23.5	20.6	20.2	17.8	15.4
in manufacturing	Female	17.6	17.4	14	11.3	11	9.8	7.5
Mean real hourly wages	Male	2.98	3.11	3.14	3.11	3.12	3.15	2.88
(in logarithms)		(0.63)	(0.65)	(0.66)	(0.69)	(0.70)	(0.71)	(0.73)
	Female	2.59	2.75	2.78	2.77	2.88	2.92	2.61
		(0.73)	(0.70)	(0.72)	(0.72)	(0.66)	(0.68)	(0.77)
Age	Male	36.8	37.0	36.2	36.1	36.8	36.2	37.1
	Female	35.7	35.8	35.4	35.8	35.0	36.0	37.9
Level of education								
Primary or less	Male	40.9	38.4	35.3	32.6	31.9	27.5	26.9
	Female	38.4	31.1	32.9	29.1	24.2	22.1	21.3
Secondary	Male	32.5	31.4	34.5	35.3	34.8	42.1	42.3
	Female	44.0	47.5	44.3	47.1	53.3	52.1	48.9
Technical	Male	21.4	23.3	23.5	24.7	25.2	21.8	21.1
	Female	9.8	13.8	13.0	13.0	11.6	9.8	12.4
Tertiary	Male	5.2	6.8	6.6	7.4	8.1	8.6	9.7
	Female	7.8	7.5	9.8	10.7	10.8	16.0	17.4
Number of observations	Male	2,452	2,386	2,235	1,901	1,719	1,492	1,222
	Female	1,199	1,185	976	828	756	701	540

Source: Based on the household survey, ECH, INE, Uruguay. Real hourly wages are computed for employees only and include bonuses; the base year is 1997.

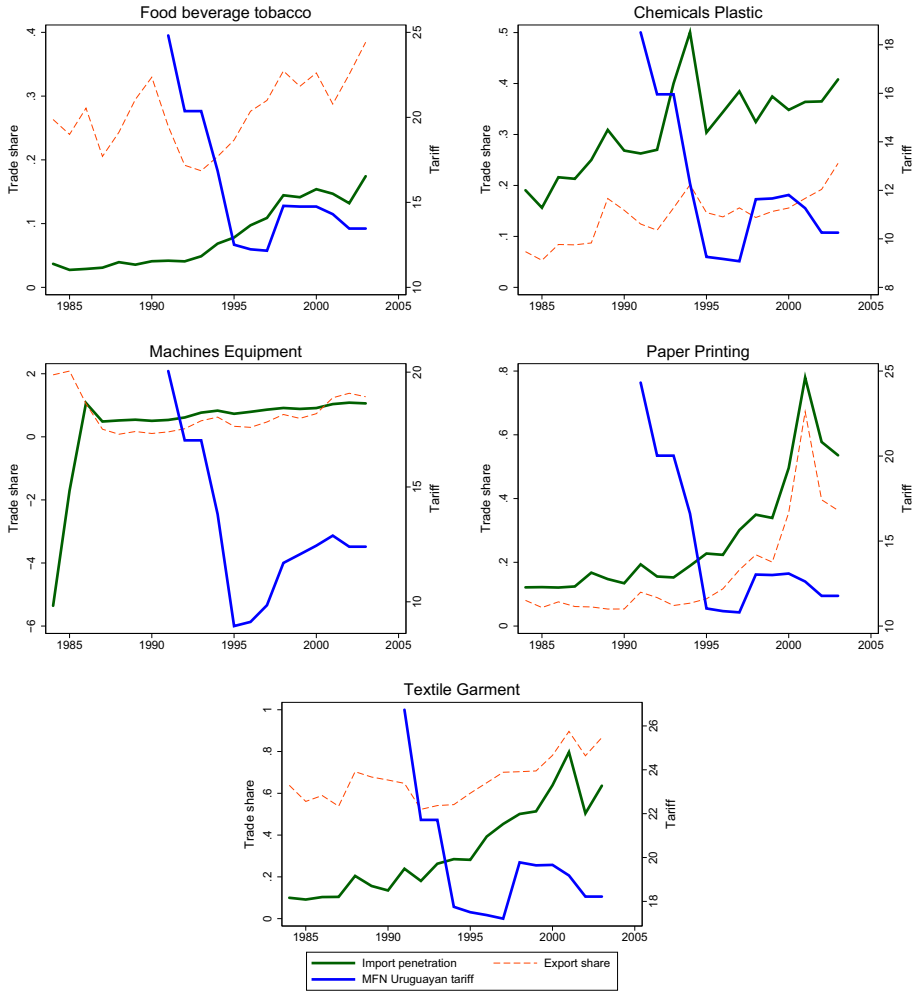

Fig. A.1. Uruguay's export share, import penetration and tariff. (*Source*: Author's calculations based on trade data from the *TradeProd Database*, CEPII and data on MFN tariff from the Latin American Integration Association (LAIA) also known as ALADI. Uruguayan import penetration is calculated as a share of domestic absorption $\frac{Imports}{Production+Imports-Exports}$. The export share is $\frac{Exports}{Production}$.)

A.3. Empirical results

Appendix B. A partial equilibrium model of trade with taste-based discrimination

B.1. The setting

Two countries D and F (for the domestic and foreign country) with heterogenous firms trade a homogeneous good under oligopolistic competition. Firms in both countries engage in intra-industry trade to capture some of the rents that exist in the foreign market.[14] There is an exogenous fixed number of *potential* entrants, i.e. the maximal number of firms operating in a market, as in Helpman and Krugman (1987)[chapter 5]. They are denoted N_D at home and N_F abroad. A potential firm is able to enter rapidly and produce without incurring additional fixed costs. Put differently, fixed costs have already been incurred and are not modeled in the model. Even if a potential firm does not produce, it exerts a competitive pressure as other firms account for the total number of potential competitors.

[14] Brander, 1981 first formalised how strategic interactions among Cournot oligopolists in two countries lead to intra-industry trade. This type of model was subsequently used and developed by Neary, 2002 among many others.

Demand and production. Domestic and foreign consumers' inverse demand functions are respectively:

$$p_D = b_D - Q_D \qquad \text{and} \qquad p_F = b_F - Q_F \tag{4}$$

Labour is the only factor of production and is inelastically supplied at the sectoral level. Male and female labour supplies in a given sector are denoted by $\bar{L}_m$ and $\bar{L}_f$.[15] Firms produce following a linear production function with male labour l_m and female labour l_f that are perfect substitutes: $q_i = l_{if} + l_{im}$.

Domestic firms, indexed by i, are *ex ante* heterogeneous in the employer's prejudice against women $d_i \in [0;\bar{d}]$. As explained below, the equilibrium wage gap d^*, however, is endogenous and

[15] The sector index is dropped for readability. Comparative statics later show how the gender wage gap responds to changes in the supply of female and male labour at the sector level. However, endogenizing the sectoral female and male labour supplies is beyond the scope of this model. To do so, one would need to develop general equilibrium model with imperfect worker mobility. Perfect worker mobility would equalize the gender wage gaps across sectors, which is at odd with empirical facts in any country. In fact, the literature documents very high intersectoral mobility costs, especially in developing countries (Artuç, Chaudhuri, & McLaren, 2010;Cruz, Milet, & Olarreaga, 2017;Ashournia, 2018). Artuç, Lederman, and Porto, 2015 show that US workers do not respond much to intersectoral wage differentials and wages are not equalized across sectors either in the short or long run. The evidence underpins the assumption of exogenous sector labour supply that simplifies the exposition of the model here.

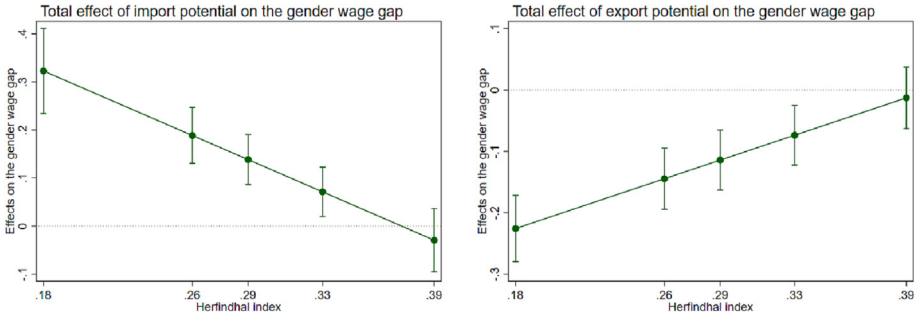

Fig. A.2. Total effect of the import potential and export potential on the gender wage gap. (*Notes*: Total effect of the import potential and export potential on the gender wage gap. Figures are based on the regression results shown in column (4) of Table 3.)

Table A.2
Market Potentials and the Gender Wage Gap. Wild Bootstrap.

	Dependent variable: Adjusted gender wage gap						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\ln CA_{j,t-1}$	0.125**	0.138**	0.141**	0.141**	0.146**	0.390	0.138**
	[.038,.179]	[.084,.253]	[.097,.273]	[.095,.277]	[.042,.316]	[-1.773,5.474]	[.038,.341]
$\ln CA_{j,t-1} \times \ln \overline{C}_{j,0}$	-0.436**	-0.529**	-0.517**	-0.517**	-0.509**	-0.641**	-0.441
	[-.654,-.161]	[-.712,-.151]	[-.695,-.163]	[-.71,-.166]	[-.698,-.24]	[-1.782,-.078]	[-.851,.478]
$\ln MA_{j,t-1}$	-0.125**	-0.139**	-0.147**	-0.147**	-0.146**	-0.364	-0.130**
	[-.161,-.07]	[-.184,-.099]	[-.219,-.11]	[-.221,-.106]	[-.243,-.045]	[-3.812,1.948]	[-.167,-.085]
$\ln MA_{j,t-1} \times \ln \overline{C}_{j,0}$	0.229**	0.232**	0.215**	0.215**	0.233	0.333**	0.208**
	[.159,.253]	[.08,.114]	[.169,.258]	[.174,.255]	[-.139,.791]	[.022,.817]	[.06,.283]
$\ln \overline{C}_{j,t-1}$		0.215**	0.230**	0.230**	0.174**	0.214**	0.205
		[.049,.38]	[.066,.387]	[.046,.389]	[-.012,.336]	[.026,.405]	[-.084,.381]
$\ln FLS_{j,t-1}$			0.0690	0.0690	0.110	0.0740	0.0340
			[-.308,.389]	[-.305,.378]	[-.212,.575]	[-.534,.331]	[-.358,.331]
$\ln FSLS_{j,t-1}$			-0.0430				
			[-.133,.065]				
$\ln MSLS_{j,t-1}$			0.116				
			[-.086,.316]				
$\ln FWCS_{j,t-1}$				-0.0430			
				[-.136,.068]			
$\ln MWCS_{j,t-1}$				0.116			
				[-.085,.306]			
$Minwage_{j,t-1}$					1.016		
					[-1.612,4.3]		
$\ldots \times \ln FLS_{j,t-1}$					-1.089		
					[-6.556,5.901]		
$Longhours_{j,t-1}$						0.179	
						[-.942,1.052]	
$\ln CA_{j,t-1} \times$						-0.474	
$longhours_{j,0}$						[-9.163,3.385]	
$\ln MA_{j,t-1} \times$						0.434	
$longhours_{j,0}$						[-4.178,5.934]	
$Importedinputs_{j,t-1}$							0.0960
							[-.085,.598]
$\ldots \times \ln \overline{C}_0$							0.102
							[-.486,.382]
Observations	91	91	91	91	91	91	91

Note: All regressions include year and 2-digit sector fixed-effects. Weighted least squares regressions where the weights equal the inverse of the standard errors in the gender wage gap estimation. Market potentials using all trade partners, 1983-2013. $\overline{C}_0$ is the sector-specific Herfindahl index over 1983-1985. It is centered at the cross-section median value which is the index for machinery and equipments. Wild bootstrapped with Webb's six-point distribution. Bootstrap P-values *** p<0.01, ** p<0.05, * p<0.1 ; 95% bootstrap confidence intervals are in brackets.
Variables: FLS_j is the female labour share in sector *j*, $FSLS_j$ ($MSLS_j$) is the share of women (men) with a post-secondary degree in the female (male) workforce of sector *j*, $FWCS_j$ ($MWCS_j$) is the share of white collar workers in the female (male) workforce of sector *j*, Min $wage_j$ is the share of workers earning minimum wages in sector *j*, $long\ hours_{j,0}$ is the share of male employees working more than 45 hours a week in sector *j* at the start of the period.

ultimately determines the type of workers a firm hires along with its wage bill. The *ex post* distribution of firms' outcomes, e.g. marginal cost and production, is thus endogenous.

Employers' prejudice *d* are, in Becker's words, a distaste for, or aversion to, cross-gender contact at work. As a result, employers do not maximize profits but their utility function which depends on both profits and the monetary value of the disutility of employing women $d_i \times l_f$. This disutility is integrated in the production cost. The cost function features constant returns to scale once the firm operates in the market, $C(q_i) = c_i q_i$. The manager of firm *i* acts upon the *perceived* unit cost of production, which is $c_i = w_f + d_i$if firm *i* employs women and $c_i = w_m$ if firm *i* employs men. Foreign

firms are assumed to be homogeneous, so that all firms in F produce at the same unit cost of c_F.[16]

To export to market D, foreign firms have to pay an iceberg trade cost τ_D, while domestic firms have to pay τ_F to export to market F. As firms produce under constant returns to scale, they maximise separately the profits -adjusted for their prejudices- that they make on the domestic market $\pi_{iDD} = q_{iDD} \times (p_D(q_{DD}, q_{FD}) - c_i)$ and the foreign market $\pi_{iDF} = q_{iDF} \times (p_F(q_{DF}, q_F) - c_i\tau_F)$, taking the production of other domestic and foreign firms as given. q_{iDD} and q_{iDF} are the sales of domestic firm i in market D and F respectively. The sales of other domestic firms are q_{DD} in the domestic market and q_{DF} in the foreign market. Foreign firms export q_{FD} to market D and sell q_F in their own market. The first order conditions for sales at home and in the foreign market are, respectively, $q_{iDD} = p_D - c_i$ and $q_{iDF} = p_F - c_i\tau_F$.

Firms' reaction functions. The expression for firms' reaction functions are given by substituting the prices given by Eqs. 4 into the first order conditions, and using $Q = \sum_{j\neq i}^{N} q_j + q_i$. Domestic sales and exports of firm i are:

$$q_{iDD} = \frac{b_D - (N_D + N_F - 1)c_i - \sum_{j\neq i} c_j}{N_D + N_F + 1} \tag{5a}$$

$$q_{iDF} = \frac{b_F - (N_D + N_F - 1)c_i\tau_F - \sum_{j\neq i} c_j}{N_D + N_F + 1} \tag{5b}$$

where N_D is the number of domestic firms and N_F is the number of foreign firms. The sum of unit costs of firm i 's competitors is $\sum_{j\neq i} c_j = \sum_{j}^{N_{Df}} c_{jf} + N_{Dm}c_m + N_F c_F \tau_d$in Eq. (5a), where N_{Df} is the number of domestic firms that employ women and N_{Dm} is the number of domestic firms that employ men. It is $\sum_{j\neq i} c_j = \sum_{j}^{N_{Df}} c_{jf}\tau_F + N_{Dm}c_m\tau_F + N_F c_F$in Eq. (5b).

The equilibrium gender wage gap. Employer i will hire women if the gender wage gap compensates the utility loss d_i, i.e. $w_f + d_i < w_m$. The equilibrium gender wage gap is determined by the level of prejudice of the marginal firm in the domestic market N_{Df}, i.e. the last firm which hires women and is indifferent between employing men and women. This setting leads to complete gender segregation across firms except for the marginal firm.[17] As a result, the gender wage gap $d^* = w_m - w_f$ is given by: $d^* \in \left[d_{N_{Df}}; d_{N_{Df+1}}\right[$.

There is a continuum of equilibrium gender wage gaps comprised between the prejudice of the marginal employer $d_{N_{Df}}$ and the prejudice of the next firm $d_{N_{Df+1}}$. Choosing a discrete uniform distribution over $[0; \bar{d}]$ for employers' prejudices, the difference in prejudice between two firms is $d_i - d_{i+1} = \frac{\bar{d}}{N_D - 1}$ and the gender wage gap can be expressed as:

$$d^* = (N_{Df} - 1)\frac{\bar{d}}{N_D - 1} + v \qquad \text{with} v \in \left[0; \frac{\bar{d}}{N_D - 1}\right[$$

Note that this general case $d^* = d_{N_{Df}} + v$ can be reasonably reduced to $d^* = d_{N_{Df}} + \epsilon$ as all firms i with $d_i > d_{N_{Df}}$ can hire men by setting a wage just above that which renders the previous firm indifferent between men and women. Without loss of generality, the wage gap can thus be expressed as:

$$d^* = (N_{Df-1})\frac{\bar{d}}{N_D - 1} \tag{5c}$$

where N_{Df} is the number of female firms and N_D is the total number of firms in the domestic market, as previously defined. It is at greater than 1 and finite. In case of a monopoly, N_D=1, the equilibrium gender wage gap is equal to the disutility parameter of the manager of the single firm.

The marginal firm may possibly have a mixed labour force. The analysis below considers the case where the N_{Df} firms exactly absorb female labour supply so that there are no mixed firms. This hypothesis does not alter the results of the model and only facilitates the resolution of the labour-market clearing conditions for women and for men :

$$\bar{L}_f = \sum_{i=0}^{d^*} q_{iDD} + q_{iDF} = N_{Df}\left(p_D + p_F - (1+\tau_F)\left(w_f + \frac{N_{Df} - 1}{N_D - 1}\frac{\bar{d}}{2}\right)\right)$$

$$\bar{L}_m = \sum_{i=d^*+r}^{\bar{d}} q_{iDD} + q_{iDF} = N_{Dm}(p_D + p_F - w_m(1+\tau_F))$$

where N_{Df} is the number of domestic female firms and N_{Dm} the number of domestic male firms.

The labour-market clearing condition combined with the first order conditions and the price Eq. (5c) give the equilibrium wages and thus gender wage gap:

$$d^* = \frac{2\bar{d}}{1+\tau_F}\left(\frac{\bar{L}_f}{\bar{d} + (N_D - 1)d^*} - \frac{\bar{L}_m}{(N_D - 1)\left(\bar{d} - d^*\right)}\right) \tag{5d}$$

where N_D is the number of domestic firms. The proofs of the existence and uniqueness of d^* appear in Appendix B.3.

B.2. Trade liberalisation and the gender wage gap

B.2.1. The market size effect of a reduction in export costs

The response of the gender wage gap to a fall in trade costs can be derived from the equilibrium gender wage gap defined in Eq. (5d). This exercise keeps the number of producing firms constant, equals to N_D and allows firms output levels to vary (intensive margin).

Defining $\Phi \equiv d^* - \frac{2\bar{d}}{1+\tau_F}\left(\frac{\bar{L}_f}{\bar{d}+(N_D-1)d^*} - \frac{\bar{L}_m}{(N_D-1)\left(\bar{d}-d^*\right)}\right) = 0$, and applying the implicit function theorem, simple comparative statics show that:

$$\frac{\partial d^*}{\partial \tau_F} = -\frac{\frac{\partial \Phi}{\partial \tau_F}}{\frac{\partial \Phi}{\partial d^*}} < 0$$

This is obtain from: $\frac{\partial \Phi}{\partial \tau_F} = \frac{2}{(1+\tau_F)^2}\mu$ where $\mu = \bar{d}\left(\frac{L_f}{\bar{d}+(N_d-1)d*} - \frac{L_m}{(N_D-1)\left(\bar{d}-d*\right)}\right)$ represents the cost disadvantage of male firms and is positive. And $\frac{\partial \Phi}{\partial d^*} = 1 + \frac{2\bar{d}}{1+\tau_F}(N_D - 1)\lambda$ where $\lambda = \bar{d}\left(\frac{L_f}{\left(\bar{d}+(N_d-1)d*\right)^2} - \frac{L_m}{\left((N_D-1)\left(\bar{d}-d*\right)\right)^2}\right)$ is positive and smaller than μ.

Holding the number of producing firms constant, a fall in export costs τ_F further increases the gender wage gap. High-cost discriminatory firms benefit relatively more from the fall in the iceberg trade costs that are proportional to a firm's unit cost. As a result, the labour demand of discriminatory firms increases relatively

[16] I abstract from heterogeneity in costs among foreign firms, and in particular from differences due to discrimination. This assumption has no implications for the determinants of the wage gap in the domestic country, as what matters for employers' decisions are the final equilibrium prices in the domestic and foreign markets.

[17] Alternatively, if employers' satisfaction depends on the share of women in firm employment instead of the absolute number of women (as in Arrow, 1973), firms have mixed workforce. This outcome is more realistic, but the quantitative results of the model are not affected by the specification choice. From here on, I denote "'female firms"' the firms that employ women, while "'male firms"' are those that employ men.

more than that of less discriminatory firms and the wage gap increases. The size of the effect is proportional to the cost disadvantage of male firms μ and decreases with the number of firms.

The import costs to enter the domestic market τ_D does not enter the equilibrium gender wage gap defined in Eq. (5d). This is because τ_D does not enter the domestic firms' cost function directly. Even if it affects the domestic price, it does not change the relative costs of discriminatory vs non-discriminatory firms. Therefore, the marginal firm remains the same. In other words, τ_D does not affect the gender wage gap in this setting. The next subsection looks into the impact of foreign trade costs τ_F and domestic trade costs τ_D on the gender wage gap when higher-cost firms may cease production, keeping the number of *potential* firms constant.

B.2.2. Adding firm selection in the foreign and domestic markets

To further understand how foreign competition affects wage discrimination via the selection of firms, I make use of the cost threshold above which a domestic firm cannot sell in a market. This exercise allows the number of producing firms to decrease (extensive margin). I use here one cost-threshold for all domestic firms, abstracting from the relative unit cost and production difference between male and female firms (intensive margin). When the cost threshold is reduced, the higher cost firms either cease production or reduce their unit cost,As the higher cost firms are male firms, a fall in the cost threshold reduces the labour demand for male workers. As a result, the lower is this cost threshold, the lower the gender wage gap.

The competition effect of a reduction in export costs. I first explore how a change in competition in the foreign market affects the domestic gender wage gap. Let $\bar{c}_{DF}$ denote the cost threshold above which a domestic firm does not export to the foreign market F. It is defines as $q_{DF}(\bar{c}_{DF}) = 0$ and, given the first order condition, it is equal to the price in the foreign market $\bar{c}_{DF} = p_F$. Using the expression for the price abroad, we get: $\bar{c}_{DF} = b_F - N_D(p_F - \bar{c}_{DF}\tau_F) + N_F(p_F - c_F)$ where N_F and N_F are the number of domestic and foreign firms, τ_F is the trade cost to enter the foreign market and c_F the unit cost of foreign firms. Rearranging and using $\bar{c}_{DF} = p_F$, we obtain: $\bar{c}_{DF} = \frac{b_F + N_F c_F}{1 + N_D(1-\tau_F) + N_F}$. First, the effect of a fall in τ_F is given by:

$$\frac{\partial \bar{c}_{DF}}{\partial \tau_F} = \frac{N_D(b_F + N_F c_F)}{(1 + N_D(1-\tau_F) + N_F)^2} > 0$$

Reduced export barriers lowers the costs to enter the export market. As a result of firms' strategic interactions in the foreign market, the foreign price falls and so does the cost threshold for exporting.

Second, the reduction in the equilibrium gender wage gap with trade liberalisation depends on the number of domestic firms. Taking the cross-partial derivative, one can show that $\frac{\partial^2 \bar{c}_{DF}}{\partial \tau_F \partial N_D} > 0$.[18] For a high number of domestic firms N_D, trade liberalisation in partner countries favors then the low-cost non-discriminatory firms and this selection of firms into exporting contributes to a reduction in the gender wage gap. If the number of firms is small, high-cost firms might still be able to export and the fall in the gender wage gap is less strong.

Other comparative statics show that the greater the number of domestic and foreign firms, the lower the cost cut-off: $\frac{\partial \bar{c}_{DF}}{\partial N_F} < 0$. The lower the unit-cost of foreign firms, the smaller is the cost threshold: $\frac{\partial \bar{c}_{DF}}{\partial c_F} > 0$. So that for high enough N_F and c_F, domestic discriminatory firms, that have higher production costs, are not able to export.

[18] $\frac{\partial^2 \bar{c}_{DF}}{\partial \tau_F \partial N_D} = (b_F + N_F c_F)\Big((1 + N_D(1-\tau_F) + N_F)^2 - N_D + 2N_D(1 + N_D(1-\tau_F) + N_F)\Big)$.

The competition effect of a reduction in import costs. I now turn to the effect of a change in foreign competition in the domestic market on the domestic gender wage gap. Let $\bar{c}_D$denote the cost threshold above which a domestic firm cannot break even in its domestic market. This cost threshold is given by $q_{DD}(\bar{c}_D) = 0$ or $c_D = p_D$. Using the first order conditions and prices given by Eq. 4, the cost threshold can be expressed as: $\bar{c}_D = \frac{b_D - N_F c_F \tau_D}{N_F + 1}$ where τ_D is the trade cost to enter the domestic market, N_F is the number of foreign firms selling in the domestic market, and c_F their unit cost.

A reduction in the domestic country's trade barriers puts downward pressure on its domestic cost cut-off: $\frac{\partial \bar{c}_D}{\partial \tau_D} = \frac{N_F c_F}{N_F + 1} > 0$. And a fall in the sectoral cost cut-off reduces the sectoral gender wage gap. The reduction in the gender wage gap with increased import competition can be intuitively explained by several mechanisms. First, foreign firms pay lower trade costs to enter country D's market so that the average cost of competitors falls. Second, as foreign firms sell now at lower cost they are able to sell more, this generates a fragmentation effect.

In addition to the effect of trade costs, other comparative statics are of interest. The cost cut-off also falls with the number of foreign firms N_F entering the domestic market, $\frac{\partial \bar{c}_D}{\partial N_F} < 0$. This effect also operates through the two mechanisms cited above: downward pressure on the average cost here because of an increase in the number of firms, and the fragmentation effect, as more firms sell in market D. Last, $\frac{\partial \bar{c}_D}{\partial c_F} > 0$. It is obvious that competition is fiercer when foreign competitors are more productive, i.e. when c_F is low.

Finally, it follows that the competition effect of a fall in import costs is larger with many foreign firms that have a low unit cost: $\frac{\partial^2 \bar{c}_D}{\partial \tau_D \partial N_F} > 0$ and $\frac{\partial^2 \bar{c}_D}{\partial \tau_D \partial c_F} > 0$.

B.3. Proofs of the existence and uniqueness of the wage gap

The wage gap d^* is defined by $d = F(d)$. This equation has a solution if the function F crosses the 45° line. As F falls in d, it has a solution if $F(0) > 0$ and $F(\bar{d}) < \bar{d}$.

First, $F(0) = 2\left(L_f - \frac{L_m}{(N-1)}\right)$ so that $F(0) > 0$ if $L_f > \frac{L_m}{N-1}$. Second, $F(\bar{d}) < 0$ so that $F(\bar{d}) < \bar{d}$ for all d. Moreover F is strictly decreasing, $F\prime(d) < 0$, which implies that $F(d)$ crosses the 45° line only once. Hence d^* is unique.

To sum up, $d = F(d)$ has a unique solution if $L_f > \frac{L_m}{N-1}$, which requires that the female labour force is not employed by one firm only. If $L_f \leqslant \frac{L_m}{N-1}$, the equilibrium wage gap equals the prejudice level of the least-prejudiced employer which is zero in this version of the model.

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