

IMPACT OF MINIMUM WAGE CHANGE ON WOMEN COMPETITIVENESS IN THE  
LABOR MARKET: A COMPARATIVE STUDY AMONG OECD COUNTRIES

A Thesis  
submitted to the Faculty of the  
Graduate School of Arts and Sciences  
of Georgetown University  
in partial fulfillment of the requirements for the  
degree of  
Master of Public Policy  
in Public Policy

By

Ziyan Song, B.L.

Washington, D.C.  
March 27, 2021

Copyright 2021 by Ziyang Song  
All Rights Reserved

# IMPACT OF MINIMUM WAGE CHANGE ON WOMEN COMPETITIVENESS IN THE LABOR MARKET: A COMPARATIVE STUDY AMONG OECD COUNTRIES

Ziyan Song, B.L.

Thesis Advisor: Andrew Wise, Ph.D.

## ABSTRACT

This thesis uses panel data from the World Bank Group and the OECD datasets for the years 2001 to 2019 and employs two models in simple OLS and fixed effects to examine the relationship between minimum wage changes and women's competitiveness in the labor market, measured using the gender wage gap and the female labor force participation rate. The study's two major findings are: First, the effects of minimum wage changes on the gender wage gap are still ambiguous as my two models present contradictory results. Second, the relationship between minimum wage change and female labor force participation rate is positive, indicating that an increase of the minimum wage can serve as a positive incentive to attract more women to enter the labor market. The results suggest that raising minimum wage may not be the most suitable way to promote gender equity in the labor market, and that women in low-income industries and in poverty may need more help.

INDEX WORDS: minimum wage, gender wage gap, female labor force participation rate

## **ACKNOWLEDGEMENTS**

The research and writing of this thesis  
is dedicated to everyone who helped along the way.

Many thanks,  
ZIYAN SONG

## TABLE OF CONTENTS

Introduction.....	1
Background.....	3
Literature Review.....	6
Theoretical Model.....	10
Data and Descriptive Statistics .....	11
Empirical Model .....	17
Results.....	19
Conclusion .....	24
References.....	27

## LIST OF FIGURES

Figure 1. Change of Minimum Wage over Time, On Average in OECD Countries, 2001-2019 .....	4
--	---

## LIST OF TABLES

Table 1. Descriptive Statistics of Gender Wage Gap .....	11
Table 2. Descriptive Statistics of Labor Force Participation Rate.....	12
Table 3. Descriptive Statistics of Minimum Wage.....	12
Table 4. Descriptive Statistics of Gender Equity.....	13
Table 5. Descriptive Statistics of Education.....	13
Table 6. Descriptive Statistics of Female Marginally Attached Workers .....	14
Table 7. Descriptive Statistics of Female Employment.....	14
Table 8. Descriptive Statistics of GDP per Capita.....	15
Table 9. Descriptive Statistics.....	17
Table 10. Dependent Variable: Gender Wage Gap .....	22
Table 11. Dependent Variable: Female Labor Force Participation .....	23

## INTRODUCTION

The minimum wage, usually defined as the lowest payment that employers can legally pay their employees, has steadily increased in the past ten years in most of the countries in the world. According to one recent study by the U.S. Congressional Budget Office, the increase in the federal minimum wage would increase low-wages workers' earnings and lift them out of poverty (Kelly, 2019). Among these workers, women represent a disproportionate percentage, almost two-thirds (Tucker & Patrick, 2017). Therefore, promoting gender quality is a critical potential benefit of the minimum wage.

Current studies of the minimum wage mainly focus on labor force participation and gender wage gap issues. The relationship between the minimum wage and labor force participation is still ambiguous as researchers held different points of view. As for the gender wage gap, however, most scholars agreed that increasing the minimum wage is a useful tool in narrowing the gender wage gap. Among current empirical studies, there are still two drawbacks: (1) most of the studies are largely confined to one country and cannot make cross-country comparisons; and (2) for papers on the relationship between labor force participation and a minimum wage change, few focus on the gender aspect.

Therefore, to fill the gap in the present studies, in this research, I intended to explore the relationship between increases in the minimum wage and women's competitiveness in labor markets among OECD countries to see whether minimum wage policy is a suitable method for improving gender equality in the labor market. My measures of women's competitiveness consist of: (1) labor participation rates; and (2) the gender wage gap. My hypothesis is that: the minimum wage changes are negatively related to the gender wage gap and positively to the

female labor force participation rate, holding control variables (e.g., country income level, gender equity, education, marginal attached workers, GDP per capita and employment rate) constant.

Most of my data come from the World Bank Group – Gender Statistics and the OECD – Labor theme database. The Gender Statistics database is a comprehensive source with records over 50 years. The OECD-Labor theme dataset contains annual labor force statistics for the 34 OECD Member countries plus Colombia, Brazil and the Russian Federation. My dependent variables are the female labor force participation rate, and the gender wage gap. My independent variable of interest is the minimum wage, and which I converted into three measures: the original minimum wage, the log minimum wage and a minimum wage indicator variable. As for the control variables, I added education, gender equity, GDP per capita, employment rate and marginal attached workers, among others.

The paper proceeds as follows: In Section II, I discuss the background of this topic and review related literature. In Section III, I develop a theoretical framework to explain the relationship between minimum wage and women competitiveness. Section IV contains a discussion of the data and descriptive statistics used to study this issue. Section V provides the empirical equations estimated to study the relationship. In this section I also discuss the results from estimating those equations. Finally, the last section summarizes and concludes with policy implications and recommendations.

## BACKGROUND

The minimum wage is usually defined as “the minimum amount of remuneration that an employer is required to pay their workers for the work performed during a given period, which cannot be reduced by collective agreement or an individual contract” (International Labour Conference, 2014).

Minimum wage legislation first emerged at the end of the nineteenth century during the first wave of global industrialization (Rudolf, 1928). It initially covered few categories of workers to protect them from extreme vulnerability. New Zealand was the first country to implement a minimum wage in 1894, followed by the Australian state of Victoria in 1896, and the United Kingdom in 1909. After the Second World War, the number of countries with a minimum wage increased. The legal coverage also largely expanded to almost all workers as a right of protection against extreme low wages (International Labour Organization). According to the report of the International Labor Organization, by September 2015, about 92% of its member states applied minimum wage law in their own countries. Minimum wage systems are diverse: some countries have one uniform minimum wage law, while some countries base wage laws on different industries and occupations (International Labour Organization). Interestingly, some highly developed countries have no legal minimum wages, including Sweden, Iceland, and Norway as unions took the responsibility to organize wage distribution.

Figure 1 shows that since 2001, for all the countries I analyzed in this research, on average all have enacted minimum wage increases recently. However, the magnitudes across countries were not the same. On average, increment of minimum wage in high income countries rose the fastest and those have the highest minimum wage value.

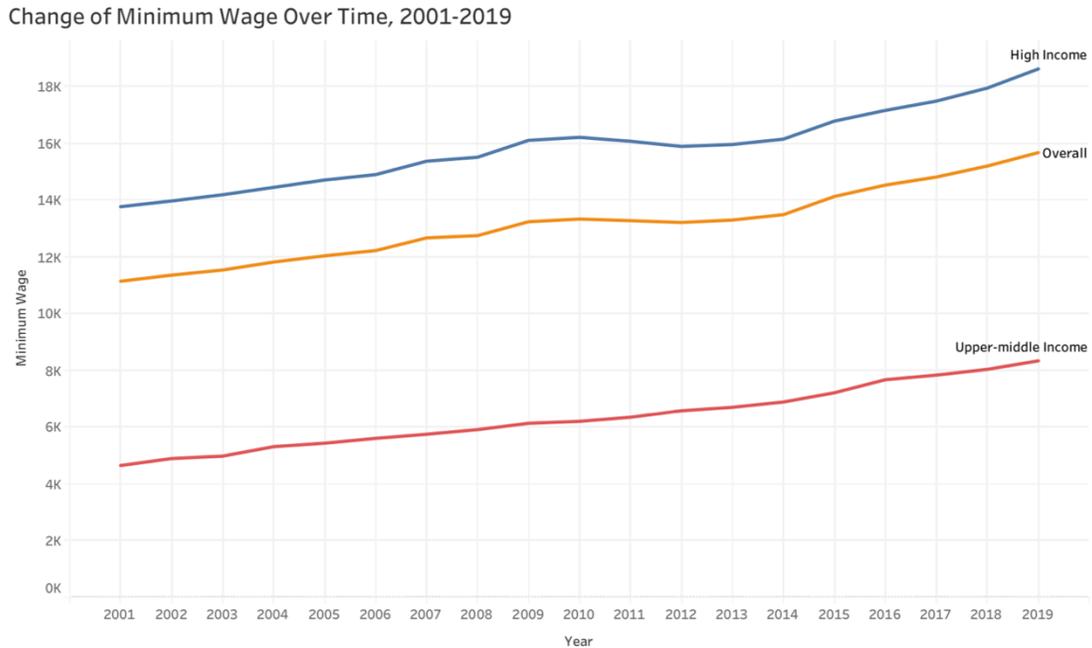


Figure 1. Change of Minimum Wage Over Time, On Average in OECD countries, 2001-2019

Theoretically, the formulation of the minimum wage is of vital importance and can bring large benefits. First, it eliminates low pay work and boosts work productivity. According to one recent study by the U.S. Congressional Budget Office, the increment of minimum wage would increase low-wage workers’ earnings and lift them out of poverty (Congressional Budget Office). Also, a higher minimum wage helps to reduce income inequality. In addition, proponents agree that the minimum wage can serve as an engine of economic growth and assist low-skilled labor during downturns in the business cycle (Sabia, 2015). Apart from that, raising the minimum wage could have sizable positive effects throughout the society (The Leadership Conference Education Fund, 2018). Also, a higher minimum wage is especially helpful for women as women occupy a disproportionate percentage of low wage workers, about two-thirds (National Women’s Law Center).

However, research in practice sometimes demonstrated that the effects of minimum wage law might not be as positive as proponents expected. For example, some studies showed that the minimum wage can lead to a decrease in employment rate, especially for women. Also, the labor force participation rate sometimes is shown to be negatively related to minimum wage increase (Boffy-Ranirez, 2019).

Even when identical in background and experience, a 10% gender wage gap still remains (Yellen, 2020). Around the world, there is also a labor force participation rate gap between females and males. Data in 2019 showed that a gap of around 20 percentage points still exists (Catalyst, 2020). As researchers showed, the minimum wage can be one effective way to narrow the gender wage gap within the labor force (Shannon, 1996) and the effect is more significant in the long run (Li & Ma, 2015). Though the effect for minimum wage on employment is still ambiguous, it is still valuable to analyze this policy and find its relationship with women's competitiveness in the labor market. Analyzing this topic has strong practical and policy meaning. Since promoting gender equity and empowering women are two of the most important goals in many countries, minimum wage law can be one useful policy tool to achieve these goals.

## LITERATURE REVIEW

This literature review consists of the following parts: minimum wage effects on income, labor force participation, and other determinants.

### **Minimum Wage and Income**

Research on the relationship between the minimum wage and the gender wage gap has mostly produced clear and consistent results. Most of the studies agreed that the minimum wage improved workers' income and narrowed the gender wage gap among the labor population.

For example, Overstreet found that a 1% increase in the minimum wage was correlated with a 1.13% increase in per capita income in Arizona. This result proved smaller increases in the minimum wage may not disturb the labor market but instead may lead to income growth (Overstreet, 2019). In addition, by using a database from China's Industrial Enterprise and the International Labor Organization, researchers showed that increasing the minimum wage was an effective measure to increase labor's income share and thus casted doubt on neoclassical explanations (Zhan, Zeng, Wang and Mu, 2019). However, other studies argued even if the minimum wage increased labors' income, the wage gap and income inequality would still exist and even became even wider. Using the National Occupation and Employment Survey, researchers demonstrated that minimum wage widened the gap in income earnings (Rodríguez, Bolívar and Reyes, 2019). Teal also found that the state's minimum wage did not impact that state's income inequality, all else held equal (Teal, 2019).

Concentrating on the gender wage gap, most of studies agree that the minimum wage is a useful tool to reduce the gender wage gap, but outcomes depended on various constraints. By using differences-in-differences estimation, Robinson concluded that there were variations in the

narrowing of the overall gender pay gap across regions, consistent with regional differences in the magnitude of low pay (Robinson, 2003). By analyzing minimum wage in urban China, Li and Ma concluded that minimum wage did help to reduce gender wage gaps (Li & Ma, 2015). The researcher also found after introducing a minimum wage in Macedonia, the gender wage gap was reduced by up to 23 percentage points (Angel-Urdinola, 2008).

### **Minimum Wage and Labor Force Participation**

Most researchers agreed that an increase in the minimum wage leads to a decrease in the labor force participation rate, especially among teenagers. By using quarterly data of labor participation rates, Wessels concluded that a 10 percent increase in the minimum wage would reduce the employment of teenagers by 1 to 3 percent (Wessels, 2001). From the empirical research results, the researcher showed that the minimum wage had a significant negative effect on teenage labor force participation rate and will reduce the value of entering the labor market (Wessels, 2005).

For the overall population effect, by using evidence from an individual-level panel, a researcher summarized that immediately following a minimum wage increase, labor force participation rate decreases (Boffy-Ranirez, 2019). However, few or no studies have focused on the relationship between minimum wage and female labor force participation rate.

### **Other Determinants of Women Competitiveness as Minimum Wage Changes**

#### ***Age***

For the age share of minimum wage workers, Turner found a disproportional share of those workers were teenagers (Turner & Demiralp, 2000). Also, by estimating a pseudo panel of

engagement, researchers found the increase of minimum wage would lead to a substitution effect between younger and older workers in the informal job sector (Mora & Muro, 2010).

### ***Occupation***

Using a bunching estimator, researchers found the overall number of low-wage jobs remained essentially unchanged over five years after a minimum wage increase, but there was evidence that tradeable sectors faced reduced employment (Cengiz, Dube, Linder and Zipperer, 2019).

### ***Marginal Workers***

Analyzing Germany's minimum wage, researchers found the minimum wage had no statistically significant effect on regular employment, but had a statistically significant negative effect on marginal employment (Bonin, 2018). This implied that marginal workers would be negatively influenced more than regular workers by a minimum wage change.

### ***Income***

Li and Ma's research proved that the minimum wage's positive effect was more obvious for the low-wage group compared to groups with higher income (Li & Ma, 2015).

### ***Employment***

The results of studies on minimum wage and employment are usually controversial. In neoclassical economics, the law of supply and demand states that by raising the price of a good, its demand would decrease. Therefore, neoclassical economists argue that raising the minimum wage will have negative effects on employment (Henry, 1979). Opponents of the minimum wage thus argue that raising the minimum wage makes low-skilled workers worse off as many of them will lose their jobs (Neumark and Wascher, 2010). However, other researchers hold an opposite

view of these points. For example, the influential study by Card and Krueger, by surveying fast food restaurants before and after a minimum wage increase, challenged the traditional prediction, arguing that the increase in minimum wage slightly increased the employment rate (Card and Krueger, 1993). Other studies concluded that there is no evidence to believe that there is an association between the minimum wage and employment rates (Cengiz, Dube, Linder and Zipperer, 2019). Turner also found that the negative employment effects of minimum wage, if any, appeared to be slight and difficult to detect (Turner, 2000).

### **The Current Study**

This review of the current literature suggests that: (1) most studies are confined to one country, and thus lack a worldwide comparison; and (2) for the research about the relationship between the minimum wage and the labor market, few focus on the gender aspect. However, as women occupy the vast majority low-wage jobs, it is essential to determine whether increasing minimum wage will pose a risk to their competitiveness. Therefore, given these drawbacks, my research plan is to focus on worldwide data, using OECD and the World Bank Group datasets to make comparison across countries and analyze the relationship between the minimum wage and female competitiveness in the labor market.

## THEORETICAL FRAMEWORK

To examine the relationship between minimum wage changes and women's competitiveness in the labor market, I develop the theoretical models described below. The models create a framework for a discussion of the factors that, in theory, influence the dependent variables, which consists of Gender Wage Gap and Female Labor Force Participation Rate.

$$\text{Gender Wage Gap} = f(\text{Minimum Wage, Control variables, } e) \quad (1)$$

$$\text{Female Labor Force Participation} = f(\text{Minimum Wage, Control variables, } e) \quad (2)$$

The logic of the model is that the minimum wage would ensure that members of the labor force receive reasonable payment and eliminates low pay work in the labor market. Raising the minimum wage could be seen as a positive signal for employees and an incentive for more individuals to enter the labor market. As for the gender wage gap, most studies agree that the minimum wage not only improve labors' income but also narrowed the gender wage gap. For the labor force participation, most researchers agreed that the increase in the minimum wage will lead to a decrease in the labor force participation rate, though the effect specified to women is still uncertain. Adding control variables helps to eliminate omitted variable bias and produce a more precise result.

## DATA AND DESCRIPTIVE STATISTICS

In order to estimate the relationship between the change in the minimum wage and women's competitiveness in the labor market, my research utilizes data from the World Bank Group and OECD. The World Bank Gender Statistics database is a comprehensive source for the latest data covering demography, education, gender equity and economic opportunities, with data records over 50 years. The OECD-Labor theme dataset contains annual labor force statistics for the 34 OECD Member countries plus China, Colombia, Brazil, and the Russian Federation.

The first primary dependent variable is derived from the OECD dataset. Gender wage gap is a continuous variable that provides the difference between median earnings of men and women. In my dataset, it has over 880 observations and about 18 years of records, with an average value of 14.32 US dollars. High income countries' gender wage gap is almost twice as wide as upper middle-income countries.

**Table 1. Descriptive Statistics of Gender Wage Gap**

Income Level	Mean	Std. Dev.
High Income	\$14.91	\$6.43
Upper Middle Income	\$8.26	\$6.14
Total	\$14.32	\$6.67

The second primary dependent variable is also derived from the OECD dataset. Labor force participation rate (female and male) is calculated as the labor force divided by the total working-age population by gender. Table 2 shows that the average female labor force participation rate is about 64.06% and the average male labor force participation rate is about 79.73%, so the average participation gender gap is around 15.67 percentage points. Countries with higher income levels tend to have higher female labor participation rates and a narrower labor force participation gender gap.

**Table 2. Descriptive Statistics of Labor Force Participation Rate**

Income Level	Gender	Mean (%)	Std. Dev.
High Income	Female	67.23	7.80
	Male	79.70	4.96
Upper Middle	Female	52.48	11.29
	Male	79.67	6.65
Lower Middle	Female	32.09	5.61
	Male	83.13	2.39
Total	Female	64.06	10.90
	Male	79.73	5.33

The independent variable of interest comes from the OECD dataset. Real minimum wage is statutory minimum wages that are converted into a common hourly pay for the 28 OECD countries and 4 non-member countries from which the data are available. As many countries in this dataset do not have a minimum wage law, I created a new Minimum wage dummy variable to see the difference between countries with and without the minimum wage law. Also, to better present the percentage change of the minimum wage, I converted Real minimum wage into a log function with the new variable named Log minimum wage. Table 3 shows that the average value of the real minimum wage is around 12,640.10 USD Purchasing Power Parity per year, with a constant tendency to increase over the most recent twenty years.

**Table 3. Descriptive Statistics of Minimum Wage**

Income Level	Real Minimum	Minimum Dummy	Log Minimum
High income	\$14,367.12	0.072	9.46
Upper middle	\$5,671.45	0.026	8.44
Total	\$12,640.10	0.028	9.25

Gender equity is one of the control variables I used in the regression. It was developed from three main parts: Job equity, Work equity and Law equity. These three are all dummy variables, so that each variable equal to one means that a law is in place guaranteeing that a female individual holds the same rights as a male individual. Job equity measured if a woman could get

a job in the same way as a man, and it increased from about 0.65 to 0.89 on average over the past fifty years. Work equity measured if women are able to work in the same industries as men and increased on average from 0.33 to 0.61 over the past 50 years. Law equity measured if the law mandates equal return for females and males for work of equal value, and its average value across countries increased 3 times on average by 2019 compared to the year 1970. Also, Gender equity is quite different among countries. Typically, higher income countries are more likely to have policies supporting gender equity.

**Table 4. Descriptive Statistics of Gender Equity**

Income Level	Job Equity	Work Equity	Law Equity
High income	0.90	0.50	0.31
Upper middle	0.83	0.48	0.13
Lower middle	0.75	0.33	0.10
Low income	0.57	0.30	0.17

Education is another control variable in the regression. It measured school life expectancy (from primary to tertiary) years for females. The average value is 10.74 years and increased on average from 6.56 years to 13.47 years over the past 50 years. High income countries have the highest average education years, around 13.95 years, followed by upper middle-income countries with about 11.95 years, and lower middle-income countries are the next, with about 8.85 years. Low-income countries are the lowest, with around 5.46 years of average education years.

**Table 5. Descriptive Statistics of Education**

Income Level	Mean	Std. Dev.
High Income	14.91	6.43
Upper Middle Income	8.26	6.14
Lower Middle Income	8.85	3.37
Low Income	5.46	3.17
Total	14.32	6.67

Another control variable is from the OECD dataset. Female marginally attached workers indicates persons aged 15 and over, neither employed, nor actively looking for work, but also are willing to or desire to work and are available to get a job. And they have looked for work during the past 12 months. The proportion in the dataset is around 7.03% for female marginally attached workers. Lower income countries tend to have larger proportion of female marginally attached workers.

**Table 6. Descriptive Statistics of Female Marginally Attached Workers**

Income Level	Mean (%)	Std. Dev.
High Income	6.81	4.30
Upper Middle Income	16.13	1.54
Total	7.03	4.48

Another set of control variables fall under the category of Employment. There are four categories of Employment: Agriculture, Self-employed, Industry and Service. These are all the questions about the female employment ratio in each named sector. For example, Agriculture indicates the proportion of female employment in the agriculture sector out of the total employment for females. On average, Agriculture, Self-employed and Industry sectors all faced a decline in recent years, while Service increased considerably in the past few years. For observed countries, due to development status differences, the proportions are not similar.

**Table 7. Descriptive Statistics of Female Employment**

Income Level	Agriculture (%)	Self-employed (%)	Industry (%)	Service (%)
High income	4.29	12.04	13.08	82.63
Upper middle	20.60	36.92	16.41	62.99
Lower middle	44.64	66.64	12.75	42.62
Low income	67.16	86.78	6.42	26.43

Last but not least is the GDP per capita control variable, derived from the World Bank Group and measuring the sum of marketed goods and services produced within a national

boundary, then averaged across everyone who lives within this country. Countries with higher GDP usually have higher GDP per capita, and as shown in Table 8, there is a huge gap between the high-income countries and upper middle countries.

**Table 8. Descriptive Statistics of GDP per Capita**

Income Level	Mean	Std. Dev.
High Income	\$55,693.14	\$28,451.17
Upper Middle Income	\$5,525.49	\$3,183.72
Low Middle Income	\$1,699.32	\$1,097.50
Low Income	\$581.34	\$325.10
Total	\$13,646.97	\$21,504.44

**Table 9. Descriptive Statistics**

Variable	Mean	Std. Dev.	Min	Max
Minimum Wage	\$1,2663.19	\$6708.273	\$538.8399	\$2,6252.45
Minimum Dummy	0.0285907	0.1666573	0	1
Log Minimum	9.260587	.6807988	6.289419	10.17552
Gender Wage Gap	\$15.19975	\$7.821309	\$0	\$41.65435
Marginal Workers	6.91151	4.357246	.0124256	29.65213
Male Labor Force	79.69756	5.209108	62.75142	91.83077
Female Labor	63.79709	10.7314	22.4	86.16512
Agriculture	30.23232	27.20972	0.008	96.767
Self-Employed	46.10668	31.60656	0.027	99.23
Industry Employ	13.13197	8.073606	0.276	63.147
Service Employ	56.63571	25.4477	1.605	98.67
Job Equity	0.7934392	0.404859	0	1
Work Equity	0.4190476	0.4934293	0	1
Law Equity	0.1862434	0.3893236	0	1
Education	10.74912	4.076039	0.36103	23.48418
GDP per capita	\$1,3646.97	\$2,1504.44	\$111.9272	\$18,9422.2

## EMPIRICAL MODEL

### Model 01

Dependent Variable =  $\beta_0 + \beta_1 \text{MinimumWageDummy} + \beta_2 \text{MarginalWorkers} + \beta_3 \text{GDP} + \beta_4$   
 $\text{GenderEquity01} + \beta_5 \text{GenderEquity02} + \beta_6 \text{GenderEquity03} + \beta_7 \text{Education} + \beta_8 \text{Employment} + \mu$  (3)

### Model 02

Dependent Variable =  $\beta_0 + \beta_1 \text{MinimumWage} + \beta_2 \text{MarginalWorkers} + \beta_3 \text{GDP} + \beta_4 \text{GenderEquity01}$   
 $+ \beta_5 \text{GenderEquity02} + \beta_6 \text{GenderEquity03} + \beta_7 \text{Education} + \beta_8 \text{Employment} + \mu$  (4)

### Model 03

Dependent Variable =  $\beta_0 + \beta_1 \text{LogMinimumWage} + \beta_2 \text{MarginalWorkers} + \beta_3 \text{GDP} + \beta_4$   
 $\text{GenderEquity01} + \beta_5 \text{GenderEquity02} + \beta_6 \text{GenderEquity03} + \beta_7 \text{Education} + \beta_8 \text{Employment} + \mu$  (5)

Equation 3 uses a Minimum wage dummy as the key independent variable, which equals 0 if the country has no uniform minimum wage and equals 1 if the country has a minimum wage law. I use it to estimate if the existence of minimum wage has an impact on the dependent variables. Equation 4 uses the level of the Minimum wage as the key independent variable. I use it to analyze how a one dollar change in the minimum wage relates to the dependent variables. The key independent variable of Equation 5 is the log transformation of minimum wage to better show the percentage change. I use it to estimate how a one percentage point change in the minimum wage is associated with changes in the dependent variables. I will compare the predictive power of Equations 4 and 5 to choose the more accurate one for further discussion.

The dependent variables include: Gender wage gap is the difference between median earnings of men and women; Female labor force participation rate is calculated as the female labor force divided by the total working-age population. Together these two variables are the measures of women's competitiveness in the labor market. I expect the relationship between the gender wage gap and minimum wage is negative, which means that an increase in the minimum wage would narrow the gender wage gap. The reason is discussed in the literature review section above: most scholars agree that increasing minimum wage is an important tool to eliminate gender wage gap and achieve gender equity. I would expect that the relationship between female labor force participation and minimum wage is positive, which means that an increase in the minimum wage would raise the female labor participation. The increase of the minimum wage can serve as a positive incentive for more women to enter the labor market and find a job.

Gender equity, Marginal attached workers, GDP per capita, Employment and Education are control variables. These variables have proved to be important variables when analyzing the relationship. Adding them will reduce omitted variable bias and improve prediction accuracy. In my expectation, I predict that variables such as GDP, Marginal attached workers, Education, Gender equity and Employment have a negative association with the Gender wage gap. Countries that are more developed and advanced tend to be more equal, to have higher education levels and thus these factors will lead to narrower gender wage gaps. I predict that GDP per capita, Gender equity, Employment, Education variables are all positively associated with Female labor force participation, because these control variables serve as positive incentives to attract more women enter the labor market. In the next section, I discuss my results from estimating these equations.

## RESULTS

I estimate indicator variable models (Minimum wage dummy as independent variable), continuous models (Minimum wage as independent variable) and log models (Log of minimum wage as independent variable) for two dependent variables, gender wage gap and female labor force participation rate. The continuous models and log models are similar to each other: both estimate how minimum wage changes relate to the dependent variables. After comparison, I found the results of the log models are more robust, and thus I concentrate on those. In addition, to better control for variables that are not in the regression, I used fixed effects models with the log of minimum wage as my independent variable.

For each table, three models are provided: Model 1 is the regression model of an indicator for minimum wage as the independent variable (that equals 1 if a country has a minimum wage for a year during the period 2001-2019 and zero otherwise) and controlling for other variables in the regression. Model 2 has the log minimum wage as the dependent variable, all else holding the same as the Model 1. Model 2 shows what happens if the minimum wage changes one percentage point, then how will the dependent variables react. Model 3 is the fixed effects model, which takes the log function of the minimum wage as the dependent variable and controls for all the variables that are fixed over time but vary across countries and all variables that are the same for all countries but change over time. For each model, standard errors are shown in parentheses underneath the coefficient on the corresponding independent variable listed. If  $p < 0.01$ , three stars are next to the coefficient. If  $p < 0.05$ , two stars are next to the coefficient. If  $p < 0.1$ , one star is next to the coefficient.

Table 10 shows the results of my regressions using Gender wage gap as the dependent variable. According to the Model 2 output, holding other variables in the regression constant, the log function of minimum wage has a negative association with the gender wage gap. This means an increase of the minimum wage would narrow the gender wage gap, and the results are statistically significant at the 0.01 level. The increase of the minimum wage of one hundred percentage points is associated with a 5.02 US PPP dollars narrower gender wage gap, holding other variables in the regression constant. The outputs are similar to those in the related literature. However, in contrast to this primary finding, for the fixed effects model, the log function of minimum wage has a positive relationship with the gender wage gap. In this case, the increase of the minimum wage of one hundred percentage points is associated with about a 9.48 US PPP dollars wider gender wage gap, holding other variables fixed over time and fixed across countries constant. The signs are significantly different from each other, and this may result from the factors beyond current control such as the inflation rate, the peace index and need further analysis to determine the result that is accurate.

Table 11 shows the results of my regressions using the Female labor force participation rate as my dependent variable. Holding other variables in the regression constant, the existence of a minimum wage has a negative relationship with the female labor force participation rate. Compared to countries without a minimum wage, countries with a minimum wage have about a 2.38 percentage point lower female labor force participation rate. This may be due to the fact that most countries without a minimum wage are countries that are highly developed and wealthy, and thus women are more encouraged to work. In contrast, holding other variables in the regression constant, the log function of the minimum wage has a positive association with the

female labor force participation rate. This indicates that an increase in the minimum wage would attract more women to enter the labor market. In this model, a one percentage point increase in the minimum wage is associated with about a 3.22 percentage point increase in the female labor force participation rate. Though the result is not statistically significant at conventional levels, the sign of the fixed effects model also shows that the minimum wage has a positive relationship with the female labor force participation rate. This strongly support the log model's conclusion.

For these two independent variables, some control variables are also statistically significant. The Gender wage gap is negatively associated with GDP, Education and Work equity, and positively correlated with Law equity and Female labor force participation rate. Taking the log model as an example, though the result is not substantively important, a one dollar increase in the gender wage gap is associated with a 0.001 dollar increase in GDP per capita. A one dollar increase in the gender wage gap is associated with 1.43 less years at school for women. This may arise because countries with larger gender wage gaps are less developed countries, and thus educational attainment is not as high as highly developed countries with narrower gender wage gaps. Also, larger gender wage gaps hinders work equity for women. The Female labor force participation rate is positively associated with GDP, Education, Gender wage gap, Law equity and Work equity, and negatively related to Self-employed. Taking the log model for instance, the increase of female labor force participation is correlated with countries promoting work equity and law equity, perhaps because women serve more and more important roles in the society and economy. The relationship between female labor force participation and gender wage gap is also positive, indicating that as female labor force participation increases by one percentage point, the gender wage gap increases about 0.005 dollars.

**Table 10. Dependent Variable: Gender Wage Gap**

	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>
Dummy Min Wage	1.19284	---	---
Log Min Wage	---	-5.01514**	9.14098**
GDP	-.00014***	-.00001***	.00001
Marginal Workers	-.10901	-.25836	.04459
Education	-1.61064***	-1.42552**	-.29993
Female Labor Force Participation Rate	.34129***	.40161***	.18321
Work Equity	-2.96112***	-3.80118***	0.158641
Law Equity	2.53446***	1.94136**	-3.00306**
Agriculture-employed	-466.8802	-659.0868	-589.0003*
Self-employed	-.018227	-.13227	-.22685
Industry-employed	-466.925	-659.5089	-588.4291
Service-employed	-466.5858	-659.0333	-589.0733
Constant	46688.67	65975.51	58829.59
R-squared	0.4230	0.5625	0.5182
Observations	267	187	187
F-statistics			4.57

Level of statistical significance: \*  $\leq 0.05$ ; \*\*  $\leq 0.01$ ; \*\*\*  $\leq 0.001$

**Table 11. Dependent Variable: Female Labor Force Participation**

	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>
Dummy Min Wage	-2.38295*	---	---
Log Min Wage	---	3.22245^	2.16507
GDP	.00008**	.00003	-.00004
Marginal Workers	-.067262	.12870	-.07722
Education	.78885***	.74156	.23670
Gender Wage Gap	.32737***	.46961***	.08331
Work Equity	4.91121***	5.16602***	.19302
Law Equity	2.93566***	3.09852**	0.45781
Agriculture-employed	86.88428	171.643	185.1722
Self-employed	-.49242***	-.169522	-.49055***
Industry-employed	86.67068	172.0463	184.58
Service-employed	86.77199	171.9015	184.5781
Constant	-8628.447	-17181.73	-18418.81
R-squared	0.7024	0.6435	0.7241
Observations	267	187	187
F-statistics			13.0

Level of statistical significance: \* <=0.05; \*\* <=0.01; \*\*\*<=0.001

## CONCLUSION

Using the World Bank Group and OECD panel datasets for the period 2001 to 2019, I set out to study the relationship between minimum wage changes and women's competitiveness in the labor market. The measures of women's competitiveness are the gender wage gap and the female labor force participation rate. I hypothesized that since women occupy a larger proportion of low-paid jobs, an increment in the minimum wage would narrow the gender wage gap. Also, an increase in the minimum wage could be a positive incentive for more women to enter the labor market and raise the female labor force participation rate.

Controlling for variables measuring Education, GDP, Employment, Gender equity, Marginally attached workers in my OLS regressions and for fixed effects variables for the fixed effects regressions, the following are my findings:

First, the effects of minimum wage changes on the gender wage gap remain ambiguous; My two models return contradictory results. Taking the model that only considers the control variables that I manually added, the gender wage gap has a negative relationship with a minimum wage change. The result is similar to my hypothesis and previous researchers' results. However, my fixed effect model presents the opposite result. This difference may result from a potential omitted variable bias in my OLS model.

Second, the effects of minimum wage changes on female labor force participation are similar to my hypothesis: The two variables have a positive relationship with each other. The increase in the minimum wage appears to attract more women enter the labor market and find a job. The minimum wage increase thus can be seen as a positive signal here. My findings lead to the following policy recommendations.

First, a uniform minimum wage does not seem to be the most suitable method to improve women's competitiveness and support gender equity in the labor market. This is because the minimum wage increase does not correlate with a constant and convincing result in narrowing the gender wage gap. Also, even though the relationship between the minimum wage and female labor force participation is positive, it has such a small magnitude as to be negligible. Holding other variables constant in the regression, female labor force participation could be improved three percentage points if the minimum wage increased by one hundred percentage points. This seems unrealistic and other policy methods may be more helpful and effective in increasing female labor force participation rate.

Second, although not discussed in this paper, many other papers have cast doubt on the idea that increasing the minimum wage will lead to a decrease in demand for workers, and thus the employment rate will be negatively affected. In addition, though all countries that I researched have increased their minimum wage over time, the relative poverty gap is still a concern, especially for women in low-income industries and in poverty. Therefore, perhaps other economic policies should be formulated to improve gender equity in the labor market. For example, in some countries, minimum wage laws are adjusted according to the different industries, regions, and standards.

Finally, my study contains several limitations. The results should not be used to determine whether there is any causation between minimum wage change and women's competitiveness in the labor market, even within my sample. There is correlation between these variables, but the true minimum wage effects on the dependent variables remain difficult to detect due to the omitted variable bias. Also, since only the OECD has included a minimum wage variable in a

dataset and only since 2001, my data are limited, the number of the observations are limited and most countries are high income countries, with a few upper middle-income countries. Therefore, the representativeness of the countries in my dataset is restricted. The number of my control variables is also confined.

For further study and research could consider adding additional relevant variables into the analysis, such as the global peace index, inflation rates, and the consumer price index to reduce omitted variable bias. Plus, my method of variable measurement can also be considered a limitation of the study. For an instance, even though some countries do not have a uniform minimum wage, there are still minimum wage laws in different industries. This should be taken into account to accurately represent the country's minimum wage result.

## REFERENCES

- Angel-Urdinola, D. (2013). Can The Introduction Of A Minimum Wage In FYR Macedonia Decrease The Gender Wage Gap? : Can The Introduction Of A Minimum Wage In FYR Macedonia Decrease The Gender Wage Gap?
- Boffy-Ramirez, E. (2019). The Short-Run Effects of the Minimum Wage on Employment and Labor Market Participation: Evidence from an Individual-Level Panel.
- Bonin, H. (2019). The German Statutory Minimum Wage and Its Effects on Regional Employment and Unemployment.
- Boockmann, B. (2009). The Combined Employment Effects of Minimum Wages and Labor Market Regulation – A Meta-analysis.
- Card, D. & Krueger, A. (1993). Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania.
- Catalyst. (2020). Women in the Workforce – Global: Quick Take.
- Cengiz, D., Dube, A., Linder, A. & Zipperer, B. (2019). The Effect of Minimum Wages on Low-Wage Jobs: Evidence from the United States Using a Bunching Estimator.
- Henry, H. (1979). Economics in One Lesson.
- Hoffman, S. (2015). Are the Effects of Minimum Wage Increases Always Small? A Reanalysis of Sabia, Burkhauser, and Hansen.
- International Labour Conference. (2014). General Survey of the reports on the Minimum Wage Fixing Convention, 1970, and the Minimum Wage Fixing Recommendation, 1970.

International Labour Organization. How many different minimum wage rates should there be?

Congressional Budget Office. How Increasing the Federal Minimum Wage Could Affect Employment and Family Income.

Kelly, J. (2019). The Unintended Consequences Of Raising Minimum Wage To \$15.

Li, S. & Ma, X. (2015). Impact of Minimum Wage on Gender Wage Gaps in Urban China.

Mora, J. & Muro, J. (2014). Informality and Minimum Wages by Cohort in Colombia.

National Women Center. Low-wage Jobs.

Neumark, D. & Wascher, W. (2010). Minimum Wages.

Overstreet, D. (2019). The Effect of Minimum Wage on Per Capita Income in Arizona: Empirical Analysis.

Robinson, H. (2003). Regional evidence on the effect of the National Minimum Wage on the gender pay gap.

Rodríguez, T., Bolívar, H.& Reyes, A. (2020). Impacts of the minimum wage and informal employment on income earnings in Mexico.

Rudolf, K (1928). Minimum Wage Legislation in Various Countries: Bulletin of the United States Bureau of Labor Statistics.

Sabia, J. (2015). Do Minimum Wages Stimulate Productivity and Growth?

Shannon, M. (1996) Minimum Wages and The Gender Wage Gap.

Teal, A. (2019). Assessing the Impact of Minimum Wage on Income Inequality.

The Leadership Conference Education Fund (2018). Why We Need to Raise Wages for America's Lowest-Paid Families.

Turner, M. & Demiralp, B. (2000). Effects of Higher Minimum Wages on Teen Employment and School Enrollment.

Wessels, W. (2001). The Effect of Minimum Wages on the Labor Force Participation Rates of Teenagers.

Wessels, W. (2005). Does the minimum wage drive teenagers out of the labor force?

Yellen, J. (2020). The History of Women's Work and Wages and How It Has Created Success for Us All.

Zhan, Q., Zeng, X., Wang, Z. & Mu, X. (2020). The influence of minimum wage regulation on labor income share and overwork: evidence from China.