The impact of trade liberalization on the gender wage gap: the case of Peru 2004- 2010

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VERY VERY PRELIMINARY DRAFT. COMMENTS WELCOME BUT PLEASE DO NOT QUOTE.

Abstract

Using labour force survey, trade and tariff data for 21 Peruvian manufacturing sectors, the aim of this paper is twofold. Firstly, assess the extent of the gender wage differential and decompose it by adopting a method akin to that developed by Blinder (1973) and Oaxaca (1973). Then, through an econometric approach, determine if and how trade liberalization can account for the discrimination component of the male-female wage gap.
Then, the analysis extends Nopo (2009) and represents, as far as known, the first attempt to link trade liberalization to differences in gender earnings on the labour market.

Keywords: Gender Inequality, Trade, Peru

JEL classification codes: F11, F16, J70, O54

1 Introduction

During the past decade many developing countries have turned from autarky to an open economy. In the light of these trade developments many economists have aimed at assessing if and how trade liberalization could have benefited households living in the poorest part of the world.
One strand of related literature analysis the link between increased opennes and labour market outcomes. Specifically, there are a number of papers which consider the rise in wage differentials between high and low skilled workers and whether the latter was eased or worsened by the country's decision to trade more (Attanasio et al., 2004, Goh et al., 2005, Hasan et al., 2010, Kumar et al., 2011, Noria, 2010, Revenga, 1997).
Beside considering inequality among different types of skilled workers, other writers have focused on gender differentials. From this point of view there seems to be no disagreement on the fact that trade liberalization generates higher employment ratios for female workers, but there are two different thoughts for why

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this may happen. On the one hand, trade liberalization is believed to cause fragmentation of the production process (Feenstra et al., 1996) and thus, the deskilling of the labour force. It follows that females are exploited and segregated into low-return jobs: women are recruited because they can be paid lower wages with fewer benefits. This process has been defined as "trade led-female marginalisation". On the other hand, trade liberalization in developing countries will benefit women since they have more chances to find employment, they will have access to cash income and thus, be more indipendent. This phenomenon has been named as "trade led-female industrialization" (Ghiara, 1999).
This article examines the impact of trade liberalization on gender wage differentials in the Peruvian manufacturing sector over the period 2004-2010.
Since the 1990s Peru's administration pursued an ambitious agenda of trade liberalization as a strategy to promote growth and poverty reduction. The country became member of the WTO in 1995 and concluded a number of preferential trade agreements with the US and other Latin American countries. More recently, Peru signed a trade deal with China, one of its main trading partners. Consequently, policy makers in Peru reformed the country's tariff structure, which in turn has determined a further surge in its trading activity.
Gender inequality in Peru is relevant. Nopo (2009) analysis gender differentials in this country over the period 1986-2000 assessing that males earn on average 45 percent more than females. According to the sample data used for this study over the period 2004-2010 the average (logarithm) female monthly wage was 0.84, while the average (logarithm) male monthly wage was 1.36, that is, males earned 61 percent more than females.
Differences in earnings are commonly thought to reflect differences in some observable characteristic of the individuals that are determinants of wages (Reimers, 1983), which in turn reflect productivity differences.
Nevertheless, Becker (1971) introduces the concept of discrimination on the labour market; applied to the gender literature, discrimination entails the possibility of differences between male and female wages that cannot be explained by differences in characteristics. Thus, it becomes crucial to investigate if the observed gender wage gap is due to productivity differences or rather to discrimination.
The Blinder-Oaxaca decomposition (Oaxaca, 1973, Blinder, 1973), then generalized by Neumark (1988) and Oaxaca et al. (1988) and Oaxaca et al. (1994), is the most popular approach adopted in the gender wage gap literature. It allows to decompose the male and female wage differential into a part that is explained by differences in the observed characteristics (due to productivity differences) and one attributable to differences in the estimated coefficients (due to discrimination).
Using labour force survey data, tariff and trade data from 2004 to 2010 the aim of this paper is twofold. Firstly, assess the extent of the gender wage differential and decompose it by adopting the Blinder-Oaxaca methodology. Then, through an econometric approach, determine if and how trade liberalization can account for the unexplained portion of the wage differential.
This paper contributes to the current literature by extending Nopo (2009) to the

period 2004-2010. In addition, it examines the extent to which trade liberalization can account for the unexplained portion of the wage differential. Indeed, only a few attempts have been made to analyse the relationship between trade liberalization and the gender wage gap for developed (Black et al., 2004) and developing countries (Menon et al., 2009, Hazarika et al., 2004 and Berik et al., 2004). As far as known, this is the first paper to consider the case of Peru.
The results provided help to shed some light on which between the "trade led-female marginalisation" and the "trade led-female industrialization" effect is the strongest. Knowledge on the dynamics of the gender wage differential and the factors which may affect it in developing countries is helpful in providing hints for implementing labour market and trade policy reforms that are able to reduce gender disparities. The latter is one of the 2015 United Nations' Millenium Development Goals and thus, represents an important tool for achieving growth and poverty reduction in the least developed world.
The paper is structured as follows. Section 2 explains the method used to separate the gender wage differential into the portion due to differences in average characteristics and the portion due to differences in unobserved factors thus, discrimination. It will also describe how the theoretical literature links trade liberalization to the gender wage gap. Section 3 will provide a description of the data used for the analysis as well as a brief history on Peru's trade policy. The results are summarized in section 4 while the last section provides some concluding remarks.

2 Theoretical models

Wage differential was initially examined by Blinder (1973) and Oaxaca (1973). Both authors were concerned in developing a method which would allow the decomposition of the wage gap between two groups into a part that could be explained by productivity differences and one that was attributable to differences in the estimated coefficients thus, representing the discrimination component.
From the properties of ordinary least squares it is possible to estimate the (logarithm) mean wage on a set of given individual's characteristics, so that:

$$\ell n\bar{W}_j - \ell n\bar{W}_k = \bar{X}_j\hat{\beta}_j - \bar{X}_k\hat{\beta}_k \tag{1}$$

where $\bar{X}_j$ and $\bar{X}_k$ are the vector of mean values for group j and k respectively, while $\hat{\beta}_j$ and $\hat{\beta}_k$ are the corresponding vectors of estimated coefficients. For the purpose of this paper, group j and k stand for men and women respectively. Following a method similar to that developed in Oaxaca (1973) the difference in average wages can be further decomposed giving:

$$\ell n\bar{W}_j - \ell n\bar{W}_k = (\bar{X}_j - \bar{X}_k)\hat{\beta}_k + (\hat{\beta}_j - \hat{\beta}_k)\bar{X}_k + (\bar{X}_j - \bar{X}_k)(\hat{\beta}_j - \hat{\beta}_k) \tag{2}$$

This is a "three fold decomposition" that is, the differential is divided into three parts indicated on the right hand side of equation (2):

$$Gender\ Wage\ Gap = E + U + I \tag{3}$$

The first term equal to

$$E = (\bar{X}_j - \bar{X}_k)\hat{\beta}_k \tag{4}$$

amounts to the part that is due to differences in characteristics between males and females (explained part of the differential); the second term

$$U = (\hat{\beta}_j - \hat{\beta}_k)\bar{X}_k \tag{5}$$

is the contribution of differences in coefficients (discrimination component or unexplained part of the differential). The third term

$$I = (\bar{X}_j - \bar{X}_k)(\hat{\beta}_j - \hat{\beta}_k) \tag{6}$$

is the interaction component accounting for the fact that differences in characteristics and coefficients exist simulteneously between the two groups.[1]

This paper applies this theoretical framework in order to study the male-female wage differential in Peru over 2004-2010. In addition, it seeks to identify whether and how trade liberalization can account for the unexplained portion of the differential.

The related theoretical literature links increased trade openness to a decrease in the gender wage gap. The baseline model to be taken into consideration is that of Hecksher-Ohlin. According to the latter, following trade liberalization a country specializes in the sector using a higher share of the relative abundant factor; the Stolper-Samuelson theorem predicts that the relative price of that factor will increase. Since in a developing country the abundant factor is the unskilled labour force and that women usually tend to have lower skills than men, it follows that the gender wage gap should decrease.

The limited number of existing studies that employ econometric tecniques to identify the impact of international trade on the gender wage gap have found conflicting results. Berik et al. (2004) find evidence that increasing trade openness is associated with higher residual wage gaps between men and women in two East Asian economies, a sign that the authors interpret as increased wage discrimination. Similarly, in India, increasing openness to trade is associated with larger wage gaps (Menon et al., 2009). Yet, Hazarika et al. (2004) find that for Mexico trade liberalization contributed to a decrease in gender earnings differential. This paper aims at shedding some light on this topic by taking into consideration the Peruvian case.

The strategy used to estimate the impact of trade liberalization on the unexplained part of the differential is the following:

$$U_{it} = \beta_0 + T_{i,t-1}/\Delta T_{i,t}\beta_1 + \epsilon_{it}\ \ i{=}1,\ldots,m \tag{7}$$

[1] Decomposition (2) is formulated from the viewpoint of the female group, that is, the explained part of the differential measures the expected change in females mean wages, if females had males predictor levels. The unexplained part quantifies the expected change in female mean wages, if females had males coefficients.

where U_{it} indicates the unexplained part of the differential in manufacturing industry i at time t constructed following the methodology described above. The notation $T_{i,t-1}$ represents trade flows variables in manufacturing industry i at time *t-1*; while $\Delta T_{i,t}$ is the change in tariff rates between year t and *t-1*.
In this paper the interest relies on capturing the impact that Peru's commercial trade with all partner countries, the USA, China and the Andean Community[2] has on the unexplained part of the gender wage gap.
To this end, different types of regressions will be performed, each including a different set of explanatory variables. Moreover, several econometric tools are used in order to develop this panel data model. Section 4 below describes in more detail the methodology applied.

3 Survey and Trade Data

The employment data source used for this study is the Encuesta Permanente de Empleo, undertaken by the Peruvian National Institute of Statistics (INEI). The period taken into consideration is the one from 2004 until 2010, one of great trade dynamism for the country and when many of its bilateral trade agreements came into force. The sample includes male and female workers in the area of Lima. For the purpose of this paper, only workers in the manufacturing sector are considered.
As shown in table (1) females in the Peruvian manufacturing sector have lower average monthly wage rates than their male counterparts.
This difference in earnings is commonly thought to reflect differences in characteristics between males and females that the labour market rewards.
For example, table (1) shows that women are younger than men. Lower working age mirrors an earlier entrance into the labour market or an earlier retirement. Nevertheless, both factors imply lower earnings: earlier entrance suggests less educational background while early retirement shorter tenure (Nopo, 2009).
Indeed, the data shows that average tenure for women is around 43 months, while that of men amounts to about 68 months. Thus, women in the sample are both younger and less experienced. These factors could very well account for women's lower wages.
Moreover, women work on average less hours in a week than men. This difference may well be attributed to women undertaking household maintanance activities and childcare. This notwithstanding, earnings tend to rise with hours worked.
As regards to educational attainment and skills[3] there are not any relevant differences between gender: males and females in the sample have on average completed secondary school and their level of skills is almost equal.

This paper seeks to identify how much of the gender wage gap in the Peruvian manufacturing sector is due to differences in the above mentioned observed

[2]Peru is member of the Andean Community together with Bolivia, Colombia and Ecuador.

[3]Skills are defined according to the individual's occupation. High skilled workers include politicians, professionals, middle skilled technicians, firm heads and employees and qualified workers for personal services; low skilled workers include manufacturing, mining and non qualified workers.

Table 1: Mean of selected variables: overall sample (2004-2010)

Variables	Men	Females
$\ell nWage$	1.36	0.84
age	36.18	34.58
tenure	67.80	43.94
weekly hrs	45.02	51.71
edu	6.39	6.42
skill	0.23	0.28

Source: Encuesta Permanente de Empleo 2004-2010 - INEI Peru.

characteristics and how much is due to differences in coefficients (discrimination).
To this end, the wage differential is decomposed using a method akin to that developed by Blinder (1973) and Oaxaca (1973), as described above.
A further scope of this paper is to take the discrimination component of the differential and verify its relationship with Peru's trade liberalization process.
Peru can be defined as one of the most trade oriented developing countries. After thirty years of inward oriented strategies, from the 1990s the Peruvian administration carried out several initiatives toward greater trade liberalization.
In 1995 Peru joined the WTO; later on, trade promotion policies had been put in place under the Panigua transitional Government (2000-2001) and with the Toledo administration (2001-2006). Specifically, tha latter pursued an export-led growth agenda aimed at integrating Peru into the regional and global economy. The medium term objective was to set up the foundations for economic growth that could increase employment, alleviate poverty and create long term stability. To this end, the Government opted for a strategy of bilateral and multilateral trade liberalization. The main project was to conclude the Free Trade Agreement (FTA) negotiations with the US; others regarded signing agreements with other countries in Latin America, in Asia and in Europe.
During Garcia's mandate (2006-2011) trade policy was also aggressively directed to the pursue of trade deals with commercial partners. The most important achievement was the signing of the Peru-US FTA, a project that was initiated by the former President Toledo; the agreement came into force in 2009.
Over the same period, the FTA between Peru and China was finalized. For the Peruvian economy increasing trade with China was seen as a key to diversify its exports toward an area of dynamic demand as well as to cope with the global economic downturn.
The Peruvian authorities have been engaged in the signing of a trade agreement with the European Union, although it has not yet entered into force. Negotiations are also underway with other countries in Latin America and Asia.
Over the same period, Peru's GDP grew 5 percent in 2004 and 8.8 percent in 2010; employment rose from 64 percent to 71 percent of total working age popu-

lation, while inflation was 3.7 percent in 2004, dropping to 1.5 percent in 2010.[4] Discovering whether these positive macroeconomic effects are due to Peru's trade liberalization process is beyond the scope of this study. This notwithstanding, it should be aknowledged that greater economic growth coincided with the country's greater openness.

In the light of this trade dynamism, this paper seeks to identify the contribution of trade liberalization to the unexplained part of the gender wage differential. The trade and tariff data used in the empirical application below come from the WITS UN COMTRADE Database. By considering all partner countries the analysis can account for multilateral trade liberalization. Nevertheless, the interest relies also on capturing any relevant effects of bilateral trade liberalization; then, trade and tariff data with respect to Peru's main trading partner countries are also used in the analysis. Specifically, trade flows include exports and imports to/ from all partner countries, the US, China and the Andean Community.[5] Furthermore, to capture the effect of trade reforms, tariff data is downloaded from the same source; in this case the paper makes use of most favoured nation (MFN) and effectively applied (AHS) tariff rates to all partner countries, the US, China[6] and the Andean Community.[7]

4 Methodology and Results

The methodology used for the purpose of this paper is the following. Firstly, a separate wage function is estimated for males and females for each year in 21 manufacturing industries. The latter are listed in table (2) and represent an aggregation of ISIC3 classified sectors. In this way, there are more observations for each sector and the wage function can be estimated more precisely.

To exemplify, table (3) shows the wage regression results for the overall period.[8] The dependent variable is the (logarithm) monthly deflated income. The latter is regressed on a set of explanatory variables: position in the family, educational attainment, tenure (as a measure of experience), skill (by occupation) and weekly hours worked.[9] All of these variables are intended to control for productivity differences.

As in standard labour economics literature, the relevant explanatory variables (age, tenure and skill) are significant with the expected sign, except for the female wage regression for whom earnings fall with increasing age. A possible interpretation is that, as women get older they become more engaged in household and childkeeping activities thus, they prefer to be employed in part-time

[4]Source: World Development Indicators: http://data.worldbank.org/indicator.

[5]Trade flows with the Andean Community are computed by summing separately exports and imports to/ from Bolivia, Colombia and Ecuador.

[6]For China effectively applied tariff rates (AHS) are dropped since they correspond to most favoured nation (MFN) rates.

[7]Tariff rates to the Andean Community are computed as an import weighted tariff average of rates applied to Bolivia, Colombia and Ecuador.

[8]The wage regression results for each year and sector are available on request by the author.

[9]Table (3) omits the dummy variables position in the family, education and month. The full table is available on request by the author.

Table 2: Reclassification of Industries

Industry Description	New Code	Years
151: Production, processing and preservation of meat, fish, fruit, vegetables, oils and fat	1	all
152; 153; 155: Manufacturing of food and beverages	2	all
154: Manufacturing of other food products	3	all
171: Spinning, weaving and finishing of textiles	4	all
172: Manufacturing of other textiles	5	all
173: Manufacturing of knitted and crocheted fabrics and articles	6	all
181; 182: Manufacturing of wearing apparel and fur	7	all
191: Tanning and dressing of leather, man of luggage, handbags, etc.	8	all
192: Manufacturing of footwear	9	all
201; 202: Manufacturing of wood products	10	no 2010
210:Manufacturing of paper	11	all
221: Publishing	12	no 2010
222; 223: Services related to printing and recording media	13	all
241; 242; 243: Manufacturing of chemicals	14	all
251; 252: Manufacturing of rubber and plastic	15	all
261; 269: Manufacturing of non-metallic mineral products	16	all
271; 272; 273; 281; 289: Manufacturing of metals	17	all
291; 292; 293: Manufacturing of machinery and equipment	18	all
300- 359: Manufacturing of office, eletrical and transport equipment	19	all
361: Manufacturing of furniture	20	no 2010
369: Manufacturing n.e.c.	21	all

Source: Author's own calculations.

Table 3: Male and Female Wage Equations - overall sample (2004-2010)

$\ell\ Wage$	Male	Female
$\ell n\ age$	0.106*	-0.101*
	(0.014)	(0.027)
$\ell n\ tenure$	0.054*	0.081*
	(0.003)	(0.005)
skill	0.376*	0.546*
	(0.010)	(0.017)
hrs	0.479*	0.758*
	(0.009)	(0.012)
cons	-1.402*	-2.916*
	(0.144)	(0.144)
No. Of obs.	19520	8793
R^2	0.40	0.53

Note: Standard-error in parantheses. * p<0.01; ** p<0.05; *** p<0.1.
Source: Author's own calculations.

jobs although with lower remuneration.
Once the regressors' coefficients are found, equation (1) makes use of males' and females' average characteristics to compute the gender wage gap. Then, the wage differential is decomposed as in equation (2). As shown in table (4), the male-female wage differential for the overall period is 0.83 log points, accounted for 0.68 log points by differences in coefficients (discrimination) and by 0.27 log points by differences in characteristics. That is, 82 percent of the differential remains unexplained.
The interest relies in taking the unexplained part for each year and sector of the differential and regressing it on the corresponding trade related variables. The aim is to find whether and how trade policy reforms in Peru can account for the part of the gender wage differential that cannot be explained by differing characteristics between males and females.

For this purpose the benchmark model used is that expressed in equation (7). Two main types of regression models are performed. The first considers the lags of imports and exports; indeed, it is plausible that the gender wage gap is affected by the previous year's trade flows. Specifically, a first estimation is carried out considering trade flows from all partner countries; further estimations include, in turn, lags of trade flows with Peru's main trading partners. The second considers the difference in tariff rates between yeat t and *t-1*; indeed, the latter should capture the change in trade policy occured in Peru between 2004 and 2010. Again, a first estimation considers only the difference between year t and *t-1* MFN and AHS applied tariffs to all partner countries, while further estimations include, in turn, yearly tariff rates changes applied to Peru's main trading partners.

Table 4: Decomposition of Gender Wage Differential - overall sample (2004-2010)

	Values
$\ell n\bar{W}_j = \bar{X}_j\hat{\beta}_j$	1.305
	(0.048)
$\ell n\bar{W}_k = \bar{X}_k\hat{\beta}_k$	0.471
	(0.064)
$\ell n\bar{W}_j - \ell n\bar{W}_k$	0.834
	(0.080)
Decomposition	
$E = (\bar{X}_j - \bar{X}_k)\hat{\beta}_k$	0.275
	(0.020)
$U = (\hat{\beta}_j - \hat{\beta}_k)\bar{X}_k$	0.682
	(0.092)
$I = (\bar{X}_j - \bar{X}_k)(\hat{\beta}_j - \hat{\beta}_k)$	-0.122
	(0.028)

Note: Standard-error in parantheses.
Source: Author's own calculations.

The above mentioned estimations are developed using two alternative methods. The first approach involves the use of Ordinary Least Squares (OLS) to the panel dataset of industry level observations over time. The second approach is based on a Fixed Effect (FE) strategy to control for time invariant, industry specific characteristics that may impact wage differential determinants (Menon et al., 2009). Before turning to the estimation results, a few words should be spent on the expected signs of the explanatory variables. As mentioned above, the theoretical literature suggests that trade liberalization should increase women's earnings. Thus, higher values of trade flows should decrease the gender wage gap. That is, the expected sign on the lag of both imports and exports should be negative indipendently of the partner country considered. As regards to tariffs, decreasing MFN and AHS rates are a sign of increased trade openness. Therefore, there should be a direct relationship between tariff changes and the gender wage gap; the sign of both the yearly difference in MFN and AHS tariff rates should be positive.

Discussions of the results begin with table (5), where the unexplained part of the differential is regressed against Peru's lagged trade flows with all partner countries (column 1) and then in turn with the US, China and the Andean Community in model (2), (3) and (4) respectively, using OLS applied to the panel dataset.

In model (1) exports to the rest of the world are significant and have the expected negative sign: higher exports to all partner countries reduce the gender wage differential. The same results are observed in column (3) and (4) when

world flows are considered together with those to/ from China and members of the Andean Community.
Surprisingly, imports do not reflect expectations: they are significant and with a positive sign in columns (1), (2) and (3). This means that increasing imports from the rest of the world increase the gender wage gap.
The only other significant variable is the lagged of exports to the US; the sign is, as predicted negative meaning that increasing exports to the US contribute in reducing the unexplained part of the gender wage gap.
These results seem to suggest that there is scope for both the "trade-led female marginalisation" and "trade-led female industrialization" theory. On the one hand, Peru is a labour intensive country and, as predicted by neoclassical trade theory, as a result of trade liberalization it specializes in goods using a relative higher share of labour. Women could be marginalised into labour intensive tasks as a result of discrimination thus, having lower earnings relatively to men. On the other hand, increasing imports, which will include more capital intensive goods, will increase the demand for low skilled labour in Peru to be employed in the export sector; then, females' earnings will increase. The net effect depends on which of the two above mentioned forces is the strongest.
The fact that neither trade with China nor with the Andean Community is significant, could be related to the fact that these trading partners are also labour intensive countries and thus, have a similar specialization structure to that of Peru. In this case, other forces would influence the gender earnings, such as international competition (Becker, 1971). Unfortunately, due to lack of data, this paper is not able to account for competitive forces. However, the promise is to retrieve the data needed to conduct more research on the topic.
The results found in table (7), which considers the same models as in table (5) but using the FE estimation technique are rather disappointing. Although in some cases the explanatory variables maintain the sign as in the OLS estimation (see for example model (1)), the coefficients are higher and not significant. As a result, this paper cannot make any conclusive evidence that Peru's trading relationships affect the discrimination component of the gender wage differential in the manufacturing sectors.
Further discontent comes when analysing table (6). In this case the unexplained part of the differential is regressed against a set of indipendent variables that seek to capture trade reforms in Peru. Specifically, the yearly change in MFN and AHS applied rates are considered, which may account for the deep trade liberalization process that Peru untertook over the 2004-2010 period. Here, the interest is primarily focused on assessing whether the FTA with the US and the trade agreement with China are linked with the gender wage gap.
This analysis predicts that lower barriers to trade thus, lower levels of tariffs, should reduce the gender wage gap. While the sign of the change in MFN applied tariff rates to all partner countries reflects this prediction, the one on the difference in AHS does not. Nevertheless, the coefficients are not significant so, again this paper cannot draw any relevant conclusions on how Peru's trade reforms have affected the unexplained part of the gender wage differential. Still, when performing the FE estimation with the same explanatory variables, a sta-

tistically significant relation between the difference in MFN world applied rates and the unexplained part of the gender wage gap emerges, as shown in table (8) column (1). The sign is also positive as predicted; this may suggest that there is a weak but direct relationship between changing trade barriers and gender earnings.

Clearly, these unsatisfying results recommend further and intense work to improve the analysis. To perform the kind of investigation this paper aims at, there is a need to revise tha data used and find sources to collect information regarding other forces that may account for the gender wage differential (such as a measure of international competition, as mentioned above). Thus, this study is not to be thought at as complete and concluded. Precisely, it is just a first and minute step in trying to find a correct and robust way to account for the link between the gender wage differential and trade liberalization in a dynamic developing country such as Peru.

Table 5: Ordinary Least Square Estimates of Male-Female Unexplained Wage Gaps by Industry - Trade Flows

	(1)	(2)	(3)	(4)
$wld\ exp_{t-1}$	-0.121***	0.075	-0.158***	-0.154***
	(0.072)	(0.125)	(0.092)	(0.080)
$wld\ imp_{t-1}$	0.151***	0.276***	0.174***	0.102
	(0.078)	(0.166)	(0.097)	(0.122)
$usa\ exp_{t-1}$		-0.164***		
		(0.085)		
$usa\ imp_{t-1}$		-0.107		
		(0.106)		
$chi\ exp_{t-1}$			0.020	
			(0.036)	
$chi\ imp_{t-1}$			-0.041	
			(0.077)	
$and\ exp_{t-1}$				0.101
				(0.115)
$and\ imp_{t-1}$				0.001
				(0.139)
γ_{2005}	0.433	0.610	0.386	0.492
	(0.363)	(0.371)	(0.376)	(0.371)
γ_{2006}	0.372	0.528	0.339	0.430
	(0.361)	(0.366)	(0.369)	(0.368)
γ_{2007}	-0.107	-0.008	-0.122	-0.067
	(0.360)	(0.360)	(0.365)	(0.364)
γ_{2008}	-0.303	-0.247	-0.322	-0.268
	(0.358)	(0.355)	(0.361)	(0.361)
γ_{2009}	0.573	0.582	0.570	0.600
	(0.356)	(0.353)	(0.359)	(0.359)
γ_{2010}	(dropped)	(dropped)	(dropped)	(dropped)
cons	-0.981	-2.253	-0.481	-1.027
	(1.001)	(-1.301)	(1.204)	(1.010)
No. Obs.	123	123	123	123
R^2	0.11	0.15	0.12	0.12

Note: The dependent variable across models is the unexplained component of the gender wage gap. *exp* and *imp* stand for export and import flows, respectively. *wld* ,*usa*, *chi* and *and* stand for trading partners: the rest of the world, the US, China and the Andean Community. Standard-error in parantheses. * p<0.01; ** p<0.05; *** p<0.1.
Source: Author's own calculations.

Table 6: Ordinary Least Square Estimates of Male-Female Unexplained Wage Gaps by Industry - MFN and AHS rates

	(1)	(2)	(3)	(4)
$\Delta mfn\ wld$	0.274	0.253	0.233	0.349
	(0.176)	(0.235)	(0.232)	(0.224)
$\Delta ahs\ wld$	-0.053	-0.049	-0.040	-0.155
	(0.196)	(0.197)	(0.201)	(0.233)
$\Delta mfn\ usa$		-0.056		
		(0.199)		
$\Delta ahs\ usa$		0.074		
		(0.144)		
$\Delta mfn\ chi$			0.032	
			(0.115)	
$\Delta mfn\ and$				0.005
				(0.098)
$\Delta ahs\ and$				0.024
				(0.031)
γ_{2005}	-0.155	-0.204	-0.188	-0.050
	(0.529)	(0.542)	(0.545)	(0.547)
γ_{2006}	-0.374	-0.386	-0.385	-0.031
	(0.503)	(0.507)	(0.506)	(0.690)
γ_{2007}	-0.789	-0.835	-0.823	-0.657
	(0.551)	(0.563)	(0.567)	(0.578)
γ_{2008}	(dropped)	(dropped)	(dropped)	(dropped)
γ_{2009}	0.118	0.083	0.089	0.252
	(0.514)	(0.523)	(0.527)	(0.546)
γ_{2010}	-0.469	-0.511	-0.499	-0.455
	(0.633)	(0.643)	(0.645)	(0.637)
cons	0.097	0.126	0.124	-0.033
	(0.491)	(0.498)	(0.503)	(0.522)
No. Obs.	123	123	123	123
R^2	0.14	0.14	0.14	0.14

Note: mfn and *ahs* stand for most favoured nation and effectively applied tariff rates, respectively. *wld* ,*usa*, *chi* and *and* stand for trading partners: the rest of the world, the US, China and the Andean Community. Standard-error in parantheses. * p<0.01; ** p<0.05; *** p<0.1.
Source: Author's own calculations.

Table 7: Fixed Effects Estimation on the Gender Wage Gap by Industry - Trade Flows

	(1)	(2)	(3)	(4)
$wld\ exp_{t-1}$	-0.425	-0.366	-0.352	-0.545
	(0.403)	(0.550)	(0.446)	(0.434)
$wld\ imp_{t-1}$	0.218	-0.078	0.837	-0.022
	(0.415)	(0.484)	(0.591)	(0.664)
$usa\ exp_{t-1}$		-0.319		
		(0.371)		
$usa\ imp_{t-1}$		0.347		
		(0.407)		
$chi\ exp_{t-1}$			-0.013	
			(0.094)	
$chi\ imp_{t-1}$			-0.444	
			(0.301)	
$and\ exp_{t-1}$				0.350
				(0.449)
$and\ imp_{t-1}$				-0.029
				(0.346)
cons	1.958	4.675	-1.938	3.162
	(3.631)	(4.382)	(4.916)	(4.178)
No. Obs.	123	123	123	123
R^2	0.11	0.15	0.16	0.08

Note: The dependent variable across models is the unexplained component of the gender wage gap. *exp* and *imp* stand for export and import flows, respectively. *wld* ,*usa*, *chi* and *and* stand for trading partners: the rest of the world, the US, China and the Andean Community. Standard-error in parantheses. * p<0.01; ** p<0.05; *** p<0.1.
Source: Author's own calculations.

Table 8: Fixed Effects Estimation on the Gender Wage Gap by Industry - MFN and AHS rates

	(1)	(2)	(3)	(4)
$\Delta mfn\ wld$	0.254***	0.250	0.228	0.356
	(0.131)	(0.209)	(0.194)	(0.219)
$\Delta ahs\ wld$	-0.091	-0.095	-0.088	-0.199
	(0.127)	(0.130)	(0.129)	(0.194)
$\Delta mfn\ usa$		-0.032		
		(0.213)		
$\Delta ahs\ usa$		0.037		
		(0.147)		
$\Delta mfn\ chi$			0.022	
			(0.118)	
$\Delta mfn\ and$				0.008
				(0.097)
$\Delta ahs\ and$				0.016
				(0.021)
cons	-0.233	-0.237	-0.234	-0.223
	(0.113)	(0.115)	(0.113)	(0.115)
No. Obs.	123	123	123	123
R^2	0.1	0.1	0.10	0.10

Note: mfn and *ahs* stand for most favoured nation and effectively applied tariff rates, respectively. *wld* ,*usa*, *chi* and *and* stand for trading partners: the rest of the world, the US, China and the Andean Community. Standard-error in parantheses. * p<0.01; ** p<0.05; *** p<0.1.
Source: Author's own calculations.

5 Concluding remarks

Gender wage inequality in developing countries has collected much interest between economists, especially after the United Nations declared gender equality and women's empowerment as one of the 2015 Millenium Development Goals.
In the current labour economics literature there are many studies devoted to identify gender differentials on the labour market. But, even though developing countries have started to reduce their trade barriers as a growth-led strategy, there have been only a few attempts to measure econometrically to what extent increased trade liberalization has affected gender wage disparities in developing countries.
This paper tries to give its own contribution by analysing the case of Peru over the period 2004-2010.
Gender inequality in Peru is relevant; furthermore, since the 1990s the country is undertaking an intense trade liberalization process, especially in the last decade with the finalization of the FTA with the US and the trade agreement with China, its main trading partners. This in turn makes Peru one of the most trade dynamic developing countries. For these reasons it is interesting to study whether and how trade liberalization is linked to the male-female wage gap in the Peruvian manufacturing sector.
For this purpose the paper mekes use of the labour force survey conducted by the Peruvian National Statistical Office (INEI) for 21 manufacturing sectors over the period 2004-2010.
For each year and sector two separate wage functions are estimated for males and females respectively; as a result, the difference in the predicted male and female wage is found. Then, using a method akin to that developed by Blinder (1973) and Oaxaca (1973), this wage differential is decomposed in three parts. One due to differences in characteristics (explained part of the differential), that should account for productivity differences between males and females; one due to differences in the estimated coefficients (discrimination or unexplained part of the differential); lastly, an interaction term. The latter accounts for simultaneous changes that occur to the explained and unexplained part of the differential.
The aim of this paper is to take the unexplained part of the differential and find whether increased trade openness can account for it. To this end, tha analysis makes use of trade and tariff data from the WITS UN COMTRADE dataset and aggregates it across years and industrial sectors. Specifically, trade flows are intented to capture any relevant change in Peru's trading activity, while tariffs should account for changes in the country's policy reforms. As well as considering trade relationships with the rest of the world, the study is intended to find any particular effect with regards to specific bilateral trade agreements. Consequently, the trade and tariff data downloaded also include the US, China and the Andean Community as trading partners.
The discrimination component of the gender wage differential is then regress against the set of trade related explanatory variables. More precisely, the lagged trade flows are included in the first four sets of estimation models. Indeed, the gender wage gap could be influenced by the previous year's trade flows. The

change in MFN and AHS tariff rates between year *t* and *t-1* are the explanatory variables in the second four sets of estimation models, because it is the OLS applied to panel data; secondly the FE estimation methodology.
Overall, the results are disappointing. For the OLS estimation the coefficient on the lagged exports with the rest of the world results statistically significant with the expected negative sign: increasing exports to all partner countries decreases the unexplained portion of the wage differential. However, lagged imports with the rest of the world are statistically significant with an unexpected negative sign: increasing imports from the rest of the world increases the discrimination component of the gender wage differential. This may suggest that increased trading activity can marginalise females into lower paid jobs and, at the same time, increase the demand for female labour and thus, their earnings. The net effect on females' wages depends on which of the two forces is the strongest. As regards to trade flows with specific trading partners, the only statistically significant coefficient is that related to the lagged of exports with the US. In this case the sign is negative as predicted. The fact that neither trading with China nor with the Andean Community result significant could be explained by the similar trading structure of these countries with that of Peru. This entails that other forces are to be accounted for explaining the changes in the gender wage gap. This notwithstanding, the results for the OLS estimation are not reflected in the FE ones. Therefore, presently this paper cannot reach any satisfactory conclusion on how Peru's trading activity can influence the gender wage gap over the period 2004-2010.
Turning to the second four sets of estimations where the explanatory variables are represented by the yearly changes in tariff rates, this paper finds a statistically significant result only for the MFN world applied rate in the FE estimation. The sign of the related coefficient is positive as expected: an increase in tariff trade barriers is linked to a higher unexplained part of the male-female wage differential and viceversa. Nevertheless, this result is weak and cannot be taken as conclusive.
In the light of these unsatisfactory results, the paper tries to defend itself by affirming that it is only a first attempt to study the link between gender wage differentials and trade liberalization. Undoubtetly the analysis can be improved in various directions. As regards to the datasets: (i) double-checking the labour force and trade related data; (ii) accounting for other forces that can impact females and males earnings in the labour market, such as international competition. Unfortunately, present lack of data has prevented the paper to consider the latter, but research is currently underway to try and fill this gap. As regards to the methodology adopted: (i) sample selection is a big issue in standard labour economics, it should also be accounted in this analysis; (ii) extend the estimation techniques adopted in order to find the most suitable tool for the panel dataset. Work is in progress as regards the above mentioned issues; the analysis will certainly improve and will arrive at more robust results. The paper will be able to contribute to shed more light on which are the relevant forces that influence tha gender wage gap in developing countries. This in turn will open a lively debate on what type of efforts should be made to improve women's situation in

the Peruvian labour market.

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