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THE GENDER WAGE GAP ACROSS AND WITHIN FIRMS: EVIDENCE FROM LITHUANIA

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1. INTRODUCTION

Despite gains in the economy and culture for women, women continue to earn much less than their male counterparts in the job market. Because men and women are not and have seldom been paid the same salaries, understanding the gender wage gap is an essential objective for economists (Bertrand, 2018; Blau and Kahn, 2003; Blau and Kahn, 2017; Goldin, 2014; Gregory, 2010; Ponthieux and Meurs, 2015; Olivetti and Petrongolo, 2016).

Blau and Kahn (2017) conclude that many traditional explanations of the gender wage gap are not feasible to explain a substantial portion of the unexplained gender pay gap. The same study also indicates that the unexplained gender pay gap is highest near the top of the wage distribution, where it narrows more slowly than elsewhere in the income distribution. It shows differing processes underlying pay for men and women at various ability levels and the motivations of employers in many high-performance required situations to reward individuals who can give more flexibility in excessive working hours disproportionally highly (Goldin, 2014). Goldin et al. (2017) have shown that around 40% of the increased gender gap in wages is caused by a disproportionate men's movement to higher-paid institutions, while the remaining 60% are attributed to women's inability to advance their earnings within firms. A recent study on the role of companies in contributing to the gender wage gap seeks to distinguish between the amount to which women sort into lower-paying enterprises and the extent to which women extract less surplus than males within a particular firm. Particularly, Card, Cardoso and Kline (2016) estimate gender-specific firm pay premiums to examine the influence of firm-specific pay policies on the gender wage gap. This approach enables a calculation of gender differences in firm pay premiums and extinguishing it into the sorting channel (what women would be paid if they worked at businesses where men work) and bargaining channel (what women would be paid in the particular firm if they were men). Card, Cardoso and Kline's (2016) approach toward the gender pay gap allowed them to disentangle the firm-specific premiums and concluded ⅔ of the sorting effect and ⅓ of the negotiating effect of the overall firm-specific premia.

This thesis aims to document the role of firms in the gender wage gap in Lithuania. Lithuania is an interesting case of empirical analysis, as it had relatively recent alterations in the general legislation for

gender equality, which was made by the influence of the accession to the E.U. Changes in the Labour Code, which came into effect in 2017, have also increased the curiosity about the role of firms in the gender wage inequality in Lithuania. According to my knowledge, the impact of firms on the gender wage gap in Lithuania has not been investigated yet. Thus, this thesis will attribute the existing literature on the gender wage gap in the named country. The analysis of this thesis is inspired by Card, Cardoso and Kline (2016) but given data limitations on Lithuania, it will be only able to unveil the contribution of different factors to the gender wage gap and perform a comparison across and within firms.

Several econometric model specifications are investigated to see whether any observable factors are essential in determining the gender pay gap. Four sets of characteristics were distinguished and tested if they significantly impacted the raw gender wage gap. Following, an "across firms" regression model included all the specifications in one equation, resulting in a relatively minor change in the gender wage gap, which led to beliefs that including the "within firms" component in the equation would explain more of the raw gender gap. However, there has also been a minor change, even diminishing the explanation received from the previous "across firms", indicating that the omitted variable bias problem in the gender wage gap equation is not fully solved yet. Thus, the first part of the econometrics left questions about the effect of each set of covariates on the gender pay gap.

Subsequently, Gelbach's decomposition has been conducted on "across" and "within" firms models. Analysis has shown that in the "across firms" model, firm characteristics explained around 35.7% of the raw gender pay gap, year dummy (which is interlinked with the new Labour Code established in 2017) has also attributed to another 5% of the gender pay gap. The explained part was nearly offset by the job characteristics (-10%) and worker characteristics (-21.5%), leaving 91% of the gender wage gap unexplained. The "Within firms" model has revealed marginally different results, showing that firm fixed-effects accounted for 41.6% of the gender gap. In the interim, job and worker characteristics have decreased to -12% and -22.4%, respectively, clearing just 7.2% of the raw gender wage gap.

The thesis structure is as follows: the second section presents the literature review, where the role of firms on wages and different factors of the gender pay gap are discussed. The third section overviews the institutional background in Lithuania and what alterations in Lithuanian law paid attention to the growing gender wage gap. In the fourth section, the data and methodology are presented that have been

used for the econometric calculations of the thesis. The fifth section analyses and discusses the results. Lastly, the sixth section concludes.

2. LITERATURE REVIEW

This section overviews the existing literature related to the gender pay gap factors, the importance of firms on wages, and firms' role in gender differences.

2.1 The literature on the classical factors determining the gender pay gap

Becker's seminal work in 1957 has made an immense impact on the analysis of the gender pay gap across the globe. Even though he examined distinctions between blacks and whites, the concept of bias and its harmful implications is easily transferable to women versus males. Since then, a large body of research has been conducted to analyse and explain the gender pay gap using different methodologies and data sources.[1]

The gender pay gap has been intensively investigated by invoking the common individual-level factors, such as age, education, etc. Income for both females and males tends to increase with age who works full-time, however, the gender pay gap also increases with age, and discrepancies among older employees are significantly larger than differences among the younger ones (Miller and Vagins, 2018). It indicates that significant factors play a major role in the wage difference between gender over a lifetime. Earlier studies acknowledged that education may have considerably influenced closing the gender wage gap (Gill and Leigh, 2000; Loury, 1997). However, even though women now make up most of the tertiary education graduates, they still earn far less than their male colleagues.[2] The issue with educational attainment is gender segregation in higher education. According to Barone and Assirelli (2020), women are consistently over-represented in subjects of study such as social sciences and humanities, which provide relatively poor labour market prospects; at the same time, women are under-represented in disciplines such as engineering and I.T., which perform above average. It has been

[1] For more recent cross-country evidence, look at: Blau and Kahn (2003), Gregory (2010), Ponthieux and Meurs (2015), Olivetti and Petrongolo (2016).

[2] Triventi (2013) provides conclusion that the unadjusted gender wage exists among higher education graduates in all 11 examined European countries, where Austria and Germany showed the most significant wage difference between men and women (30-32%).

projected that the choice of subjects of study accounts for up to ¼ of the gender wage discrepancy among college graduates (Brown and Corcoran, 1997; Bobbitt-Zeher, 2007).

Job characteristics also play a vital role in determining the wage inequality between gender (Hegewisch and Hartmann, 2014; Pearlman, 2018; Qu, Guo & Wang, 2019). One of the critical determinants contributing to the gender wage gap, which is strongly related to educational segregation, is occupational distribution (Hegewisch and Hartmann, 2014; Hegewisch et al., 2010; Pearlman, 2018). Male-dominated occupations tend to pay more than female-dominated occupations at comparable skill levels, especially those that demand higher education (Hegewisch et al., 2010). Even though occupational segregation has decreased over the years, occupations remain comparatively segregated by gender (Tomaskovic-Devey et al., 2006). Blau, Brummund and Liu (2013) have pointed out that occupational segregation by sex in the 2000s fell by only 1.1 percentage points (on a decadal basis). According to Pearlman (2018), women are more likely to be working in jobs that emphasise collaboration and service (for example, teaching and long-term care) and less likely to be employed in fields where success is defined by out-performing the competitors (for example, I.T. and financial service executive). Considering these findings, they contribute to the Ridgeway (2011) statement that women are over-represented in low-paid occupations and under-represented in high-paid ones, allowing the gender pay gap to persist.

According to Goldin (2014), gender inequality in pay between occupations and occupational groupings substantially impacts work flexibility and continuity.[3] OECD (2014) provides statistical numbers that women tend to devote a disproportionately larger amount of their time to unpaid work (such as cooking, cleaning, and taking care of kids) than men.[4] This factor accounts for women being more likely to be engaged in part-time employment (OECD, 2014).[5] Therefore, men can be more flexible for their employers and, consequently, superior to women in the labour market. Goldin (2014) says that modifications within the labour market (primarily how jobs are structured and remunerated to enhance the versatility of time) must be involved to reduce the gender pay gap. The gender wage gap could even disappear if companies did not have a stimulus to favour persons who work long or specific hours (Goldin, 2014).

[3] By work flexibility, Goldin (2014) means a wide range of temporal issues such as the amount of hours worked, specific timings, predictability and the capacity to arrange one's hours.
[4] OECD (2014) specifies that women spend two to ten times more time on unpaid care work than men around the world.
[5] Eurostat (2020) provides the data that women's participation (30%) in part-time jobs is nearly four times bigger than men's (8%).

2.2 The role of firms on wages

According to economists like Abowd, Kramarz, and Margolis (1999), wages differ between enterprises, even after adjusting for worker heterogeneity. For example, when individual variables were controlled for, establishment accounted one-fifth of pay variance in Germany (Card, Heining, and Kline, 2013). Different studies have shown that wages differ with different firm characteristics, such as firm size, peer effect and industry, which will be analysed in this subsection.

Moore (1911) was the first of the traditional literature to identify a positive relationship between firms' size and workers' pay, which has been replicated in other contexts (Slichter, 1950; Oi and Idson, 1999). Slichter (1950) and Oi and Idson (1999) suggest that the size-wage premium is ascribed in part to the effective matching of productive workers and employers and in part to management tactics in which large firms pay efficiency salaries to discourage shirking (managing monitoring problems) or use a discretionary wage setting to distribute rents. Lalleman, Plasman and Rycx (2007) detected that, on average, if the company's size increases, the earnings also significantly increase, even when human capital characteristics, occupations, and gender are controlled for.[6] However, there is no general agreement on why wages increase with firm size. A contemporary study conducted by Bloom et al. (2018) has found that the firm size impact on wages is still significant, but, over the past 3 decades, it has declined. A broader spectrum of wage differentials between small and large firms has also been found in recent studies. For example, Cosic's (2018) study shows that in the U.S., between 1992 and 2012, firm size attributed to a substantial part in the shaping of the wage distribution. The author says that wages at small firms are more unequally distributed than wages at large firms and that this is primarily due to residual inequality or disparity among individuals with the same observed characteristics. Thus, Cosic's (2018) paper suggests that workers in larger firms are more likely to receive better pay-outs. Arellano-Bover (2020) provides even a different perspective on the significance of firm size. In his paper, Arellano-Bover (2020) estimates the long-term effects of getting a first job at a large firm versus a small one. He examined Spanish social security data and found that matching with a larger firm on the first job significantly improves the lifetime income and that this

[6] The research paper studied five European countries and found out that if the establishment's size doubles, the wage increase by 0.6% in Denmark, 3.0% in Belgium, 3.3% in Italy, 3.9% in Ireland, and 4.5% in Spain

benefit lasts through subsequent jobs. Summarising the literature above, we can observe that firm size substantially affects one's wage size.

Co-workers in the firm also have an essential role in one's wage. Falk and Ichino (2006) have conducted a laboratory experiment that concludes that peer effects raise productivity, and workers with low productivity are the most responsive to peer behaviour. Thus, if the pay is based on group incentives, peer effects may significantly improve performance. Mas and Moretti (2009) give convincing evidence in a specific supermarket chain that a cashier's productivity rises when they work beside more productive peers. It is unclear how these findings, based on a specific firm or laboratory experiment, apply to more common contexts and labour markets. More recent research investigated peer effects in one or more local labour markets. Both Cornelissen, Dustmann and Schönberg (2017) and Cardoso et al. (2018) findings state that there is a positive effect on the overall impact of co-workers on wages in Germany and Portugal, accordingly. However, a much more significant effect was found in Cardoso et al. (2018) research, where they investigated the Portuguese data. Hong and Lattanzio (2022) have researched the dynamic effect of co-workers on future wages. The Italian study found that an increase in co-worker quality notably raises one's wage in the next year, but it is essential to mention that the effect decreases gradually. Thus, taking all the considerations, it is observable that peer effects considerably impact remunerations in the firm.

While there is documented significance of firm size and peer effect on wage differential, the presence of systematic wage differentials across different industries that different firms participate in has also been acknowledged for many years (Krueger and Summers, 1988; Lucifora, 1993; Rycx, 2002). It implies that individual earnings are influenced not only by personal characteristics and work descriptions but also by the characteristics of employers in each sector.[7] Martins (2004) examined that sectors with high average premia will have even higher premia among high-paid employees under the unobserved quality explanation of industry pay differentials. However, he dismisses the idea that high-wage businesses attract a disproportionate number of high-ability people. As a result, he believes that non-competitive factors may play a significant role in wage determination. There is no agreement on the precise extent of industry pay premia (Abowd, Kramarz, Margolis, 1999; Gibbons and Katz, 1992; Goux and Maurin, 1999). However, there is some consensus that these impacts are durable, strongly

[7] Even after adjusting for a wide range of worker characteristics, certain sectors pay their employees more than others, both across time and across nations (Dickens and Katz, 1987).

associated from country to country and of different magnitude in the industrialised nations (Helwege, 1992).

2.3 The importance of firms in the gender wage gap

Given the relevance of firms' effect on wages, recent literature has started to investigate the role of firms on gender pay differentials. Heinze and Wolf (2010) find that the gender wage gap decreases with firm size but increases with firm market power. The findings of Heinze and Wolf (2010) may be counterintuitive, as firms with increasing size gain more firm market power, so it depends on which effect dominates in the market to decide the movement of the gender wage gap. Thus, Heinze and Wolf (2010) provide an alternative view of relative business size's effect: market-dominating firms may have monopsonistic power (Robinson (1933) first introduced this concept). According to this approach, if there is little or no rivalry in the factor market, a single employer may set wages below the marginal revenue product. The more inelastic the labour supply, the wider the difference between the feasible wage rate and the marginal revenue product. The monopsonist can maximise his profit by differentiating salaries between groups with distinct elastic labour supply curves, and gender, for example, might be one dimension along which the employer can differentiate (Heinze and Wolf, 2010). However, this is only a theoretical alternative provided by Heinze and Wolf (2010), as they did not have direct information capturing the monopsonistic power of the establishment.

Slichter (1950) discovered the impact of co-workers' gender on the wage differentials, which is another approach of firm characteristics to the gender wage gap. He states that there exists a negative relationship between the salaries of unskilled male employees and the proportion of workers who were female. Carrington and Troske (1998) and Ostroff and Atwater (2003) show that both men and women receive lower salaries in organisations with a large ratio of women, with women suffering a more significant penalty than men. It implies that co-workers in the firm have a measurable impact on the wage differentials between men and women.

More recent studies have proved that firm-specific salary or productivity premiums affect the gender pay gap via negotiating and sorting channels (Card, Cardoso and Kline, 2016). According to Card, Cardoso and Kline (2016), women in Portugal are less likely to work in high-productivity enterprises

earning high wages indicating the sorting channel. Furthermore, females are paid less than males in the same firms – the negotiating channel. The importance of the sorting and negotiating channels in the gender pay gap differs for low- and high-skilled employees, with the sorting channel playing a dominating role for low-skilled workers and the bargaining channel playing a dominant role for high-skilled individuals. Firm-specific productivity premiums account for 21% of the gender wage difference in Portugal, with ⅔ attributed to the influence of sorting and ⅓ to the effect of negotiating (Card, Cardoso and Kline, 2016).

Only a few researchers have used the perspective on the problem provided by Card, Cardoso and Kline (2016). Firm-level productivity premiums in France explain just 8% of the gender pay difference, while the sorting effect plays a dominating role (Coudin, Maillard and Tô, 2018). The authors attribute the poor value of negotiating to high minimum salaries that protect low-wage employees. Bruns (2019) discovers that firm-level productivity premiums explain up to 26% of the gender wage difference in Germany, with the sorting effect again playing a prominent role. He places a low value on collective bargaining and collective wage setting. Firm-level productivity premiums have the most important role in explaining the gender pay gap in Italy, accounting for 30% of the difference (Casarico and Lattenzio, 2019). They attribute ⅔ of the effect to sorting and ⅓ to bargaining, as in the original Portuguese data research. In addition, Masso, Meriküll and Vahter (2021) have also conducted research relying on the Card, Cardoso and Kline's (2016) structure with Estonian data. They found that firm-level productivity premiums decipher about 35% of the gender pay gap (14% from sorting and 21.1% from bargaining effects), which is the largest proportion found in analogous research using the Card, Cardoso and Kline's (2016) methodology. The Estonian paper authors argue that this finding can be attributed to their sample country's permissive labour market rules and women being less efficient pay negotiators.

Some researchers have used the Card, Cardoso and Kline (2016) technique without disentangling the bargaining impact and just tested the influence of firm sorting on the gender wage gap (Gallen, Lesner and Vejlin, 2019; Jewell, Razzu, Singleton, 2019; Sorkin, 2017). The shortcoming of these researches has been their inability to relate their firm-level fixed effects to firm-level productivity statistics. This prevents them from normalising firm fixed effects and disentangling the importance of the bargaining channel. Finally, other research examines the employer's role only by adjusting for the average establishment earnings (Goldin et al., 2017). All of the research examined in this paragraph suggests

that company-level characteristics and firm sorting are crucial in explaining the salary disparity between men and women.

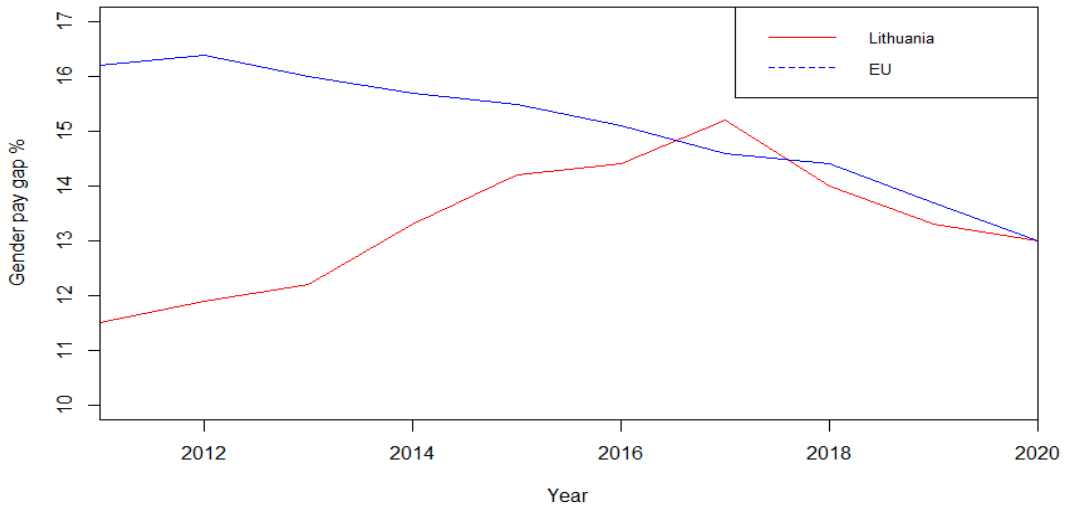
3. INSTITUTIONAL BACKGROUND IN LITHUANIA

This section highlights the importance of changed legislation on the gender wage gap in Lithuania and compares whether the data used in the thesis of different years consent to the movement of the gap presented in the Eurostat dataset.

The E.U. accession process from 2000 to 2004 was a significant impetus for law changes on gender equality. Lithuania made obligations to ensure that national legislation and administrative powers align with E.U. legal standards. According to E.U. legal standards, formally, equal treatment and equal pay for the same work exist in the legal system of Lithuania. This occurred as the result of the transposition of the E.U. legislation. The Law on Equality for Women and Men prohibit unequal treatment of women and men in terms of remuneration for the same work. The Labour Code in Article 26 includes the provisions that wages cannot be reduced according to employees' gender. However, national statistics show that vertical and horizontal gender segregation in the labour market prevails, and the gender pay gap significantly persists (the trend for the gender pay gap in Lithuania can be seen in Table 3.1, the E.U. gender pay gap has been added for the gap comparison).

Figure 3.1

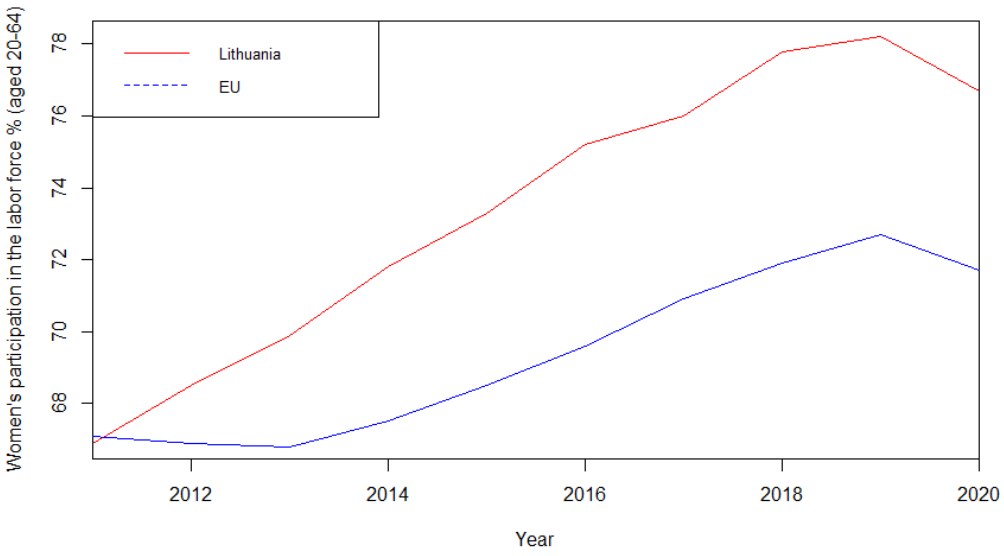
The unadjusted gender pay gap in Lithuania vs E.U. in 2011-2020 (sourced from Eurostat)



The gender pay gap in Lithuania was trending upwards by peaking at 15.2% in 2017. The Labour Code, which was established in 2017, has implemented changes that significantly impacted the gender pay gap in Lithuania. For instance, the new Labour Code regulates that in companies with 20 or more employees, the employer is obliged to establish the work council in the company. Work councils lead to increased investment in company-specific human capital. For example, employers are required to consult with the works council before making decisions about work rules, job standards, and the payment system that is not determined by a collective agreement. Thus, work councils generate more transparency between employees and employers, and people tend to be

Figure 3.2

Women participation in the labour force in Lithuania vs E.U. in 2011-2020 (sourced from Eurostat)



more satisfied with their jobs. When the Labour Code came into force in 2017, it created an opportunity for women that usually suffer from the motherhood penalty to work from home.[8] Therefore, women have more opportunities to participate more actively in the labour market. Such

[8] The new Labour code allows pregnant women, women who have recently given birth, employees who are taking care of children the age of three, exclusively parenting a kid under the age of fourteen, or a handicapped child under the age of eighteen to work from home for at least ⅕ of their entire working hours if it does not result in excessive costs.

regulations incentivise women not to take a break from their careers and experience a significant wage loss during the break.[9] Thus, *Figure 3.2* suggests that the new Labour Code has given a boost for a steeper increase in women's participation in the labour force in Lithuania from 2017 to 2018, compared to the increase from 2016 to 2017. There have been made some changes to minimum wage as well – before the alteration of the Labour Code, there were no restrictions on paying minimum wage for a job with professional skills. The alteration fixed restrictions that minimum wage cannot be paid for work with professional competence. Consequently, this change should have substantially impacted women's wages (as they are usually more likely to be at the bottom of the wage distribution).[10] The trending downwards effect after the new Labour Code implementation seen in *Figure 3.1* suggests that the new changes in the labour laws in Lithuania have marginally diminished the gender pay gap.

Looking at the data used in this thesis, it is found that the average gender pay gap decreased from 15.3% in 2014 to 12.3% in 2018 data, which corresponds to a nearly 20% decrease in the gender gap in pay. The evidence consents to the impact of the Labour Code on the gender wage gap movement from 2017. Thus, it may be essential to understand the year's role in the sample. However, according to Eurostat data, the Lithuanian gender wage gap has increased from 13.3% in 2014 to 14% in 2018. It may indicate a sampling error in the dataset, which may not properly represent the population parameters – a limitation to be aware of.

[9] According to Blau and Kahn (2007), employment interruptions may be one of the major determinants of a persisting gender wage gap.

[10] Kahn (2015) states that wage compression increases women's wages more than men, as women tend to be at the bottom of the distribution

4. METHODOLOGY AND DATA

4.1 Structure of earnings survey

The primary data source used in the analysis is Lithuania's Structure of Earnings Survey (SES). The dataset is a matched employer-employee dataset set carried out by Statistics Lithuania. The SES includes detailed information on employees (e.g., sex, age, education), their jobs (e.g., labour income, hours worked, occupation, tenure), and the companies where they work (e.g., economic activity, size). For the thesis, I use the two publicly available data files corresponding to 2014 and 2018. These files refer to two different cross-sections of workers and their employers. This implies that the data has no longitudinal design, a limitation to keep in mind.

To obtain the analysis sample, I perform the following data cleaning. First, I remove observations with missing information relevant to my analysis, such as labour income and hours, to be able to compute my primary dependent variable. Second, I drop observations from the top and the bottom 0.1% of the hourly wage distribution to avoid the inclusion of outliers. Third, I drop observations of local units with less than 3 representative employees to avoid error values from calculating the variables later in the thesis. Fourth, the 2014 labour income is still in Litas, as Lithuania introduced Euro into its economic system only on 2015 January 1st. Therefore, I converted labour income variables from the 2014 dataset into Euros using the Exchange Rate of Litas against Euros on 2014 October 31st established by the Bank of Lithuania, which corresponded to 3.4528 Litas per Euro. Finally, I deflate the labour income (gross earnings, earnings-related to overtime, special payments for shift work, average gross hourly earnings, grossing-up factor for the employees) to express it in real terms corresponding to Euros of 2014. The analysis sample consists of 87,940 workers and 9,021 firms.

4.2 Descriptive statistics

In this sub-section, I discuss basic descriptive statistics of my analysis sample. Even though women are

Table 4.2.1

Descriptive statistics separated by gender

Variable	All	Male	Female
Age			
Fraction of 14-29 years old group:	0.21	0.23	0.19
Fraction of 30-39 years old group:	0.22	0.23	0.20
Fraction of 40-49 years old group:	0.23	0.22	0.24
Fraction of 50+ years old group:	0.34	0.32	0.36
Education			
Fraction of people with basic or secondary education:	0.54	0.59	0.47
Fraction of people with tertiary education (=<4 years):	0.26	0.24	0.29
Fraction of people with tertiary education (>4 years):	0.20	0.16	0.25
Earnings			
Hourly Wage:	4.763	5.113	4.395
(standard deviation)	(3.46)	(3.87)	(2.92)
Monthly Wage:	772.79	851.65	690.26
(standard deviation)	(593.64)	(671.00)	(487.00)
Special payments for shift work:	10.79	14.00	7.42
(standard deviation)	(34.72)	(40.66)	(26.73)
Monthly Hours:	167.3	171.2	163.1
(standard deviation)	(43)	(40)	(46)
Type of employment contract			
Fraction of people with indefinite duration contract:	0.94	0.94	0.93
Fraction of people with temporary/fixed duration contract:	0.06	0.06	0.07
Contractual working time			
Fraction of people working full-time job:	0.84	0.88	0.80
Fraction of people working part-time job:	0.16	0.12	0.20
Tenure:	6.20	6.14	7.72
Size of the company			
Fraction of people working in a 1-49 employees company:	0.28	0.28	0.27
Fraction of people working in a 50-249 employees company:	0.29	0.30	0.28
Fraction of people working in a larger than 250 employees company:	0.43	0.42	0.45
Collective pay agreement			
Fraction of people with non-collective agreement:	0.72	0.73	0.71
Fraction of people with enterprise or single employer agreement:	0.24	0.24	0.24
Fraction of people with industry agreement:	0.04	0.03	0.05
Observations:	87,940	44,971	42,969

more educated and have more experience in a company (on average, women's tenure is longer), they earn 14.02% less in hourly wage than men – very alike to the gender pay gap in hourly wages in the E.U. in 2014 (Boll and Lagermann, 2018).[11] Findings in the sample show that women account for 53.2% of observations below the 20th percentile, while observations above the 80th percentile represent only 39.5% of women. It indicates that women are more segregated in the lower wage distribution while men are more likely to be at the top.[12] Women, on average, work less and have a larger standard deviation of monthly hours worked. Larger dispersion of women's monthly hours can be understood that women are more likely to work part-time jobs than men, and the contractual working time section in *Table 4.2.1* consents to this hypothesis. EPI (2020) suggests that part-time workers get paid around 20% less than their full-time counterparts that work in the same occupation and industry.[13] With that in mind, contractual working time can be a great variable that could explain a part of the gender wage gap. As women tend to work less, such observation contributes to the significant (almost double) difference in special payments for shift work between men and women.[14] The sample provides strong segregation into the indefinite duration contract of the type of employment contract by all workers. Nonetheless, it is a meaningful factor that can help determine the gender differences in pay.[15] Looking at the characteristics of their workplaces, women tend to be employed in larger firm groups than men – the same pattern can be seen in the U.S. (Papps, 2012) and the U.K. (Mumford and Smith, 2008)[16]. According to Lalleman, Plasman, and Rycx (2007), employees who work at larger firms receive higher wages. However, women in Lithuania receive lower wages even though they, on average, work in larger companies. This suggests that firms may be a relevant dimension explaining the gender gap in Lithuania, which is the main goal of this thesis.

Table 4.2.2 shows the industry distribution of firms where men and women work. This distribution is constructed using the Nomenclature of Economic Activities codes (NACE Rev. 2) by extracting each

[11] Gender pay gap in EU countries based on SES (2014) shows that the EU cross-country gap in average wages of men and women is around 14.2%.

[12] It is also important to keep in mind that there are fewer women than men in the sample to understand the magnitude of women segregation in the wage distribution

[13] Quotation from EPI (2020): *"[…] part-time workers get paid about 20% less than otherwise comparable full-timers simply because they are in part-time jobs, independent of whatever occupation and industry they work in […]".*

[14] Goldin (2014) mentioned that employees who are more flexible, regarding the working hours, to their employers are appraised with disproportionate rewards.

[15] Jimeno and Toharia (1993) found that fixed-term workers in Spain earn approximately 9-11% less than indefinite-term counterparts. Hagen (2002) found the same trend in Germany that fixed-term contracts negatively impacts the wage gap by 6-10%.

[16] Papps (2012) and Mumford and Smith (2008) show that women's workplaces are larger by around 10% than men's in the U.S. and U.K., respectively.

company's economic activity.[17] Comparing the industry distribution between men and women, the fractions of men and women in some of the industries do not differ too much. However, we can see gender segregation in specific industries. The manufacturing sector takes the major part of employees, where men dominate. Transportation and Storage is an industry that is also significantly dominated by men. By continuing to examine where men dominated, the construction industry is also prevailed by men; the same results were found in England too.[18] Thus, we see that men dominate in blue-collar industries. While looking at Human Health and Social Work Activities, this sector is greatly dominated

Table 4.2.2

Industry distribution separated by gender

Industry distribution	All	Male	Female
Manufacturing:	0.23	0.26	0.20
Transportation and Storage:	0.09	0.13	0.04
Human Health and Social Work Activities:	0.08	0.02	0.13
Public Administration and Defence; Compulsory Social Security:	0.07	0.07	0.08
Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles:	0.07	0.06	0.08
Administrative and Support Service Activities:	0.07	0.07	0.06
Education:	0.05	0.03	0.07
Professional, Scientific and Technical Activities:	0.05	0.04	0.06
Construction:	0.05	0.09	0.01
Information and Communication:	0.04	0.05	0.04
Arts, Entertainment and Recreation:	0.04	0.03	0.05
Financial and Insurance Activities:	0.03	0.02	0.05
Accommodation and Food Service Activities:	0.03	0.02	0.05
Water Supply; Sewerage, Waste Management and Remediation Activities:	0.03	0.04	0.02
Electricity, Gas, Steam and Air Conditioning Supply:	0.02	0.03	0.01
Other Service Activities:	0.02	0.03	0.03
Real Estate Activities:	0.02	0.01	0.02
Mining and Quarrying:	0.01	0.01	0.00[19]
Observations:	87,940	44,971	42,969

[17] NACE Rev. 2 - Statistical classification of economic activities presented by Eurostat.
[18] According to Hanna, Gough, Markham (2018) construction industry in England remains dominated by men as 99% of the on-site workforce and 89% of the overall workforce is concluded by men.
[19] There are only 146 observations in this sector across women, therefore when rounding up the number up to 2 decimals the value disappears.

by females – as indicated by the OECD (2019) report, which observes that around ¾ of women working in this industry. The education sector in Lithuania is also dominated by women. OECD (2017) data consents with this observation as it states that, on average, across OECD countries, around ⅔ of the teachers from pre-primary to tertiary education are women.

Table 4.2.3 provides information about the occupation distribution in our sample. This distribution is constructed of main groups of occupations using the International Standard Classification of Occupations (ISCO-08) by extracting each employee's occupation. We see that women dominate in the Professionals occupations, and information in *Table 4.2.2* complies with the industry distribution as Health Professionals and Teaching Professionals are included in Professionals occupations where women prevail. To continue with female dominance in occupations, they dominate as Technicians and Associate Professionals, Service and Sales Workers, Clerical Support Workers, and in Elementary Occupations. Men dominate as Craft and Related Trades Workers, Plant and Machine Operators, and Assemblers, Managers. As men are well-represented in managers occupation, it implies that men are more likely to be promoted to higher positions in Lithuania than women – a similar likelihood is

Table 4.2.3

Occupation distribution separated by gender

Occupation Distribution	All	Male	Female
Professionals:	0.27	0.19	0.35
Craft and Related Trades Workers:	0.14	0.20	0.08
Plant and Machine Operators, and Assemblers:	0.13	0.20	0.05
Technicians and Associate Professionals:	0.13	0.10	0.14
Managers:	0.10	0.12	0.08
Elementary Occupations:	0.09	0.08	0.11
Service and Sales Workers:	0.09	0.07	0.12
Clerical Support Workers:	0.05	0.03	0.07
Skilled Agricultural, Forestry and Fishery Workers:	0.00[20]	0.00	0.00
Observations:	87,940	44,971	42,969

[20] The same problem arises as in *Table 4.2*: There are too little of observations to get a value when I round the fraction to 2 decimals (there are only 23 observations for men and only 6 observations for women in this occupation).

stated in Gobillon, Meurs and Roux (2015) and Bjerk (2008) studies.[21] This evidence contribute to the gender gap, because managers' earnings are usually more substantial than any other occupations. Thus, it boosts average men's pay and increases the wage dispersion between genders.

Table 4.2.4 shows us individuals' workforce composition in a company. All these characteristics were calculated based on Card & De La Rica's (2006) to account for peer effects to capture more firm heterogeneity later on in regression models. A shocking observation is a significant difference in the fraction of female employees at men's and women's workplaces – 30% vs 68% accordingly. This observation clearly shows that there is noteworthy gender division across firms, which has a substantial effect on the gender wage differentials.[22] The segregation of men and women in companies can explain the difference between men's and women's co-workers share with tertiary education - women are more likely to have tertiary education; therefore, on average, women have more educated colleagues around themselves. As women are, on average, older too, they have a bigger fraction of co-workers older than 50 years in a company and have a smaller fraction of co-workers with tenure less than 2 years in a company because women tend to work longer in a certain company.

Table 4.2.4

Workforce composition separated by gender

Workforce variables:	All	Male	Female
Average fraction of female co-workers in a company:	0.49	0.30	0.68
Average fraction of co-workers with tertiary education in a company:	0.47	0.42	0.51
Average fraction of co-workers older than 50 years in a company:	0.34	0.33	0.35
Average fraction of co-workers with tenure less than 2 years in a company:	0.34	0.35	0.33
Observations:	87,940	44,971	42,969

[21] Gobillon, Meurs and Roux (2015) results in France economy indicate that gender difference in the probability of getting a job rises along the pay ladder from 9% to 50%, thus females have a significantly lower probability of getting high-paid jobs than low-paid ones. Bjerk (2008) found a significant under-representation of women at higher levels of the organizational hierarchy.

[22] Slichter (1950), Carrington and Troske (1998), and Ostroff and Atwater (2003) have found negative correlation between wages and the fraction of women in the workplace, as it was mentioned in the literature review.

4.3 Econometric model

To start examining the gender wage gap across and within firms, I specify several wage equations that allow interpreting the impact of different variables on the gender wage gap. I denote individual hourly wage as w_i, where index i indicates different individuals from the dataset. To take a first glance at the gender pay gap, I estimate a raw gender pay gap using a standard Mincer (1958, 1974) wage equation of the following form:

$$\ln(w_i) = \beta_0 + \beta_1 Female_i + \varepsilon_i \quad (1)$$

where $Female_i$ is a dummy variable that takes on 1 value if a person is a female and 0 if a person is a male and ε_i is an error term for an i individual. $Female_i$ is the main variable that I am focusing on its coefficient in this analysis as it directly explains the magnitude of the gender wage gap. Now, I start adding different observed characteristics to the raw gender pay gap equation to understand how much they explain the identified raw gender pay gap. First, I add to the Equation (1) year dummy variable to potentially acknowledge the Labour Code impact on the raw gender pay gap:

$$\ln(w_i) = \beta_0 + \beta_1 Female_i + \beta_2 2018Y_i + \varepsilon_i \quad (2)$$

where $2018Y_i$ is a dummy variable that can take on 1 value if an employee worked in the year 2018 and 0 if an employee worked in the year 2014 accordingly. The Labour Code was briefly examined in the section 3, thus it is important to evaluate a potential impact of year on the gender wage gap in the sample. Second, I enhance Equation (1) with a set of worker characteristics to see how much worker characteristics explain the raw gender pay gap:

$$\ln(w_i) = \beta_0 + \beta_1 Female_i + \beta_2 X_i + \varepsilon_i \quad (3)$$

where X_i is a set of worker characteristics, such as age group and education level. It was examined in the descriptive statistics section that substantial differences in fractions of distinct age groups and education levels between genders exist; thus, it is noteworthy to understand the impact of these characteristics on the raw gender gap. Third, I look at the relevance of job characteristics to the raw gender pay gap:

$$\ln(w_i) = \beta_0 + \beta_1 Female_i + \beta_2 Z_i + \varepsilon_i \quad (4)$$

where Z_i represents a set of job characteristics, such as occupation, tenure, tenure squared (the variable allows me to model more accurately the effect of tenure, which may have a non-linear relationship with an individual's hourly wage), type of employment contract, contractual working time, special payment for shift work. Descriptive statistics have shown that the occupation variable is an important dimension for explaining the gender pay gap as the sample encountered segregation in occupations. There also exist differences in tenure, contractual working time and special payment for shift work between men and women; thus, it is also crucial to comprehend the influence of these variables on the gender wage gap. The type of employment contract is likewise a meaningful factor that can decide the gender differences in pay; therefore, I include it into the equation. Fourth, I examine the role of firm characteristics using a similar regression:

$$\ln(w_i) = \beta_0 + \beta_1 Female_i + \beta_2 W_i + \varepsilon_i \quad (5)$$

where W_i is a set of firm characteristics, such as the economic activity of the enterprise, size of the enterprise, workforce composition and collective pay agreement. The industry, size of the enterprise and workforce composition importance on the scope of wage was briefly discussed in the literature review and descriptive statistics sections. It was seen that men and women are segregated between industries and firms of different magnitude, thus, they are significant factors for clarifying the gender

pay gap. Workforce composition is an important dimension too, which enhances the analysis by including different firm-related heterogeneity, so with the explanation of descriptive statistics in mind, it is crucial include workforce composition in the regression. Collective pay agreement variable, after the introduction of the new Labour Code in 2017, have less importance in the wage determination in firms without any collective pay agreement in the dataset part, which refers to year 2018, nonetheless, it may explain the variation of wages between men and women with different transparency levels between workers and employers. Finally, I introduce all the observed characteristics together in my Mincer equation to account for potential correlations between variables. This regression model is as follows:

$$\ln(w_i) = \beta_0 + \beta_1 Female_i + \beta_2 2018Y_i + \beta_3 X_i + \beta_4 Z_i + \beta_5 W_i + \varepsilon_i \quad (6)$$

To better understand the role of firms in the gender gap in Lithuania, I enhance Equation (5) by including fixed effects on firms:

$$\ln(w_{ij}) = \beta_0 + \beta_1 Female_i + \beta_2 X_i + \beta_3 Z_i + \alpha_{j(i)} + \varepsilon_{ij} \quad (7)$$

where $\alpha_{J(i)}$ is an unobserved firm fixed-effects (j indicates a firm that an individual i was working) and ε_{ij} is an error term for individual i in a firm j. The year dummy variable was excluded from the equation to avoid multi-collinearity as the dataset lacks longitudinal design, thus the comparison and identification of the gender pay gap within firms are constructed by comparing workers in the same firm in a given year (either 2014 or 2018) and not comparing firms between years. The set of firm variables was also excluded from the regression to avoid multi-collinearity as I compare workers that work in a particular firm that has the same firm characteristics. Simply speaking, fixed effects diminish the omitted variable bias problem by including observed and unobserved characteristics into the equation. In this case, with fixed-effects term on firms, I control for the average differences across firms in observed variables and, most importantly, unobserved predictors (such as the firm-level productivity, etc.), which are an important part of determining the gender pay gap between males and

females. Thus, as Equations (6)-(7) are thoroughly specified, it is believed that they should explain a substantial part of the gender pay gap, persisting in Lithuania.

The ultimate goal of my exercise is to evaluate the role of different characteristics on the gender gap. To this end, I test for the statistical difference of gender coefficients between estimations - I use the formula for the Z-test that is proposed by Clogg, Petkova, and Haritou (1995):

$$Z = \frac{\beta_1 - \beta_2}{\sqrt{((SE\beta_1)^2 + (SE\beta_2)^2)}} \quad (8)$$

I have chosen this Z-test formula to test for statistical difference as this statistical method is dedicated to comparing coefficients between different regression models in the setting where one of the models is nested, thus it should fit the analysis.

4.4 Gelbach's decomposition

After analysing whether different characteristics are correlated with the raw gender gap, it is key to understand how much each factor drives the observed wage differential. Thus, I use Gelbach's (2016) decomposition to comprehend the impact of different components in the full across-firms and within-firms Mincer equation models.

Gelbach (2016) criticises the comparison of coefficients from specifications in which covariates are added sequentially to the base model as it does not generally identify population parameters of interest. He proposes a comprehensive decomposition based on the omitted variable bias formula that allows for unambiguous disentanglement of each omitted variable's contribution to the change in the coefficient of the variable of interest. The main element of Gelbach's (2016) technique that makes it order invariant is that the parameter estimates on which the decomposition is based are derived entirely from the full specification. I propose the general illustration of Gelbach's decomposition that will be made with the across-firms and within-firms models following Gelbach's notation. As I have a vector of wages, W,

and two matrices of independent variables, X_1 and X_2, where X_1 contains the group indicator variables ($Female$), and X_2 comprises additional covariates. Depict $\hat{\beta}_1^{base}$ as the estimated coefficient on X_1 in a baseline regression that does not contain other variables (X_2), and $\hat{\beta}_1^{full}$ and $\hat{\beta}_2$ the estimated coefficients on X_1 and X_2 in the full model. Gelbach observes that the difference between coefficients is algebraically equivalent to the sample omitted variables bias formula:

$$\hat{\beta}_1^{base} = \hat{\beta}_1^{full} + (X_1'X_1)^{-1}X_1'X_2\hat{\beta}_2 \tag{9}$$

Therefore, decomposing this formula is equal to breaking down the differences between the restricted and full-model coefficients of $Female$:

$$\hat{\delta} \equiv \hat{\beta}_1^{base} - \hat{\beta}_1^{full} = (X_1'X_1)^{-1}X_1'X_2\hat{\beta}_2 \tag{10}$$

If I determine $X_{2,k}$ as the column of observations of the *kth* variable in X_2, Equation (10) would imply that the part of the sample omitted variable bias $\widehat{\delta_k}$ consists of: $\gamma_k = (X_1'X_1)^{-1}X_1'X_{2,k}$ (which is the estimated ordinary least squares coefficient from an auxiliary regression of $X_{2,k}$ on X_1), and $\hat{\beta}_{2,k}$, which is the estimated coefficient of $X_{2,k}$ from the full model. Thus, I can specify the omitted variable bias by excluding the covariates X_2 as a natural decomposition of the difference between the base and full model coefficients on X_1:

$$\hat{\delta} = \gamma_1\hat{\beta}_{2,1} + \cdots + \gamma_k\hat{\beta}_{2,k} \tag{11}$$

Equation (11) allows to divide the bias into parts by the set of characteristics and explain what influence each set of those characteristics has on the baseline regression's $Female$ coefficient (a.k.a. the raw gender pay gap). For example, let me denote the bias of aggregated set of worker characteristics as $\hat{\delta}_{worker} = \gamma_1 \hat{\beta}_{2,educ} + \gamma_2 \hat{\beta}_{2,age}$. Dividing the aggregated sets of worker characteristics estimates of omitted variable bias by $\hat{\beta}_1^{base}$, the baseline $Female$ coefficient provides an estimate of the contribution of the variables to the gender pay gap as a proportion of the baseline, unconditional relationship:

$$\tilde{\delta}_{worker} = \frac{\hat{\delta}_{worker}}{\hat{\beta}_1^{base}} \tag{12}$$

A similar process will be followed with all sets of the characteristics to examine the explanation of the covariates on the raw gender gap.

5. RESULTS

5.1 Results of the econometric model

Table 5.1.1 shows the regression estimates of Equations (1) to (5). It presents only the Female coefficient (that represents the gender pay gap) as it is my main focus of this analysis.[23] Column (1) estimation, which I will refer to as the baseline estimation, indicates that females in Lithuania across firms get around 11.7% lower wages than men. The baseline estimate substantially differs from the gender pay gap in the descriptive statistics. The usage of natural logarithm function on wages in the regression should have made an impact on the difference. It grants a larger weight for the bottom wage distribution (where women dominate in the sample) and diminish the importance of the top wage distribution (where a major part is consisted of men), in such manner marginally adjusting the gender pay gap – a restriction presented by the Mincerian equation, which applies to all of the Equations in the methodology and data section.

Columns (2) to (5) show the results for different specifications that look at the gender gap, including different sets of characteristics. Results, presented, in the Column (2) shows that by including the year dummy variable, the raw gender pay gap has decreased by 0.6%. Even though the margin is not significant between the baseline regression and Equation (2) estimation, the existing difference can be contributed to the Labour Code, evaluated in the section 3. Column (3) shows that, when including worker characteristics, the gender gap increases. In particular, the results indicate that the gender wage gap is now 18.4%, around a 57% increase compared to the results in Column (1). The difference between specifications is statistically significant at the 1% level when using the Z-test. This result could be expected, as from the summary statistics I have documented that women tend to be more educated than men. Given that higher levels of education are associated with higher wages, not accounting for education differences may underestimate the gender gap. Subsequently, I analyse Column (4) with job characteristics included in the baseline regression. By computing the gender pay gap with job characteristics, the estimated gender difference is now 14%. Comparing the gender gap

[23] Appendix B Table B.1 shows the results for all the coefficients included in the regression.

coefficients of Column (1) and Column (4), I come to the conclusion that they are statistically different at 1% level by using the same Z-test. Essentially, there has been a 20% increase in the gender gap by additionally using job characteristics. The increase, by including the job distinctiveness in the baseline regression, should have also been expected because the descriptive statistics pointed out that women tend to be segregated into the occupations which are less paid, they are more likely to work in a part-time job (what drives for the lower wages) and receive fewer special payments for the shift work. Thus, the differences between men and women in job distinctiveness contributes to the increase of the gender gap. Column (5) of *Table 5.1.1* regression model is constructed of the firm covariates and the baseline model. Indeed, the gender wage gap has decreased to 10.4% by controlling the firm characteristics. Z-test shows that there exists a statistical difference at 5% level between the baseline regression's and Equation (5) Female coefficients. This significant difference can be driven by a certain covariates in the

Table 5.1.1

Regressions explaining the raw gender pay gap with different characteristics

	Dependent variable:				
	ln(w)				
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Female	*-0.11678****	*-0.11122****	*-0.18396****	*-0.13975****	*-0.10409****
	(0.004)	*(0.004)*	*(0.003)*	*(0.003)*	*(0.004)*
Observations	*87,940*	*87,940*	*87,940*	*87,940*	*87,940*
R^2	*0.011*	*0.088*	*0.214*	*0.302*	*0.233*

$^{*}p$ $^{**}p$ $^{***}p<0.01$

Note: Columns (1)-(5) represent Equations (1)-(5) estimations accordingly, where Female coefficient shows the gender wage gap in the sample.

set of firm characteristics. It was documented in the 4.2 section: women tend to work in larger companies (according to the literature, firm-size implement an increase in wages, thus controlling for the firm-size variable the gender pay gap should increase), they are segregated into lower-paid industries (controlling for the industry variable should decrease the raw gender gap), tend to work around more females (literature has also reviewed the negative impact of the female co-workers on wages, thus this variable should decrease the gender gap) and more educated co-workers (controlling this peer effect should increase the gender gap as women work around a larger part of educated co-workers, but still tend to earn less). The reasoning would be that the impact of the industry and share of women in the company covariates' dominated over the size of the enterprise and share of co-workers with tertiary education variables effect on the gender wage gap. Thus, the gender pay gap has significantly decreased when firm characteristics are controlled for.

Table 5.1.2

Full model regressions of across- and within-firms

	Dependent variable:	
	ln(w)	
	(1)	*(2)*
Female	*-0.10626****	*-0.10839****
	(0.004)	*(0.003)*
Observations	*87,940*	*87,940*
R^2	*0.423*	*0.362*

$^{*}p$ $^{**}p$ $^{***}p<0.01$

Note: Columns (1)-(2) represent Equations (6)-(7) estimations accordingly, where Female coefficient presents the gender wage gap in the sample.

Table 5.1.2 presents the Female coefficient estimate of Equations (6) and (7). Column (1) in *Table 5.1.2* introduces Equation (6) with all characteristics included in the across firms model. *Table 5.1.1* has shown that each set of characteristics has a certain impact on the baseline estimate. Including all of

the characteristics in the Equation (6), the estimate on the gender pay gap has yielded around 9% decrease in the gender wage gap. The Z-test showed statistical difference on 5% level between the Equation (1) and Equation (6) coefficients. Including all the characteristics in the Equation (6), it represent the best specified across firms model for a given dataset. Only a 9% explanation of the raw gender pay gap indicates there might be other variables that are not included into the regression, which might substantially explain the gender pay gap. Therefore, it could be expected that fixed firm effects should explain the gender pay gap more effectively. However, analysing the Column (2) in the *Table 5.1.2* with Equation (7), the result of estimate on the Female coefficient hardly changes from the Column (1).[24] This suggests that a set of firm characteristics is a well-explained set of variables as the firm fixed-effects did not significantly affect the gender pay gap. To examine the cause of the inefficient gender wage gap explanation in the Equations (6)-(7), more calculations are required.

5.2 Results of Gelbach's Decomposition

As the latter subsection has encountered the problem of proper explanation of each set of characteristics' impact on the gender gap, Gelbach's decomposition comes in handy to unravel such issue.

Table 5.2.1

Gelbach Decomposition with the Equation (6) model

Decomposition of the Gender Wage Gap across firms (Gelbach, 2016)						
		$\hat{\delta} \equiv \hat{\beta}_{1,f}^{base} - \hat{\beta}_{1,f}^{full}$	Decomposition of the change into:			
Base Model Female estimate	Full Model Female Estimate	Change (1)-(2)	Firm characteristics	Job characteristics	Worker characteristics	Year dummy
(1)	(2)	(3)	(4)	(5)	(6)	(7)
-0.1167831	-0.1062585	-0.0105246	-0.0416661	0.0116924	0.0250857	-0.0056366

[24] The Z-test could not capture a statistical difference of Equation (7) and the baseline regression coefficient at 5% level.

To begin the analysis of the decomposition, I first examine the results of the gender pay gap across-firms. To understand the role of different characteristics on the gender pay gap across firms, Columns (4)-(7) (which present the bias of different set of characteristics and year dummy on the raw gender gap) of the *Table 5.2.1* is the essential part which allows interpreting the gender pay gap change from the baseline to the Equation (6) model. By taking the first glance at Columns (4)-(7), all of these biases follow the same pattern as in the econometric exercise presented in section 5.1. Worker and job characteristics increase the gender pay gap, year dummy and firm characteristics suppress such increase. To investigate what impact each set of the characteristics implied on the baseline model Female estimate, I present *Figure 5.2.1*, where Equation (12) is being used to examine the proportion influence of all characteristics on the raw gender gap.

Figure 5.2.1

Characteristics' impact on the Raw Gender Wage Gap across firms

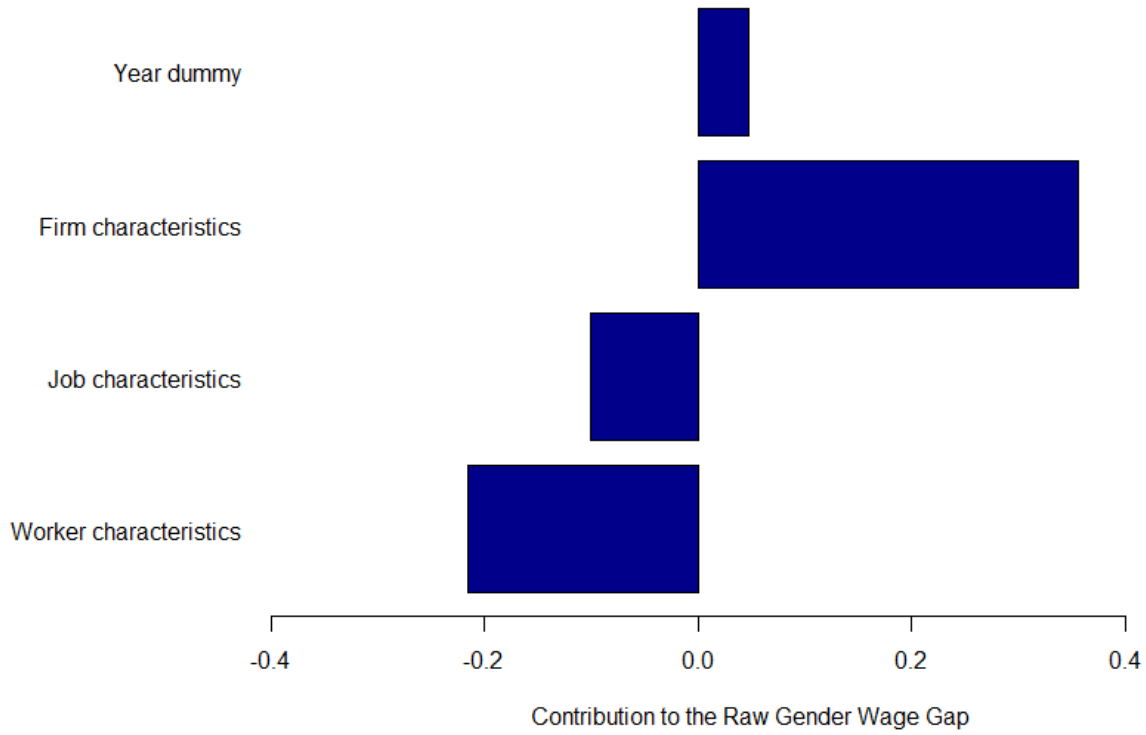


Figure 5.2.1 indicates that firm characteristics alone can explain 35.7% of the gender pay gap, while year dummy explain another 5% of the gender wage gap. However, job characteristics offset the pay gap by -10%. This suggests that as women tend to choose other occupations and job conditions (for example, different working time) than men, they may pay the penalty for such choices. The bias of worker characteristics – once conditioning out the other characteristics – further counterweight the gender gap by -21.5%. This result provides a proposal that women's option for getting a higher level of education is seriously underrated in the labour market. The underappreciation of women's higher education may be correlated with the pointed fact in the literature review that they tend to major in subjects that increase unemployment and overeducation and lead to less rewarding positions. Combining all the characteristics' biases together, they together explain around 9% of the gender gap, while the remaining 91% are left unexplained. It indicates that the model used in the research may be insufficient to present a brief overview of the gender wage gap components across firms.

Table 5.2.2 presents Gelbach decomposition in the within-firms model. By measuring wage disparity of men and women within firms, the characteristics' biases face a slight change – gender differences in worker and job characteristics tend to increase the gender wage gap by a bit more than across firms, while firm effects are prone to explain even more of the gap between men and women.

Table 5.2.2

Gelbach Decomposition with within-firms full model

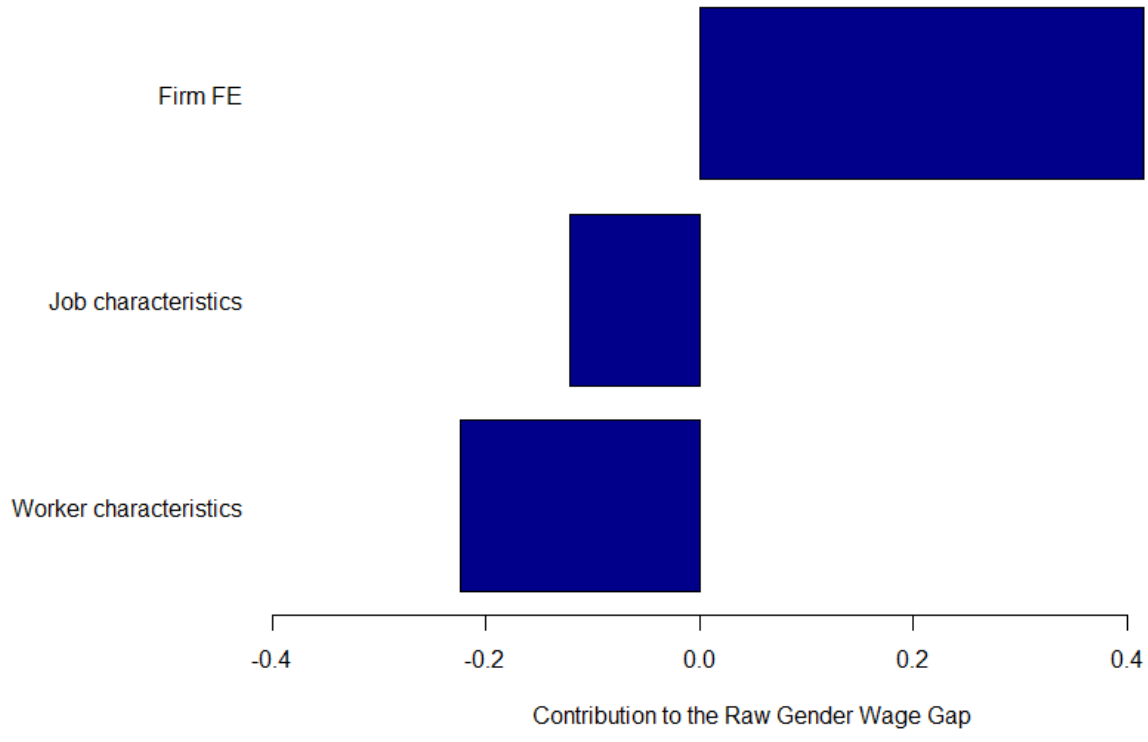
Decomposition of the Gender Wage Gap with fixed-effects on firms (Gelbach, 2016)					
		$\hat{\delta} \equiv \hat{\beta}_{1,f}^{base} - \hat{\beta}_{1,f}^{full}$		Decomposition of the change into:	
Base Model Female estimate	Full Model Female Estimate	Change (1)-(2)	Firm F.E.	Job characteristics	Worker Characteristics
(1)	(2)	(3)	(4)	(5)	(6)
-0.1167831	-0.1083883	-0.0083948	-0.0485778	0.0140802	0.0261028

Figure 5.2.2 examines the role of firm fixed-effects on the gender wage gap explanation. It specifies that firm fixed-effects account for 41.6% of the gender pay gap (5.9 percentage point increase,

compared to the firm characteristics bias from the across-firms model). Different job characteristics between men and women now counterweight the raw gender gap by -12%. A larger negation of the gender wage gap explanation within-firms shows that unobserved firm characteristics are correlated with job distinctiveness, thus, controlling for all of the firm characteristics, the bias has changed. Controlling for the firm fixed-effects also result in the offset of the worker characteristics explanation of the raw gender pay gap – now, the worker characteristics bias control for -22.4% of the raw gender gap. Taking into account all the characteristics in the within-firms model, they clarify 7.2% of the raw gender gap, leaving 92.8% of the raw gender gap unexplained. These results in the Equation (7) model also questions whether the model and sample limitations prevents from deeper explanation of the raw gender pay gap.

Figure 5.2.2

Characteristics' impact on the Raw Gender Wage Gap within-firms



6. CONCLUSIONS

I have used Structure of Earnings Survey data of Lithuania to study the role of firms on the gender wage gap. The investigation of the econometric model in the thesis was insufficient to explain a large proportion of the gender wage gap in the sample. Indeed, it had only explained around 9% and 7.5% with "across" and "within" firms models accordingly.

The conclusion of the decomposition results shows that the role of firms is a significant factor in both across and within-firms models in the explanation of the unadjusted gender gap. However, the job and worker characteristics offsets the understanding of the gender wage gap in Lithuania. Figures C.1 and C.2 in the Appendix C (that represent decomposition characteristics broken down to smaller extent) show that the offset of the gender pay gap is majorly determined by education, occupation and tenure in Equation (6)-(7) models. These findings could indicate that women's education is underappreciated in the labour market compared to men, they might receive lower wages than men in the occupations that they dominate and that their experience in the labour market is less valued, as they have a longer tenure than men in the sample. If it would be clear that the model and the sample fully specifies the population, the unexplained part could be dedicated as a discrimination towards women. However, with limitations of this sample and econometric model in mind, more investigation is required to clarify the unexplained part of the gender gap in Lithuania.

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THE GENDER WAGE GAP ACROSS AND WITHIN FIRMS: EVIDENCE FROM LITHUANIA

Bachelor thesis

Quantitative Economics

Vilnius University, Faculty of Economics and Business Administration

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Summary

The ultimate goal of this thesis was to examine the role of firms in the gender wage gap in Lithuania. Motivated by findings in the existing literature on the firms' significance on the gender pay inequality, the thesis implemented econometric modelling to examine "across" and "within" firms models on the unadjusted gender pay gap. The paper consists of six main sections: introduction, the literature review, institutional background in Lithuania, methodology and data, results and conclusions.

The literature review examined the existing literature on classical factors determining the gender pay gap, where importance of age, education was overviewed. The section of the role of firms on wages inspected the industry, size of the enterprise and peer effects on the wage size. The last section discussed findings on the role of firms on the gender pay gap, where companies' size, co-workers' characteristics and firm-specific premiums were briefly analysed.

Institutional Background has given a broader understanding of the legislations made in Lithuania for gender equality and, especially, a cause of the gender wage gap decrease from 2017, which should have impacted the gender wage gap magnitude on a data file from 2018. Thus, this section inspired to analyse the impact in the gender wage gap of different years of data.

The methodology and data section provided a proper comprehension of the men's and women's segregation into the different parts of the Lithuanian labour market, which allowed to interpret the results in the findings, and methodology for the explanation of the gender wage gap was gradually explained.

Results derived from the empirical investigation have left a significant part of the gender wage gap unexplained in "across" and "within" firms models.

The conclusion section discusses why the substantial part of the gender wage gap left unexplained. It also indicates what could be plausibly be if it could be possibly diminished if the dataset was enhanced with more variables and with a longitudinal design.

LYČIŲ DARBO UŽMOKESČIO SKIRTUMAS TARP ĮMONIŲ IR JŲ VIDUJE: LIETUVOS DUOMENYS

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Santrauka

Galutinis šio baigiamojo darbo tikslas buvo išnagrinėti įmonių vaidmenį moterų ir vyrų darbo užmokesčio skirtumą Lietuvoje. Įkvėptas esamos literatūros išvadomis apie įmonių reikšmę lyčių darbo užmokesčio nelygybėje, šis baigiamasis darbas pritaikė ekonometrinį modeliavimą, siekiant ištirti įmonių įtaką lyčių darbo užmokesčio nelygybės modeliuose: „visų“ įmonių ir įmonių „viduje“. Darbą sudaro šešios pagrindinės dalys: įvadas, literatūros apžvalga, institucinis pagrindas Lietuvoje, metodika ir duomenys, rezultatai ir išvados.

Literatūros apžvalgoje išnagrinėta esama literatūra apie klasikinius lyčių darbo užmokesčio skirtumus lemiančius veiksnius, apžvelgta amžiaus, išsilavinimo svarba. Firmų vaidmens darbo užmokesčio skyriuje buvo apžvelgta pramonės šakos, įmonės dydžio ir kolegų įtaka darbo užmokesčio dydžiui. Paskutinėje dalyje buvo aptarti literatūros radimai apie įmonių vaidmenį vyrų ir moterų darbo užmokesčio skirtumui, kur buvo trumpai išanalizuotas įmonių dydis, bendradarbių charakteristikos ir konkrečiai įmonei būdingos priemokos.

Institucinis kontekstas suteikė platesnį supratimą apie Lietuvoje priimtus teisės aktus, skirtus lyčių lygybei. Ypač svarbi priežastis buvo paminėta, kodėl lyčių nelygybė darbo užmokesčio atžvilgiu pradėjo mažėti nuo 2017 metų. Šis darbo užmokesčio nelygybės mažėjimas turėjo turėti įtakos duomenims, surinktiems 2018 metais. Todėl, šis atradimas įkvėpė išanalizuoti skirtingų metų duomenų įtaką lyčių darbo užmokesčio skirtumui.

Metodologijos ir duomenų skiltyje buvo galima tinkamai suprasti vyrų ir moterų segregaciją į skirtingas Lietuvos darbo rinkos dalis, o tai leido interpretuoti išvadose gautus rezultatus. Metodologijos dalis palaipsniui paaiškina vyrų ir moterų darbo užmokesčio skirtumo paaiškinimo metodika.

Remiantis empirinio tyrimo rezultatais, didelė darbo užmokesčio skirtumo tarp lyčių dalis liko nepaaiškinta „visų“ ir „vidaus“ firmų modeliuose.

Išvadų skyriuje aptariama, kodėl didelė dalis lyčių atlyginimo skirtumo liko nepaaiškinta. Išvados taip pat nurodo, kad patobulintas duomenų rinkinys, naudojant daugiau kintamųjų bei naudojant išilginį dizainą galėtų suteikti didesnes galimybes platesnei lyčių nelygybės skirtumo analizei.

APPENDIX A

Variable definitions:

Age This categorical variable is constructed to take on the following values: *14-29, 30-39, 40-49* and *50+*.

Education This categorical variable is constructed using the information on education, namely the highest International Standard Classification of Education (ISCED) and is divided into 4 categories: G1 – basic education, G2 – secondary education, G3 – tertiary education that took less than 4 years to obtain it (it is related to a bachelor's degree or equivalent level), G4 – tertiary education that took more than 4 years to obtain it (it is related to Master's or Doctoral degree or equivalent level)

Earnings This continuous variable shows the average hourly wage of worker.

Tenure To compute the average length of experience of a person in the enterprise, we take all observations of years worked in the enterprise and compute the average value for men, women and the sample.

Type of the employment contract This categorical variable takes on a value "A" if a person has signed indefinite duration contract and "B" if a person has signed a temporary/fixed term contract.

Working time This categorical variable takes on a value "P.T." if a person works a part-time job and "F.T." if a person works a full-time job.

Special payment for shift work This continuous variable shows additional earnings for an employee working specific or/and additional hours.

Collective pay agreement a categorical variables that takes on a value "B" if the employee's firm provides industry agreement, "C" if the employee's firm provides agreement for individual industries in individual regions, "D" if the employee's firm provides an enterprise or single employer agreement and "N" if the collective pay agreement does not exist in the firm.

Size of the company This categorical variable is constructed using 3 intervals for the size of the company. This variable takes on a value "1_49" if a person works in a company that do not have more

than 50 employees, "50_249" if a person works in a company that has from 50 to 249 employees and "GT_250" if a person works in a company that has more than 250 employees.

Industry The categorical variable is constructed using International Standard Classification of Occupations (ISCO-08). The variable has information on different economic activities in which a person works. *The economic activities obtained in the sample are: 1. Manufacturing, 2. Transportation and Storage, 3. Human Health and Social Work Activities, 4. Public Administration and Defence; Compulsory Social Security, 5. Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles, 6. Administrative and Support Service Activities, 7. Education, 8. Professional, Scientific and Technical Activities, 9. Construction, 10. Information and Communication, 11. Arts, Entertainment and Recreation, 12. Financial and Insurance Activities, 13. Accommodation and Food Service Activities, 14. Water Supply; Sewerage, Waste Management and Remediation Activities, 15. Electricity, Gas, Steam and Air Conditioning Supply, 16. Other Service Activities, 17. Real Estate Activities, 18. Mining and Quarrying.*

Occupation The categorical variable is constructed using International Standard Classification of Occupations (ISCO-08). The variable has information on different occupations that a person works. The main groups of occupations, according to ISCO-08 are: 1. Professionals, 2. Craft and Related Trades Workers, 3. Plant and Machine Operators, and Assemblers, 4. Technicians and Associate Professionals, 5. Managers, 6. Elementary Occupations, 7. Service and Sales Workers, 8. Clerical Support Workers, 9. Skilled Agricultural, Forestry and Fishery Workers.

Average fraction of women in a company The variable is computed for every observation - I take all workers of a certain company in the sample and calculate the average fraction of females in that company by excluding the current observation from the fraction calculation. Then I take the average of all these fractions and provide statistics for all the sample, men and women.

Average fraction of people with tertiary education in a company The variable is computed for every observation – I take all workers of a certain company in the sample and calculate the average fraction of people with tertiary education in the company for every worker of the specific company by excluding the current observation from the fraction calculation. Then I take the average of all fractions and provide statistics for all the sample, men and women.

Average fraction of people older than 50 years in a company The variable is computed for every observation – I take all workers of a certain company in the sample and calculate the average fraction of people that are older than 50 years in the company that every worker works in by excluding the current observation from the fraction calculation. Then, I take the average of all fractions and provide statistics for the sample, men and women.

Average fraction of people with tenure less than 2 years in a company The variable is computed for every observation – I take all workers of a certain company in the sample and calculate the average fraction of people that has tenure less than 2 years by excluding the current observation from the fraction calculation. Then, I take the average of all fractions and provide statistics for the sample, men and women.

APPENDIX B

Table B.1

Table 5.1.1 with all coefficients included (GenderF is equal to Female coefficient)

	Dependent variable:				
	log(Avg_gross_hourly_earnings)				
	(1)	(2)	(3)	(4)	(5)
as.factor(YEAR)2018		0.309*** (0.004)			
GenderM	0.117*** (0.004)	0.111*** (0.004)	0.184*** (0.003)	0.140*** (0.003)	0.104*** (0.004)
Age30_39			0.108*** (0.005)		
Age40_49			0.061*** (0.005)		
Age50			0.016*** (0.005)		
Education_levelG2			0.152*** (0.009)		
Education_levelG3			0.468*** (0.009)		
Education_levelG4			0.751*** (0.010)		
Ocp_mainCraft_and_Related_Trades_Workers				-0.045*** (0.008)	
Ocp_mainElementary_Occupations				-0.301*** (0.009)	
Ocp_mainManagers				0.551*** (0.009)	
Ocp_mainPlant_and_Machine_Operators_and_Assemblers				-0.081*** (0.008)	
Ocp_mainProfessionals				0.404*** (0.008)	
Ocp_mainService_and_Sales_Workers				-0.209*** (0.009)	
Ocp_mainSkilled_Agricultural_Forestry_and_Fishery_Workers				-0.267*** (0.087)	
Ocp_mainTechnicians_and_Associate_Professionals				0.089*** (0.008)	
Tenure				0.012*** (0.0005)	
Tenure_sq				-0.0003*** (0.00002)	
Type_of_employment_contractB				-0.009 (0.007)	
Working_timePT				-0.146*** (0.004)	
Special_payment_for_shift_work				0.003*** (0.00005)	
Economic_Activity_2ADMINISTRATIVE_AND_SUPPORT_SERVICE_ACTIVITIES					-0.061*** (0.012)
Economic_Activity_2ARTS_ENTERTAINMENT_AND_RECREATION					-0.177*** (0.013)
Economic_Activity_2CONSTRUCTION					0.066*** (0.013)
Economic_Activity_2EDUCATION					-0.086*** (0.013)
Economic_Activity_2ELECTRICITY_GAS_STEAM_AND_AIR_CONDITIONING_SUPPLY					0.132*** (0.015)
Economic_Activity_2FINANCIAL_AND_INSURANCE_ACTIVITIES					0.207*** (0.014)
Economic_Activity_2HUMAN_HEALTH_AND_SOCIAL_WORK_ACTIVITIES					0.010 (0.012)
Economic_Activity_2INFORMATION_AND_COMMUNICATION					0.164*** (0.013)
Economic_Activity_2MANUFACTURING					0.121*** (0.010)
Economic_Activity_2MINING_AND_QUARRYING					0.262*** (0.020)
Economic_Activity_2OTHER_SERVICE_ACTIVITIES					0.046*** (0.015)
Economic_Activity_2PROFESSIONAL_SCIENTIFIC_AND_TECHNICAL_ACTIVITIES					0.059*** (0.013)
Economic_Activity_2PUBLIC_ADMINISTRATION_AND_DEFENCE_COMPULSORY_SOCIAL_SECURITY					-0.047*** (0.012)
Economic_Activity_2REAL_ESTATE_ACTIVITIES					0.033** (0.016)
Economic_Activity_2TRANSPORTATION_AND_STORAGE					0.002 (0.012)
Economic_Activity_2WATER_SUPPLY_SEWERAGE_WASTE_MANAGEMENT_AND_REMEDIATION_ACTIVITIES					0.062*** (0.014)
Economic_Activity_2WHOLESALE_AND_RETAIL_TRADE_REPAIR_OF_MOTOR_VEHICLES_AND_MOTORCYCLES					0.006 (0.011)
Size_of_the_enterprise50_249					0.260*** (0.005)
Size_of_the_enterpriseGT_250					0.326*** (0.005)
Collective_pay_agreementC					-0.098*** (0.037)
Collective_pay_agreementD					-0.165*** (0.010)
Collective_pay_agreementN					-0.152*** (0.010)
Shr_w					-0.156*** (0.008)
Shr_tert_educ					0.653*** (0.007)
Shr_tnr_2yr					-0.165*** (0.007)
Shr_older_50					-0.126*** (0.008)
Constant	1.330*** (0.003)	1.182*** (0.003)	0.902*** (0.010)	1.154*** (0.007)	1.101*** (0.016)
Observations	87,940	87,940	87,940	87,940	87,940
R^2	0.011	0.088	0.214	0.302	0.233

Note: *p<0.1; **p<0.05; ***p<0.01

Table B.2

Table 5.1.2 with all coefficients included (GenderF is equal to Female coefficient)

	Dependent variable:	
	log(Avg_gross_hourly_earnings)	
	(1)	(2)
as.factor(YEAR)2018	0.313*** (0.003)	
GenderF	-0.106*** (0.004)	-0.108*** (0.003)
Education_levelG2	0.051*** (0.007)	0.035*** (0.007)
Education_levelG3	0.131*** (0.009)	0.117*** (0.007)
Education_levelG4	0.307*** (0.009)	0.282*** (0.008)
Age30_39	0.071*** (0.004)	0.088*** (0.004)
Age40_49	0.024*** (0.004)	0.073*** (0.004)
Age50	0.003 (0.005)	0.033*** (0.004)
Economic_Activity_2ADMINISTRATIVE_AND_SUPPORT_SERVICE_ACTIVITIES	-0.021** (0.010)	
Economic_Activity_2ARTS_ENTERTAINMENT_AND_RECREATION	-0.218*** (0.011)	
Economic_Activity_2CONSTRUCTION	0.032*** (0.011)	
Economic_Activity_2EDUCATION	-0.161*** (0.011)	
Economic_Activity_2ELECTRICITY_GAS_STEAM_AND_AIR_CONDITIONING_SUPPLY	0.061*** (0.013)	
Economic_Activity_2FINANCIAL_AND_INSURANCE_ACTIVITIES	0.135*** (0.012)	
Economic_Activity_2HUMAN_HEALTH_AND_SOCIAL_WORK_ACTIVITIES	-0.071*** (0.010)	
Economic_Activity_2INFORMATION_AND_COMMUNICATION	0.076*** (0.011)	
Economic_Activity_2MANUFACTURING	0.074*** (0.009)	
Economic_Activity_2MINING_AND_QUARRYING	0.209*** (0.017)	
Economic_Activity_2OTHER_SERVICE_ACTIVITIES	0.020 (0.012)	
Economic_Activity_2PROFESSIONAL_SCIENTIFIC_AND_TECHNICAL_ACTIVITIES	-0.037*** (0.010)	
Economic_Activity_2PUBLIC_ADMINISTRATION_AND_DEFENCE_COMPULSORY_SOCIAL_SECURITY	-0.083*** (0.010)	
Economic_Activity_2REAL_ESTATE_ACTIVITIES	0.046*** (0.013)	
Economic_Activity_2TRANSPORTATION_AND_STORAGE	-0.038*** (0.010)	
Economic_Activity_2WATER_SUPPLY_SEWERAGE_WASTE_MANAGEMENT_AND_REMEDIATION_ACTIVITIES	0.036*** (0.012)	
Economic_Activity_2WHOLESALE_AND_RETAIL_TRADE_REPAIR_OF_MOTOR_VEHICLES_AND_MOTORCYCLES	-0.001 (0.009)	
Size_of_the_enterprise50_249	0.276*** (0.004)	
Size_of_the_enterpriseGT_250	0.331*** (0.004)	
Collective_pay_agreementC	-0.056* (0.030)	
Collective_pay_agreementD	0.040*** (0.008)	
Collective_pay_agreementN	0.012 (0.008)	
Ocp_mainClerical_Support_Workers	0.158*** (0.008)	0.184*** (0.008)
Ocp_mainCraft_and_Related_Trades_Workers	0.188*** (0.006)	0.236*** (0.006)
Ocp_mainManagers	0.641*** (0.007)	0.691*** (0.006)
Ocp_mainPlant_and_Machine_Operators_and_Assemblers	0.157*** (0.006)	0.211*** (0.006)
Ocp_mainProfessionals	0.447*** (0.006)	0.483*** (0.006)
Ocp_mainService_and_Sales_Workers	0.073*** (0.006)	0.132*** (0.007)
Ocp_mainSkilled_Agricultural_Forestry_and_Fishery_Workers	0.107 (0.074)	0.241*** (0.077)
Ocp_mainTechnicians_and_Associate_Professionals	0.227*** (0.006)	0.275*** (0.006)
Tenure	0.012*** (0.001)	0.010*** (0.0004)
Tenure_sq	-0.0002*** (0.00001)	-0.0002*** (0.00001)
Type_of_employment_contractB	-0.032*** (0.006)	-0.026*** (0.006)
Working_timePT	-0.011*** (0.004)	0.039*** (0.004)
Special_payment_for_shift_work	0.002*** (0.00004)	0.001*** (0.00004)
Shr_w	-0.098*** (0.006)	
Shr_tert_educ	0.247*** (0.007)	
Shr_tnr_2yr	-0.029*** (0.006)	
Shr_older_50	-0.211*** (0.008)	
Constant	0.575*** (0.015)	
Observations	87,940	87,940
R^2	0.492	0.362
Note:		*p<0.1; **p<0.05; ***p<0.01

APPENDIX C

Figure C.1

Figure 5.2.1 with expanded sets of characteristics

Figure C.2

Figure 5.2.2 with expanded sets of characteristics