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Pay Inequality Between the Two Genders

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Abstract

This thesis consists of three chapters that investigate the influence of wage differentials between the two genders on economic growth.

In the first chapter, we explain how we used the generalized method of moments (GMM) analysis technique to estimate the relationship between the gender wage gap and economic performance for an unbalanced panel data for both OECD and European countries during the period 1980–2015. The results show that an increase of 1% in wage inequality between the two genders leads to a 0.002% decrease in the economic growth rate per capita in the case of OECD countries and a 0.003% decrease in the case of European countries. The relationship is statistically significant at 5% and 10% for each of the country groups respectively, which is consistent with previous studies.

In the second chapter, we show how we tried to address the institutional changes that might have an important impact on women's access to education, property, land, employment and so forth, which in turn influence gender wage inequality. We used the two-stage least squares (2SLS) analysis technique to estimate the relationship between the gender wage gap and economic performance. To control for potential endogeneity in the model, we instrumented the gender wage gap using data on legal restrictions on women. We took the restrictions on women into account in the analysis because they shape social and economic opportunities for males and females and affect females' independence in taking decisions. As the data on legal restrictions on women include many variables, this study used principal components analysis (PCA) to transform a large set of possibly correlated variables into a smaller set of uncorrelated variables. The results show that there was no significant difference between the gender wage gap and gross domestic product (GDP) per capita in the developing countries, which can be attributed to institutional changes deficiencies, and which contradicts the existing literature.

In the third chapter, we describe how we tried to move beyond the characteristics of individuals and consider the importance of firms or workplaces in explaining the wage

differentials between the two genders. We used descriptive analysis techniques to analyse gender wage gap movement, according to firms' characteristics such as profitability, productivity and age. In addition, we strived to determine the source of the gender wage gap in economic sectors by using cross-sectional data for UK firms of 250 employees and more for the year 2017. Also, the study used the probit analysis technique to investigate how UK firms' characteristics affect firm's compliance with the government regulation which requires employers of 250 employees or more to publish their gender wage gap data. The results show that the average gender pay gap in such firms was less than the national gender wage gap in UK firms, which means that the gender pay gap in small firms was higher than in large firms. Moreover, the results show that most of the gap between the two genders comes from within firms in all sectors. Furthermore, we found that the wage gap between the two genders increases with firms' increasing profitability, productivity and age. In addition, the results indicate that females are less likely to work for the most productive firms. Also, women are still under-represented in senior positions in UK firms, while the proportion of females in senior jobs is inversely related to firms' productivity. Finally, we found that with higher age and firm's liquidity ratio, the firms will be more likely to comply with the government regulation which requires employers of 250 employees or more to publish their gender wage gap data. In addition, the results showed that with increasing profits and firms' productivity, the firms will be less likely to publish the gender wage gap data.

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Introduction

The reduction of gender inequality is an important matter concerning economists and social scientists, not only because of its well-being dimensions but also because it has various economic impacts.

Many studies have emphasized the importance of human capital as an economic determinant; the inclusion of human capital in economic models was achieved through the Solow model, and, moreover, human capital can be incorporated into the endogenous growth model (Romer, Weil and Mankiw, 1992). Lucas (1988) introduced a definition of human capital as a general skill level, and he pointed out that human capital can contribute to production growth by increasing productivity and technological improvements. In addition, Romer (1990) pointed out that human capital contributes to improving technical progress through knowledge accumulation. Hence, many kinds of theoretical literature have started to point out that inequality between the two genders will be harmful to economic growth through misallocation of resources (Pervaiz and others, 2011).

However, the relationship between gender inequality and economic growth is complex, because gender inequality has direct and indirect pathways that impact on growth. The direct effect revolves around the optimum use of labour in an economy and the extent to which inequality between the two genders reduces the quality of human capital and the average productivity of labour in the economy. Klasen (1999) identified two pathways through which this effect could happen. The first is premised on the assumption that innate abilities and talents are randomly distributed between males and females, so equality in the distribution of resources between the two genders will maximize the productivity of the human capital available in the economy. This means that gender inequality in education, employment and wages gives males who are less able than their female counterparts a better chance of being educated and employed or even getting more wages than females, and this would produce human capital with lower productivity in the economy and result in a reduction in economic growth. The second is premised on the assumption that women tend to spend more of

their income on children's health, nutrition and education, which can contribute to development in the long run by increasing the productivity of the next generation.

The indirect effects relate largely to various positive externalities associated with improving and facilitating women's access to education, health and work, which influence mortality and fertility. Promoting women's education is associated with reducing fertility and mortality levels, in addition to increasing the education of the next generation (Klasen and Lamanna, 2009). The impact of gender inequality in education is not limited to its impact on economic growth through human capital; it also has an impact on investment. Female education might have an impact by increasing the returns on investments, which in turn would lead to an increased investment rate in the economy (Klasen, 1999; 2002; 2006).

Adopting a broader perspective, Lai and Wan (2013) and Rasekhi and Hosseinmardi (2012) argued that the relationship between female education and international competitiveness would influence economic growth. They found that female education has a positive impact on economic growth through international competitiveness; in addition, they showed that many East Asian countries use a strategy that depends on intensive use of women's labour in export manufacturing industries, and they have been able to compete in the world market.

There is also persuasive evidence that females' employment contributes to growth. Esteve-Volart (2004) showed that reducing employment opportunities for females might distort the economy as gender discrimination in education does, by reducing the pool of talented workers that employers can select from, which results in a reduction in the average ability of the labour force in the economy. In addition, gender inequality in employment can affect economic growth through demographic effects, by increasing the fertility rate (Cavalcanti and Tavares, 2007).

There is greater disagreement about the influence of the gender wage gap on economic performance; this reflects the fact that the influence of gender inequality in wages probably varies with income level and the structure of the economy. However, there are some studies that investigate the relationship between the gender wage gap and economic growth. These studies are quite divided. On one hand, studies by Cavalcanti and Tavares (2007), Day (2012), the World Bank (2011) and Galor and Weil (1996)

have asserted that an increase in gender wage inequality will reduce economic growth. This is because the inequality between the two genders in terms of wages reduces female participation in the labour market; also, it increases the fertility rate, which results in a decrease in economic growth. In contrast, Seguino (2000a) indicated a different mechanism, leading to opposing results. Seguino suggested that high gender wage inequality increases the international competitiveness of export-oriented economies, which boosts economic performance for these countries.

The studies have identified a number of variables that might cause wage inequality between the two genders. These factors were classified as observable and non-observable characteristics; the observable characteristics included experiences, education, marital status, age, hours worked, and field of study. Blau and Kahn (2006) noted that while the gender wage gap has decreased over time, a proportion of that gap is not explained by an increase in human capital factors. Moreover, Hanushek and Woessmann (2010) pointed out that while human capital factors explain a significant part of the gender wage gap, the analysis leaves a proportion of gender wage gap unexplained. However, the unexplained portion of the gender wage gap relates to the impact of unobservable variables, including discrimination against females in the labour market. Furthermore, firms' wage policies may contribute to the wage gap between the two genders when females' wage negotiations skills fall short of men's, or if females are not working in high-paying businesses. Females tend to work at less productive firms that offer their employees lower wages, which results in a higher poverty rate and lower female participation in the labour market, which reduces economic growth.

It is important to indicate that it is very difficult theoretically to separate the influences on gender inequality in employment, education and wages. In fact, most of the models state that inequality between the two genders in one dimension tends to lead to gender inequality in other dimensions, because the causality works' in both directions (Klasen and Lamanna, 2008).

However, this thesis investigates the impact of gender pay inequality on economic performance by applying different analysis techniques to two groups of countries: OECD and developing countries; in addition, it explores how females' and males'

wages vary with firms' characteristics such as profitability, productivity and age in the UK.

The first chapter explores the relationship between the gender wage gap and economic growth. Also, it shows that there are a few channels by which gender wage inequality can influence economic performance. Gender pay differentials affect females' income, which in turns discourages them from participating in the labour market, which can lead to decreased growth by decreasing labour force participation and productivity. In addition, it impacts on economic growth by decreasing fertility because higher wages for females lead to an increase in the opportunity cost of having children, which reduces the number of children in the household, which lowers population growth, increases capita per worker and increases economic growth (World Bank, 2011; Day, 2012; Galor and Weil, 1996). Moreover, due to inequality in wages, parents will probably invest less in the education of girls relative to boys, which is likely to reduce female participation in the labour market in future and as a result lower income for families. Decreasing family income will adversely affect children's well-being, health, educational attainment and productivity and hence reduce economic growth (Morrison and others, 2007).

To estimate the relationship between the gender wage gap and economic growth, and as described in chapter 1, we used the generalized method of moments (GMM) technique, proposed by Arellano and Bond in 1991, to analyse an unbalanced panel data for OECD countries during the period 1980–2015. We used the lagged period for the gender wage gap variable in order to avoid the endogeneity problem. The results show that a decrease in the wage gap of 1% leads to a 0.002% increase in the economic growth rate per capita; this relationship is statistically significant at 5%. This means that a low gender wage gap encourages females to participate in the labour market, thus increasing economic growth by increasing productivity and labour force participation. In addition, higher wages for females lead to lower fertility rates by delaying marriage, as well as an increase in the opportunity cost of having children, which reduces the number of children in the household (Galor and Weil, 1996). Reduction in fertility lowers population growth, increases capita per worker and increases economic growth (Day, 2012; World Bank, 2011).

However, the results of Arellano and Bond's GMM technique for European countries are consistent with our results for OECD countries for the same analysis technique: the empirical work shows that an increase in wage inequality between the two genders of 1% leads to a 0.003% decrease in the economic growth rate per capita. This relationship is statistically significant at 10%. Both of our set of results, for OECD countries and European countries, are consistent with those of Day (2012), Pervaiz and others (2011), World Bank (2011) and Vidyattama and others (2009).

To check for robustness, this study included additional explanatory variables: growth rate of the population, public expenditure as a percentage of gross domestic product (GDP), and enrolment rates of tertiary schools in OECD countries and European countries. The sign for the gender wage gap remains the same for Arellano and Bond's GMM analysis technique. However, the quantitative impact of gender wage inequality on the economic growth rate per capita indicates presents a small degree of sensitivity in the model. Hence, providing women with proper access to education and employment, and also equal wages, could increase economic growth in the long run.

In the second chapter, we state that addressing gender inequality in a country requires knowledge of the roots of discrimination. Most studies use indicators that measure inequality between the two genders in terms of access to employment, political representation, healthcare, education and wages. But the fundamental problem of these indicators is that they measure the results of the inequality rather than trying to understand its underlying causes (Jütting and Morrisson, 2005). Also, these indicators ignore the institutional changes that guide the behaviour of humans and hence the treatment of women (Jütting and Morrisson, 2005). Ignoring the institutional changes that are represented by customs, norms, traditions, explicit or implicit laws, and codes of conduct can hurt or reduce the usefulness of any policy aimed at empowering women. Therefore this chapter assumes that institutional changes have an important impact on women's access to education, property, land, employment and so forth, which in turn influence gender wage inequality; in other words, improper access for women to various resources will be adversely reflected in their wages, which will negatively affect economic growth.

To analyse the relationship between the gender wage gap and economic growth, this study used an unbalanced panel data for 58 developing countries during the period 2006–2016. To control for potential endogeneity in the model, we instrumented the gender wage gap using data on legal restrictions on women. Then, to estimate the relationship between the gender wage gap and economic performance, we used the two-stage least squares (2SLS) analysis technique. This technique is considered to be an extension of the ordinary least squares method. The 2SLS method allowed us to deal with a model that has some endogenous variables between its explanatory variables in a linear regression framework. As the data on legal restrictions on women include many variables, this study used principal components analysis (PCA) to transform a large set of possibly correlated variables into a smaller set of uncorrelated variables. The results show that there was no significant difference between the gender wage gap and GDP per capita in the developing countries, which can be attributed to the institutional changes deficiencies, and which contradicts the existing literature.

To check for robustness, this study included additional explanatory variables: female labour force participation, the ratio of women to men in parliament, and foreign direct investment as a percentage of GDP. The signs for variable coefficients remain the same for the first and second stages of analysis. However, the quantitative impact of gender wage inequality on the economic growth rate per capita indicates presents a small degree of sensitivity in the model.

There is a growing body of literature that has moved beyond characteristics of individuals and considers the importance of firms or workplaces to explore pay differentials between the two genders, for example Simón and Russell (2005) and Heinze and Wolf (2010). According to this research, firms play an essential role in creating and sustaining inequality between the two genders through their recruitment policies, training practices and distributing of employees (Heinze and Wolf, 2010). As described in chapter three, we have tried to contribute to the literature by moving to the workplace and exploring how females' and males' wages vary with firms' characteristics such as profitability, productivity and age, and why wages differ between males and females in firms. In chapter 3 we also analyse the impact of wage

transparency policies on the gender wage gap in UK firms in narrowing the wage gap between the two genders.

To achieve the study's purpose, the work in chapter 3 utilized new data on gender pay inequality for UK firms. The UK government issued a new regulation in April 2017 that requires employers of 250 employees or more to publish their gender wage gap data. This policy is considered part of the attempt to reduce workplace discrimination. This chapter uses the wage decomposition analysis technique to explore the sources of the gap in wages between the two genders and to decide whether the causes of wages differentials come from across firms or from within firms.

Chapter 3 found that the average wage gap between the two genders for firms with at least 250 employees was 14.33%, less than the national gender pay gap in the UK in 2017. This indicates that the gender pay gap in small firms was higher than in large firms in the UK. In addition, it shows that most of the gap between the two genders across all sectors comes from within firms, as the ratio of the gap within firms is 61.8% for 2017 year.

To analyse how the wage gap between the two genders varies with firms' characteristics, we matched the data on the gender wage gap with the financial data for UK firms. Due to the nature of the available data, this study followed descriptive analysis techniques for cross-sectional data for UK firms for the year 2017. This approach captures a specific point in time. The descriptive analysis results for the data of UK firms show that the average gender wage gap for firms with at least 250 employees dropped from 14.33% in 2017 to 14.21% in 2018. A probable cause of this decline is that of wage transparency policies. Moreover, we found that gender wage gap increases is positively related to firms' profitability, productivity and age. In addition, the results state that females, compared to their male counterparts, are less likely to work for the most productive firms and more likely to work in the least productive firms. This is supported by the fact that females are over-represented in the hospitality and retail sectors, which tend to have lower productivity than other sectors. Furthermore, we found that females are still under-represented in senior positions in UK firms, where the proportion of females in senior jobs decreases when the firms' productivity increases. Similarly, we found that females are more likely to work in the

least profitable or oldest firms. In addition, the results show that females are still under-represented in senior positions in these firms. Finally to investigate how UK firms' characteristics affect firm's compliance with the government regulation which requires employers of 250 employees or more to publish their gender wage gap data. The results showed that with higher age and firm's liquidity ratio, the firms will be more likely to publish their gender wage gap data. In addition, the results showed that with higher profits and firms' productivity, the firms will be less likely to publish the gender wage gap data.

This thesis is divided into three chapters. The first chapter traces the impact of gender inequality on economic growth for OECD countries. Chapter two explores the impact of the gender wage gap on economic growth in an empirical study on developing countries. The gender wage gap and characteristics of UK firms for 2017 are explored via descriptive analysis in chapter three.

Chapter 1

The Impact of Gender Inequality on Economic Growth: An Empirical Approach for OECD Countries

1.1. Introduction

Gender inequality is pervasive among countries worldwide, according to the Economic World Forum 2015 report. No country in the world has fully closed the gender gap, the highest-ranking country has closed 88% of the gender gap, while the lowest-ranking country has closed 48% and the average global gender gap is 69.5%. The Global Gender Gap Index includes indicators of economic participation, political empowerment and educational attainment, and health criteria.

The reduction of gender inequality is an important matter concerning economists and social scientists, not only due to its well-being dimensions but also because it has different economic impacts. Gender inequality not only deprives women of basic freedom but also adversely affects development outcomes for society. For instance, if women do not have proper access to education and employment and also do not receive equal wages, this will adversely affect the education of the next generation and their health as well, which in turn decreases economic growth through its effect on productivity (King, Klasen, and Porter, 2008; Klasen and Lamanna, 2008; Abu-Ghaida and Klasen, 2004; World Bank, 2001).

Figure 1. 1
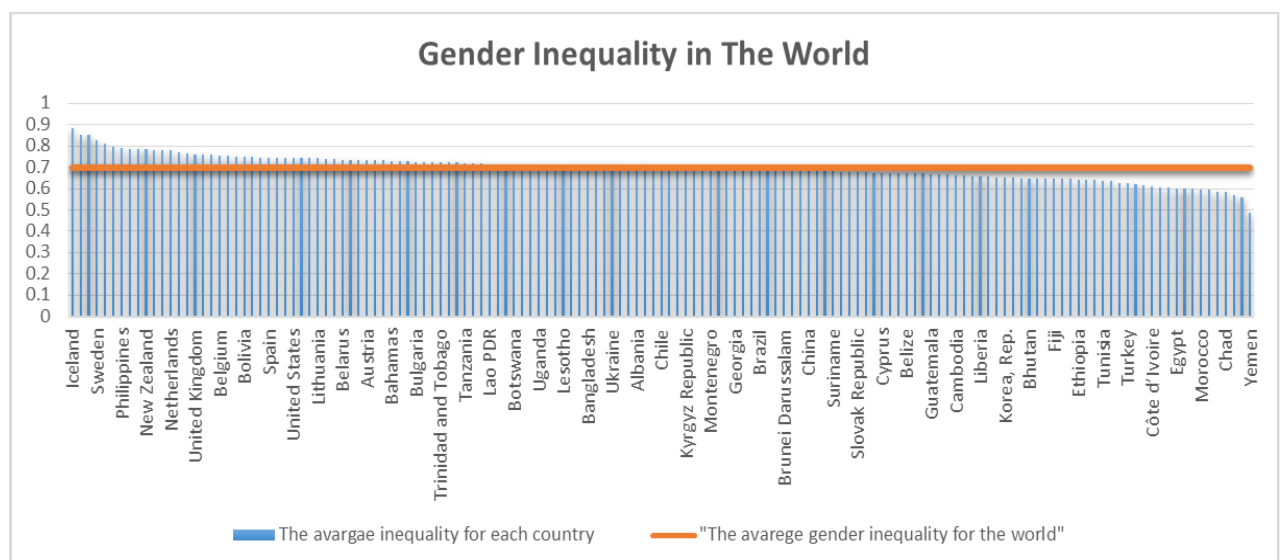
Source: World Economic Forum 2015

The relationship between economic growth and gender disparity is considered complex and not conclusive. Some studies have found a negative relationship between a gender gap in education and economic performance

 (Tansel and Gungor, 2013; World Bank, 2011; King and others, 2008; Forbes, 2000; Hill and King, 1995; Benavot, 1989); these studies argued that female education is useful to economic growth through reduction in fertility and the positive influence of mothers' education on the later generation. By contrast, Barro (1995) and Barro and Lee (2001) found a positive relationship between gender inequality in education and economic growth.

To unveil the relationship between gender inequality and economic performance, a considerable amount of literature has been published. These studies have used various methods and techniques to estimate this relationship, and some of them have used microeconomic or macroeconomic models to explain the relationship between the two variables in the short run or long run. Most of the studies or papers in this field have concentrated only on exploring the impact of inequality in education and employment on economic growth, whereas far too little attention has been paid to investigating or to explaining the impact of gender pay inequality on economic growth; in addition, most of the existing studies in this field have used a single country to estimate this relationship. However, this study attempts to contribute to the literature by providing new evidence on the impact of gender inequality on economic growth by using the gender wage gap as a proxy for discrimination.

There are a few channels by which gender wage differentials can influence economic performance. The wage inequality between the two genders affects females' income, which in turns discourages them from participating in the labour market, which can lead to decreased growth by decreasing labour force participation and productivity. In addition, due to the inequality in wages, parents will probably invest less in the education of girls relative to boys, which is likely to reduce female participation in the labour market in the future and as a result lower income for families. Decreasing family income will adversely affect children's well-being, health, educational attainment and productivity and hence reduces economic growth (Morrisson and Jütting, 2005).

Moreover, gender wage inequality might negatively affect the bargaining power of women in their families. Since women are culturally responsible for children's education and well-being, future generations' learning and abilities might suffer, leading to a decrease in economic growth (Pervaiz and others, 2011). Another argument traces the effect of the gender wage gap on fertility. Higher wages for females lead to an increase in the opportunity cost of having children, which reduces the number of children in the household (Galor and Weil, 1996). In addition, the gender wage gap may lower fertility by delaying marriage. Reduction in fertility lowers population growth, increases per capita worker and increases economic growth (Day, 2012; World Bank, 2011). Finally, females tend to spend more of their income on children's health and education, which can contribute to development in the long run. Therefore, when the gender wage gap between males and females is reduced, one can expect more spending to be allocated to investment in human capital and other productivity-enhancement channels that increase economic growth in the long run (Pervaiz and others, 2011).

To estimate the relationship between the gender wage gap and economic growth, this study used the generalized method of moments (GMM) technique, which was proposed by Arellano and Bond in 1991, for an unbalanced panel data set for Organisation for Economic Co-operation and Development (OECD) countries during the period 1980–2015. The results show that an increase of 1% in the wage gap leads to a 0.002% decrease in economic growth rate per capita, and this relationship is statistically significant at 5%. In addition, the results of Arellano and Bond's GMM technique for European countries are consistent with our results for OECD countries for the same analysis technique, in that the empirical work shows that in the European countries an increase of 1% in wage inequality between the two genders leads to a 0.003% decrease in economic growth rate per capita. This relationship is statistically significant at 10%. These results are consistent with those of Day (2012), Pervaiz and others (2011), the World Bank (2011) and Cassells and others (2009).

The rest of the chapter is structured as follows:

The second section traces the existing literature related to the relationship between the gender pay gap and economic growth. Section three presents the importance of gender

equality to economic growth. Section four discusses the reasons for the gender wage gap. Section five discusses the methodology. Data are presented in section six. Section seven presents the empirical estimations and the results and concludes the chapter.

1.2. Related Literature

Numerous studies since the early 1970s have investigated the relationship between gender inequality and economic development. The relationship between the two variables is considered complex and inconclusive. For instance, some studies have shown a negative relationship between education gaps and economic growth (Tansel and Gungor, 2013; World Bank, 2011; King and others, 2008; Forbes, 2000; Hill and King, 1995; Benavot, 1989); these studies argued that female education is useful to economic growth through a reduction in fertility and the positive influence of mothers' education on the later generation. However, Barro (1995) and Barro and Lee (2001) argued that gender disparity in education has a positive impact on economic growth.

In addition, researchers who have studied the relationship between inequality in labour force participation and economic growth have found a negative impact between the two variables (ILO, 2015; Thévenon and others, 2012; Klasen and Lamanna, 2008; Esteve- Volart, 2004).

While there are many studies that discuss gender inequality in education and labour force participation and its effect on economic performance, few studies have investigated the impact of the gender pay gap on economic growth (Cassells and others, 2009; Busse and Spielmann, 2006; Seguino, 2000a).

A study by Cassells and others (2009) used a growth model to estimate the impact of the gender pay gap on Australian economic performance for the period 1990–2008. They found that an increase of 1% in the gender wage gap is expected to reduce GDP by 0.5%. Similarly, Kennedy and others (2017) found that reducing the gender wage gap by 10% can increase per capita output by up to 3% in Australia. Cabegin (2012) reported that gender wage inequality is sensitive to economic performance. It decreases as economic growth increases, and it widens with a deceleration of growth. In contrast to Cassells and others (2009) and Kennedy and others (2017), Oginni and

others (2014) found a positive relationship between the gender wage gap and economic performance in Nigeria.

Adopting a broader perspective, Seguino (2000a) argued that the relationship between gender pay inequality and economic growth would increase international competitiveness. She pointed out that gender wage inequality can stimulate economic growth through export expansion. The mechanism of this effect is as follows: if women work in the export production sector and this sector produces labour-intensive goods, then lower wages would stimulate competitiveness in this sector and lead to an expansion in exports. In a comparable way, the gender pay gap might increase investment. This view is supported by Busse and Spielmann (2006), who confirmed the positive relationship between gender disparity and trade openness in a sample consisting of 92 developing and developed countries. They showed that countries with a higher gender pay gap export more labour-intensive goods. Similarly, Erturk and Cagatay (1995) pointed out that a gender wage gap will result in lower labour unit costs and so stimulate investment. In the same vein, Standing (1999) indicated that globalization has induced companies to employ more female in order to become more competitive. Conversely, Schober and Winter-Ebmer (2011) reported that the relationship between the gender wage gap and economic growth is not positive.

In the same context, Oostendorp (2004) used a cross-country regression that included more than 80 countries during the period 1983–1999 to explore the impact of globalization on the gender wage gap. He found that occupational gender wage inequality decreased with higher GDP per capita. In addition, he found that occupational gender wage inequality is negatively associated with trade and foreign direct investment (FDI) for low-skilled occupations in both poorer and richer countries. Moreover, the researcher found the same results when he reinvestigated the relationship between globalization and the gender wage gap (Oostendorp, 2009). Likewise, by using ordinary least squares (OLS) analysis for time series data for India for the period (1983–2004), Menon and Rodger (2009) found a negative relationship between trade openness and gender wage disparity. This view was supported by Villalobos and Grossman (2010) and Chen and others, (2013).

In the same vein, Rasekhi and Hosseinmardi (2012) examined the impact of globalization on gender wage inequality for 21 selected developing countries during 2000–2007; by using a panel data technique they found that globalization reduces the gender wage gap and also showed that the increase in education level and the Human Development Index (HDI) led to a decrease in gender wage inequality.

Furthermore, other researchers have traced the effect of the gender wage gap on fertility. Galor and Weil (1996) showed that reproductive decision-making depends on the relative wages of females and males. Higher wages for females mean an increase in the opportunity costs of having children, which reduces the number of children in the family. In addition, the World Bank (2011) and Day (2012) have stated that when women get higher wages, they will delay marriage and therefore fertility and population growth will go down. A reduction in population growth would increase output per capita and hence increase economic growth.

This brief review of empirical studies has explored the relationship between gender inequality and economic growth. These studies used various techniques to estimate this relationship; some used macroeconomic or microeconomic models to explain the impact of gender inequality on economic growth in the short run or long run. However, such studies remain narrow in focus, dealing only with gender inequality in education and employment, and its impact on economic performance. Also, there has been little quantitative analysis of the impact of the gender wage gap on economic growth. Moreover, no previous study has investigated the influence of the gender wage gap on economic growth in OECD countries. In addition, most of the existing studies in this field have used a single country to estimate this relationship.

However, this study attempts to contribute to the literature by providing new evidence on the impact of gender inequality on economic growth by using gender pay inequality as a proxy for discrimination. This study used the GMM technique, which was proposed by Arellano and Bond in 1991, to explore the impact of the gender pay gap on economic growth, and to achieve this purpose this study used a panel data technique for OECD countries for the period 1980–2015.

1.3. Gender Inequality and Economic Growth

The relationship between gender inequality and economic growth is complicated and it has direct and indirect links. Many researchers have emphasized the importance of human capital as one of the key economic determinants, and the inclusion of human capital in economic models was achieved through the Solow model; moreover, human capital can be incorporated into the endogenous growth model (Romer, Weil, and Mankiw, 1992).

Lucas (1988) introduced a definition of human capital as a general skill level; furthermore, human capital can contribute to production growth by increasing productivity and technological improvements. In addition, Romer (1990) pointed out that human capital contributes to improvements in technical progress through knowledge accumulation. Hence, many kinds of theoretical literature have started to point out that the inequality between the two genders will harm economic growth through misallocation of resources (Pervaiz and others, 2011).

Many studies have explained how gender inequality might influence economic performance. For instance, Klasen (1999) identified two pathways through which this effect could happen.

The first is premised on the assumption that women tend to spend more of their income on children's health, nutrition and education, which can contribute to development in the long run by increasing the productivity of the next generation. Therefore, providing women with proper access to resources such as education and employment, and also equal wages, can increase economic growth in the long run.

The second is premised on the assumption that innate abilities and talents are randomly distributed between males and females, so equality in the distribution of resources between the two genders will maximize the productivity of the human capital available in the economy. But gender inequality in education, employment and wages means that males who are less able than their female counterparts have a better chance of being educated and employed or even getting higher wages than females

and this would produce human capital with lower productivity in the economy and result in a reduction in economic growth.

Moreover, Klasen (2006; 2002; 1999) pointed out that inequality in education might increase fertility and mortality levels, and also decrease the education of next generation; each element has a negative effect on economic performance. The impact of gender inequality in education is not limited to its impact on economic growth through human capital; it also has an impact on investment. Female education might have an impact by increasing the returns on investments, which in turn would lead to an increased investment rate in the economy.

Adopting a broader perspective, Chen and others (2013) and Rasekhi and Hosseinmardi (2012) argued that the relationship between female education and international competitiveness would increase economic growth. They found that female education has a positive impact on economic growth through international competitiveness. In addition, they showed that many East Asian countries use a strategy that depends on intensive use of women's labour in export manufacturing industries, and they have been able to compete in the world market.

Furthermore, other researchers have traced the effect of gender discrimination in employment. Esteve-Volart (2004) showed that reducing employment opportunities for females might distort the economy in the same way that gender discrimination in education does, by reducing the pool of talented workers that employers can select from, which results in reducing the average ability of the labour force. In addition, gender inequality in employment can affect economic growth through demographic effects, by increasing the fertility rate (Cavalcanti and Tavares, 2007).

Moreover, gender inequality in employment and wages might negatively affect the bargaining power of women in their families (Klasen and others, 2008; Lawrence and others, 2007). Since females are culturally responsible for children's education and well-being, future generations' learning and abilities might suffer, as a result of gender inequality leading to a decrease in economic growth (Pervaiz and others, 2011; Stotsky, 2006; Thomas, 1997).

Furthermore, there are a few channels by which gender wage inequality can influence economic performance. Wage inequality between the two genders affects females' income, which in turns discourages them from participating in the labour market, which can lead to decreased growth through a decrease in labour force participation and productivity (Cavalcanti and Tavares, 2007). Another argument traces the effect of the gender wage gap on fertility. Higher wages for females lead to an increase in the opportunity cost of having children, which reduces the number of children in the household (Galor and Weil, 1996). In addition, the gender wage gap may lower fertility by delaying marriage. Reduction in fertility lowers population growth, increases capita per worker and increases economic growth (Day, 2012; World Bank, 2011). Finally, females tend to spend more of their income on children's health and education, which can contribute to development in the long run. Therefore, when the gender wage gap between males and females is reduced, one can expect more spending to be allocated to investment in human capital and other productivity-enhancement channels that increase economic growth in the long run (Pervaiz and others, 2011).

However, it is important to indicate that is very difficult, theoretically, to separate the impact of gender inequality on employment, education and wages, because gender inequality in one dimension leads to gender inequality in other dimensions, for instance, gender inequality in education might lead to gender inequality in employment, particularly in sectors that prefer educated workers. Therefore, if there are barriers to women's employment or even gender wage gaps, rational families might decide that girls' education is not profitable, which results in lower demand for female education, which causes gender inequality in education. Hence, gender inequalities in employment, education and wages are closely related (Klasen and Lamanna, 2008).

1.4. Reasons for the Gender Wage Gap

The literature has identified a number of factors that might cause a wage gap between the two genders; the studies try to explain the wage gap in terms of observable characteristics (such as experiences, education, marital status, age, hours worked and field of study) and non-observable characteristics. However, Blau and khan (2000) pointed out that it is not only age, occupation and education but also childcare and college grades that might be included as explanatory variables for the gap between the two genders. However, the unexplained portion of the gender wage gap resulted from the impact of unobservable variables, including discrimination against females in the labour market. Blau and Kahn 2006) noted that while the gender wage gap has decreased over time, a portion of that gap is not explained by an increase in human capital factors. Moreover, Hanushek and Woessmann (2010) pointed out that while human capital factors explain a significant part of the gender wage gap, the analysis leaves a proportion of the gender wage gap unexplained.

We can summarize the main factors that have an influence on the gender wage gap, either positively or negatively, as follows:

1.4.1 Human Capital Factors

An early theory that tried to clarify the gender wage gap in the labour market was human capital theory, which assumed that the individual tends to invest in education and training to increase their skills, and that this depends on the returns they expect to receive from this investment. Since females received lower wages from these skills than their male counterpart did, females sought to catch up with men in the labour force. However, although they could catch up with males in educational attainment, they could not catch up in terms of wage equality. Blau and Kahn (2000) attributed to the businesses that are less likely to employ females because employers expect to get fewer returns when they invest in female training because females have more breaks than their male counterparts. In addition, Becker and others (1990) pointed out that women are likely to expend some of their efforts on unpaid housework as well as their market work. Therefore, human capital theory attributed the gap between males and

females to the lack of women participating in the labour market due to traditional family roles such as childbearing that impede women in participating in the labour market and benefiting from training and experience in the markets.

1.4.2 Occupational Segregation

Occupational segregation refers to the concept that some occupations are dominated by males and others by females. Females tend to be concentrated in particular jobs and those jobs are identified as lower-paid jobs. Bratton and Gold (2012) argued that occupational segregation is more likely to occur for low-skilled workers and for females with children as well. In addition, Hanushek and Woessmann (2010) noted that workers with higher educational attainment are concentrated in a much larger number of jobs than workers with lower educational attainment, and mothers are more likely to work in sales jobs or service jobs than females without children. This might be a consequence of mothers' self-selection into jobs that are more convenient for their family responsibilities or it might be related to employers not offering jobs or careers to females with children.

Furthermore, segregation in occupations is termed either vertical, where males always occupy higher managerial jobs with high wages, while females are under-represented in these occupations and are also less likely to reach senior positions; or horizontal, where female are concentrated in low-paid jobs, for example, cleaning, caring, catering, sales jobs and clerical jobs. Blau and Kahn (2000) pointed out that wages in jobs dominated by females tend to be kept low by the prevalence of part-time opportunities and the existence of discrimination in the labour market, which might lead to an oversupply of female workers for these occupations.

1.4.3 Workplace Flexibility

Females tend to choose lower-paying jobs because these kinds of jobs provide flexibility, which enables women to coordinate their job and family responsibilities. Therefore, females are less likely to choose a high-paying occupation because they are concerned about combining family's responsibilities and their job (Solberg and Laughlin, 1995). However, some findings regarding to gender wages and workplace flexibility were different (Landes, 1977); these indicated that males have more access

to occupations that have flexibility than do females, who need to choose these jobs to enable them to coordinate family and occupation. This viewpoint is supported by Witt and Nye (1992) and Weaver (1998).

1.4.4 Working Hours

The traditional division of the family hurts females in the labour market, because females devote more time and effort to housework than men do, and have less time for performing market work. Becker (1993) and Miranda (2011) pointed out that women work fewer paid hours than men because of their responsibilities in looking after their children; in addition, housework is still unequally distributed between partners. Therefore, part-time jobs can help women to balance their job responsibilities and their family's needs, but that might come at a cost. Jaumotte (2004) noted that part-time jobs are characterized by lower wages, poor benefits, variable hours, low job tenure, less training and low prospects promotion.

Furthermore, part-time employees usually face an earning penalty when we compare them with their counterpart employees who work full-time jobs (Economic Committee Democratic Staff, 2016). Moreover, less time in the job can make employers look at female workers as less committed to the job, and they are more likely to take leave from their jobs to care for their families than male workers do; this position means that females employees appear to be less valuable than their male counterparts, and therefore they receive lower wages for their work. In addition, females who work part-time are less likely to qualify for benefits such as health insurance and sponsored retirement plans (Economic Committee Democratic Staff, 2016).

1.4.5 Direct Discrimination

Discrimination by employers refers to different treatment for two equally qualified individuals based on group membership such as gender, age, race, disability, religion, etc. However, discrimination takes two forms: 'taste discrimination' is based on the individuals, in case where employers prefer specific individuals or groups to others; and 'statistical discrimination' is when employers make their decisions about

individuals based on imperfect information, and that might be through prior facts and perceived notions.

1.4.6 Gender Stereotypes

Gender stereotypes are important, especially in occupational segregation, because they have an impact on male and female education and career decisions Fapohunda (2013). Sorsa and others (2015) and the OECD (2012) affirmed that women's behaviour in the labour market is influenced by culture and social values, in which might abound arguments for discriminating against women by stereotyping different types of work or determining lifestyles for males or females. Educational choices for women are determined partly by job opportunities, because not all jobs are available to them, and also partly by the gender stereotypes that prevail in the community.

1.5. Estimation Framework

The model to estimate the relationship between the gender wage gap and economic growth has been elaborated on the basis of the existing literature, in particular Naguib (2015), who estimated the relationship between inequality and economic growth as follows:

$$Ln(GDP_t) = \alpha_0 + \alpha_1 \ln(gdp_{t-1}) + \alpha_2 GINI_{t-1} + \alpha_3 FDI + \alpha_4 School_t + \alpha_5 Open_t + \alpha_6 Life_t + \alpha_7 Ocse_t + \alpha_8 d_{1,t} + \alpha_9 d_{2,t} + \alpha_{10} d_{3,t} + \varepsilon_t \dots\dots\dots\dots\dots (1)$$

Where GDP_t stands for the annual per capita GDP growth rate, and this variable is computed using the following equation:

$$lnGDP_t = ln\left(\frac{GDP_t}{GDP_{t-1}}\right) = Ln(GDP_t) - Ln(GDP_{t-1})$$

$\ln(GDP_{t-1})$ stands for annual per capita GDP in the lagged value. $GINI_{t-1}$ Is the value of the GINI coefficient in the lagged period. FDI stands for the net influx of foreign direct investment in a given year as a percentage of the country's GDP. $School$ measures the level of education of the population; this indicator is calculated using total enrolment in secondary education. $Open$ stands for economic openness,

which has been computed by adding the exports and imports of a country and dividing by its GDP. $Life_t$ represents life expectancy at birth. $Ocse_t$ is a dummy variable that takes the value 0 if the country in year t was not an OCSE member and the value 1 otherwise $d_{1,t}, d_{2,t}$ and $d_{3,t}$ represent dummy variables, which take the value 1 if the observation refers to the 1970s, 1980s, or 1990s, and take the value 0 otherwise.

However, the main objective of this is to investigate the relationship between the gender wage gap and economic growth; therefore, to achieve the study's purpose, we rewrote the previous equation, and in addition we added other explanatory variables to the model in order to avoid omitted variable bias (Barro, 2000), as follows:

$$Ln(GDP_t) = \alpha_0 + \alpha_1 \ln(gdp_{t-1}) + \alpha_2 GWG_{t-1} + \alpha_3 FDI + \alpha_4 School_t + \alpha_5 Open_t + \alpha_6 Life_t + \alpha_7 INF_t + \alpha_8 I_t + \varepsilon_t \quad .... (2)$$

Where GWG_{t-1} represents the gender wage gap in the lagged period, and the lagged value is used in order to avoid the endogeneity problem. FDI represents foreign direct investment. $School$ measures the level of education for the population. $Open$ stands for economic openness. $Life_t$ represents life expectancy at birth. I_t stands for investment, and INF_t represents the inflation rate. However, this study used a panel data approach for OECD countries. Each variable has two parts i and t, where i represents country and t represents time.

The panel data estimation technique has many advantages, as outlined by Hsiao (2007). It has the ability to capture the complication of human behaviour better than a time series or cross-sectional data. Therefore, it allows researchers to control for individual heterogeneity and unobservable or unmeasured variables. These variables include differences in cultural aspects and factors that change over time; for example, international agreements and national regulations are factors that are considered for individual heterogeneity. In addition, it can produce more precise expectations for individual outcomes by pooling the data rather than producing expectations of individual outcomes by using 'individuals'' data. Furthermore, panel data techniques provide a large number of data and large degrees of freedom, and reduce the problem

of collinearity between independent variable, which has an important impact on improving the effectiveness of economic estimates.

There are several possible techniques for estimating the panel data. The first is the fixed effects least square. It pools all variables with a separate intercept term for each cross section. The second is random effects. This technique deals with individual effects by including them in the error term (Naguib, 2015). The third method of estimation is pooled least square, which ignores the structure of the panel data.

However, this chapter uses a dynamic model, as it includes a variable in period t-1 among its explanatory variables, and therefore the estimation with panel data methodology will make both fixed effects and random effects techniques give a biased estimate (as a result of the so-called Nickell bias), due to the correlation between the error term and explanatory variables. Moreover, Grijalva (2011) indicated that neither the random effects nor the fixed effects technique is consistent in the case of the existence of a lagged period in the dependent variable.

To remove the bias in the estimation, we used the GMM technique, which was proposed by Arellano and Bond in 1991, and that was done through choosing an instrumental variable with a lagged value of more than one for the endogenous variable, such as $\ln(gdp_{t-2})$, $\ln(gdp_{t-3})$, etc. In addition, we used the first difference of the exogenous variables. The problem we want to solve lies in the endogenous lagged variable. As $\ln(gdp_{t-1})$ has the error term, which is $\varepsilon_{i,t-1} = u_i + v_{i,t-1}$, and is correlated with it, and because the error term at time t is defined as $\varepsilon_{i,t} = u_i + v_{i,t}$, so $\ln(gdp_{t-1})$ is correlated with $\varepsilon_{i,t}$, as both of them contain u_i. In order to obtain an unbiased estimation for the studied variables, the GMM technique, requires the equation to be rewritten in a first difference form, which in turn cancels out the correlation between the errors and lagged endogenous variable, as follows:

$$\Delta Ln(GDP_{i,t}) = \alpha_1 \Delta \ln(gdp_{i,t-1}) + \alpha_2 \Delta GWG_{i,t-1} + \alpha_{3\Delta} FDI_{i.t} + \alpha_4 \Delta School_{i,t} +$$
$$\alpha_5 \Delta Open_{i,t} + \alpha_6 \Delta Life_{i,t} + \alpha_7 \Delta F_{i,t} + \Delta \varepsilon_{i,t} \ldots\ldots\ldots\ldots\ldots \text{(3)}$$

Where is $\Delta Ln(GDP_{i,t})$=$Ln(GDP_{i,t})$ - $Ln(GDP_{i,t-1})$ and the same thing for the rest of the variables in the equation 3, the error term will be equal to

$$\Delta\varepsilon_{i,t} = u_i + v_{i,t} - u_i - v_{i,t-1}$$

$$\Delta\varepsilon_{i,t} = v_{i,t} - v_{i,t-1}$$

However, when the lagged variable is used as $\Delta\ln(gdp_{i,t-1})$, this variable will be included within the error term $\varepsilon_{i,t-1}$; it means that $v_{i,t-1}$ is correlated with $\Delta\varepsilon_{i,t}$, and the hypothesis of non-correlation between error terms and explanatory variables is violated. Therefore, it is necessary to use instrumental variables of an order of more than one (Naguib, 2015).

1.6. Data

This study used unbalanced panel data for OECD countries which include; Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Rep., Latvia, Luxembourg , Mexico, Netherlands, New Zealand, Norway, Poland, Portugal , Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States. The data covers the period 1980–2015. This study could not find data farther than this period; in addition, some of the variables include one or two distracted observations which decreased our sample from 35 to 27 countries. However, the main sources of our data are world development indicators which published by World Bank and the OECD website. The data that were extracted from the World Bank website includes GDP per capita, Trade openness; it has been computed by adding the exports and imports of a country and dividing by its GDP. Also, FDI represents foreign direct investments. In addition, School, which measures the level of education in the country, is calculated using the total enrolment in secondary education. Life_t represents life expectancy at birth, and I_t is investment, for which we used capital formation as a proxy, INF_t stands for the inflation rate. Finally, the gender wage gap (GWG) was extracted from OECD website, and it is computed as the difference between males and female's wages divided by male's wages. A detailed overview about all data sources is available in Table 1.A.1 and 1.A.2 in the Appendix 1.A.

1.7. Empirical Results

In this section, we introduce the results of the random effects and fixed effects estimates, and the results of the GMM technique for OECD countries for the period 1980–2015.

Table 1. 1

Panel Fixed Effects (FE), Random Effects (RE) and Generalized Method of Moments (GMM) for OECD Countries

Variables	Fixed Effects (1)	Random Effects (2)	Fixed Effects (3)	Random Effects (4)	GMM (5)
GDP_1			-0.1143*** (0.00)	-0.0160*** (0.00)	0.589*** (0.00)
Gender wage gap	-0.0011*** (0.00)	.00007 (0.70)	-0.0017*** (0.00)	0.00008 (0.69)	-0.002*** (0.00)
Foreign direct investment	0.0027*** (0.00)	0.00255*** (0.01)	0.0037*** (0.00)	0.0024** (0.02)	0.001*** (0.00)
Life expectancy	-0.0057*** (0.00)	-0.00318*** (0.00)	0.0023 (0.101)	-0.0013 (0.103)	0.017*** (0.00)
Secondary schools	0.0577 (0.00)	0.0353*** (0.00)	0.0425*** (0.00)	0.0369*** (0.00)	0.003 (0.88)
Trade openness	0.00048*** (0.00)	0.00003 (0.79)	0.0005*** (0.00)	0.00005 (0.244)	.0006*** (0.00)
Inflation rate	-0.0003*** (0.00)	-0.00066** (0.032)	-0.0007*** (0.01)	-0.0007*** (0.01)	-0.0022*** (0.00)
Gross capital formation	0.0667*** (0.00)	0.0583 (0.00)	0.0966*** (0.00)	0.0621*** (0.00)	0.2021*** (0.00)
Constant	0.3830*** (0.00)	0.1661*** (0.00)	0.8099*** (0.00)	0.177*** (0.00)	2.210*** (0.00)
Hausman test	37.38*** (0.00)		74.00*** (0.00)		
Sargan test					25.09 (0.80)

*Note: ***, **, * represent 1%, 5%, 10% levels of significance respectively.*

Table 1.1 presents the results obtained from estimating the relationship between gender wage inequality and economic performance. The first and second columns in table 1.1 report the results of the random effects and fixed effects analysis without the dynamic condition, while the third and fourth columns report the same kind of analysis with a dynamic condition. Moreover, table 1.1 shows the results of the GMM technique. However, we find a non-significant positive relationship between the

gender wage gap and economic growth in the random effect analysis with a dynamic condition or without it, while in the fixed effects analysis, whether there is a dynamic or non-dynamic condition, gender wage inequality has a negative significant impact on economic growth. Furthermore, random effects and fixed effects analysis present information of the explanatory power (R^2), which means the percentage of variance or changes in the dependent variable that can be explained by the independent variables that are included in the model. There are three types of R^2: within, between and overall. In the case of random effects, the values of these variables are 0.22, 0.66 and 0.30 respectively, and in the same case for the fixed effects the values of R^2 are 0.26, 0.25 and 0.13 respectively.

Moreover, in order to determine whether the most suitable estimation approach is fixed effects or random effects, the Hausman test results are reported in table 1.1. We found that the Hausman test results are 37.38 and 74.00 for dynamic and non-dynamic conditions respectively, and they are significant at 5%. Since we can reject the null hypothesis, the fixed effects approach seems to be appropriate for both dynamic and non-dynamic models. However, the results of random effects and fixed effects analysis and the Hausman test have to be interpreted with care in the context of a dynamic model, because it might be inconsistent and biased (Naguib, 2015).

The fifth column in table 1.1 reports the results of using Arellano and Bond's GMM technique for OECD countries. This study finds a negative impact of gender wage inequality on economic growth. The empirical work shows that an increase of 1% in the wage gap leads to a 0.002% decrease in economic growth rate per capita. This relationship is statistically significant at the 5% level. This is consistent with the finding of Day (2012), Pervaiz and others (2011), the World Bank (2011) and Vidyattama, and others (2009).

However, this study predicted a negative relationship between gender wage inequality and economic growth, which means that an increase in the gender wage gap in OECD countries will decrease the economic growth rate. The increase in the gender wage gap will discourage women from participating in the labour market and hence decrease growth by decreasing labour force participation and productivity in the economy as a

whole. In addition, reducing the wage gap between males and females will reduce fertility by increasing the opportunity cost of having children (Galor and Weil, 1996). Moreover, the gender wage gap will probably delay marriage, which lowers fertility and population growth even more and increases the potential for economic growth (Day, 2012; World Bank, 2011).

Furthermore, the fifth column reports a positive relationship between explanatory variables such as FDI, life expectancy, trade openness, secondary schools, gross capital formation and economic growth. The relationships for these variables are statistically significant at 5%, except for secondary schools, for which relationships were not significant. In addition, there is a negative significant relationship between inflation and economic growth.

However, FDI can increase the economic growth by increasing the variety and quality of goods available and also the physical amount of capital stock (Neuhaus, 2006), in addition FDI might contribute in creation new jobs and investments which affect in economic growth positively. Our findings are consistent with Brooks and Sumulong (2003), Lane and Lion (2005). Trade openness ensures a better allocation of resources and enhances investments as a result of economies of scale, technology and knowledge spill overs, which, in turn, increase the economic growth. The positive relationship between trade openness and economic growth was also reported by reported by Iftikhar (2012). In terms of the positive impact of life expectancy on economic growth, an important group of literature dealing with life expectancy as an indicator of health which is considered an important factor in economic development, however our result is consistent with ; Barro (1997) and Aghion et al. (2010). Finally, school enrolment might enhance the human capital accumulation rate which increases labour productivity and thus increase economic growth.

However, the Sargan test indicates that the instruments are valid and the model formulation is correct, based on the failure to reject the null hypothesis. The tests are stated in table 1.1.

However, we conducted the same estimation for the European countries for the same period 1980–2015, to verify whether the economic mechanisms that link the gender wage gap and economic growth vary from one group of countries to another. We find the same results as for OECD countries, where the results show a non-significant positive relationship between the gender wage gap and economic growth in the random effects analysis with a dynamic condition or without it, while the fixed effects analysis shows that the gender wage gap has a negative significant impact on economic growth in the case of the non-dynamic condition only. Moreover, the Hausman test results are 37.91 and 52.62 for dynamic and non-dynamic conditions respectively, as reported in table 1.2, and they are significant at 5%. Since we can reject the null hypothesis, the fixed effects approach seems to be appropriate for both dynamic and non-dynamic models.

Table 1. 2

Panel Fixed Effects (FE), Random Effects (RE) and Generalized Method of Moments (GMM) for European Countries

Variables	Fixed Effects (1)	Random Effects (2)	Fixed Effects (3)	Random Effects (4)	GMM (5)
GDP_1			-0.1083*** (0.00)	-0.0237*** (0.00)	0.6608*** (0.00)
Gender wage gap	-0.0002 (0.60)	0.00021 (0.56)	-0.00095* (0.07)	0.0005 (0.20)	-0.0030* (0.054)
Foreign direct investment	0.0025* (0.09)	0.0035** (0.012)	0.0035** (0.015)	0.0028** (0.05)	0.0001 (0.96)
Life expectancy	-0.0062*** (0.00)	-0.0031*** (0.00)	0.0012 (0.50)	0.00017 (0.90)	0.0102*** (0.00)
Secondary schools	0.08446*** (0.00)	0.0443*** (0.00)	0.0731*** (0.00)	0.0519** (0.00)	0.0496 (0.153)
Trade openness	0.00077*** (0.00)	0.00002 (0.57)	0.00075*** (0.00)	0.00008 (0.120)	0.0008*** (0.00)
Inflation rate	0.0001 (0.60)	-0.0003 (0.35)	-0.00041 (0.20)	-0.0004 (0.24)	-0.0015*** (0.00)
Gross capital formation	0.07502*** (0.00)	0.0608*** (0.00)	0.1071*** (0.00)	0.0701** (0.00)	0.2068*** (0.00)
Constant	.4100*** (0.00)	0.1713** (0.05)	0.8216*** (0.00)	0.1379 (0.12)	2.109*** (0.00)
Hausman test	37.91*** (0.00)		52.62*** (0.00)		
Sargan test Chi2					13.24 (0.99)

Note: ***, **, * represent 1%, 5%, 10% levels of significance respectively.

What is interesting in table 1.2 is that the results of Arellano and Bond's GMM technique for European countries are consistent with our results for OECD countries using the same analysis technique, in that the empirical work shows that in the European countries an increase of 1% in wage inequality between the two genders leads to a 0.003% decrease in economic growth rate per capita. This relationship is statistically significant at 10%. In addition, the Sargan test points out that the instruments are valid and the model formulation is correct based on the failure to reject the null hypothesis. The tests are stated in table 1.2.

Finally, this study reports a positive relationship between these explanatory variables such as FDI, trade openness, secondary schools, life expectancy and gross capital formation. The relationships for these variables are statistically significant at 5%,

except for secondary schools and FDI, for which relationships were not significant. In addition, there is a negative significant relationship between inflation and economic growth: the relationship is statistically significant at 1%.

1.7.1 Robustness Check

In order to check whether the results obtained in this study are sensitive to change in the model formulation, this study used two approaches, the first approach conducted estimation by including additional explanatory variables, including growth rate of population, public expenditure as a percentage of GDP and enrolment rates of tertiary schools, in the OECD countries model. Growth rate of population and public expenditure as a percentage of GDP are expected to be negative, while the coefficient sign for tertiary school enrolment is positive (Naguib, 2015; Barro, 2008).

The first and second columns in table 1.3 report the results of the fixed effects and random effects techniques in a dynamic model. We find a significant negative relationship between the gender wage gap and economic growth in the fixed effects analysis only. However, the Hausman test has been conducted. Since we can reject the null hypothesis, the fixed effects approach seems to be appropriate. The tests are stated in table 1.3.

The third column in table 1.3 reports the results of Arellano and Bond's GMM technique for OECD countries. We find that all additional explanatory variables have the expected signs for their coefficients. However, the relationship between the gender wage gap and economic growth is still statistically significant. The empirical work shows that an increase of 1% in the wage gap leads to a 0.002% decrease in economic growth rate per capita. This relationship is statistically significant at the 5% level. In addition, the Sargan tests still provide adequacy of the instruments, and the model formulation is correct, based on the failure to reject the null hypothesis. The tests are stated in table 1.3.

The signs for the coefficients of the rest of the variables remain the same as in the previous regression analysis; the variables are FDI, life expectancy, secondary schools, trade openness, inflation rate and gross capital formation, and their coefficients are 0.00015, 0.0133, 0.00265, 0.00018, -0.00188 and 0.1792 respectively.

Table 1. 3

Panel Fixed Effects (FE), Random Effects (RE) and Generalized Method of Moments (GMM) for OECD Countries

Variables	Fixed Effects (1)	Random Effects (2)	GMM (5)
GDP_1	-0.1430***	-0.01202**	0.6450***
	(0.00)	(0.02)	(0.00)
Gender wage gap	-0.0015***	-0.00038	-0.00222***
	(0.00)	(0.53)	(0.00)
Foreign direct investment	0.00011	0.00024	0.00015
	(0.51)	(0.15)	(0.20)
Life expectancy	0.00426***	-0.0012	0.0133***
	(0.00)	(0.21)	(0.00)
Secondary schools	0.01859*	0.0432***	0.00265
	(0.08)	(0.00)	(0.85)
Trade openness	0.00016	0.00005	0.00018
	(0.14)	(0.32)	(0.37)
Inflation rate	-0.00006	-0.000038	-0.00188***
	(0.82)	(0.24)	(0.00)
Gross capital formation	0.10711***	0.06942***	0.1792***
	(0.00)	(0.00)	(0.00)
Growth rate in population	-0.01266***	-0.0097***	-0.0118**
	(0.00)	(0.00)	(0.02)
Tertiary education	0.00066***	0.00011	0.00086***
	(0.00)	(0.28)	(0.00)
Government consumption	-0.00579***	-0.0022***	-0.00924***
	(0.00)	(0.00)	(0.00)
Constant	0.96308***	0.1695**	2.2302***
	(0.00)	(0.019)	(0.00)
Hausman test	93.71***		
	(0.00)		
Sargan test			23.26
			(0.86)
Chi2			

*Note: ***, **, * represent 1%, 5%, 10% levels of significance respectively.*

Furthermore, we conducted estimation by including the additional explanatory variables, including growth rate of population, public expenditure as a percentage of GDP and enrolment rates of tertiary schools, in the European countries model. We found a significant negative relationship between the gender wage gap and economic growth by using Arellano and Bond's GMM estimation technique. In addition, the Sargan test still indicated that the instruments are adequate and that the model formulation is correct, based on the failure to reject the null hypothesis. In conclusion, adding the three dependent variables did not change the coefficient sign for gender wage inequality for either the OECD or the European countries for the period 1980–

2015. However, the values of the explanatory variables indicate various degrees of sensitivity to the model formation.

The second approach used two step difference GMM by using XTABOND2 commands, where we used the instruments in level and in the first difference to investigate the impact of the gender wage gap on economic growth, the results showed a significant negative relationship between the two variables at the 1% level, and the coefficient was (.007%) in case of using the instruments in the first difference and (.006%) in case of using the instruments in the level. To check the validity of the model specification, we used Hansen over identification test and the second ordered serial correlation (AR2) test. Both of the two tests indicated that the instruments are valid and that the model formulation is correct, based on the failure to reject the null hypothesis for the two tests. However, the signs for the coefficients of the rest of the variables remain the same as in the previous regression analysis.

1.8. Conclusion

This chapter examines the relationship between the gender pay gap and economic growth for OECD and European countries. An unbalanced panel data analysis for both countries was used for the period 1980–2015. We used different estimation techniques such as fixed effects and random effects in addition, and Arellano and Bond's GMM technique to investigate the relationship between gender wage inequality and economic performance. Moreover, in order to determine whether the most suitable estimation approach is fixed effects or random effects, Hausman testing was conducted. We found the Hausman test results for both dynamic and non-dynamic condition are significant at 5% for both OECD and European countries. Since we can reject the null hypothesis, the fixed effects approach seems to be appropriate for both dynamic and non-dynamic models for both groups of countries. However, the results of random effects and fixed effects analysis and Hausman testing have to be interpreted with care in the context of a dynamic model, because it might be inconsistent and biased (Naguib, 2015).

The results of Arellano and Bond's GMM technique for both OECD and European countries indicate that inflation has a significant negative impact on GDP, while FDI, trade openness, secondary schools, life expectancy and gross capital formation have a positive impact on GDP. The relationships for most of these variables are statistically significant at 5%. FDI is not significant for European countries, and in addition secondary schools enrolment is not significant for either group of countries. Moreover, we found a significant negative relationship between the gender wage gap and economic growth for the two groups of countries for the period 1980–2015. The empirical work shows that an increase of 1% in the wage gap leads to a 0.002% decrease in economic growth rate per capita for OECD countries. This relationship is statistically significant at the 5% level. Likewise, we find that the results of Arellano and Bond's GMM technique for European countries are consistent with our results for OECD countries, in that the empirical work shows that in the European countries an increase of 1% in wage inequality between the two genders leads to a 0.003% decrease in economic growth rate per capita. This relationship is statistically

significant at 10%. The Sargan test for both groups of countries points out that the instruments are valid and the model formulation is correct based on the failure to reject the null hypothesis. Furthermore, the results of Arellano and Bond's GMM technique for the relationship between the gender wage gap and economic performance are consistent with those of Day (2012), Pervaiz and others (2011), the World Bank (2011) and Cassells and others (2009).

To check for robustness, this study used two approaches, the first one included additional explanatory variables in the OECD countries model and the European countries model: the population growth rate, public expenditure as a percentage of GDP and enrolment rates of tertiary schools. The signs for variable coefficients remain the same for fixed effects and random effects techniques and also in addition Arellano and Bond's GMM analysis technique. However, the quantitative impact of gender wage inequality on economic growth rate per capita indicates a small degree of sensitivity in the model. The second approach used two step difference GMM by using XTABOND2 commands, where we used the instruments in level and in the first difference to investigate the impact of the gender wage gap on economic growth, the results showed a significant negative relationship between the two variables at the 1% level, and the coefficient was (.007%) in case of using the instruments in the first difference and (.006%) in case of using the instruments in the level. Future work might consider other groups of countries divided by income or regions.

1. A Appendix

1. A.1 descriptive statistics for the data set of OECD countries

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP	1,172	32349.33	19066.76	3910.77	110001.1
Gross Capital formation	1,172	23.68	4.21	9.83	41.54
Inflation	1,173	9.32	28.02	-4.48	555.38
Life Expectancy	1,225	76.19	3.92	58.69	83.59
Gender wage gap	575	19.17	9.28	.384	52.78
Trade Openness	1,172	78.73	48.46	15.92	391.49
Foreign Direct investment	1,120	3.64	10.58	-58.98	255.42
Secondary school	1,100	2784971	4226835	20817	2.47
Government consumption	1,172	18.72	4.50	7.52	41.48
Tertiary Schools	1,103	46.00	22.99	1.44	110.26
Growth rate of population	1,259	.62	.736	-2.57	6.02

Data source: The data abstracted from World Development Indicators, published by the World Bank include: GDP per capita, Trade openness, foreign direct investments, secondary school, life expectancy at birth, and capital formation and the inflation rate. while gender wage gap abstracted from OECD website.

1. A.2 definition of the data

variable	definition
GDP	GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2010 U.S. dollars.
Gross Capital formation	Gross capital formation (% of GDP)
Inflation	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used.
Life expectancy	Life expectancy at birth indicates the number of years a new-born infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.
Gender wage gap	The gender wage gap is defined as the difference between average earnings of men and women relative to average earnings of men. Data refer to full-time employees.
Trade openness	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.
Foreign direct investment	Foreign direct investment (% of GDP)
Secondary school	the total number of pupils enrolled at secondary level in public and private schools
Government consumption expenditure	Final consumption expenditure (% of GDP)
Tertiary Schools	the total number of pupils enrolled at tertiary level in public and private schools
population	Population growth (annual %)

Chapter 2

The Impact of the Gender Wage Gap on Economic Growth: an Empirical Study for Developing Countries

2.1. Introduction

Institutions employ formal rules such as laws and constitutions, as well as informal constraints like traditions, taboos, customs, and code of conduct (North, 1990). These can be rooted in history and culture, and in some cases are taken as granted and therefore become persistent beliefs and norms (De Soysa and Jütting, 2007). Our study will concentrate on the constraints related to gender inequality because these constraints influence the distribution of the roles between males and females in the household and labour market, and also in political life. Furthermore, they shape the social and economic opportunities of males and females and affect female independence in decision making (Abadian, 1996; Bloom et al., 2001; Dyson and Moore, 1983).

Addressing gender discrimination in a country requires knowledge of the root or the source of discrimination. Most studies use indicators that measure inequality between the two genders in terms of access to political representation, health care, education, employment, and wages. But the fundamental problem with these indicators is that they measure the results of the inequality rather than trying to understand its underlying causes, (Jütting, Morrisson, 2005). Besides, these indicators ignore the institutional changes that guide human behaviour, and hence the treatment of women (Jütting and Morrisson, 2005). Ignoring the institutional changes represented by customs, norms, traditions, explicit or implicit laws, and codes of conduct can harm the usefulness of any policy that aims to empower women. The main argument of this chapter is that institutional changes have an important impact on women's access to different resources such as education, property, land, employment and so forth, which in turn influence gender wage inequality; in other words, women's imperfect access to different resources will adversely be reflected in their wages, and thus will negatively affect economic growth. The inequality in wages between two genders affects female's income, which in turns reduce female's employment, increase fertility, hence lower economic growth due to a reduction in labour force participation and productivity.

To analyze the relationship between the gender wage gap and economic growth, this study uses unbalanced panel data for 59 of developing countries during 2006-2016. To

control for potential endogeneity in the model, we instrumented the gender wage gap by using data of legal restrictions on women. Then, to estimate the relationship between the gender wage gap and economic performance, we used two-stage least squares (2sls) analysis. This technique is considered to be an extension of the ordinary least square method, which allows us to deal with a model that has some endogenous variables between its explanatory variables in a linear regression framework.

As the data of legal restrictions on women includes many variables, this study uses principal components analysis (PCA) to transform a large set of possibly-correlated variables into a smaller set or a smaller number of uncorrelated variables.

Previous studies concerned with the effect of the gender wage gap on economic growth did not take the endogeneity issue into account. This study fills the gap in this subject by instrumenting the gender wage gap using institutional changes. The findings of this study do not support previous studies. It shows that there is no significant relationship between the gender wage gap and gross domestic product per capita (GDP) in the 59 developing countries. The coefficient of the gender wage gap is -.029, which does not support the previous research of Seguino (2000a), Busse and Spielmann (2006), Ertürk and Çagatay (1995), who found a significant positive relationship between the two variables, and Schober and Winter-Ebmer (2011), Cassells et al., (2009), Oginni et al., (2014), and our research in chapter one which found a significant negative relationship between the gender pay gap and economic growth.

This chapter is divided into seven sections. The second section traces the existing literature related to the relationship between the gender pay gap and economic growth, and incorporates social changes into the model. Section three presents the importance of social institutions in gender equity. Section four discusses the methodology. Data and restrictions on women's rights are introduced in section five. Section six presents the empirical estimations and the results. Section seven concludes the chapter.

2.2. Literature Review

 This study investigates the relationship between the gender wage gap and economic growth. Since the variable of the gender pay gap has endogeneity problem, we use the institutional changes which are represented in legal restrictions on women as instrumental variables. This study uses the two-stage least squares (2sls) analysis technique which is considered as an extension of the ordinary least square method. Moreover, this approach is used to deal with a model which has some endogenous variables between its explanatory variables in a linear regression framework.

The data about legal restrictions on women includes many variables, so we use the principal components analysis (PCA) technique. This technique is a mathematical procedure to transform a large set of possibly-correlated variables to a smaller set or a smaller number of uncorrelated variables. However, the field of institutional changes and their influence on gender inequality has not received much attention. Research has tended to focus on the influence of gender inequality in employment and education, rather than the gender pay gap on economic growth. There has been little quantitative analysis of the influence of institutional changes on gender inequality. Furthermore, no studies have investigated the influence of the gender wage gap on economic growth in the context of the framework of institutional changes.

Most of the literature since the early 1970s has investigated the relationship between gender inequality and economic development. The relationship between the two variables is considered complex and inconclusive. For example, some studies show a positive effect of gaps in education on economic performance (Barro and Lee, 2001; and Barro (1995). However, King et al.,(2008), World Bank (2011) and Tansel and Gungor (2013) argued that gender disparity in education has a negative impact on economic growth. In addition, researchers who studied the relationship between inequality in labour force participation and economic growth found a negative impact between the two variables, (ILO, 2015; Thévenon et al., 2012; Klasen and Lamanna, 2008; Esteve- Volart, 2004).

While there is plenty of research that discussed gender inequality in education and labour force participation and its effect on economic performance, only a few studies

have investigated the impact of the gender pay gap on economic growth (Cassells et al., 2009; Seguino, 2000a; Busse and Spielmann; 2006).

A study by Cassells et al., (2009) used a growth model to estimate the impact of the gender pay gap on Australian economic performance for the period 1990-2008. They found that an increase in the gender wage gap of 1% was expected to reduce the gross domestic product GDP by 0.5% of total GDP. Likewise, Kennedy et al., (2017) found that reducing the gender wage gap by 10% can increase per capita output by up to 3% in Australia. Cabegin (2012) reported that gender wage inequality was sensitive to economic performance, decreasing with economic growth increases, and it widened with a deceleration of growth. In contrast to Cassells et al.,(2009), Oginni et al.,(2014) found a positive relationship between the gender wage gap and economic performance in Nigeria.

Adopting a broader perspective, Seguino (2000a) argues that the relationship between gender pay inequality and economic growth would increase international competitiveness. She pointed out that gender wage inequality can stimulate economic growth through export expansion. The mechanism of this effect is as follows: if women work in the export production sector, and this sector produces intensive labour goods, then lower wages will stimulate competitiveness in this sector and lead to an expansion in exports. In a comparable way, the gender pay gap might increase investment. This view is supported by Busse and Spielmann (2006) who confirmed the positive relationship between gender disparity and trade openness in a sample consisting of 92 developing and developed countries. They showed that countries with a higher gender pay gap have a higher export of labour-intensive goods. Similarly, Ertürk and Çagatay (1995) pointed out that the gender wage gap in the labour market associated with lower costs of labour units stimulates investment. In the same vein, Standing (1999) indicated that globalization has induced companies to employ more female workers in response to competitive results. Conversely, Schober and Winter-Ebmer (2011) reported that the relationship between the gender wage gap and economic growth is not positive.

Other researchers have traced the effect of the gender wage gap on fertility. Galor and Weil (1996) showed that fertility decisions depend on the relative wages of females

and males. Higher wages for females mean an increase in the opportunity costs of having children, which reduce the number of children in the family. In addition, the World Bank (2011), and Day (2012) stated that when women earn higher wages, they will delay their marriage age and therefore childbirth and population growth would go down accordingly. The reduction in population growth would increase workers per capita and hence increase economic growth.

The studies reviewed above used different types of indicators for gender discrimination, such as gender inequality in education, healthcare, labour participation, and wages. The problem with these indicators, however, is that they only measure the results of gender disparity rather than understanding the reasons behind this discrimination.

Feminist studies such as Elson (1995), Marchand and Parpart (1995), and Parpart (1993), pointed out that institutions have a major role in gender inequality, indicating that patriarchal structures have an important impact in persisting gender inequality. To overcome it, women should challenge the existing powers and change them or abolish the patriarchal institutions. In addition, the World Bank study (2001) indicated that to establish equal opportunities and rights for women, countries need to reform their institutions.

A number of studies have begun to examine the relationship between social institutions and gender inequality and how social institutions could affect the inequalities between males and females. Gonzales, Chandra, and others (2015) used panel data for 100 developing countries to analyze the impact of different legal restrictions on gender inequality in labour force participation. They used different legal factors such as: equal property; women's liberty to pursue a profession; equal inheritance rights for daughters and sons; obtaining a job; a women's right to set up legal proceedings without permission from her husband; opening a bank account; joint titling for married couples; right to be the head of a household; the right to sign a contract, and the legal guarantee of equality between males and females. They found a statistically significant positive relationship between fewer legal restrictions and female participation in the labour market. Similarly, Branisa and others (2013) using cross-country regressions found that social institutions that deprive females of their

autonomy, reduce their bargaining power in the family, and reduce investment in girls are significantly associated with lower education of women and higher child mortality and fertility rates. Moreover, they found higher levels of corruption in countries where social institutions prohibit the freedom of females to participate in different social lives. In the same context, Morrisson and Jütting, (2004) pointed out that social institutions such as norms, laws, codes of conduct and traditions represent the most important factors that limit women's freedom to choose an economic activity, which in turn hinder economic development.

In the same vein, Potrafke and Ursprung (2012) used the new OECD Social Institutions and Gender Index (SIGI) to identify the effect of globalization on social institutions that limit women's freedom and prevent gender inequality in 100 developing countries. They found that globalization has a positive impact on social institutions, which reduces female submission and promotes equality between the two genders. Likewise, World Bank's Women, Business and the Law Database (WBL) (2018) indicated that gender inequality in property rights and legal status are important restrictions on female entrepreneurship and female participation in the labour market. The World Bank also pointed out that increasing economic right equality is linked to higher participation for females in the labour market because weaker property rights reduce women's ability to access the assets and institutions that provide loans to set up and improve their businesses.

Hallward-Driemeier and others (2013) noted that the reforms to family law in Ethiopia in 2000, which removed a husband's consent to permit their wives to work outside the home increased the minimum age of marriage and removed the consent of both the spouses in the administration and ownership of the marital property, led to an increase in women's participation in more productive sectors. Similarly, Quisumbing and Maluccio (2000) pointed out that the reforms in inheritance law in India, which equalized the shares of inheritance for unmarried women contributed to delayed marriage and an increase in educational attainment for girls. Moreover, Ragasa and others (2012) showed that if women had equal rights to men, the number of children suffering from malnutrition could be reduced by about 1.7 million in sub-Saharan Africa and by about 13.4 million in South Asia. WBL (2018) showed that laws

constraining women from working and determining the type of job they can do may limit women's employment opportunities, which in turn increases the gender wage gap. Doepke and others (2012) indicated that equal property rights stimulate investment by eliminating inefficiencies, which in turn increases economic growth. Furthermore, they showed that the introduction of women's voting rights has shifted public spending towards spending on education, health and child care.

This brief review of the empirical studies on the relationship between gender inequality and economic development explored the relationship between institutional changes and gender discrimination. However, such studies remain narrow in focus, dealing only with gender inequality in education, employment, wages and their impact on economic growth. Moreover, there has been little quantitative analysis of the influence of institutional changes in gender inequality. Furthermore, no previous studies have investigated the influence of the gender wage gap on economic growth in the context of the framework of institutional changes.

The main purpose of this study is to develop an understanding of social changes and their influence on the gender wage gap. Social institutions can influence gender inequality through their impact on the roles of females and their access to different resources such as land, credit, property, and education.

2.3. The Importance of Social Institutions to Gender Equality

It is necessary here to clarify exactly what is meant by the term 'social institution'. According to North (1990), "institutions are the rule of the game in a society" that shapes human interaction. From an economic view, social institutions are perceived as the results of the collective choices of people in a society to achieve gains from cooperation by reducing transaction costs and collective action dilemmas. From a cultural perspective, institutions are complementary to the rational choice, so institutions are defined as beliefs and meanings. Hence social institutions are defined in society as values, norms, and codes of conduct that find expression in cultural practices, customs, and traditions. These factors shape the social and economic opportunities between males and females and their independence in taking decisions (Bloom et al., 2001; Hindin, 2000; Dyson and Moore, 1983).

Effectively addressing gender inequality in a specific country requires knowledge of the source of discrimination and its depth in that country. The various indicators that capture different aspects of gender inequality are important for informed policymaking. The current indicators tend to concentrate on gender inequality related to access to education, political representation, healthcare, earnings, and so forth. The problem with these indicators, that they measure the results of discrimination between two genders rather than attempting to understand its underlying causes. For example, female participation rates in the labour force, the gender pay gap, the female enrolment ratio in different education levels and the percentage of women in parliaments are useful indicators to compare women's status in different countries but they do not explain why these differences arise. Furthermore, these indicators ignore the institutional changes that guide human behaviour and hence the treatment of women (Jütting and Morrisson, 2005).

Recently, researchers have shown an increased interest in institutional changes such as social norms, sets of laws, customs, and codes of conduct, because institutional changes shape roles and relationships between males and females, and influence what resources they have access to, the activities that they can or cannot do, and their participation in society and the economy. In addition, social institutions shape incentives that can reduce or increase discrimination between the two genders in a country. Even when informal or formal institutions don't explicitly distinguish between men and women, they may still practice it either implicitly or explicitly by employing social norms and code of conducts that are consistent with gender roles. These social institutions can be slow and resistant to change.

Social institutions can influence gender inequality in two ways: first through traditions, social norms, customs, and codes of conduct that constrain women's activities directly. They can impose direct limits on female activities and freedom. For instance, these limitations can include, but are not limited to, preventing women from undertaking their own business, and limiting access to some important resources such as credit, land and other productive assets. Culturally they can constrain jobs, and prevent women from leaving the house alone. These factors hinder women from

participation in different kind of economic activities, which are the first step toward self-esteem, autonomy, and liberty of choice.

To determine the effects of social norms on gender inequality, Morrisson and Jütting (2004) measured the depth of discrimination caused by social institutions, using economic indicators such as the right to inherit, freedom of dressing and movement, and the right to own property. In addition, they used noneconomic indicators such as genital mutilation, marriage before the age of twenty, polygamy and authority over children. They found a negative relationship between economic and noneconomic variables on the economic role of women in society; this means that the higher the value of economic and noneconomic variables the lower becomes the probability of women playing an active role in the economy.

The second way in which social institutions can influence gender inequality is indirect. It is well known that better education for women and access to healthcare affect women's opportunities to participate in the labour market and get better jobs such as technician, professional, and administrator with better pay (Jütting and Morrisson, 2005). Social norms and traditions can deny females access to resources like education, health care, and capital, which limit human capital accumulation. For example in societies where females marry early, parents might prefer to invest in male rather than female education, which in turn causes a direct or indirect cost to the household and society. In some part of the world, for example rural Sudan, parents are unwilling to send their daughters to school at all if they feel schooling goes against their local traditions and culture (Jütting and Morrisson, 2005).

In the same context, households play an essential role in shaping relations between the genders early in life and transmit these relations to the following generations. People make many decisions in their life within households, such as having children and how to raise them, choosing more work or leisure, investing in the future, and how tasks or resources are allocated between daughters and sons. All of these factors may reduce or increase gender inequality particularly since these decisions are made in the context of communities. Furthermore, traditions and norms determine people's behaviours in society's framework. For example, when the government wants to introduce standard policies to promote gender equality by building more schools where norms forbid

females to leave home, these policies will not make a difference. Also, giving more micro-credit to females in rural areas where the customs or traditions deny women access to land will not achieve the desired effects.

Restrictive laws linked to family and gender inequality are likely to hinder female empowerment (World Bank and IFC 2013; Klugman and Twigg 2012).

In summary, social institutions, laws, norms, code of conducts, and traditions are the main sources of persisting inequality between women and men in developing countries (Jütting and Morrisson, 2005). To address gender inequality in any country properly, therefore, requires more knowledge about the sources of discrimination. The key contribution of this study is to analyze the impact of different kinds of legal restrictions on the gender wage gap in developing countries.

2.4. Estimation Framework

This study aims to explore the relationship between the gender wage gap and economic growth for a set of developing countries in the period 2006-2016 by using the following models:

$$GDP_{it} = \beta_0 + \beta_1 GWG_{it} + \beta_2 GCF_{it} + \beta_3 FPrimaryS_{it} + \beta_4 CONT_{it} + \beta_5 TRAD_{it} + \beta_6 POP_{it} + \epsilon_{it} \quad \text{...................................... (2)}$$

$$GWG_{it} = \beta_0 + \beta_1 INSTIT_{it} \quad \text{.....................................… (3)}$$

Where GDP_{it} represents-Real Gross Domestic Product per capita; GWG_{it} stands for the gender wage gap; GCF_{it} represents gross fixed capital formation; $FPrimaryS_{it}$ denotes primary schools for females; $CONT_{it}$ represents contraceptive prevalence amongst females; $TRAD_{it}$ stands for trade openness; POP_{it} represents population growth rate; $INSTIT_{it}$ represents institutional changes that are legal instructions for women, and ϵ_{it} represents the error term. All control variables were chosen based on previous literature, where they are used as determinants of growth in cross-country studies; see Barro, R., Sala-i-Martin, X., (1995) and Barro (1996).

This study uses a panel data approach for 59 developing countries. Each variable has two parts, i and t, where i represents the country and t represents time.

The panel data estimation technique has many advantages as outlined by Hsiao (2007). It allows controlling for individual heterogeneity and unobservable or unmeasured variables by researchers or by time-series analysis. These variables include differences in cultural aspects and factors that are changing over time. For example, international agreements and national regulations are factors which are considered for individual heterogeneity. Furthermore, panel data provides a large number of data, large degrees of freedom, and reduces the problem of collinearity between independent variables, which has an important impact on improving the effectiveness of economic estimates.

There are several possible techniques to estimate the panel data. The first one is the fixed effect least square. It pools all variables together with a separate intercept term for each cross section. The second one is the random effect. This technique deals with individual effects by including them in the error term (Naguib, 2015). The third method of estimation is pooled least square, which ignores the structure of the panel data.

To control for potential endogeneity and omitted variable bias in the model, we use the two-stage least squares (2sls) analysis technique, which is considered to be an extension of the ordinary least square method. The 2sls approach is used to deal with a model which has some endogenous variables between its explanatory variables in a linear regression framework. An endogenous variable is an explanatory variable correlated with the error term in the model. The main principle of the 2sls analysis technique is to use instrumental variables to estimate the model. These instruments should satisfy two conditions: first, they should be correlated with the endogenous variable, and second, they should not be correlated with the error term in the regression model (Wooldridge, 2010).

However, in the model that we use to investigate the relationship between the gender wage gap and economic growth, there is a potential endogenous issue in the gender wage gap variable. There are two reasons for the potential endogeneity of the gender wage gap: the first one is the omitted variables; in spite of including many control variables, there are unobserved variables that may lead to bias estimates as education

and individual abilities. The second reason is the reverse causality that may occur between economic growth and the gender wage gap.

Because the data of legal restrictions on women includes many variables, this study will use principal components analysis (PCA). This technique is a mathematical procedure to transform a large set of possibly-correlated variables to a smaller set or a smaller number of uncorrelated variables. PCA detects a linear combination between the variables, such as the maximum variance, and then removes it and detects a second linear combination that explains the maximum portion of the remaining variance. PCA is, therefore, a linear combination of variables weighted by their influence to explaining the variance in a specific orthogonal dimension (Jolliffe, 2011).

This study also uses the components of institutional changes obtained from the PCA as instrumental variables to the variable of the gender wage gap to estimate the relationship between the gender wage gap and economic growth for 59 developing countries in 2006-2016.

2.5. Data

This section is divided into two sub-sections. The first shows the sources of the different variables used in the study. The second describes and analyzes the nature of the legal barriers that prevent women from participating in different economic activities.

2.5.1 Data Sources

This study uses unbalanced panel data for 59 developing countries from 2006 to 2016. These countries are: Algeria; Angola; Argentina; Bangladesh; Benin; Bolivia; Brazil; Bulgaria; Burkina Faso; Cambodia; Cameroon; Chile; Colombia; Costa Rica; Cote d'Ivoire, Dominican Republic, Egypt; Ethiopia; Georgia; Ghana, Guatemala; Honduras; India; Indonesia; Iran, Islamic Rep.; Jamaica; Jordan; Kazakhstan; Kenya; Kyrgyz Republic; Madagascar; Malawi; Malaysia; Mali; Mauritania; Mexico; Mongolia; Morocco; Mozambique; Namibia; Nicaragua; Pakistan; Paraguay; Peru; Philippines; Senegal; South Africa; Sri Lanka; Tajikistan; Tanzania; Thailand; Tunisia; Uganda; Ukraine; Venezuela; Vietnam; Zambia; Zimbabwe.

The study uses the developing countries as a case study because traditions, social institutions and cultural practice as norms, laws, and code of conducts often represent the major source of persisting discrimination against women in these countries. In the next section, we describe the restrictions on women more broadly.

The main source of data is the World Development Indicators, which is published on the World Bank website. The data extracted from the World Bank website includes GDP per capita, trade openness, the growth rate of the population, gross capital formation (% GDP), female labour force participation, and foreign direct investment (% GDP). Moreover, this study uses different reports from the World Economic Forum to extract data for the gender wage gap, contraceptive prevalence, women ratio in parliament, and female primary schools. Legal and regulatory restrictions on women's entrepreneurship and employment data were extracted from the Women, Business and the Law website, published by the World Bank.

Finally, two important limitations in the data need to be addressed. First, this study could not find data for the gender wage gap before the year 2006, which limited the

study period to 11 years, this might influence in the results, where the institutional changes like traditions, taboos, customs, and code of conduct need long time until its effect appears on the gender wage gap and hence on the economic growth. Furthermore, since the gender wage gap has not been reported for many developing countries, therefore, countries with one or two values of gender wage gap during the study period were excluded from the study, which reduced the number of the countries from 109 to 59, where might in these excluded countries the impact of the institutional changes on the gender pay gap is deeper and larger than others, which might lead to weakening the relationship between the gender wage gap and economic growth. Second, the data on the restriction on women was not reported for some countries, which reduced the number of countries under consideration even more.

2.5.2 Restrictions on Women's Rights

The dataset of Women, Business and the Law concentrates on how regulations and laws differentiate between males and females. It includes data on legal barriers that prevent women from participating in economic and entrepreneurial activities in 143 countries, and focuses on seven indicators of gender-related variation in the legal and institutional framework:

1- Accessing institutions: this explores the female's legal ability to interact with the private sector and public authority in the same ways as males. Lack of autonomy to conduct an official transaction or interact with government institutions may constrain women's access to resources and services and limit their ability to get a job or to be an entrepreneur. This topic was expanded to include disaggregated information on 11 categories of legal ability, showing differences between unmarried and married women, such as the variation between males and females in getting national identity cards.

2- Using property: this represents women's ability to manage, own, control and inherit property. Recent editions of the Women, Business and the Law Report expand the data to include the ownership rights for women in the

marital home and whether legislation accounts for unpaid work for women, such as caring for children and the elderly.

3- Getting a job: this subject explores restrictions on female work. For example preventions on working night shifts or working in some industries. This indicator also contains data of laws on work-related paternity, maternity, retirement age, and parental benefits. Some differentiation in labour laws might increase job opportunities for females, while other laws might limit them.

Parental leave policies are expected to create a more equitable distribution of childrearing responsibilities, which in turn give females the same opportunities for work advancement as males. But constraints on participation or working hours in some industries may limit women's choices regarding the jobs that they want.

4- Providing an incentive to work: this item assesses tax consideration. It explores income tax liabilities, and takes into account tax credits and also the deductions which are available to women relative to men. This indicator includes taxation as well as public service provision of education and childcare.

5- Building credit: this subject explores access to finance by identifying minimum loan thresholds in public credit registers and private credit bureaus, and tracks public registries and private credit bureaus which collect the information from microfinance institutions. Low minimum loan thresholds mean more loans for small businesses, which are mostly taken by women. Such a loan may help women to build credit histories if credit businesses and bureaus put low criteria for inclusion in their data. And because most of the users of microfinance are women, they are more likely to benefit from credit registries and bureaux that gather and distribute microfinance data.

6- Going to court: this topic analyzes access to small courts, which can ease access to the legal system for the owner of a small business, making it faster and cheaper for women who own small businesses to sort out disputes. The

topic also analyzes data about whether the testimony of women is given the same weight as that of men, and whether married women can set up legal cases on their own or if they need permission from their husbands to do so.

7- Protecting women from violence: this theme assesses the laws on domestic violence against females and the existence of laws regarding sexual harassment.

Of the 143 economies covered by Women, Business and the Law 2014, almost 90% of the economies covered have at least one such legal difference between males and females that may limit women's economic participation, see table 2.1. Twenty-eight economies have 10 or more legal inequalities, which are distributed as follows: 14 economies in the Middle East and North Africa; 11 economies in sub-Saharan Africa: two economies in East Asia and the Pacific, and one in South Asia.

The nature of the legal restrictions imposed on women varies across countries; for example, in 18 countries husbands can legally prevent their wives from working or accepting any job. In 79 countries, the laws constrain the type of job or work that women can do. The most extensive limitation on female employment is in central Asia and Eastern Europe. There are some benefits that can reduce women's labour force participation, for example when paid maternity and paternity leave exceeds two years. Sub-Saharan Africa, the Middle East and North Africa, and South Asia have explicit legal inequalities between two genders, both in using property and accessing institutions. All 14 countries, covered in North Africa and the Middle East, have at least one legal inequality both in using property and accessing institutions.

However, no economy imposes all legal inequalities on females. On average, low- and middle-income economies have more legal differentiations than high-income countries. However, legal differentiations don't vanish as income levels rise. In fact, 17 out of the 39 high-income countries have at least one legal inequality.

Most of the countries have followed some procedures to reduce the legal restrictions against women, Figure 2.1 shows the evolution of restrictions during the period of 1960 to 2010, where 280 changes took place to reduce or to remove the legal

restriction against women, most of them concerning the ability of married females to get a job, and female property rights. The data stated that more than half of the limitations in using property and accessing institutions in 1960 had been removed by 2010. The limitations on working for married women, such as getting permission from their husbands, were removed in 23 countries, most recently in South Africa (1998) and Turkey (2001). In addition, restrictions on opening a bank account for married women were eased in 20 economies in the sample, most recently Lesotho in 2006 and Mozambique in 2004, Gonzales and others (2015).

Since 1960, 18 of the countries have removed the requirements that married females should have permission from their husband to initiate judicial proceedings. Also, 19 countries made legal changes to getting a job. Besides the reforms made in Mongolia, Albania, and Syria there were 12 changes toward more gender equality.

Although the number of economies which ban women from being head of the household has reduced by almost 50%, 23 economies out of 100 still retain this law.

Women, Business and the Law report 2014 also stated that 11 countries implemented some reforms on the subject of building credit. And several countries made some changes in their personal income tax law during the period considered.

12 economies made some changes in their court legislation such as introducing courts for small claims and increasing the amount of small claims courts.

Figure 2. 1

Evolution of restrictions during the period 1960-2010
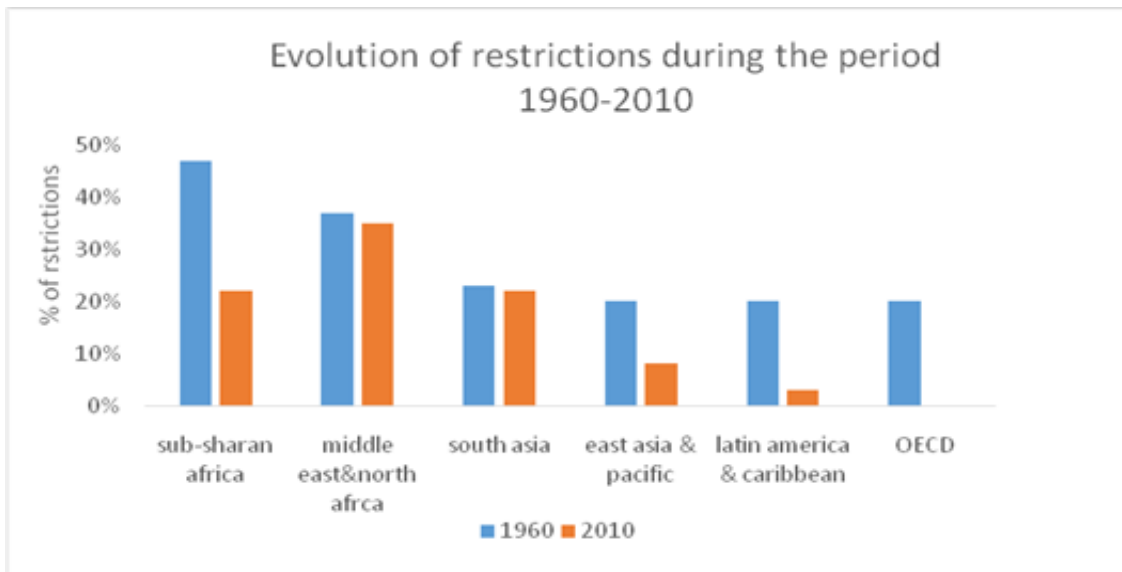
Despite the progress that was achieved in gender-related legal restrictions in many countries, there are still some sticking points and a number of legal restrictions against women in some countries in South Asia, sub-Saharan Africa, and the Middle East. These restrictions include inheritance rights for married and unmarried women and the head of household provisions. Even though there are some changes at an individual level, the gender bias still exists.

A Women, Business and Law concentrate on inequality in legal treatment affecting women's participation in the economy. The following table shows the questions tracked in the period 1960 to 2010. However, recent editions of the Women, Business and Law reports for the years 2012, 2014, and 2016 retained in the same structure of the 2010 report, expanding the depth of data covered; the number of main subjects covered is still seven indicators.

Table 2. 1

Legal Restriction against Women in the Period 1960-2010.

Property ownership	Marital regimes	Inheritance	Property titling
- Unmarried Equal property rights-immoveable - Married Equal property rights -immovable	- Default Marital Property Regime (majority)	- Sons and daughters equal inheritance - immoveable property (majority) - surviving spouses equal inheritance re: immovable property (majority)	- Joint titling default for married couples

Status and capacity	Access to judicial system	Constitutions guaranteed Equality	
- Adult married women head of household or head of the family - Married women can get a job/pursue profession - A married woman can open a bank account - A married woman can sign a contract	- Married women can initiate legal proceedings without the husband's permission	- Non-discrimination clause covering gender/sex - Customary Law valid source under the Constitution? - Customary law invalid if violates non-discrimination clause - Religious law valid source under Constitution - Religious law invalid if violates non-discrimination clause	

Source: Women, Business and Law report 2016

2.6. Empirical Results

In this section, we introduce the results of the principal component analysis (PCA). In addition, the results of the two-stage least squares analysis (2SLS) technique for the 59 developing countries for 2006-2016 are presented.

The variables used in the PCA are: Married Equal property rights - immoveable, Default Marital Property Regime (majority), Sons and daughters equal inheritance - immoveable property (majority), surviving spouses equal inheritance re: immovable property (majority), Married women can get a job/pursue profession, Married woman can sign contract, Non-discrimination clause covering gender/sex, Customary Law valid source under Constitution, and Religious law valid source under Constitution.

Table 2. 2

The Results of the Principal Component Analysis PCA

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	3.02737	1.07109	0.3364	0.3364
Comp2	1.95628	.803736	0.2174	0.5537
Comp3	1.15255	.343222	0.1281	0.6818
Comp4	.809326	.211687	0.0899	0.7717
Comp5	.597639	.025141	0.0664	0.8381
Comp6	.572498	.151951	0.0636	0.9017
Comp7	.420547	.042796	0.0467	0.9485
Comp8	.377751	.291717	0.0420	0.9904
Comp9	.0860336	0	0.0096	1.0000

With the PCA, it is important to determine how many components we should retain. This study uses two methods for this: the first one is the Kaiser Rule, which keeps a component which has an eigenvalue greater than one. The Eigenvalue explains the variation in all variables accounted for by each component. So if the component has a high eigenvalue, then it has an important contribution in explaining the variations in the variables. And if the eigenvalue is low, then few variable variations are explained

by the component. This approach is widely used in research. Based on the Kaiser Role approach, this chapter selects the first three components because each one of them has an eigenvalue of more than one. The first three components explain about 68% of the total variations.

The second approach is a scree diagram, which plots the component with each eigenvalue and finds an obvious elbow or break. From table 2.2 and Figure 2.2, we can select the first three components which have an eigenvalue greater than one.

Figure 2. 2

Scree Plot of Eigenvalues after PCA
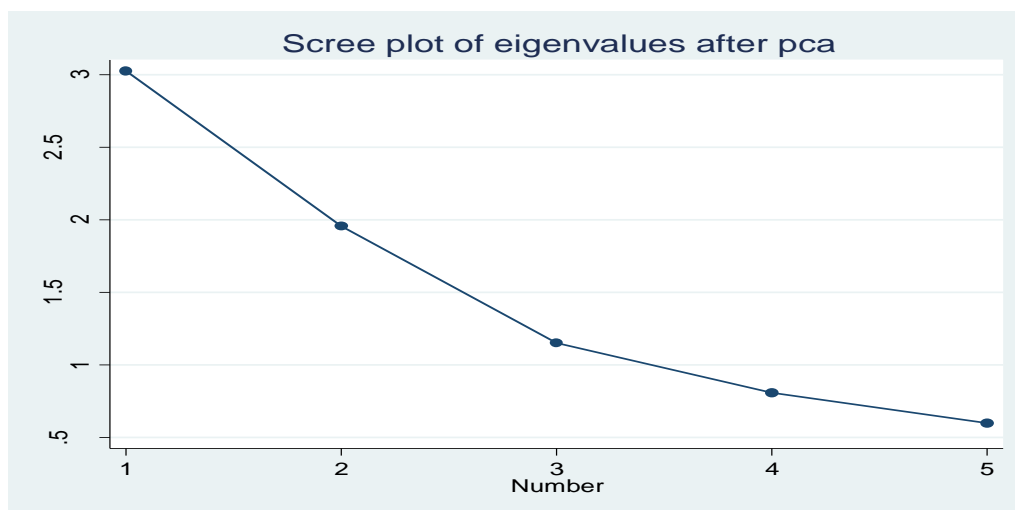
To interpret the principal component results, we should compute the eigenvector –the correlation between each component and original variables as stated in Table 2.3 below.

The interpretation of the principal components is complex. It depends on finding the strongest correlation between the variable and each component. However, choosing the strength of the correlation between the variables and the components is a subjective matter.

Table 2. 3

Principal Components (Eigenvectors)

Variable	Comp1	Comp2	Comp3
Married equal property rights	0.1165	0.5535	-0.3165
Default marital property regime (majority)	0.3620	-0.1966	-0.0985
Sons and daughters equal inheritance - immoveable property	0.4983	-0.1683	0.2202
Surviving spouses equal inheritance re: immoveable property	0.5068	-0.1910	0.1476
Married women can get a job/pursue profession	0.2859	0.3995	-0.1267
Married woman can sign contract	0.2671	0.3370	-0.2403
Non-discrimination clause covering gender/sex	0.1598	0.4512	0.2522
Customary law valid source under constitution	0.0685	0.2205	0.7846
Religious law valid source under constitution	-0.4086	0.2546	0.2586

This study interprets the results of the PCA with respect to the highest value of the correlation of the variable with each component that has a value of 0.45 or more as follows:

First principal component: The first component is correlated with four of the original variables. The first component increases with increasing default marital property regime (majority); sons and daughters equal inheritance - immoveable property; surviving spouse's equal inheritance re: immovable property, and decreasing religious law valid source under constitution. This component can be viewed as a measure of the degree, or the importance, of the default marital property regime; sons and daughters equal inheritance - immoveable property; surviving spouses equal inheritance, and religious law valid source under constitution. Furthermore, this study sees that the first principal component has a strong correlation with surviving spouse's equal inheritance re: immovable property, and sons and daughters equal inheritance - immoveable property. This conclusion is based on the correlation coefficients of 0.5068 and 0.4983 for those variables with the first component respectively. So, as stated before, this component primarily measures the variables of the sons and daughters' equal inheritance - immoveable property and surviving spouse's equal inheritance.

Second principal component: The second component increases with four variables: married equal property rights; married women can get a job/pursue profession; a married woman can sign a contract, and non-discrimination clause covering gender/sex. This study finds that the second principal component has a strong correlation with married equal property rights indicated by a correlation coefficient of 0.55 and non-discrimination clause covering gender/sex, with a correlation coefficient of 0.45. Hence the second component primarily measures married equal property rights and non-discrimination clause covering gender/sex.

Third principal component: the third principal component increases with only one variable, customary law valid source under the constitution. Based on the highest correlation coefficient between the third component and customary law valid source under a constitution which is 0.78, we conclude that this component primarily measures of the customary law valid source under the constitution.

After reporting the principal component of the legal restrictions on women, we use these three components as instrumental variables to the gender wage inequality variable.

In the following paragraphs, this chapter reports the results of a two-stage least square technique for 59 developing countries in 2006-2016.

Table 2. 4

Panel Fixed Effect two-stage least square (FE2SLS)

	First Stage	FE-2SLS
	Wage gap	Growth rate GDP PC
Gender wage gap	-	-0.02911 (0.88)
Gross capital formation (GDP %)	-0.00043 (0.96)	0.01228** (0.023)
Female primary school	-0.00117 (0.848)	0.00219* (0.065)
Contraceptive prevalence	0.00402 (0.335)	0.00330*** (0.002)
Trade openness	0.01254 (0.778)	0.07238*** (0.000)
Population growth	0.04115 (0.195)	-0.00928 (0.306)
Pc1	-0.03478*** (0.00)	
Pc2	0.03579*** (0.00)	
Pc3	0.01785*** (0.001)	
Time	0.02285* (0.076)	0.0457*** (0.000)
Time2	-0.00386** (0.043)	-0.0040*** (0.000)
Cons	0.52007** (0.02)	8.5099*** (0.000)
F	53.05 [0.000]	
Wald test		4.99 [0.00]
Kleibergen-PaaPrk LM statistic		6.6 [0.08]
Hansen j Statistic		1.856 [0.39]

*Note: ***, **,* represent 1%, 5%, 10% Level of significance respectively. The probability value is in [ ].*

The first column in Table 2.4 reports the results of the first stage of fixed effect two-stage least square (FE2SLS) analysis. We find that gross capital formation as a percentage of GDP and female primary school have a non-significant negative impact on the gender wage gap while contraceptive prevalence has a non-significant positive relationship with the gender wage gap. Even though the two variables have the expected sign, they are non-significant because they affect gender wage inequality indirectly. The instrumental variables pc1 pc2 and pc3 have a strong significant

relationship with the gender wage gap at (1%) significance level. Moreover, according to Staiger and Stock's (1997) rule of thumb, an F test of more than ten shows that the instruments are jointly significant in the model.

The second column in Table 2.4 reports the results of the fixed effect of two-stage square analysis (FE2SLS). This study does not find a significant difference between the gender wage gap and gross domestic product per capita (GDP) in the developing countries as previous research has suggested.

However, this study expects a negative relationship between the gender wage gap and economic performance, which means that an increase in the gender wage gap in developing countries will reduce the economic growth rate. The increase in the gender wage gap will discourage women from participating in the labour market and hence reduces growth by decreasing labour force participation and productivity in the economy as a whole. In addition, due to the discrimination in wages, parents tend to invest less in the education of females relative to males, which is likely to reduce female participation in the labour market in the future and lowers the incomes for families. The reduction in income adversely affects children's wellbeing and health, lowers their educational attainment and their productivity and reduces economic growth, (Morrisson et al., 2007).

Moreover, the gender wage gap may negatively affect the bargaining power of women in their families. A financial constraint on women limits their ability to invest in their children's education, which reduces economic growth (Pervaiz and others, 2011). Besides this, reducing the wage gap between males and females will reduce procreation by increasing the opportunity cost of having children (Galor and Weil, 1996). The gender wage gap is likely to delay the marriage age which lowers childbirth even more, lowers population growth and increases the potential of economic growth (Day, 2012, World Bank, 2011). Finally, female consumption patterns are different from males. Females tend to spend more money of their income on children's health and education, which can contribute to development in the long run. Therefore, by reducing the gender wage gap, one can expect more spending on

productive channels, which increase economic growth in the long run (Pervaiz and others, 2011).

This study instruments the gender wage gap in the institutional changes, which represents the legal restrictions on women's economic roles; we find a negative impact of gender wage inequality on economic growth. The empirical work shows that an increase in the wage gap by 1% leads to a 0.02% reduction in economic growth rate per capita. This relationship is not statistically significant due to the weak effect of institutional changes on gender wage to make a significant impact on the GDP per capita. This finding of this study do not support our findings in the first chapter, where our results in the first chapter showed that a decrease in the wage gap of 1% leads to a 0.002% increase in the economic growth rate per capita; this relationship is statistically significant at 5%. This means that a low gender pay inequality encourages females to participate in the labour market, this results in an increase in the average ability of the labour force, thus increasing economic growth by increasing productivity and labour force participation. However the findings of the current study also do not support the previous research of Schober and Winter-Ebmer (2011), Cassells et al., (2009), Oginni et al., (2014), who found a significant negative relationship between the gender pay gap and economic growth, and Seguino (2000a), Busse and Spielmann (2006) who found a significant positive relationship between the two variables.

Furthermore, this study reports a positive relationship between explanatory variables such as gross capital formation as a percentage of GDP); female primary school; contraceptive prevalence; trade openness, and the economic growth rate. The relationships for these variables are statically significant at 5%, 10%, 1%, and 1% respectively. In addition, there is a negative insignificant relationship between population growth and economic growth.

Finally, The Kleibergen-Paaprk LM test shows that all instruments are relevant and the regressions are not under-identified. In addition, the Hansen j test statistic indicates that the instruments are valid, based on them failing to reject the null hypothesis. Both of the tests are stated in column 2 in Table 2.4.

2.6.1 Robustness Check

In order to check if the results obtained in this study are sensitive to change in the model formulation, we conducted another estimation by including additional explanatory variables, including female labour force participation, women ratio in parliament, and foreign direct investment as a percentage of GDP. The expected signs for the female labour force participation and women ratio in the parliament coefficients in the first stage equation are negative, while the coefficient sign for the foreign direct investment as a percentage of GDP is positive. The expected coefficient signs for all these variables in the second stage of the equation are positive.

The first column in Table 2.5 reports the results of the first stage equation. We find that all additional explanatory variables have the expected signs for their coefficients. However, the relationship between the gender wage gap and economic growth is still statically insignificant. The negative relationship between the gender wage gap, female labour force participation and women ratio in the parliament indicates that an increase in the gender wage gap reduces female labour participation and women ratio in parliament. The signs for coefficients of the rest of the variables remain the same as in the previous regression analysis; the variables are gross capital formation, female primary school, contraceptive prevalence, trade openness, and population growth. Their coefficients are -0.00166, -0.00082, 0.00622, 0.01058, and 0.04302 respectively.

Table 2. 5

Panel Fixed Effect Two-Stage Least Square (FE2SLS)

	First Stage	FE-2SLS
	Wage gap	Growth rate (GDP pc)
Wage Gap		-0.01212 (0..94)
Gross capital formation (GDP %)	-0.00167 (0.858)	0.01225** (0.02)
Female primary school	-0.00082 (0.899)	0.00169 (0.20)
Contraceptive prevalence	0.00622 (0.239)	0.00320*** (0.005)
Trade openness	0.01058 (0.818)	0.07146*** (0.00)
Population growth	0.04302 (0.195)	-0.01057 (0.217)
Female labour force participation	-0.02545 (0.893)	0.04334 (0.291)
Women ratio in parliament	-0.05459 (0.423)	0.00571 (0.828)
Foreign direct investment (GDP %)	0.00035 (0.81)	0.00003 (0.911)
PC1	-0.03520*** (0.001)	
PC2	0.03720*** (0.000)	
PC3	0.02541** (0.039)	
Time	0.02305* (0.08)	0.0448*** (0.00)
Time2	-0.00377** (0.05)	-0.0038*** (0.00)
Cons	0.63223 (0.386)	8.34628*** (0.00)
F-test	24.61 [0.00]	
Kleibergen-Paaprk LM statistic		7.41 [0.059]
Hansen j statistic		2.92 [0.23]

Note: ***, **,* represent 1%, 5%, 10% Level of significance respectively. The probability value is in [ ].

The instrumental variables represented by pc1 pc2 and pc3 have a strong significant relationship with the gender wage gap at (1%) level. In addition, a high F-test value of 24.61 indicates that the instrumental variables included in the model are jointly significant, according to Staiger and Stock's (1997) rule of thumb, greater than 10 F-test value.

In conclusion, adding the three dependent variables did not change the coefficient signs. However, the impact of gender wage inequality on economic growth rate per capita is insignificant.

The second column in Table 2.5 reports the results of the fixed effect of two-stage square analysis (FE2SLS). It shows that all additional variables, female labour force participation, women ratio in parliament, and foreign direct investment (GDP %) have the expected signs. However, these are not statistically significant. The rest of the variable coefficient doesn't change; for example the gender wage gap still has a negative relationship with growth rate of economics per capita, and the relationship is statistically not significant.

The Kleibergen-Paaprk LM test reports that all instruments are relevant and the regressions are not under-identified. Furthermore, the Hansen j statistic test indicates that the instruments are valid since we cannot reject the null hypothesis. Both of the tests are reported in column 2 of Table 2.5.

2.7. Conclusion

This chapter examines the relationship between gender pay inequality and economic growth for 59 developing countries. An unbalanced panel data for 59 developing countries is used for the period 2006-2016. To deal with potential endogeneity in the model we instrumented the gender wage gap using data of legal restrictions on women. We used 2sls analysis to estimate the relationship between the gender wage gap and economic performance. This technique is considered as an extension for the ordinary least square method, and is used to deal with a model which has some endogenous variables between its explanatory variables in a linear regression framework.

Since the data on legal restrictions for women includes many variables, this study uses PCA, a mathematical procedure to transform a large set of possibly-correlated variables to a smaller set or a smaller number of uncorrelated variables. The variables used in our PCA are: married equal property rights - immoveable; default marital property regime (majority); sons and daughters equal inheritance - immoveable property (majority); surviving spouses equal inheritance re: immovable property (majority); married women can get a job/pursue profession; married woman can sign contracts; non-discrimination clause covering gender/sex; customary law valid source under constitution, and religious law valid source under constitution. After applying PCA we got nine components. Based on the Kaiser Role, a component which has an eigenvalue greater than one is retained. Therefore, this study kept the first three components, which have an eigenvalue more than one. These components explain about (68%) of total variations. We use the first three components as instrumental variables for the gender wage gap.

The results of the first stage analysis indicate that gross capital formation as a percentage of GDP and female primary school have a negative insignificant impact on the gender wage gap, while contraceptive prevalence has a positive insignificant relationship with the gender wage gap. An explanation for the insignificant relationship between female primary schooling and contraceptive prevalence with the gender wage gap is because these factors may not directly affect gender wage

inequality. However, the results of the instrumental variables report that they have a strong significant relationship with the gender wage gap at a 1% level. In addition, the model is significant since the F test value is more than ten according to Staiger and Stock's (1997) rule of thumb.

The results of the 2sls do not find significant differences between the gender wage gap and GDP per capita in the developing countries under study. This is because the influence of institutional changes in the gender wage gap are not dominant enough to make a significant impact on the GDP per capita in the period of the study. The findings of the current study do not support previous research. The negative sign of the gender wage gap indicates that an increase in the gender wage gap of 1% will reduce the economic growth rate per capita by 0.02%. As mentioned earlier, an increase in the gender wage gap will discourage women from participating in the labour force, and adversely affects economic growth.

For a robustness check, this study included additional explanatory variables: female labour force participation, women ratio in parliament, and foreign direct investment as a percentage of GDP. The signs for variable coefficients remain the same for the first stage and second stage analysis. However, the quantitative impact of the gender wage inequality on the economic growth rate per capita presents a small degree of sensitivity in the model. These research techniques could be applied to other groups of countries that have similar traditions, taboos, and codes of conduct, As well as at the level of the individual country.

Chapter 3

The Gender Wage Gap and Firms' Characteristics: Descriptive Analysis for UK firms for 2017

3.1. Introduction

Despite the increase in females' education, professional experience and participation rates over the last decade, females still receive lower pay compared to their male counterparts. In the UK, females' hourly wages were on average 18.4% lower than males in 2017. This gap in wages dropped slightly to 17.9% in 2018 (Office for National Statistics).

Many studies that have analysed the wage gap between the two genders have focused primarily on individual characteristics, such as age, experience, education, household activities and time spent caring for the family (Dias, Joyce and Parodi 2018; Cukrowska-Torzewska and Lovasz, 2016; Christofides and others (2013); Manning and Swaffield 2008). Nevertheless, a large part of the wage differentials between the two genders is still not fully explained. Therefore, gender wage inequality continues to attract the attention of researchers who want to understand its roots and developments. There has been a growing body of literature that has explored other factors that influence the wage gap, such as firms' workplace environments, where firms play an essential role in creating and sustaining inequality between the two genders through their recruitment policies, training practices and employee allocation (Heinze and Wolf, 2010; Simón and Russell, 2005). There have been a series of literature investigating the impact of workplace on the gender wage inequality in UK. Mumford and smith (2007) by using the British Workplace Employee Relations Survey 1998 (WERS98) found that the work place in which the employee works has an important contribution in the wage gap between two genders. Similarly, Butcher, Mumford and Smith (2016) used the dataset of the British Workplace Employee Relations Survey 2004 (WERS04); the British Workplace Employee Relations Survey 2011 (WERS11); and the Annual Survey of Hours and Earnings (ASHE) 2004, 2011 and 2015 to investigate the impact of employee characteristics, occupation; and workplace characteristics such as industry; region; high performance workplace practices; Physical and market conditions which captured by: workplace size; workplace age; whether the firms have multiple site work in UK; whether the workplace is foreign controlled on the gender wage inequality, the results show that females segregation

into workplace, industries and workplace account for an important proportion of the raw wage gap between two genders.

However, this study attempts to analyse how females' and males' wages vary with firms' characteristics such as profitability, productivity and age and why wages differ between males and females in firms. Also, it analyses the impact of wage transparency policies on the gender wage gap in UK firms in narrowing the wage gap between the two genders.

Firms' wage policies may contribute to the wage gap between the two genders when females' wage negotiation skills fall short of men's or if females are not working in high-paying businesses. Females tend to work at less productive firms that offer their employees lower wages. This is probably because females are over-represented in the hospitality and retail sectors, which tend to be less productive than other sectors. Even when females are employed by high-paying firms, their wage increase is less than that of their male counterparts, probably because they are less effective negotiators. One of the most common explanations for the gap between the two genders is the occupational segregation of the genders, where females tend to work in lower-paid occupations more than males. This might be related to gender stereotyping, social norms, part-time jobs, caring responsibilities or a lack of flexible management positions suitable for females with childcare responsibilities. However, some studies have shown that the age of firms might have an impact on the wage gap between the two genders. According to Becker's (1957) theory of discrimination, the inequality in wages between the two Genders is narrowing due to competition pressures, Li and Dong (2011). This evidence thus rather suggests that new firms would have smaller gaps in pay because they cannot bear the costs of discrimination against females to stay in the market as a result of market pressures, Magda and Cukrowska-Torzewska (2019).

To explore the sources of the gender wage gap in the UK's firms, this study utilizes new data on gender pay inequality for UK firms. This study goes beyond individual characteristics of workers and addresses the contribution of firms' characteristics to explain wage differences between the two genders. The UK government issued a new regulation in April 2017 that requires employers of 250 employees or more to publish

their gender wage gap data. This policy is considered part of the attempt to reduce workplace discrimination. To achieve the study's purpose, this chapter uses the wage decomposition analysis technique to explore the sources of the gap in wages between the two genders and to decide whether the causes of wage discrimination come from across firms or within firms.

This study found that the average wage gap between the two genders for firms with at least 250 employees was 14.33%, less than the national gender pay gap in the UK in 2017. This indicates that the gender pay gap in small firms was higher than in large firms in the UK. In addition, it shows that most of the wage gap between the two genders in all sectors comes from within firms, as the ratio of the gap within firms is 61.8% for 2017.

To analyse how the wage gap between the two genders varies with firms' characteristics, we matched the data on gender wage gaps with the financial data for UK firms. Due to the nature of the available data, this study followed descriptive analysis techniques for cross-sectional data for UK firms for the year 2017. This approach captures a specific point in time. The descriptive analysis results for the data on UK firms show that the average gender wage gap for firms with at least 250 employees dropped from 14.33% in 2017 to 14.21% in 2018. A probable cause of this decline is that of wage transparency policies. Moreover, we found that gender wage gap growth is positively related to firms' profitability, productivity and age. In addition, the results state that compared to their male counterparts females are less likely to work for the most productive firms, and more likely to work for the least productive firms. This is supported by the fact that females are over-represented in the hospitality and retail sectors, which tend to have lower productivity than other sectors. Furthermore, we found that females are still under-represented in senior positions in UK firms, and the proportion of females in senior jobs decreases when firms' productivity increases. Similarly, we found that females are more likely to work in the least profitable firms or oldest firms. In addition, the results show that females are still under-represented in senior positions in these firms. Finally to explore how UK firms' characteristics affect firm's compliance with the government regulation which requires employers of 250 employees or more to publish their gender wage gap data.

We found that with increasing age and firm's liquidity ratio, the firms will be more likely to publish their gender wage gap data. In addition, the results showed that with higher profits and firms' productivity, the firms will be less likely to publish the gender wage gap data.

This chapter is divided into seven sections. The second section traces the literature related to the relationship between the gender pay gap and workplace performance.

Section three states the reasons for the gender wage gap in firms. Section four discusses the methodology. The data and descriptive statistics are introduced in section five. Section six presents the results of the descriptive analysis. Section seven concludes the chapter.

3.2.   Related Literature

This study analyses the sources of the gender pay gap within economic sectors. In addition, it analyses how the wages of women and men change with firms' characteristics such as profitability, productivity and age. Firms' wage policies may contribute to the gender wage gap when females are at a disadvantage in wage negotiations compared to men, or if females are less likely to work in high-paying businesses. Females tend to work in less productive businesses that pay their employees lower wages.

Many studies have explored gender wage differentials by focusing on the personal characteristics of male and females that determine wages, and how firms reward these characteristics. Christofides and others (2013) attempted to explain the gender wage gap by focusing on education and age, while Dias, Joyce and Parodi (2018), OECD (2012) and Blau and Kahn (1999) took into consideration the differences in career decisions for women and men, relative working hours and labour market experience. Cukrowska-Torzewska and Lovasz (2016) and Manning and Swaffield (2008) focused on household activities and time spent caring for family. However, a large part of the gender wage gap is still not explained by the aforementioned factors. Therefore, there is a growing body of literature that still focuses on individual characteristics of employees but also emphasizes the importance of the workplace in explaining gender

wage differentials. Simón and Russell (2005) investigated the gender wage gap for a set of European countries using a cross-national survey of matched employer–employee data. They found that workplace characteristics play an important role in explaining wage disparities between female and males in European countries. Similarly, Drolet (2002) utilized the matched employee-employer data from a 1999 survey of workplaces and employees in Canada to show that workplace characteristics such as workplace practices, high performance, non-profit organization, foreign ownership, training expenditure, part-time rates and desirable employment contracts accounted for 27.9% of the gender wage gap compared to 10.8% for worker characteristics. Moreover, using panel data on the hourly wages of the Portuguese labour market, Card, Cardoso and Kline (2015) found that firms' characteristics accounted for 21% of the mean gender pay differential.

Gupta and Rothstein (2005) indicated that occupation has a much larger influence than the workplace in explaining the gender gap for salaried workers but not for manual workers. Gupta and Eriksson (2006), using a difference in differences model for Denmark data, showed that adopting new workplace practices increases the gender wage gap in the firm. Bøler and others (2015), using employer-employee data for the Norwegian manufacturing sector for the period 1996–2010, found that gender pay inequality for educated workers in exported businesses is higher than in non-exported businesses by an average of 3%. This view is supported by Bernard, Jensen and Lawrence (1995) and Busse and Spielmann (2006), who confirmed the positive relationship between gender pay gap and trade openness. Using data for 92 developing and developed countries, Busse and Spielmann (2006) found that countries with higher gender pay differentials have a higher rate of export of goods that depend on labour intensity.

In the same vein, Heinze and Wolf (2010) indicated that when firms face more market competition they work in a more egalitarian way. Likewise, Black and Brainerd (2004) and Meng (2004) found that when competition increases it leads to a decrease in the gender pay gap in firms. Moreover, there are some researchers who take into consideration the impact of firm size on the gender wage gap, such as Heinze and Wolf (2010). Using employer–employee data for Germany, they indicated that wage

disparity between males and females decreases with firm size. This subject has also been explored in the racial discrimination literature. Sørensen (2004) stated that there is more discrimination in smaller firms than larger ones, indicating that larger firms offer more equal opportunity than smaller ones.

Transparency is another factor that affects the gender pay gap, Bennedsen and others (2019), using employer–employee data for Denmark, indicated that the law that forces firms to declare their gender pay gap has contributed to a reduction in the wage gap between the two genders. However, Breza and others (2017), using data from Indian manufacturing firms, found that information on wages and how much peers are receiving might create negative feelings and decrease job satisfaction. Other studies have analysed the relationship between the gender pay gap and age of firms. Brixy and others (2007) found that on average wages in new firms are 8% lower than in equivalent old firms. Magda and Torzewska (2019) used data on earnings in eight European countries and pointed out that in all eight countries the wage gaps between the two genders clearly increased with age of firms.

In the same context, Rycx and Tojerow (2004) investigated the relationship between profits and the gender wage gap in the Belgian private sector. They indicated that about 14% of the gender pay gap can be explained by the fact that females are usually employed in less profitable firms. This view is supported by Navon and Tojerow (2006). Using employer–employee data from the private manufacturing sectors in Israel for 1995, he found that about 12% of the gender pay gap can be explained by profits. Moreover, Bennedsen, Simintzi and Tsoutsoura (2019) indicated that a reduction in wage bill in firms does not affect firm profitability because it is offset by lower productivity due to gender wage gap transparency. There have been a series of studies exploiting the associated evidence of characteristics for both individual worker and workplace. Butcher, Mumford, and smith (2019) used the Workplace Employee Relations Survey (WERS11) to investigate the determinants of wage gap between two genders in UK, found that occupation, individual characteristics, and industry, female segregation into occupation, industries workplace account for an important proportion of the raw earning gap between two genders. Similarly, Mumford and smith (2007) by using the British Workplace Employee Relations Survey 1998 (WERS98) found that

the work place in which the employee works has an important contribution in the wage gap between two genders. likewise, Butcher, Mumford and Smith (2016) used the dataset of the British Workplace Employee Relations Survey 2004 (WERS04); the British Workplace Employee Relations Survey 2011 (WERS11); and the Annual Survey of Hours and Earnings (ASHE) 2004, 2011 and 2015 to investigate the impact of employee characteristics, occupation; and workplace characteristics such as industry; region; high performance workplace practices; Physical and market conditions which captured by: workplace size; workplace age; whether the firms have multiple site work in UK; whether the workplace is foreign controlled on the gender wage inequality, the results show that females segregation into workplace, industries and workplace account for an important proportion of the raw wage gap between two genders. In the same vein, Chatterji, Mumford, and Smith (2011) showed that employee characteristics explain a small proportion of the gender wage gap in the public and private sectors in the UK, while the differences in workplace characteristics contribute in a considerable size in the gender wage inequality. Drolet and Mumford (2009) pointed out that workplace increased the gap by 3.2% in UK and reduced the gender wage gap by 14.5% in Canada. Other studies have analysed the relationship between the gender wage gap and workplace for the employees in terms of gender-working time (male and female full/part –time). Mumford and Smith (2008) indicated that female work place segregation has an important contribution in the full/part time earning gap between two genders. In the same context, Mumford and Sechel (2020) analysed the gender wage differentials for academic economists, across institutions in UK. The results of the decomposition analysis stated that the significant proportion of the pay gap between the genders is related to males, where males receiving higher wages than females from being older or married; and from workplace characteristics. Mumford and smith (2004) by using used the British workplace employee relations survey 1998 (WERS98), found that the pay gap differentials between two genders is substantial and persistent, however, workplace characteristics and occupational segregations explain important part of the wage gap. This view supported by Drolet and Mumfored (2009) who used cross-sectional data from Australia, France, Japan and UK to investigate the role of country-specific workplace

and human capital in explaining the gap in wages between males and females, they found that country-specific institutions were important in explaining the gender pay inequality between countries.

These studies used different data sets and techniques to explain or to understand the gender gap in wages. While there is plenty of research that explains gender wage differentials by focusing on personal characteristics of male and females (such as education and age) that determine wage levels, and also determine how firms reward these characteristics, there are a few studies that have moved beyond the individual characteristics of employees to consider the importance of firms' characteristics in explaining gender wage differentials such as firm size and age, workplace practices, high performance, competitiveness and whether the firm is considered as an exporter or not. This study is the first to use the new data set on the gender wage gap for UK firms that hire 250 employees or more. Furthermore, this study analyses the sources of wage differentials between the two genders within sectors, within firms and across firms. This study adds to the previous literature by providing new evidence on the sources of the gender wage gap in the workplace. It analyses the movement of females' and males' wages using firms' characteristics. Also, it analyses the impact of wage transparency policies on the gender wage gap in UK firms in narrowing the wage gap between the two genders.

3.3. Reasons for Wage Inequality between the two Genders in the Firms

Studies have identified a number of factors that cause wage inequality between the two genders. These studies have explained inequality in terms of observable and non-observable characteristics. Observable characteristics such as experiences, education, marital status, age and hours worked have been studied by Glauber (2018), Fuller and Hirsh (2018), Dias, Joyce and Parodi (2018), Yu and Kuo (2017) and Christofides and others (2013). Blau (1997) pointed out that it is not only age, occupation and education that should be included as explanatory variables for the gap between the two genders, but also childcare and university grades. However, Hanushek and Woessmann (2010) pointed out that while human capital factors explain a significant

part of the gender wage gap, the analysis leaves a proportion of the gender wage gap unexplained.

There is a growing body of studies that go beyond the personal characteristics of labour and consider the importance of firms' characteristics in explaining the gender pay gap (Heinze and Wolf, 2010; Simón and Russell, 2005). The workplace plays a vital role in creating and sustaining the inequality between the two genders through locating employees, training policies, and training practices. Workplaces can also create gender pay gaps via occupational segregation, where some jobs are dominated by males and others by females and females tend to be concentrated in lower-paid jobs. Bratton and Gold (2017) argued that occupational segregation is more likely to occur for low-skilled workers and also for females with children. Also, Hanushek and Woessmann (2010) noted that workers with higher educational attainment are concentrated in larger numbers in higher-paying jobs than those with lower educational attainment. Moreover, mothers are more likely to work in sales jobs or service jobs than females without children. Bratton and Gold (2017) argued that occupational segregation is more likely to occur for low-skilled workers and also for females with children.

Furthermore, segregation by occupation is referred to as being either vertical or horizontal. Vertical occupational segregation refers to the situation where males always occupy higher managerial jobs with high wages, while females are under-represented in these occupations and are less likely to reach senior positions. The factor that holds females back from moving to the senior or managerial level is the lack of gender diversity models at senior levels in firms. In addition, there exists the assumption that females, particularly mothers, do not want to be in a position or at a job level that might enable them to gain promotion because of their domestic responsibilities (Mordaunt, 2019). Horizontal segregation refers to the situation where females are concentrated in low-paid jobs such as cleaning, caring, catering, sales jobs and clerical jobs. Blau and Khan (2000) pointed out that wages in jobs that are dominated by females tend to be kept low by the prevalence of part-time posts and the existence of discrimination in the labour market, which might lead to an oversupply of female workers for these occupations.

Another way in which the workplace might create gender wage inequality is through work flexibility and part-time jobs. Part-time jobs and job flexibility are characterized by lower wages. Females tend to choose these kinds of jobs because they help them to deal with unexpected family circumstances, such as sick children and school closures, without suffering penalties for their absence (Damaske and others, 2014). This viewpoint is supported by Becker (1993) and Miranda (2011). However, Jaumotte (2004) reported that part-time jobs are characterized by low wages, poor benefits, variable hours, low job tenure, less training, and low prospects for promotion. Less time in the job can make employers view female workers as less committed to the job and more likely to take leave from their jobs to care for their families than male workers. This means that female's employee appear to be less valuable than their male counterparts and, therefore, they receive lower wages for their work. Also, females who work part-time are less likely to qualify for benefits such as promotions, health insurance and sponsored retirement plans (Economic Committee Democratic Staff, 2016).

The final factor that feeds into the wage gender gap is the gender stereotype, which affects females' education and career decisions (Fapohunda, 2013). Educational choices for women are determined partly by job opportunities, since not all jobs are available to them, and by gender stereotypes that prevail in the community. Sorsa and others (2015) and the OECD (2012) affirmed that women's behaviour in the labour market is influenced by culture and social values that might discriminate against them by stereotyping. However, employers are likely to rely on such stereotypes when they lack information about workers when they are hiring. A stereotype about females with children that they are less productive and less committed to work might pose an obstacle to their employment and high wages.

3.4. Descriptive Analysis Framework

This study aims to analyse how the wages of males and females vary with firms' characteristics in the UK for the year 2017. Also, it analyses the sources of the differences in earnings between males and females in the workplace. To achieve the study's purpose, we used the wage decomposition analysis technique to explore the sources of the gap in wages between the two genders and determine whether the wage gap is caused by differences between firms or by factors within the firms themselves. To do this, we used the following equations:

$$Between = \sum_{i=1}^{n} \overline{w}_i \ (nf/tnf) - \sum_{i=1}^{n} \overline{w}_i \ (nm/tnm) \dots \dots \dots \dots \dots \dots \dots \dots \dots . (1)$$

$$within = \sum_{i=1}^{n} w^f{}_i \ (nf/tnf) - \sum_{i=1}^{n} w^m{}_i (nm/tnm) \dots \dots \dots \dots \dots \dots \dots \dots \dots (2)$$

where $\overline{w}_i$ represents the average wage in the firm, nf denotes the number of females in the firm, tnf stands for the total number of females across the firms, nm denotes the number of males in the firm, and tnm stands for the total number of males across the firms. $w^f{}_i$ represents the average wage for females in the firm, and $w^m{}_i$ represents the average wage for males in the firm. The results of the wage decomposition analysis technique can determine the sources of the wage gap between the two genders: whether it comes from within the firm, from between firms or both.

3.5. Estimation framework

This study used the following probit model to investigate how UK firms' characteristics affect firm's compliance with the government regulation which requires employers of 250 employees or more to publish their gender wage gap data.

$$Y_{it} = \beta_0 + \beta_1 Age_{it} + \beta_2 Turnover_{it} + \beta_3 Liquidity_{it} + \beta_4 Profit_{it} + \epsilon_{it} \dots \dots (3)$$

Where Y_{it} represents firm's compliance with government regulation, it takes the value of one if the firm publish the gender wage gap and zero otherwise; $\boldsymbol{Age_{it}}$ denotes

firm's age; $\textbf{\textit{Turnover}}_{it}$ represents firm's turnover per employee; $\textbf{\textit{Liquidity}}_{it}$ represents liquidity ratio of the firm; $\textbf{\textit{Profit}}_{it}$ represents firm's profit, and $\boldsymbol{\epsilon}_{it}$ represents the error term.

3.6.   The data

This part is divided into two sections. The first section shows the sources of the variables used in the study. The second section includes descriptive statistics for the data.

3.6.1   Data Sources

This study used cross-sectional data for the UK for the year 2017. The data on the gender pay gap are derived from the gender wage gap service website (https://gender-pay-gap.service.gov.uk/). This new website was founded by the UK government in 2017, and firms that have at least 250 employees or more are legally required to publish their figures on gender pay differences between the two genders on the site. The published report for each firm should include the following information:

- mean gender wage gap in hourly pay

- median gender wage gap in hourly pay

- mean bonus gender wage gap

- median bonus gender wage gap

- the proportions of females and males receiving a bonus

- the proportions of females and males in each quartile.

The gender wage gap service data set includes data on 10,560 UK firms for the year 2017 and data on 10,740 firms for the year 2018.

Financial data such as profit before tax, remuneration, turnover per employee, total assets growth rate, age of firms and number of employees were extracted from the Forecasting Analysis and Modelling Environment (FAME) database for the year 2017. The FAME is a database containing information about private and public firms in the UK and Ireland. It covers firm financials, in detailed format, with up to10 years of history and also detailed firm structures and firm family.

A standard firm report includes a balance sheet, turnover, profit and loss, ratios, number of employees, and other financial information. Moreover, the data covers detailed information about firms' ownership and their subsidiaries.

Linking two data sets requires some variables that are common between both data sets, which are considered as identifiers. This research used the name of a company as the identifier for both data sets, so we matched the two data set based on their names. However, when matching the gender pay gap data set of 10560 companies for 2017, with the (13568) companies which was extracted from the FAME dataset for firms with 250 employees and more for the same year, it resulted in 7224 companies.

3.6.2 Descriptive Statistics

Different studies have used different ways to measure and define the wage gap between the two genders. The gender wage disparity was computed as the differences in the average hourly wage rates of all males and females across the firms divided by average male hourly wages. All firms with more than 250 employees are required by law to declare their gender pay gaps. These firms employ about 16.4 million people, who constitute around 56% of all employees in the UK (Business, Energy and Industrial Strategy Committee, 2018).

Table 3.1 indicates that the average wage gap between the two genders for firms with at least 250 employees was 14.33% in 2017. This gap dropped to 14.21% in 2018, and wage transparency policies might have had some influence in this decline. However, this gap is smaller than the national gender wage gap, which was 18.4% and 17.9% for the years 2017 and 2018 respectively.

Of the 10,560 firms covered by the data set, 11.69% of the firms paid their female employees more than males in 2017. In addition, 0.71% of firms reported that their gender wage gaps were equal to zero in the same year. Moreover, 12.37% of the firms had a gender pay gap of over 30% in 2017.

Table 3. 1

Summary Statistics for All Data

Variable	Mean 2017	Mean 2018
Gender wage gap	14.33	14.21
Females in the lower quartile	53.67	53.82
Males in the lower quartile	46.32	46.17
Females in the lower middle quartile	49.48	49.77
Males in the lower middle quartile	50.51	50.22
Females in the upper middle quartile	45.14	45.58
Males in the upper middle quartile	54.85	54.41
Females in the top quartile	39.19	39.72
Males in the top quartile	60.80	60.27

Furthermore, it can be seen from table 3.1 that in 2017 the proportion of females in the lower quartile was 53.67% for all firms, while the males constituted 46.32% of the same quartile. In contrast, females in the top quartile constituted 39.19% in all firms, while males constituted 60.80% of all firms for the same quartile. In addition, the table illustrates that the proportion of women in the top quartile in 2018 slightly increased compared to the previous year. These figures reflect the fact that most highly paid jobs are dominated by males and that females are more often found in lower-paying jobs.

The data sets for the gender wage gap for firms for the years 2017 and 2018 were distributed to sectors based on the 2017 The Standard Industrial Classification (SIC) codes. The data set for 2017 includes 10,560 firms; 962 firms did not attach the SIC code and therefore they were dropped. The remaining 9,598 firms were used in the study. In the data set for the gender wage gap for 2018, there were 10,740 firms; 693 of the firms did not attach the SIC code and were therefore dropped. We were left with 10,047 firms. Therefore, the number of firms will be slightly different when distributing the firms into sectors.

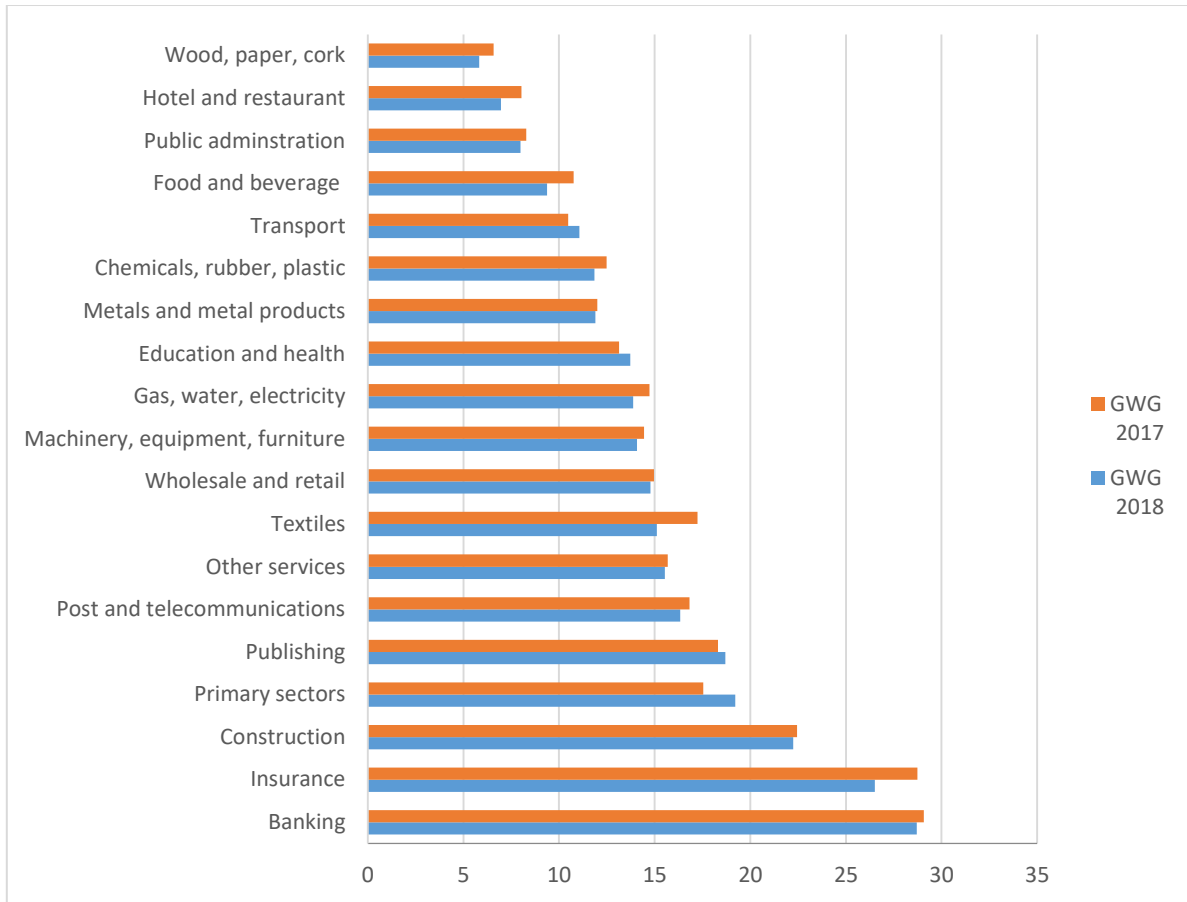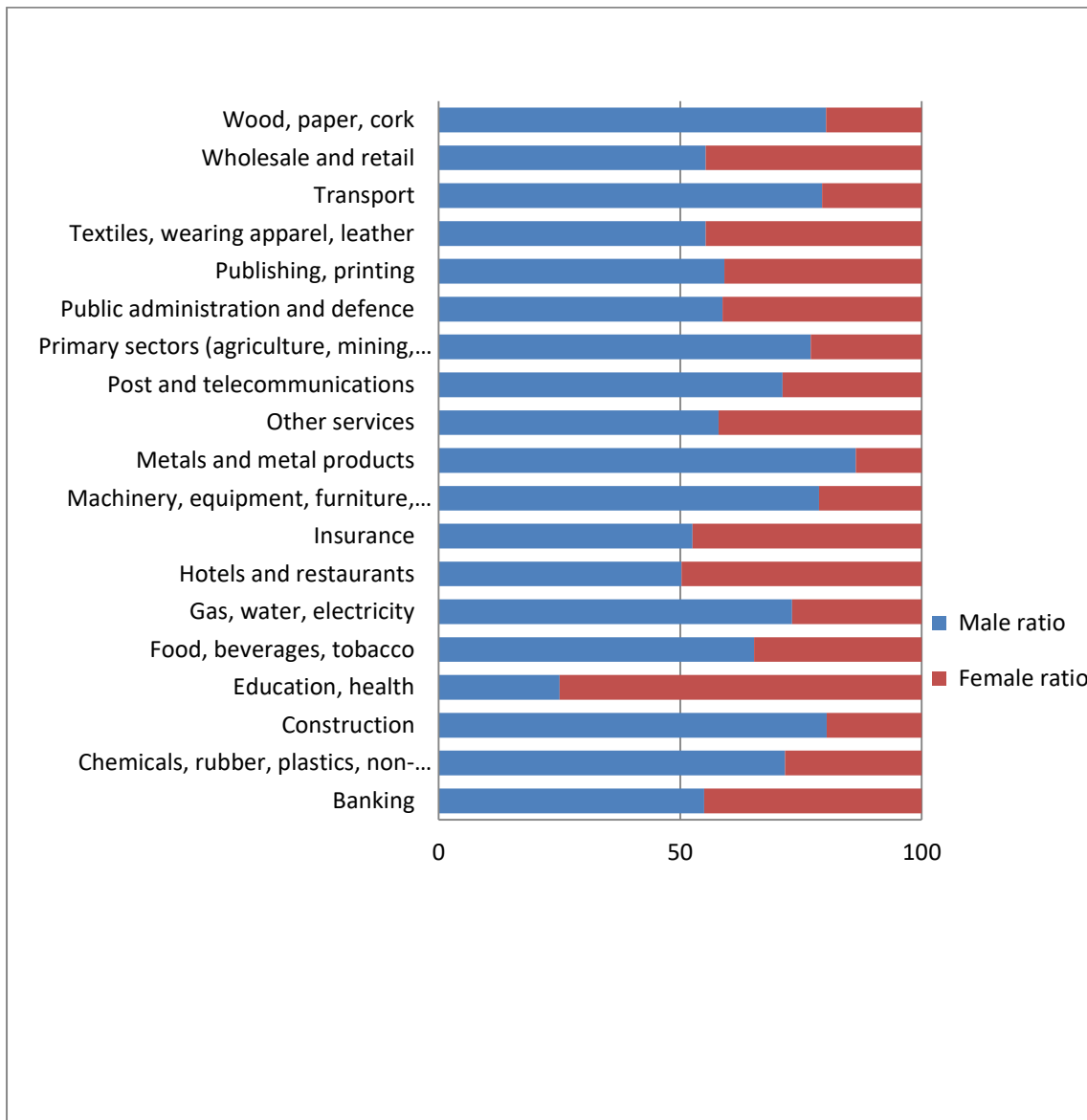Figure 3. 1

Gender Wage Gap by Sector %

Figure 3.1 shows that each sector in the economy has a gap in wages between the genders. But the size of this gap varies from one sector to another. The largest average wage gap between the two genders in 2017 was in the banking and the insurance sectors, where the pay gaps were 29.07% and 28.74% respectively.

Figure 3. 2

Comparison Between Male and Female Ratios in the Sectors, 2017

However, there are substantial differences between the sectors that females and males tend to work in. As figure 3.2 shows, females are more likely to work in the education and health sectors while males are more likely to work in the metal and metal products, transport and construction sectors. Females tend to work in education and health services because they are provided by the public sector which is considered more compatible with family responsibilities, perhaps due to flexibility in working hours and better labour protection.

Figure 3. 3

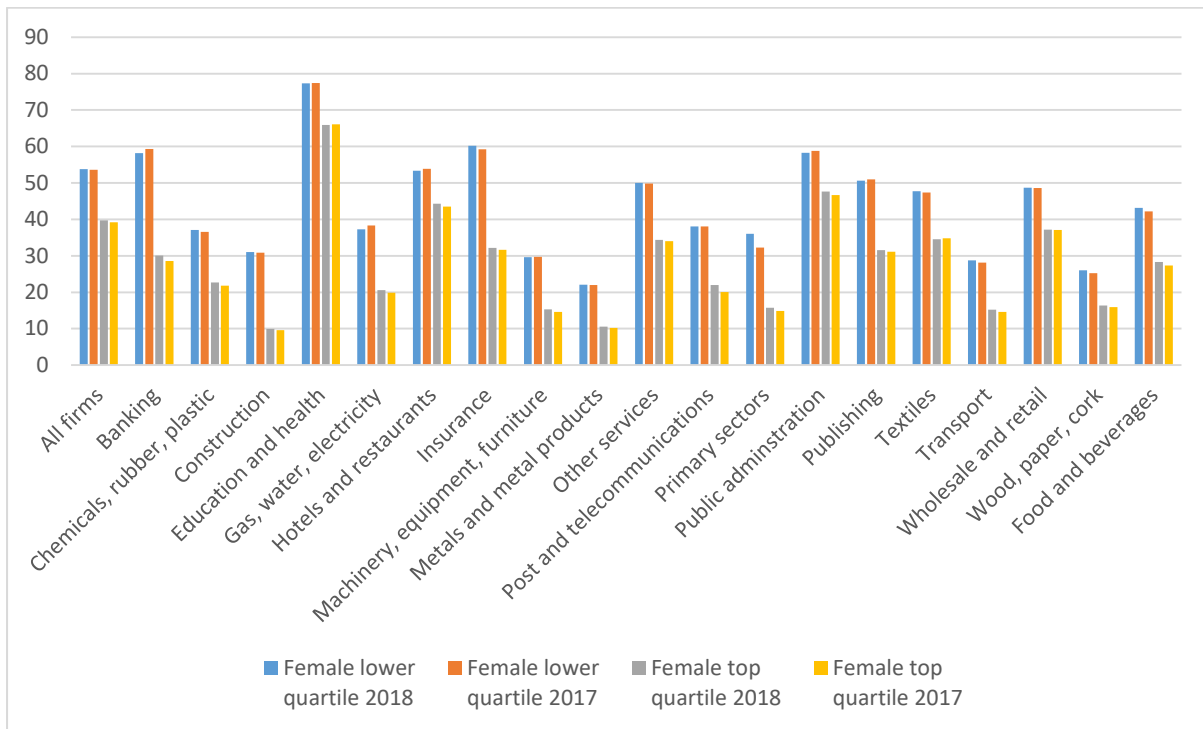Comparison Between Female Ratios in the Quartiles for 2017–2018

Figure 3.3 shows that in 2018 the proportion of females in the top quartile slightly increased to 39.72% compared to 2017. The largest proportions of females in the top quartile in the years 2017 and 2018 were in the education and health and public administration sectors, with 66.07% and 46.7% respectively. Furthermore, figure 3.3 shows that the lowest ratios of females in the same quartile were in the construction and metals and metal products sectors, with 9.57% and 10.2% respectively. In addition, figure 3.3 shows that in 2017 education and health, banking and insurance had the highest proportions of females in the lower quartile, where the proportions of females amounted to 77.4%, 59.3% and 59.1% respectively. However, these ratios slightly declined for these sectors in 2018, except for insurance, where the ratio slightly increased to reach 60.17%.

The gender wage gap data used in figure 3.1 have been matched with the firm data characteristics that were extracted from the FAME database. The FAME data contain detailed financial information on all firms in the UK. The matching between the two data sets reduced the number of firms from 10,560 to 7,224.

Table 3. 2

Descriptive Statistics for Gender Wage Gap Data Sets Matched With Financial Data of Firms

	Gender pay gap	Female ratio	Female ratio in lower quartile	Female ratio in lower middle quartile	Female ratio in upper middle quartile	Female ratio in top quartile
Banking	29.3	47.4	58.3	51.9	41.7	28.2
Chemicals, rubber, plastics, non-metallic products	12.7	28.6	37.8	28.1	24.7	22.5
Construction	22.7	22.1	33.1	20.5	13.7	11.4
Education, health	12.8	74.1	79.3	77.5	74.4	68.7
Food, beverages, tobacco	11.4	36.8	43.1	37.1	30.6	27.9
Gas, water, electricity	14.5	28.9	38.5	27.7	21.6	19.5
Hotels and restaurants	8.3	51.7	53.8	52.1	50.1	42.9
Insurance	30.1	47.3	58.8	53.6	46.2	31.2
Machinery, equipment, furniture, recycling	14.8	20.3	30.3	22.3	17.8	14.4
Metals and metal products	11.8	15.0	20.9	12.7	10.7	10.2
Other services	17.1	42.7	50.2	45.3	39.7	32.9
Post and telecommunications	17.3	23.1	38.8	29.5	25.8	21.1
Primary sectors (agriculture, mining, etc.)	19.6	30.6	35.1	23.7	18.2	14.7
Public administration and defence	11.3	33.2	53.0	41.3	35.7	34.7
Publishing, printing	17.9	43.8	49.7	44.6	37.4	31.5
Textiles, wearing apparel, leather	18.7	45.7	51.8	46.9	44.2	36.1
Transport	10.4	26.5	28.4	21.2	17.6	15.3
Wholesale and retail trade	15.2	53.6	48.1	48.8	44.8	37.0
Wood, cork, paper	6.7	22.3	26.6	18.5	16.8	17.2
All	15.1	44.4	50.5	45.9	41.3	35.5

Table 3.2 reports the descriptive statistics for the gender wage gap service data set, which was matched with financial data on the firms. The table shows that the average wage gap between the two genders for firms with at least 250 employees was 15.1% in 2017.

Furthermore, it can be seen from the table above that the largest average wage gaps between the two genders in 2017 were in the insurance and banking sectors, where the pay gaps were about 30.1% and 29.3% respectively. Moreover, the lowest average

gender wage gap was in the sectors of wood, cork and paper and hotels and restaurants, where the wage gaps between the two genders were about 6.3% and 8.3% respectively. However, table 3.2 shows that the education and health sector has the largest proportion of females in the top quartile, where the ratio was 68.7%. Table 3.2 also shows that the lowest ratio of females in the top quartile was in the metals and metal products sector, where the proportion of females was 10.2%.

Figure 3.4 shows that the proportion of females in the lower quartile was 50.5% for all firms, while in the top quartile the ratio was 35.5%. These figures reflect the fact that most highly paid jobs are dominated by males.

Figure 3. 4

Males and Females Working in High- and Low-Paying Quartiles 2017
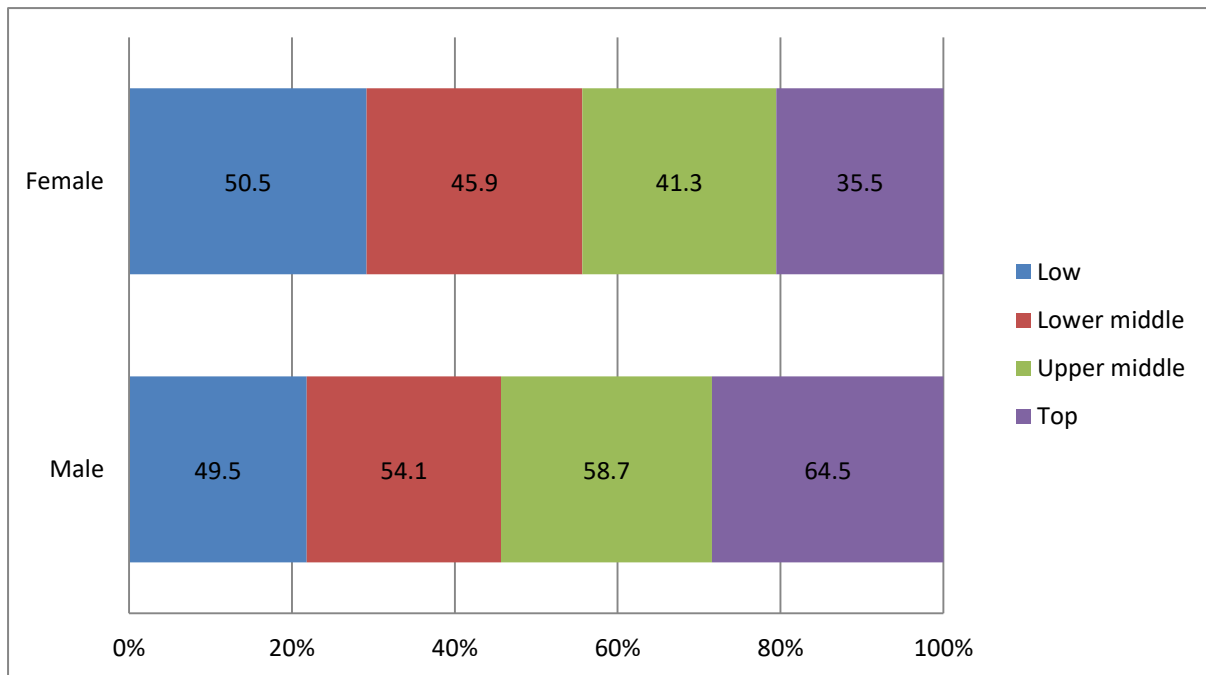
3.7. Probit analysis results

In this section, we introduce the results of the probit regression for uk firms for the period 2017

Table 3.3

Probit Estimates of the Characteristics of the UK firms

Variables	Coef
Age of firms	0.009***
	(0.00)
Turnover per employee	-0.026*
	(0.01)
Liquidity ratio	0.011**
	(0.00)
Profit for period	-0.013*
	(0.00)
Cons	0.283**
	(0.13)

*Note: ***, **,* represent 1%, 5%, 10% Level of significance respectively*

The first column in Table 3.3 reports the results of the probit regression of the UK firms' characteristics. We find that with higher liquidity ratio and firm age, the firms will be more likely to comply to the government regulation which requires employers of 250 employees or more to publish their gender wage gap data, the relationship for these variables are statically significant at (5%) and (1%) respectively. In addition, we find that with higher productivity and firm profits, the firms will be less likely to publish the gender wage gap data. The relationships for both two variables are statically significant at (10%).

3.8. Main Descriptive Results

In this section, we present the results of the wage decomposition analysis for the UK firms for the year 2017 and discuss the results of the descriptive analysis techniques.

3.8.1 Wage Decomposition Analysis

Table 3.4 shows the results of the wage decomposition for the UK firms for 2017. This analysis technique states the sources of gender wage inequality and indicates whether it comes from between firms or from within firms.

Table 3. 4

Decomposition Analysis of the Gender Wage Gap for UK Firms, 2017

Sectors	Between	Within	Within ratio %
All	-24.61	-39.94	61.87
Banks	-13.46	-56.63	80.79
Chemicals, rubber, plastics, non-metallic products	0.850	-12.33	107.4
Construction	-10.65	-34.20	76.24
Education, health	-7.698	-20.90	73.08
Food, beverages, tobacco	-16.67	-27.68	62.40
Gas, water, electricity	-3.811	-17.27	81.92
Hotels and restaurants	-2.209	-10.96	83.23
Insurance companies	-6.126	-36.58	85.65
Machinery, equipment, furniture, recycling	-2.026	-17.90	89.83
Metals and metal products	-3.837	-16.04	80.70
Other services	-12.71	-30.73	70.73
Post and telecommunications	-4.772	-8.951	65.22
Primary sectors (agriculture, mining, etc.)	9.293	-14.44	280.4
Public administration and defence	2.468	-13.15	123.1
Publishing, printing	3.957	-13.43	141.7
Textiles, wearing apparel, leather	-12.80	-29.71	69.88
Transport	-0.476	-22.40	97.91
Wholesale and retail trade	-13.37	-26.45	66.42
Wood, cork, paper	-21.31	-32.16	60.14

The third column in table 3.4 shows that most of the wage gap between the two genders comes from within firms for all sectors, and the wage gap for the within-firm ratio was 61.8% in 2017. However, the largest value of the within-firm ratio was in the primary sectors (agriculture, mining, etc.) and the smallest value was in the wood, cork and paper sector, and the within ratios for these two sectors were 280.4% and 60.14% respectively. Column 2 in the same table indicates that the banking and insurance sectors had the highest gender wage gaps within the firm, and the values of the gaps were -56.6 and -36.6 respectively. One explanation for the wage gap could be that banks and insurance companies have many retail clerical roles. Females tend to work in local retail companies and in banks, where wages tend to be low, while the highly senior jobs tend to be taken by males. The lowest gender wage gaps within firms were in the post and telecommunications and hotel and restaurant sectors (8.9% and 10.9% respectively).

3.8.2 Descriptive Analysis

In the following paragraphs we analyse how females' and males' wages change with firms' characteristics. Firms' pay policies may contribute to the gender pay gap when females are less competent in wage negotiations than men or when females are less likely to work in high-paying businesses. Females tend to work for less productive businesses that offer their employees lower wages, and these sectors are less likely to offer training to their employees. Figure 3.5 describes the distribution of men and women by firms' productivity for the year 2017. Turnover per employee was used as a proxy for firms' productivity. This figure shows that females, compared to their male counterparts, are less likely to work for the most productive firms, and more likely to work in the least productive firms. This is probably because females are over-represented in the hospitality and retail sectors, which tend to have lower productivity than other sectors, because of a lack of training for their employees and a deficiency of management practices (Innes and Rincon-Aznar, 2018). However, when females are employed in high-paying firms, their wages increase less than those of their male counterparts because of their lack of negotiation skills.

Figure 3. 5

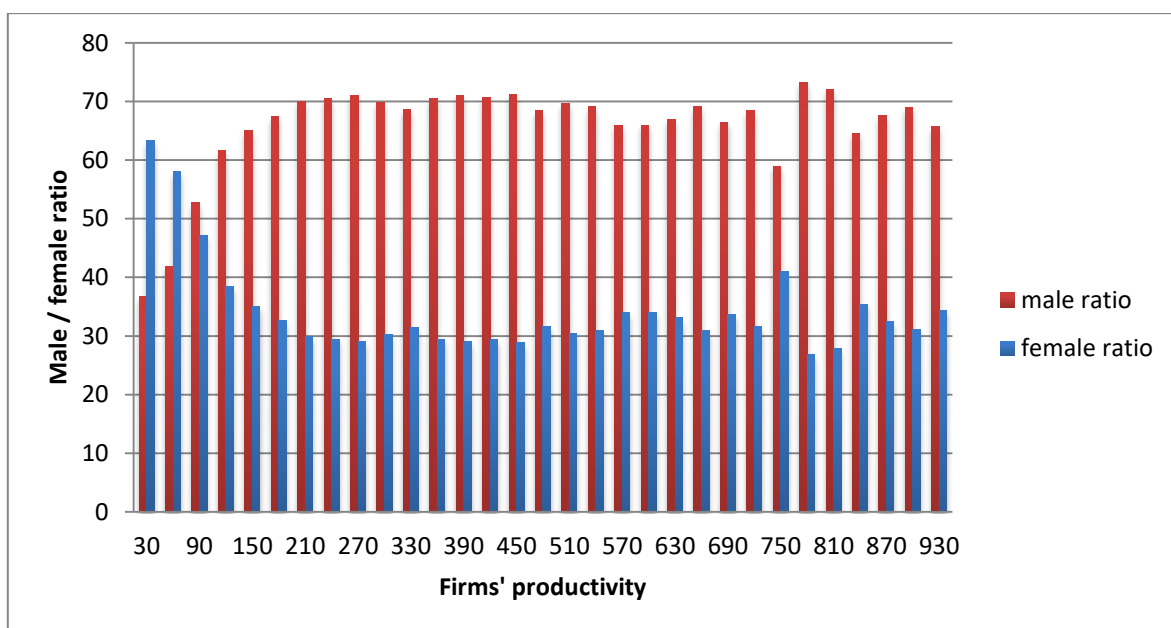Distribution of Males and Females by Firms' Productivity 2017

Figure 3.6 shows that the gender wage gap grows with firms' productivity. It indicates that when females are employed by high-paying firms, their wages increase less of than their male counterparts.

Figure 3. 6

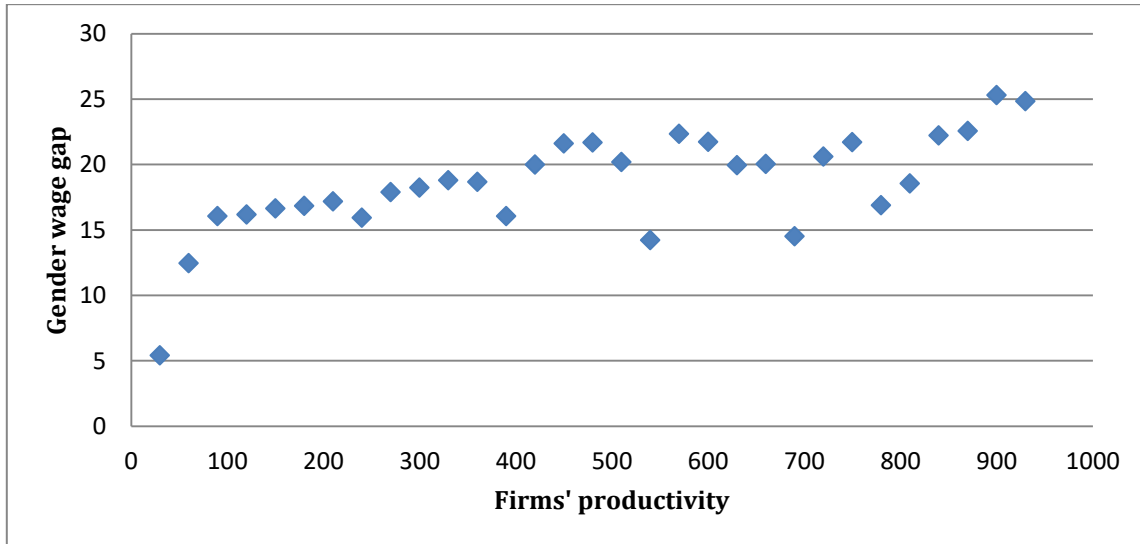Distribution of Gender Wage Gap by Firms' Productivity 2017

Figure 3.7 reinforces the results in figure 3.5 that show that females tend to be concentrated in low-paying firms, this result is consistent with the results of (Butcher, Mumford, and Smith ,2019; Butcher, Mumford, and Smith ,2016; Mumford and Smith, 2008; Mumford and smith, 2007).

Figure 3. 7

Distribution of Males and Females by Firms' Remuneration 2017
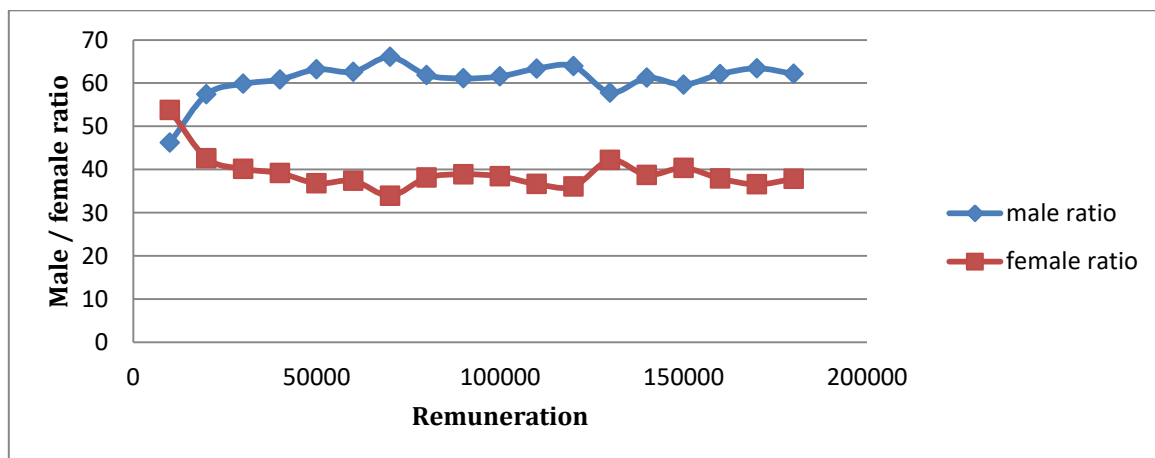
However, one of the most common explanations for the gap between the two genders is the occupational segregation of the genders, such that females tend to work in

lower-paid occupations than males. Occupational segregation can be either horizontal, where females are employed in different low-paid jobs compared to their male counterparts, or vertical, where males are employed in skilled and higher-paid positions within the same occupations. There are some factors that might enhance horizontal segregation, such as gender stereotyping, social norms and part-time jobs. Vertical segregation or the under-representation of females in senior positions is a continuous problem across all sectors of the workforce; the latest Grant Thornton International Business Report states that the proportion of females in senior jobs globally is 24% in 2018. In addition, some studies indicate that a large portion of the wage gap between the two genders is due to females' concentration in low-paid occupations that have low proportions of males (Butcher, Mumford, and Smith, 2019; Butcher, Mumford, and Smith, 2016; Card and others, 2015; Morton and others, 2014; Olsen and others, 2010; Mumford and Smith, 2008; Mumford and smith, 2007; Meng and Meurs, 2004). One explanation for this result might be that females have family caring responsibilities, or the lack of flexible and suitable management positions for females with childcare responsibilities. Figure 3.8 shows that females were still under-represented in senior positions in UK firms according to the firm data for 2017, which consistent with the finding of Mumford and Sechel (2020). The data show that the proportion of females in senior jobs decreases when firms' productivity increases.

Figure 3. 8

Distribution of Male and Females in the Top Quartile by Firms Productivity 2017
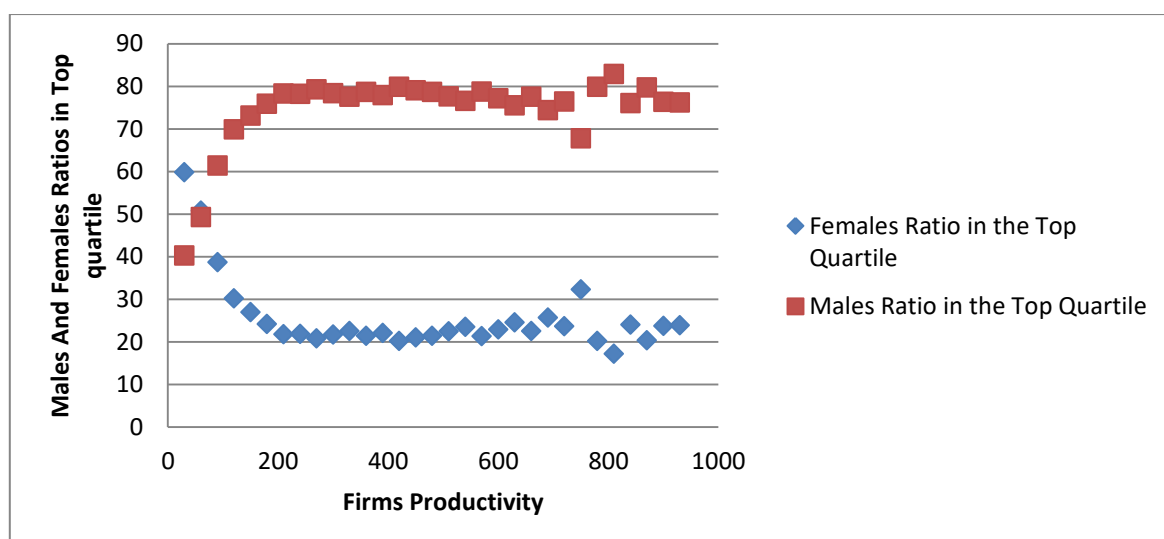
The same results were found when we replaced the productivity of firms with the profitability of firms: the gender wage gap increases with firms' profit. Furthermore, we found that females tend to work in less profitable firms compared to their male counterparts, as stated in figure 3.9. This result is consistent with Navon and Tojerow (2006), who stated that females are more likely to work in less profitable firms than males.
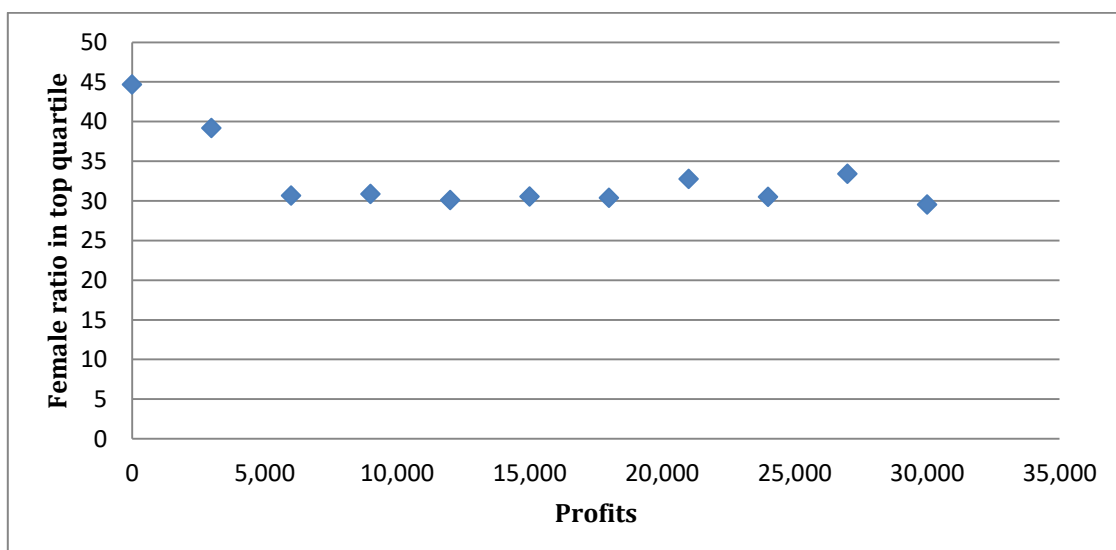
Figure 3. 9

Distribution of male and female ratios by profit, 2017

Figure 3.10 indicates that when the profits of firms increase, females are still under-represented in senior occupations.

Figure 3. 10

Distribution of Female Ratio in Top Quartile by Profits, 2017

Similarly, we traced how females' and males' wages change with firm age. Brixy and others (2007) found that on average wages in new firms are 8% lower than in comparable old firms. However, Magda and Cukrowska-Torzewska (2019) indicated that in Central European countries the size of the wage gap between the two genders increases with the age of firms. According to Becker's theory of discrimination (1957), it is expected that new firms face more competitive pressures than old firms and thus behave in a more egalitarian way. Because those new firms are not in a position to differentiate in wages between their employees who share the same characteristics, Magda and Cukrowska-Torzewska (2019).

Figure 3. 11
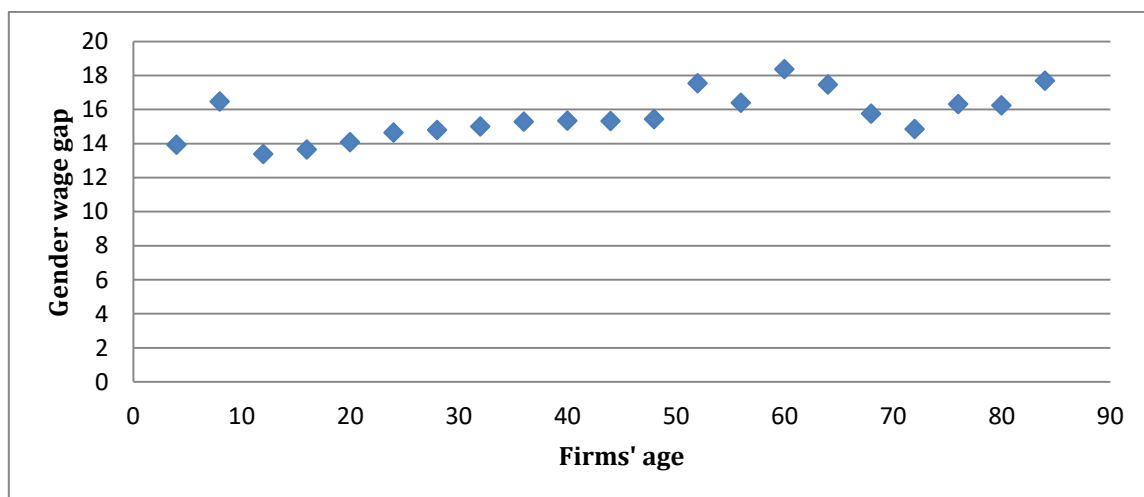
Distribution of Gender Wage Gap by Firms' Age, 2017

Figure 3.11 indicates that the pay gap between the two genders in UK firms grows when firm age increases. This result is consistent with the finding of Mumford and Sechel (2020) who found that women earning less in the old universities and in more feminized workplaces. These results support the hypothesis of competition, which clarify that older companies that have a market power, do not need to compete with other firms for employees, therefore they might have less concern to follow equal wage policies. Moreover, the analysis shows that the proportion of females in the firms decreases as firm age increases. In addition, the analysis states that when the age of firms increases, females are still under-represented in senior occupations, which consistent with the finding of Mumford and Sechel (2020).

3.9. Conclusion

This chapter used descriptive analysis techniques to analyse movement of the wage gap between the two genders according to firms' characteristics. In addition, this chapter identified the sources of the gender wage gap across economic sectors for UK firms.

This chapter used new data on gender pay inequality for UK firms, The UK government issued a new regulation in April 2017 that requires employers of 250 employees and more to publish their gender wage gap data. This policy is considered part of an attempt to reduce workplace discrimination. Therefore, cross-sectional data for the year 2017 were used. This chapter used different descriptive analysis approaches and wage decomposition analysis to demonstrate how females' and males' wages vary with business characteristics.

We found that the average wage gap between the two genders for firms with at least 250 employees was 14.33%, less than the national gender pay gap in the UK in 2017, which indicates that the gender pay gap in small firms was higher than in large firms in the UK. Moreover, the results show that the average gender wage gap dropped to 14.21% in 2018 as a result of wage transparency policies.

Furthermore, the results show that the largest gap between the two genders comes from within firms in all sectors, where the within-firm ratio of the gap was 61.8% in 2017. However, the banking and insurance sectors have the highest gender wage gaps within firms, where the ratios of the gaps were -56.6% and -36.6% respectively in 2017. The explanation for this result is that banks and insurance companies have many retail offices that are dominated by females. Females tend to be concentrated in roles in retail companies and banking where their workplaces are local and wages tend to be lower, while the highly senior jobs tend to be taken by males.

Moreover, we found that the wage gap between the two genders increases with an increase in firms' profitability, productivity and age. In addition, we found that females are less likely to work for the most productive firms compared to their male counterparts. This is probably because women are over-represented in the hospitality and retail sectors, which tend to have lower productivity than other sectors. Furthermore, the results show that women are still under-represented in senior

positions in UK firms, where the proportion of females in senior jobs decreases when firms' productivity increases. Similarly, we found that females are more likely to work in the least profitable or oldest firms. In addition, the results show that females are still under-represented in senior positions in such firms. Finally we found that with higher liquidity ratio and firm's age, the firms will be more likely to comply with the government regulation which requires employers of 250 employees or more to publish their gender wage gap data. In addition, the results showed that with higher productivity and firm's profits, the firms will be less likely to publish the gender wage gap data.

Conclusion for All Chapters

This thesis has explored the impact of gender wage inequality on economic performance by applying different analysis techniques; in addition, it has explored the source of the gender wage gap at the level of the country.

In the first chapter, we explored the relationship between the gender pay gap and economic growth for OECD and European countries. An unbalanced panel data for both countries was used for the period 1980–2015. We used fixed effects and random effects techniques, in addition to Arellano and Bond's GMM analysis technique, to investigate the relationship between gender wage inequality and economic performance. Moreover, in order to determine whether the most suitable estimation approach is fixed effects or random effects, Hausman testing was conducted. Hausman test results for both dynamic and non-dynamic conditions were significant at 5% for both OECD and European countries. Therefore, we could reject the null hypothesis, so the fixed effects approach seemed to be appropriate for both the dynamic and non-dynamic models for both groups of countries. However, the results of random effects, fixed effects and Hausman testing have to be interpreted with caution in the context of a dynamic model, because it might be inconsistent and biased (Naguib, 2015).

The results of Arellano and Bond's GMM technique indicate that an increase in the wage gap of 1% leads to a 0.002% decrease in the economic growth rate per capita for OECD countries. This relationship is statistically significant at the 5% level. Likewise, we found that the results of Arellano and Bond's GMM technique for European countries are consistent with our results for OECD countries, where the empirical work shows that an increase in wage inequality between the two genders of 1% leads to a 0.003% decrease in the economic growth rate per capita. This relationship is statistically significant at 10%. The Sagran test for both group countries confirms that the instruments are valid and the model formulation is correct, based on the failure to reject the null hypothesis. Furthermore, the results of Arellano and Bond's GMM technique for the relationship between the gender wage gap and economic

performance are consistent with those of Day (2012), Pervaiz and others (2011), the World Bank (2011) and Vidyattama and others (2009).

To check for robustness, this study included additional explanatory variables: growth rate of the population, public expenditure as a percentage of GDP, and enrolment rates of tertiary schools in OECD countries and European countries. The sign for the gender wage gap remains the same for Arellano and Bond's GMM analysis technique. However, the quantitative impact of gender wage inequality on the economic growth rate per capita indicates a small degree of sensitivity in the model.

In the second chapter, we used the 2SLS analysis technique to estimate the relationship between the gender wage gap and economic performance. This approach is used to deal with models that have some endogenous variables between their explanatory variables in a linear regression framework. An unbalanced panel data for 59 developing countries for the period 2006–2016 was used. To control for potential endogeneity in the model, we used the data on legal restrictions on women as instrumental variables for the gender wage gap. Since the data on legal restrictions for women include many variables, this study used PCA. This PCA technique is a mathematical procedure to transform a large set of possibly correlated variables to a smaller set or a smaller number of uncorrelated variables. Based on the Kaiser role, a component that has an eigenvalue greater than one is retained. Therefore, this study kept the first three components, each of which has an eigenvalue of more than one. These components explain about 68% of total variation. We used the first three components as instrumental variables for the gender wage gap.

The results of the 2SLS do not find a significant difference between the gender wage gap and GDP per capita in the developing countries under study. This is because the institutional changes influencing the gender wage gap are not dominant enough to make a significant impact on GDP per capita for this period. The findings of the current study do not support the previous researches. The negative sign of the gender wage gap indicates that an increase of 1% in the wage gap between the genders will decrease the economic growth rate per capita by 0.02%. As mentioned earlier, an increase in the gender wage gap will discourage women from participating in the labour force and adversely affect economic growth.

To check for robustness, this study included additional explanatory variables: female labour force participation, the ratio of women to men in parliament, and foreign direct investment as a percentage of GDP. The signs for variable coefficients remain the same for the first and second stages of analysis. However, the quantitative impact of gender wage inequality on the economic growth rate per capita indicates a small degree of sensitivity in the model.

In the third chapter, we used the new data on gender pay inequality for UK firms. The UK government issued a new regulation in April 2017 that requires employers of 250 employees or more to publish their gender wage gap data. We used various descriptive analysis approaches and, in addition, wage decomposition analysis to explore how females' and males' wages vary with business characteristics.

We found that the average wage gap between the two genders in firms with at least 250 employees was 14.33%, less than the national gender pay gap in the UK in 2017. In addition, the results show that largest gap between the two genders comes from within firms in all sectors, as the within-firm ratio of the gap was 61.8% in 2017. However, the banking sector and insurance companies have the highest gender wage gaps within firms: the ratios of the gaps were -56.6% and -36.6% respectively in 2017. Moreover, we found that the wage gap between the two genders increases with an increase in firms' profitability, productivity and age. In addition, we found that females are less likely to work for the most productive firms compared to their male counterparts. Furthermore, the results showed that women are still under-represented in senior positions in UK firms, and the proportion of females in senior jobs decreases when firms' productivity increases. Similarly, we found that females are more likely to work in the least profitable or oldest firms. Also, we found that with higher age and firm's liquidity ratio, the firms will be more likely to comply with the government regulation which requires employers of 250 employees or more to publish their gender wage gap data. In addition, the results showed that with increasing profits and firms' productivity, the firms will be less likely to publish the gender wage gap data.

Future works might consider other groups of countries divided by income or regions or a combination of both, or it could be conducted at the level of an individual country.

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