The impact of trade liberalization on female labor market participation: the case of Vietnam's accession to the WTO

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Abstract

Vietnam's accession to the WTO in 2007 and the consequential decrease in trade barriers offers a useful occasion for studying the link between changes in tariffs and changes in the ratio of female participation in the workforce. The phenomenon is examined considering the changes in participation among both "blue-collar" and "white-collar" workers, exploring the channels of export tariffs -the duties imposed by foreign countries on Vietnamese exports,- import tariffs -the domestic duties imposed on foreign exports to Vietnam,- and input tariffs -the domestic duties on the intermediate inputs of foreign origin used in production by domestic firms.- During the last decade, many authors studied the topic, jointly with the theme of gender wage gap. For a number of trade reforms, decreasing tariffs meant increased female participation and increased relative wages, with numerous exceptions showing opposite results, or a lack of differences in the effects among women and men. Those scholars raised a number of hypothesis -in some cases verifying their consistency- regarding the mechanisms through which the ratios of tariffs and female participation might be related. The most notable thesis consider the role of decreasing tariffs for the technological upgrading of firms' machinery, affecting positively female production workers, given the lower need for muscular force; the effect of increased competition towards domestic firms caused by a liberalization reform affecting the discriminating employers either by pushing them to change their inefficient hiring choices, or to fail or shrink; a further mechanism, which affects female participation not at the firm-level but at the national-level, is the growth of a female intensive sector enjoying a comparative advantage from a trade reform, in a context were sectorial segregation is permanent. For this study, the firm-level data were retrieved from two rounds of the Enterprise Survey performed by the World Bank in Vietnam in 2005 and 2009, and matched with tariff data through the 2-digits industry sector of the firms in 2005. At first, the data showed mixed evidence of a link between trade liberalization and and female participation. In fact, lowering exports tariffs seem to be linked with a decrease in female participation, while lowering import tariffs with increased female participation. Nonetheless, when considering only those firms that did not change sector between the two years, thus avoiding a probable measurement error in the changes in tariffs, decreasing export, import, and input tariffs are linked with increased female participation among production workers. Finally, when excluding all the lagged variables to avoid the risk of violating the strict exogeneity assumption, a significant link between the decrease of import tariffs and the growth of female participation among production workers is observed, coherently with the hypothesis of technology upgrading.

Contents

1 Introduction

I found Vietnam to be an interesting case study for exploring the link between trade liberalization and female labor force participation. In few decades, the state-planned and closed country that emerged from the devastating Vietnam War -lasted from 1955 until 1975- and from an arduous process of reunification, became an important trading economy, exporting a growing amount of manufactures, with an increasing amount of foreign investment inflows. Furthermore, compared to other emerging economies, the national average ratio of female labor market participation is historically high, and decreased by a tiny fraction over the years of the research.

The availability of two rounds of the World Bank Enterprise Survey for Vietnam, before and after the accession to the WTO -which entered into effect in 2007,- guarantees the possibility to test the presence of a link between trade liberalization and within-firm female participation, enlarging the growing literature on the topic by including a different country and a different set of reforms.

In the second place, the study has the goal to understand if the accession to the WTO participated in decreasing the official ratio of female participation which are foreseen at national level during the period of the study, or if, on the other hand, the reforms counteracted an otherwise steeper decrease in labor market participation by Vietnamese women. Finally, this research has the ambition to understand -or at least to have a hint- concerning the possible mechanism through which, in this context, female participation is affected by the change in tariffs.

2 Literature review

2.1 Vietnam accession to the WTO

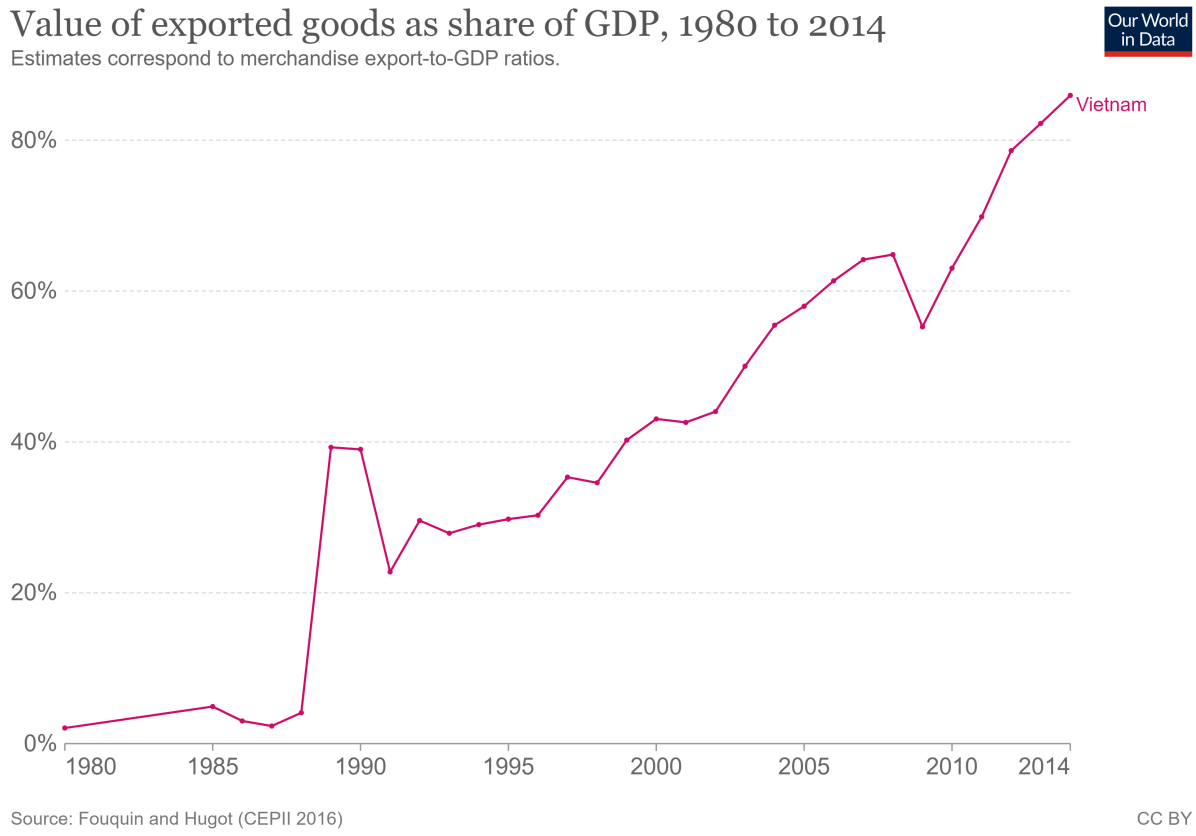
Vietnam is officially part of the World Trade Organization (WTO) since the 11^{th} of January 2007, after 12 years from the beginning of the negotiations, becoming the 150^{th} member. The accession to the WTO represented the culminating stage of a long process of reforms which increased the degree of openness of the country. Doi Moi ("Renovation/Innovation") is the name of a series of reforms introduced in 1986 during the 6^{th} National Congress of the Communist Party of Vietnam (CVP), with the goal of transforming the country from a centralised, planned, Soviet-type economy to a "Socialist-Oriented Market Economy." The reforms, together with allowing for the private property of small enterprises and creating a stock exchange for both public and private companies, paved the way for an increased participation of Vietnamese firms into the World Market.

Since 1978, Vietnam was member of the Council for Mutual Economic Assistance (COMECON), an organization for the economic cooperation of the Eastern Block and other Socialist countries led by the URSS. During a period when the Vietnamese economy and trade were heavily regulated by the CPV, with import and export licenses, COMECON had the objective of stimulating alignment between the participants, through trade objectives, quotas and bilateral agreements (Cima, 1989). In 1989, Vietnam joined the Global System of Trade Preferences among Developing Countries (GSTP) which currently encompasses 42 members, including the Mercosur block since 2006. After the lifting of the US trade embargo in 1994, Vietnam became member of the Association of South-East Asian Nations (ASEAN) in 1995, entering also into the Asian Free Trade Area (AFTA) in 1996, and later, into the Free Trade Agreements between ASEAN and its international counterparts.

Among those agreements there is the ASEAN-China FTA, started in 2005, and completed -in the case of Vietnam- in 2015, and the ASEAN-Japan Comprehensive Economic Partnership, entered into force in 2008, followed by a bilateral trade agreement between Vietnam and Japan which came into effect in 2009. In 2010 were implemented the ASEAN-Korea FTA, followed by a Bilateral Trade Agreement between Vietnam and S. Korea that kicked-in in 2015, the ASEAN–India Free Trade Area (AIFTA) and the ASEAN-Australia-New Zealand Free Trade Area. Finally, an agreement between ASEAN and Hong Kong came into operation in 2019.

In 2001, the United States-Vietnam Bilateral Trade Agreement (USVBTA) entered into effect, and paved the road for the other agreements signed by Vietnam bilaterally or as a member of ASEAN. In recent years, Vietnam signed a FTA with the Eurasian Economic Union (EAEU) composed by Russia, Armenia, Belarus, Kazakhstan, and Kyrgyzstan, which started in 2016. The Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) was signed in 2018 together with Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, Peru, New Zealand, and Singapore, and entered into force in January 2019. In 2020, the EU-Vietnam Free Trade Agreement (EVFTA) also commenced. And finally, on the 1st January of 2021 the bilateral agreement between Vietnam and UK became operative.

After the accession to the WTO of 2007, the trade liberalization process continued gradually, but the changes were moderate compared to those dictated by the previous reforms. The planned change consisted in "reductions in most bound rates, from 17.4 percent on average in 2007 to 13.4 percent by 2019" (WTO, 2006). At the same time, other countries of the WTO lowered their tariffs on Vietnamese imports and removed import quotas imposed on its textile and apparel products at the beginning of 2007. Vietnam had also to remove duty drawbacks and rules of local content. Not only the tariffs



were modified by the agreement: Vietnam committed to change its economic landscape on various sides. It had to rewrite its commercial legislation and legal procedures, change the legislative framework relative to contracts, properties, and the settling of trade disputes. Moreover, business laws had been changed in order to guarantee the same treatment to Vietnamese and foreign firms. Vietnam committed also to change the policies related to FDIs in concordance with Trade-Related Investment Measures (TRIMs) agreement. (Cling Jean-Pierre, 2009) (Boumellassa & Valin, 2009)

2.2 International Trade: 2005 and 2009 at glance

It might be useful to have a brief overview of some statistics on Vietnam for 2005 and 2009, the years of the two Enterprise Surveys. According to the World Integrated Solutions (WITS) database of the World Bank, Vietnam in 2005 imported goods for 34.88bn US$ and services for 4.47bn US$, measured in 2020 value. Exports of goods and services amounted to 32.44bn US$ and 4.17bn US$. Imports and exports of goods and services amounted respectively to 67.02 percent and 63.70 percent of GDP, while the Vietnamese GDP was 57.63bn US$. The main three imports at HS 6 digit level of classification were, in descending order: petroleum oils and oils obtained from bituminous

minerals (not crude); gold, non-monetary, unwrought (but not powder); iron or non-alloy steel, semi-finished products of iron or non-alloy steel. The main three exports were: petroleum oils and oils obtained from bituminous minerals; semi-milled or wholly milled rice; frozen shrimps and prawns. The main three source countries of imports flowing to Vietnam were, in descending order, China, Singapore,and Taiwan, while the main three countries of destination for Vietnamese exports were the United States, Japan, and China.

How did the same parameters change in 2009? The GDP climbed to 106.01bn US$. The value of imports grew to 64.70bn US$ for goods and 8.18bn US$ for services. The value of exports was 57.09bn US$ for goods and 5,76bn US$ for services. Imports of good and services accounted for 72.10 percent of national GDP, and exports for 62.61 percent. It must also be considered that, during the last part of 2008, and the whole 2009, international trade was impacted by the negative effects of the Global Financial Crisis. The main three imports were: petroleum oils and oils obtained from bituminous minerals (not crude); oil-cake and other solid residues of soya-bean; and transmission apparatus incorporating reception. The main three categories of exports were: petroleum oils and oils obtained from bituminous minerals; Semi-milled or wholly milled rice; and coffee, not roasted or decaffeinated. The main three imports source countries were China, Japan, and Republic of Korea, while the main three destinations countries remained the United States, Japan, and China.

2.3 Theory of trade liberalization and firms

At the beginning of the 21st century the economic research on international trade started concentrating on the role of firm heterogeneity and on the impact of trade on heterogeneous firms. Several studies analyzed the effects of a tariff decrease, in particular on productivity. Melitz (2003), introduced modifications to the traditional Krugman's model, including firm heterogeneity in the level of productivity, in a theoretical setting characterized by monopolistic competition and with increasing returns. The model tested by Melitz showed how trade liberalization forced the less productive firms to exit from the market or to shrink, while the most productive firms started to export, became more productive and profitable, causing an higher concentration of market shares towards the latter. The simulation showed that a country shifting from autarky to trade benefitted in terms of aggregate productivity and welfare.

Trefler (2004) studied the effect on Canadian firms of the FTA between Canada and US which entered into force the 1st January 1989. He observed a 5 percent reduction of all manufacture employment, particularly among the less productive import-competing firms which lost 12 percent of their workforce. The FTA caused also an overall sectoral growth of labor productivity of 15 percent among the most impacted import-competing group

of industries, and 14 percent among the most impacted export-competing industries. In general, manufacture labor productivity increased by 6 percent.

Pavcnik (2002) analyzed the effect of a large decrease in tariffs, that took place in Chile during the period between 1979 and 1986, on manufacturing plants with ten or more employees. She found out that the productivity level of manufacturers of import-competing goods improved on average by 3 to 10 percent more than the productivity of plants in the other sectors. The channel was, at least in some cases, the shift of resources from the less productive firms to the most efficient ones. Moreover, plants exiting from the market were on average 8 percent less productive than the surviving firms. No significant productivity growth is seen among producers of exportable products.

The effect of trade liberalization on firm productivity is discussed also in a work by De Loecker (2011) who captured the importance of the measurement criteria of productivity. In fact, he studied the effect of trade liberalization on Belgian textile industry at firm level using a decomposed measure of productivity that allowed to separate demand and price effects from real productivity. Interestingly, he discovered that "abolishing all quota protections increased firm-level productivity by only 2 percent as opposed to 8 percent when relying on standard measures of productivity."

2.4 The effect of intermediate inputs

While the previously reviewed literature focused on the decrease of export tariffs causing the firms to compete on international markets and on the decrease of import tariffs causing increased competition in the local markets brought by the so-called import-competing firms, additional studies analyzed the effect of trade liberalization on firms through the intermediate inputs of foreign origin used in productive process by the firms.

Amiti and Konings (2007) studied the impact of the annexation of Indonesia to the WTO in 1995 on firms. After having observed the results found by Pavcnik (2002) and Trefler (2004), Amiti and Konings raised the hypothesis that these authors considered firms to be import-competing while they "may actually be importing their inputs rather than competing with imports." In particular, a 10 percent fall in input tariffs caused a 12 percent increase in productivity among firms that imported their intermediate inputs. This effect was at least twice as high as any gain obtained from reducing output tariffs. The identification strategy was also important for any further similar study because it signalled how omitting the input tariffs channel can result in OVB. The authors raised the following hypothesis, without the possibility of verifying them, that the effect observed may stem from one -or from all- of the following causes: "learning effects, higher-quality foreign inputs, and more differentiated varieties of inputs."

Another study by Goldberg, Khandelwal, Pavcnik, and Topalova (2010) regarding

India during its intense liberalization process which started in 1991 and had the objective to comply with the IMF adjustment program, investigated one of the previously cited possible mechanism through which a change in import tariffs can impact firms through its intermediate inputs. The authors estimated that the role of new inputs in increasing the scope of newly produced goods by Indian firms was around 31 percent.

2.5 Female labor force participation

Equal workforce participation between genders is not only an important human right objective, and a desirable attainment for the society in itself, it is also linked with other social and economic key development parameters. Female participation seems to have positive effects on the economic development of emerging economies, particularly through decision making (Duflo, 2012). A study by Bulte, Lensink, and Vu (2016) performed in Vietnam confirmed the growing evidence that increasing female employment and entrepreneurship strengthen the bargaining power of wives within their families, which on average tend to spend a larger part of the economic surplus on the human capital of children, in particular for what concerns health and nutrition (Duflo, 2003) with exceptions regarding education (Duflo, 2012).

The factors influencing female participation are numerous. Among them there are social norms, discrimination, the need for muscular force, the technology used by firms etc. Female participation is generally believed to be negatively linked with fertility rates and positively with marriage age (Duflo, 2012). In some contexts, the relationship between economic development and female labor market participation took a U-shaped form. In fact, at the lowest level of income, an initial increase in income may be enough to encourage women to have more children and drop out from the labor force. This relation is inverted and increase when the income grows further and with the increased availability of education opportunities that allow women to work in white-collar jobs (Goldin, 1994) (Çağatay & Şule Özler, 1995).

Nonetheless, in some region of the world, like South-East Asia, while the last decades were characterized by a high economic growth, a stagnating -or even decreasing- average female participation rate was witnessed, apart exceptions like Bangladesh and Indonesia. In Vietnam, female participation on total workforce decreased slightly from 48,15 percent of total labor force in 2005, to 47,96 percent in 2009 (World Bank). Female participation on total over-15 years old female population decreased slightly from 71,78 percent in 2005 to 71,48 percent in 2009, following the International Labour Organization (ILO) estimates.

A possible reason contributing to the stagnating growth rate of female participation observed in Vietnam is suggested by Kreibaum and Klasen (2015). The authors studied the role of Vietnam War for the cohorts and the provinces most involved into the conflict.

The men fighting and participating less to the economic life and eventually remaining injured or missing, pushed more women to enter into the workforce. This effect might have been transmitted to the generations of women that joined the workforce after the war, even if the effect is less strong and robust, suggesting a cultural transmission of the different role of female in society. Another possible factor is the impact of socialism on the society of the northern part of the country, as the socialist government was actively sustaining female workforce participation (Werner, 1981). By going temporarily farther from the period of war and socialism, these effects may have shrank gradually with the reemergence of old social models gaining back their prevalence or for the emergence of new tendencies.

A study from Vo and Ha (2021) tried to explore the drivers of gender discrimination within Vietnamese firm between 2011 and 2015. First of all, the authors assess the role of discrimination to account, of the differences among male-intensive and female-intensive sectors, for "26.11 percent of the number of female employees and 87.78 percent of the difference in the proportion of female workers." The factors linked with larger female participation are exporting, the presence of female employers, participation of the firm to trade associations, sociopolitical organizations, links with the Communist Party, investments in human capital, industrial sector (presence of female-intensive sectors like textiles, growing from comparative advantages in international trade), a larger asset size and a longer time from the starting of the operations. On the contrary, labor remuneration and the level of capital per worker are linked negatively with female participation, coherently with the hypothesis from Becker (1957, 1971), and contrary to the hypothesis of Galor and Weil (1996) who examined a mechanism which links positively female relative wage and the level of capital per worker because female labor is supposed to have higher complementary with capital than male labor.

2.6 The effects of trade on female labor force participation

Trade liberalization reforms can affect aggregate female labor force participation through comparative advantages and sectoral segregation. In fact, if women are relatively more employed in those sectors that enjoy a comparative advantage and if gender segregation within sectors is persistent, as argued for example by Borrowman and Klasen (2017) and Do, Levchenko, and Raddatz (2016), a trade liberalization reform can raise overall female participation as the female-intensive sectors expand favoured by their comparative advantage.

A paper by Kis-Katos, Pieters, and Sparrow (2018) studied the impact of trade liberalization on female labor market participation in Indonesia. Analyzing data from a panel of 259 districts for the years 1993, 1996, 1999, and 2002, the authors found that

lowered import tariffs impacted positively on women employment levels through locally important inputs. Female-intensive sectors expanded and female segregation in other sector diminished more in the areas that were more exposed to a reduction of input tariffs. The effect of lowering export tariffs is dominated by that of import tariffs through the inputs used by firms. The most positively affected women are less educated and aged 20 or older. Other related effects are lower marriage rates and lower fertility, as well as declining participation in domestic duties.

Similar effects are noted by Do et al. (2016) which observed that countries with comparative advantages in female-intensive sectors showed lower fertility, and by Aguayo-Tellez, Airola, Juhn, and Villegas-Sanchez (2014) which, together with a growth of female intensive sectors detected a shift in household spending from tobacco, alcohol, and man clothing towards women's clothing and education.

On the contrary a study by Keller and Utar (2018) noted that Chinese import competition increased fertility rate, parental leave, marriage rates, and lowered rates of divorce among young Danish women. The causes are to be searched in reduced labor market opportunities, affecting more the women because of their higher reservation value in staying in the labor market during the period of fertility.

Mansour, Medina, and Velasquez (2020) studied the effect of increased competition from Chinese firms after the entrance into the WTO, on Peru labor force participation. The authors observed a short term reduction in employment of both male and female workers in the districts most exposed to Chinese imports. Nonetheless, in the long run, male employment reached the level of before the reform. The same employment recovery however is not observed among women, especially if low-educated. The authors also observed that the districts where such long-term effect is spotted the most for women are the ones that present a low initial level of employment in the non-tradable sectors, suggesting a link with the frictions in labor market reallocation and the lack of opportunities for women. The authors explored also the possibility of a shift to the informal sectors but in the long period no relevant differences between women and men in the growth of participation in workforce in the informal sector are noted.

Regarding the effect of trade liberalisation on female participation to the informal sector, Ben Yahmed and Bombarda (2020) using the Mexican labor force survey and tariff data from between 1993 and 2001, applying a general equilibrium model, found that import liberalization was linked with a growth in the probability of low skilled women holding an informal job in the service sector. Instead, in manufacturing sector both men and women increased their probability to work in a formal job, with men benefiting the most.

A study by Sauré and Zoabi (2014), highlighted another side of the relationship be-

tween trade liberalization and female labour market participation and gender wage gap. This paper studied the effects of NAFTA across US States. While in other contexts trade liberalization is observed to impact on gender wage gap by expanding those female-intensive sectors that enjoy a comparative advantage, the authors noted results going in the opposite direction. The hypothesis is the following: trade liberalization expanded the female-intensive sectors enjoying a comparative advantage, and shrank the male-intensive sectors, causing a reallocation of men to the stretching sectors. If female labor has a stronger complementary with capital than male labor, the flow of men to the female-intensive sectors decreases the rate of capital per worker. This would lower the marginal productivity of women compared to men, increasing the gender wage gap and decreasing the relative female labor force participation. The same mechanism applies in the case of technological progress biased towards female-intensive sectors. As technological progress increases wages, more males enter in the sector decreasing the level of capital per worker, and curbing female participation.

"Men, women, and machines" is a study by Juhn, Ujhelyi, and Villegas-Sanchez (2014) exploring the impact of the lessening of tariffs caused by the NAFTA of 1994 on changes of female labor force participation within Mexican firms and on their relative wages. The authors used establishment-level data, from two rounds of a survey dated between 1991 and 2000 and observed a positive impact of trade liberalization on women employment and wage for blue collar jobs. The supposed channel is the following: lower export tariffs caused more firms to enter in the export market and to upgrade their technology, adopting newer and more efficient machinery, like computers, consistently with the findings of Bustos (2011). The newer technologies have a positive complementarity with female work, making the need for muscular force, particularly among skilled blue collar workers, less important, therefore augmenting the relative productivity of female workers, as studied also by Weinberg (2000). This causes employers to hire more female workers and to pay them relatively more. The authors initially observed that an average reduction of US import tariffs of 5.2 percent caused a growth of the share of female employment in blue-collar occupations by 20 percent. The same reduction of tariffs increased women relative wage by 24 percent. The results conserved their directions also after that the authors applied a number of controls, as including the change in import tariffs and the change in import tariffs weighted through the Input-Output table to account for the effects of intermediate inputs like as in the study by Amiti and Konings (2007). To support the hypothesis that technological upgrade is the main channel through which trade liberalization influenced female participation, the authors run also a regression studying the impact of the shrinking tariffs on the value of machinery employed by the firms. They find a strong, positive impact. Another factor adding value to the technology hypothesis is that the increase in

female participation is not observed among white collar workers, whose productivity is not highly dependant on muscular force.

Black and Brainerd (2004) are part of a number of authors that explored another mechanism trough which trade liberalization may impact on female labor market participation and gender wage gap. The study is based on the hypothesis of "taste for discrimination." This theory dates back to "Economics of Discrimination" by Becker (1957, 1971). The taste for discrimination -that may be headed against women but the same can apply to other discriminated social groups- is expensive to satisfy because it prevents the owner of the business to employ the profit-maximising share of women and therefore it reduces profits or it causes the employer to pay more for an equally skilled worker from the preferred social group. The increased competition in a sector or a region, may reduce overall discrimination. In particular, in Becker's theory, this effect is achieved through the growth of firms not applying discrimination at the expense of the shrinking or failing discriminating firms. This is coherent with historical data about manufacturing firms of US, which between 1976 and 1993 -after controlling for skills- showed a faster reduction in gender wage gap, stemming from an increase in competition caused by trade liberalization, in more concentrated industrial sectors rather than in the already competitive manufacturing sectors.

Other authors like Ederington, Minier, and Troske (2009) applied a modified version of the Becker's Model, finding similar results. The mechanism of taste for discrimination, in the hypothesis of the authors, works in a slightly different way: the competitive pressure affects initially concentrated sectors by making the cost for discrimination more expensive, and thus pushing employers to hire more women. Using plant-level data from 1984 to 1991, during a period of trade liberalization reforms in Colombia, the authors observed a 6.9 percent increase in female participation, compared to industries with no change in tariffs.

Not all the evidence points in the same direction as Black and Brainerd (2004) and Ederington et al. (2009). Berik, Van der Meulen Rodgers, and Zveglich Jr (2003), with a study performed using data from Taiwan and South Korea, during the 1980s and the 1990s, showed how a change in competition from trade liberalization in concentrated industries is positively linked to the gender wage gap. The possible explanation for this phenomenon is that, in contradiction to Becker's discrimination model, women in these contexts were the first to be discriminated and to suffer the worst economic consequences from firms cutting down the expenses, because of the increased competition, having lower bargaining power compared to men.

An hypothesis was raised by Bøler, Javorcik, and Ulltveit-Moe (2015), explaining a mechanism through which trade liberalization might be linked with decreased female par-

ticipation: gender wage gap may be caused by the surplus in the request of commitment and flexibility by employers towards employees in the exporting sector compared to the non-exporting sector. Women may be perceived to be less committed and flexible. To study this mechanism, the authors used a matched employer-employee data-set from the Norwegian manufacturing sector, from 1996 to 2010. During that period a new legislation was approved, increasing the parental leave only for fathers. This external shock has a positive impact on the reduction of the gender wage gap, more in the exporting sector compared to the non-exporting one, confirming the hypothesis of the authors. Similar results are obtained considering as explanatory variable the large creation of kindergartens, starting from 2003. This study is related to trade liberalization from the moment that the latter can expand the exporting sectors.

To conclude, other papers, like the one by Gaddis and Pieters (2017) applying a diff-in-diff model in the context of Brazil's trade liberalization reforms during the 1990s found that in proportional terms there wasn't any impact on female labor force participation relative to male participation in the more exposed micro-region compared to the others.

3 Data

In this section I will briefly summarize the characteristics of the data used for the research. I start describing the firm-level data, from which I retrieved the main response variables measuring changes in female participation and a number of other controls. Secondly, I describe the tariff data and the other tools used to transform it and to make it usable for the analysis: the IO table and the concordance table.

3.1 Firm-level data

The World Bank Enterprise Survey collects many information relative to firms in many countries around the world through a set of interviews to the business owner or to the top management. For many countries, the surveys are repeated during different years. Three surveys are available for Vietnam: 2005, 2009, and 2015. For studying the effects of the accession to the WTO, which came into force in 2007, it is appropriate to consider only the years 2005 and 2007, as 2015 is chronologically too far from the reform, and too many other phenomenons may have influenced female participation in the meantime.

The survey contains data on firms from the private sector, excluding 100 percent State owned firms, informal firms, and firms with less than 5 workers. It embodies a large amount of information like finance, cost of labor, performance of the business, trade, crime, corruption, land use, relations with the government, infrastructure, energy, characteristics of the labor force and of the business environment etc. The sectors surveyed are only

some of the sectors of the economy: construction, retail, wholesale, hotels, restaurants, transport, storage, communications, and IT. The methodology followed for the sample is stratified random sampling, using three levels of stratification.

1) Industry stratification, is defined in the documentation of the survey as "5 manufacturing industries, 1 services industry -retail -, and two residual sectors. Each manufacturing industry had a target of 120 - 145 interviews. The services industry and the two residual sectors had a target of 120 interviews. For the manufacturing industries sample sizes were inflated by about 25 percent to account for potential non-response cases when requesting sensitive financial data and also because of likely attrition in future surveys that would affect the construction of a panel." The sector used for stratification are built by aggregating different ISIC Rev. 3.1 2-digits industry sectors in larger groups.

2) Establishment size: establishments are stratified in small (from 5 to 19 employees), medium (from 20 to 99 employees), and large (more than 99 employees), considering permanent full-time workers. The survey tends to over-sample large firms for their rareness in most economies and for their leading role, moreover, large firms tend to survive more than small firms, therefore are probably over-represented in the panel data containing only the firms that stayed in the market from 2005 to 2009.

3) Region: the stratification is defined in five regions containing 14 provinces. Red River Delta (Hanoi, Ha Tay, Hai Duong, and Hai Phong), the North Centre Coast (Thanh Hoa, Nghe An), Mekong River Delta (Can Tho, Long An, Tien Giang), South Centre Coast (Khanh Hoa, Da Nang) and South East (Ho Chi Minh City, Binh Duong, Dong Nai).

Table 1: Summary statistics of the ratio of full-time female workers on total full-time workers, ratio of full-time female production workers on total full-time production workers, ratio of full-time female non-production workers on total full-time non-production workers.

	Mean	Std Dev	Obs
2005			
RatioFemale	0.4039	0.2654	322
RatioFemaleProd	0.4177	0.3033	322
RatioFemaleNon-Prod	0.2901	0.2388	325
2009			
RatioFemale	0.4349	0.2782	325
RatioFemaleProd	0.4042	0.3249	326
RatioFemaleNon-Prod	0.5327	0.5198	326

The firms surveyed in 2005, that were surveyed a second time in 2009 were 356. The survey includes data on total full-time workers and total female full-time workers, both in blue and white collar jobs, at the end of the previous year. From this data it is easily possible to construct the ratios of female in the two categories of workers and, secondly,

Table 2: Summary statistics of ratio of full-time total production workers on full-time total workers, and ratio of full time total non-production workers on full-time total workers.

	Mean	Std Dev	Obs
2005			
RatioProd	0.8026	0.0083	348
RatioNon-Prod	0.1974	0.0083	348
2009			
RatioProd	0.7904	0.0079	330
RatioNon-Prod	0.2096	0.0079	330

the change in female participation by computing simple differences between the ratios in 2009 and 2005. The ratio of females among non-production workers passed from 29 to 53,3 percent. Among production workers, women decreased slightly from 41.7 to 40.4 percent.

Table 3: Summary statistics of the changes in the ratios of female workers on total workers, female production workers on total production workers, female non-production workers on total workers

	Mean	Std Dev	Obs
$\Delta RatioFemale$	0.0205	0.2251	294
$\Delta RatioFemaleProd$	-0.0259	0.2840	295
$\Delta RatioFemaleNonProd$	0.2503	0.5646	297

Changes are calculated as simple differences between the value in 2009 and 2005. Changes in female production and female non-production workers measure the differences between 2009 and 2005 ratios of female workers within their categories

Among the firms for which data on female participation were available for both the years, on average, the total ratio of female participation increased by 0.02, while the ratio of female blue collar workers decreased by 0.026 and the ratio of female non production workers increased by 0.25.

To summarize, the firms displayed a large majority of production workers respect to non-production workers and, during the 4 years, the ratio of production workers on total workers diminished slightly -from 80 percent to 79 percent- in favor of non-production workers. Female where highly represented among production workers in 2005, and their ratio of participation decreased a little -from 41 percent to 40 percent- among the two years of the survey. Among non-production workers, instead, the ratio of female participation increased largely, becoming the majority in 2009.

3.2 Tariff data

I retrieved data on tariffs from the World Bank Integrated Solution (WITS) website which gives access to the WTO-IDB database. I considered the effectively applied rates. The data used in the analysis are from 2005 and 2009, in concordance to the years in which the World Bank Enterprise Survey for Vietnam was performed. The following tariff data are used: 2-digits export tariffs for Vietnam used for measuring the impact of competition on the international markets for Vietnamese exporting (directly or indirectly) firms, 2-digits import tariffs used for measuring the effect of international competitors on the local markets, and 2-digits input tariffs for studying the effect of inputs of foreign origin on Vietnamese firms.

The level of aggregation of the classification used is selected coherently with the Enterprise Survey which, for every firm and for each of the two years, displays the 2-digits classification of the industry sector. The 2-digits classification, concerning the input tariffs, is also needed for linking the tariff data with the Input-Output table.

To avoid endogeneity problems stemming from the possible impact of change in tariffs on the relative importance of Vietnam's trade partners during the years, and therefore on the average weighted tariffs between Vietnam and other WTO countries, data from 2005 and 2009 are weighted using the trade flows between Vietnam and its main five trade partners in 2004. Those countries were, in decreasing order of importance, China, Taiwan, Singapore, Japan, and South Korea for trade towards Vietnam. For Vietnamese outflows the five most important partners were United States, Japan, China, Australia, and Singapore. Trade flows data at 2-digits level of classification, ISIC Rev. 3, are retrieved from the UN-Comtrade database accessed through WITS.

Subsequently, I weighted the tariffs between Vietnam and each one of its 5 main trade partners multiplying the 2-digit level tariffs between Vietnam and one of the countries by a ratio obtained dividing the value of trade flows in 2004 incurring between Vietnam and that country on the sum of flows with all the 5 partners. Then, the five obtained values are summed together to get the weighted tariffs for each 2-digit industry sector. The procedure is repeated for each year (using 2004 trade flows also for 2009 tariffs) and for both export tariffs, and import tariffs, considering in the first case the 5 main receivers of Vietnamese exports in 2004, while for the second case the 5 main sources of trade flows towards Vietnam, still in 2004.

The classification of the tariff data follows the International Standard Industrial Classification (ISIC), Third Revision, while the classification of sector included in the Enterprise Survey is ISIC Rev. 3.1. For this reason, I used a concordance table retrieved from the United Nations website (Statistics Division of the Department of Economic and Social Affairs) to concord the tariff data from Rev. 3 to Rev. 3.1. Considering only the sectors

of the firms used in the analysis, at 2-digits level of classification, there were no changes between Rev. 3 and Rev. 3.1.

A possible issue in identifying the impact of WTO accession is that the tariff changes displayed by the WTO-IDB database, between 2005 and 2009, may possibly include changes caused by other trade reforms between Vietnam and the five countries. Nonetheless, the substantial objective of the study, which is to measure the impact of trade liberalization on female labor market participation, would remain intact. Other trade reforms overlapping with the WTO accession are the BTA between Vietnam and the USA which entered into force on the 10^{th} of December in 2001, and for which the bulk of changes were implemented before 2004-2005, but some minor changes extended until 2011. Regarding Japan, the entrance into effect of AJCEP and VJCEPA in December 2008 and October 2009 respectively, impacted the average tariffs for 2008 and 2009 between the two countries. For Singapore, the ASEAN Free Trade Area which Vietnam joined in 1996 caused the tariffs to change during a ten year period ending the 1^{st} January 2006. Vietnam and China started lowering bilateral tariffs in concordance with the ASEAN-China FTA in 2005, until 2015.

Table 4: Summary statistics of the export, import, and I-O weighted tariffs obtained the with the procedure described in the text.

	Mean	Std Dev	Obs
2005			
ExportTariffs	0.0394	0.0339	326
ImportTariffs	0.1739	0.1397	326
IOtariffs	0.1052	0.0792	356
2009			
ExportTariffs	0.0323	0.04	337
ImportTariffs	0.1179	0.068	337
IOtariffs	0.0773	0.0717	356

3.2.1 Input-Output Table

To evaluate the impact of a change in tariffs through the channel of intermediate inputs, following the mechanism studied by Amiti and Konings (2007), it is necessary to use an Input-Output table for matching the import tariffs, weighted by the amount of inputs coming from that same sector, with the output sector of the goods and services produced. The I-O table for Vietnam is retrieved from the OECD website, and the nomenclature used is ISIC Rev. 3, with 2-digits level of classification. The year considered is 2005, and it is used both for 2005 tariffs and for 2009 tariffs, in order to avoid endogeneity problems stemming from the fact that the change in tariffs might have influenced the

composition of inputs between the two years, moreover the technology did not change to a great extent during a 4-years period.

The I-O table includes the value of both local and imported inputs used in production in all the industrial sectors, in US$. The import tariffs -already weighted using the relative importance of trade flows between the main five source countries of import towards Vietnam- are weighted through the use of the I-O table. The import tariffs are matched with each one of the sectors of provenience of the inputs, and multiplied by a ratio obtained dividing the value of the inputs for that sector with the value of total inputs. The obtained values are then summed together and finally assigned to the output industry sector. After being converted to ISIC Rev. 3.1, using the concordance table, the tariff data are linked to the firms in the Enterprise Survey based on their 2-digits industrial sector.

Table 5: Summary statistics of the changes in export, import, and I-O weighted tariffs obtained computing differences between the value in 2009 and 2005.

	Mean	Std Dev	Obs
$\Delta ExportTariffs$	-0.0079	0.0249	308
$\Delta ImportTariffs$	-0.0648	0.1148	308
$\Delta IOtariffs$	-0.0279	0.0794	356

4 Methodology

The objective of the analysis is to explore the link between the changes in tariffs due to trade liberalization reforms and changes in female labor market participation, both among white collar and blue collar jobs. The effects of those reforms are studied focusing on three channels: the decrease in export tariffs impacting Vietnamese firms by inducing them to compete on the international markets; the decrease in import tariffs, causing a larger pressure on that local firms that produce goods and services competing with those offered by foreign firms; and finally, the lowered price of foreign intermediate inputs used in production by Vietnamese firms.

The mathematical specification is inspired by the study by Juhn et al. (2014), and consists in a first-difference model including as explanatory variable the changes in tariffs and as response variable the change in ratio of female participation. Initially, other variables are included to control for initial firm-specific characteristics. Those variables will be excluded in a later stage of the analysis.

To calculate the change in tariffs between 2005 and 2009, the tariff ratio considered for 2009 pertains to the same 2-digits industry sector as that of the firm in 2005, even for those firms that changed sector between the two years. The reasoning behind this choice

is to avoid the possible endogeneity of results since the change in tariffs can influence firms to modify their production choices and, possibly, to change sector.

Nonetheless, using tariffs from the same sector in 2009, for calculating the change in tariffs, even when the firms changed sector between the two years, will probably results in measurement error: the change in tariff assigned to a firm is different from the true change faced by the firm. A robustness test will be computed at a later stage of the analysis to account for this issue.

The World Bank Enterprise Survey included also the 4-digits sector of classification of the most sold product by the firm. Nonetheless, the firms changed the 2-digits industry sector approximately 46 percent of the times, while they changed the 4-digits sector of the most sold product around 90 percent of the times.

Moreover, at a later stage of the analysis, the regressions are run again keeping only those firms that maintained their sector of pertinence, to test how this affects the results. The choice of utilizing the 2-digits sector data guarantees a minimum amount of observations that, although small, permit to perform the analysis. The same does not happen when using tariffs at 4-digits sector of classification of the most sold product.

Another reason for choosing the 2-digits industry sector in place of the 4-digits sector is that, while for some firms the most sold product or service represents the entirety -or the vast majority- of the annual sales, for other firms the most sold product represents less than half of the value of the annual share of sales. Therefore, when assigning the change in tariffs relative to the most sold product -4-digits level,- the results of the analysis can be heavily influenced by the degree of specialization of the firm.

For all these reasons it might be more useful for the purpose of the analysis to utilize the 2-digits industry sector, sacrificing precision by using a high level of aggregation in order to avoid those problems. This represents one of the main differences in approach between this study and Juhn et al. (2014).

4.1 First-difference regressions

A first-difference model is used in order to account for any possible unobserved, time-constant factor that affect the dependent variable (Wooldridge, 2018). The model includes also a set of initial year firm characteristics used as controls, and categorical dummy variables to control for the possible impact of different regions and initial firm's size levels. Regarding the choice between the usage of heteroskedasticity-robust standard errors or clustered standard errors I picked the first. I will briefly explain my reasoning.

Following (Abadie, Athey, Imbens, & Wooldridge, 2017), with fixed effects, one should cluster if either there is clustering in the sampling and there is heterogeneity in the treatment effects, or there is clustering in the assignment and there is heterogeneity in

the treatment effects. To my understanding, the setting of the study can be assumed to be similar to a fixed effects setting, as first-differencing, like the inclusion of fixed effects, accounts for unobservable time-constant variables impacting on the dependent variable.

Moreover, the assignment can be defined as clustered: considering the average tariffs at 2-digits level of classification, the same average change in tariffs is assigned to all the firms pertaining to the same industry sector, from which the surveyed firms are retrieved. Finally, the treatment effect can be hypothesised as heterogeneous: different firms may react differently to the a same change in tariffs.

The choice would go towards clustering the standard errors. Nonetheless, the number of clusters (2-digits industry sectors), 12, is too small to cluster the standard errors. For this reason, heteroskedasticity-robust standard errors are used.

$$\Delta Y_{f,2005,2009} = \beta_1 \Delta ExportTariffs_{i,2005,2009} + \beta_2 \Delta ImportTariffs_{i,2005,2009}$$

$$+\beta_3 \Delta IOtariffs_{i,2005,2009} * DummyImporting_{f,2005}$$

$$+\beta_4 \Delta IOtariffs_{i,2005,2009} + \beta_n X_{f,2005} + \eta + \sigma_f + \Delta\epsilon_{f,i,2005,2009} \quad (1)$$

Where $\Delta Y_{f,2005,2009}$ indicates the change in ratio of female participation, calculated as simple difference, respectively among production or non-production workers, for firm f, between 2005 and 2009.

$\Delta ExportTariffs_{i,2005,2009}$ indicates the change in ratio of export tariffs, calculated as simple difference, between 2005 and 2009, considering the 2-digits industry sector i of the firm in 2005.

$\Delta ImportTariffs_{i,2005,2009}$ indicates the change in ratio of import tariffs, calculated as simple difference, between 2005 and 2009, considering the 2-digits industry sector i of the firm in 2005.

$\Delta IOtariffs_{i,2005,2009}$ indicates the change between 2005 and 2009, calculated as simple difference, in ratio of import tariffs weighted using the inputs utilised by the firms, through the use of I-O table, considering the 2-digits industry sector i of the firm in 2005.

$DummyImporting_{f,2005}$ indicates a dummy variable that takes the value of 1 if the firm f used inputs of foreign origin imported directly, in 2005.

$X_{f,2005}$ represents set of firm-level characteristics for firm f, in 2005:

a) Foreign: a dummy variable of value 1 if the share of ownership by private foreign individuals, companies, and organizations was larger than 10 percent in 2005, and zero otherwise. b) Government: a dummy variable of value 1 if the share of ownership by the government was larger than 10 percent in 2005, and zero otherwise. c) Union: a dummy variable of value 1 if the share of unionized workers was larger than 10 percent in 2005,

and zero otherwise. d) Labor costs per worker: natural logarithm of the ratio of total labor costs (in millions of VND) divided by the number of full-time employees at the end of 2004. e) Equity per worker: natural logarithm of the ratio of total equity (in millions of VND) divided by the number of full-time employees at the end of 2004. f) The initial female participation ratio in 2005, respectively for production or non production workers.

η indicates a set of categorical dummy variables for each region, following the regional stratification of the survey, to account for possible effects specific of each region.

σ_f indicates a set of categorical dummy variables for each size-level considering the following levels: smaller than 20 employees, between 20 and 99, and more than 99; coherently with the stratification methodology. The objective is to control for possible effects that are specific of each size level.

$\Delta\epsilon_{f,i,2005,2009}$ indicates the first-differenced error term.

4.1.1 Robustness test. First-difference regressions with firms maintaining the same sector

To avoid measurement errors in the change in tariffs assigned to each firm, it might be useful to test the results obtained with the previous model using only those surveyed firms that maintained the same industry sector in 2005 and 2009. This should increase the robustness of the results because considering the tariffs level of 2009 for the same sector of 2005, when computing the change in tariffs, for those firms that changed sector between the two years, can result in an underestimation or an overestimation of the effect of the change in tariffs.

Nonetheless, the fact that a firm maintained the same industry sector might not happen randomly, and might be influenced by the change in tariffs. In this sense, the sub-sample might be less representative of the Vietnamese firms compared to the initial sample. Moreover, the results might be endogenous.

4.1.2 Robustness test. Exclusion of the initial ratio of female participation and other firm-specif variables

A further robustness test can be run. In fact, as Wooldridge (2018) states, a critical assumption for the first-difference model is strict exogeneity of the regressors. In order to avoid the risk of violating this assumption, all the initial firm-specific characteristics, which are included in the cross-sectional regressions as lagged variables -including in particular the initial ratio of female participation,- are excluded from the model.

$$\Delta Y_{f,2005,2009} = \beta_1 \Delta ExportTariffs_{i,2005,2009} + \beta_2 \Delta ImportTariffs_{i,2005,2009}$$

$$+\beta_3 \Delta IOtariffs_{i,2005,2009} + \eta + \Delta\epsilon_{f,i,2005,2009} \quad (2)$$

4.1.3 Robustness test. Regressions with levels

For testing further the robustness of the results obtained during the previous part of the analysis, it might be useful to run panel-data regressions involving the levels -and not the changes- of the previously used explanatory and response variables. The tariffs used for 2005 and 2009 are, again, those relative to the 2-digit industry sector of the firm in 2005. The panel-data regressions include firm and region fixed effects to control for constant unobserved firms' characteristics and common region unobserved variables, and year fixed effects to control for possible trends that vary over time but that are common across firms during the same year.

A first-difference model with two periods and a panel-data regression with the same periods, should display identical results (Wooldridge, 2018).

The firm-specific control variables are not included because often they are not available for both years. Anyway, the same lagged controls were removed from the last version of the first-difference model, in order to avoid the risk of violating the assumption of strict exogeneity.

Furthermore, differently from the first-difference model, the panel data regression allows to include robust standard errors clustered at firm-level, coherently with the interpretation that I gave to Abadie et al. (2017), as explained in the paragraph describing the first-difference model.

The panel-data regressions are run including only those firm that maintained the same industry sector between 2005 and 2009. The panel-data regressions are run also excluding the interaction between the import tariffs weighted using the I-O table and a dummy variable taking the value of 1 if the firms imported directly its intermediate inputs in 2005, and the fixed effects considering the initial size level of the firm, still for avoiding the risk of violating the strict exogeneity condition.

$$Y_{f,t} = \beta_1 ExportTariffs_{i,t} + \beta_2 ImportTariffs_{i,t} + \beta_3 IOtariffs_{i,t} * DummyImporting_{f,2005}$$

$$+\beta_4 IOtariffs_{i,t} + \eta + \gamma_f + \tau_t + \sigma_f + \epsilon_{f,t} \quad (3)$$

$$Y_{f,t} = \beta_1 ExportTariffs_{i,t} + \beta_2 ImportTariffs_{i,t}$$

$$+\beta_3 IOtariffs_{i,t} + \eta + \gamma_f + \tau_t + \epsilon_{f,t} \quad (4)$$

Where the newly defined variables respect to regressions (1) are:

$Y_{f,t}$ indicates the levels of ratios of female participation, respectively among production workers or non-production workers of firm f at year t.

$ExportTariffs_{i,t}$ indicates the levels of export tariffs in year t, for the same 2-digits industry sector i of the firm in 2005.

$ImportTariffs_{i,t}$ indicates the levels of import tariffs in year t, for the same 2-digits industry sector i of the firm in 2005.

$IOtariffs_{i,t}$ indicates the levels of import tariffs weighted using the I-O table in year t, for the same 2-digits industry sector i of the firm in 2005.

γ_f indicates firm fixed effects.

τ_t indicates year fixed effects.

η indicates region fixed effects.

σ_f indicates initial size level fixed effects (only for regressions (3), excluded in (4))

$\epsilon_{f,i,t}$ indicates the error term.

5 Results

5.1 First-difference model

The regressions run display that the change in export tariffs is positively linked with the change in female participation, and the coefficient is statistically significant in the case of production workers (Table 6).

A possible explanation for this result might be that, following the findings of Bøler et al. (2015), the exporting firms by adapting their strategy to compete on the international markets might require more commitment by the workers, at the same time considering female workers less flexible because of their higher dedication to childcare compared to male workers. This would shift the employer choices towards male workers.

Contrary to the changes in export tariffs, the changes in import tariffs display a significant and negative link with the changes in female participation, for blue collars workers. This suggests a mechanism based on technological upgrading of firms' machinery like in Juhn et al. (2014).

The channel of intermediate inputs studied by Juhn et al. (2014) and Amiti and Konings (2007) shows only weak statistical significance for non-production workers. An higher initial ratio of equity per worker is linked with lower change of female participation among non-production workers.

Interestingly, an higher initial ratio of participation is linked with a smaller change in female participation, both among production and non-production workers. What could be the reason for this link? A possible theory is that it might exist an efficient level of

female participation for every specific firm at a point in time. The optimal ratio of female participation is not reached because of some reason, e.g. because of discrimination in the hiring process. When firms face lower levels of discrimination, the firms that are farther from the efficient ratio of female workers experience a faster growth in female participation, with a sort of "catch-up effect," while those firms that are near to the efficient level grow slower, because the improvements are steeper at the beginning and tend to be flatter near the efficient ratio (e.g. because the need to fill the difference between the ratios of participation of men and women become a less urgent thing to be solved to the eyes of the employers the more the percentage of women working for the firm increase).

Table 6: First-difference model

	$\Delta FemProd$	$\Delta FemNonProd$
	(1)	
$\Delta ExportTariffs$	3.0857***	1.1816
	(0.8288)	(0.7404)
$\Delta ImportTariffs$	-0.6958***	-0.2839
	(0.2059)	(0.1876)
$\Delta IOweightedtariffs$ *DummyImporting	0.0869	-0.6975*
	(0.3875)	(0.3898)
$\Delta IOweightedtariffs$	0.0702	0.0436
	(0.3208)	(0.317)
Foreign_{2005}	0.0533	0.0112
	(0.0401)	(0.0613)
Government_{2005}	0.0566	-0.0947*
	(0.0397)	(0.05)
Union_{2005}	-0.0322	0.022
	(0.0437)	(0.0517)
$\text{lnCostPerWorker}_{2005}$	-0.0289	-0.0224
	(0.0191)	(0.0222)
$\text{lnEquityPerWorker}_{2005}$	-0.0185	-0.0415**
	(0.0163)	(0.0182)
$\text{InitialFemProd}_{2005}$	-0.5712***	
	(0.0769)	
$\text{InitialFemNonProd}_{2005}$		-0.9035***
		(0.0694)
Region dummies	Yes	Yes
Initial Size dummies	Yes	Yes
Observations	269	271
R^2	0.3217	0.3636

Region and size level categorical dummy variables included. Robust standard errors in parenthesis, * p<0.1, ** p<0.05, *** p<0.01

5.2 Robustness test. First-difference regressions with firms maintaining the same sector

When considering only those firms that maintained the same industry sector between the two years, avoiding the probable measurement problems described in the "Methodology" section, the results change (Table 7). In fact, the coefficients of the changes in import tariffs, export tariffs, and import tariffs weighted using the I-O table for non-production workers are negative and significant, coherently with the hypothesis of a positive effect of technological advancement on female blue collar workers. It must be noted that, in the context of this study, the impact of lowering tariffs on technological advancement is not proven.

Notwithstanding these relevant results, as noted before, the choice of considering only the sub-sample of firms that did not change sector might be caused by the change in tariffs itself.

5.3 Robustness test. Exclusion of the initial ratio of female participation and other firm-specif variables

When repeating the regressions using only those firms that did not change industry sector between the two years and excluding all the lagged firm-specific variables, to avoid the risk of violating the strict exogeneity assumption, the coefficients of change in tariffs are all negative for both blue collar and white collar workers (Table 8). The only statistically significant coefficient is that of change in import tariffs for production workers. A decrease in the differences between the ratios of import tariffs between 2005 and 2009 of 0.01, is linked with an increase in the change of ratios of female participation between the two years of 0.0074.

5.4 Robustness test. Regressions with levels keeping only those firms that did not change sector

When performing the panel-data regressions, considering only those firms that did not change industry sector between 2005 and 2009, the results (Table 9) are similar to those obtained with the latest version of the first-difference model (Table 8), in particular for the panel-data regressions excluding the initial size levels fixed effects and the initial status of direct importer of foreign inputs (that was interacted with input tariffs), to respect the strict exogeneity assumption (Table 10). Specifically, in the last version, a ratio of import tariffs lower by 0.01, is linked with an higher ratio of female participation, by 0.0084.

6 Conclusion

The analysis of the link between the change in tariffs and the change in female participation resulted in some interesting findings.

The usage of tariffs at 4-digits, or even 6-digits, level of classification of the most sold product -like in the study by Juhn et al. (2014)- could cause identification issues: within this sample, the firms changed 4-digits sector between 2005 and 2009 in the large majority of the times, and many firms sell multiple products, with the most sold that often accounts only for less than half of the total sales of the firms.

For this reason, I chose the 2-digits sectors of the firm as the best level of classification of the tariffs, even if such high degree of aggregation could affect the results.

Moreover, after running the first couple of regressions including both the firms that changed and those that maintained the same industry sector between the two years, I decided to concentrate the analysis on the sub-sample that contains only those firms that did not switch sector. This can help avoiding a probable measurement error affecting the change in tariffs but could also mean that the results found in this sub-sample might be less representative of Vietnamese firms, and the risk of endogeneity is possible.

These things considered, at first I applied a model including a set of initial firms characteristics, added as lagged variables in the right side of the regression, following the methodology of Juhn et al. (2014). Nonetheless, after having considered that a critical assumption for first-difference and fixed-effects models is that of strict exogeneity (Wooldridge, 2018) I run a new set of regressions excluding those variables, in order to avoid the risk of breaking this assumption.

To check the robustness of the results I run another set of panel-data regressions including levels of tariffs and ratios of female labor force participation. The results that I found are similar to those of the first-difference regressions (Table 8 and Table 10). In both cases, the statistically significant coefficient is that of import tariffs for production workers, which shows a negative link between the change -or the level- of import tariffs and the change -or level- of female participation among blue collar workers.

In the first case, a decrease in the differences of ratios of import tariffs between 2005 and 2009 of 0.01, is linked with an increase of 0.0074 in the differences of ratios of female participation, while, in the case of the panel-data regression a ratio of import tariffs lower by 0.01, is linked with an higher ratio of female participation by 0.0084. Similarly to Juhn et al. (2014), the negative coefficients of these results, and the fact that they regard production workers and not non-production workers, suggest an interpretation based on the role of international competition in improving the technological advancement of firms' machinery, which benefits the efficiency of female blue collar workers by diminishing the

need for muscular force in production jobs, therefore favouring the employment of more women.

A new aspect compared to Juhn et al. (2014), apart from the methodology used, consists in the fact that in that case the authors found the change in export tariffs -and thus the increased competition faced by Mexican firms in the international markets- to impact on female participation, while in this case it is the change in import tariffs -therefore the increased competition brought by foreign firms to Vietnamese firms on the domestic markets- to be linked with the change in participation.

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Table 7: Robustness test. First-difference regressions with firms maintaining the same sector

	$\Delta FemProd$	$\Delta FemNonProd$
	(1)	
$\Delta ExportTariffs$	-3.1609**	2.0515
	(1.5964)	(2.5279)
$\Delta ImportTariffs$	-1.8774***	-0.2209
	(0.3312)	(0.4385)
$\Delta IOweightedtariffs$ *DummyImporting	1.8084	3.5598
	(2.6516)	(3.2354)
$\Delta IOweightedtariffs$	-5.3606*	-1.798
	(2.9318)	(3.6306)
Foreign_{2005}	0.0164	-0.0644
	(0.0479)	(0.0615)
Government_{2005}	0.0539	-0.0914
	(0.0398)	(0.0582)
Union_{2005}	-0.0446	0.0482
	(0.0561)	(0.0749)
$\text{lnLaborCostPerWorker}_{2005}$	-0.0218	-0.0123
	(0.0224)	(0.0267)
$\text{lnEquityPerWorker}_{2005}$	0.0022	-0.0339
	(0.0189)	(0.0276)
$\text{InitialFemProd}_{2005}$	-0.6224***	
	(0.0909)	
$\text{InitialFemNonProd}_{2005}$		-0.9837***
		(0.0877)
Region dummies	Yes	Yes
Initial Size dummies	Yes	Yes
Observations	170	172
R^2	0.3415	0.3807

Region and size level categorical dummy variables included. Robust standard errors in parenthesis, * p<0.1, ** p<0.05, *** p<0.01

Table 8: Robustness test. Exclusion of the initial ratio of female participation and other firm-specif variables

	$\Delta FemProd$	$\Delta FemNonProd$
	(2)	
$\Delta ExportTariffs$	-2.3644	-0.6237
	(1.6321)	(2.6756)
$\Delta ImportTariffs$	-0.7409***	-0.5789
	(0.2273)	(0.4226)
$\Delta IOweightedtariffs$	-3.8077	-3.1843
	(3.2391)	(4.5572)
Region dummies	Yes	Yes
Initial Size dummies	No	No
Observations	172	174
R^2	0.0406	0.0315

Region categorical dummy variables included. Robust standard errors in parenthesis, * p<0.1, ** p<0.05, *** p<0.01

Table 9: Panel-data regressions of levels of taxes and levels of ratio of female participation keeping only the firms that did not change industry sector

	FemProd	FemNonProd
	(3)	
ExportTariffs	-2.6	-1.005
	(2.475)	(4.2591)
ImportTariffs	-0.8357**	-0.5727
	(0.3455)	(0.6131)
IOweightedtariffs *DummyImporting	1.1764	0.9083
	(4.3242)	(6.2504)
IOweightedtariffs	-4.5073	-4.3531
	(4.9873)	(6.9665)
Region Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Size Fixed Effects	Yes	Yes
Observations	332	334
$R^2(overall)$	0.8337	0.6538

Fixed-effects comprehending: region; firm; year; size. Robust standard errors clustered at firm level in parenthesis.

Table 10: Panel-data regressions of levels of taxes and levels of ratio of female participation keeping only the firms that did not change industry sector. Interaction excluded.

	FemProd	FemNonProd
	(4)	
ExportTariffs	-2.4996	-0.9212
	(2.5325)	(3.9547)
ImportTariffs	-0.8421**	-0.5771
	(0.3445)	(0.6109)
IOweightedtariffs	-4.3218	-4.2023
	(4.8725)	(6.6786)
Region Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Size Fixed Effects	No	No
Observations	332	334
$R^2(overall)$	0.8335	0.5882

Fixed-effects comprehending: region; firm; year. Robust standard errors clustered at firm level in parenthesis.