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ABSTRACT

Do firms reorganize gender composition of their employment in response to trade shocks? Using novel data on gender composition of employment across several occupational groups for Chilean manufacturing firms matched with customs data for 1995–2007, a developing country with low gender equality, and utilizing the 1998 Chile–Mexico Free Trade Agreement (FTA) as the quasi-natural shock, we document the first evidence that the share of female white-collar workers increased by 10% for new exporters exporting to Mexico due to the FTA. This happened through a substitution effect from male to female high-skilled workers due to higher use of technology (both domestic and foreign), high-skilled non-production tasks, and reduction in discrimination. We also show that this increase in this share of white-collar female workers is due to a demand-rather than supply-side effect. Overall, we emphasize that trade policy can play an important role in addressing the gender gap in employment.

1. Introduction

The gender gap in employment stifles economic progress and long-run growth (Lagerlof, 2003).¹ According to ILO (ILO, 2018), only 47% of women aged 15 and older compared to 80% of men participated in the labour force in Latin American countries.² Despite increased awareness that higher female labour force participation can augment economic growth, accomplishing this goal

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¹ Achieving gender equality and empowering all women and girls by 2030 is one of the seventeen sustainable development goals laid out by UN (United Nations) in the UN Millennium Development Goals. See: <https://www.un.org/sustainabledevelopment/gender-equality/>. Also see Cuberes and Teignier (2014) for a critical review of the mechanisms between gender inequality and economic growth.

² At the global level, the numbers are 75% of men compared to 48.5% of women. For OECD countries, the employment gap varies between 15%–25% with the pay gap between 4%–40% (OECD, 2018).

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is challenging in economies where significant gender imbalances prevail (World Bank, 2011; OECD, 2011; Eurostat, 2017; World Bank and WTO, 2020).³

Given that a host of developing countries have started to liberalize or participate in the global market, especially from the 1990s onward, it is imperative to understand whether and how such trade policy changes can contribute toward enhancing gender convergence in employment, an aspect which is relatively under-researched due to paucity of data.⁴

We contribute to this literature by exploiting a Free Trade Agreement (FTA) that was signed between Chile and Mexico in July 1998 and came into force in August 1999 as a quasi-natural experiment and investigate its effect on gender employment gap for Chilean manufacturing firms. Three features drive our choice: (a) following the debt crisis of the 1980s, a lot of Latin American countries adopted the export-led development strategy by signing new economic cooperation and trade agreements, and Chile was the leader among them; (b) the agreement with Mexico was among the earliest and first major trade agreement signed by Chile; and (c) this FTA led to the highest increase in exports (> 200%) for Chile to any single-country till 2007 accompanied by the highest drop in tariffs for Chilean exports; average tariff on Chilean exports was dropped from 14% to zero. Furthermore, Chile provides an interesting study case because of its diverse manufacturing sector, a developing nation with a severe gender employment gap at 23.2%, and wage gap at 20.4% in 2020 (INE, 2022).⁵

Our intuition builds on the basic premise of the heterogeneous trade theory models (Bustos, 2011; Tang and Zhang, 2021; Melitz, 2003; Juhn et al., 2014). By lowering the cost of entering new foreign markets (in our case in the Mexican market), the FTA can induce exporters (Chilean) to invest in new technologies (domestic and/or foreign), innovate new products, engage in more marketing, publicity and promotional activities in the foreign market that would require different amounts and skills of white-collar workers.⁶ Now, if new export opportunities require more intensive use of these tasks, as these are non-production in nature, require cognitive ability, and physically less demanding, where women have a comparative advantage (Weinberg, 2000; Choi and Greaney, 2022; Black and Spitz-Oener, 2010; Bonfiglioli and De Pace, 2021), then an expansion in foreign activities will increase the demand for females in white-collar occupations for the exporters exporting to destination(s) (for which export opportunities increased) as compared to other exporters and non-exporters.⁷ This can have a significant spillover effect on both the labour and overall productivity of a firm.

We test this hypothesis using novel data on gender composition of employment across several occupational groups from *Encuesta Nacional Industrial Anual* (ENIA) for Chilean manufacturing firms over the period 1995–2007. We match this firm level dataset with detailed administrative customs level information on export destinations of firms over time and utilize the 1999 Chile–Mexico FTA as a quasi-natural shock to investigate its effect on the share of female white- and blue-collar workers.⁸

Our matched dataset has three key advantages that are crucial to our analysis and identify the true effects of the concerned FTA: (a) this is a national annual survey of the Chilean manufacturing sector with detailed information on gender-specific employment across several occupational groups; (b) it also gives information on a host of different firm level outcomes, such as technology adoption (both domestic and foreign), innovation/research related expenses, publicity and promotional expenses, use of machinery, gender composition of ownership and CEOs, etc. which allows us to examine the possible mechanisms behind our observed changes; and (c) the customs dataset helps us to identify which firms are exporting to Mexico vis-a-vis other countries before and after the FTA and how did the gender employment composition changed for those compared to other exporters.

We start by motivating our analysis with a simple graph on how the FTA affected employment, especially female. Fig. 1 presents an unconditional relationship between the total number of female employees in an average Chilean manufacturing firm and Mexican tariffs for Chile.⁹ We find that the lower the tariffs of Mexico for Chile, the higher is the female employment in a Chilean manufacturing firm.¹⁰

This simple correlation paves the way for rigorous empirical investigation. We estimate an employment equation in a simple difference framework. By taking differences between two periods (before and after the FTA) of the average values of our outcome variables of interest and tariff changes, we circumvent the unobservables (affecting both) problem endemic to estimating the labour market consequences of trade. At the heart of our empirical strategy lies the changes in export tariffs faced by Chilean exporters while exporting to Mexico. We interact changes in those tariffs with an exporter dummy specific to firms exporting to Mexico which would potentially divulge the differential effect of the Chile–Mexico FTA on the exporters exporting to Mexico as compared to other

³ A recent joint study by World Bank and the World Trade Organization (WTO) (World Bank and WTO, 2020) highlight that trade has the potential to act as an impetus for countries to improve women's rights and participation, but we still have very limited consistent evidence in this regard.

⁴ Current research has shown that gender gaps (both employment and wages) have started to decline slowly since 1990s, a period from which countries across the world have started to become increasingly integrated through international trade.

⁵ 96.6% of the women declare care-taking and household chores as the main reasons for not entering the labour force. In 2018, 40.1% of women in the economically active population did not report any personal income, while only 15.0% of men reported the same situation (INE, 2022).

⁶ Trade policy can also affect gender composition of employment through at least three other different channels: (a) higher participation in the global market promotes competition which can reduce discrimination by either driving discriminating firms out of business or inducing firms to discriminate less (Becker, 1957); (b) if countries have a comparative advantage in female-intensive products or if trade policies benefit female-oriented industries, then trade can increase women's relative employment and wages (Wang et al., 2020); and (c) it can lead to a reallocation of production factors across different sectors of production (Mansour et al., 2022).

⁷ Acosta et al. (2014) and Guimón et al. (2018) argue that for Latin American countries adopting new and advanced technologies may correct for the gender gap and utilize an untapped labour force which can be useful in the overall development of the economies.

⁸ Section 2 describes in detail the Chile–Mexico FTA.

⁹ We follow (Trefler, 2004) and use the difference in the Mexican tariffs for Chile to Mexican tariffs for RoW.

¹⁰ We do the same for male employment in Figure B.1 (Appendix B). We find opposite effect — the correlation is upward sloping.

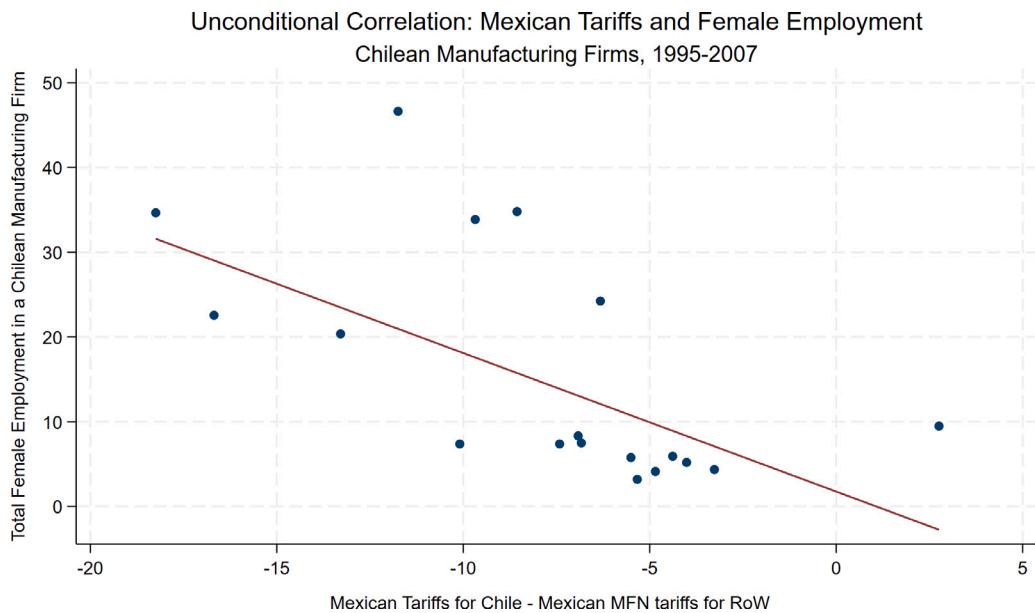


Fig. 1. Chile–Mexico FTA and Female Employment, Chilean Manufacturing Firms, 1995–2007.

Notes: The figure plots the unconditional correlation (non-parametric) between tariff rates for Mexico imposed on Chilean exports and total female employment of a firm. We follow standard approach in the trade literature and define the tariff change as: $Chile - Mexico FTA Tariffs_j = \ln(1 + \text{Mexico tariff in industry } j \text{ on Chilean exports}) - \ln(1 + \text{Mexico tariff in industry } j \text{ on exports from Rest of World})$. The data are divided into 20 bins of each variable.

exporters and non-exporters. In particular, our interaction term would interpret the difference in response to the Chile–Mexico FTA between these groups of firms in terms of gender composition of employment of white- and blue-collar workers.

Our identification strategy potentially alleviates any concern regarding endogeneity through reverse causality since gender employment decisions of firms cannot possibly be regarded to be influencing the signing of a FTA or drop in tariffs. However, we explicitly check for such concerns by regressing the share of female white-collar workers before the FTA on the change in tariffs after the reform. We do not find any effect; more on this in Section 4. Additionally, we also check for pre-trends in the differences between (i) exporters and non-exporters and (ii) exporters particularly to Mexico and other exporters in terms of total and female employment, the demand for female white-, and blue-collar workers; we do not find any conceivable differences between these sets of firms before the Chile–Mexico FTA.

Lastly, to ensure that our benchmark results are robust to omitted variables, we control for destination, product, and industry-region fixed effects (such as location or natural endowment-related shocks specific to each industry, labour supply, etc.). This allows us to absorb all other confounding factors that may simultaneously affect exports and employment trajectories of firms. We also use Chilean imports by Mexico for robustness checks, and our results remain qualitatively similar to all these different sets of estimations.¹¹

We have three sets of results. First, our estimations reveal that a 10% drop in tariffs after the trade agreement increased the share and number of female white-collar workers for a new exporter exporting to Mexico by 1% and 2.9%, respectively. In other words, the Chile–Mexico FTA or complete elimination of tariffs led to about 10% increase in the share of female white-collar workers for a new Chilean manufacturing exporter exporting to Mexico. For example, an average Chilean exporter had about 11.9% female white-collar workers before the FTA, and that increased to 13.3%. Our benchmark result is propelled by (a) firms of all size categories, except for the top quartile indicating a possible reorganization in the labour force across all types of new exporters except for the big ones which may already have higher share of female white-collar workers; and (b) domestic firms producing final goods.

Second, this increase in the share of female white-collar workers is primarily driven by an increase in the employment of skilled workers. In particular, we find a substitution effect from male to female in this category of workers. As a result, the female/male ratio of white-collar workers increases by around 1.8% (due to a 10% drop in tariffs). As for the blue-collar workers, our results are mixed. Although we find a significant effect of tariff changes on the share, we do not find any result while controlling for input tariffs or pre-trends.

We also find an overall increase in female employment (both number and share) for an average Chilean manufacturing firm with a simultaneous decrease in the share of male employment as a result of the FTA.

¹¹ Our results are also robust to controlling for exports to major developed economies, such as Canada, the US, and EU.

Lastly, in terms of mechanism, we find that strong evidence for two: (a) changes in a new exporter's (exporting to Mexico) non-production tasks: use of technology (both domestic and foreign), innovation-related expenses, and publicity and promotional expenses. Our results are consistent with both the theoretical frameworks that focus on productive efficiency gains associated with trade (Melitz and Trefler, 2012; Juhn et al., 2013) and that of comparative advantage and skill-premium of women (Black and Spitz-Oener, 2010; Cortes et al., 2018). The mechanism also lines up with the technology choice models of Bustos (2011), Juhn et al. (2014) and Bonfiglioli and De Pace (2021), which are based on the trade-related incentives of an exporting firm to modify technology. This modification specifically happens through skill-based non-production and interactive tasks;

and (b) reduction or correction of discrimination. Our results show that the increase in the share of female white-collar workers is significantly higher (3–15 times) in firms which have higher proportion of males in the C-suite (both as owners and CEOs). We do find effects with female ownership, but lower than males. On other hand, we do not find evidence of a supply-side effect. Overall, our results suggest a demand-side mechanism at work.

This paper adds to multiple strands of literature. Our first contribution is regarding the impact of global market participation on labour force reorganization.¹² Studies are divided into two categories: import competition (Black and Spitz-Oener, 2010; Hakobyan and McLaren, 2016; Mansour et al., 2022) and export participation (Juhn et al., 2013; Sauré and Zoabi, 2014; Bonfiglioli and De Pace, 2021) effects of international trade.¹³ Overall results are mixed. For instance, Bonfiglioli and De Pace (2021)¹⁴ find a reduction in gender gap for white-collar workers for exporters using German data, whereas (Juhn et al., 2014) show a reduction in gender gap for blue-collar workers in the case of Mexican firms. On the other hand, Sauré and Zoabi (2014) and Mansour et al. (2022) show a reduction in the female labour force participation in the US and Peru following trade expansion and import competition.¹⁵

We add to this debate by employing detailed data on gender composition of several occupational categories along with customs data following an FTA for Chilean manufacturing firms. To the best of our knowledge, ours is one of the first to show that increased export market opportunities can induce a reallocation of white-collar workers toward more female employees, thereby reducing the overall gender employment gap. We take this analysis a step further by finding that employment of skilled female workers increases with a simultaneous drop for male workers (skilled).¹⁶ Moreover, this substitution is driven by the increase in interactive non-production skilled tasks that explains the increase in female workers or the decrease in gender employment gap. Our results regarding changes in production technologies in favour of non-production tasks support the argument of women's advantage in these interactive roles, which require "brain" over "brawn". This is our primary contribution. And, this happened as firms (or new exporters) started to export to Mexico due to the FTA.

Secondly, we contribute to the literature that studies the drivers of the gender gap in labour force participation. Specifically, we document the role of trade induced skill-biased technological change in non-production tasks that explains the change in the female white-collar worker share. This result is similar to Black and Brainerd (2004) for US firms in case of the overall gender wage gap and Juhn et al. (2014)¹⁷ for Mexican firms for blue-collar workers.¹⁸ In addition, while most of the existing studies rely on either individual level labour census or household survey data, or firm level survey data, our paper exploits firm level panel

¹² Researchers over the years have highlighted a lot of factors that can potentially reduce the perceived gender inequality gap (both wage and employment), especially in the labour markets: (a) changes in social norms or culture (Fernández and Fogli, 2009; Choi and Greaney, 2022; Tang and Zhang, 2021); (b) technological advancements (Weinberg, 2000; Greenwood et al., 2005; Black and Spitz-Oener, 2010); (c) bargaining power (Alan, 2011; Nekby, 2003); and (d) social institutions (Bertola and Rogerson, 1997; Muralidharan and Prakash, 2017; Kondylis et al., 2020; Banerjee, 2022).

¹³ There is a seemingly large volume of studies which investigates the effect of globalization on gender inequality in both developed countries, such as US (Hakobyan and McLaren, 2016; Ghosh et al., 2022; Black and Brainerd, 2004; Sauré and Zoabi, 2014), Germany (Bonfiglioli and De Pace, 2021; Black and Spitz-Oener, 2010), Korea (Choi and Greaney, 2022), Norway (Boyer et al., 2018), East Asia (Berik et al., 2004), etc. and developing economies such as Brazil (Paz and Ssozi, 2021), Egypt (Alazzawi, 2014), Indonesia (Kis-Katos et al., 2018), Mexico (Ben Yahmed and Bombarda, 2020), China (Wang et al., 2020), India (Gupta, 2021) and Peru (Mansour et al., 2022).

¹⁴ Our findings are, in spirit, similar to Bonfiglioli and De Pace (2021). However, their results only show a correlation between exports and the share of female white-collar workers, whereas we clearly establish a causal effect of new export opportunities due to a signing of a FTA, and the demand for female white-collar workers. In addition, they do not show any kind of substitution happening between female and male white-collar workers, which is one of our main contributions.

¹⁵ Similar results are found with cross-country studies as well. On the other hand, Berik et al. (2004) show that higher foreign competition resulting from trade increases gender wage gap in East Asian countries, whereas (Oostendorp, 2009) shows opposite effects using data for 80 countries.

¹⁶ Weinberg (2000) shows that the adoption of computers by the US firms in the 1970s and 80s increased the demand for female workers even if women have no advantage in using computers or in acquiring computer skills.

¹⁷ Our paper is closest to Juhn et al. (2014) who uses the NAFTA to study its impact on gender employment gap for Mexican firms. However, it differs in at least four key aspects: (a) (Juhn et al., 2014) show that increased export opportunities lead to a reduction in gender inequality of blue-collar workers while leaving the white-collar gender gap unchanged. We, on the other hand, find a drop in gender-employment gap for white-collar workers due to drop in export tariffs while a drop gender-employment gap for blue-collar workers due to import or input tariffs. Juhn et al. (2014) find no effect for input tariffs; (b) we add to the results by showing that this reorganization in the Chilean white-collar labour force happens through substitution from male skilled workers to female skilled workers; (c) we show that it is the use of foreign technology, more research, and other non-production tasks that lead to this change while (Juhn et al., 2014) show it is the use of modern machinery that is the cause of the change in blue-collar female workers ratio. We show similar changes for female blue-collar workers, but due to changes in input or import tariffs. In addition, we find only increase in hiring of female unskilled workers with no substitution effect like (Juhn et al., 2014); (d) we also show that is the reduction or correction of discrimination in hiring that also explains the increase in the share of female white-collar workers while there is no such mechanism in place in Juhn et al. (2014); and (e) we find that this reallocation of white-collar workers led to a significant change in labour productivity, while there is no such case in Juhn et al. (2014).

¹⁸ In a slightly different context, both (Tang and Zhang, 2021) and Choi and Greaney (2022) show that acquisition of domestic Chinese and Korean firms, respectively by multinationals also increase the proportion of female white-collar workers thereby highlighting the cultural norms to be a main driver of reduction of gender gap.

matched with detailed customs data over a considerably large period of time with gender composition of employment details for several occupational groups reflecting employment adjustment within the firm for the Chilean manufacturing sector.

Lastly, our results also contribute to the literature on how the presence of women in C-suite affects workplace gender inequality (Bertrand et al., 2019; Flabbi et al., 2019; Kunze and Miller, 2017; Maida and Weber, 2022). The findings are not unanimous. Bertrand et al. (2019) document that a gender quota policy in Norway reduces the gender gap in earnings within boards but has no effect on other female employees. In contrast, Kunze and Miller (2017) find the reverse. Flabbi et al. (2019) find a positive impact of female leadership at the top of the female wage distribution, but a negative impact at the bottom for Italian firms. We add to this debate by showing that the effect of trade policy can also reduce discrimination by increasing the chance of employment for female workers (in our case, white-collar) in firms with male members in the C-suite. This is our secondary contribution.

The rest of the paper is organized as follows. Section 2 describes the Chile–Mexico FTA and lays down the institutional background. We describe our dataset in detail in Section 3 with a few stylized facts. Section 4 explains our empirical strategy. Section 5 presents our baseline results, robustness checks, threats to identification, and the mechanisms behind them. Section 6 concludes.

2. Chile–Mexico FTA

After the debt crisis in the 1980s, Latin American countries started to pursue both product and market diversification using trade agreements with two main goals: (a) boost exports, especially in the new markets; and (b) pursue an export-led development strategy. Chile, after returning to democracy at the beginning of the 1990s, was the leader in signing Economic Cooperation Agreements (ACEs) and/or trade agreements. By 2012 it became the country with the highest number of FTAs signed in Latin America (Dingemans and Ross, 2012).

In particular, Chile signed 7 ACEs (among them, the major one being with the MERCOSUR in 1996) before signing their first FTA with Canada, also in 1996. It entered into force on July 1997. The second FTA, interestingly the first significant one that was signed by Chile, was with Mexico in 1998 and entered into effect by August 1999. It was a natural extension of the ACE signed between them in 1992. However, the commercial and diplomatic relationship changed dramatically due to the FTA as the tariff drop reached 98.3% of the traded items between Chile and Mexico (Subsecretaría de Relaciones Económicas Internacionales [SUBREI], 2014).

The reasons to the focus on the Chile–Mexico rather than the Chile–Canada FTA are manifold: (a) the Chile–Canada FTA was signed in the same year when Chile entered into an economic partnership agreement with MERCOSUR, therefore identifying or disentangling the effects of the Chile–Canada FTA would be difficult; (b) tariffs on products in the case of the Chile–Canada FTA were not immediately dropped to zero after the FTA, creating a certain level of uncertainty regarding when or whether the agreement would be implemented or not. However, it was finally implemented in 2003–04. Focusing on a FTA which is uncertain in nature, in terms of its timing of implementation, would not yield desired results as uncertainty in trade policies can lead to negative firm outcomes; (c) the coverage of the goods in the Chile–Mexico agreement was significantly larger than the Chile–Canada FTA; and (d) the drop in tariffs in the case of Mexico was the highest compared to any other destinations involved in a FTA with Chile, such as Canada.

2.1. Stylized facts: Chilean exports to Mexico

#1: Tariffs dropped to zero for almost every industrial sector

Columns (1) and (2) in Panel A of Table 1 presents Chile's median tariff schedule divided into pre- and post-FTA, i.e., for the years 1995–1998 and 1999–2007. Column (1) calculates the median tariff faced by Chilean exporters while exporting to Mexico, while column (2) does the same for Mexican exporters. The median tariff for Chilean exports to Mexico was 14% before the FTA, which dropped to zero after. On the other hand, this was not the case with Mexican exports to Chile: the tariffs were only about halved. The tariff drop due to the Chile–Mexico FTA were highest for Chile compared to any other destinations (during the same time period), such as Latin America (column (3)), EU (column (6)), World (column (8)), and especially Canada (column (5)) with whom a FTA was signed by Chile a couple of years before.¹⁹

#2: Both levels and share of exports to Mexico increased

Columns (1)–(2) in Panel B of Table 1 displays Chile's trade (exports and imports) with Mexico. In addition, columns (3)–(8) of Panel B does the same for other important trade partners of Chile, such as the other Latin American countries, US, Canada, Asia, and the rest of the World.

Median real exports from Chile to Mexico were around 2800 (in '000 USD) between 1995 and 1998, which grew by more than 200% after the FTA (between 1999 and 2007) to 8500 (in '000 USD). Panel A of Fig. 2 plots the share of Chilean imports in Mexico's total imports before and after the FTA. It show very similar picture: the share of Chilean imports was just below 4% before the FTA

¹⁹ Columns (1) and (2) Table C.1 (Appendix C) splits aggregate tariffs into (a) final and intermediate goods, and (b) every 2-digit industrial sector before (1995–1998) and after (1999–2007) the FTA. Apart from sector 16 (Tobacco) and 23 (Petroleum), median tariffs for every other sector was dropped to zero. For Tobacco, it actually increased to 67 from 0 and for Petroleum it was dropped to 3.7 from 5. Overall, the final goods industry experienced a bigger tariff cut, due to the FTA, than the intermediate goods sector.

Table 1
Chile's trade with Mexico and others.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Panel A: Tariffs	Tariffs with Mexico		Tariffs for Exports to Other Countries						
	Exports to Mexico	Imports from Mexico	Latin America	US	Canada	EU27	Asia	World	
	1995–1998	13.91	11.00	13.57	0.00	2.50	3.09	3.70	10.56
	1999–2007	0.00	6.00	9.78	0.00	0.00	0.01	3.85	6.78
Panel B: Trade Values	Trade with Mexico		Exports to Other Countries						
	Exports to Mexico	Imports from Mexico	Latin America	US	Canada	EU27	Asia	World	
	1995–1998	2,786	9,708	25,778	19,017	1,650	36,059	39,555	114,898
	1999–2007	8,444	6,162	33,804	25,068	3,207	33,732	35,759	132,157
	Growth	203%	−37%	31%	32%	94%	−5%	−10%	15%

Notes: In Panel A, numbers represent median weighted tariffs across all manufacturing sectors. In Panel B, numbers represent real median trade values (deflated using the yearly Wholesale Price Index of the manufacturing sector) in '000 USD. For Canada, the values are for the periods 1995–1997 and 1998–2007; for others it is as mentioned.

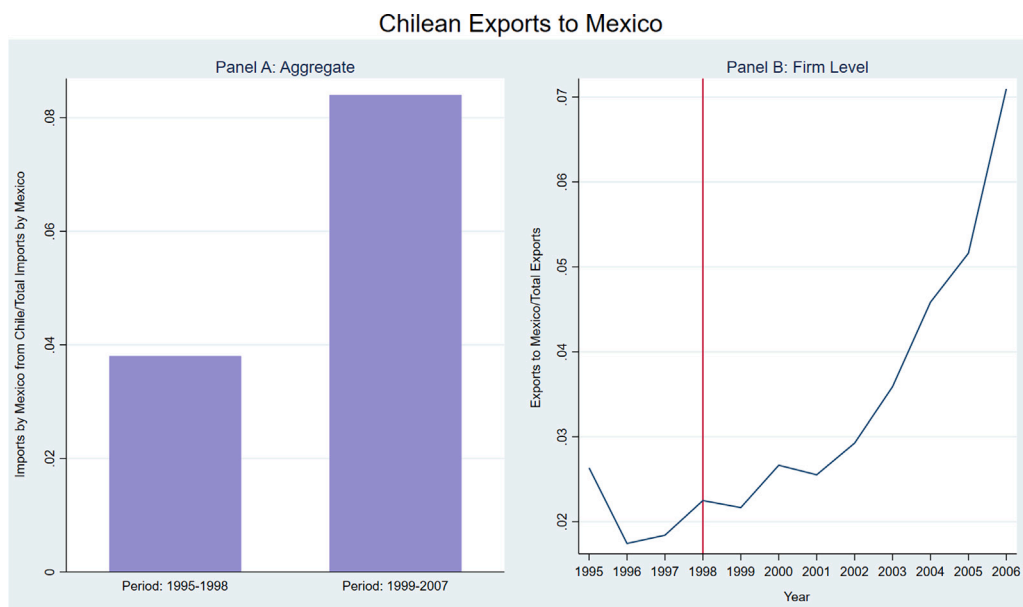


Fig. 2. Chile–Mexico FTA and Chilean Exports: Aggregate and Firm Level, Chilean Manufacturing Firms, 1995–2007. Notes: Panel A plots the Mexican share of Chilean imports (Imports by Mexico from Chile/Imports by Mexico from World). Panel B plots the share of exports of a Chilean exporter to Mexico (Exports to Mexico/Total Exports).

and it increased to more than 8% after the FTA. During the same time frame, exports to other destinations such as Latin American countries, US, Canada, European Union, World increased only by 31, 32, 94, 5, and 15%, respectively.²⁰

3. Dataset

Our primary source of data for the 1995–2007 period is from the Chilean *Encuesta Nacional Industrial Anual* (ENIA), which is a national annual survey of the manufacturing sector. The survey is conducted by the Chilean National Statistics Institute (INE), and it covers all establishments (plants) with ten or more workers.²¹ The dataset is organized at the International Standard Industrial

²⁰ Likewise, columns (3), (4), and (5) of Table C.1 presents exports by Chile to Mexico by different industrial sectors before and after the FTA, and % change. Exports from Chile to Mexico grew substantially almost across every industrial sector: paper and paper products (sector 21) register the highest increase (2700%) followed by wood (1220%), petroleum (980%), chemical products (730%), motor vehicles (530%), etc. In terms of share (columns (6)–(8)), the picture is very similar, except for a few sectors where we see a drop, such as Petroleum and Non-metallic minerals.

²¹ Different versions of this dataset have previously been used by Pavcnik (2002), Levinsohn and Petrin (2003), Alvarez and López (2005), Fernandes and Paunov (2012), Petrin and Sivadasan (2013), Canavire-Bacarreza and Castro Peñarrieta (2021), among others.

Classification of All Economic Activities (ISIC) Revision 3 from the United Nations (UN) classification system to codify a plant's economic activity at the four-digit level.

Our unit of observation is an “establishment” (plant). There are firms that are single-plant, and there are firms with more than one plant integrated either vertically or horizontally (multi-plant and multi-activity). In the case of multiple plants that belong to a single firm, the survey includes each of the firm's plants. This could present a problem if most firms are multi-plant; however, as noted by Pavcnik (2002), Fernandes and Paunov (2012), and Alvarez and Opazo (2011), around or more than 90% of the Chilean manufacturing firms are single-plant firms. Therefore, our data consists of an unbalanced panel of Chilean manufacturing plants over 13 year period.

This dataset is unique in terms of its coverage — especially from the early 1990s. Below we list the other advantages of using the ENIA database:

(a) a crucial feature of the dataset, which we utilize as our key dependent variable, is that it disaggregates the overall employment of a firm in seven different occupational groups: (i) owner, (ii) CEO, (iii) skilled workers, (iv) administrative workers, (v) unskilled workers, (vi) services workers, and (vii) commissioned workers.²² And, these different occupational groups are further subdivided into male and female workers. We use the sum of the owner, CEO, and skilled workers as the white-collar workers, whereas unskilled and services are put together as blue-collar workers.

(b) a key mechanism that we highlight in the paper in terms of explaining the changes in female white-collar workers after the Chile–Mexico FTA in 1998 is the changes in the non-production related tasks such as technology transfer/adoption (both foreign or domestic), research expenses, publicity and promotional expenses of a firm. We argue that the Chile–Mexico FTA induced new exporters to adopt these tasks at a higher scale. Since women have a comparative advantage in these tasks, their share increases. The dataset provides detailed data on each of these variables.

(c) lastly, the dataset also provides information on a series of firm level characteristics inclusive of, but not limited to, total sales, sales related to manufacturing, total wages (divided into white- and blue-collar), value-added, exports, imports, cost of production, raw material expenditure, expenses on energy, capital employed, expenditure on machinery (total plus new), assets, among others. All nominal values are represented in '000 Pesos deflated with respect to the industry-specific Wholesale Price Index (WPI) with the base year as 2003. The details are given in Appendix A.²³

We match this dataset with the administrative official customs records for the period 1995–2007. We obtain the value of export for each HS 6-digit product exported to each of the destination by an exporter. Using confidential information on tax identification number, we matched the firms from ENIA with the customs data, obtaining a panel of information on exports, export destinations, employment, and other key firm characteristics by each individual firm.²⁴ For example, we now know which firm is exporting to Mexico before and after the FTA and the details of its employment structure (say, in terms of female and male white-collar workers, female and male blue-collar workers, etc.) compared to a firm which does not export to Mexico and/or non-exporting firms. Across our primary and the matched dataset, we now present a few key stylized facts below.

3.1. Stylized facts — firm level export: Intensive and extensive margin

#1: Firm level export share also increased

Panel B of Fig. 2 calculates and plots the share of firm level exports to Mexico for 1995–2007. The trend line shows a spectacular increase after the signing of the FTA — it jumped from about 2% to close to 7%.

Table C.4 lists the names of the top 10 export destinations for Chilean exporters according to the total number of product lines (at HS 6-digit level) exported to that particular destination. Before the FTA, Mexico was either out of the top 10 export destination or in the bottom of the top 10 names. And, this changed dramatically after the FTA — it jumped up to be one of the top 5 destinations.²⁵ We also calculate the region wise of firm level exports to Mexico (as a share of total exports) by dividing Chile into 13 major regions in Table C.5. The percentages show that the increase in the share of exports to Mexico is pervasive across all the regions and not restricted to any particular province. Araucania (13,275%) registered the highest increase, followed by Aisen (2300%), Tarapaca (1293%), Los Lagos (1274%), etc.

²² We note that there is some scope for subjective interpretation of these terminologies. However, ENIA has standard definitions across these classifications, and all the plants/firms follow them.

²³ Table C.2 gives a snapshot of our firm level dataset. We have 9000+ plants/firms with 8% being foreign-owned. 30% are exporters and the rest non-exporters. Regarding the number of workers, around 47% have 10–20, 29% have 21–50, 12% have 51–100, and 13% have more than 100 workers. A firm on average has 64 workers out of which 37 are blue-collar, 16 are white-collar, and the rest other types of workers. Sales and value-added of a firm are about 5516 and 2789 thousand pesos, respectively. Table C.3 presents region-industry wise number of firms. For most of the industries, there is a high concentration of firms in Metropolitan area of Santiago, followed by Biobio, Valparaiso, Los Lagos, etc. On the other hand, industries like food (15), non-metallic minerals (26), furniture (36), etc. are present across all the regions of Chile.

²⁴ It is important to note here that the manufacturing survey is collected at the plant level, while the customs record data at the firm level. Since all the plants owned by the same firm share the same tax identification number, we aggregate information across plants belonging to the same firm and created a dataset at the firm rather than plant level while also retaining plants identification. In the matched data, only about 3.5% firms are multi-plants.

²⁵ Figure B.2 presents the share of product lines (at HS 6-digit codes) exported to Mexico as a share of (a) top 3 export destinations (Panel A) and (b) all exporting destinations (Panel B). For the former, it increased from 9% to 25% and for the latter it went up from below 3% to 5% after the FTA.

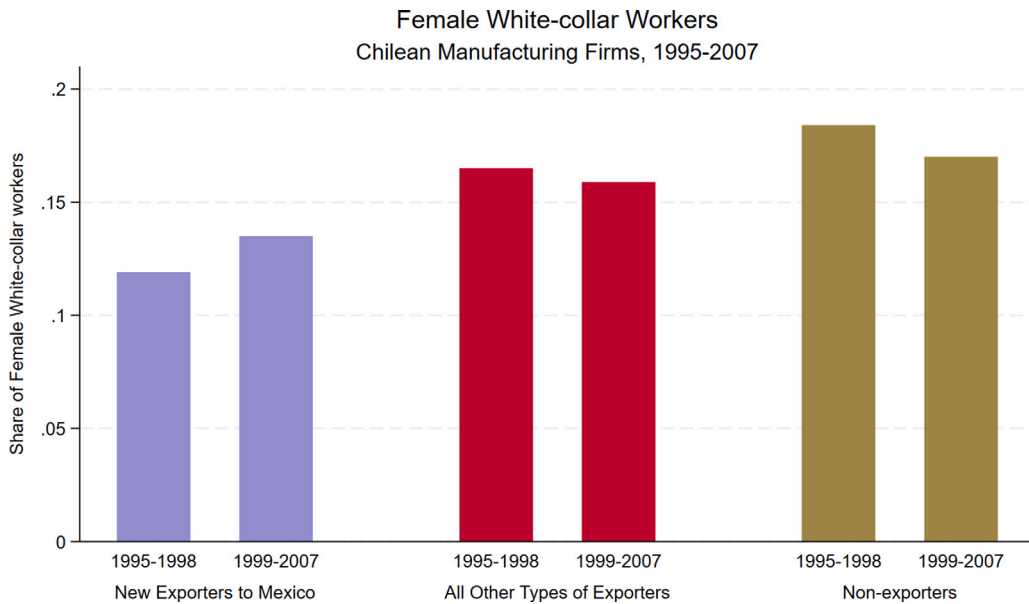


Fig. 3. Chile–Mexico FTA and Female White-collar Workers: By Exporter Type, Chilean Manufacturing Firms, 1995–2007.

Notes: Figure plots the average share of female white-collar workers (female white-collar/total white-collar) according to different types of exporters for the period 1995–1998 and 1999–2007.

#2: Extensive margin also changed substantially

We count the number of firms exporting to Mexico, before and after the FTA, by different regions of Chile and by different industry type in Tables C.6 and C.7, respectively. We note the following: (a) overall there has been an increase of 117%; (b) the increase in the number of exporters to Mexico is widespread. Santiago has the highest number of exporters with Maule and O’Higgins being the second.; (c) picture is similar if we divide our sample according to different industries. Intermediate goods industry saw the biggest increase, but the number of exporters are higher for final goods industry (significantly dominated by the food products).

3.2. Stylized facts — share of female white-collar workers

#1: No difference between Mexican exporters and Other Exporters

Columns (1)–(2) and (3)–(4) of Table C.8 presents the mean and standard deviation for a number of key outcomes, employment related variables in **Panel A** and performance related variables in **Panel B**, for Mexican exporters and other exporters. Columns (5) and (6) does the same for non-exporters.

Exporters (combining both Mexican and others), on average, are larger in size (in terms of employment), have higher sales, value-added, imports, labour productivity, and share of foreign capital. They also employ more white- and blue-collar workers. This is consistent with observations across firms in both developed and developing economies (World Bank and WTO, 2020). However, there is not much of difference between Mexican exporters and other exporters. For example, a Mexican exporter employs about 7 female white-collar workers while the number is 6.6 for other exporters. Such is the case for the share as well. In terms of female blue-collar workers, both types of firms employ about 39 workers. On the other hand, in terms of value-added a Mexican exporter does about 19,433 (’000) Pesos while the same is 17,443 (’000) Pesos for other exporters. The picture is similar for labour productivity, share of foreign capital, etc.

#2: Share of female white-collar workers increased only for the Mexican exporters

Fig. 3 present the share of female white-collar workers for (a) new exporters to Mexico, (b) all other types of exporters (including other exporters to Mexico) and (c) non-exporters for the period 1995–1998 (before the FTA) and 1999–2007 (after the FTA). The plot clearly shows that the increase in the share of female white-collar workers only happened for exporters to Mexico. In particular, it increased from about 11.9% to 13.5% — a jump of about 13.5%. And, we see a simultaneous drop in the share of the same type of workers for both other exporters and non-exporters hinting toward a possible reallocation of workers toward new exporters to Mexico due to the FTA.

#3: Female white-collar workers increased higher for final goods industry and across regions

Table C.9 presents the overall and industry wise change in the number of female white- and blue-collar workers. The numbers show that overall there was about 28% increase in the female white-collar worker. And, this increase is primarily driven by increase in the final goods industry. In terms of change in different provinces (Table C.10), the increase is significant in most regions. On the other hand, for blue-collar workers, the picture is somewhat mixed.

4. Empirical strategy

We use the matched firm-customs level data to estimate the effect of the 1999 Chile–Mexico FTA on Chilean manufacturers using a simple reduced-form equation. Following (Stefano et al., 2025), our study design utilizes a simple difference framework over the period 1995–2007, where we use changes between the periods 1995–1998 and 1999–2007 for our variables of interest. Essentially, we use two periods: one pre-FTA and one post-FTA. We use the following specification:

$$\Delta y_{ijt} = \beta_1 \left(\Delta \text{Tariff}_{jt}^{\text{Mexico}} \times \text{Exporter}_i^{\text{Mexico}} \right) + \beta_2 \Delta \text{Tariff}_{jt}^{\text{Mexico}} + \delta_j^r + \nu_p + \eta_d + \Delta \epsilon_{ijt} \quad (1)$$

where i indexes firms, j indexes industries, and $t \in \{1995-1998, 1999-2007\}$ indexes periods.²⁶ y_{ijt} represents our outcome variable of interest for firm i in sector j between the period 1995–1998 and 1999–2007. It assumes several outcomes of interests, such as the share of female white-collar workers, the absolute number of female white-collar workers, the share of female blue-collar workers, the absolute number of female blue-collar workers, the female-male ratio of white- and blue-collar workers, male white- and blue-collar workers, etc.²⁷

In our analysis y is the difference in the average of, say share of female white-collar workers in total (male + female) white-collar workers for firm i between the period 1995–1998 and 1999–2007. In other words, our unit of analysis is the difference in the average value of the share of female white-collar workers for each firm between 1999–2007 and 1995–1998.²⁸

$\Delta \text{Tariff}_{jt}^{\text{Mexico}}$ is the difference in the average tariffs at 4-digit ISIC (International Standard Industrial Classification) 3.1 faced by Chilean exporters while exporting to Mexico for each industry, j , between 1999–2007 and 1995–1998. We interact this simple difference in tariffs between two periods with $\text{Exporter}_i^{\text{Mexico}}$ in order to investigate the differential effect for Mexican exporters as a result of the drop in tariffs on Chilean exports to Mexico (due to the Chile–Mexico FTA). $\text{Exporter}_i^{\text{Mexico}}$ is a binary variable that takes value 1 if firm i exports to Mexico in any year between 1995–2007 or zero otherwise. And, it is a time-invariant dummy. Additionally, we divide our exporter dummy into incumbent and new exporters. An incumbent, $\text{Exporter}_{\text{Incumbent},i}^{\text{Mexico}}$, is one if it has exported at least once to Mexico before the signing of the FTA, whereas a new exporter, $\text{Exporter}_{\text{New},i}^{\text{Mexico}}$, is one if a firm exported to Mexico for one or more years after the FTA given that it has not exported to Mexico before the FTA. All these different exporter dummies are time-invariant.²⁹ We use two-way clustering of our standard errors — at the industry (4-digit) and period level.³⁰

The main advantage of using a simple difference between two periods is that it sweeps out the unobservable differences in firm heterogeneity, which can affect our outcome variable of interest. In other words, it circumvents the firm fixed effects. On the other hand, the Chile–Mexico FTA is certainly not the only external shock that could possibly influence the demand for more female white-collar workers (for example) for the manufacturing firms in Chile.

One of the major factors that can possibly affect the employment of more female white-collar workers could be some destination-specific unobservables. For example, demand for goods from Chile decreased in certain countries and that led firms to switch to Mexico or some firms in Mexico wanted their suppliers from Chile to balance their gender employment ratio, etc. In addition, there could be favourable real exchange rate shocks or financial conditions favouring Chilean exports to Mexico compared to other trading partners and this may drive the share of female white-collar workers. In order to control for such events, we control for destination fixed effects, η_d , in our regressions. There could also be demand for certain products that increased due to the FTA and the production of those products are correlated with the employment of more women in a firm. We use ν_p or product fixed effects at the HS 6-digit level to control for any product-specific unobserved heterogeneity.

Lastly, there could also be regional policies supporting the exporters of say, certain export-oriented industries to be successful at the export market, such as export subsidies or promoting more social justice programmes for increasing women employment, etc. And, this may significantly impact the firm level decision-making process regarding the employment of more women given the industry that the firm belongs. It is quite likely such events, especially the ones happening around 1999, could impact our estimates. In order to control for such phenomenon, we add region(r)-industry fixed effects to all our specifications, δ_j^r .

²⁶ We have also divided the overall time period into three equally-spaced time intervals in a robustness check in Section 5.2.1.

²⁷ We also explored our results using the approach of Autor et al. (2013) where we interact the changes in tariffs at the industry level (4-digit) with industrial composition of local labour markets. Although the results remain the same, we refrain from using the approach as the variation across regions is not that high given that Chile is a very small country, with the entire country only divided into 13 regions and with a high concentration of firms in the Santiago metropolitan area.

²⁸ So, essentially, our data collapses to two periods: one, before FTA 1995–1998, and two, after FTA 1999–2007.

²⁹ We have experimented our results using different versions, such as a firm exporting at least thrice after the FTA, the results remain qualitatively the same.

³⁰ This is due to the fact that our main variable of interest, tariffs, vary at the 4-digit level.

Controlling for all such factors, our coefficient of interest, β_1 , in Eq. (1) would then measure the differential effect of the Chile–Mexico FTA on the share of female employment (for white- and blue-collar jobs) for an exporter exporting to Mexico relative to all other exporters and non-exporters (when we drop the destination and product fixed effects). Therefore, $\beta_1 + \beta_2$ would measure the net effect due to the changes in tariffs for a Chilean manufacturing firm due to the Chile–Mexico FTA. The argument goes as follows: any event that is not firm-specific (e.g., a domestic macroeconomic policy change) would impact both the Mexican exporters, other types of exporters, and/or non-exporting firms in an identical fashion. Thus the net effects shown by the Mexican exporting firms in the post-FTA period over and above all the other types of firms (other exporters plus the non-exporters) in this context would represent an effect attributable only to the Chile–Mexico FTA. In summary, we expect a higher demand for female white-collar workers and hence, a rise in their share due to a probable change in the production technology of the exporters as a result of the FTA.

However, the basic estimates still may not provide any conclusive evidence of the causal effect because of the following reasons: (a) reverse causality; (b) differential trends in the pre-FTA period between the exporters and non-exporters or to be specific Mexican exporters and other types of exporters; and (c) omitted variable bias. Below we will consider each of them separately and show that our results are robust to all three. We first show that employment of a firm or any other related feature, such as the female share of white- and blue-collar workers, did not influence the Chile–Mexico FTA or the drop in tariffs through any kind of lobbying using a series of explicit exogeneity checks. As for the latter ones, we show that no pre-trends exist, i.e., neither the exporters and non-exporters or Mexican exporters and other exporters are not on differential trends with respect to overall employment, the female share of overall employment, female share of white-collar jobs, and the female share of blue-collar jobs. We address the problem of omitted variables by sequentially adding various firm and industry characteristics to our baseline specification.

4.1. Pre-trends and endogeneity checks

We do a series of endogeneity checks in Table 2. We start by showing that changes in tariffs (between Chile and Mexico) are not influenced by either total employment of a firm or the female share of employment or the female share of white- and blue-collar workers in the pre-FTA period (1995 to 1998) in Panel A. Columns (1)–(4) regresses change in tariffs at time t on our variables of interest at time $t - 1$. In effect, we run the following specification³¹:

$$\Delta \text{Tariff} f s_{jt}^{\text{Mexico}} = \pi X_{it-1} + \phi_i + \theta_j^t + \delta_j^r + \mu_r^t + \text{firmcontrols}_{it} + \epsilon_{ijt} \quad (2)$$

where X includes total employment (a larger firm size, especially the exporters, may lobby for the FTA in order to reap higher gains), female employment (higher or lower female share in the exporting firms may influence the signing of the FTA in order to expropriate further benefits or increase their employment share), female share of white-collar workers (a highly skilled (female) workforce may also push for the FTA in order to influence changes in the production technology such that they can obtain benefits from higher technology use), and female share of blue-collar workers of a firm. All our specifications control for firm (ϕ_i), industry (2-digit)-year (θ_j^t), industry-region (δ_j^r), and region-year (μ_r^t) fixed effects. We cluster our standard errors at the industry level (4-digit). The coefficients indicate no statistical correlation between the Chile–Mexico FTA and any of the firm characteristics in the pre-FTA period.

Next, in Panel B we regress the same firm characteristics, using our firm-year level data, on the interactions of $D_t \times \text{Exporter}_i$ where $t = 1995, 1996, 1997, \text{ and } 1998$. This is to understand whether there were any discernible differences between the exporters and non-exporters in terms of total and female employment. Panel C does the same for Mexican and other types of exporters. We additionally include destination and product fixed effects in these regressions to control for any destination- and/or product-specific unobservables. The estimates from these two different panels suggest that there is no differential time trend in either total employment or female share of employment or female share of white and blue-collar workers between exporters and non-exporters in the pre-FTA period.

Interpreting it differently, our idea for these two panels of estimates is to check whether any other shocks or other trade policy changes, such as the Chile–Canada FTA, had any previous impact on the gender composition of employment. As our estimates show, no such effects exist. Combining all of the above observations, we can conclude that the Chile–Mexico FTA was exogenous to the prevailing conditions of the Chilean labour market, especially with respect to female employment and there was no differential trend between neither the exporters and non-exporters nor Mexican exporters and other types of exporters.

5. Results

5.1. First order effects

Before we start to investigate the effect of the Chile–Mexico FTA on the gender composition of employment across different occupational groups, it is imperative to understand the impact of the FTA on different margins of trade. For instance, did the drop

³¹ We also use two other approaches: (a) interaction term between $\Delta \text{Tariff} f s_{jt}$ and $\text{Exporter}_i^{\text{Mexico}}$; and (b) interaction term between a dummy indicating the FTA, FTA_{1999} taking a value if the year is ≥ 1999 , and $\text{Exporter}_i^{\text{Mexico}}$ as the outcomes variable of interest; the results remain the same.

Table 2
Endogeneity of tariffs and pre-trends check for Chile–Mexico FTA.

	(1)	(2)	(3)	(4)
Panel A: Endogeneity Checks				
	$\Delta Tariff_{jt}$			
Total Employment _{<i>it-1</i>}	0.084 (0.075)			
Female Employment _{<i>it-1</i>}		0.053 (0.131)		
Female White-collar Workers _{<i>it-1</i>}			-0.374 (0.299)	
Female Blue-collar Workers _{<i>it-1</i>}				0.146 (0.121)
R-Square	0.85	0.85	0.85	0.85
N	41,757	42,250	42,250	42,250
Panel B: Differences in Pre-Trends VExporters vs. Non-exporters				
	Total Employment	Female Employment	Share of Female White-collar Workers	Share of Female Blue-collar Workers
$D_{1995} \times Exporter_i$	-0.012 (0.017)	0.027 (0.024)	-0.011 (0.007)	-0.006 (0.009)
$D_{1996} \times Exporter_i$	-0.002 (0.015)	0.006 (0.022)	-0.008 (0.006)	-0.006 (0.005)
$D_{1997} \times Exporter_i$	0.008 (0.014)	0.009 (0.019)	-0.008 (0.006)	-0.009 (0.005)
$D_{1998} \times Exporter_i$	0.005 (0.011)	0.001 (0.016)	-0.010* (0.006)	-0.004 (0.005)
R-Square	0.96	0.93	0.77	0.77
N	24,852	24,869	24,869	24,869
Panel C: Differences in Pre-Trends Mexican Exporters vs. Other Exporters				
$D_{1995} \times Exporter_i^{Mexico}$	0.022 (0.026)	-0.048 (0.083)	-0.006 (0.010)	-0.008 (0.009)
$D_{1996} \times Exporter_i^{Mexico}$	-0.014 (0.028)	-0.026 (0.052)	-0.002 (0.005)	0.006 (0.007)
$D_{1997} \times Exporter_i^{Mexico}$	-0.006 (0.024)	-0.004 (0.040)	0.005 (0.005)	-0.002 (0.008)
$D_{1998} \times Exporter_i^{Mexico}$	0.001 (0.021)	0.011 (0.035)	0.007 (0.004)	0.007 (0.007)
R-Square	0.96	0.94	0.86	0.89
N	143,691	143,933	143,933	143,933
Destination FE	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes
Industry FE (2-digit) × Year FE	Yes	Yes	Yes	Yes
State FE × Year FE	Yes	Yes	Yes	Yes
State FE × Industry FE (2-digit)	Yes	Yes	Yes	Yes

Notes: In Panel A, we use $\Delta Tariff_{jt}$ as the dependent variable. This is the yearly change in tariffs at the industry level (4-digit). These tariffs are faced by Chilean exporters while exporting to Mexico. Or in other words, these tariffs are imposed by Mexico on Chilean exporters. These are estimated at 4-digit industry level. In Panels B and C, columns (1)–(4) use total employment, share of female employment (in total employment), share of female white-collar workers in total white-collar workers, and share of female blue-collar workers as the dependent variable, respectively. $Exporter_i$ is an exporter dummy. It takes a value of 1 if a Chilean firm’s average exports across 1995–1998 is greater than zero. $Exporter_i^{Mexico}$ is an exporter dummy specific to exporters exported to Mexico before the implementation of the FTA. It takes a value of 1 if a firm’s average exports to Mexico across 1995–1998 is greater than zero. D_{1995} , D_{1996} , D_{1997} , D_{1998} are year dummies. These dummies equal to 1 for the respective years. Firm controls include ownership dummy and size (natural logarithm of real gross value-added). Standard errors in parentheses are clustered at 4-digit industry level (Panel A) and firm level (Panel B and C). Intercepts are not reported. *, **, *** denotes 10%, 5%, and 1% level of significance, respectively.

in tariffs (due to the FTA) actually led to an increase in firm level exports to Mexico or, per se, induced firms to participate in the export market? To test these implications, we estimate the following equation:

$$\Delta y_{ijt} = \beta(\Delta Tariff_{jt} s_{jt}^{Mexico} \times Exporter_i^{Mexico}) + \delta_j^r + \nu_p + \eta_d + \Delta \epsilon_{ijt} \quad (3)$$

y_{ijt} denote (a) change in the average of the total exports of a firm between 1995–98 and 1999–2007; or (b) the number of firms exporting to Mexico; or (c) if a firm is exporting to Mexico or has a positive export value for Mexico for any year ≥ 1999 ; or (d)

Table 3
Chile–Mexico FTA and 1st order effects.

	Exports					Export/ Sales (6)	Mexican Exporters		Products Exported to Mexico (9)
	(1)	(2)	(3)	(4)	(5)		(7)	(8)	
$\Delta Tariff_{jt}^{Mexico}$	-0.153** (0.064)	0.120* (0.068)	0.139** (0.066)	0.051 (0.063)	0.145** (0.066)	0.001 (0.002)	-0.102** (0.052)	-0.068* (0.035)	2.777** (1.186)
$\Delta Tariff_{jt}^{Mexico} \times Exporter_i^{Mexico}$		-0.322*** (0.027)							
$\Delta Tariff_{jt}^{Mexico} \times Exporter_{Incumbent,i}^{Mexico}$			-0.090*** (0.014)	-0.029** (0.014)		0.006** (0.003)			-0.404** (0.164)
$\Delta Tariff_{jt}^{Mexico} \times Exporter_{Continuing,i}^{Mexico}$					-0.113*** (0.015)				
$\Delta Tariff_{jt}^{Mexico} \times Exporter_{New,i}^{Mexico}$			-0.278*** (0.025)	-0.216*** (0.027)	-0.270*** (0.023)	-0.021*** (0.003)			-3.796*** (1.057)
R-Square	0.52	0.56	0.56	0.63	0.57	0.43	0.31	0.19	0.54
N	329,803	329,803	329,803	329,803	329,803	427,390	429,236	474,175	427,390
Pre-FTA Mean (Nex Exporter)	-	-	-	-	-	0.265	-	-	45.83
Firm Controls	No	No	No	Yes	No	No	No	No	No
State FE × Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Product FE	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes

Notes: All the regressions are for the years 1995–2007. Columns (1)–(5) use the difference in the average exports of a firm between the years 1999–2007 and 1995–1998; column (6) uses the difference in the average exports to sales ratio of a firm between the years 1999–2007 and 1995–1998; column (7) uses the difference in the number of exporters to Mexico between the years 1999–2007 and 1995–1998; column (8) uses the probability of being an exporter to Mexico after the enforcement of the FTA i.e., after 1998; column (9) uses the difference in the number of products exported by a firm between the years 1999–2007 and 1995–1998 as the dependent variable, respectively. $\Delta Tariff_{jt}^{Mexico}$ is the difference in the average tariffs of an industry j (at 4-digit level) between the years 1999–2007 and 1995–1998. So, $t \in \{1995-1998, 1999-2007\}$ indexes periods. $Exporter_i^{Mexico}$ is a dummy variable which takes value 1 if a firm exports to Mexico at any point in time during the sample time period. $Exporter_{Incumbent,i}^{Mexico}$ and $Exporter_{New,i}^{Mexico}$ are also exporter dummies which takes value 1 if a firm exported to Mexico before and after the FTA, respectively. So, the former one represents an incumbent exporter and the latter a new exporter. Firm controls include a ownership dummy (domestic or foreign) and size (log value of real gross value-added). Standard errors in parentheses are two-way clustered at the industry level (4-digit) and period. Intercepts are not reported. *, **, *** denotes 10%, 5%, and 1% level of significance, respectively.

the number of products (HS 6-digit product lines) exported to Mexico. All others remain the same as in Eq. (1). Table 3 reports the required results.

Column (1) regresses change in total exports of a firm on change in export tariffs for Mexico. Our estimate shows that a 10% drop in tariffs, as a result of the Chile–Mexico FTA, led to a significant increase in exports of a firm by 1.5%. Column (2) introduces the interaction between tariffs and a dummy variable indicating a firm to be an exporter to Mexico. This dummy takes a value 1 if a firm exports to Mexico in any year between 1995 and 2007. The point estimate of the interaction term postulates that the entire increase in the exports of a firm as shown in column (1) is driven by exports toward Mexico. A 10% drop in tariffs led to 3.2% increase in exports to Mexico for an average exporter.

Column (3) divides all exporters to Mexico into — incumbent ($Exporter_{Incumbent,i}^{Mexico}$) and new exporter ($Exporter_{New,i}^{Mexico}$). The former takes a value 1 if a firm has exported to Mexico in any year before the FTA and the latter after the FTA given that it has not exported to Mexico before the FTA. Dividing the set of exporters into incumbent and new shows that the increase in exports is highly concentrated among the new exporters. Column (4) does the same while controlling for firm characteristics (size and ownership) — the estimate does not change. A 10% drop in tariffs led to about 2.2–2.8% increase in exports for an exporter who added Mexico as one of its export destinations after the FTA. One problem with our definition of ex-ante or incumbent exporters could be that a lot of them may have continued to export to Mexico after the FTA and our current definition of incumbent exporters may fail to capture it. In column (5), we create a new indicator for firms exporting to Mexico before and after the FTA, $Exporter_{Continuing,i}^{Mexico}$ and replace it with $Exporter_{Incumbent,i}^{Mexico}$. Continuing exporters also see an increase in their exports, but our results for new exporters continue to have the largest increase.

We replace the value of exports by exports as a ratio to total sales of a firm in column (6). Our estimate shows that 10% drop in tariffs, due to the Chile–Mexico FTA, also led to an increase in the exports to sales ratio by 0.8% ($= (0.021/0.265) \times 10$) for firms who started to export to Mexico after the FTA. In other words, our finding continues to be driven by the set of new exporters.

Columns (7) and (8) report the results on the extensive margin due to the FTA. Column (7) calculates the difference in the number of exporters exporting to Mexico before and after the FTA and regresses on the change in tariffs due to the FTA. We find that a 10% drop in tariffs significantly increased the number of exporters exporting to Mexico by 1%. Column (8) checks for the probability of becoming a new exporter to Mexico after the FTA (the dependent variable takes a value 0 or 1) with the reduction in tariffs. And, this increases by 0.68% (at the mean) with respect to a 10% drop in tariffs.³² Lastly, we use the number of products

³² We also check for overall entry and exit rates of firms in the manufacturing sector. Table C.11 presents such outcomes. The Chile–Mexico FTA also had a significant impact on the entry rates of firms with no effect on exit. A 10% drop in tariff rates, due to the Chile–Mexico FTA, led to about 0.2% increase in entry rates for firms in the manufacturing sector as a whole.

Table 4
Chile–Mexico FTA and female employment dynamics: Benchmark results.

	Female Workers/Total (Female + Male) Workers					
	All		Mexican Exporters			
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: White-collar Workers						
$\Delta Tariff s_{jt}^{Mexico}$	0.001 (0.001)	-0.002 (0.002)	0.002 (0.002)	0.0002 (0.002)	-0.000 (0.002)	0.000 (0.002)
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_t$		-0.003* (0.002)	0.001 (0.002)			
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_t^{Mexico}$			-0.002*** (0.0008)			
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{Incumbent,i}^{Mexico}$				0.006*** (0.003)	0.007** (0.003)	0.013*** (0.004)
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{Continuing,i}^{Mexico}$						-0.006* (0.003)
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{New,i}^{Mexico}$				-0.012*** (0.002)	-0.012*** (0.002)	-0.018*** (0.003)
R-Square	0.24	0.45	0.24	0.34	0.34	0.35
Pre-FTA Mean (New Exporter)	0.119	0.119	0.119	0.119	0.119	0.119
Panel B: Blue-collar Workers						
$\Delta Tariff s_{jt}^{Mexico}$	-0.002 (0.001)	0.001 (0.001)	0.002 (0.002)	0.000 (0.002)	0.000 (0.002)	0.000 (0.002)
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_t$		-0.003*** (0.001)	-0.001 (0.002)			
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_t^{Mexico}$			-0.002** (0.001)			
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{Incumbent,i}^{Mexico}$				0.003 (0.002)	0.003 (0.002)	0.010** (0.004)
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{Continuing,i}^{Mexico}$						-0.007* (0.004)
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{New,i}^{Mexico}$				-0.009*** (0.001)	-0.009*** (0.002)	0.016*** (0.004)
R-Square	0.23	0.23	0.23	0.27	0.24	0.28
Pre-FTA Mean (New Exporter)	0.147	0.147	0.147	0.147	0.147	0.147
N	427,390	427,390	427,390	427,390	427,390	427,390
Firm Controls	No	No	No	No	Yes	Yes
State FE × Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: All the regressions are for the years 1995–2007. Columns (1)–(5) of Panel A use share of female white-collar workers in total white-collar workers (female + male) and Panel B use share of female blue-collar workers in total blue-collar workers (female + male) as the dependent variable, respectively. Both the dependent variables are expressed as the difference in the average for each firm between the years 1999–2007 and 1995–1998. $\Delta Tariff s_{jt}$ is the difference in the average tariffs of an industry j (at 4-digit level) between the years 1999–2007 and 1995–1998. So, $t \in \{1995 - 1998, 1999 - 2007\}$ indexes periods. $Exporter_t$ is a dummy variable that takes value 1 if a firm is an exporter to any country, i.e., it has a positive value for exports. $Exporter_t^{Mexico}$ is a dummy variable which takes value 1 if a firm exports to Mexico at any point in time during the sample time period. $Exporter_{Incumbent,i}^{Mexico}$, $Exporter_{Continuing,i}^{Mexico}$, and $Exporter_{New,i}^{Mexico}$ are also different types of exporter dummies. $Exporter_{Incumbent,i}^{Mexico}$ takes value 1 if a firm exported to Mexico before and after the FTA; $Exporter_{Continuing,i}^{Mexico}$ takes a value 1 if a firm exports to Mexico before and after the FTA; $Exporter_{New,i}^{Mexico}$ takes a value 1 if a firm started to export to Mexico after the FTA given the fact that it has not exported to Mexico before the FTA, respectively. Firm controls include a ownership dummy (domestic or foreign) and size (log value of real gross value-added). Standard errors in parentheses are two-way clustered at the industry level (4-digit) and period. Intercepts are not reported. *, **, *** denotes 10%, 5%, and 1% level of significance, respectively.

exported by a firm as our outcome variable of interest in column (9). This is the number of HS 6-digit level product lines exported by a firm across all destinations. The number of products exported by a firm also increased after the FTA and it is driven by new exporters.

5.2. Benchmark results

We now present our baseline results in Table 4. Panel A reports the results for white-collar workers (Owner + CEO + Skilled), while Panel B does the same for blue-collar workers (Unskilled + Services). Our dependent variable here is either the share of female white-collar workers in the total (male + female) white-collar workers (for Panel A) or the share of female blue-collar workers in total (male + female) blue-collar workers of a firm (for Panel B).

Column (1) regresses the change in the share of female white-collar workers between 1995–1998 and 1999–2007 on $\Delta Tariff s_{jt}$ controlling for industry-region, destination, and product fixed effects. Our point estimate shows no effect of the drop in tariffs on

female white-collar workers. Column (2) estimates the differential effect for the exporters by introducing an interaction of $\Delta Tariff s_{jt}$ with an $Exporter_i$ dummy. This dummy is not specific to any country. It takes a value 1 if a firm has a positive export value for any country across the period 1995–2007. We find significant but limited effects for an exporter. Column (3) additionally controls for the interaction of tariffs with $Exporter_i^{Mexico}$ dummy. This dummy takes a value 1 if one of the export destinations of a firm is Mexico during any year of our sample. Our estimates show that the differential effect for an exporter, on the share of female white-collar workers, is entirely driven by exporters toward Mexico.

Column (4) disaggregates all Chilean exporters which are exporting to Mexico into incumbent and new exporters and column (5) does the same, but in addition controls for key firm characteristics (size and ownership). We find that drop in tariffs, due to the Chile–Mexico FTA, significantly increases the share of female white-collar workers, but for the new exporters. Lastly, in column (6) we add the continuing exporters. The interaction term of tariffs change ($\Delta Tariff s_{jt}$) and new exporters ($Exporter_{New,i}^{Mexico}$) is negative, significant, opposite in sign to the absolute effect and the incumbent exporters, and three times higher than the continuing exporters.

In particular, it shows that a 10% drop in tariffs, due to the Chile–Mexico FTA, led to about 1% ($= (0.012/0.119) \times 10$) increase in the share of female white-collar workers for an average new Chilean manufacturing exporter exporting to Mexico. And, this increase in the share of female white-collar workers for the new exporters could be a result of the reallocation from the incumbent exporters. On the other hand, a 10% drop in tariffs due to the FTA led to about 0.49% increase in the female share of white-collar workers for an average Chilean manufacturing firm.

Similarly in **Panel B**, we find that a 10% drop in tariffs due to the Chile–Mexico FTA increased the ratio of the female blue-collar workers for a new exporter to Mexico by 0.75%. However, we do not find any consistent evidence of reallocation from any other group of firms.

Although we use difference between two periods across all our specifications to control for unobservables, our results could still possibly be driven by the differences in the pre-trends between our treated (exporters exporting to Mexico) and control (other exporters) groups. To control for such, we regress the share of female white- and blue-collar workers in total white- and blue-collar workers on the interactions of $\Delta Tariff s_{jt}$ with year dummies (λ_t) and plot the coefficients for new Mexican exporters. We use the following regression equation:

$$\Delta y_{ijt} = (\lambda_t \times \Delta Tariff s_{jt}) + \delta_j^* + v_p + \eta_d + \epsilon_{ijt} \quad (4)$$

Panel A in **Fig. 4** plots the evolution of the share of female white-collar employment for new Mexican exporters relative to other exporters following Eq. (4). Our yearly coefficients portray that the share of female white-collar workers before the FTA is economically small and not statistically significant, thereby indicating no differential pre-reform trends in female white-collar employment between new exporters to Mexico and other exporters.³³ And, this changed after 1999. Drop in tariffs significantly increased the share of female white-collar employment (the coefficients are negative and significant) — the share started to increase significantly from 2000 onward.³⁴

We plot the coefficients from a similar regression with the share of female blue-collar workers to the total blue-collar workers as dependent variable in **Panel B**. While controlling for trends, we do not seem to find any significant difference in the coefficient trends in the pre- and post-FTA period for female blue-collar workers.³⁵

5.2.1. Robustness checks

We run a battery of exercises to check for the robustness of our results. **Table 5** presents our first set of robustness checks. Likewise before, **Panels A** and **B** present the results for female white- and blue-collar workers, respectively.

We start by replacing unweighted tariffs, our variable of interest, by weighted tariffs in column (1). We use initial share of Chilean imports in total Mexican imports by industry (4-digit — the same level as the variation of tariffs) as the weights. Our benchmark finding does not change. Input tariff liberalization can also have similar or opposite effect on the employment of workers. We use the input–output table of Chile for the year 1996 and exploit the input coefficients to calculate the input tariffs for each respective industrial sector (at 4-digit). Column (2) controls for the interactions between input tariffs and different exporter dummies (we present only the result for new exporter); our result and direction of coefficient estimate for new exporters to Mexico continues to be the same, but the magnitude jumps by 3.5 times.

In column (3), we control for export tariffs faced by Chilean exporters while exporting to Canada. Recall that although Chile–Mexico FTA was the first FTA signed by Chile, the Chile–Canada FTA was signed a few years earlier, and it did not get effectively

³³ This absence of pre-trends also negates the fact that Chile–Canada FTA have had any effect on female employment and Chile–Mexico FTA was simply an amplification effect.

³⁴ We also the plot the yearly coefficients by changing the base year to 1998 in **Figure B.3**. Both the plots show very similar outcomes as **Fig. 4**.

³⁵ **Tables C.12** and **C.13** present some heterogeneity of our benchmark results, but only for female white-collar workers. The former table presents the coefficients (regarding the effect on female white-collar workers) for both the new and incumbent exporters (exporting to Mexico) for each of the 2-digit industrial sector. While we find some interesting heterogeneity, the effect for new exporters are pervasive (with differences in the magnitude of the effect) across almost two-thirds of all the industrial sector. As for the incumbent exporters, the effect (increase in the share of female white-collar workers) is only visible for 4 sectors. As for the latter table, it carries out another set of analysis regarding the variation in tariff drop. Recall that the median tariff drop, due to the FTA, was 0. In order to check whether there is any variation in the effect on female white-collar workers in terms of differential drop in tariff rates we compare industrial sectors where the tariff rates were dropped greater than 75% of the overall drop in tariffs with less than 25% drop in tariffs. For example if the tariff rates of both the sectors was 100, we are comparing a sector for which the tariff rate after the FTA is below 25 with another sector which has post-FTA tariff rate greater than 75. We find slight differences, with the effect higher for firms/industries which experienced a larger drop in tariffs, but not significant. This highlights that the effect of the FTA was pervasive and did not depend on the distribution of tariff cuts.

Chile-Mexico FTA and Female Employment

Chilean Manufacturing Firms, 1995–2007

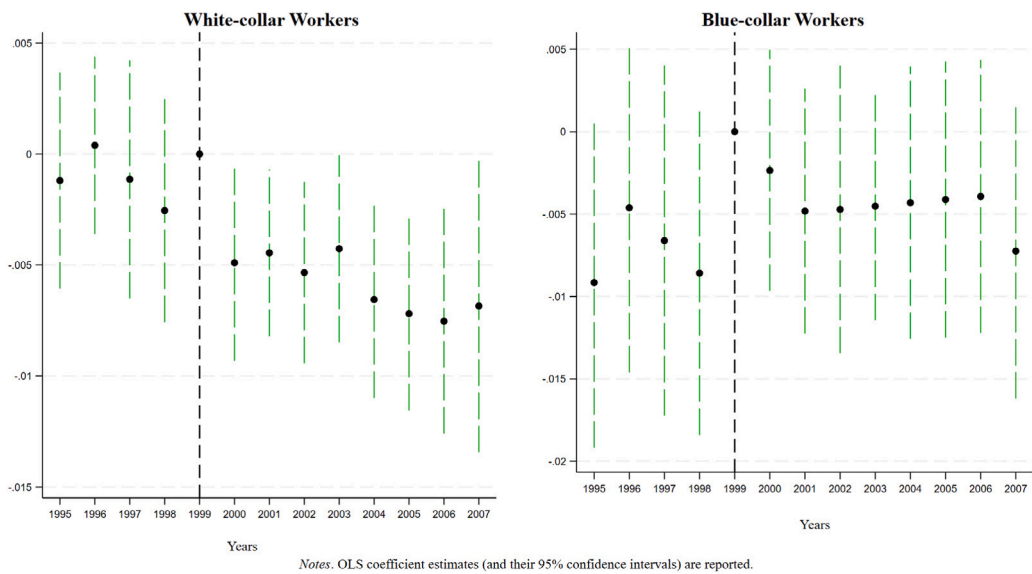


Fig. 4. Chile–Mexico FTA and Female Employment (White- and Blue-collar Workers), Chilean Manufacturing Industries, 1995–2007.

Notes: The figure plots the yearly OLS coefficients (and their 95% confidence intervals) which are the differences in the share of female white-collar workers (Panel A) and female blue-collar workers (Panel B) for exporters (new) to Mexico and other exporters. The vertical line denotes the Chile–Mexico FTA. These yearly coefficients are plotted by regressing share of female white-collar workers (Panel A) and female blue-collar workers (Panel B) on the interactions between tariff changes and year fixed effects.

implemented till 2004. However, it could still be possible that tariff lines in the Chile–Mexico FTA are correlated with Chile–Canada FTA, and the latter was driving the main effect. Even when controlling for Canadian tariffs, our results continue to hold with no change in the magnitude of the effect. On the other hand, we find limited effects on the share of female white-collar workers for the new exporters to Canada due to changes in tariffs between Chile and Canada.

Another problem with our finding could be that the results may be a delayed effects of the FTA with Canada and MERCOSUR, among others. In order to control for such events, we follow [Trefler \(2004\)](#) and use FTA-mandated drop in tariffs computed as the difference between the change in Mexico's import tariffs on Chilean goods and the change in RoW's (Rest of the World) tariffs on Chilean goods in column (4). This would provide us with a cleaner identification of the desired effect. We continue to find similar results. Column (5) breaks the overall time period into three small periods instead of two (that we have done as of now) to create more periods of similar lengths, such as 1995–1998, 1999–2003, and 2004–2007. Using periods of similar lengths do little to alter our results.

As of now the results we present are comparing the exporters to Mexico with exporters to other destinations without including non-exporters since we use product and destination fixed effects. We drop these fixed effects from column (6) and include the entire sample of firms. Including non-exporters in our sample also does little to change our benchmark finding. New export opportunities could bring more administrative duties to a firm. And, firms could employ more female administrative workers to increase the administrative capacity, and this can also have an effect on the share of female white-collar workers. To check whether such is the case or not, we add administrative workers to the share of white-collar workers in column (7). We continue to find very similar effects on the share of female white-collar workers suggesting that administrative workers do not play any significant role in the increase in the share of female white-collar workers.³⁶

An increase in the share does not completely signify that the numbers have actually increased. It could be possible that there has been a drop in the male white-collar workers (for any other reason) without any change in female white-collar workers, and this has an effect on the share. In order to check this, we use the absolute number of female white-collar workers as a dependent variable in column (8). We find that the absolute number of female white-collar workers also increased by 2.9% ($= (0.432/1.477) \cdot 10$) after the FTA for any new exporter exporting to Mexico due to a 10% drop in tariffs. Lastly, in column (9), we replace tariffs by the share of Chilean imports in the total imports of Mexico as the variable of interest. We find very similar results, indicating a consistent

³⁶ Another problem that could still plague our findings is the effect of trade agreements on firms' entry and exit. In order to directly test for this, we construct entry and exit rates of firms. We create a firm level indicator variable which equals 1 if a firm is observed first time after 1999 and not observed in the sample after 1999, respectively. We control for these indicators in our regression and our benchmark finding does not change (results available on request).

Table 5
Chile–Mexico FTA and female employment dynamics: Robustness checks.

	Female Workers/Total (Female + Male) Workers								
	Weighted Tariffs (1)	Input Tariffs (2)	Canada FTA (3)	Trefler (2004) (4)	3 Time Periods (5)	Including Non-Exporters (6)	With Admin/Comm (7)	Absolute Number (8)	Using Imports (9)
Panel A: White-collar Workers									
$\Delta Tariff s_{jt}^{Mexico}$	0.000 (0.002)	-0.009 (0.008)	0.001 (0.002)	0.002 (0.002)	0.001* (0.0004)	0.001 (0.002)	0.0002 (0.002)	0.191 (0.119)	
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{Incumbent,i}^{Mexico}$	0.006** (0.003)	0.028** (0.012)	0.007* (0.003)	0.002 (0.002)	0.005** (0.002)	0.006** (0.003)	0.006** (0.003)	0.227 (0.163)	
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{New,i}^{Mexico}$	-0.012*** (0.002)	-0.041*** (0.014)	-0.013*** (0.002)	-0.010*** (0.003)	-0.015*** (0.003)	-0.012*** (0.002)	-0.013*** (0.002)	-0.432*** (0.201)	
$\Delta InpTariff s_{jt}^{Mexico} \times Exporter_{New,i}^{Mexico}$		0.031** (0.014)							
$\Delta Tariff s_{jt}^{Canada} \times Exporter_{New,i}^{Canada}$			-0.001* (0.0008)						
$\Delta Imports_{jt}^{Mexico}$									-0.203* (0.088)
$\Delta Imports_{jt}^{Mexico} \times Exporter_{Incumbent,i}^{Mexico}$									-0.007 (0.120)
$\Delta Imports_{jt}^{Mexico} \times Exporter_{New,i}^{Mexico}$									0.359*** (0.108)
R-Square	0.34	0.35	0.35	0.27	0.40	0.19	0.34	0.21	0.25
Panel B: Blue-collar Workers									
$\Delta Tariff s_{jt}^{Mexico}$	0.000 (0.002)	-0.005 (0.008)	-0.001 (0.002)	0.002 (0.002)	0.001* (0.0003)	0.001 (0.002)	0.000 (0.002)	1.488** (0.594)	
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{Incumbent,i}^{Mexico}$	0.002 (0.002)	0.025*** (0.009)	0.003 (0.002)	0.002 (0.003)	0.003* (0.002)	0.003 (0.002)	0.003 (0.002)	-0.062 (0.659)	
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{New,i}^{Mexico}$	-0.009*** (0.002)	-0.014 (0.010)	-0.009*** (0.002)	-0.010*** (0.003)	-0.011*** (0.002)	-0.009*** (0.002)	-0.009*** (0.002)	-1.126** (0.493)	
$\Delta InpTariff s_{jt}^{Mexico} \times Exporter_{New,i}^{Mexico}$		-0.023** (0.010)							
$\Delta Tariff s_{jt}^{Canada} \times Exporter_{New,i}^{Canada}$			-0.002 (0.002)						
$\Delta Imports_{jt}^{Mexico}$									-0.213** (0.106)
$\Delta Imports_{jt}^{Mexico} \times Exporter_{Incumbent,i}^{Mexico}$									0.012 (0.179)
$\Delta Imports_{jt}^{Mexico} \times Exporter_{New,i}^{Mexico}$									0.428*** (0.155)
R-Square	0.27	0.28	0.28	0.28	0.51	0.13	0.26	0.30	0.24
N	427,390	427,390	427,390	310,051	427,390	474,175	427,390	427,390	427,390
State FE × Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes

Notes: All the regressions are for the years 1995–2007. Columns (1)–(9) of Panel A use share of female white-collar workers in total white-collar workers (female + male) and Panel B use share of female blue-collar workers in total blue-collar workers (female + male) as the dependent variable, respectively. Both the dependent variables are expressed as the difference in the average for each firm between the years 1999–2007 and 1995–1998, except for column (5) where we express in three time periods — 1995–1998, 1999–2003, and 2004–2007. $\Delta Tariff s_{jt}$ is the difference in the average tariffs of an industry j (at 4-digit level) between the years 1999–2007 and 1995–1998. So, $t \in \{1995-1998, 1999-2007\}$ indexes periods. $\Delta InpTariff s_{jt}$ is the difference in the average input tariffs of an industry j (at 4-digit level) between the years 1999–2007 and 1995–1998. $\Delta Imports_{jt}$ is the difference in the average share of Chilean imports in Mexican total imports at 4-digit level industry between the years 1999–2007 and 1995–1998. $Exporter_{Incumbent,i}^{Mexico}$ and $Exporter_{New,i}^{Mexico}$ are dummies which takes value 1 if a firm exported to Mexico before and after the FTA, respectively. So, the former one represents an incumbent exporter and the latter a new exporter. $Exporter_{New,i}^{Canada}$ is an exporter dummy for exporters that started to export to Canada after the Chile–Canada FTA. It takes value 1 if a firm starts exporting to Canada after the signing of the Chile–Canada FTA in 1996. All the regressions control for the interaction of any exporter ($Exporter_i$) and tariffs ($\Delta Tariff s_{jt}$). Standard errors in parentheses are two-way clustered at the industry level (4-digit) and period. Intercepts are not reported. *, **, *** denotes 10%, 5%, and 1% level of significance, respectively.

impact of the Chile–Mexico FTA on the female white-collar employment for the Chilean manufacturing firms.³⁷ Overall, we find that new Chilean exporters to Mexico had a significant increase in the share of female white-collar workers due to the Chile–Mexico FTA and one of the reasons for this increase could be due to reallocation from incumbent exporters and/or non-exporters.

³⁷ We also re-run this specification controlling for the share of Chilean imports to Canada — results remain qualitatively similar to our column (3) results with no effect for the Canadian share of Chilean imports, like the changes in Canadian tariffs on Chilean exports.

While using female blue-collar workers as the outcome variable of interest in **Panel B** we do not find consistent results of the effect for new exporters. This is especially true when controlling for input tariffs. Our result shows that the increase in the share of female blue-collar workers is driven by changes in input tariffs. New exporters (to Mexico) may have expanded their production using new imported intermediate inputs, such as new machinery thereby employing more female blue-collar workers.³⁸

Firm Characteristics: We finish this section by checking how does our main finding, increase in the share of female white-collar workers, vary when we divide our sample of firms by their size, ownership, end-use (the type of product produced), and importers. Results are reported in **Table C.17**. We find that (a) increase in the share of female white-collar workers are significantly driven by firms below the 75th percentile or who are not the big firms. The effect is significantly higher for firms in the 3rd quartile compared to 2nd and 1st; (b) the effect is driven by domestic firms producing final goods; (c) we do not find any additional effect if a firm is simultaneously an importer.

5.2.2. Other threats to identification

In spite of the fact that Chile's exports to Mexico were the largest in the post-FTA period and our results hold while using (Trefler, 2004), one could still potentially argue that the effects that we find in terms of changes in the gender composition of employment due to the Chile–Mexico FTA could actually be a result of the Chile–Canada FTA and/or exports to other major developed countries and the Chile–Mexico FTA is only attributing an amplification toward the overall effect. We counter these arguments in the following way.

First, we establish that the Chile–Canada FTA and/or exports to any developed economy, say the US, had no effect on the changes in gender composition of employment before the Chile–Mexico FTA. To do this, we run a simple placebo test by shortening the time period from 1995 to 2000 (this is only one year after the implementation of the Chile–Mexico FTA) and regress the share of female white-collar workers (in total white-collar workers) and female blue-collar workers (in total blue-collar workers) on the following:

(a) change in tariffs between Chile and Canada ($\Delta Tariffs_{jt}^{Canada}$) and its interaction with $Exporter_i^{Canada}$. $\Delta Tariffs_{jt}^{Canada}$ is the first-difference in tariffs between Chile and Canada at the 4-digit industry level and $Exporter_i^{Canada}$ takes a value 1 if a firm is exporting to Canada between 1995 and 2000 and 0 otherwise; (b) change (first-difference) in the share of Chilean imports in total imports of Canada ($\Delta ShareM_{jt,Chile}^{Canada}$) and its interaction with $Exporter_i^{Canada}$; and (c) change (first-difference) in the share of Chilean imports in total imports of US ($\Delta ShareM_{jt,Chile}^{US}$) and its interaction with $Exporter_i^{US}$.³⁹ Results are reported in **Table C.18**.

Our thought process here is the following: (a) if there was any impact of the Chile–Canada FTA and/or exports to other major developed country partners, that should be visible by this time, and (b) since altering the composition of labour force is a time-consuming process, we should not expect to see any immediate effect of the Chile–Mexico FTA by 2000. Consistent with these conjectures, we find no significant changes either in the share of female white- or blue-collar workers as a result of the Chile–Canada FTA and/or exports to other major developed country trading partners.⁴⁰

Second, we show that the Chile–Canada FTA did not have any impact on Chilean imports to Canada using pre- and post-FTA data. We estimate the following equation:

$$y_{jt} = \beta_t (\lambda_t) + \delta_j^* + \epsilon_{jt} \quad (5)$$

where y_{jt} represents (a) Chilean exports to Mexico as a share of total imports of Mexico, (b) Chilean exports to Canada as a share of total imports of Canada, and (c) ratio of imports by Mexico from Chile to imports by Canada from Chile for industry j at time t . We regress these outcome variables of interest on year fixed effects (λ_t) which are our coefficients of interest controlling for the interactions between industry-region fixed effects (δ_j^*). We plot these yearly coefficients in Figure B.4.

The plots clearly show that as soon as the Chile–Mexico FTA was implemented there was a significant increase in the share of Chilean imports in total imports of Mexico (**Panel A**) and such was not the case for Canada (**Panel B**) for the implementation of the Chile–Canada FTA in 1995 (it actually started to increase in 2003–04 when the tariffs started to go down, or the concerned FTA was effectively implemented). Lastly, **Panel C** exhibits that on and before 1999, the year when Chile–Mexico FTA was implemented, there was no difference in the ratio of imports by Mexico from Chile to imports by Canada from Chile, and this changed dramatically afterwards. These graphs also clearly show that there were no anticipation effects for the Chile–Mexico FTA.

³⁸ **Table C.14** presents the second set of robustness checks using tariffs and our outcome variable of interest at levels. For this case, we use natural logarithm of tariffs interacted with our different dummies for Mexican exporters and control for interactions of destination-year, product-year, region-year, and destination-industry (2-digit) fixed effects. **Tables C.15** and **C.16** present results using firm-year level data. The former uses tariffs and outcome variables of interest in simple difference and the latter a difference-in-difference set up. For these regressions, we first identify a Mexican exporter (and its different forms) from our customs data and match it back to the firm level data using unique firm identifiers. For all these different types of estimations, we find a very similar and consistent result to our benchmark finding: increase in the share of female white-collar workers driven by the new exporters to Mexico and no such consistent effect for female blue-collar workers.

³⁹ We chose US as a proxy for exports to developed countries as US is one of the largest trading partners of Chile.

⁴⁰ This is not unexpected given that the tariff rates with US and Canada were very low to being with; as for Canada the median tariff before the FTA was 2.5% whereas for US it was already zero. Therefore, with tariffs close to zero and zero already in place, it is hard to find any effect happening.

Table 6
Chile–Mexico FTA and female employment share in total employment.

	Female Workers/		Absolute Employment				
	Total Employment		Total	Female		Male	
	White-Collar (1)	Blue-Collar (2)	(3)	Absolute (4)	Share (5)	Absolute (6)	Share (7)
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{New,i}^{Mexico}$	-0.004*** (0.001)	-0.006*** (0.001)	-2.976** (1.301)	-1.895*** (0.627)	-0.009*** (0.002)	-1.996 (3.580)	0.014*** (0.003)
$\Delta Tariff s_{jt}^{Mexico}$	0.0003 (0.001)	0.001 (0.001)	9.116*** (2.621)	1.681** (0.651)	0.001 (0.002)	7.266* (4.309)	0.0004 (0.002)
R-Square	0.26	0.26	0.33	0.31	0.04	0.37	0.55
N	427,390	427,390	427,390	427,390	428,712	427,390	427,390
State FE × Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pre-FTA Mean (New Exporter)	0.023	0.104	222.79	41.14	0.202	181.65	0.822

Notes: All the regressions are for the years 1995–2007. Columns (1) and (2) use the share of total female workers for white- and blue-collar categories in total employment; column (3) uses total employment; columns (4) and (5) use absolute number and share of female employment; and columns (6) and (7) use absolute number and share of male employment in total employment of a firm as the dependent variable, respectively. All the dependent variables are expressed as the difference in the average for each firm between the years 1999–2007 and 1995–1998. $\Delta Tariff s_{jt}$ is the difference in the average tariffs of an industry j (at 4-digit level) between the years 1999–2007 and 1995–1998. So, $t \in \{1995 - 1998, 1999 - 2007\}$ indexes periods. $Exporter_{New,i}^{Mexico}$ is a dummy which takes value 1 if a firm started to export to Mexico after the FTA. All the regressions control for the interaction of incumbent exporters ($Exporter_{Incumbent,i}^{Mexico}$), any exporter ($Exporter_{i,t}$), and tariffs ($\Delta Tariff s_{jt}$). Standard errors in parentheses are two-way clustered at the industry level (4-digit) and period. Intercepts are not reported. *, **, *** denotes 10%, 5%, and 1% level of significance, respectively.

5.3. What happened to the overall employment?

All these changes regarding the share of female white- and to some extent, blue-collar workers may have some effect on the composition of the overall employment of a firm as well. We check for such changes in Table 6 using Eq. (1). We start by looking at the share of female white- (column (1)) and blue-collar (column (2)) employment in total employment of a firm. Our estimates show that the increase in both types of female workers due to the Chile–Mexico FTA even got reflected in the share of total employment of a firm. The ratio of female white- $((0.004/0.023) \times 10)$ and blue-collar workers $((0.006/0.104) \times 10)$ to the total number of workers increased by 1.7 and 0.58%, respectively for a new Chilean exporter who started exporting to Mexico after the FTA. This implies that the FTA, or complete elimination of tariffs, led to 17 and 5.8% increase in employment for female white- and blue-collar workers.

Columns (3)–(7) check for the effects on total, female, and male employment. Our thought process here is to investigate the direction of change in the overall employment of a firm due to the trade shock. We start by regressing the total employment of a firm on our main variable of interest, i.e., interaction of $\Delta Tariff s_{jt}$ and $Exporter_{New,i}^{Mexico}$ in column (3). Our point estimate shows that the Chile–Mexico FTA had a positive effect on the overall employment for a new exporter exporting to Mexico (as compared to other firms); it increased by about 0.13%.

Columns (4)–(5) and (6)–(7) divides the total employment of a firm according to its gender composition: female and male. We use both, the absolute number of employees by gender, and its share in total employment. We find that the trade agreement had a significant positive effect on both the number and the share of female employees. There is a 0.46% $(= (1.895/41.14) \times 10)$ increase in the absolute number (column (4)), and the same is 0.45% $(= (0.009/0.202) \times 10)$ in terms of the share (column (5)). On the other hand, although we do not find any effect on the number of male employees, but the share of male employees decreased by 0.17% $(= (0.014/0.822) \times 10)$ as seen from column (7). This reduction in the share of male employees matched with the increase in the share of female employees in firms which started to export to Mexico after the FTA, hints toward a possible substitution in employment across genders which we investigate in the next section.

5.4. Checking for the substitution effect

Our observed increase in the share of female white- and blue-collar (albeit a bit less consistently) workers could be due to the following reasons: (a) the overall size of an exporting firm may have increased due to new export opportunities, and they employed more female white- and blue-collar workers without any perceived changes in the male workers composition, (b) male workers were dropped without any changes in the number of female workers, (c) both female and male workers have increased as the size of an exporting firm augmented, but the numbers were more for female workers, and (d) more female workers were employed and simultaneously male workers were dropped possibly suggesting toward a substitution effect (as indicated in Table 6).

In order to understand which channel lies behind the observed phenomenon of the increase in the female worker ratio (for both white- and blue-collar), it is imperative to look at the ratio of female workers relative to the male workers and the total number of male workers. Table 7 reports the required results.

Panel A report results for the white-collar and Panel B similarly for the blue-collar workers. Columns (1) and (2) of Panel A use female to male white-collar workers ratio and the number of male white-collar workers as the dependent variable, respectively. The

Table 7
Chile–Mexico FTA and female employment dynamics: Substitution effect.

	(1)	(2)
Panel A: White-collar Workers		
	Female/ Male Workers	Total Male White-collar Workers
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{New,t}^{Mexico}$	-0.044*** (0.006)	1.063** (0.430)
$\Delta Tariff s_{jt}^{Mexico}$	-0.004 (0.012)	1.861* (1.028)
R-Square	0.22	0.36
Pre-FTA Mean (New Exporter)	0.244	25.47
Panel B: Blue-collar Workers		
	Female/ Male Workers	Total Male Blue-collar Workers
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{New,t}^{Mexico}$	-0.023** (0.011)	-2.698*** (0.714)
$\Delta Tariff s_{jt}^{Mexico}$	-0.000 (0.013)	2.700** (1.205)
R-Square	0.17	0.35
Pre-FTA Mean (New Exporter)	0.564	70.06
N	427,390	427,390
State FE \times Industry FE	Yes	Yes
Destination FE	Yes	Yes
Product FE	Yes	Yes

Notes: All the regressions are for the years 1995–2007. In Panel A, for column (1), we use the ratio of female white-collar workers to male white-collar workers and for column (2) we use the total male white-collar workers as the dependent variable, respectively. In Panel B, we follow the same pattern but, for blue-collar workers. All the dependent variables are expressed as the difference in the average for each firm between the years 1999–2007 and 1995–1998. $\Delta Tariff s_{jt}$ is the difference in the average tariffs of an industry j (at 4-digit level) between the years 1999–2007 and 1995–1998. So, $t \in \{1995 - 1998, 1999 - 2007\}$ indexes periods. $Exporter_{New,t}^{Mexico}$ is a dummy which takes value 1 if a firm started to export to Mexico after the FTA. All the regressions control for the interaction of incumbent exporters ($Exporter_{Incumbent,t}^{Mexico}$), any exporter ($Exporter_{i,t}$), and tariffs ($\Delta Tariff s_{jt}$). Standard errors in parentheses are two-way clustered at the industry level (4-digit) and period. Intercepts are not reported. *, **, *** denotes 10%, 5%, and 1% level of significance, respectively.

estimates clearly show that the ratio of female to male workers increased by 1.8% ($= (0.044/0.244) \times 10$). Column (2) substitutes the female to male white-collar ratio with the number of male white-collar workers. We find that the increase in the share of female white-collar workers is driven by not only an increase in the employment of female white-collar workers but also a simultaneous fall in the number of male workers; the Chile–Mexico FTA resulted in a drop in the male white-collar workers by 0.42% ($= (1.063/25.47) \times 10$). All these results point toward a possible substitution effect in the white-collar labour force in favour of female workers with respect to male workers as a result of a firm's increased participation in the global market.

In line with the white-collar labour force, we see a similar significant increase of 0.41% ($= (0.023/0.564) \times 10$) in the female to male ratio in the blue-collar labour force (column (1) of **Panel B**) for new exporters to Mexico. However, we do not find any effect when we look at the number of male blue-collar workers. This finding hints toward the fact that exporting to a new destination, Mexico, may have led to expansion in production and therefore hiring of new blue-collar workers, in this case female, without any significant changes for the male blue-collar workers. And, this increased the ratio for female blue-collar workers.

One of the unique features of the Chilean dataset is that it gives detailed information on sub-categories within the white- and blue-collar workers. We use this data on different occupational groups in **Table 8** to dig deeper in order to understand changes in which kind of worker categories, due to the Chile–Mexico FTA, is driving our main result. This would help us infer the mechanisms behind these changes.

Panel A, **Panel B**, and **Panel C** report the results for female to male ratio and the absolute number of female and male workers across five different categories — Owner, CEO, Skilled, Unskilled, and Services. The former three categorize the white-collar and the latter two blue-collar workers. We find the following as a result of the Chile–Mexico FTA: (a) firms with female CEOs increased and this got reflected in the female to male CEO ratio. Female CEOs increased by 1.6% (column (2), **Panel B**); (b) an increase in the female skilled workers, where the ratio of female to male skilled workers increased by 1% (column (3), **Panel A**). This happened through a clear substitution effect: increase in employment of female skilled workers by 1.8% in absolute terms with a simultaneous drop in male counterpart by 0.43% (column (3), **Panel B** and **Panel C**); (c) an increase in female to male unskilled workers ratio by 1.2% for new exporters to Mexico (column (4), **Panel A**). However, in this case, this increase in the ratio is driven only by an

Table 8
Chile–Mexico FTA and female employment dynamics: Different categories.

	White-collar			Blue-collar	
	Owner	CEO	Skilled Workers	Unskilled Workers	Services Workers
	(1)	(2)	(3)	(4)	(5)
Panel A: Female Workers/Male Workers					
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{New,i}^{Mexico}$	-0.000 (0.001)	-0.003*** (0.001)	-0.022** (0.011)	-0.070*** (0.019)	-0.005 (0.004)
$\Delta Tariff s_{jt}^{Mexico}$	-0.000 (0.001)	0.003** (0.001)	-0.016 (0.011)	0.006 (0.014)	-0.0002 (0.004)
R-Square	0.16	0.19	0.19	0.19	0.30
Pre-FTA Mean (New Exporter)	0.096	0.107	0.210	0.572	0.034
Panel B: Total Female Workers					
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{New,i}^{Mexico}$	0.001 (0.002)	-0.045** (0.019)	-0.350*** (0.097)	-2.378** (0.991)	-0.071 (0.040)
$\Delta Tariff s_{jt}^{Mexico}$	0.001 (0.003)	0.033** (0.015)	0.161 (0.114)	1.756*** (0.610)	-0.063 (0.068)
R-Square	0.31	0.29	0.18	0.29	0.25
Pre-FTA Mean (New Exporter)	0.148	0.397	1.917	16.742	0.169
Panel C: Total Male Workers					
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{New,i}^{Mexico}$	-0.010 (0.009)	0.072 (0.142)	0.915** (0.409)	-2.351 (1.504)	-0.107 (0.095)
$\Delta Tariff s_{jt}^{Mexico}$	0.017*** (0.006)	0.222* (0.119)	1.827 (1.504)	3.328*** (1.203)	-0.261 (0.163)
R-Square	0.35	0.34	0.41	0.34	0.22
Pre-FTA Mean (New Exporter)	0.629	3.366	21.474	68.975	1.089
N	427,390	427,390	427,390	427,390	427,390
State FE × Industry FE	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes	Yes

Notes: All the regressions are for the years 1995–2007. In Panel A: the dependent variable is the share of female workers in a specific category to the total number belonging to that category. For example, in column (1), our dependent variable is the number of female owners divided by the total number of owners (female plus male), and so on. Panels B and C use total female and male workers in the respective categories as the dependent variables, respectively. All the dependent variables are expressed as the difference in the average for each firm between the years 1999–2007 and 1995–1998. $\Delta Tariff s_{jt}$ is the difference in the average tariffs of an industry j (at 4-digit level) between the years 1999–2007 and 1995–1998. So, $t \in \{1995 - 1998, 1999 - 2007\}$ indexes periods. $Exporter_{New,i}^{Mexico}$ is a dummy which takes value 1 if a firm started to export to Mexico after the FTA. All the regressions control for the interaction of incumbent exporters ($Exporter_{Incumbent,i}^{Mexico}$), any exporter ($Exporter_t$), and tariffs ($\Delta Tariff s_{jt}$). Standard errors in parentheses are two-way clustered at the industry level (4-digit) and period. Intercepts are not reported. *, **, *** denotes 10%, 5%, and 1% level of significance, respectively.

increase in the employment of female blue-collar workers (column (4), **Panel B**) with no changes for male blue-collar workers. All these results point toward a possible substitution of male with female skilled workers due to the Chile–Mexico FTA.⁴¹

Another result from the previous tables – Tables 4, 5, 6, and 7 – that we want to highlight is that our results hint toward a possible reallocation of female workers, especially white-collar, from other exporters and/or non-exporters to exporters within the same industry-region. The Chile–Mexico FTA led to new firms to export to Mexico with overall expansion of employment through a reallocation of white-collar female workers from other firms to the new exporters. We now check for other mechanisms.

5.5. Mechanisms

Participation in new export markets can affect the gender employment gap within a firm through the following channels: (a) firms can adopt new machinery which will reduce the demand for physical labour and increase the demand for female blue-collar workers (Juhn et al., 2014) and/or invest in advanced technology and interactive non-production tasks, which require more cognitive abilities thereby increasing the demand for female white-collar workers (Bonfiglioli and De Pace, 2021); (b) pro-competitive effects can drive discriminating firms out of business or induce firms to discriminate less thereby increasing the demand for female workers (Black and Brainerd, 2004); (c) female workers are easier to hire, so expansion of economic activities can induce firms to hire more female workers. And, this could be due to women are easily available (since a lot of them maybe unemployed or

⁴¹ We run similar regressions separately for administrative workers (white-collar) and commissioned workers (blue-collar) in Table C.19. We find that employment of both female and male administrative workers increased for new exporters to Mexico, as a result of the Chile–Mexico FTA, with no effect on commissioned workers.

Table 9
Chile–Mexico FTA and female employment dynamics: Mechanisms.

Panel A: Non-production Tasks	Technical Assistance		Patent	Advertising
	Foreign (1)	Domestic (2)	Expenses (3)	Expenses (4)
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{New,i}^{Mexico}$	-0.235** (0.108)	-5.425** (2.327)	-2.211** (0.961)	-24.818* (15.187)
$\Delta Tariff s_{jt}^{Mexico}$	0.212 (0.203)	-7.353 (4.648)	3.241 (2.201)	-10.560 (18.367)
R-Square	0.27	0.32	0.31	0.38
N	427,390	427,390	427,390	427,390
Pre-FTA Mean ('000 Pesos) (New Exporter)	2.05	62.66	25.84	405.63

Panel B: Discrimination	Female White-collar Workers/ Total White-collar Workers			
	Female Owner		Female CEO	
	> 0 (5)	= 0 (6)	> 0 (7)	= 0 (8)
$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{New,i}^{Mexico}$	-0.004* (0.002)	-0.013*** (0.002)	-0.001 (0.001)	-0.015*** (0.001)
$\Delta Tariff s_{jt}^{Mexico}$	-0.004 (0.003)	-0.001 (0.002)	0.002 (0.002)	-0.0002 (0.003)
R-Square	0.54	0.37	0.31	0.44
N	23,685	402,887	136,192	289,990

Panel C: Labour Supply and Demand	Female White-collar Workers/ Total White-collar Workers			
	Supply		Demand	
	Ratio > Median (9)	Ratio < Median (10)	EC Industries (11)	Non-EC Industries (12)
	$\Delta Tariff s_{jt}^{Mexico} \times Exporter_{New,i}^{Mexico}$	-0.012*** (0.003)	-0.013*** (0.001)	-0.004*** (0.001)
$\Delta Tariff s_{jt}^{Mexico}$	0.001 (0.002)	-0.005 (0.003)	-0.017** (0.006)	0.0004 (0.002)
R-Square	0.31	0.48	0.38	0.34
N	248,302	178,108	46,096	380,750
State FE × Industry FE	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes

Notes: All the regressions are for the years 1995–2007. Column (1) uses foreign technology adoption; column (2) uses domestic technical transfer; column (3) uses expenses regarding patent filings, rights, etc.; column (4) uses advertising and publicity expenses of a firm as the dependent variables, respectively. All these variables are used in their real terms. Columns (5)–(12) use share of female white-collar workers in total white-collar workers (female + male) as the outcome of interest. All the dependent variables are expressed as the difference in the average for each firm between the years 1999–2007 and 1995–1998. $\Delta Tariff s_{jt}$ is the difference in the average tariffs of an industry j (at 4-digit level) between the years 1999–2007 and 1995–1998. So, $t \in \{1995 - 1998, 1999 - 2007\}$ indexes periods. $Exporter_{New,i}^{Mexico}$ is a dummy which takes value 1 if a firm started to export to Mexico after the FTA. All the regressions control for the interaction of incumbent exporters ($Exporter_{Incumbent,i}^{Mexico}$), any exporter ($Exporter_i$), and tariffs ($\Delta Tariff s_{jt}$). Standard errors in parentheses are two-way clustered at the industry level (4-digit) and period. Intercepts are not reported. *, **, *** denotes 10%, 5%, and 1% level of significance, respectively.

voluntarily employed ex-ante) i.e., relative supply of female labour is higher than the rest and they can be hired at a lower cost (than men)⁴²; and (d) overall demand for female labour may have increased.

In this section, we test for all these possible mechanisms or channels that could potentially explain our observed changes in the composition of white-collar workers in the Chilean firms due to the Chile–Mexico FTA. We report our results in Table 9.

⁴² On the other hand, the Chile–Mexico FTA can affect the supply of labour through a change in socio-economic factors like incentivizing more women to take part in the labour market etc.

5.5.1. Non-production tasks

Bonfiglioli and De Pace (2021) using German employer-employee data points out that women have a comparative advantage in skilled non-production tasks which require interpersonal interaction. Spitz-Oener (2006), Black and Spitz-Oener (2010), and Cortes et al. (2018) also highlight that female employees have an advantage in high-skilled non-production tasks.

In order to check what happened to these kinds of tasks for Chilean firms when they increase their participation in the global market, we follow (Bonfiglioli and De Pace, 2021) and use foreign and domestic technical assistance, research expenses through the use of patents, and publicity and advertising expenses, as the potential outcomes of interest in columns (1) – (4) of Panel A. All of these variables are used in their real terms. We find that the Chile–Mexico FTA significantly increased all of these tasks. In particular, both foreign and domestic technical assistance increased by 1.1% ($= (0.235/2.05) * 10$) and 0.86% ($= (5.425/62.66) * 10$) respectively for a new Mexican exporter (columns (1) and (2)) with a 10% drop in tariff, and 11% and 8.6% respectively with a complete removal of tariff. An exporter's research investment in terms of patent expenses increased by 8.5%, (column (3)), while advertising expenses also increased by 6.1% (column (4)) as a result of the FTA. All these changes in the production technology for a new Mexican exporter are suggestive of the shift in the gender composition among the white-collar workers.

Additionally, we also check whether the effects, in terms of increase in the share of female white-collar workers, are stronger for firms that belong to the top quartile of these investment categories vis-a-vis the firms in the bottom quartile. In columns (1)–(4) of Table C.20 we find that the increase in female white-collar workers is almost two times larger in firms that belong to the ex-post upper quartile of foreign and domestic technical expenses as opposed to the firms in the bottom quartile. This implies that after the FTA, the firms that invested more in foreign and domestic technical assistance, also hired more women white-collar workers. We find similar results for firms in top and bottom quartiles of patent expenses from columns (5) and (6). The results are significantly stronger in the domain of publicity and promotional expenses. Firms that belong to the top quartile of publicity and promotional expenses post-FTA increase the share of female white-collar workers by about 6 times more than firms that are in the bottom quartile.⁴³

5.5.2. Discrimination

A key implication of Becker (1957) is that certain employers hold a “taste for discrimination” and an increase in competition in the product market can reduce that discrimination against women in the long run. In other words, the pro-competitive effects of trade liberalization can reduce discrimination by either driving discriminating firms out of business or inducing firms to discriminate less. This can lead to a pareto improvement for the victims of discrimination or females (in our case, female white-collar workers) to work for firms run by men. On the other hand, an increase in export opportunities can increase economic profits and, therefore, can increase the employer's ability to discriminate. This can impact the industry level female share in an opposite direction.

In order to test for this theory, we categorize firms with female and male ownership and CEO. In particular, we compare firms where there is a female owner or CEO with firms having no female owner and CEO ex-ante FTA. A recent set of studies, Bertrand et al. (2019) and Maida and Weber (2022) find no effect of the presence of women in the C-suite of a firm on the hiring of female employees or reducing gender gap.⁴⁴ On the other hand, Cardoso and Winter-Ebmer (2010), Stojmenovska (2019), and Kunze and Miller (2017) find that female corporate leadership benefits women lower in the hierarchy. Assuming the effects of discrimination are lower in women-owned or -led firms, if discrimination is the channel, then our benchmark results (increase in the share of female white-collar workers) should be higher for firms with the presence of men in the C-suite with lower to no effect for women-led firms since pro-competitive effects (with increased participation in export markets) will reduce discrimination in those firms.

Panel B of Table 9 compare firms that have no female owner/CEO (i.e., all male owner/CEO) with firms that have at least one female owner/CEO ex-ante the FTA. We find (a) our results are largely driven by firms that have only male CEOs (column (2)) and only male owners (column (4)); with (b) a smaller effect in firms with female owners, but none with the presence of female CEOs.⁴⁵ In other words, pro-competitive effects of an export market liberalization led to a possible ‘correction’ or ‘reduction of discrimination’ for female white-collar workers. This is because the increase in women white-collar workers is significantly higher for firms that have all male owners or leaders i.e., the firms which potentially have high discrimination against women.⁴⁶ Our findings on discrimination echo the work by Cooke et al. (2019), who show that product market competition reduces gender-gap in employment and pay for skilled workers in Portugal.

⁴³ Recall that our results also hint toward the fact that drop in input tariffs resulted increase in employment for female blue-collar workers. This could be a result of using new machinery in production which are not physically demanding to operate. In particular, it could be possible that reduction in tariffs induced firms to modernize their production technology. And, these new technologies could involve computerized production processes, thereby lowering the need for physically demanding skills. As a result, firms can hire more female unskilled or blue-collar workers. In order to check for this, we investigate whether exporters used more new machinery as a result of the FTA or not. Table C.21 use expenses toward purchase of new machinery and value of goods produced by new machinery as the outcomes of interest. We find a significant increase for both the cases.

⁴⁴ In a slightly different context, Beaman et al. (2012) show that women leadership do not directly affect labour market opportunities for women. Instead, it influences the long-term aspirations of adolescent girls and improves gender-gap in education.

⁴⁵ We find similar results when we compare firms with female owners and CEOs > 1 with < 1 .

⁴⁶ We also see a similar pattern when using female to male white-collar worker ratio as the dependent variable. On the other hand, similar to Flabbi et al. (2019) for Italian firms, we find limited or no evidence for blue-collar workers in firms with female leadership.

5.5.3. Ease of hiring women — Availability

Another potential mechanism which can explain the improvement in the gender gap in Chilean manufacturing firms is the supply side channel. It is possible that the new exporting firms are hiring more women because most of the available labour supply pool in Chile is women. In such a scenario, any policy change that improves the gender gap in employment in Chile could merely be due to the skewness of the sex-ratio of the population toward female in certain regions. We test for this spatial heterogeneity in columns (9) and (10) in **Panel C**.

We use the gender ratio (female-to-male) of the skilled worker ratio (in the total population) across 13 regions of Chile from the Office of National Statistics for the year 2000 and divide 13 regions into two halves — higher and lower than the median female-to-male skilled worker ratio.⁴⁷ Interestingly, we observe an increase in the share of female white-collar workers across all regions, irrespective of the share of women in the working-age population. This highlights that spatial heterogeneity of female labour supply plays a limited role in explaining our finding.^{48,49}

5.5.4. Demand-side

Lastly, we look at the demand side. We follow (Black and Brainerd, 2004) and divide our industries into export competitive (EC) and non export-competitive (Non-EC) or concentrated industries in columns (11) and (12). The idea here is that the FTA opens up new trading opportunities for all industries and would expose all industries to (international) competition. However, these new opportunities would affect the Non-EC industries more as they faced less competition ex-ante. Therefore, if labour demand is the channel behind our observed increase in the share of white-collar workers, then we should find an increase in the share only or higher for non-export competitive industries with little to no increase for the EC industries.

We term those industries as competitive for which the export earnings in the pre-FTA period (1995–1998) are greater than the average of the manufacturing sector. From columns (11) and (12), we find that the increase in the share of female white-collar workers is visible across both types of industries, with higher effects for Non-EC industries thereby suggesting that labour demand channel could be at play. Helm (2019) argue that demand shocks can significantly change the labour structure for firms like the one we observe.⁵⁰

Summing up, our results show that the Chile–Mexico FTA created new exporters to Mexico. These firms, which had men in their C-suite, then adopted more technology (both foreign and domestic), spent higher amount on account of research, publicity, and promotion also hired more female skilled or white-collar workers who have both comparative advantage and complementary skills in these tasks. In the process, new export opportunities led to a reduction of discrimination in hiring of female white-collar workers through trade induced technical change.

6. Concluding remarks

International trade is known to influence firm level choices and thereby affect the within-firm gender gap (Black and Brainerd, 2004; Juhn et al., 2014; Bonfiglioli and De Pace, 2021). However, the impact is fairly heterogeneous, and the underlying mechanisms behind this effect are still not well understood. We attempt to fill this gap by exploiting the 1999 Chile–Mexico FTA as a quasi-natural experiment and studying its impact on the gender employment gap for Chilean manufacturing firms using matched customs and firm level data.

We find that the Chile–Mexico FTA resulted in increasing the share of female white-collar workers by 10% and 5% for a new exporter exporting to Mexico and average Chilean manufacturing firm, respectively. This increase is due to a clear substitution effect from male to female white-collar workers, particularly in the skilled worker category. While examining the mechanism(s), our evidence suggests that this phenomenon may have been caused due to an increase in investments toward high-cognitive but non-production tasks, such as increased in technology adoption, research expenses, publicity and promotional expenses, etc. and reduction in discrimination. To the best of our knowledge, ours is one of the first studies to highlight that skill-biased technological change due to international trade can enable women to exploit their comparative advantage in non-production high-skilled tasks, thereby narrowing the gender employment gap.

Our findings have multiple relevant policy implications. First, we emphasize the role of globalization in improving the employment ratio of the high-skilled women, especially in white-collar jobs. Second, it highlights that the adoption of technology, as a result of participation in higher amount of exporting, can also be regarded as one of the factors in improving female labour ratio. Third, improvements in the employment gap can have long-run consequences in terms of educational and career choices of women, economic growth, standard of living, and inter-generational redistribution (Pierre-Richard et al., 2021; World Bank and WTO, 2020).

⁴⁷ The Office of National Statistics of Chile provides gender wise skilled worker ratio at the national level, the earliest being for the year 2000. We use this to calculate regionwise female-to-male skilled worker ratio using the region level sex ratio as the weights.

⁴⁸ We have also used region level female-to-male ratio of the labour force participation rate, employment rate, and total population — in all the cases the results are akin to the female-to-male skilled worker ratio. Results are reported in **Table C.22**.

⁴⁹ Another reason why hiring women could potentially be easier is female workers are paid less wages than their male counterparts. One limitation of our dataset is that it does not provide information on wages by gender and occupation, but it does by occupation. We use total (**Panel A**) and average (**Panel B**) real wages for white-collar and blue-collar workers in **Table C.23** as our outcomes of interest. We find that both total and average real wages of white-collar workers (male + female) increased after the FTA suggesting that the women white-collar workers did not necessarily cost less.

⁵⁰ High-tech industries can also have inelastic demand for labour, as the skill required is often niche. Supply-side factors of labour such as higher availability, migration or relative lower wages have little to no impact on the employment for skilled labour in these industries. We find that employment of female white-collar workers also increased significantly for high-tech industries (industries that are in the top quartile of the technology adoption of the Chilean manufacturing sector).

Declaration of competing interest

The authors declare that he has no relevant or material financial interests that relate to the research described in this paper.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at <https://doi.org/10.1016/j.jinteco.2025.104143>.

Data availability

Can Trade Policy Change Gender Equality? Evidence from Chile (Original data) (Mendeley Data)

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