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THE IMPACT OF TRADE LIBERALIZATION ON GENDER WAGE  
INEQUALITY IN SOUTH KOREA'S LABOR MARKET

Shinyoung Kim

A Thesis Submitted in Partial Fulfillment  
Of the Requirements for the  
University Honors Program

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Department of Economics  
The University of South Dakota  
May 2020

The members of the Honors Thesis Committee appointed  
to examine the thesis of Shinyoung Kim  
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## ABSTRACT

The Impact of Trade Liberalization on Gender Wage Inequality  
in South Korea's Labor Market

Shinyoung Kim

Director: Sebastian Wai, Ph.D.

This paper examines the impact of export growth on the real gender wage gap in the manufacturing industry in South Korea. Using industry-level panel data, I measure the effect of output growth, triggered by export growth, on both female employment and the real gender wage gap from 1994 to 2017. There is insufficient evidence that output or export growth contributed to lessening the real gender wage gap.

KEYWORDS: Exports, Gender Wage Gap, International Trade

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# 1 Introduction

Traditional trade theories based on comparative advantage, such as the Heckscher-Ohlin (HO) model and the Stolper-Samuelson (SS) theorem, state international trade will widen the income gap between skilled and unskilled labor in capital-abundant countries while narrowing it in labor-abundant countries. Traditionally, female workers constitute a major portion of the low-skilled labor force in emerging economies. Consequently, these trade theories predict increasing exposure to trade will reduce the real gender wage gap in labor-abundant countries. In lieu of countries, I applied these theories to different manufacturing industries. I chose manufacturing because its high labor intensity makes it applicable to this theorem. South Korea is an interesting case to examine due to its export performance and its labor market outcome on the real gender wage gap. South Korea is well-known for its phenomenal performance in exports during the last few decades (Michelle & Yi, 2015). From 1990 to 2018, real GDP increased by 300%, and exports-to-GDP ratio increased by 74%. Korea has the highest gender pay gap over the last 30 years among the Organization for Economic Co-operation and Development (OECD) countries. However, the real wage gap is reducing steadily over time. It was 47% in 1992, and it went down to 34.1% in 2018. Based on these two results in export growth and the reduced real gender wage gap by using industry-level fixed effects regression, this paper examines the impact of export growth on the real gender wage gap in South Korea. This paper's main contribution is to attempt to measure the effect of export growth on the real gender wage gap in the Korean labor market. The results do not support the previous literature. Contrary to the hypothesis, the results show there is insufficient evidence that export growth leads to a reduced real gender wage gap. Two conditions in the Korean labor market are inconsistent with previous literature. While women typically make up a larger proportion of low-skilled labor, the manufacturing industry in South Korea is male

dominated. Another fact is that although the overall real gender wage gap has been declining, the real gender wage gap in manufacturing has been increasing.

## 1.1 The Gender Wage Gap Literature

The theory of human capital, introduced by Theodore Schultz in 1961, views individual differences in productivity as the root causes of earning disparities. Schultz's theory attributes higher wages to higher levels of investment in human capital, mainly education. Previous studies attempt to gauge the magnitude of gender wage discrimination in South Korea's labor market using the Blinder-Oaxaca decomposition (1973) technique. Using linear regression, the technique divides the real wage gap into the explained and unexplained parts. The explained portion is attributed to measurable productivity factors – educational attainment or work experience while the residuals may be a measure of discrimination (Ben, 2008). According to Blau and Kahn (2017), this unexplained portion is often taken as an estimate of labor-market discrimination. Keum (2001) works with industry-level panel data from 1998 and finds productivity heterogeneity only explains 39.73 % of the real gender wage gap, while 60.27% remained unexplained. Seo and Lim (2002) use occupational-level data from 1999 and find 49.4% of the real wage gap is due to productivity characteristics. In 2005 and 2008, the explained portion increases to 57.3% and 54.2%, respectively (Keum, 2011). However, Shin's (2011) decomposition results indicate only 35% of the gender pay gap could be related to differences in observable characteristics. Overall, decomposition results (table 1) show productivity heterogeneity explains only about half of the real wage gap, with the rest caused by other institutional factors. I hypothesize that export growth would reduce the unexplained portion of the real wage gap. I use both wage ratio and the real wage gap because using wage ratio alone can mislead the results. Increased wage ratio may suggest the real wage gap is decreasing when it is

Table 1: Blinder-Oaxaca decomposition results

author	year	explained real wage gap (%)	unexplained real wage gap (%)
Keum	1998	39.73	60.27
Seo, Lim	1999	49.4	50.6
Keum	2005	57.3	42.7
Shin	2007	35	65
Keum	2008	54.2	45.8

not. Wage ratio is the ratio of female wages to male wages, and the real wage gap is the real wage gap between female and male workers in levels. The following section explains how export growth can help achieve pay equality.

## 1.2 Trade Liberalization’s Effects on the Gender Wage Gap

According to the literature, opening the domestic market to international trade can achieve wage equality through three channels. First, the relative size of export-driven industries increases where female labor is traditionally concentrated (Ozler, 2000). Nordia (2003) finds that light industries, which tend to be export-oriented, are typically dominated by women. Using cross-country data (1960-85), Wood (1991) shows that an expansion of exports stimulates the relative demand for female labor in manufacturing in most developing countries. Pearson (1998) observes a substantial growth in women’s share of employment in export-led industries in Asian countries. Joeke’s (1999) result shows expansion of manufacturing exports in developing countries chiefly benefits the wages and employment of women. Using plant-level data from Turkey (1983-85), Ozler (2000) concludes that the export share of manufacturing industries’ output is positively associated with female employment. Aguayo-Tellez et al. (2010) find that reducing tariffs under NAFTA increases the demand for female labor within all sectors with an increased relative wage (1990-2000).



Contrary to these studies, a few researchers find increased real gender wage gaps in emerging economies where female labor constitutes a major portion of unskilled labor. Using industry-level panel data from Korea (1970-90), Seguino (1997) finds that a strong demand for female workers does not contribute to narrowing the real gender wage gap due to women's weaker social status. Consistent with Seguino's study, Oostendorp (2009) observes 161 occupations in 83 different countries (1983-99) and finds that the real gender wage gap tends to decrease with trade in richer countries. However, there is little evidence of this trend in poorer countries. Berik's (2000) result on industry-level panel data from Taiwan (1984-93) shows that wages for both genders are adversely affected by export growth. However, the penalty for men is greater than it is for women, which narrows the real gender wage gap. Fatema et al. (2018)'s study also finds a positive relationship between trade openness and the gender pay gap in developing countries.

The second channel is the incorporation of advanced technology. Trade economists find that exporting firms use more advanced technologies (Juhn, 2011). Galor and Weil's (1996) model shows technological advancement stimulates women's integration into production because capital is more complementary to female labor inputs. Autor, et al. (2003) find that as physically demanding jobs are replaced by new technology, women become more productive in blue-collar jobs. Using Mexican firm-level data, Juhn, et al. (2013) shows tariff reforms have a significant impact on increasing female workers' relative employment in blue-collar jobs. Weinberg (2000) uses U.S. data finding more than half of the demand growth in female workers is generated by increases in computer use across industries. However, Joekes' (1995) study finds advances in technology required more skilled labor, which led to a decline in the demand for female labor. Saure and Zoabi (2014)'s study of U.S. trade with Mexico is consistent with Joekes' study. They argue the high complementary rate between

capital and female labor reduces female labor demand.

The third channel is a reduction in gender-based discrimination. Black and Brainerd (2004) test Becker's (1957) hypothesis and find the relationship between international competition and the real gender wage gap; the more competition experienced by concentrated U.S. manufacturing industries, the smaller the real gender wage gap because trade has resulted in high competition, which increases the cost of discrimination for any firm. Consistent with Becker's theory, using the plant-level data, Ederington et al. (2010) find that increasing competition through Colombian tariff reforms results in the increased employment of blue-collar women. However, Berik et al. (2004) find a positive relationship between foreign competition and wage discrimination for industries in Korea and Taiwan during the 1980s and 1990s. They argue discrimination is a product of competition in countries where women's qualifications are undervalued. Nidhiya (2007) works with industry-level panel data and finds increased trade widens the gender pay gap in India's concentrated manufacturing industries because increasing competitive forces led firms to seek cost efficiency by cutting women's pay.

## **2 Background**

### **2.1 Review of the Labor Market**

Women typically make up a larger proportion of low-skilled labor (e.g. Mexico, Colombian, and Turkey. (Aguayo-Tellez, et al. (2010), Ederington, et al. (2010), and Ozler (2000))); however, this is untrue in South Korea. The overall labor force participation rate for both genders remains nearly constant from 1990 onward (Figure 1). However, in the manufacturing industry specifically, male participation increases

Figure 1: Trends in labor force participation rate, 1994-17

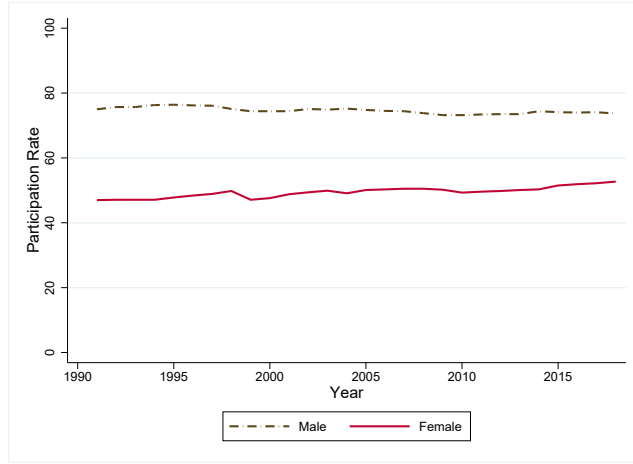
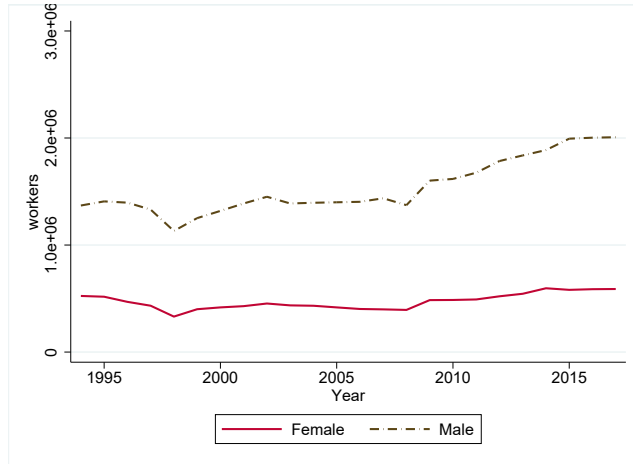


Figure 2: Number of male and female workers in manufacturing, 1994-17



more rapidly than female's (Figure 2).

Figure 3 shows the trend in female share of manufacturing employment (broken down by sectors) from 1994 to 2017. Female employment share in food & beverages and textile & leather manufacturing is relatively higher than in other industries; however, women's participation stays lower than men's. Unlike other countries from the previous literature (e.g. Mexico, Colombian, and Turkey. (Aguayo-Tellez, et al. (2010), Ederington, et al. (2010), and Ozler (2000))), South Korea's manufacturing industry continues to be male-dominated. Based on the variation from the previous literature, showing how export growth affected the real gender wage gap is difficult.

Figure 3: Female share of manufacturing employment, 1994-17

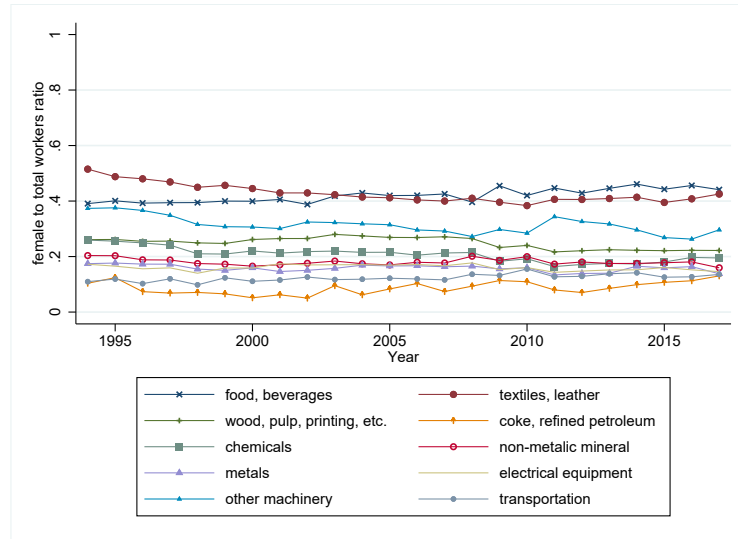


Figure 4 shows the ratio of female to male earnings. There is a positive trend with some large variations in food & beverages and coke & refined petroleum. Though the increased relative wage suggests the lessening of the real gender wage gap, the absolute value of the real wage gap has been steadily widening (Figure 5). Wages for both genders increased, but men have a higher absolute wage increase than women; this seems to be consistent throughout the years. Because the wage for women is lower, the percentage change each year for women's wages appears to be more significant than the wages are in levels. The more detailed comparison between the real wage gap and the wage ratio can be found in appendix s.3. Therefore, I use both the real wage gap and wage ratio to examine the effect of export growth on gender wage disparity.

The real gender wage gap overall in South Korea has declined (In 1992, it was 47 % and it went down to 34.1 % in 2018) with the exception of the manufacturing industry, which has increased. Output growth, triggered by export growth, could lead to an increase in relative demand for male workers instead of female workers. This outcome does not lend itself to proving my hypothesis correct.

Figure 4: The ratio of female to male wage in manufacturing industries, 1994-17

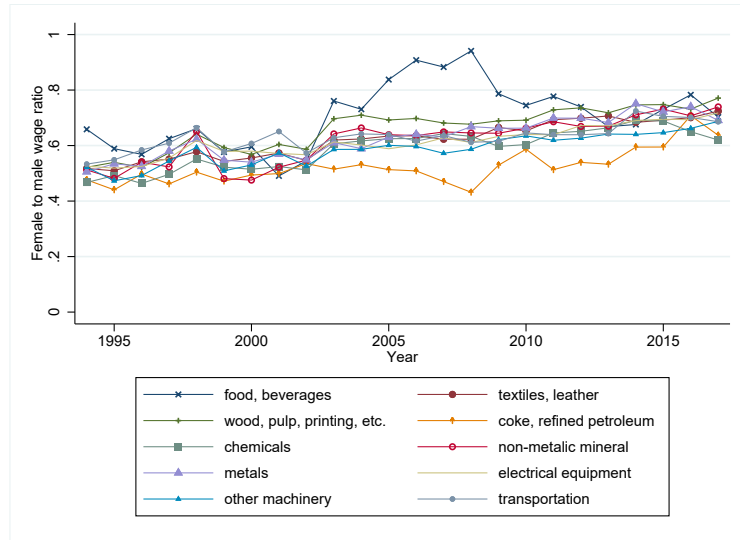


Figure 5: Wage gap in levels (inflation-adjusted) in manufacturing industries, 1994-17

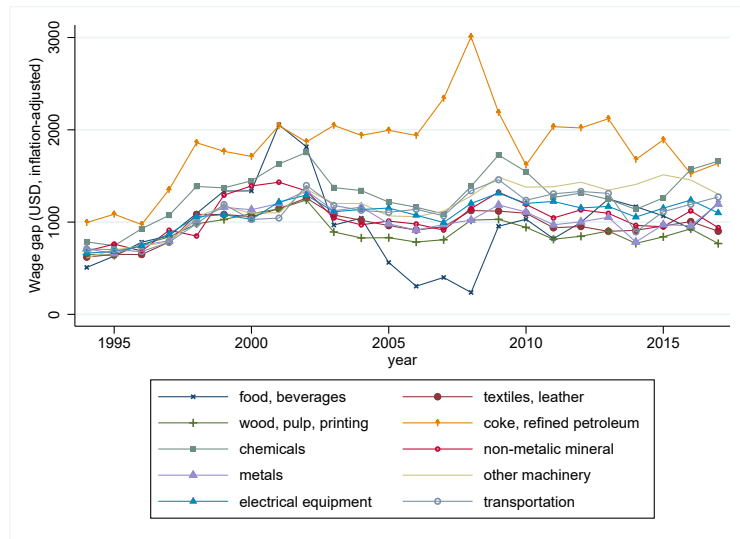


Table 2: Current South Korea FTA

Free Trade Agreement	Year of implementation
Korea-Chile	2004
Korea-Singapore; EFTA	2006
Korea-ASEAN	2007
Korea-India	2010
Korea-EU; Peru	2011
Korea-US	2012
Korea-Turkey	2013
Korea-Australia	2014
Korea-Canada; China; New Zealand; Vietnam	2015
Korea-Colombia	2016

## 2.2 Trade Liberalization in South Korea

South Korea pursued multilateral trade policy until its 1997 financial crisis. The 1997 Asian financial crisis raised doubts about the benefits of pursuing multilateral trade negotiations under the World Trade Organization (WTO) and Asia-Pacific Economics Cooperation (APEC). After the crisis, East Asian countries' made efforts to achieve bilateral or cross-regional trade agreements. In response to these Asia-Pacific trends, Korea's movement toward freer trade also became bilateral and cross-regional. Korea's FTA policy was defensive and passive at first to minimize their adjustment costs and political adversaries; most of the FTA negotiations in the early period were devoted to East Asian regional cooperation. However, failure in institutionalizing the regional trading regime with Japan and China shifted Korea's FTA policy radically. Korea began pursuing FTAs with large, developed economies, aiming for a high degree of liberalization. This new FTA policy began with the FTA negotiation with the United States in 2006 (Lee, 2007; Kim, 2008). South Korea currently has 15 Free Trade Agreements with 53 countries (table 2).

Table 3: Descriptive Statistics

	count	mean	sd	min	max
RealWageGap	240	1137.895	365.9116	237.5715	3007.498
RealOutput	240	26.01835	17.97244	5.36103	83.04749
RealExport	240	35.37064	37.40591	1.721805	193.382

### 3 Data Overview

The employment and wage data from 1994 to 2017 were collected by Statistics Korea (KOSTAT), a government organization for national statistics, and Bank of Korea (BOK). The data cover the entire labor force in Korea and are recorded at the industrial level. Both KOSTAT and BOK adopted the Korean Industrial Classification which contains 24 manufacturing industries. The gross output data for each industry are from The National Accounts, an annual guide also provided by the BOK, aimed at facilitating economic policy and analysis. These data are collected from the Korea International Trade Association (KITA) and the Bloomberg Terminal. Table 3 shows the summary statistics. The mean value is the average amount of the 10 manufacturing sectors' real amounts (wage gap, outputs, and exports) from 1994 to 2017. Real wage gap refers to monthly real wage gap in dollars. Real outputs and real exports are in millions of dollars.

#### 3.1 Variables

This section provides an explanation for the variables.

1. Wage

The wage includes monthly wage payments and the amounts of the previous year's bonuses divided by 12. *WageRatio* is the monthly wage ratio of female to

male. *RealWageGap* is the wage difference in male and female wages in dollars. I converted the nominal wage from Korean currency into U.S. dollars, using average annual exchange rates. I then adjusted Korea's wage relative to U.S. prices using the relative price level of goods between the two countries. Finally, the nominal wage in U.S. dollars must be the ratio of the price levels to convert nominal wages to real wages. Equation 1 demonstrated this transformation.

$$realvalue_{KOR}^{USprices} = \frac{pricelevel_{USA}}{pricelevel_{KOR}} * nominalvalue_{KOR}^{USprices} \quad (1)$$

## 2. Female employment share

*fShare* is calculated by dividing the number of female laborers by the total number of laborers.

## 3. Output

Output is the sum, in thousand dollars, of the gross value added (output less intermediate consumption) by each industry, plus all taxes less subsidies on products. The calculation follows the same formula as in equation 1.

## 4. Exports

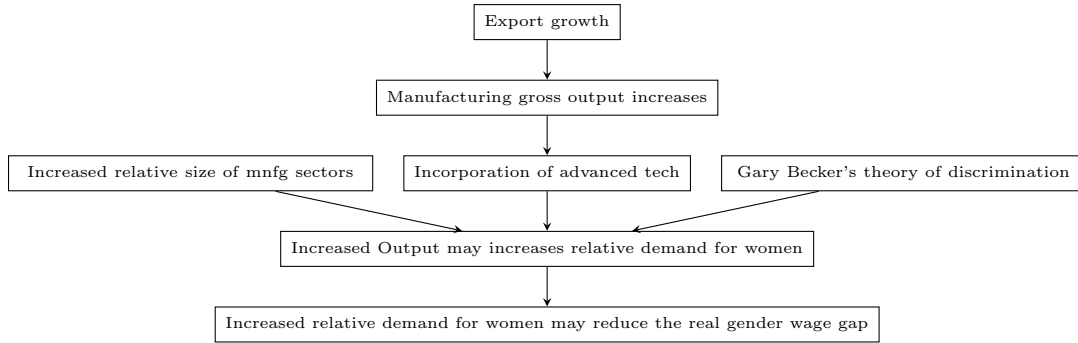
Export is the annual export amounts in thousand dollars for each manufacturing industry. I added the individual export amounts for each two-digit Harmonized System (HS) code to calculate the export amounts for each manufacturing sector. Each two-digit HS code matches one of ten manufacturing sectors.<sup>1</sup> The calculation follows the same formula as in equation 1.

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<sup>1</sup>I used export amounts appearing to have a pattern similar to the export volume index. Accordingly, I feel fairly confident using these particular amounts. Detailed information can be found in the appendix s.2



Figure 6: Diagram of trade policy’s effect on the real gender wage gap



## 5. Equal Employment Opportunity policy

*EEOs* are anti-discrimination policy variables, where each variable indicates a revision of the Equal Employment Opportunity Law, originally established in 1987. The policy is not directly related to trade policy; but may be both policies are correlated, so I include policy dummy variables for a robustness check. Detailed explanation about the revisions are located in the appendix s.1.

## 4 Model

Figure 6 shows a process of how export growth potentially affects the gender-based outcomes in the labor market. FTAs facilitate exports by reducing trade barriers which would increase gross manufacturing output. Increased output may increase relative demand for women through three channels: increased relative size of export-led manufacturing, incorporation of advanced technology, and a reduction in gender-based discrimination. Eventually, increased relative demand for women may reduce the real gender wage gap.

Using industry fixed effects I use three regressions to test three relations among the aforementioned processes. Except policy dummy variables, all variables are in loga-

rithms. The first regression (2) tests whether increased exports lead to an increased gross output. The results will determine whether export growth would have a significant effect on the manufacturing gross output.

$$\ln RealOutput_{it} = \alpha_0 + \beta \ln RealExport_{it} + \gamma_i + \epsilon_{it} \quad (2)$$

The second regression (3) substantiates whether increased output and/or exports increase relative demand for women. Except policy dummy variables, all variables are in logarithms. Policy dummy variables are mainly for robustness check.

$$\ln fShare_{it} = \alpha_0 + \beta_1 \ln RealOutput_{it} + \beta_2 \ln RealExport_{it} + \lambda_j EEO_{jt} + \gamma_i + \epsilon_{it} \quad (3)$$

The last two regressions (4 and 5) test whether increased relative demand for women resulted in a reduction in gender wage inequality.

$$\ln WageRatio_{it} = \alpha_0 + \beta_1 \ln RealOutput_{it} + \beta_2 \ln RealExport_{it} + \lambda_j EEO_{jt} + \gamma_i + \epsilon_{it} \quad (4)$$

$$\ln RealWageGap_{it} = \alpha_0 + \beta_1 \ln RealOutput_{it} + \beta_2 \ln RealExport_{it} + \lambda_j EEO_{jt} + \gamma_i + \epsilon_{it} \quad (5)$$

*WageRatio* is the monthly wage ratio of female to male. *RealWageGap* is the wage difference in male and female wages in thousands of dollars. I found using wage ratio alone can lead to contrasting results. For instance, an increased wage ratio does not mean the reduced real gender wage gap. Therefore, I used both wage ratio and the real wage gap.

Table 4: The effect of export growth on the output growth

(1)	
	lnRealOutput
lnRealExport	0.491*** (0.0754)
_cons	8.638*** (1.265)
FE	ind,year
$N$	240
adj. $R^2$	0.615

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

## 5 Empirical Results

Table 4 estimates the effect of export growth on output growth. Regression includes fixed effects for each industry and each year. The result from regression 1 indicates export growth is positively associated with output growth and is significant at the .001 level of significance. A 1% increase in export amounts results in a .49% increase in output growth. This result supports one of my propositions, which asserts export growth leads to output growth.

Table 5 shows the effect of output and export growth on the female share of employment. Each regression includes fixed effects for each industry and each year. Regressions 2 and 4 include the Equal Employment Opportunity policy dummy variables for checking robustness. Regressions 1 and 2 show output growth is negatively associated with the female share of employment, but it is not statistically significant. A 1% increase in output amounts results in a .06% and a .07% decrease in female share of employment, respectively. Regression 3 shows export growth is negatively associated with the female share of employment, while regression 4 shows these are positively related. However, the effect of a 1% increase in export amounts results in

Table 5: The effect of output/export growth on female share of employment

	(1)	(2)	(3)	(4)	(5)
	lnfShare	lnfShare	lnfShare	lnfShare	lnfShare
lnRealOutput	-0.0590 (0.0505)	-0.0730 (0.0618)			
EEO2		-0.111* (0.0379)		-0.124* (0.0534)	
EEO3		-0.0181 (0.0250)		-0.0452 (0.0279)	
EEO4		0.0557 (0.0278)		0.0408* (0.0170)	
EEO5		0.00969 (0.0464)		-0.0174 (0.0345)	
lnRealExport			-0.0134 (0.0386)	0.0265 (0.0398)	
year					-0.00204 (0.00312)
_cons	-0.587 (0.852)	-0.277 (1.029)	-1.357 (0.648)	-1.895* (0.638)	2.513 (6.266)
FE	ind,year	ind,year	ind,year	ind,year	ind,year
$N$	240	240	240	240	240
adj. $R^2$	0.026	0.089	-0.000	0.078	0.011

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

a .01% decrease and a .03% increase in the female share of employment, which shows the impact is practically and statistically insignificant. Out of these four regressions, I find regression 3 most useful in determining the effect of export growth on female share of employment because there is sufficient evidence that export growth leads to output growth (table 4). These results do not confirm the hypothesis, which states output growth spurred by export growth will increase relative demand for women. The trend in the female share of manufacturing employment has been declining, and it is not statistically significant (regression 5). The patterns of female employment do not seem to vary with economic development. Rather, the patterns reflect industry-specific influences.

Table 6 estimates the effects of output and export growth on the gender wage ratio. Each regression includes fixed effects for each industry and each year. Regressions 2 and 4 include Equal Employment Opportunity policy dummy variables for checking robustness. Regressions 1 and 2 show output growth and the wage ratio are positively correlated. Regression 1 suggests a 1% increase in output results in a .2% increase in wage ratio, and it is statistically significant at the .001 level. Regression 2 suggests a 1% increase in output results in a .02% increase in wage ratio, and it is not statistically significant. Regression 3 shows export growth and the wage ratio are positively associated. A 1% increase in export results in a .1% increase in wage ratio, and it is statistically significant at the .01 level. Regression 4 suggests a 1% increase in exports results in a .002% decrease in wage ratio, and it is not statistically significant. I find regression 3 most useful in determining the effect of export growth on the gender wage ratio because there is sufficient evidence that export growth leads to output growth (table 4). These results do not support the hypothesis, which says output growth triggered by export growth will reduce gender wage disparity.

Table 7 estimates the effects of output and export growth on the real gender wage gap.

Table 6: The effect of output/export growth on the gender wage ratio

	(1)	(2)	(3)	(4)
	lnwRatio	lnwRatio	lnwRatio	lnwRatio
lnRealOutput	0.205*** (0.0213)	0.0220 (0.0239)		
EEO2		0.0799*** (0.0137)		0.0808*** (0.0135)
EEO3		-0.0302 (0.0166)		-0.0234 (0.0185)
EEO4		0.103** (0.0279)		0.107** (0.0256)
EEO5		0.0831*** (0.00887)		0.0886*** (0.00817)
lnRealExport			0.112** (0.0247)	-0.00191 (0.0192)
_cons	-3.956*** (0.360)	-1.023* (0.396)	-2.369*** (0.414)	-0.631 (0.313)
FE	ind,year	ind,year	ind,year	ind,year
$N$	240	240	240	240
adj. $R^2$	0.361	0.609	0.273	0.608

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Table 7: The effect of output/export growth on the real gender wage gap

	(1)	(2)	(3)	(4)
	lnRealWGap	lnRealWGap	lnRealWGap	lnRealWGap
lnRealOutput	0.353*** (0.0465)	0.288* (0.110)		
EEO2		0.264*** (0.0375)		0.189*** (0.0353)
EEO3		0.248*** (0.0374)		0.297*** (0.0491)
EEO4		-0.111 (0.0641)		-0.0726 (0.0526)
EEO5		-0.114* (0.0454)		-0.118 (0.0578)
lnRealExport			0.221*** (0.0324)	0.149 (0.0675)
_cons	1.034 (0.784)	1.829 (1.806)	3.283*** (0.543)	4.193** (1.073)
FE	ind,year	ind,year	ind,year	ind,year
$N$	240	240	240	240
adj. $R^2$	0.222	0.440	0.223	0.432

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Each regression includes fixed effects for each industry and each year. Regressions 2 and 4 include the Equal Employment Opportunity policy dummy variables for checking robustness. Regressions 1 and 2 suggest output growth and the real wage gap are positively correlated. They both are significant at the .001 and .05 level, respectively. A 1% increase in output results in a .35% increase and a .29% increase in the real gender wage gap, respectively. Regressions 3 and 4 show export growth and the real wage gap are positively associated. Regression 3 suggests a 1% increase in export amounts results in a .2% increase, and it is statistically significant at the .001 level. Regression 4 suggests a .15% increase, but it is not statistically significant. Out of these four regressions, I find regression 3 most useful in determining the effect of export growth on the real gender wage gap because there is sufficient evidence that export growth leads to output growth (table 4). These results suggest export growth and the real wage gap are positively correlated, which does not support the hypothesis. Variation from the previous literature results in contrasting outcomes. For example, a predominantly male workforce may make Gary Becker's theory of discrimination inappropriate for this situation. In conclusion, there is no conclusive evidence in South Korea to support the impact of export growth in regard to the reduced real gender wage gap.

## 6 Conclusion

The main goal of this paper is to examine the impact of export growth on gender wage inequality in South Korea's labor market. Based on my research, I found no evidence in South Korea to support the impact of export growth on the reduced real gender wage gap. The result shows a positive relationship between exports and outputs. However, output growth does not lead to an increased relative demand for female



workers, nor a reduction in the real gender wage gap. While conventional sources of the gender pay gap explain half of the real wage gap, recent empirical literature suggests that gender discrimination cannot be ignored. The unexplained real wage gap (the portion not accounted for by observed productivity) continues to occupy a significant portion of the real wage gap. Export growth does not seem to reduce gender wage disparity in the Korean labor market. Output growth, prompted by export growth, seems to lead to a significant increase in male workers, and this makes it difficult for women to enjoy benefits from export growth.

## **6.1 Limitations and Future Works**

The most commonly used proxy for trade liberalization is the ratio of exports and imports to the gross domestic product (GDP). Few previous literature uses both variables to estimate the effect of export growth on the female share of employment. In the future, I may add import amounts and export ratio to trade amounts to the model. Also, the effect of firms adopting advanced technology is ambiguous. Trade liberalization may be less associated with labor reallocation. Instead, it may be more related to technology upgrading within firms. Upgrading technology reduces the need for physical skills; however, it may shift industries to more capital and skills-intensive operations, resulting in higher demand of skilled labor.

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## 8 Appendix

### 8.1 Equal Employment Opportunity Law

In 1989, the first revision specified the definition of discrimination: employees could not be discriminated against based on their gender, marital status, or pregnancy status. (article 2-2). Women could no longer be required to quit their jobs upon marriage, and it was also the year when the rule of equal pay for equal labor value was stipulated (article 6-2). Moreover, the penal provisions were reinforced (articles 23); employers who violated equal opportunity in recruitment and employment were also fined. In 1995, the second revision (*EEO2*) banned the required section on résumés for filling out physical conditions such as appearance, height, weight, etc., in addition to disclosing marital status (article 6-(2)). In 1999, the third revision (*EEO3*) prohibited indirect discrimination; however, the nuances of the policy were not explicitly defined, meaning the legislation was merely symbolic and did little for equality. The third revision states “. . . the discrimination shall also include where the business owner sets the standard or conditions for personal affairs which either men or women find very difficult to meet.” Additionally, the prevention of sexual harassment was first addressed in the third revision. It not only prohibits harassment, but it also mandates sexual harassment prevention training at work (article 8-2). In 2001, the fourth revision (*EEO4*) broadened the scope of discrimination. Moreover, the assistance to maternity leave before and after childbirth was strengthened; the State pays some amount of money equivalent to the ordinary wages for a period of leave (article 18-2). The compensation was further improved in the fifth revision in 2005 (*EEO5*); the State will pay the full amount of an individual’s wage for a period of leave, including women who experience a miscarriage.

Table 8: The correlation between export amounts and the export volume index

	(1) c10	(2) c13	(3) c16	(4) c19	(5) c20
evi10	50555.8*** (3431.5)				
evi13		235848.1*** (28702.2)			
evi16			33112.3*** (4613.5)		
evi19				726162.3*** (109749.6)	
evi20					533819.2*** (31231.4)
_cons	515417.3* (225190.5)	-5796192.7 (3842695.4)	896157.4* (407223.8)	-15833921.0* (7428342.6)	-5755673.4* (2062244.7)
<i>N</i>	24	24	24	24	24
adj. <i>R</i> <sup>2</sup>	0.904	0.743	0.687	0.650	0.927

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

## 8.2 Export Amounts and Export Volume Index

Export is the annual export amounts (inflation-adjusted) in thousand dollars for each manufacturing industry. I added the individual export amounts for each two-digit Harmonized System (HS) code to calculate the export amounts for each manufacturing sector. Export amounts appears to have a pattern that is similar to the export volume index, which is retrieved from KOSTAT.<sup>2</sup> Table 8 and 9 show the correlation between export amounts and the export volume index. Except, other machine and equipment industry, the majority of them are highly correlated.

<sup>2</sup>Export Volume Index: changes in export amount of the manufacturing sector from 1994 to 2017, with the base year of 2015

Table 9: The correlation between export amounts and the export volume index

	(1) c23	(2) c24	(3) c29	(4) c28	(5) c30
evi23	420277.7*** (59087.2)				
evi24		719915.3*** (84319.6)			
evi29			0.557*** (0.130)		
evi28				531717.3*** (69950.6)	
evi30					830201.0*** (29906.7)
_cons	-8414502.6* (3657178.2)	-13390896.6* (6269146.7)	28795331.2 (22637606.7)	29166112.7*** (3985503.8)	4331691.8* (1953717.4)
<i>N</i>	24	24	24	24	24
adj. <i>R</i> <sup>2</sup>	0.683	0.758	0.431	0.712	0.971

Standard errors in parentheses  
 \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Figure 7: Export amounts & export volume index - food, beverages, 2000-17

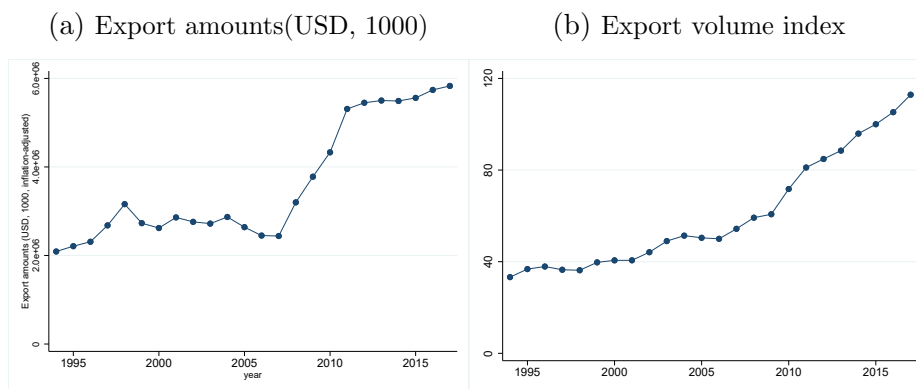


Figure 8: Export amounts & export volume index - textiles, leather, etc., 2000-17

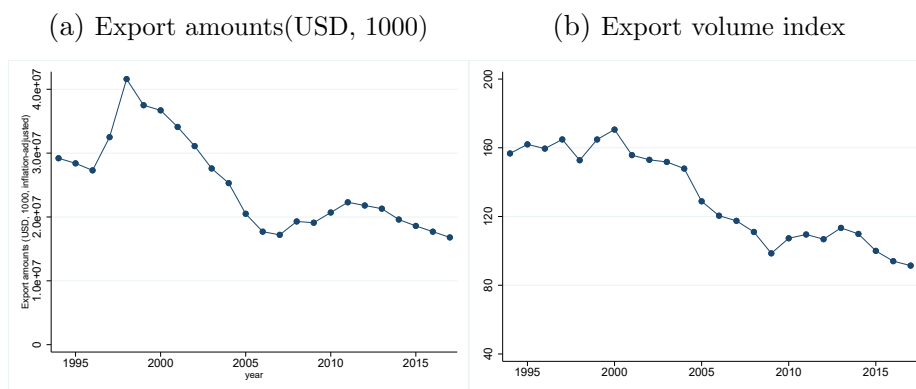




Figure 9: Export amounts & export volume index - wood, pulp, printing, 2000-17

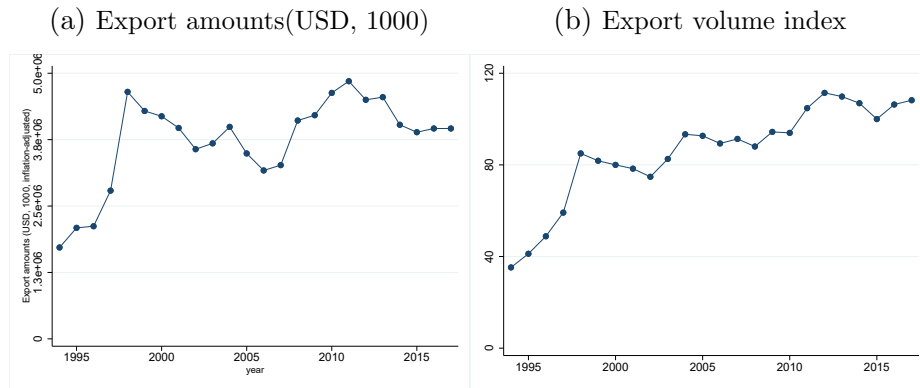


Figure 10: Export amounts & export volume index - coke, refined petroleum, 2000-17

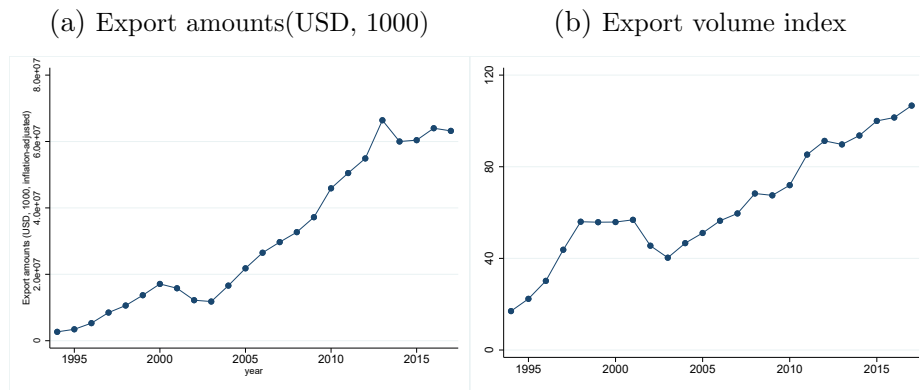


Figure 11: Export amounts & export volume index - chemicals, 2000-17

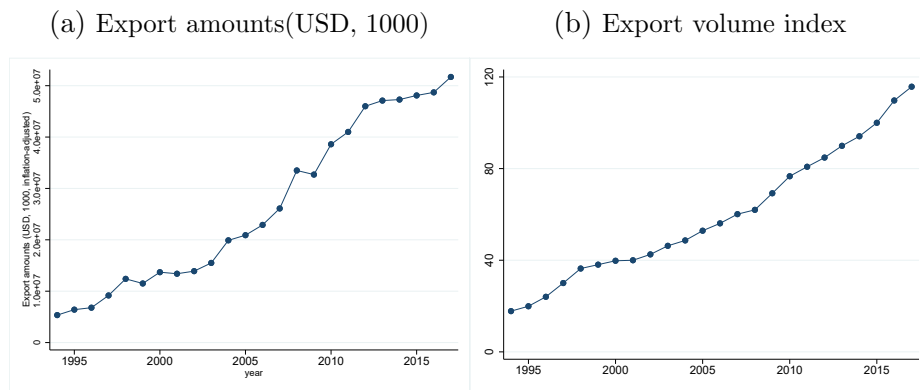


Figure 12: Export amounts & export volume index - non-metallic mineral, 2000-17

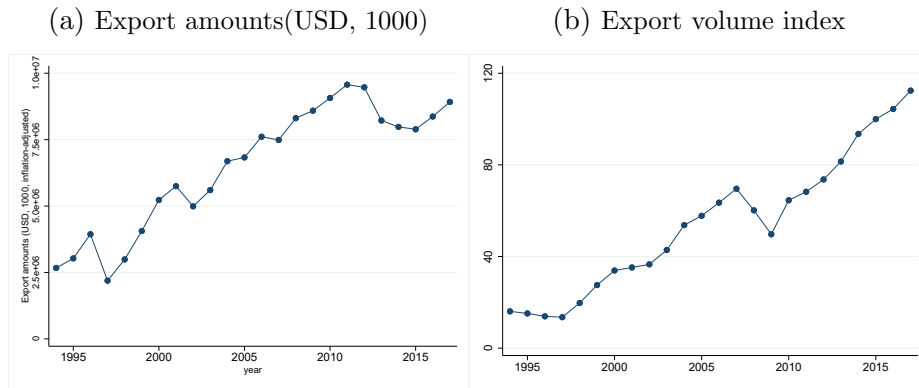


Figure 13: Export amounts & export volume index - metals, 2000-17

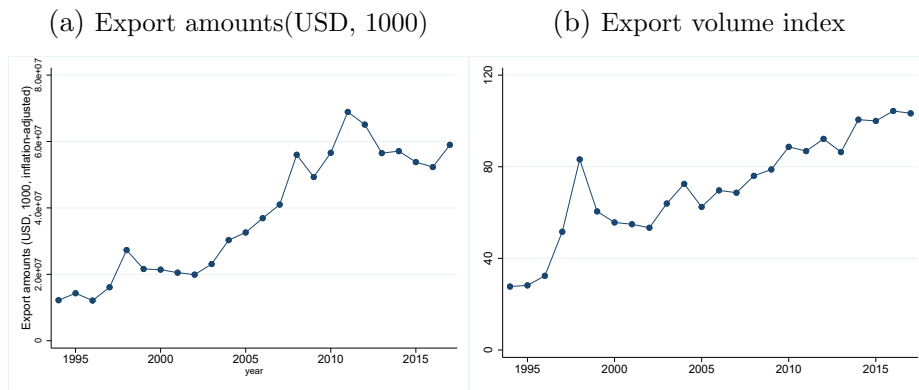


Figure 14: Export amounts & export volume index - other machinery, 2000-17

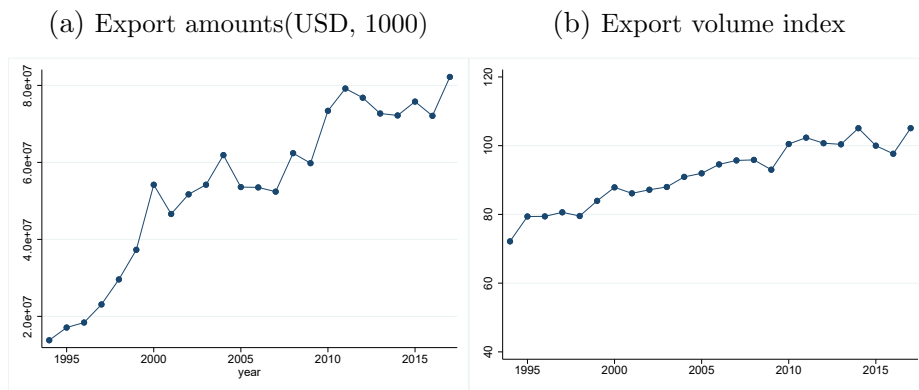


Figure 15: Export amounts & export volume index - electrical equipment, 2000-17

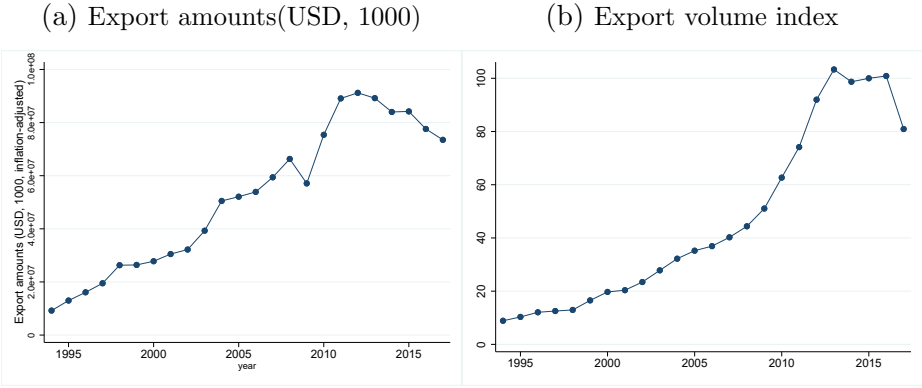


Figure 16: Export amounts & export volume index - transportation, 2000-17

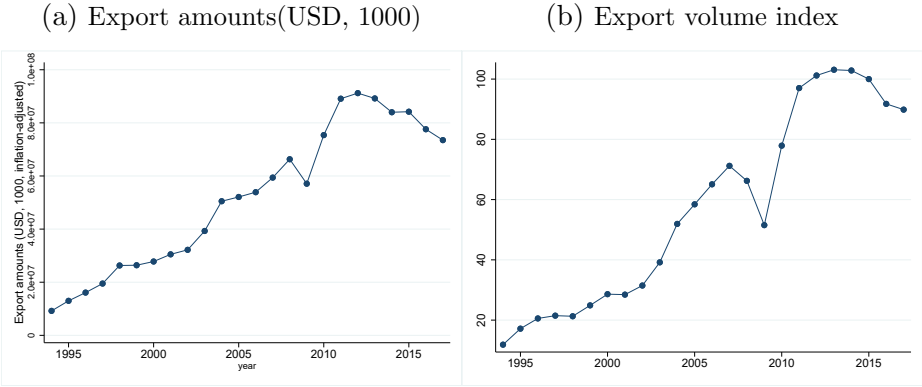


Figure 17: Real Wage Gap & wage ratio - food, beverages, 1994-17

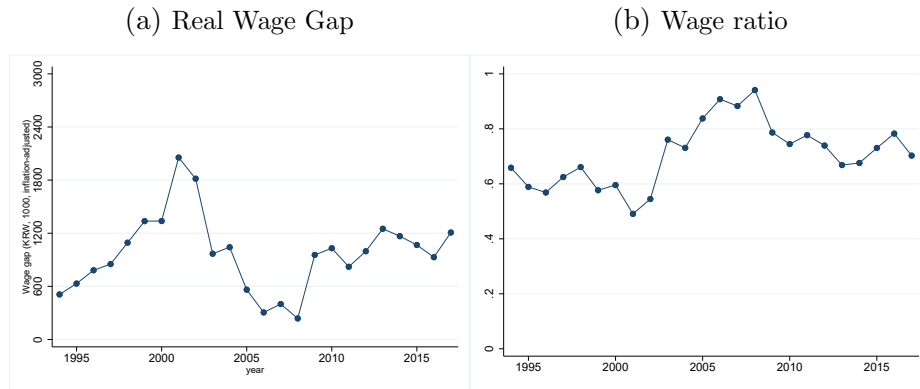
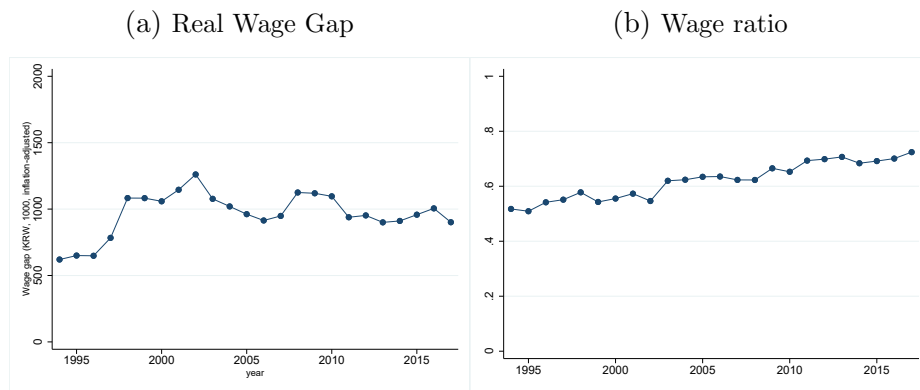


Figure 18: Real Wage Gap & wage ratio - textiles, leather, etc., 1994-17



### 8.3 Real Wage Gap and Wage Ratio

The increased relative wage would seem to suggest that the real gender wage gap has narrowed; however, the real wage gap has been also steadily widening. Because the wage for women is lower, the percentage change each year for women’s wages appears to be more significant than they are in levels. I used both wage ratio and the real wage gap for this reason.

Figure 19: Real Wage Gap & wage ratio - wood, pulp, printing, 1994-17

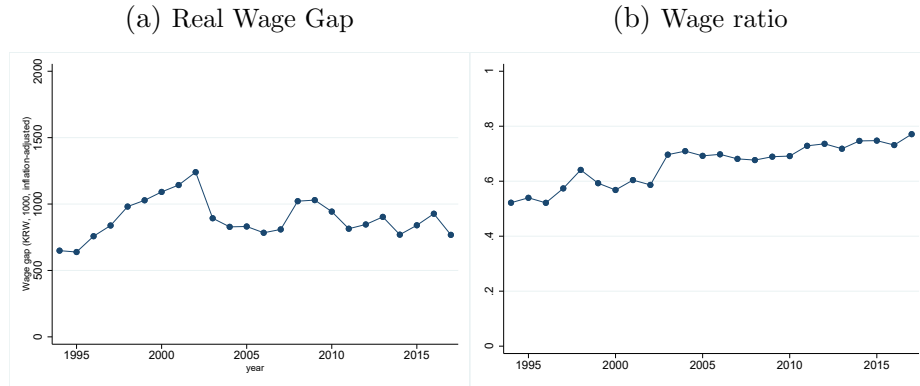


Figure 20: Real Wage Gap & wage ratio - coke, refined petroleum, 1994-17

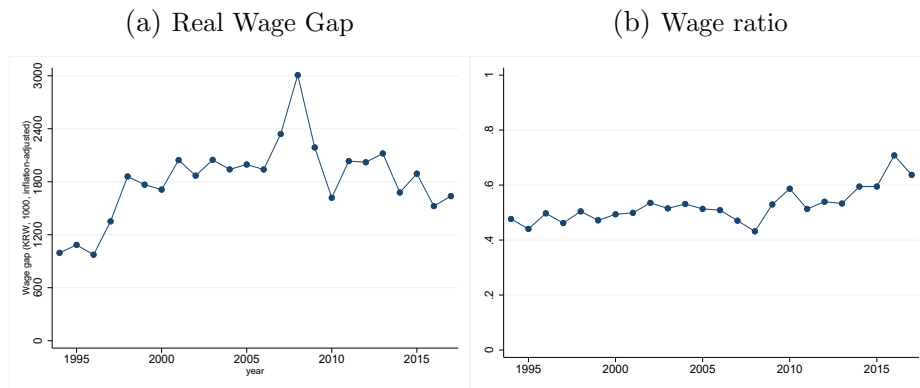


Figure 21: Real Wage Gap & wage ratio - chemicals, 1994-17

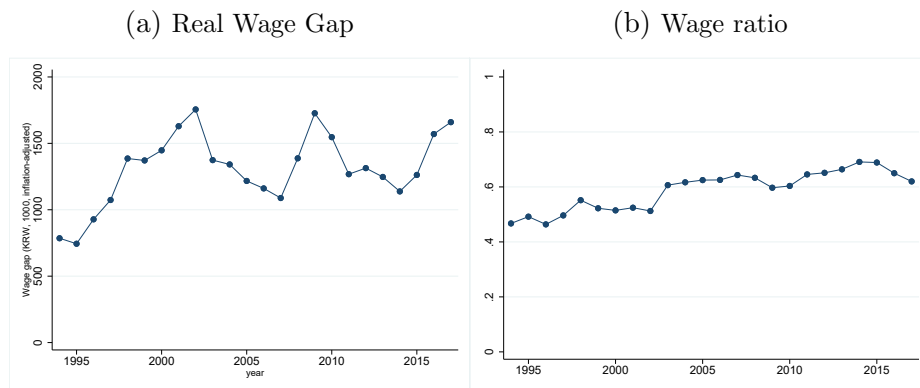


Figure 22: Real Wage Gap & wage ratio - non-metallic mineral, 1994-17

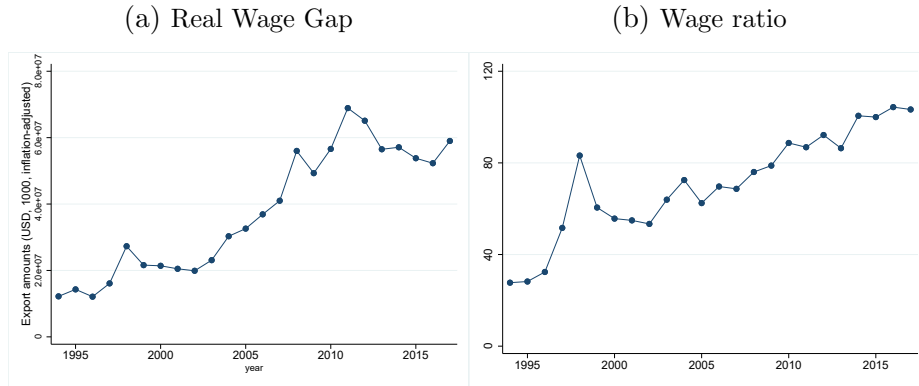


Figure 23: Real Wage Gap & wage ratio - metals, 1994-17

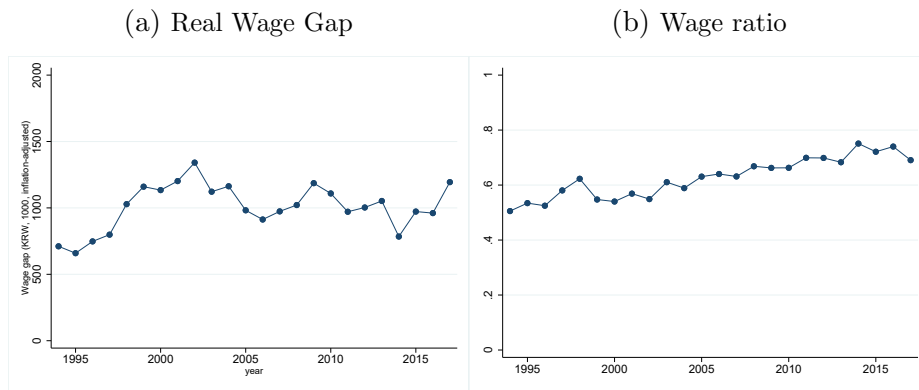


Figure 24: Real Wage Gap & wage ratio - other machinery, 1994-17

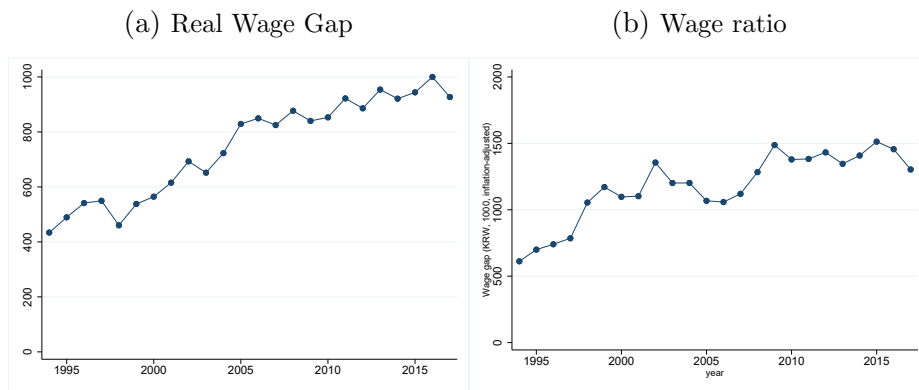


Figure 25: Real Wage Gap & wage ratio - electrical equipment, 1994-17

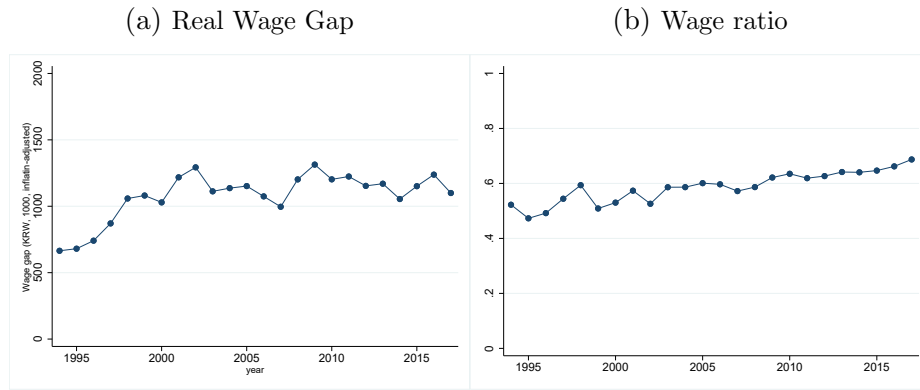


Figure 26: Real Wage Gap & wage ratio - transportation, 1994-17

