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STEN ANSPAL

Essays on gender wage inequality in the Estonian labour market

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Essays on gender wage inequality in the Estonian labour market

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CONTENTS

LIST OF PUBLICATIONS

The thesis consists of three original publications, referred to in the text of this and subsequent chapters by their respective Roman numerals:

I. **Anspal, S**. "Gender wage gap in Estonia: a non-parametric decomposition." Baltic Journal of Economics 15.1 (2015): 1–15.
II. **Anspal, S.** "Non-parametric wage gap decomposition and the choice of reference group." International Journal of Manpower (accepted for publication).
III. **Anspal, S.**, and Järve, J. "Downward nominal wage rigidity and Gender." Labour 25.3 (2011): 370–385.

INTRODUCTION

Motivation for research

The difference between women's and men's pay in a country is a very commonly used indicator of gender equality. This indicator is important for several reasons. It may indicate that there is discrimination in the country's labour market, which would be problematic in both the moral and legal senses, as pay discrimination would constitute a violation of human rights under Article 23 of the Universal Declaration of Human Rights (United Nations 1948). However, although the gender wage gap is sometimes – mostly in popular discussion – interpreted as evidence of discriminatory pay setting practices, it may in fact be due to a host of other factors such as differences in the choices made by individuals about work or education, which may in turn be influenced by values, culture and much more. Nevertheless, even if the gender wage gap were entirely due to factors other than direct pay discrimination, it would still be an important indicator to consider since it can be thought of as an indication of lost economic potential. If the wage gap were due to gender differences in the education levels or subjects chosen for study for example, there would be potential gains to be made from equalising those; if the gap were due to segregation by occupation or industry, both individuals and the economy as a whole could benefit from there being a wider pool of workers to be matched to jobs, and so on. To design appropriate policy responses, therefore, it is important to go beyond the overall gender wage gap and examine what specific factors are behind the gender pay differential.

In Western countries, where the gender wage gap has been studied for a long time, it has been documented that although the gap remains, it has fallen significantly over time (Blau and Kahn 2007). In Estonia a significant gender wage gap was inherited from Soviet times[1] when the country regained independence in 1991. Although it has declined somewhat since then, it has persisted at a very high level throughout the transition from a planned economy to a market economy, thus resisting the transformation of the economic system that has taken place during the past two and a half decades. Although the focus of this thesis is not on international comparisons, they are helpful for putting the figures in context and illustrating the scale of the issue: in 2013, the difference in average hourly pay for male and female paid employees in Estonia was 28.2%, the highest among European Union countries and seven percentage points higher than the next highest in the Czech Republic (see Figure 1). Not only is this figure higher than those of Southern European countries, in which women's employment rates are lower and the observed pay gap is accordingly smaller, but it is also higher by some margin than the gap in Northern European countries with high levels of female employment. Particularly notably, the figure is more than double those of the other Baltic countries, Latvia and Lithuania,

[1] The adjusted gender wage gap was 0.365 log points in 1989, according to estimates by Noorkõiv *et al* (1998).

whose historical and economic developments in the past decades have been similar.

What, then, explains the gender wage gap in Estonia? A number of authors have sought an answer to this question, reaching the overall finding that the greater part of the gap cannot be explained by differences in men's and women's observable characteristics. Noorkõiv *et al* (1998), studying employment and wage dynamics in Estonia during the transition period of 1989–1995, find that the adjusted wage gap that remains after controlling for various human capital and job characteristics decreased over the period from 0.365 to 0.288. Using data from 1998–2000, Rõõm and Kallaste (2004) are able to explain

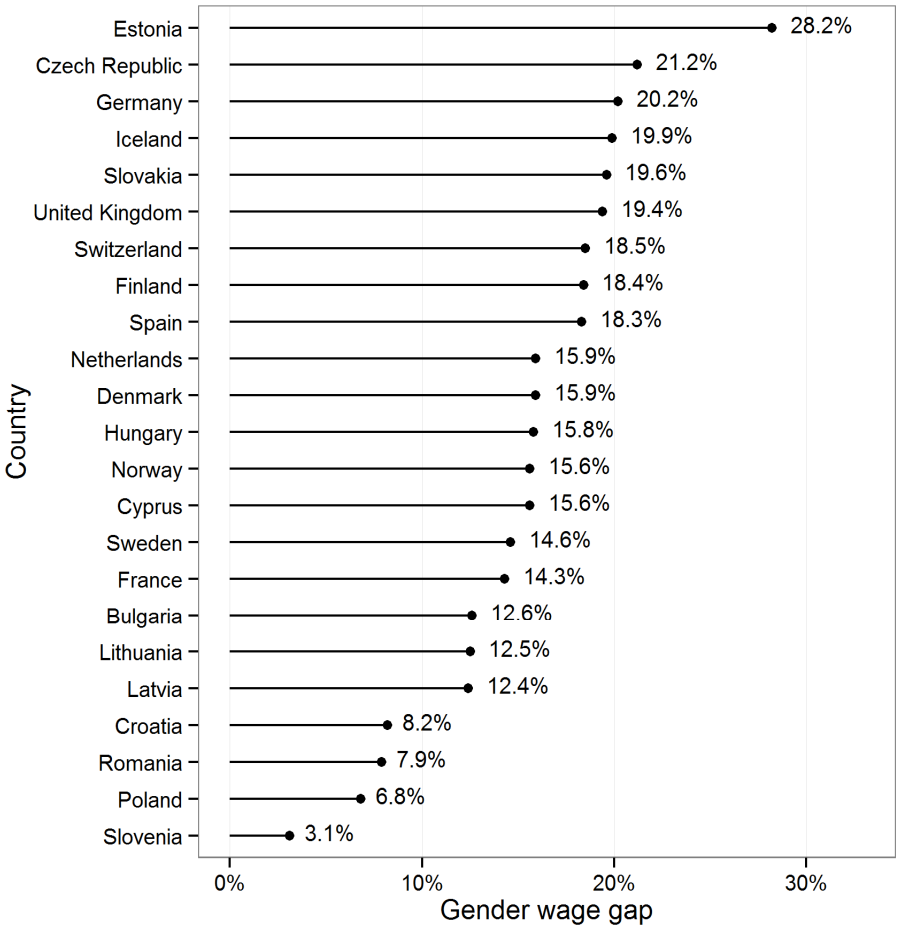

Figure 1. Gender wage gap in European countries, 2013. Difference between average gross hourly earnings of male and female paid employees as a percentage of average gross hourly earnings of male paid employees. The sample covers industry, construction and services, excluding households as employers and extra-territorial organisations and bodies, and taking enterprises with 10 or more employees.

Source: Eurostat.

about one-third of the gender wage gap, with 20 to 21 percentage points left unexplained. Anspal, Kraut and Rõõm (2010) study the period from 2000 to 2008, finding that even less of the gap can be explained, as the explained part made up between 10% and 15% of the overall wage gap, depending on the method used. Masso and Krillo (2011), studying the periods 2005–2007, 2008, and 2009, find the explained part of the gender wage gap ranging between –10% and 26%, depending on the period. Christofides *et al* (2013) are able to explain only 31–44% of the gap, depending on the methodology used.

That the unexplained part of the gap is so large is unsatisfactory because it leaves the significance of most of the gender wage gap fundamentally unclear. The unexplained gap is often interpreted as "discrimination" in the literature, but it is far from clear that it reflects the extent of pay discrimination – although it is possible that discrimination plays a role, there are other equally plausible factors that could increase the unexplained wage gap. For example, Anspal, Kraut and Rõõm (2010) argue that the occupational and industry variables are measured in insufficient detail in the commonly used Estonian Labour Force Survey, which may obfuscate the variables and make it impossible to ensure comparison between male and female workers with comparable characteristics. They hypothesise that the unexplained gap would be smaller if more detailed data were used. They also point out that the unexplained wage gap may be increased by potentially important variables that are usually omitted from Estonian studies, such as work experience, which is a key variable in the human capital model. These potential leads are taken up and evaluated in this thesis.

Several authors (Anspal, Kraut and Rõõm 2010, and Masso and Krillo 2011) have documented how the gender wage gap has changed over the business cycle: it increased during the boom years and decreased in the recession. Studying this may also offer potential clues as to the nature of the differential valuation of men's and women's characteristics. This line of inquiry is also followed in this thesis.

Aims and objectives of the research

The primary question addressed in this thesis is whether better explanations for the gender wage gap in Estonia could be obtained by the use of different methods and data from those used in previous studies. Specifically, the thesis takes as its starting point some of the issues identified in prior research which can be addressed using newer methods and different data sources.

One of these issues is to ensure the comparability of men and women when decompositions are carried out and characteristics are controlled for. The issue mentioned above of whether the large unexplained gap found in previous studies arises because the data are insufficiently detailed is examined, as is the extent to which the use of more detailed data would reduce the unexplained gap. If the occupational classification used in statistical analysis groups together brain surgeons and librarians (ISCO major group 2) for example, can it really be

said that job characteristics have been controlled for? Furthermore, even if the detail of the measurement is appropriate, the question remains of how far not only the various individual characteristics but also the specific combinations of those characteristics matter; it could be that certain combinations of the characteristics have different labour market outcomes than would be expected from a linearly additive model. It could also be the case that some combinations of individual characteristics are found among women but not among men, or vice versa. Thus one of the aims of this study is to explore the implications of these considerations in the context of explaining the gender wage gap, using more detailed data sources and appropriate analysis methods.

The second aim is to explore the dynamics of the gender wage gap throughout the business cycle. One of the objectives in this study is to test a hypothesis of one possible mechanism that could lead to changes in the valuation of individual characteristics over the business cycle, namely that downward nominal wage rigidity may be different for men and women. This is a topic that has not previously received attention in the literature on either the gender wage gap or nominal wage rigidity.

The time period for the thesis is limited to the past decade, 2005–2014,[2] and so it does not consider the gender wage gap during the process of transition from the communist economy to the market economy. The time period is chosen so as to include recent years that encompass the boom and recession periods.

A secondary aim in choosing the specific research objectives was the novelty and international relevance of the research carried out. While Estonia stands out in international comparison for the high level of its gender wage gap, it is a small country and the relevance of specific empirical estimates could accordingly be of limited interest elsewhere. For this reason, it was decided to choose the data or methodology so that the research may potentially be of some relevance beyond Estonia, and to publish it in the form of research articles in international journals.

To fulfil the objectives of the research, the following specific research tasks were set:

1. To give an overview of the main theoretical explanations for the gender wage gap as a framework for interpreting the empirical results of this thesis;
2. To provide a descriptive analysis of the situation of men and women in the Estonian labour market as context for the empirical studies;
3. To carry out various common decompositions of the gender wage gap in order to highlight some of the issues that their results leave open, so as to motivate the empirical studies;

[2] As described below, the descriptive analysis in Chapter II covers the entire period, while two of the empirical studies (Studies I and II) are based on a single year within this period and one (Study III) on a time series.

4. To evaluate the hypothesis that a substantial factor behind the large unexplained part of the gender wage gap is that the data on occupation and industry are insufficiently detailed;
5. To evaluate the hypothesis that a substantial factor behind the large unexplained part of the gender wage gap is the problem of support, i.e. the incomparability of the particular combinations of characteristics of male and female workers;
6. To examine the extent to which non-parametric decomposition methods may be sensitive to the choice of reference category, and to propose an alternative method that makes the asymmetry of male and female advantage and disadvantage explicit;
7. To examine the reasons behind the observed changes in the gender wage gap during the Great Recession, specifically testing the hypothesis that downward nominal wage rigidity is different for men and women.

The structure of the thesis

The thesis consists of three original research articles which address the research questions, as described below. The research articles are preceded by an overview of the theoretical explanations of the gender wage gap in Chapter I and a descriptive analysis of the situation of men and women in the Estonian labour market in Chapter II.

Chapter I describes the main theoretical explanations together with selected empirical results from the literature on the gender wage gap. Since this literature is vast in scope, the chapter does not aim for exhaustive coverage of all the approaches but outlines the main groups of explanations that are most relevant for the focus of the empirical part of the thesis. The first is the approach rooted in the human capital theory started by Mincer (1958). Although the explanatory power of this theory for the gender wage gap has declined since its inception as men's and women's human capital endowments have become more equal, the variables suggested by the theory are still relevant in empirical work. In this sense, the approach suggested by human capital theory is still a core component of empirical studies even today, and remains a useful starting point for exploring other explanations. Moreover, human capital theory remains an important channel through which other explanations may operate: for example, if there is discrimination in the labour market, the human capital framework can be used to describe the feedback effects through the mechanisms of human capital accumulation. The second group of explanations consists of the various theories of discrimination, such as taste-based (Becker 1957), statistical (Phelps 1972) and "pollution"-based discrimination (Goldin 2013). Although this thesis does not specifically aim to prove or disprove pay discrimination, it is important to discuss what forms discrimination may take, and what would and would not constitute empirical evidence of discrimination. The explanations in the third group are the newest, and they explore whether there are differences between

men and women that are not due to differential human capital accumulation or ability. These are the various non-cognitive characteristics such as risk aversion, competitiveness and gender identity. Whether innate or mediated by culture, these characteristics can potentially explain why different individuals make different choices in education and the labour market, perform differently in specific situations, and so on. Although much of this literature is empirical (often experimental) rather than theoretical in nature and the link to the gender wage gap is often implied rather than explicit, a summary is nevertheless given here because it is relevant for the results of Study III. Since the finding of the study is that the downward rigidity of women's pay is lower than that of men's, this literature provides compelling possible explanations for why such a result can occur.

Chapter II provides a context for the empirical studies by giving a descriptive overview of the situation of men and women in the Estonian labour market, and aims to motivate the empirical studies by demonstrating the large unexplained gap that remains after account is taken of the various personal and job characteristics that are available in the commonly used Estonian Labour Force Survey dataset. It raises the question of whether and to what extent this unexplained wage gap arises because the data on occupation and industry are insufficiently detailed, as this would make it impossible to ensure that the male and female workers in the sample are comparable. The chapter also explores the evolution of the gender wage gap over the past decade and the business cycle, finding that the unexplained part of the gender wage gap increased during the recession and raising the hypothesis of gender differences in downward wage rigidity.

Chapter III consists of the three studies:

Study I examines the extent to which the gender wage gap could be explained by characteristics if much more detailed data on occupation and industry were used than has been the case in previous studies. It is found that while the explained part of the gender wage gap increases, a substantial gap of 16.5%, out of the overall unadjusted gap of 30.5%, remains unexplained. Moreover, this unexplained gap comes from those men and women in the sample who have an exact match among the other sex in terms of personal and job characteristics.

Study II deals with the methodological issues found in the decomposition method used in Study I. Although the method has appealing properties – it explicitly addresses the problem of support, i.e. the existence of matches among the opposite sex with identical combinations of characteristics; it also takes those individuals who lack such a match into account; and it offers a convenient way to consider all possible interactions between variables – it is sensitive to the choice of reference category of male or female. It is demonstrated in the study that this essentially arbitrary choice can lead to diametrically opposed conclusions about the explained and unexplained parts of the wage gap. An extension of the method is proposed that addresses this issue, expressing the wage gap as male and female advantage or disadvantage in comparison to the average wage.

Study III tests whether there are differences in downward nominal wage rigidity for men and women. The findings indicate that this is indeed the case and women's wages are more downwardly flexible than those of men. While the data used were insufficient to answer the question of what the reason for that phenomenon was, the evidence is consistent with newer explanations of gender differences in the labour market that are based on differences in non-cognitive characteristics such as risk aversion.

The chapters are followed by a conclusion and a summary in Estonian.

The research tasks, the specific propositions associated with each task, and their place in the structure of this dissertation are summarised in **Table 1**.

Table 1. Research tasks, propositions, and their correspondence to sections of the dissertation.

Proposition	Method	Chapter/ section
Research task 1. To give an overview of the main theoretical explanations for the gender wage gap	Literature review	1
Research task 2. To provide a descriptive analysis of the situation of men and women in the Estonian labour market	Descriptive analysis	2.2
Research task 3. To carry out decompositions of the gender wage gap	Regression, Oaxaca-Blinder decomposition, Smith-Welch decomposition, Firpo-Fortin-Lemieux decomposition	2.3
Proposition 1: The omitted work experience variable is a significant factor behind the unexplained part of the gender wage gap	Oaxaca-Blinder decomposition	2.3.2
Proposition 2: The unexplained gender wage gap exhibits a "glass ceiling" effect	Firpo-Fortin-Lemieux decomposition	2.3.4
Proposition 3: Changes in the gender wage gap over the business cycle are related to changes in the valuation of characteristics	Smith-Welch decomposition	2.3.3
Research task 4. To evaluate the hypothesis that a substantial factor behind the large unexplained part of the gender wage gap is that the data on occupation and industry are insufficiently detailed	Ñopo decomposition	3.1

Proposition	Method	Chapter/ section
Proposition 4: a substantial factor behind the large unexplained part of the gender wage gap is that the data on occupation and industry are insufficiently detailed	Ñopo decomposition	3.1
Research task 5. To evaluate the hypothesis that a substantial factor behind the large unexplained part of the gender wage gap is the problem of support, i.e. the incomparability of the particular combinations of characteristics of male and female workers	Ñopo decomposition	3.1
Proposition 5: a substantial factor behind the large unexplained part of the gender wage gap is the problem of support, i.e. the incomparability of the particular combinations of characteristics of male and female workers	Ñopo decomposition	3.1
Research task 6: To examine the extent to which non-parametric decomposition methods may be sensitive to the choice of reference category, and to propose an alternative method that makes the asymmetry of male and female advantage and disadvantage explicit	Ñopo decomposition	3.2
Proposition 6: non-parametric, matching-based decomposition methods are sensitive to the choice of reference category	Ñopo decomposition	3.2
Research task 7: To examine the reasons behind the observed changes in the gender wage gap during the Great Recession, specifically testing the hypothesis that downward nominal wage rigidity is different for men and women	Histogram location method	3.3
Proposition 7: downward nominal wage rigidity is different for men and women	Histogram location method	3.3

Data and methodology

The second chapter of the thesis, containing a descriptive analysis of men and women in the Estonian labour market and decompositions of the gender wage gap, uses data from the Estonian Labour Force Survey for the years 2005 to 2014. This time period covers the construction boom of 2005–2007, the recession in 2008–2010, and the subsequent recovery in 2011–2014, and allows us to present the basic empirical facts of the last decade and over the business

cycle. It also allows us to identify the limitations and shortcomings of this commonly used dataset, as the data on occupation and industry are insufficiently detailed, and there is no information on actual work experience.

The methods used in the decomposition of the gender wage gap in Chapter 2 are single-equation wage regressions, Oaxaca-Blinder-type decomposition, the Smith and Welch (1986, 1989) decomposition and the unconditional quantile regression method of Firpo, Fortin and Lemieux (2009).

To examine the consequences of the limitations of the dataset, other datasets have been employed. The OECD's recent Programme for the International Assessment of Adult Competencies (PIAAC) survey dataset includes information on work experience and was used to compare the results when actual work experience is used instead of age in Chapter 2.

To examine how the use of more detailed data on occupation and industry affects the results of the gender wage gap decompositions, Statistics Estonia's dataset on the structure of earnings was employed. This dataset contains rich information on the distribution of male and female workers by occupation and industry, as well as data on hourly wages and the level of education.

The structure of earnings dataset is also used to examine whether the results of the decomposition are affected by the problem of support, i.e. the extent to which the sample includes men and women who are comparable in terms of their particular combinations of personal or job characteristics. The method used is the non-parametric method of Ñopo (2008).

In Study II, the properties of the decomposition method of Ñopo (2008) are examined further, specifically the sensitivity of its results to the choice of reference group. An extension of this method is proposed that expresses the gender wage gap as male and female advantage or disadvantage compared to the average wage. The method is illustrated by applying it to the PIAAC international dataset.

In Study III, data from the Estonian Tax and Customs Board for 2001 to 2008 were used. The dataset covered all the companies registered in the Estonian Commercial Register, whether private or government-owned, but excluded government institutions and non-profit organisations. The histogram location method of Kahn (1997) was used to test for downward nominal wage rigidity.

The specific research tasks, data sources and methodologies chosen all have their own limitations as to the conclusions that can be drawn from the research. The focus is on using micro-level data to attempt to explain the gender wage gap in terms of personal and job characteristics, rather than on using it to identify causal relationships that may exist between specific labour market institutions or social policies and the gender wage gap. If some policy or institution affects the gender wage gap, it will be reflected in the results of the decompositions only through its effect on characteristics such as work experience, educational choices, etc, but the actual effects of the policy or institution as such will not be estimated. It is also not possible to answer the question of why the gender wage gap is higher in Estonia than some other countries, since

cross-country differences in institutions, policies, wage distributions etc are not considered here.

Contributions of individual authors

Studies I and II were authored by Sten Anspal.

Study III was co-authored with Janno Järve. Janno Järve was responsible for choosing the research methodology, carrying out the data analysis, and writing the parts of the article that covered those matters. Both Janno Järve and Sten Anspal contributed to formulating the research question, describing the theoretical background and the Estonian institutional context, and discussing the results.

The author is solely responsible for any errors or omissions in this thesis.

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I appreciate the discussions with and helpful comments received from Tairi Rõõm and Jaanika Meriküll on various occasions. In particular, collaboration with Tairi Rõõm and Liis Kraut in a previous study (Anspal, Kraut and Rõõm 2010) was instrumental in motivating the research undertaken in this thesis.

I thank Prof. Tiiu Paas, Kaire Põder, Kadri Ukrainski, Priit Vahter, Jaan Masso and Prof. Urmas Varblane for their valuable suggestions and discussions during the preliminary defence.

I thank Aira Veelmaa and Aime Lauk from Statistics Estonia for their assistance in getting access to and using the structure of earnings dataset.

Thanks are also due to Janek Saluse, co-ordinator of the Doctoral School of Economics and Innovation at the University of Tartu, for his kind help in various practical matters.

Last but not least I am grateful to my family for their patience and support.

1. THE GENDER WAGE GAP: THEORETICAL EXPLANATIONS AND SELECTED EMPIRICAL RESULTS

1.1. Introduction

The aim of this chapter is to provide a theoretical framework for the empirical study of the gender wage gap in Estonia in subsequent chapters, describing the main theoretical approaches and selected important empirical results.

The theoretical and empirical literature on the causes of the gender wage gap is vast. The accumulated knowledge from this literature from the 1950s has been reviewed by a number of authors and has been the subject of several thorough literature surveys (e.g. Altonji and Blank 1999, Bertrand 2011). The aim of the present chapter is thus not to offer a fully comprehensive review, but to give a broad overview of the main lines of theoretical development and to focus more on recent contributions to the field.

Even though the chapter mainly aims to give an overview of the theoretical explanations of the gender wage gap, the presentation is interwoven with empirical results. The reason is that in many cases, developments in theoretical models are both driven by results from empirical work and accompanied by empirical tests of proposed relationships. In particular, much of the recent literature on differences in labour market outcomes based on differences in non-cognitive characteristics such as risk aversion is more empirical in emphasis than were earlier contributions in e.g. human capital theory, often consisting in establishing the existence in such differences in various settings.

The review of theoretical approaches to the study of the gender wage gap undertaken here is far from exhaustive. The selection of theories described was motivated by the aim of describing the most important approaches that are relevant as the background for the empirical studies carried out in this work. In particular, the literature on the comparative effects of labour market institutions and tax-benefit systems on gender inequality has not been discussed, since the studies here are not concerned with cross-country comparisons. Likewise, the literature on the effects of globalisation and trade on the gender wage gap has not been discussed. Nevertheless, the theories of human capital and discrimination discussed below are also important building blocks in the models used in this literature.

A note on terminology: throughout this thesis, the per cent difference between the average wages of men and women is primarily referred to as the *gender wage gap*. A number of other terms are found in the literature for the same phenomenon: gender pay gap, male-female pay differential, and so on. In this thesis, these are occasionally used instead of gender wage gap, without any change in meaning being implied. Mathematically, the gender wage gap is sometimes expressed as men's average wage minus women's average wage as a percentage of men's average wage. But not even this is standard in academic literature: the gender wage gap is often expressed as the log wage gap, i.e. the difference in natural logarithms of male and female average wages, which is

approximately equal to the per cent wage difference at small values of the gap. Sometimes the gap is expressed as the ratio of female to male average wages. Despite these differences in formulation, these variants all refer to the same phenomenon.

In the following subsections, some of the main theoretical explanations for the gender wage gap are outlined, followed by an overview of selected empirical results.

1.2. Explanations based on human capital theory

1.2.1. Theoretical explanations

Among the earliest explanations of the gender wage gap in economics literature are those based on the differences in characteristics affecting men's and women's productivity, such as educational attainment and work experience. Human capital theory in particular provided an early and influential framework within which the causes and development of the differences in men's and women's wages could be analysed. Laying the theoretical groundwork for the empirical specifications of wage regressions, it has enormously influenced empirical work as well. A brief outline of the basics of the theory is given below, together with some of its more important applications for explaining the gender wage gap.

The concept of human capital, as pointed out by Goldin (forthcoming), can already be found in the work of Adam Smith, who applied the term "capital" to refer to "talents" acquired through education, study or work experience, and by incurring the relevant costs (Smith 1776). However, a human capital approach or theory as such can only be discussed starting with the contributions of Mincer (1958) and Becker (1962, 1964). The human capital theory offers a consistent explanation of the process that determines wages. Ultimately, wages depend on a person's productivity, and that productivity is in turn influenced by the investment in human capital, which is defined as "activities that influence future monetary and psychic income by increasing the resources in people" and includes "schooling, on-the job training, medical care, migration, and searching for information about prices and incomes" (Becker 1962). Investment in human capital incurs costs, and the theory explains the decision about how much to invest in human capital, most significantly giving reasons why men and women may accumulate different amounts of human capital.

It is revealed that it is not only formal education that constitutes human capital but also on-the-job training and, importantly, work experience, as every additional year of experience is an accretion to a person's stock of human capital. Human capital is related to earnings through its impact on productivity: the higher the stock of human capital of the worker, the higher that worker's productivity, and thus the higher also their earnings.

A large number of studies on gender pay differentials are based on the human capital theory or developments and extensions of it. Since it describes

the most basic relationships for the determinants of earnings – how choices about investment in human capital are made and how they affect productivity and earnings – it is natural to turn first to this framework to look for explanations of pay differentials. Thus explanations are sought from gender differences in the amount of human capital that men and women choose to invest in, the types of human capital they choose, the timing of the investment and so on. The human capital approach forms a widely used baseline for approaches seeking explanations that lie in places other than differences in human capital formation; in empirical attempts to demonstrate discrimination or differential returns to human capital for example, human capital based specifications are used.

The earnings function

Much of the empirical work on earnings and earnings inequality between various groups employs wage regression specifications that, at the core, are based on Mincer's (1958) specification of the log-linear earnings function. Mincer's formulation of the earnings function enabled him to explain a substantial 60% of the variation in annual earnings using only a very parsimonious specification that includes schooling, age and weeks worked annually. Although the role of schooling in determining earnings may seem obvious now, Polachek (2008) has pointed out that prior to Mincer's contributions it was common to attribute the observed variation in earnings mostly to luck. Mincer's treatment of the schooling decision as an investment decision in the framework of capital theory enabled him to derive the basic log-linear relationship between earnings and years of schooling.

Mincer starts out by showing that given the number of years of schooling s and length of the working life n, the present value of a person's earnings is

$$V_s = E_s \int_s^{n+s} e^{-rt} dt = \frac{1}{r} E_s e^{-rs}(1 - e^{-rn}) \tag{1}$$

where r is the discount rate and E_s are earnings for years of schooling s. Then, if individuals with s_1 and s_2 years of schooling and n_1 and n_2 as the lengths of the working lives are compared, the ratio of their annual earnings could be

$$k_{2,1} = \frac{E_{s2}}{E_{s1}} = \frac{e^{-rs_1}(1 - e^{-rn_1})}{e^{-rs_2}(1 - e^{-rn_2})} \tag{2}$$

where $k_{2,1}$ is the ratio of annual earnings, s_1 and s_2 are the number of years of schooling, n_1 and n_2 are the number of years of working life, and E_{s_1} and E_{s_2} are earnings. The ratio in (2) is obtained by equating $V_{s_2} = V_{s_1}$. Setting $s_2 = s$ and $s_1 = 0$ and assuming the lengths of the working lives as $n_1 = n_2 = n$, then $k_s = e^{rs}$. Therefore, (2) can be expressed as

$$lnE_s = lnE_0 + rs \tag{3}$$

Equation (3) makes a number of specific predictions about the earnings distribution and the relationship between earnings and schooling (Mincer 1958). First, it implies that earnings differentials in per cent terms are a linear function of years of schooling. Also, even if years of schooling were distributed symmetrically, the distribution of earnings would be positively skewed. The higher the rate of return to schooling, the higher will be the earnings inequality and the skewness of the earnings distribution (*ibid*).

Mincer's original formulation has been criticised, e.g. by Rosen (1976, quoted in Willis 1985), who pointed out that if individuals maximise the present value of their earnings over their lifetime given a market interest rate, then they would choose either zero schooling if their internal rate of return is less than the market interest rate, or have infinite demand for schooling if it exceeds the market interest rate. This implication can be avoided by the assumption of marginal borrowing costs that increase with the increase in investment in schooling (Willis 1985).

Human capital, gender, and the family

Why, then, could it be expected that there may be differences in the human capital accumulated by men and women? An empirical fact that would be the obvious first place to look is that men and women differ in their orientation between work and family, as men spend more time in the labour market while women spend more time in the production of non-marketed goods at home. Though this may be called an 'obvious' fact requiring theoretical treatment it should of course be added that the extent of this gender difference varies across countries and time periods; though gender difference in labour market attachment is a widespread phenomenon, it has been much more pronounced in some places than others, and in the 20th century it was more significant in the USA for example than in countries such as Estonia that were formerly part of the Soviet Union. However, the extent and nature of women's labour market participation was very different from men's in the United States in the 1950s and 1960s when the human capital theory started, and the phenomenon of 'housewives' was widespread there but was fairly rare in Estonia during and after its time as part of the USSR, inviting theoretical exploration of its causes and consequences.

Work on the division of labour within the family was pioneered by Becker (1981, 1985). His point of departure was the assumption that there are innate biological gender differences that give one or other sex a comparative advantage in performing a certain type of work. He assumed that women have a comparative advantage in rearing children, a non-market activity. Even if these initial differences in comparative advantages are small, they would lead to specialisation and division of work within the household: in the presence of differential comparative advantages, the total household welfare would be increased with specialisation, such that women specialise in rearing children and performing household tasks, requiring them to stay home and away from the labour market, while men earn income in the labour market. This choice results from the rational collective decision of the family and maximises welfare

from the point of view of the family as a whole (although, as Becker also notes, it says nothing on the distribution of welfare between family members).

An implication of the specialisation and division of work within the family is that as women stay away from the labour market, they also accumulate less human capital in the form of labour market experience. Although Becker's model predicts the division of labour in the form of women staying away from the labour market completely, that division could also take the form of working part-time for example. Furthermore, even if women work full-time, their productivity may be affected by the household division of labour: if women's burden of household work is higher on top of their work in the labour market, this could manifest in lower performance at their jobs due to tiredness or distraction, potentially resulting in lower pay (Becker 1985).

Work experience intermittency

An area in which intra-household specialisation is common is care for infants. Following the birth of a child, there is usually a time period (which may vary widely) in which one of the parents, most commonly the mother, stays away from the labour market completely to care for the child. Even if the woman returns to full-time work after this period, the result will be intermittent labour market experience. To demonstrate the effect of this intermittency, Polachek and Siebert (1993) express the earnings function as the accumulated return to life-cycle investment,

$$\ln E_t = \ln E_0 + r_s S + r_p \sum_{i=s+1}^{t-1} s_i \qquad (4)$$

where E_t denotes earnings at time t, s denotes years of schooling, r_s the rate of return to schooling and r_p the rate of return to post-school investment in the form of work experience. If one child, and thus one period away from the labour market, is assumed, the investment in work experience can be expressed as three segments: e_1 the work experience prior to childbirth; H the time spent at home caring for the child; and e_2 the work experience after the birth of the child. Then (4) can be rewritten in terms of observable earnings Y as

$$\ln Y_t = \alpha_0 + r_s S + \alpha_1 e_1 + \delta H + \alpha_2 e_2 \qquad (5)$$

where the coefficients $\alpha_1$and α_2 can be interpreted as growth in the periods e_1 and e_2 respectively, and the coefficient δ indicates the rate of depreciation of human capital during the time the woman spends out of the labour force. Women's earnings are thus affected not only by their lower investment in human capital in the form of work investment, leading to lost seniority during the period of absence, but also by depreciation of that capital during their absence from the labour market. Polachek and Siebert (1993) estimate (5) from US data and find that the human capital stock depreciates at the rate of 0.5–2% per year, depending on population subgroup.

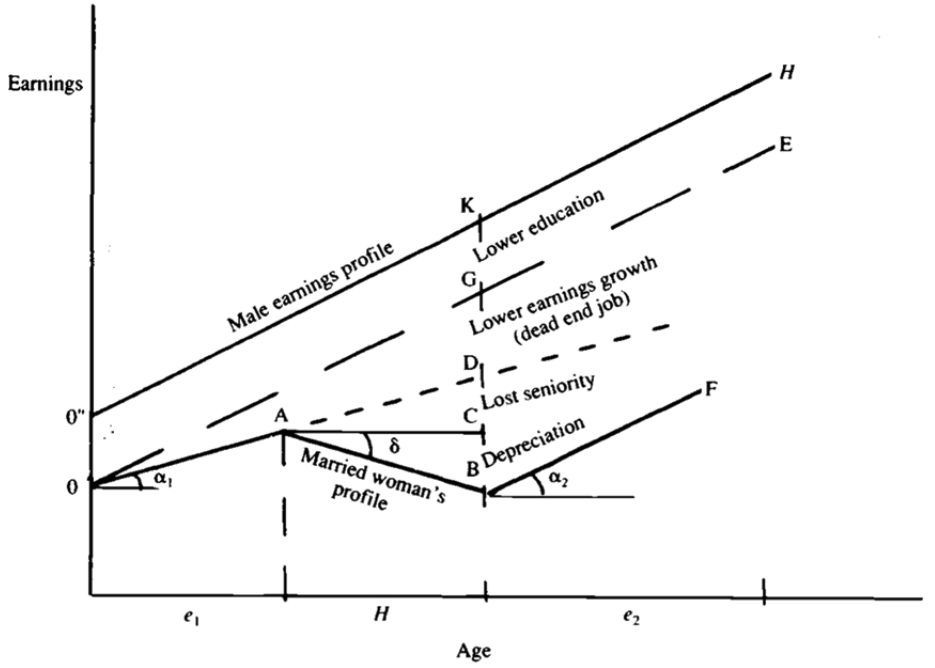

Figure 2. The effect of labour force intermittency.

Source: Polachek and Siebert (1993).

In addition, there are other ways that intermittency could affect women's earnings; if their wage upon their return to their job is the same as before in nominal terms, then the presence of inflation could make their real wage lower. Equally, if work intermittency is considered by the employer to be a factor preventing their promotion, women may be stuck in jobs with lower earnings growth. These considerations and their individual and cumulative effects are illustrated in Figure 2.

Although the mechanisms described above suggest that interruptions to work experience result in permanent loss of earnings over the lifetime, there are also mitigating factors that may reduce the persistence of the impact on earnings. For example, if the woman returns to her former job, her employer may be contractually obliged to pay her the former wage even if there is reason to suppose that her skills have depreciated during her absence.

Investment in education

Since young women expect that they will be rearing children in the future and will spend less time in the labour market, the returns from education will be smaller for them even in the absence of any labour market discrimination, since their time spent in the labour market earning the returns will be shorter. Since

the present value of their returns from education are smaller, they have less incentive to invest in education. Becker (1991) further argues that in addition to personal human capital investment decisions, parents play an important role, as they try to influence their daughters' skill acquisition choices and their preferences so as to maximise their success in the marriage market.

If a distinction is made between consumption-oriented and production-oriented varieties of education, or the types of study that are primarily followed for enjoyment rather than with the aim of gaining profitable skills for the labour market, then women's lower expected returns to education would also be expected to lead to a preference for education in fields that have more of a consumption or, alternatively, home production value rather than a labour market value.

Such differences in women's and men's choices of subject are confirmed by empirical evidence, even though there are generally not substantial differences in the levels of educational attainment of men and women in European and other more developed countries and indeed women's human capital characteristics surpass those of men in some countries, as pointed out by Christofides *et al* (2013).

Blakemore and Low (1984) propose a human capital based explanation for gender differences in the choice of college major. They introduce the concept of atrophy, which characterises each school subject and describes how quickly specialised knowledge becomes obsolete in occupations associated with these subjects if it is not kept up to date through continuous work experience. Thus differences exist between occupations in the extent to which career interruptions are penalised; science is an example of a college major with a high obsolescence parameter compared to that of history. A person faced with a choice between college majors takes their expected career intermittency into account and, all else being equal, should prefer a major in which interruptions in work experience are penalised less if substantial periods out of the labour market are to be expected. Empirically, the authors' findings confirm that females with higher rates of expected fertility choose subjects with a lower rate of atrophy and obsolescence.

Likewise, the lower expected return from women's training influences not only their own human capital investment but also their employers' decisions about investment in on-the-job training. This could in turn lead to slower wage growth and diminished chances of promotion for women (Pfeifer, Sohr 2009).

Household responsibilities, flexibility requirements, and wages

A further consequence of women's greater specialisation in domestic production is the influence that it has on their performance in labour market work. Becker's (1985) model is based on the assumption that effort is a finite resource. So if women's burden of domestic work is higher, this would be expected to influence their performance negatively due to tiredness, distraction and so on. It also limits women's ability to accommodate requests from the employer to work odd hours, to travel, to network, and so forth (Bonke *et al*

2005). If these considerations affect the productivity of a woman's market work, it would be manifest in lower earnings for her.

There are other ways in which women's greater burden of housework may influence their earnings. For example, it may influence them to seek out jobs that are more compatible with the burdens of housework in terms of working hours or easier working conditions. These could, however, constitute "job amenities" for which the woman pays in terms of lower wages (Hersch 1991 and 2009). It is also possible that monopsonistic employers make use of their market power in offering jobs to workers with special requirements or preferences for hours and working conditions (Sigle-Rushton and Waldfogel 2007).

Goldin (2014) argues for the importance of compensating differentials as a major explanation for the male-female wage gap that still remains after the "grand convergence" in human capital endowments of recent decades. She shows that there are significant differences in the extent to which different occupations put a premium on the continuity of experience, long or inflexible hours, and availability for overtime. She argues that these differences originate from the degree to which individual workers in these occupations are easily substitutable. For example, a pharmacy worker's need for a flexible schedule may be easily accommodated because a good substitute is likely to be available, and the flexibility does not bring additional penalties, because if hours are reduced, there will be a loss of pay that is proportional to the reduction in hours. The situation is different for a professional such as a trial lawyer, for whom a substitute would be much harder to find. This means that part-time work or limited availability for certain hours would be penalised more than proportionately to hours, or in other words, the relationship between hours and wages would become non-linear for some occupations but not for others. Higher demand from women for working time flexibility or career interruptions thus becomes an obstacle to the equalisation of pay between women and men, and to a greater degree than would be expected if the relationship between working time and pay was assumed to be linear. These remaining differences due to non-linear costs of working time flexibility may be further reduced to a certain extent, as they have been for a number of occupations such as doctors in the past, but they are unlikely to disappear entirely because there will probably always remain occupations that have higher requirements for availability for work (Goldin 2014).

Technology

Technological progress has been a major factor in enabling women to increase their participation in the labour market by reducing their burden of household work, as the spread of electricity enabled households to use appliances such as refrigerators, vacuum cleaners, washing machines, dryers, etc. The impact of this process has been the subject of a number of theoretical and empirical studies. However, the effect of technological progress is complicated to assess. Ramey (2009) finds that during the twentieth century, the amount of time that women in prime age in the United States spent in home production declined by

six hours per week due to the spread of electricity, indoor plumbing, and home appliances. However, she argues that the most important trend was not that new technologies freed up time for market work, but that gender specialisation in household work decreased. Household appliances vastly increased productivity in home production, but also resulted in the massive substitution of hired help by machines which were instead now operated by household members. Women's participation in the labour market increased, but so did the number of hours spent by men in household work. The number of hours in household work per household member thus changed little. This could also be due to the hypothesis of Mokyr (2000), who argues that better knowledge about the transmission mechanisms of infectious disease persuaded women to raise their standards of cleanliness and thus to allocate more time to housework.

Greenwood *et al.* (2005) develop a model along the lines of Becker's (1965) theory of the allocation of time in order to study the effects of labour-saving technological progress on women's participation in market work. They find that the introduction of new technologies in home production potentially accounts for more than half of the observed increase in female participation, the rest being explained by the decrease in the gender wage gap over time. Modelling that decrease as exogenous allows for a "feedback effect" to women's participation decision from the decline in the gender differential in returns to productive characteristics, either due to the women's liberation movement or other causes. Nevertheless, the authors argue that technological progress was of decisive importance in enabling women's participation to rise, or in the authors' words, "While sociology may have provided fuel for the movement, the spark that ignited it came from economics." Quantitatively similar empirical estimates were obtained by Coen-Pirani (2010), who found that the introduction of home appliances explained about 40% of the increase in married women's participation.

Human capital and other approaches

It should be noted that explanations of gender earnings differentials based on differences in human capital are not exclusive. The relationships described above may operate in the presence of other channels that lead to different wages, such as discrimination. Indeed, human capital theory may help explain the effects of labour market discrimination: if the valuation of schooling in the labour market is different for men and women for example, this will be taken into account by women when they make the decision of how much to invest in formal education. Since their expected return is lower, the investment will then also be lower than that of men.

1.2.2. Empirical results

There are numerous empirical studies that find that the mechanisms described by human capital theory explain a substantial part of the gender wage gap.

Obviously the apparent empirical explanatory power of the human capital model would be expected to vary depending on the country and time period under consideration, as larger differences in work experience or educational attainment, for example, would explain a larger share of gender inequality. Indeed, O'Neill and Polachek (1993) find that convergence in schooling and work experience for men and women explained one-third to one-half of the decline of about 1% per year in the gender wage gap in the US from 1976. A substantively similar conclusion was reached by Wellington (1993). Weichselbaumer and Winter-Ebmer (2005), in their meta-analysis of the international gender wage gap, found that the substantial decrease from around 65% to 30% in the overall gender wage gap from the 1960s to 1990s is attributable to women's increased human capital endowments, reflected in characteristics such as educational attainment, work experience, and training. However, they find that an unexplained component of the wage gap persists, though it has been slowly decreasing over time. Importantly, they also point out that many studies have been unable to use a measure of actual work experience, and have used an age-based approximation instead. They find that this can substantially overestimate the size of the unexplained gender wage gap. As will be seen later, this is also a problem with many studies on the gender wage gap in Estonia.

O'Neill and O'Neill (2006) argue for the continued importance of explanations of the gender wage gap based on the human capital theory. They find that the gender gap in the US in the year 2000 can be attributed in large measure to differences in men's and women's years of work experience, part-time work, and workplace and job characteristics. They find that the gender wage gap disappears between men and women whose family responsibilities are similar. Comparing the wages of unmarried and childless men and women in the 35–43 age group, they find that the gender wage gap becomes insignificant once skills, workplace and job characteristics are controlled for. They interpret their findings as indicating that the gender wage gap is due to women's choices about the amount of time and effort they devote to their careers, and argue that the loss of earnings due to those choices is compensated by their increased utility from family-related activities.

In contrast, Christofides *et al* (2013) studying data from 2007 for 26 European countries find that gender gaps are in large part unexplained by available characteristics including human capital characteristics, though there is a large amount of variation between countries. However, they find that variables measuring generous work-family reconciliation policies help explain the wage gap. Such policies include those which can also affect the accumulation of human capital, such as the length of maternity leave, the availability of formal child care, or the ability to adjust working time for family reasons, and this highlights the role of human capital considerations.

Mincer and Ofek (1982) address an important aspect of human capital theory, which is that skills atrophy during career breaks. They point out that even if human capital depreciates during the period of absence, it is easier to relearn former skills than to acquire new ones. Thus any reduction of wages due

to skill depreciation should be temporary and wages should quickly rebound. This effect is corroborated empirically by Light and Ureta (1995), who find that wages reach the levels they were at prior to the career break in four years, and Baum (2002), who finds that the negative impact of a career break persists for up to two years after the return to work. In contrast, Jacobsen and Levin (1995) find that the negative impact on wages may persist for long periods of time, with wage gaps between women with continuous and intermittent experience remaining at 5–7% even after 20 years. Another aspect of the implications of career breaks is described by Felfe (2012), who finds from German data that adjustments in working hours, flexibility of hours, and stress at work are more likely to occur for women returning to work after maternity leave, and finds limited support for a trade-off between wages and non-wage amenities and the role of the compensating wage differentials in explaining the gender wage gap.

Skans and Liljeberg (2014) use Swedish data to examine the earnings effects of subsidised career breaks. They were able to employ data on a Swedish career break programme with limited funds, in which people who applied for a subsidy after the funds were exhausted were rejected and could be used as counterfactuals. The results indicate that the wage effect of a 3–12 month career break, with a median of 12 months, is negative, as wages are about 3% lower for one to two years after the return to work. The negative effect was higher for workers who changed jobs after the career break.

Some studies have examined the effect of the timing of the career break. The findings of Blackburn *et al* (1993), Chandler *et al* (1994), and Taniguchi (1999) indicate that the later in life the birth of the first child and the associated career break occur, the higher the wage of the woman following the break. Thus career continuity at the age in which the initial stock of work experience-related human capital is accumulated may be important.

In empirical research, different measures of intermittency in labour market experience have been used. Intermittency has variously been defined as at least one period of absence from the labour market (Jacobsen and Levin 1995) or time spent out of the labour market above a certain percentage of total experience (Sorensen 1993). Hotchkiss and Pitts (2005) develop an index of intermittency in order to take account of the length, number and recency of interruptions in experience. They find a sizable wage penalty for intermittency. In a later paper (Hotchkiss, Pitts 2007), they find that as much as 19% of the observed wage differential is accounted for by differences in intermittency of experience.

In terms of educational human capital, an important parameter in addition to years of schooling is the field of study. Smyth (2005) examines gender differentiation by degree subject in 12 European countries. He finds that there are differences between countries in terms of the degree of gender segregation in education but also some regularities, namely the domination of health/welfare, education and arts courses by women and engineering courses by men. He also finds a correspondence between educational and occupational segregation in any given country.

Earlier studies for the US found that study subject choice is a major factor in the differences between the starting wages of male and female college graduates. Gerhart (1990) found that it accounted for 43% of the difference in starting salary. Brown and Corcoran (1997) found that differences in college majors are strongly related to the gender pay gap, accounting for 0.08 to 0.09 of the 0.20 log differential between male and female graduates' wages.

For Europe, Machin and Puhani (2003) find for the UK and Germany that the subject of degrees explains between 8 and 20% of the gender wage gap and Livanos and Pouliakas (2012) estimate that subject choices account for 8.4% of the gender pay gap in Greece. They find that women prefer educational subjects that have less uncertain returns, the lower risk of which is balanced by lower wage premiums in the labour market. This indicates there could be other explanations for educational choices rather than the human capital model, namely that there are possible gender differences in risk aversion (see subsection 0 below).

Gender differences in human capital endowments may also occur due to differences in the incidence of on-the-job training. Fahr and Sunde (2009) find for Germany that women are less likely than men to receive training after finishing their apprenticeship. Using data on British graduates, Booth (1993) finds that male graduates are more likely to receive training than comparable females are, and also that the impact of the training on earnings varies by gender. Similar findings based on US data are reported by Lynch (1992), and Georgellis and Lange (1997) find similar results from West German data. Sicilian and Grossberg (2001) find, however, from US data in the National Longitudinal Survey of Youth that the effect of on-the-job training on earnings in general and the gender wage gap in particular is minuscule.

1.2.3. Summary

Human capital theory describes the mechanisms leading to differences in men's and women's endowments of human capital, and the results of these differences in terms of labour market outcomes. The explanatory power of human capital-based explanations has decreased over the past decades as men's and women's endowments have become more equal, particularly so in Estonia and elsewhere in Central and Eastern Europe where women's educational attainment tends to be higher than men's, but this approach continues to occupy a key role as important empirical work is still being done on uncovering gender differences in specific aspects of human capital such as degree choice, on-the-job training, and intermittency of experience, and their implications for the gender wage gap. How far human capital theory is able to explain the gender wage gap also depends on the situation of men and women in a particular country, as there are cross-country differences in women's labour market participation, the nature of work, and their preferences for subjects of study. Consequently the relevance of

human capital theory in explaining the gender wage gap may also be expected to differ from country to country.

1.3. Theories of discrimination

Arguably one of the most important causes of the gender wage gap in terms of equality of opportunity is discrimination; unlike differences due to individual or household decisions in areas like the stock of human capital accumulated, pay discrimination by employers has direct legal ramifications in most developed countries and in fact constitutes a violation of human rights (United Nations 1948). A lot of theoretical and empirical effort has therefore been dedicated to attempting to explain the nature and consequences of discrimination, demonstrating its existence in the labour market, and assessing the extent to which the gender pay gap might be due to discrimination. The two major theoretical approaches to the nature of discrimination and the empirical strategies for estimating it are discussed below.

Before theories of discrimination can be discussed, it is worth noting that there are different definitions of discrimination, as there are legal definitions that may vary between different jurisdictions, and definitions in academic literature that may differ from legal definitions. For example, the ILO Convention No. 111 defines discrimination as "any distinction, exclusion or preference made on the basis of race, colour, sex, religion, political opinion, national extraction or social origin, which has the effect of nullifying or impairing equality of opportunity or treatment in employment or occupation" (ILO 1958). Becker (1957), on the other hand, defines discrimination as follows:

"If an individual has a "taste for discrimination," he must act *as if* he were willing to pay something, either directly or in the form of a reduced income, to be associated with some persons instead of others. When actual discrimination occurs, he must, in fact, either pay or forfeit income for this privilege. This simple way of looking at the matter gets at the essence of prejudice and discrimination." (Becker 1957).

This definition of discrimination is narrower, being explicitly expressed in terms of preferences, in accordance with Becker's theory (discussed below). Other economists have used broader definitions, such as Figart (1997) who proposes that "Labor market discrimination is a multidimensional interaction of economic, social, political, and cultural forces in both the workplace and the family, resulting in differential outcomes involving pay, employment, and status". Often, particularly in empirical studies, discrimination is not explicitly defined at all; however, it is probably fair to say that what is usually sought in estimates of discrimination is the unequal treatment of workers or job seekers who have equal productivity or productive potential, leading to differences in labour market outcomes such as pay. This is the approach to demarcating discrimination followed in this chapter. While Figart's definition of discrimination would also include gender attitudes in society, these are discussed separ-

ately from discrimination in this chapter, although of course such attitudes can be thought of as discriminatory societal phenomena.

1.3.1. Taste-based discrimination

Becker (1957) proposed an explanation for labour market discrimination that is based on "tastes", i.e. disutility for an employer, co-worker or customer arising from interacting with a member of a certain group of population, defined by gender, race, ethnicity or some other parameter. This disutility enters as a separate term in the utility function for employers, which, assuming women are the minority group, then becomes

$$U(\pi, M, F) = P \cdot Y(M, F) - w_M M - w_F F - d \cdot F \tag{6}$$

where d is the discrimination coefficient describing the extent of the utility loss due to undesirable interactions, P is the price of output, Y is the production function, M and F are the numbers of male and female employees respectively, w_M is the market wage of males, and w_F is the wage of females. Short-run utility maximisation implies that the wages of men and women are respectively

$$\begin{aligned} pY'(M) &= w_M \\ pY'(F) - d &= w_F \end{aligned} \tag{7}$$

If d is large enough that the demand for female employees is less than demand for male employees at $w_M = w_F$, a wage differential would arise between men and women (Altonji and Blank, 1999). Thus the greater the number of prejudiced employers and the greater their disutility (d) from employing women, the larger the pay gap would be.

An important implication of this model is that profits would be lower for discriminating employers, since non-prejudiced employers would be able to operate at lower cost by hiring more women at a lower rate. Assuming free entry or constant returns to scale, this would in time lead to an increase in the number or size of non-prejudiced employers to the point that the impact of prejudiced employers on women's wages, and hence also on the pay differential, would disappear.

Becker also presents similar taste-based mechanisms in which wage differentials arise from prejudice on the part of co-workers or customers. Altonji and Blank (1999) review a number of models in which search is costly, i.e. in which information about the types of agents, their degree of prejudice, or the location of vacancies, employees or customers is imperfect. In the presence of search, models of taste-based discrimination have a number of additional implications, such as the importance of the entire distribution of prejudiced tastes, not just marginal employers; the presence of discrimination even if workers belonging to the minority group are few compared to non-discriminating customers; and

the low likelihood of discrimination being eliminated by the entry of new non-prejudiced firms (Altonji and Blank 1999).

1.3.2. Statistical discrimination

Another theoretical treatment of discrimination is based not on tastes but on employers' incomplete information on the productivity of job seekers or employees. It may be difficult, costly or even impossible to find out what the actual level of productivity, or even a correlate of productivity such as skills, effort or job attachment, of a potential or actual employee is. However, the employer may have more information from direct experience or some other source about a particular group of employees such as female employees. Since the employer has no information on the individual, an estimate is made of the individual's expected productivity based on the average productivity of the group the employee fits into, and decisions about employment or remuneration are then based on that estimate or proxy. The theory thus does not presuppose any prejudice against or disutility from association with members of the group discriminated against, and explains how discrimination can result from uncertainty about personal characteristics. Employers, in this theory, are alike in their utility functions and maximise profits in the same way.

Phelps (1972) was the first to formulate a version of the statistical discrimination hypothesis. In his model, there are real, exogenous differences (or, alternatively, differences in the informativeness of the signal of productivity) between the productivities of different groups of people, uncertainty about individual productivities, and rational employers who, in the absence of better information, assume that individuals belonging to groups with lower average productivity are less productive. With statistical discrimination by gender, such an assumption may be related to the different child bearing and rearing behaviour of men and women: if, for example, it is the case in a particular country that women are more likely than men to remain away from the labour market for extended periods of time, and more likely to work part-time afterward, these considerations may be taken into account in hiring, pay, and training decisions, even though the particular individual in question may make decisions that are not typical for her group.

Lundberg and Startz (1983) assumed that the groups differ in the information of the productivity signal, and also incorporated workers' pre-market human capital investment decisions in the model. They show that pay will be lower for the group with the noisier signal even if their human capital investment is equal to that of the other group. This leads the group with the noisier signal to invest less in human capital. This prediction is interesting in light of women's increased investment in educational human capital, which indeed exceeds that of men in the Estonian case.

The version of the theory formulated by Arrow (1973) differs from that of Phelps (1973) in that it does not assume exogenous differences in productivity

between the groups of workers. Rather, employers have various beliefs about differences in productivity, and these become self-fulfilling. For example, their beliefs about individuals' skills may be influenced by the actual distributions of skills in the different groups. If the share of skilled employees is very low in a certain group, this may lead the employers to believe that an individual from this group is low-skilled. This, in turn, leads members of this group to invest less in human capital, so it becomes a self-fulfilling prophecy. A similar mechanism is described by Coate and Loury (1993). Characteristic of these models with self-fulfilling prophecies is the existence of multiple equilibria: different beliefs about a group may lead to different eventual pay outcomes due to their impact on human capital investment.

There are a number of extensions to these basic models of statistical discrimination incorporating additional aspects and considerations. For example, a number of studies examine the implications of intergroup coordination (Moro and Norman 2004), search frictions (Mailath *et al* 2000), and more in the context of statistical discrimination. An extensive review of these models is given in Fang and Moro (2011).

1.3.3. Other theories of discrimination

Devaluation

Devaluation theory (Reskin 1988, England 1992, Reskin and Bielby 2005) originates in sociology. It is an attempt to explain the negative relationship between average pay in an occupation and its share of female workers, which has been documented in numerous empirical studies (e.g. England, 1992; Tomaskovic-Devey, 1993; Reid, 1998; England *et al*. 2007). Devaluation theory claims that lower pay in female-dominated occupations is ultimately due to women being culturally devalued in society, which implies that "female" tasks and occupations are less valued. This leads to wage disparities between male-dominated and female-dominated occupations with comparable productivities, as well as wage penalties for men working in occupations that are considered to be the domain of females and, accordingly, considered to have lower value. Occupational segregation by gender, in this theory, is rooted in the same cause as lower pay for women as it is driven by the need to demarcate "female" activities such as care or interpersonal services so that occupation would be the basis for wage discrimination appropriate to the perceived lower value of women's work.

The devaluation hypothesis is difficult to test empirically. The strategy that is typically employed is to test a particular prediction of the theory, the most common being the negative relationship between pay and female share in occupation. While this exercise is valuable in establishing empirical regularities, as a test of the theory it is not very specific and may not exclude other explanations. Other studies have investigated the relationship between the prestige of an occupation and the female share, while controlling for job charac-

teristics such as complexity (e.g. Treiman and Terrell 1975, England 1979, Bose and Rossi 1983, Oswald 2003). The results have been mixed, with some authors finding that female-dominated occupations have lower prestige and some not. It has also been found that differences in average wages between male-dominated and female-dominated occupations are not explained by differences in prestige (McLaughlin 1978). Likewise, Magnusson (2009) finds that occupational prestige is a non-linear function of the share of females in the occupation and that differences in prestige fail to explain a significant part of the relationship between wages and the sex composition of occupations. This contradicts the argument of the devaluation theory that the mechanism through which sex composition affects wages is the lower prestige of "female" jobs. Magnusson (2013) also uses Swedish registry data to test the prediction of the devaluation theory that wages are a monotonically decreasing function of the share of females in an occupation. Her findings contradict the prediction of the theory as both men and women benefit from moving from strongly male-dominated or female-dominated occupations to occupations with more even distribution of genders.

Pollution

Goldin (2013) proposes an explanation for gender segregation and wage discrimination that draws on the concept of "pollution". Pollution here refers to the negative signal about the skill level required in an occupation when a women enters the occupation. In her model, men working in an occupation derive utility from both wages and prestige, the latter being associated with the level of skill or some other characteristic such as education, strength or intelligence. The level of skill required in an occupation is known to those outside the occupation, but changes in that level, due for example to technological innovation, become known only gradually. The skill level of individuals is not known to the public, but medians of men's and women's skill distributions are. Men's and women's skill distributions may be the same, but in the beginning, only males work in the labour market, with women entering the market having previously been restricted to home production.

Within this setup, it may happen that a technological innovation lowers the level of skills required to work in an occupation, perhaps through computers simplifying the work of a bank teller, an occupation where the required level of skill is above the median of the population. This is not automatically observable to the public, and men in the occupation want to maintain their former level of occupational prestige. Should a woman enter the occupation, this sends a signal to the public that a person from the group with a lower median skill level than that required in the occupation can manage to do the tasks required. The public perception of the skill level requirement of the occupation is now revised lower, and accordingly, the prestige of the occupation for the men employed in the occupation is diminished. The employer must now compensate the men for their reduced prestige (as in Becker's taste-based discrimination model) or, alternatively, create an occupation for women with similar skill requirements but segregated from men. If a woman enters an occupation with a skill require-

ment that is below the population median however, the outcome is different and women and men will be integrated in the occupation. There will thus be integration in low-skilled occupations and segregation, or wage discrimination, in high-skilled occupations.

Goldin further explores the implications of men's and women's different skill distributions, and those of the shifts in women's skill distributions over time. If women's skill endowments increase, there will be more entry attempts at high-skilled jobs that were previously dominated by men. Since women's entry would imperil the prestige of incumbent workers in those jobs, it will be resisted, and again women will work in either newly created "female" occupations or as overqualified workers in jobs requiring lower levels of skill. An example given by Goldin is that if the highest-skilled "female" occupation available is that of teacher, then women with the ability to obtain the skill level required for teacher or above that level will all be teachers, rather than lawyers, headteachers or doctors. Wage regressions in such an economy will show "wage discrimination" because women are overqualified. There will also be feedback effects as women have no incentive to obtain higher levels of skills than those required in the occupations available to them.

Goldin's model thus relies on the asymmetry of information about actual skill levels and skill requirements in jobs. Outcomes such as segregation and wage discrimination result even without any differences in actual skill distributions between men and women being assumed. While information on true skills and skill requirements can be inferred by the public and updated over time, this process is gradual and can take time.

1.3.4. Empirical evidence on discrimination

There have been numerous studies that have attempted to assess empirically the extent of labour market discrimination and its impact on wages or employment. For obvious reasons, measuring discrimination is complicated: it cannot be measured in national statistical surveys; the perpetrators are disinclined to report it; subjective perceptions of discrimination may be inaccurate; and the number of court cases understates it since most cases of discrimination do not make it to court. Therefore, the extent of discrimination must of necessity be estimated by more indirect means. Most of these fall into two categories, the first being estimates obtained by regression methods, in which an estimated parameter, a combination of parameters, or a residual component in a decomposition exercise is interpreted as discrimination. The second group consists of various experimental methods, and in addition, there are other approaches such as those based on outcomes of legal cases. The two main approaches are discussed below.

Regression-based estimates

The first approach to estimating discrimination is based on the wage equation. Typically, this involves the estimation of the wage relationship in the form described by Mincer or similar to it:

$$w = \alpha + X\beta + \theta F + \varepsilon \tag{8}$$

where w is the natural logarithm of the wage, X is the vector of all the characteristics affecting the person's productivity, F is the gender dummy, and ε is the error term. If the wage relationship is correctly specified and all relevant determinants of productivity are included, then the coefficient of the gender dummy is interpreted as discrimination, all other interpretations having been excluded as they have been captured by other variables.

Another approach is the well-known Oaxaca-Blinder decomposition, which estimates separate regression equations for men and women and expresses the male-female average wage differential as

$$\bar{w}_m - \bar{w}_f = \left(\bar{X}_m - \bar{X}_f\right)'\hat{\beta}_f + \bar{X}_m'\left(\hat{\beta}_m - \hat{\beta}_f\right) \tag{9}$$

where $\bar{w}_m$ and $\bar{w}_f$ are average wages for men and women respectively; $\bar{X}_m$ and $\bar{X}_f$ are the means of productivity-related characteristics for men and women; and $\hat{\beta}_m$ and $\hat{\beta}_f$ are the regression estimates of the returns for those characteristics for men and women respectively. The first additive component in (9) is the "explained" component of the wage differential that is due to differences in the average characteristics of male and female workers, while the second component is the "unexplained" component, sometimes interpreted as discrimination. Since separate wage equations are estimated for males and females, the coefficients on any of the explanatory variables are not constrained to be equal as in the single-equation approach described above.

There are various analogues to these regressions and decompositions that use quantile regression, matching, or other approaches. An extensive overview of Oaxaca-Blinder and related decompositions, together with a discussion of their specific assumptions and respective strengths and weaknesses, is given in Fortin *et al* (2011).

There are a number of problems with interpreting the regression coefficients of gender dummies or unexplained wage gaps as discrimination. First, it is assumed that the equation (or separate equations in the Oaxaca-Blinder decomposition) is well specified. This means, first, that the assumed functional form is correct, that the relationship between wage and explanatory variables is adequately described by the functional form used, whether log-linear as is customary or otherwise, and that all relevant interactions between variables have been specified.

Second, the specification must include all the relevant variables, as otherwise, the estimates will suffer from omitted variable bias. Given the real-world data sources, it is often the case that it is hard to argue that all relevant

variables have been included in the equation. Important variables such as actual labour market experience, ability, skills and so on are often unavailable in data from statistical surveys, and potential experience constructed from age and education, or simply age, is often used instead. Other assumptions that may not hold in practice include the assumption of common support, but some combinations of characteristics that occur for males may not be found among females, and vice versa.

Third, the gender parameter estimate or unexplained component will not include the effects of discrimination that are manifest through other explanatory variables. For example, if there is wage discrimination in the labour market, returns to investment in human capital are lower for women, who therefore might choose to invest less in work experience. Their lower wages would then be "explained", in part, by their lower stock of accumulated human capital, without identifying this as the part of the effect of labour market discrimination.

Even though there are significant problems in interpreting gender coefficients or unexplained gaps from regression-based estimates as discrimination, they nevertheless offer an insight into the extent and nature of gender wage disparities in the labour market. Their advantage is that they are typically estimated from data representative of the labour market as a whole or a significant part, as opposed to being restricted to single cases, companies or narrow industries as tends to be the case with experimental methods.

Field experiments

The second approach used for detecting discrimination relies on experimental methods. Experiments provide a way of overcoming some important limitations of observational studies. The experimental setting aims to ensure that all other factors in the form of both personal characteristics and the hiring or wage setting situation are controlled, and the only variation occurs in the subject's sex. The experimental design allows for more certainty in identifying discriminatory practices, providing more direct evidence for discrimination.

A survey by Riach and Rich (2002) traces the use of field experiments for detecting economic discrimination as far as Daniel (1968) and, for written tests, Jowell and Prescott-Clarke (1970). However, interest in experimental approaches started to intensify only in the 1980s and 1990s. Experimental studies have focused on discrimination in both labour and product markets, such as the housing market, and on discrimination not only by gender, but also by age, race, ethnicity, disability, etc. Riach and Rich (*ibid.*) reviewed fifty experimental studies, which included five studies on sex discrimination. A recent meta-analysis of field experiments conducted since 2000 (Rich 2014) reviews sixty-seven field experiments, of which four focused explicitly on gender. Among studies focusing on the labour market, there are also differences in whether discrimination in employment or in wage offers is studied, though studies focusing on wages are less common, presumably because wages are more difficult to study in an experimental setting than job interview call-back rates are.

Rich (2014) distinguishes three main types of field experiment used to detect discrimination. The first is audits or in-person tests, in which trained testers of either sex apply for jobs in person. Testers are matched as much as possible by characteristics that could be related to productivity, such as education, work experience, training and so on, and also on other characteristics such as beauty or body weight in order to eliminate other possible grounds for discrimination. Since the only difference between matched pairs of testers is gender, the differences in the outcomes are interpreted as discrimination. A second variation of this approach is tests conducted over the telephone instead of in person, again by job applicants who have been matched so as to differ only by gender. The third method is correspondence or written tests, in which comparable pairs of résumés by applicants of either gender are constructed and used to apply to open positions at companies.

In Estonia, correspondence studies have been conducted to test for ethnic discrimination (Lõgina 2013, Uudmäe 2012) but not for discrimination by gender.

As mentioned above, a number of experimental studies have demonstrated the presence of discrimination in employment. However, it is much easier to focus on hiring – an intermediate stage in the market process – than on its eventual outcome, which would estimate the extent to which wage differentials are due to discrimination (Guryan, Charles 2013).

Even though experimental studies are able to demonstrate the presence of discrimination in a market more convincingly than observational studies, here too it is rare that experiments try to identify the nature of discrimination so as to distinguish between competing theories of discrimination. An example is List (2004), who focuses on sports card dealers from majority and minority groups, the minorities in this case being white women and older white men. He finds that initial offers from buyers in the minority group were 10–13% higher than those of the majority, while offers to minority sellers were 30% lower. However, over time, as experience increases, the gaps between minority and majority groups converge, which is consistent with statistical rather than taste based discrimination. List ran a number of additional experiments on card dealers in order to distinguish between the two types of discrimination, and these further supported the statistical discrimination hypothesis. This study is a good example of how it is possible to design an experiment carefully so as to provide more information about the nature of discrimination and to test competing hypotheses about it. However, the present author is unaware of comparable experimental studies in real world labour market settings focused on gender discrimination.

Experimental studies have their limitations as well. They are typically limited to a specific economic activity, such as restaurants or the service sector, and moreover, correspondence studies are commonly restricted to low or medium skill jobs, since high-skilled jobs typically require proof of identity or qualifications (Rich 2014). Although the focus needs to be kept narrow in order to ensure the homogeneity of the experiment design across potential employers, this limits how far the results can be generalised to the labour market as a

whole. However, this limitation is not necessarily inherent to the method but also reflects the limited scale of experimental studies: compared to the nationally funded large surveys used in observational studies, the collection of experimental data has much more limited funding.

Another criticism, voiced by Heckman and Siegelman (1993), is that despite all efforts, it is in fact impossible to achieve the aim of perfectly matching the pairs of testers on all relevant characteristics, since there are sources of unobserved ability, like the ability to make a good first impression (Darity and Mason 1998). This risk is somewhat lower for correspondence studies than in-person studies, although it is still possible that résumés that are constructed so as to be completely equivalent in all aspects may still be perceived differently by the employer, if, say, the candidates attended different schools and the employer has some information or opinion about the quality of those schools.

1.3.5. Summary

Various convincing theories about the nature and effects of gender discrimination in the labour market have been proposed in the literature. However, determining the nature and extent of discrimination empirically is a very challenging task. The common approach to estimating discrimination as the unexplained component in a regression-based decomposition sets a high bar on the estimation of the parameters of the wage regressions; in order to be meaningfully interpretable as discrimination, the regressions have to include all the relevant variables in sufficient detail, which they usually can not. Experimental setups produce more credible estimates of discrimination, but are usually limited to small segments of the labour market, and are easier to apply to discrimination in hiring than in wage setting. To extend experimental methods to the study of gender pay discrimination specifically is thus an important task for future research.

Although the focus has been on gender discrimination in this subsection, workers can be discriminated against on multiple grounds simultaneously (multiple discrimination). Thus, there may be groups in the labour market that are in a particularly adverse situation due to consumers' or employers' tastes or beliefs about their average productivity.

1.4. Differences in non-cognitive characteristics

As can be seen from previous subsections, earlier explanations of gender differences in the labour market within the field of economics focused on human capital, explaining how the paths for accumulating education and experience, and therefore productivity, may differ for men and women. Ultimately, these differences originate from initial innate differences that lead to differential relative comparative advantages in either home or market production. However, as the human capital theory shows, these innate comparative

advantages, such as those related to specific biological functions like lactation, need not be large in order for their effects to snowball into large differences in labour market outcomes. For the predictions of the human capital theory to hold, it is thus not necessary to make strong assumptions about fundamental differences in men's and women's overall ability or specific psychological traits, since the outcomes can mostly be explained through economic processes. Claims about gender differences in psychological traits would have to be substantiated in fields other than economics, and hard evidence of such differences was not in abundance in the early days of labour economics.

As experimental evidence for gender differences in various non-cognitive psychological traits has accumulated in recent decades however, more explanations for the differences in labour market outcomes based on differences in these traits have been proposed within economics. The present section presents some of the most important directions taken in this literature. Since a good and extensive overview of a number of the topics treated here is given by Bertrand (2011), this section will be brief in order to avoid duplication.

Individual psychological traits such as risk aversion and attitudes toward competition and negotiation, as well as socio-psychological factors such as gender identity, will be discussed. Since most of the studies discussed below primarily concern empirical evidence, the theoretical and empirical contributions are not presented separately.

1.4.1. Risk aversion

Risk aversion is a potentially very important factor shaping decisions in the labour market. How averse to risk a person is could, for example, affect their choice of occupation and, related to that, their choices for education; their human capital investment decision if there is uncertainty about returns; the reservation wage below which they would not consider employment; the wage they ask for in wage negotiations; and so on. Thus, if risk aversion is different for men and women, it opens up multiple possible channels through which workers of different genders could end up earning different wages. This is not because a greater preference for risk guarantees higher expected rewards in the labour market, but because risks in the labour market concern not only pay but also employment. It may well be that the expected value of income is identical for, say, a person with a lower reservation wage and higher chances of employment and a person with a high reservation wage and lower chances of employment. Nevertheless, the second person would be observed in the wage statistics only if the outcome of their gamble turned out to be favourable, and thus on average the observed pay of the less risk-averse workers would be expected to be higher, ceteris paribus.

Croson and Gneezy (2009) review some of the literature, looking at 10 studies that attempt to answer the question of whether men and women differ in their degree of aversion to risk. They discuss experimental evidence from

objective probability lotteries with known probabilities and monetary outcomes, as well as portfolio selection settings which allow risk aversion to be compared in high-stake settings such as defined contribution plan asset allocation decisions. The results of the studies they review, both experimental studies and those based on real-world settings, indicate that in general, women are more risk averse than men. There are some interesting nuances to this conclusion: the findings of Finucane *et al* (2000) confirm this for whites, but not for other ethnic groups; and Schubert *et al* (1999) find that men are more risk averse than women when the outcomes of lotteries are framed not as gains but as losses. The latter finding is also confirmed by Moore and Eckel (2003).

Croson and Gneezy (*ibid.*) also review explanations proposed for the differences in risk taking. The first explanation is based on emotions. In this framework, the individual's course of action depends more on their affective reaction to a risky situation than on a calculated, rational response. Gender differences in risk aversion, then, may be rooted in differences in men's and women's emotional responses to situations involving risk. It has been found that women have more intense fear and nervousness when faced with a negative outcome (Brody 1993). However, this seems to be inconsistent with the experimental evidence cited above that has found men to be more risk averse than women when the experiment is framed in the domain of loss. It has also been found that in the same situation, men may be more likely to feel anger while women are more likely to feel fear (Grossman and Wood 1993). Anger and fear may influence the individual's perceptions of probability, with anger being associated with more optimistic and fear with more pessimistic perceptions (Lerner *et al*, 2003). Another reason why risk aversion may differ between men and women is confidence: a number of results from literature indicate that men are more overconfident than women (see Croson and Gneezy 2008 for references). The third explanation reviewed by Croson and Gneezy (*ibid.*) draws on differences in the interpretation of risky situations: men interpret such situations as challenges necessitating participation while women see them as chances to withdraw (Arch 1993).

Another review of experimental evidence from 16 studies on gender differences in risk aversion was carried out by Eckel and Grossman (2008). Like Croson and Gneezy (2009), they conclude that evidence from field studies indicates that women are more risk averse than men whereas laboratory evidence, while supporting the overall conclusion from field studies, is more mixed. They also caution against overconfidence in the results on the grounds that the studies typically do not control for wealth, knowledge and demographic factors that might affect the results.

Charness and Gneezy (2012) assemble data from 15 experiments which were all based on the same type of investment game introduced by Gneezy and Potters (1997). In this game, a participant receives an amount of money and is presented with the option of investing some of it in a risky bet that returns either a multiple of the investment or nothing. The only decision made by the participant is to choose the amount that is invested. The authors report a clear and

consistent result that women are more risk averse than men. However, these results are considered inconclusive by Filippin and Crosetto (2014), who aggregate data from studies based on a different task proposed by Holt and Laury (2002). This task involves making choices between ten different pairs of lotteries, with each pair including a lower risk and a higher risk lottery. Holt and Laury's original study found a small difference in risk aversion between men and women, with women being more averse, but no difference in the case of high-payoff lotteries. Gathering data from 54 studies, Filippin and Crosetto (*ibid.*) find that a statistically significant difference in risk aversion exists but its magnitude is such that it is economically unimportant.

Although the results from experimental literature indicate that women are more risk averse, it would be wrong to conclude that this applies to any and all groups of the population. For example, Atkinson *et al* (2003) and Johnson and Powell (1994) compare men and women among managerial groups of workers and find no significant differences in risk attitudes (Croson and Gneezy 2008). A probable reason is that selection into these groups tends to equalise men and women in terms of their risk attitudes.

Furthermore, it should be kept in mind that even if differences in risk aversion are commonly found in experimental studies, it does not necessarily follow that such differences are innate. It is also possible that nurture plays a critical role in the differential development of risk attitudes of men and women, or that the "nature" and "nurture" factors interact.

Some authors have emphasised the biological origin of differences in risk aversion, and Apicella *et al* (2008) find that testosterone levels influence risk taking in an investment game setup. Other authors have examined the role of nurture by comparing gender differences in risk attitudes in different societies. Gneezy *et al* (2009) carried out experiments in two very different societies: the matrilineal Khasi tribe in India and the patriarchal tribe of the Maasai in Tanzania. They assigned the participants the standard investment task introduced by Gneezy and Potters (1997). In this setup, the participant is given a sum of money and chooses how much of this money to invest in a bet that returns three times the bet with a probability of 50% and nothing otherwise. Interestingly, they found no gender differences in risk aversion in either society, perhaps lending support to the suggestion of Finucane *et al* (2000) that such differences may be specific to some ethnic groups, specifically whites, but not others. Cárdenas *et al* (2012) compare risk aversion in children aged 9–12 in Colombia and Sweden and find that in both countries boys are more ready to take risks than girls, but that the gap is smaller in Sweden. Gong and Yang (2012) compare risk aversion in two neighbouring ethnic groups in China, the patrilineal Yi and the matrilineal Mosuo, again using the standard investment risk of Gneezy and Potters (1997). In contrast to the results Gneezy *et al*. (2009) found with the Khasi and Maasai tribes, they find that women in both of these groups are more risk averse than men but that the difference is lower in the case of the Mosuo. The authors hypothesise that because the Mosuo have larger families, they have more reliable life security nets that allow them to take on

more risk. Using regression models, they confirm that socio-economic variables affect risk aversion, lending support to the strong role of nurture.

Booth and Nolen (2012) try to address the nature vs nurture problem by comparing risk attitudes of girls in randomly assigned groups with different gender compositions, and in mixed-sex and single-sex schools. When the participants were asked to choose between a real-stakes lottery and a sure bet, those who were in single-sex groups or attended a single-sex school exhibited a higher preference for the riskier bet than those in mixed groups or schools. Indeed, girls in single-sex groups or schools were just as likely as boys to choose the riskier bet. The authors interpret the results as suggesting that risk attitudes are affected by social learning rather than innate traits.

In an interesting study, Meier-Pesti and Penz (2008) ask whether it is biological sex or people's affinity to "feminine" or "masculine" attributes that affects risk aversion. Their results show that if masculine attributes are held constant, the observed differences between men's and women's risk aversion decrease. They also find that among males, gender priming on masculine and feminine attributes, in order to elicit stereotype congruent behaviour, affects risk aversion. Distinguishing specifically between feminine and masculine attributes allowed them to conclude that it was not femininity that entailed risk aversion, but masculinity that supported risk taking. It also emphasises that the "female" group, even if on average more risk averse, is far from homogenous in its risk aversion, females with "masculine" attributes being similar to men in that regard. The authors also point to generational differences among women, as younger women tend to have more masculine attributes and are more similar to men in risk taking.

Le *et al* (2011) examine men's and women's attitudes toward economic risk using the Australian Twin Study, a survey in which the measure of risk used was a self-assessment on a scale from 1 to 10 of how much risk the respondent is willing to tolerate when investing their money. Their results confirm that women are more risk averse than men, that risk aversion is moderately heritable, and that its heritability does not differ between men and women. They estimate that gender differences in risk aversion could account for 3 percentage points of the 24% overall gender wage gap.

Ertac and Gurdal (2012) experimentally explore situations in which the individual makes risky decisions on behalf of the group. Using the risk allocation task of Gneezy and Potters (1997), in which a single individual's decision determines each group member's payoff, they find that women are much less likely to express a preference for having their decisions implemented as the group decision and so taking the role of "leader", and, once they have accepted the role of the group leader, they take less risk than male leaders.

1.4.2. Competition

A number of recent studies have examined whether there are differences between men and women in their competitive preferences or behaviour. There are various ways in which an individual's response to competitive situations may affect eventual outcomes; first, a person with little inclination to engage in competitive behaviour may seek to avoid such situations. In the context of the labour market, this may mean people show a preference for more or less competitive occupations or work environments depending on their other inclinations (see e.g. Kleinjans' 2009 study discussed below). Second, there may be differences in the performance of individuals once actually in a competitive situation, as the situation may enhance performance for some individuals, but have the opposite effect for others (Croson and Gneezy 2009).

Croson and Gneezy (2009) review a number of studies comparing men's and women's competitiveness, and reach the overall finding that men are more inclined than women to engage in competitive behaviours, and that men's performance relative to women's is improved in competitive situations. This was first demonstrated by Gneezy *et al* (2003), where participants were instructed to solve mazes on a computer for either a piece rate compensation or on a competitive basis. The researchers found that men, but not women, increased their effort in reaction to competition. However, women reacted to competition in single-sex groups but not in mixed groups. Gneezy and Rustichini (2004) gave the participants, who were children in a physical education class, the task of running a short distance, with the teacher measuring their speed. When they ran alone, there was no speed difference in boys or girls, but in the presence of competition, boys' speeds increased while girls' speeds decreased.

Cárdenas *et al* (2012) compare competitive behaviour in Colombia and Sweden, assigning children aged 9–12 both the physical tasks of running and skipping with a rope, and the mental tasks of maths and word searches. The tasks were solved in two stages, individually in the first stage and in competition with another child who was matched from their performance in stage one in the second. In both countries, both boys and girls increased their performance in physical tasks in response to competition. With the mental tasks, it was found that boys in Sweden are more likely to choose competition than girls in both maths and word searches, while there were also indications that girls increase their performance more than boys in maths and skipping with a rope in response to competition. The authors conclude that the results do not support the idea that country differences in overall gender equality in society lead to a gender gap in competitiveness.

Niederle and Vesterlund (2007) examined preferences for competitive situations and found that even in tasks where there is no gender difference in performance with either piece-rate or competitive compensation, women still prefer piece-rate pay more than men do. Furthermore, they show that the preferences for non-competitive or competitive situations result in both men and

women making sub-optimal decisions: high-ability women choose piece-rate pay that is lower than what they would receive in competitive situations while men choose competition even when their expected pay would be higher in the piece-rate situation.

As with risk aversion, there are both nature-based and nurture-based explanations for why gender differences in competitiveness exist. Buser (2011) gave female participants a choice of whether to solve arithmetical tasks under a piece-rate or competitive compensation scheme. He found that the self-selection into the competitive situation varies strongly over the menstrual cycle and is also related to hormonal contraceptive use. His evidence indicates that this is not due to either risk aversion or overconfidence. In a study of men, Apicella *et al* (2011) find no relationship between testosterone and selection into competitive situations.

Kamas and Preston (2012) investigate whether women's reluctance to enter competitive situations is due more to actual preferences for competition or derives from differences in confidence. They find that the most important pathway leading women to shun competition is their expected ranking, a measure of confidence. Distinguishing subjects by fields of study, they find that there are no gender differences in competition in the STEM (science, technology, engineering and mathematics) subjects and that in social sciences and humanities gender differences in competition can be explained by differences in confidence. Among business school students however, they find differences in preference for competition that are not explained by differences in confidence, even though both men and women self-selecting into this field have the highest levels of competitiveness.

Kleinjans (2009) examines whether women's relative distaste for competition can explain their career choices. Using a self-reported preference for competition from survey data and combining it with Danish administrative data, she finds that competitiveness can explain some of the occupational choice differences between men and women. Women's distaste for competition appears to be related to both the level of educational attainment required for the occupation they expect to have at age 30, and the industry or sector that that occupation is in.

Wieland and Sarin (2012) examine the hypothesis that sex differences in competitiveness may be domain specific. This means that people may be more inclined to compete in domains which are familiar to them and less in others. If people's knowledge about different domains differs by sex, perhaps because of societal gender roles, this could lead to differences in competitiveness in a given domain. The study used the four domains of maths, verbal, fashion and crafts. Using self-perceived competency in these domains as a measure of domain familiarity, the authors find that that familiarity does indeed help to predict the decision to compete.

Wozniak (2012) studies gender differences in competitiveness through tournament entry decisions by professional tennis players. Specifically, he looks at "feedback effects", which are the effects of past performance in previous

tournaments on the decision to enter the next tournament. He finds that male and female players respond to feedback differently; good performance in the last tournament predicts the decision to enter the next tournament for both men and women, but for men the effect extends well past the immediately following tournament and on to future tournaments.

Flory *et al* (2014) carry out a large natural field experiment to examine whether a competitive compensation regime can cause sex differences in job entry. They randomise 6,779 job seekers in 16 US cities into different compensation regimes for the same jobs, offering fixed wage compensation that is mildly or strongly dependent on individual relative performance or team relative performance, or contains uncertain elements, and they look at whether the job seeker decides to apply formally for the position. They find that the aversion to competitive environments is stronger among men than among women.

Bönte and Jarosch (2011) investigate whether differences in men's and women's personality traits help explain gender differences in entrepreneurship. Using data from a survey carried out in 36 countries, they identify a group of traits which they term "Individual Entrepreneurial Aptitude", the levels of which are lower for women than for men, contributing to differences in entrepreneurship. They also find that women's lower level of this aptitude is chiefly due to their lower competitiveness and risk taking.

Buser *et al* (2014) examine whether measures of competitiveness obtained from lab experiments are predictive of the real-life choices of the academic track followed in secondary school. Using a sample of students in the Netherlands, they find that even at similar levels of academic ability, male students are more likely to choose the academic track and that male students are much more competitive than girls. They show that competitiveness is related to the choice of academic track even after controlling for academic ability and accounts for about 20% of gender differences in the academic choice.

1.4.3. Gender identity

A number of recent studies have focused on explaining gender differences in the labour market using the concept of gender identity. Originating from sociology, this concept has only been used in economics literature fairly recently. The concept of gender identity departs from the person-centred, individual preferences or characteristics usually employed in economic theory, and is rather connected to the *social* categories in which people think of themselves and other individuals, such as, at a very basic level, the categories of "man" and "woman". These categories are not merely taxonomic but involve *prescriptions* that indicate the ideal or expected individual characteristics or behaviour. Akerlof and Kranton (2000, 2002), who were among the earliest to use the concept of identity in economics, integrated it into economic theory via the individual's utility. Although in economic theory, utility is commonly treated simplistically as depending explicitly only on individual consumption, wealth,

income or other economic variables, there is in principle no reason why it could not explicitly depend also on more social phenomena. Thus, in Akerlof and Kranton's (2000, 2002) treatment, the way the individual's utility depends on identity is through the high or low status of the social category the individual belongs to, and through the individual's conformance to the prescriptions and ideals of that social category. More broadly, such categories could, of course, include social class, ethnicity, racial origin, subculture, and so on, but the present overview is concerned with identity as it relates to gender.

If conforming to the prescriptions of the social role of a "man" or "woman" affects the individual's utility, the consequences for the individual's labour market outcomes can be wide-ranging. Considerations of which choices are seen as socially appropriate for one gender or the other may influence decisions on education, subject choice, labour force participation, occupational choice, career expectations, work-family balance, and so on; all of these, in turn, may affect wages and thus the gender wage gap.

Fortin (2005) investigates the relationship of gender roles to women's participation, using data from 25 OECD countries. She examines gender role attitudes to household and market work, religious attitudes, and attitudes to the role of motherhood, and finds them strongly related to labour market outcomes such as participation, part-time work, and pay. Looking at data for ten years, she finds that some more traditional attitudes are on the decline.

Judge and Livingston (2008) examine relationships between attitudes toward men's and women's roles with regard to household and market work, and pay. Using longitudinal data from the National Longitudinal Survey of Youth (NLSY), they find that traditional gender role orientation was positively related to earnings for men, but slightly negatively for women. The authors conclude that even though traditional gender role attitudes are declining, they nevertheless continue to contribute to the gender wage gap.

Another recent example of findings that relate gender identity considerations directly to wages is the study of Bertrand *et al* (2013). The authors look at the distribution of income within the household and find that the share of income received by the wife is distributed with a sharp cutoff at 0.5, indicating a strong preference for marriage matches in which the woman does not earn more than the man. For couples in which the wife's potential earnings exceed those of the husband, the wife is more likely to stay at home or otherwise earn less than the husband. The existence of such preferences is also indicated by their finding that the couple is more likely to divorce if the wife's earnings exceed the husband's. They also find that if the wife's earnings are higher than the husband's, her share in household work is higher. This is consistent with a gender identity based explanation described by Akerlof and Kranton (2000) that if the wife earns more than the husband, there is disutility for him from not fulfilling the traditional gender role expectations. In order to compensate for this, the woman takes on a greater share of the burden of household work so that this disutility does not put the marriage at risk.

Stickney and Konrad (2007) examine the relationship between gender-role attitudes and earnings using data from 28 countries. They find that women with more egalitarian attitudes earned significantly more than women with more traditional attitudes, and they also detected an interaction between hours worked and gender-role attitudes: among individuals with a higher number of hours worked, the positive relationship between egalitarian attitudes and pay was higher.

Kleinjans and Krassel (2014) investigate the relationship between occupational choice and gender differences in preferences for wages and occupational prestige. Using data from Denmark, they find that relative to men, women are more likely to prefer occupations that they consider more valuable to society. The authors estimate that this difference in preferences explains about half of the 8.4% per cent wage gap that is due to occupational segregation. They interpret the differences in occupational preferences as being consistent with the hypothesis that they originate from gender roles.

Farré and Vella (2013) investigate how the attitudes about women's roles are transmitted from one generation to the next. Using data from the NLSY (National Longitudinal Survey of Youth), they find a statistically significant relationship between a mother's attitudes to women's work and those held by her children. Moreover, there is an indication that attitudes inherited from the previous generation and held in youth have measurable labour market effects for the individual's household in adulthood; men's attitudes at age 15–22 are strongly associated with the labour supply of their wives 27 years later. Johnston *et al* (2014) confirm this from the British 1970 Cohort study, finding that mothers' gender role attitudes are strongly correlated with those of their children 25 years later. They also find that such attitudes are relevant for the labour market outcomes, affecting human capital accumulation and the labour supply. Regarding human capital accumulation, they find that non-traditional gender role attitudes among mothers are negatively related to school dropouts and positively to university degree attainment. Remarkably, they find that the sizes of the effect of gender role attitudes for educational attainment are in fact comparable to the effect sizes for cognitive ability. Findings from their study also confirm the hypothesis of Fernández *et al* (2004) that sons whose mothers had non-traditional attitudes to gender roles are more likely to be married to women who work full-time.

1.4.4. Summary

Numerous studies have established that there are differences between men's and women's non-cognitive traits such as risk aversion, competitiveness and attitudes to negotiation. Important work continues to be done on how such differences are formed in different conditions and environments, and how they vary between societies and various groups within societies. These differences may potentially lead to differences in labour market outcomes in terms of

participation, employment, occupational attainment, pay, etc. However, at the present stage, the extent of the real-world significance of these differences in the labour markets has not been sufficiently studied. Nevertheless, there is great potential for future research into non-cognitive characteristics in explaining labour market gender inequalities. The real-world implications of socio-psychological factors such as gender role attitudes have been studied more, and have been shown to have significant effects on labour market outcomes.

1.5. Empirical research on the gender wage gap in Estonia

There have been a number of empirical studies that are relevant for the study of the gender wage gap in Estonia. Some of them have explicitly focused on the gender wage gap as such, while others have touched on the issue of gender as part of research focusing on other topics, by estimating wage regressions with the gender variable included for example.

Among earlier studies that focused on the transition process, Noorkõiv *et al* (1998) study employment and wage dynamics in general during the period 1989–1995. Their wage regressions indicate that the gender coefficient decreased by 8 log points from 1989 to 1995, from 0.37 to 0.29.[3]

Orazem and Vodopivec (2000) study the same time period, showing that the wage differential decreased because the returns to human capital from education increased over that period, and women's human endowments were higher than men's. Using the Blau and Kahn (1992, 1994) decomposition, they suggest that the changes in women's wages may have been due to increases in women's unmeasured skills relative to men's, or to demand shifts that favoured female-dominated sectors.

Philips (2001) studied changes in the valuation of human capital in Estonia during the transition process over the years 1989–1998. She finds that in 1989, the ratio of the female average wage to the male average wage was 60%. In the course of the transition process, job losses occurred for men and women at similar rates but men had a higher probability of regaining employment and achieved higher wage gains from changing jobs than women did. The transition process also increased significantly the returns to education, which were higher for women than for men. The adjusted gender wage gap (the estimated coefficient of the gender variable in Mincer regressions) declined from 0.443 log points in 1989 but remained high, ranging between 0.267 and 0.34 from 1992 to 1998 (*ibid.*).

Kroncke and Smith (2002) study the period from 1989 to 1994, using Cotton's (1988) method of decomposing the gender wage gap into the explained gap, unexplained male advantage, and unexplained female disadvantage. They

[3] In this subsection, the minus sign is omitted when discussing estimates of the gender parameter when the indicator variable for the female worker is used in regressions (thus, when a decrease in the coefficient is mentioned, a decrease in the absolute value of the coefficient is meant).

find that in 1989, the explained male-female wage gap, the male advantage, and the female disadvantage were each around 0.14 log points. In other words, about a third of the gender wage gap was explained. The inclusion of the occupational variables contributed most of the explanatory power. In 1994, the explained gap was less than 0.01 log points, the male advantage was 0.16 and female disadvantage 0.15 log points. In contrast to most recent studies, they find that in 1994, the inclusion of occupation variables in the model did not significantly influence the results.

Rõõm and Kallaste (2004) study the years 1998–2000. Using data from the Estonian Labour Force Survey and the Oaxaca-Blinder decomposition, they find that approximately one-third or 8–9 percentage points of the 27.3% gender wage gap can be explained by differences in various personal and job characteristics. Among the explanatory variables, they also include the share of women in the industry-occupation cell where the person is employed, and they find the coefficient for this to be large, negative and statistically significant for women but not for men. This confirms the importance of segregation for wage differentials, indicating heavy penalties for working in feminised occupations.

Anspal, Kraut and Rõõm (2010) studied the Labour Force Survey data for 2000–2008, estimating Mincer-style wage regressions, quantile regressions and the Oaxaca-Blinder decomposition. They were able to explain only about 10–15% of the overall gender wage gap. They noted several limitations of the LFS data as the occupation and industry data are insufficiently detailed and there is a lack of data on work experience, and they hypothesise that these limitations may be behind the large unexplained gap. Even at the less detailed level of measurement, the occupation variable contributed most to explaining the gender wage gap. The authors also considered whether the increase in the gender wage gap during the boom years up to 2007 was due to the increase in the share of employment in the construction sector, but find that the increase also occurred in other industries.

Masso and Krillo (2011) examine the effects of the 2008–2009 recession on various worker groups in the labour markets of the Baltic states. They carry out the Oaxaca-Blinder decomposition for the periods 2005–2007, 2008, and 2009 and they show that the gender wage gap declined during the recession, falling from 0.31 in 2008 to 0.26 in 2009. Their decompositions indicate that the unexplained gap remained unchanged as the reduction in the overall gap was due to a decrease in the explained gap.

Seppo (2012) studies people in the labour market six to ten years after they finished general secondary education in 2006–2010. Using various school characteristics and parental benefits taken from administrative data as explanatory variables, he finds that the gender coefficient in log wage regressions is 0.18. He also finds significant differences in the average wages and the wage-experience profiles between women who have received parental benefits and those who have not.

Christofides *et al* (2013) carry out decompositions of the gender wage gap in 26 European countries, including Estonia. Using the EU-SILC dataset for the

year 2007 and the Oaxaca and Ransom (1994) decomposition, they find the explained gap to be 31% to 45% of the overall gap depending on the specification. Using the Melly (2005) quantile decomposition, they find that the unexplained gap is lowest at the 10th percentile at 0.22, and that it plateaus at a high level at the higher percentiles, from 0.31 at the 25th percentile to approaching 0.4 at the 50th percentile and above. They do not find evidence of either a "sticky floor" or a "glass ceiling" effect, defining the sticky floor as the wage gap at the 10th percentile being at least two percentage points higher than that at either the 25th or the 50th percentiles and the glass ceiling as the gap at the 90th percentile exceeding that at either the 75th or the 50th percentile by at least two percentage points.

Espenberg, Themas and Masso (2013) use data from the 2010 survey of alumni from 14 Estonian universities to study the gender wage gap for graduates. They find that on average, the unadjusted gap between male and female graduates' wages is about 25%, with large variation across study fields ranging from 0 in services to 40% in health and welfare. Using the Oaxaca-Blinder decomposition, they are able to explain 58% of the gender wage gap, with occupation as the most important factor explaining 50% of the gap. The share of the explained part of the gender wage gap is higher in their study than in other studies carried out on Estonia, suggesting that discrimination may be more important for less educated workers than for university graduates (*ibid.*).

Meriküll and Mõtsmees (2014) go beyond the usual Labour Force Survey data and use a dataset from the CV Keskus job search website. In addition to background variables on socio-demographic and human capital characteristics, this dataset contained data on job seekers' desired wage. Carrying out the Oaxaca-Ransom decomposition on both desired wages and actual wages from the Labour Force Survey, they find that the unexplained gaps in desired and actual wages are remarkably similar at 22–25%. Neither work experience nor occupational mobility was found to explain much of the gender gap in desired wages. They also find that women are more risk averse in their job search, with their choices in education, occupation and industry leading to much lower probabilities of unemployment.

The same two datasets are studied by Vassil, Eamets and Mõtsmees (2014) who use a different methodology and carry out additional robustness checks but arrive at a similar result, finding that the gender wage gap in desired and actual wages is extremely similar. The results of this study and Meriküll and Mõtsmees (2014) point to the intriguing possibility of non-cognitive differences such as risk aversion or overconfidence influencing the wages asked for, and ultimately received, by women in the labour market. However, as pointed out by Vassil, Eamets and Mõtsmees (2014), the question is whether women get lower wages because their asking wage is lower, or whether they ask for lower wages because they know their wage is going to be lower.

Halapuu (2015) uses a unique dataset, the OECD's Programme for the International Assessment of Adult Competencies (PIAAC) survey of adults, to examine how far the gender wage gap may be due to differences in information

processing skills such as literacy, numeracy, or problem-solving in technology-rich environments, which have been unmeasured in previous studies. Using the Oaxaca-Blinder decomposition, she finds that numeracy makes a small but statistically significant contribution to the explained part of the gender wage gap. Men's endowments of numeracy skills are higher than women's, but so are the returns to those skills. Numeracy thus also contributes to the unexplained part of the gap. Literacy, on the other hand, did not contribute to the explained gap. The problem-solving skills variable reduced the explained wage gap as women's endowments of this skill were higher than men's. In total, the explained part made up 30.2% of the gender wage gap.

To sum up, the gender wage gap in Estonia has been found to be large and for the most part unexplained. Earlier studies have attempted to explain it using human capital variables and job characteristics such as occupation and industry, while more recent studies have also considered other potential explanations such as information processing skills or the process of formation of desired wages. Since human capital endowment in terms of educational attainment is higher for women than for men in Estonia, differences in such endowments do not explain the gender wage gap. The large unexplained gap indicates a need to consider other explanations or to overcome the limitations imposed by the data used in previous studies.

1.6. Summary

As seen above, there are numerous explanations in the theoretical and empirical literature that have been proposed to explain the existence and extent of the gender wage gap. The three most common types of explanation have been grouped above into three groups: explanations based on human capital theory, explanations based on various theories of discrimination, and explanations based on differences in various non-cognitive characteristics between men and women.

These different explanations operate through multiple channels. As described above for example, the human capital theory predicts that small initial differences between men and women in comparative advantage in household versus market work lead first to specialisation through differences in the supply of market labour in the form of the woman staying at home, working part-time, or using a flexible working time arrangement; the choice of the amount of educational investment; the choice of school subject; decisions about career intermittency; and so on. Many of the same channels of school subject choice, occupational choice, and others are likewise invoked in explanations of the gender wage gap that are based on discrimination and differences in non-cognitive characteristics. It should be emphasised that these explanations are not mutually exclusive, so there is no reason why there could not simultaneously be taste-based discrimination by gender in wage setting and gender differences in risk aversion that affect the wage asked for in negotiations. Indeed, as was

mentioned above, there may be interactions between different explanations, as in the case of human capital investments and discrimination, where the lower expected return on education as a consequence of taste-based discrimination in society could lead to lower investment in education by the group discriminated against, and subsequently to lower average productivity and wages.

In Estonia, the preponderance of empirical evidence from previous studies indicates that the gender wage gap is high, and for the most part unexplained. Since women's level of educational attainment is higher than men's, differences in human capital are unable to explain much of the gender wage gap. A few recent studies have therefore turned to explanations other than human capital theory, such as non-cognitive differences, for clues as to why the unexplained gap is so large. Past studies have also pointed out limitations in the datasets used in decompositions of the gender wage gap.

The following chapters continue with an empirical analysis of the gender wage gap in Estonia, referring to the various theoretical relationships covered above in the discussion.

2. THE GENDER WAGE GAP IN ESTONIA: LABOUR MARKET CONTEXT AND RECENT TRENDS

2.1. Introduction

This chapter gives an overview of the situation of men and women in the Estonian labour market in order to describe the labour market context as background and motivation for the empirical studies that form the core of this dissertation. The choice of background indicators is motivated by previous studies and is also constrained by available data. The figures presented in this chapter are mostly based on the Estonian Labour Force Survey so as to illustrate some of the shortcomings of this dataset, as it is the dataset that has been used most in previous studies of the gender wage gap in Estonia. Since the focus of this study is not on cross-country comparisons, comparative international data are not presented or analysed in detail. This also means that labour market institutions, which vary from country to country and may be a source of cross-country differences, will not be considered.

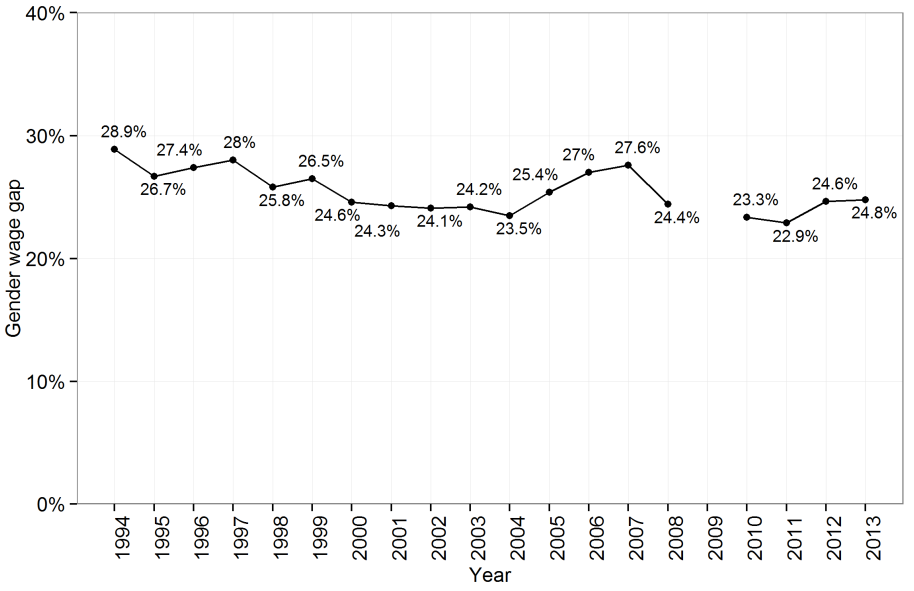

Figure 3. Gender wage gap (as percentage of male average wage), 1994–2008 and 2010–2013.

Source: Statistics Estonia.

First a descriptive overview is given in subsection 2.2, focusing on some of the key labour market indicators such as participation, employment and wages, comparing them by sex and looking at developments over the past decade. Next, some standard decompositions are carried out in subsection 2.3 in order to see how far differences in men's and women's personal and job characteristics help explain the observed differential between men's and women's wages. The decompositions include both decompositions of mean wages and decompositions of the gender wage gap at various quantiles across the wage distribution. As in the descriptive overview, the focus is on trends during the past decade, using decomposition methods to analyse changes in the gender wage gap that have occurred over the business cycle. The chapter concludes by looking at the issues that remain after the application of standard decomposition techniques and commonly used datasets, some of which will be addressed in the studies that constitute Chapter 3 of this dissertation.

2.2. Descriptive statistics: wages, participation, and employment

Figure 3 presents the time series of the unadjusted gender wage gap, defined as the difference between male and female wage earners' pay as a percentage of male average pay.[4] As can be seen, the unadjusted gender wage gap has persisted at a high level since the middle of the 1990s, remaining above 20% throughout this period. Although the time series seems to have exhibited a downward trend from 1994 to 2004, the gender wage gap started to grow quickly again during the economic boom years of 2005–2007, after which it fell during the recession, and then rose again during the recovery from the recession. The gender wage gap thus exhibits strong cyclicality, some properties of which will be explored further in the decomposition exercises presented below in this chapter. This cyclicality also makes it difficult to draw any conclusions about whether there is a longer-term downward trend in the gender wage gap to any degree or not.

As in other countries, women's labour market participation is lower in Estonia than men's, and the difference between the percentages of working age men and women in employment or seeking work was nearly 10 percentage points in 2014 (see **Figure 4**). Over the past decade, the participation rate for women has increased considerably, reaching 63.4% by 2014, which exceeds the corresponding figure for 2005 by 4.4 percentage points, which is a statistically significant difference. However, as the participation rate for men has also increased over the same period, the difference between men's and women's participation rates has not decreased despite a temporary decline during the

[4] In Figure 3, the indicator is calculated from both full-time and part-time workers' gross hourly wages, as reported by Statistics Estonia on the basis of large-sample employer surveys. In the following sub-sections of this chapter, estimates of the gender wage gap based on the Estonian Labour Force Survey use gross monthly employee-reported wages.

recession in 2009–2011, remaining slightly higher in 2014 at 9.7 percentage points than in 2005, when it was 8.5 points. Nevertheless, if these figures are put in international context, the Estonian labour market is notable for quite a high participation rate for women, as OECD figures for 2013 show the Estonian women's participation rate to be the ninth highest in the OECD countries, while the gender difference between the participation rates is the sixth lowest (OECD 2015).

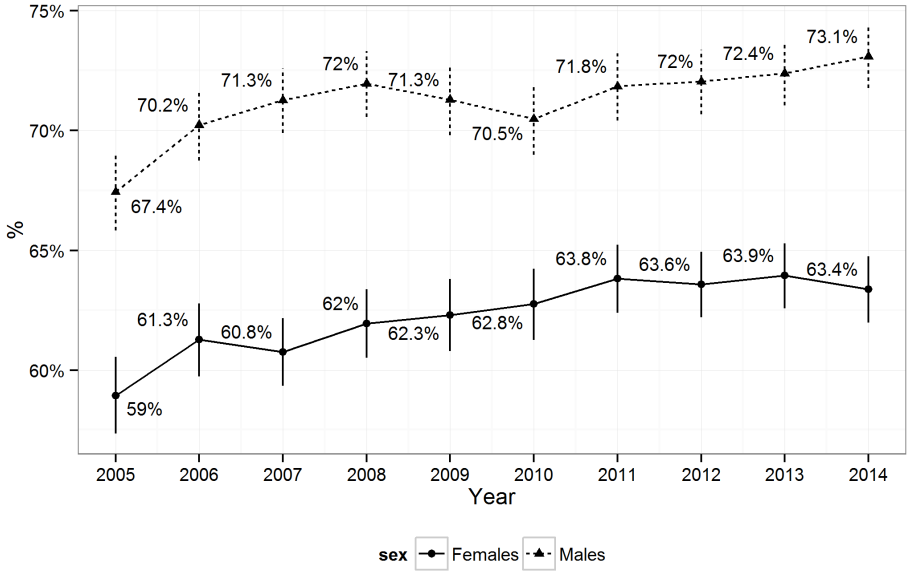

Figure 4. Participation rates, men and women aged 15–74, 2005–2014. Vertical line segments indicate 95% confidence intervals.

Source: Estonian Labour Force Survey, author's calculations.

Likewise, there are also gender differences in employment rates (see **Figure 5**), although these are less pronounced than the differences in participation rates. As with participation, women's employment rates have increased throughout the past decade, rising by more than four percentage points from 54.8% to 59.1%. The difference between men's and women's employment rates has ranged from three (2010) to nine (2008) percentage points, reaching 8.3 percentage points in 2014.

There is a positive correlation between the women's employment rate and the gender wage gap (Anspal, Rõõm and Kraut 2011). The reason is that selection into employment means that the composition of employed women will on average have higher endowments of human capital at a lower women's employment rate than at a higher employment rate. Likewise, there is a negative em-

pirical relationship between the differential of men's and women's employment rates and the gender wage gap (*ibid*). Thus Estonia's relatively high rate of women's employment and relatively small difference between men's and women's employment rates is a potentially important contextual factor behind the gender wage gap, which should especially be kept in mind when cross-country comparisons are made.

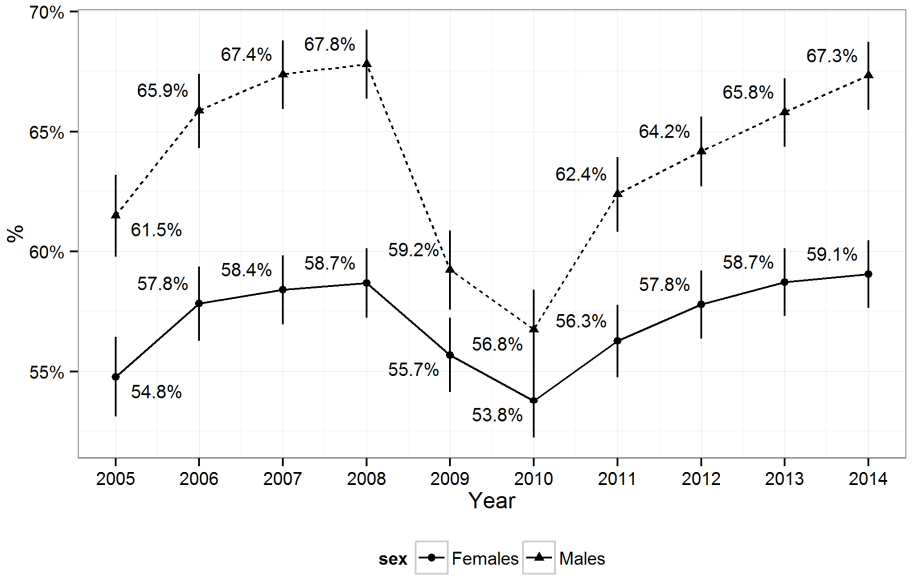

Figure 5. Employment rates, men and women aged 15–74, 2005–2014. Vertical lines indicate 95% confidence intervals.

Source: Estonian Labour Force Survey, author's calculations.

Differences in unemployment rates (Figure 6) are less pronounced than those in participation or employment rates. The unemployment rate tends to be higher for men, particularly during times of recession, as in 2009–10 when it peaked at 19.5% for men, but in some years such as 2006, 2011 or 2013 the gender difference in unemployment rates has not in fact been statistically significant in the sample from the Estonian Labour Force Survey.

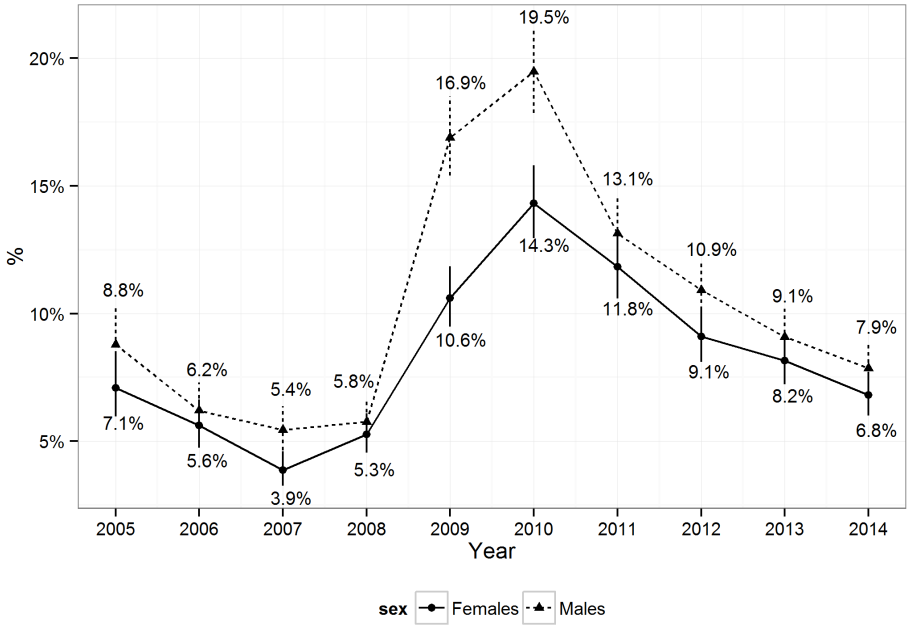

Figure 6. Unemployment rates, men and women aged 15–74, 2005–2014.
Source: Estonian Labour Force Survey, author's calculations.

Even though the difference in women's and men's employment rates is comparatively small, the structure of employment in terms of occupation and industry is very different. As can be seen in **Figure 7**, most of the nine categories of the ISCO 1-digit level classification of occupations are unbalanced by gender, some being heavily dominated by one gender. Nearly two-thirds of managers are men, while about 70% of professionals are women (the category of professionals includes teachers and medical workers, the majority of whom are women). Women also dominate clerical support, service and sales, and elementary occupations, while men are predominant in craft and related trades and plant and machine operator occupations.

Given that the occupational segregation appears to be quite high, it is reasonable to suppose that it could be a major factor behind the gender wage gap. Moreover, the occupational gender distribution is reported here on a very aggregated level, with only nine occupational categories (the tenth category, armed forces, has been omitted here). Their subcategories may in turn conceal more segregation as they may be even more segregated than the parent categories.

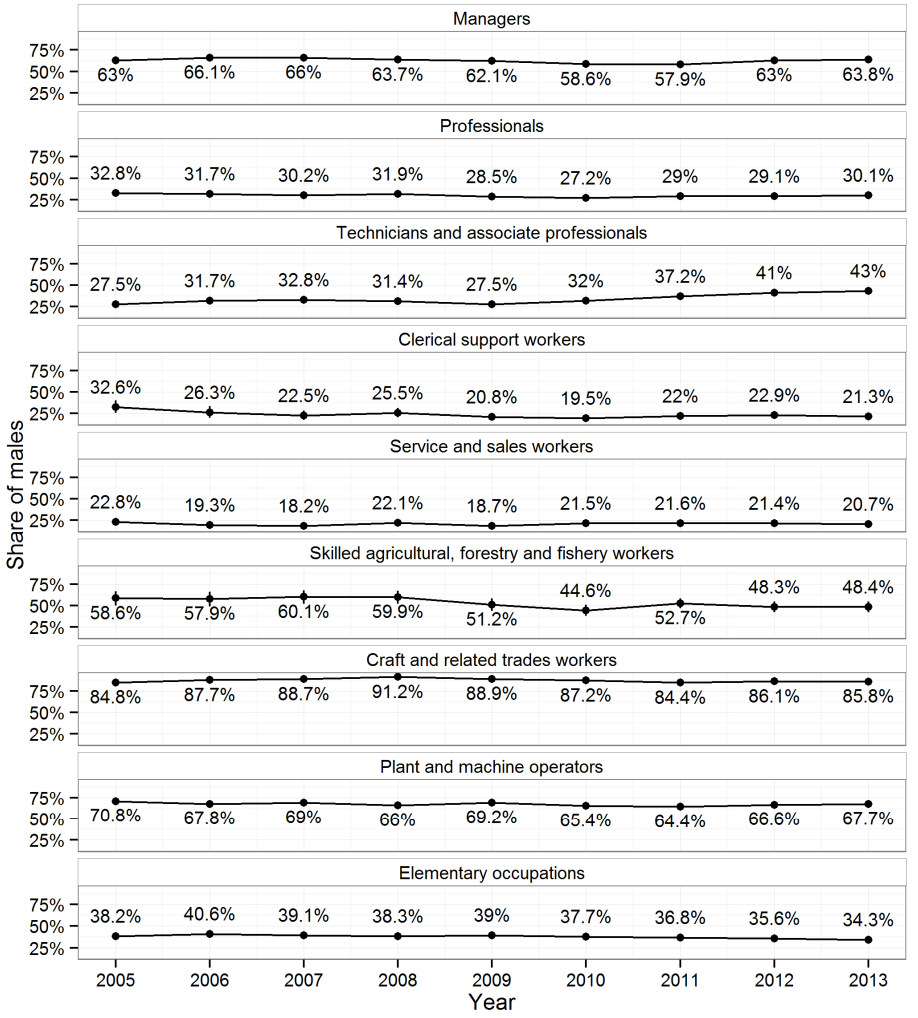

Figure 7. Share of males by occupation, 2005–2013. Vertical line segments indicate 95% confidence intervals.

Source: the Estonian Labour Force Survey, author's calculations.

However, occupational segregation is unlikely to be the sole explanation for the gender wage gap, as pay is different for men and for women even within occupations (see **Figure 8**). In most of the occupational categories, the gender wage gap is of a similar magnitude to the overall gender wage gap. There are some exceptions, and the gender wage gap is higher for managers at 33.2% and for workers in craft and related trades at 34.8%, both of these segments being dominated by men. The gap is somewhat lower for skilled agricultural and

related trades workers at 18.4%, but this is a small category, as indicated by the wide confidence intervals.

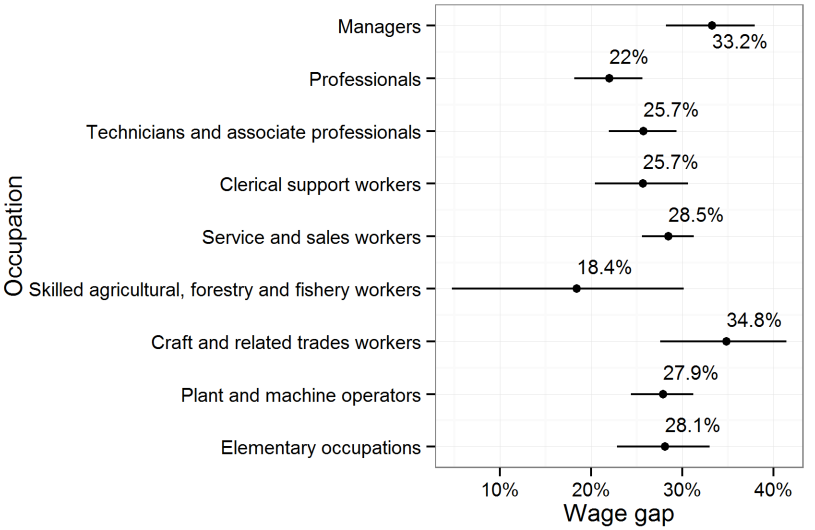

Figure 8. Gender wage gap by occupation, 2005–2013 (pooled data). The horizontal lines indicate the 95% confidence interval.

Source: the Estonian Labour Force Survey, author's calculations.

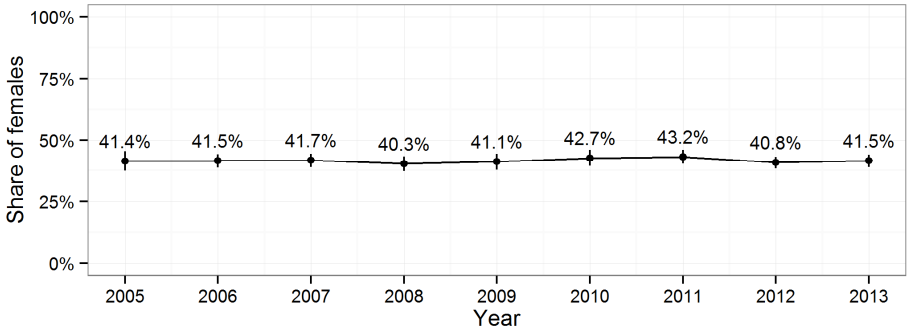

Figure 9. Share of females among workers with supervision responsibilities, 2005–2013.

Source: Estonian Labour Force Survey, author's calculations. Vertical line segments indicate 95% confidence intervals.

The share of females among workers with supervision responsibilities has remained fairly constant over the past decade at a little above 40% (**Figure 9**),

which is somewhat higher than women's share among the manager occupational group. The gender wage gap among workers with supervision responsibilities is not statistically significantly different from that among those without such responsibilities (see **Figure 10**). So even if women attain managerial positions, their pay remains lower than that of men. Although women's lower rate of attainment of such positions could help explain some of the gender wage gap, it cannot be the primary explanation.

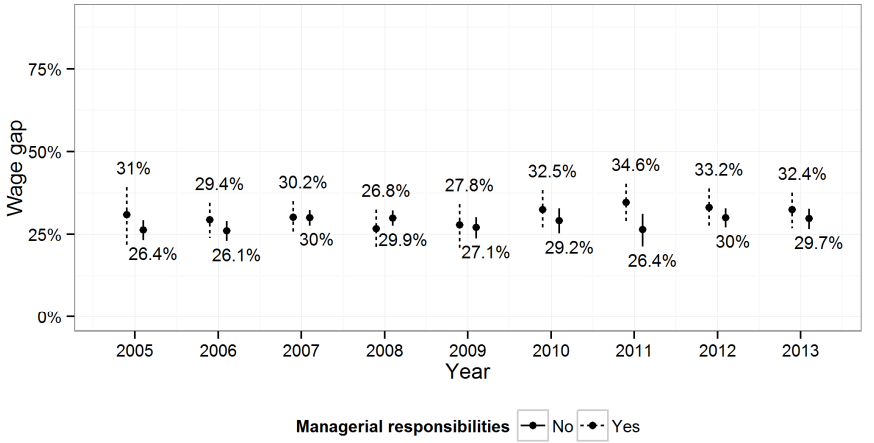

Figure 10. Gender wage gap by managerial responsibilities, 2005–2013.
Source: Estonian Labour Force survey, author's calculations.

The gender wage gap differs significantly by age group (**Figure 11**). During the decade since 2004 it has been smallest on average, at 23.3%, among young workers in the 15–24 age group. It increases to nearly 30% at ages 25–34, which is significant both substantively and statistically, and it subsequently increases even more to 32.6% in the 35–44 age group. It persists at close to 30% until the age of 54, after which it declines somewhat to around 25% in the decade before 65, after which most workers retire; the wide confidence interval in the 65–74 age group is due to the small number of observations in the sample. The steep increase in the gender wage gap in 25–34 age group, which is the main age range for bearing and rearing children, suggests that the gender wage gap may in large measure be due to breaks in women's labour market experience due to childbirth and parental leave (Anspal, Kraut and Rõõm 2010). Indeed, regulations regarding parental leave are remarkably generous in Estonia as the parents are entitled to a total of 18 months of paid parental leave, during which the the amount of the benefit received is 100% of pay during the last calendar year before childbirth. The last 12 months of parental leave may be used by either parent, the first six months being reserved for the mother, but the by far the most common practice is for the mother to use all of the parental

leave (Karu 2011). This means that there are strong incentives for women (in theory, either parent but in practice, women) to take substantial breaks from their work experience to care for children. In addition, the policy offers an incentive to have subsequent children in close succession with little time in between. It is therefore a reasonable question whether these incentives created by parental leave policies lead to women having significantly lower human capital endowment than men in terms of work experience.

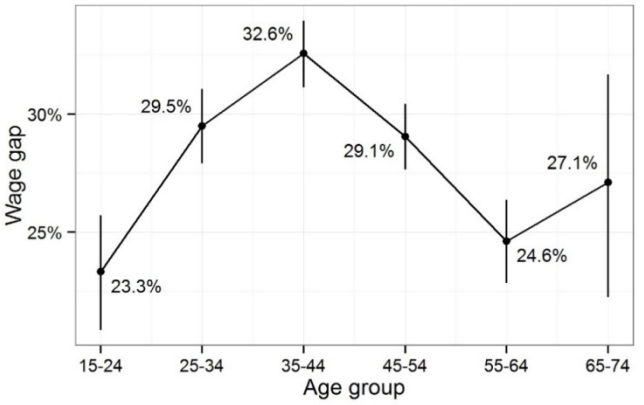

Figure 11. Gender wage gap by age group, pooled data 2004–2013. Vertical line segments indicate 95% confidence intervals.

Source: Estonian Labour Force Survey, author's calculations.

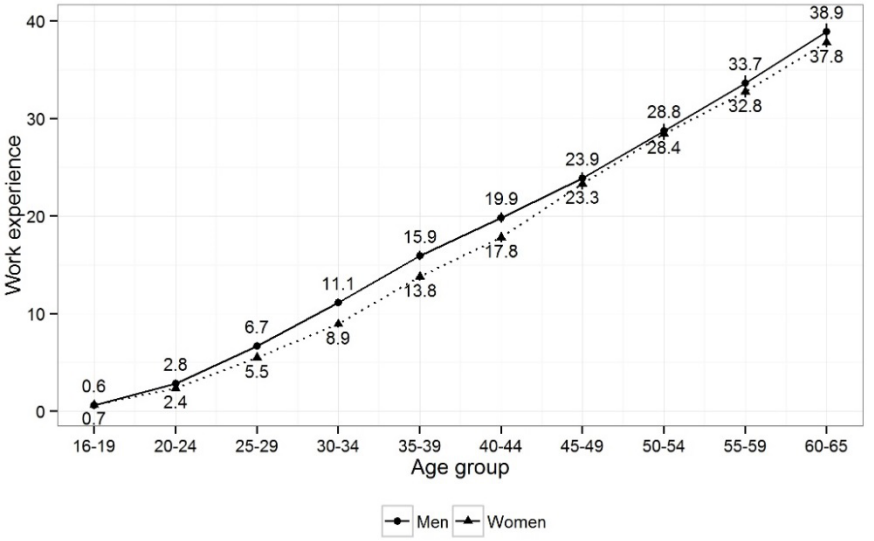

Figure 12. Work experience by sex and age group, 2011.

Source: PIAAC, author's calculations.

Figure 13. Workers' educational attainment by sex, 2005–2013.
Source: Estonian Labour Force Survey, author's calculations.

Unfortunately, the Estonian Labour Force Surveys for the time period considered do not include a questionnaire item on total work experience (only tenure in the present job). However, a recent survey, the OECD's Programme for the International Assessment of Adult Competencies (PIAAC), carried out in 2011, included such a question. A comparison of men's and women's work experience by age group, based on this survey, is reported in **Figure 12**. As can be seen, the gap between men's and women's work experience does indeed begin to widen starting from the 25–34 age group, reaching slightly over two years, where it persists until the 40–44 age group, after which differences in work experience are negligible. It should be noted that the generous parental leave policy was introduced in 2003, and so it is likely that the difference in the experience gap between the groups aged 45 and over and 44 and younger is likely in part to be due to the effect of that policy. An experience gap of two years is in fact substantial as it is equivalent to nearly 20% for the 30–34 age group. How far differences in work experience can explain the gender wage gap will be explored in the next subsection.

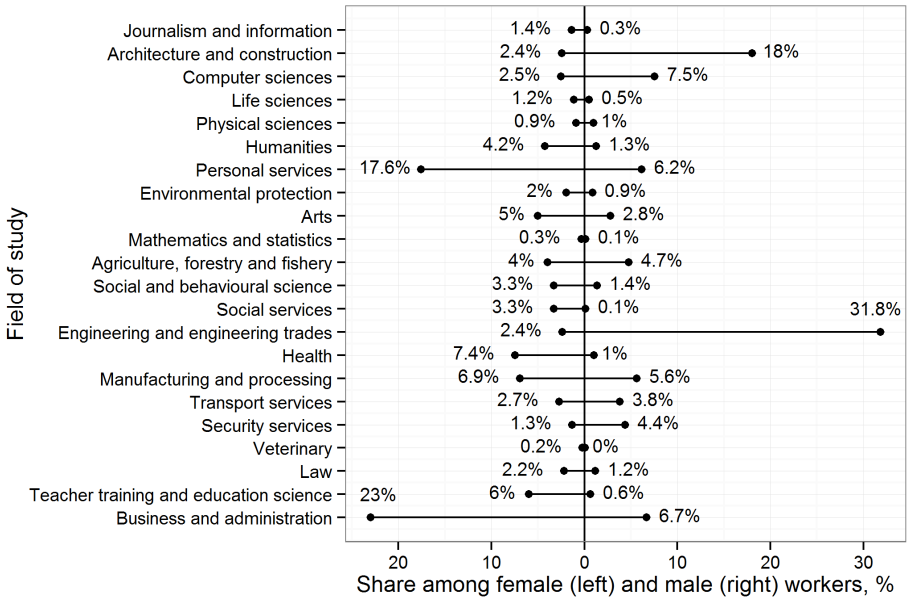

Figure 14. Distribution of male and female workers by fields of study (general education omitted), 2013.

Source: Statistics Estonia.

As for human capital endowment in terms of educational attainment rather than work experience, women have the advantage over men. Figure 13 reports the shares of workers with primary, secondary or tertiary education among male and female workers. The share of female workers with tertiary education is significantly higher than the share of men, and this difference has widened over the years in the past decade. Correspondingly, the share of workers with secondary or primary education is lower among women than among men. Particularly notable is that the share of workers with primary education has been decreasing among both men and women, but the gap between them has widened over the years.

If the level of educational attainment is not a potential explanatory factor behind women's lower pay, perhaps an explanation could be sought in differences in women's and men's choices of study subjects. The distributions of male and female workers' fields of study are compared in Figure 14. As can be seen, there are indeed great differences in which subjects for studies are most common among male and female workers. Areas where women are more likely than men to study include teacher training, which 6% of female workers have studied, and personal services, which 17.6% have studied, while 23% have studied business administration, 4.2% humanities, 2.2% law, and 7.1% health,

while men are more likely to study engineering, as 31.8% of all male workers have, and architecture and construction, which 18% of men have studied.[5]

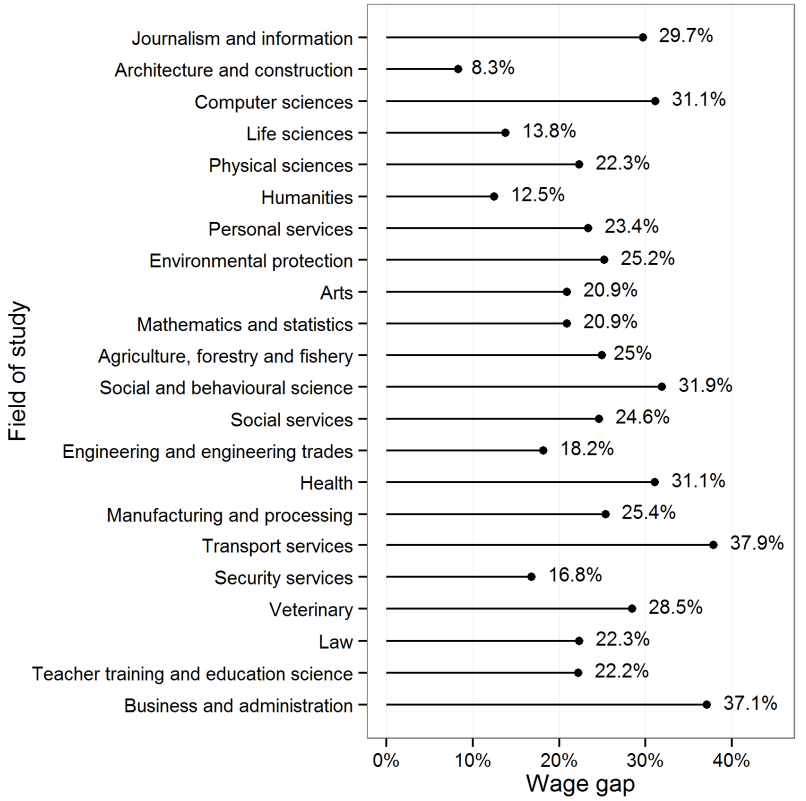

Figure 15. Gender wage gap by field of study, 2013.
Source: Statistics Estonia

However, as seen from **Figure 15**, the gender wage gap among graduates of many fields of study is comparable to the overall gender wage gap. It is highest among graduates in transport services at 37.9% and business and administration at 37.1%. In a few areas, the gender wage gap is relatively low, like in architecture and construction, which is strongly male-dominated and has a gap of 8.3%; life sciences, where the gap is 13.8%; humanities, where it is 12.5%; and security services, where it is 16.8%.

[5] This classification of fields of study is more detailed than that available in the Estonian Labour Force Survey, in which the fields are aggregated more, including those that are probably quite different in terms of the labour market outcomes of their graduates, as social sciences, business, and law are grouped together but cover both social workers and lawyers. This makes it more complicated to take the field of study into account in regression and decomposition analyses.

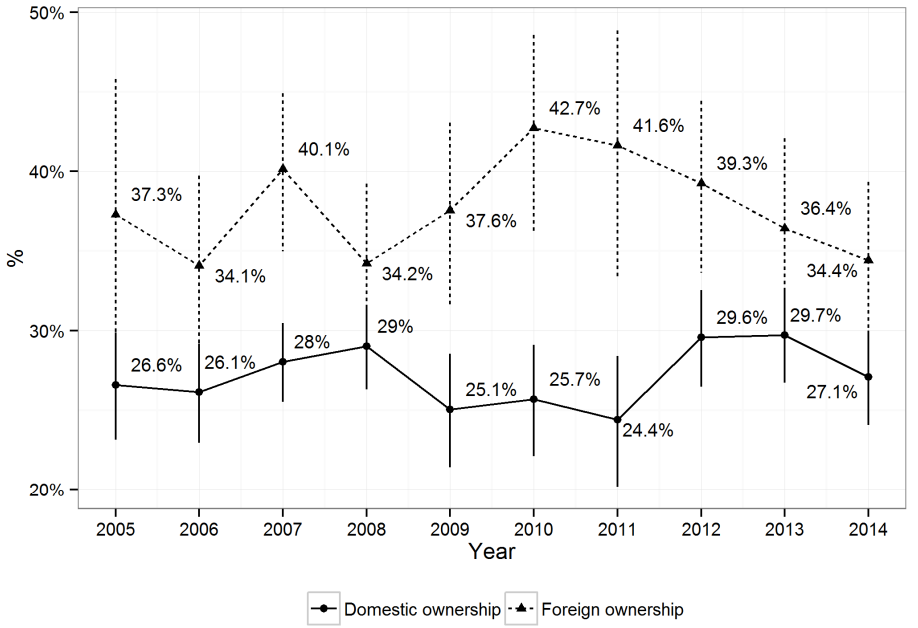

Figure 16. Gender wage gap by domestic or foreign ownership, 2005–2014.
Source: Estonian Labour Force Survey, author's calculations.

Another potential source of the gender wage gap is the unequal distribution of women and men in terms of employer ownership, as women are significantly more likely to work at companies or institutions that are owned by either the state or local government. On average 19.3% of women worked for a public-owned employer in 2005–2014, but only 10.6% of men did so. The gender wage gap exists, however, in both the public and private sectors (**Figure 17**), though it tends to be lower in the public sector, and in 2005–09 and in 2014, there was a statistically significant difference in the gender wage gap between the public and private sectors. Although the point estimate was lower for the public sector than for the private sector in other years too, the difference was not statistically significant.

Women are somewhat less likely than men to work for foreign-owned enterprises, although the difference is small as 9.7% of women and 11.8% of men work at foreign-owned firms. The gender wage gap is significantly higher in foreign-owned firms, where it exceeds 30% and in some years even 40%, while it is below 30% in domestic-owned companies and institutions. In most years during the decade under consideration, the difference is statistically significant (**Figure 16**).

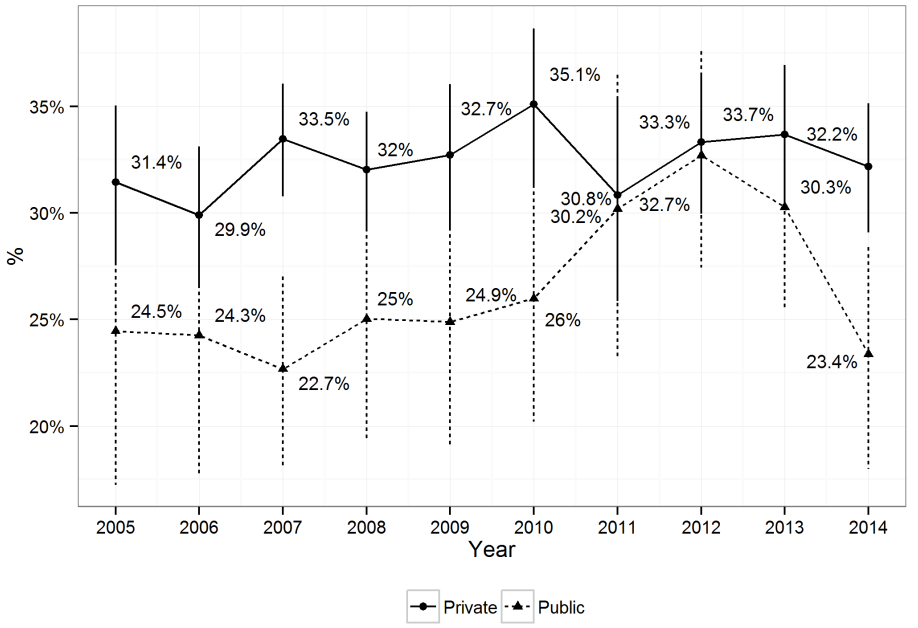

Figure 17. Gender wage gap in private and publicly-owned enterprises and institutions, 2005–2014. *Vertical lines indicate 95% confidence intervals.*

Source: Estonian Labour Force Survey, author's calculations.

2.3. The adjusted gender wage gap

2.3.1. The single-equation approach

Next we will consider the adjusted gender wage gap that remains after accounting for differences in men's and women's human capital and job characteristics. First we will look at estimates of the parameter of the gender dummy from a single-equation regression. In this basic approach, it is assumed that the returns to characteristics such as education, age and occupation are the same for women and for men, and that the adjusted gender wage gap is obtained as the estimate of the gender parameter. The assumption of equal returns to characteristics is relaxed in the decomposition exercises carried out in the following sub-sections.

The estimates of the gender parameter, together with the unadjusted log wage gap, are presented in **Figure 18**, and the full table of regression results is presented in the Appendix.[6] As can be seen from the figure, the extent to which

[6] The sample only includes full-time workers. Variables included in the regression are: age; age squared; education level (primary, secondary or tertiary); school subject; marital status; interactive term of marital status and female; dummies for presence of children aged 0–2, 3–6, and 7–17 in the household; region; public sector dummy for if the owner of the company or institution is state or local government; foreign ownership of company; dummy

the gender wage gap can be explained by differences in characteristics varies a great deal from year to year. In 2009 and 2010, the inclusion of characteristics other than gender changed the gender parameter estimate very little, as the coefficient declined from 0.29 to 0.24 in 2009 and 0.25 in 2010. In other words, only about 14% to 17% of the log wage gap could be explained by these characteristics. In other years, the part explained by the characteristics is larger, so in 2006 and 2014, the gender coefficient declines from 0.3 to below 0.2 after worker and job characteristics are added to the regression equation. On average the inclusion of the characteristics in the equation results in a 28% decrease in the gender coefficient during this period. That the explained part of the gender wage gap is very small in 2009–2010 may indicate that it is somehow related to the recession, which will be further considered below using decomposition methods.

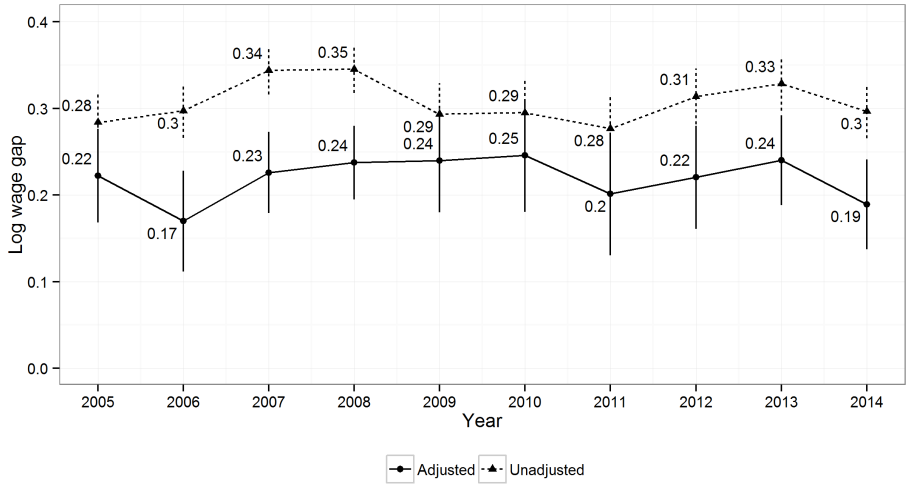

Figure 18. Adjusted and unadjusted log wage gap, 2005–2014. Vertical lines indicate 95% confidence intervals.

Source: Estonian Labour Force Survey, author's calculations.

for micro enterprise with up to 10 employees; occupation (1-digit ISCO); industry (1-digit NACE); weekly number of hours worked; and union membership.

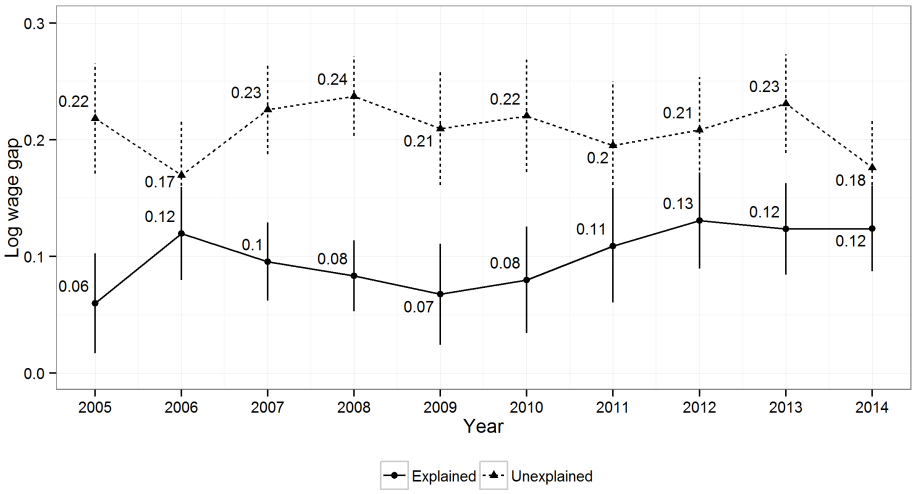

Figure 19. Decomposition of the log wage gap, 2005–2014. Vertical lines indicate 95% confidence intervals.

Source: Estonian Labour Force Survey, author's calculations.

2.3.2. Oaxaca-Blinder decomposition

In the Oaxaca-Blinder decomposition, the assumption of identical parameters for the covariates other than sex is relaxed, and separate regression equations are estimated for men and women (see the previous chapter for a mathematical exposition of the method). In the following decomposition exercise, the same covariates were used as in the single-equation approach in the previous subsection.

The results in terms of the explained and unexplained gap are presented in **Figure 19**. Overall, they are broadly consistent with the results from the single-equation approach: the explained component is significantly smaller than the unexplained component, and on average, the explained component makes up 32% of the total wage gap over the time period under consideration. Furthermore, there is significant variation over the business cycle in the share of the wage gap that is explained, as the explained gap is low relative to the overall wage gap in 2008–2010, the years of the recession, and it is lowest in 2006.

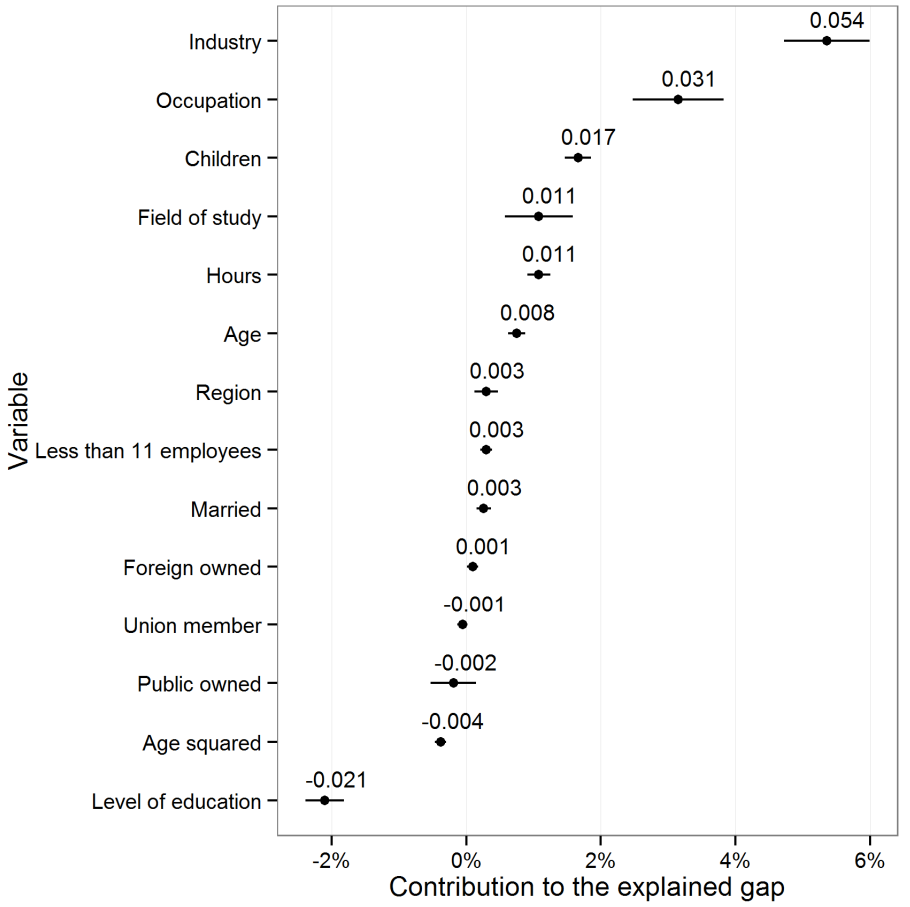

Figure 20. Contribution of covariates to the explained part of the gender wage gap, pooled sample 2005–2014.

Source: Estonian Labour Force Survey, author's calculations.

The contribution of individual variables to the explained part is reported in Figure 20.[7] Industry and occupation are the most important among the variables that explain the gender wage gap, followed by field of study, weekly hours worked, age, company size, and foreign ownership. Segregation by industry and occupation together explain some 8.5 log points of the explained wage gap, indicating that women tend to be concentrated more in lower-paying industries and jobs.

[7] The occupation, industry, region, education and field of study variables were included as deviation contrasts from the means (Yun 2005). The decomposition results for the individual dummies are presented in an aggregated manner, with estimates for dummies *occupation_1 to occupation_10* being subsumed under *Occupation* for example.

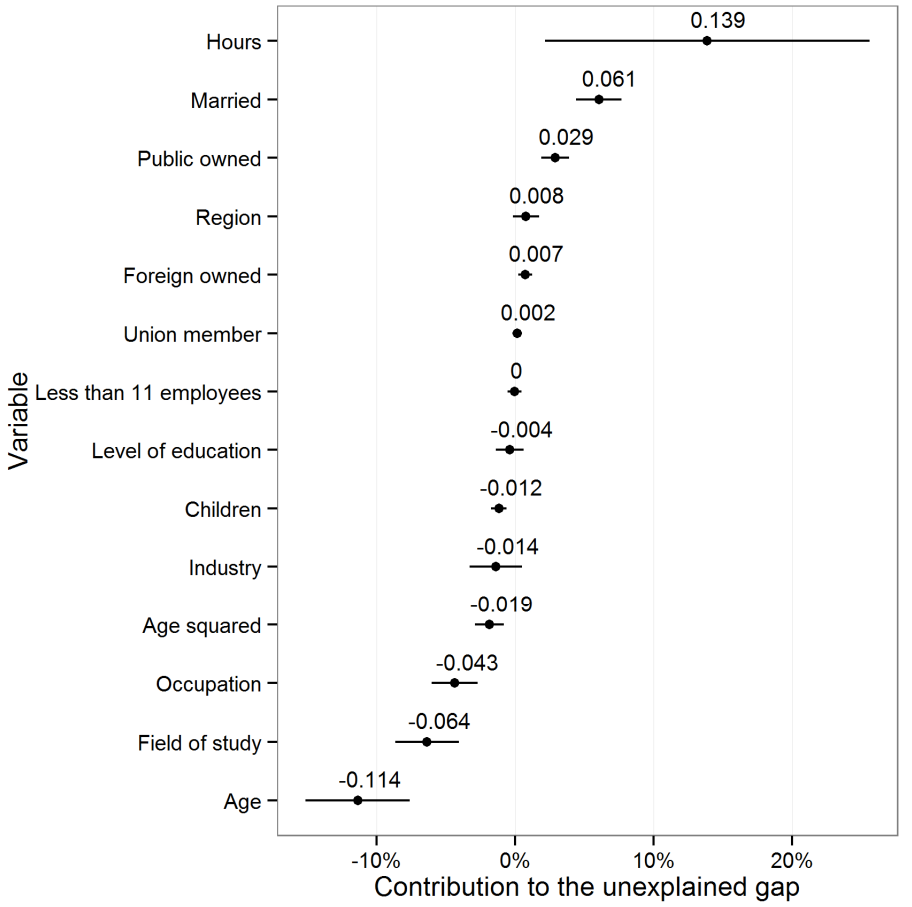

Figure 21. Contribution of covariates to the unexplained part of the gender wage gap, pooled sample 2005–2014.

Source: Estonian Labour Force Survey, author's calculations.

Somewhat anomalous results here are the statistically significant variables for marriage, children (dummies for the presence of children aged less than 3, 3 to 6, and 7 to 17 years in the household) and region. These variables have been included in the specification so as to uncover differential remuneration of these characteristics for men and women, which would be reflected in the unexplained wage gap. However, it is unexpected to see that they contribute to the explained gap, as it is unreasonable to suppose that, on average, women are more married than men, are significantly differently distributed regionally, or have significantly more children than men (although single parenthood with children in the household is more common among women than men).

Interestingly, women's larger concentration in the public-owned establishments, in which wages are on average lower than in the private sector, does not make a statistically significant contribution to explaining the gender wage gap.

An expected result is the substantial coefficient and negative sign of the variable for level of education, since women's level of educational attainment is on average higher than men's as was shown above. However, in this context it should also be noted that the contribution of the field of study to the explained wage gap is positive and statistically significant; about one percentage point of the gender wage gap is due to difference in the fields of study of women and men.

The contribution of individual variables to the unexplained gap is presented in **Figure 21**. The results show that although hours worked by men and women are different, and that they do indeed help explain the gender wage gap to a small extent, the differential remuneration of the number of hours worked contributes more to the unexplained gap. The contribution of this factor to the unexplained wage gap is remarkably large, amounting to nearly 14 log points. This indicates a potential avenue for further research into why men's and women's hours worked are rewarded differently and whether there are interaction effects with occupation or industry. As shown by Goldin (2014) in the US context, these considerations could be important in helping explain the gender wage gap.

The relationship between marriage and pay appears to be different for men, for whom it is positive, and for women, for whom it is negative, which also contributes to the unexplained gap. This has also been found in prior research (Anspal *et al* 2010) and may reflect either the difficulty for women in reconciling work and family life, or discrimination, or both. According to some human capital based explanations, raising children would be expected to affect women's performance and thereby wages, if it is assumed that women take on more of the burden of raising children than men do. However, the contribution of children to the unexplained wage gap is negative here, indicating that raising children does not hurt women's wages more than men's.

There is also a difference in how working for publicly-owned employers affects men's and women's wages compared to the effect of working in private sector companies; interestingly, for men it is associated with a higher wage, while the opposite holds for women. This may arise from the kinds of jobs that men and women do in publicly-owned establishments, as male workers in publicly-owned establishments are most likely to work in public administration or defence, while female workers are most likely to work in education, where pay is lower than in public administration.

Working for a foreign-owned company is associated with a higher wage for both men and women, but the advantage is greater for men, and so this variable also increases the unexplained gap. This has also been found in previous studies such as Rõõm and Kallaste (2004). Why working in a foreign owned company is more beneficial for men than for women warrants future research.

A most remarkable result, however, is the large and statistically significant negative contribution of occupation, implying that there is a difference in the

returns to this job characteristic that is in favour of women. The same applies for the field of study. This suggests potential measurement problems because if the occupations and fields of study are categorised at a high aggregation level, the resulting categories could end up being very heterogenous, as pointed out above, and could potentially contain inter-category segregation by gender. More detailed data on those variables would be needed to confirm these results.

One potential issue in both the single-equation and the Oaxaca-Blinder decomposition carried out above has been that the wage equations have not included work experience as an explanatory variable, since total work experience is not included in the Estonian Labour Force Survey.[8] As was described in the previous chapter, work experience is one of the key human capital variables used to explain why women may end up with lower wages in the labour market. It would be interesting to see how far the results of the decomposition would differ if actual work experience were available. Although this is not possible using the Estonian Labour Force Survey data, the work experience variable is available in the OECD's Programme for the International Assessment of Adult Competencies (PIAAC) dataset. This survey was carried out to assess literacy, numeracy and information technology skills among the adult populations of OECD countries, but it includes rich background data on the respondents' educational attainment, labour market characteristics, and more. Here, the dataset is employed to carry out a decomposition of the gender wage gap, using the more general characteristics, but not literacy, numeracy or other skills.[9]

The results of the decomposition exercise are presented in Table 2. The second and third columns of the table present the estimated components using age and age squared, and experience and experience squared among the covariates. The results show that including work experience instead of age does not increase the explained part of the gender wage gap – indeed, it does not change the results of the decomposition to a statistically significant extent.[10] It can therefore be concluded that using age instead of actual work experience, as is customary in studies using the Estonian Labour Force Survey, does not significantly affect the results of the decomposition. Differences in men's and women's work experience do not appear to explain much of the observed difference between their wages.

[8] It was included in the Labour Force Surveys before the year 2000. Philips (2001) is a study that uses this data and the work experience variable to estimate wage equations. Meriküll and Mõtsmees (2014) study the role of work experience in their analysis of the gender gap in desired wages.

[9] The role of such skills in explaining the gender wage gap has been examined by Halapuu (2015).

[10] The question might arise of whether the impact of using the work experience variable instead of age should be sought in age groups associated with bearing and rearing children, as these are the ages at which work experience differs most for men and women (see e.g. Figure 12 on page 10). However, a decomposition exercise run on the 20–40 age group yielded an increase in the explained gap from 0.246 to 0.248 with the inclusion of the work experience variable, while the unexplained gap decreased from 0.126 to 0.123. Both are statistically insignificant changes.

Table 2. Oaxaca-Blinder decomposition with age and with experience among covariates, 2011.

	Age and age squared	Experience and experience squared
Unadjusted log wage gap	0.360*** (0.0198)	0.360*** (0.0197)
Decomposition:		
Endowments	0.238*** (0.015)	0.235*** (0.015)
Coefficients	0.121*** (0.009)	0.125*** (0.009)
Observations	6826	6820

Source: OECD PIAAC dataset, author's calculations. Other covariates used in the decomposition are highest level of education (six ISCED levels), female×child under 3, language spoken at home, female×married, size of enterprise, occupation, industry.

It may be that the effect of work experience might turn out to be significant in a more complex specification. For example, work experience may have a different effect on pay for highly educated workers. The interaction of work experience with other characteristics is a topic that is potentially worth addressing in future research. Ideally, not only the length of the work experience but also its timing, continuity and content (the proportion of the experience that was spent in skilled or unskilled jobs for example) would be taken into account. However, this would require a good panel dataset.

2.3.3. The Smith-Welch decomposition

As was seen in **Figure 3**, the gender wage gap in Estonia has not remained constant over time, though it has always been at a comparatively high level. It is particularly notable that significant changes have occurred over the business cycle, and during the Great Recession the gender wage gap fell by several percentage points while the subsequent recovery saw it return to its previous levels. In the following section, the nature of those changes will be examined to see how far they were due to changes in the composition of employees in terms of their characteristics and to what extent they were due to returns to those characteristics.

The method used here is that proposed by Smith and Welch (1986, 1989), which goes beyond decomposing the differential between the mean wages of

two groups in the labour market (in their case blacks and whites) to decomposing the change in that differential over time.[11]

The following description of the method is based on the exposition by Jann (2005). Consider the following log-linear model for the wages of individuals belonging to the group $g \in \{1,2\}$ at time period $t \in \{1,2\}$:

$$Y_{gt} = X'_{gt} b_{gt} + \varepsilon_{gt} \tag{10}$$

where Y_{gt} is the wage for group g at time t, X_{gt} is the vector of characteristics for that group and time period, and ε_{gt} is an error term with $E(\varepsilon_{gt}) = 0$. The difference in log wages between the two groups in a given time period can then be decomposed as

$$\begin{aligned} dy_t = y_{1t} - y_{2t} &= x'_{1t} b_{1t} - x'_{2t} b_{2t} \\ &= (x_{1t} - x_{2t})' b_{2t} + x'_{2t}(b_{1t} - b_{2t}) \\ &\quad + (x_{1t} - x_{2t})'(b_{1t} - b_{2t}) \\ &= dx_t' b_{2t} + x'_{2t} db_t + dx_t' db_t = \mathrm{E} + \mathrm{C} + \mathrm{EC} \end{aligned} \tag{11}$$

where y denotes group mean log wage, x denotes the vector of group means of characteristics, and the d operator denotes differences between the groups. The intergroup differential in the mean log wage is thus decomposed into three components attributable to differences in endowments (denoted E) of productive characteristics; differences in coefficients (C), or returns (in the Mincer sense) to those characteristics; and the interaction of endowments and coefficients (EC). The first component, E, indicates the part of the wage gap that would arise in the absence of intergroup differences in coefficients, meaning the change in the mean wage of group 2 that would occur if the group attained the level of endowments of group 1. Likewise the second component, C, is due to differences in endowments and represents the change in the mean wage of group 2 that would arise if the latter's level of endowments were fixed but its coefficients became identical to those of group 1. The third term, EC, is an interaction term reflecting the combined contribution of differences in both endowments and coefficients.

The decomposition in (11) concerned differences between the two groups in a single time period. Looking next at the change in the wage differential from the first period to the second, the difference between the two time periods is expressed as follows:

$$\begin{aligned} dy_2 - dy_1 = [dx'_2 b_{22} - dx_1' b_{21}] + [x'_{22} db_2 - x'_{21} db_1] \\ + [dx'_2 db_2 - dx'_1 db_1] = dE + dC + dEC \end{aligned} \tag{12}$$

[11] Although the original application by Smith and Welch (1986) focused on the change of the black-white wage differential over time, the method can likewise be applied to decompositions of wage differentials in different countries, as pointed out by Jann (2005).

where d is again the time difference operator. The change in the wage differential can thus be expressed as the sum of changes in each of the three components in (11). Note that each of the components is a function of both endowments and coefficients, and thus can in turn be decomposed into components:

$$\begin{aligned} dE &= (dx_2 - dx_1)'b_{21} + dx'_1(b_{22} - b_{21}) \\ &\quad + (dx_1 - dx_1)'(b_{22} - b_{21}) \\ dC &= (x_{22} - x_{21})'db_1 + x'_{21}(db_2 - db_1) \\ &\quad + (x_{22} - x_{21})'(db_2 - db_1) \\ dEC &= (dx_2 - dx_1)'db_1 + dx'_1(db_2 - db_1) \\ &\quad + (dx_2 - dx_1)'(db_2 - db_1) \end{aligned} \tag{13}$$

As seen in (13), each of the changes in the components of the wage gap is expressed as three additive components; these are, in order, the change in the component due to changes in endowments, the change due to changes in coefficients, and the change due to the interaction of changes in both endowments and coefficients.

The Smith-Welch decomposition is applied to two time periods, looking at how the gender wage gap of 2009 had changed from 2005, and how that of 2014 compared to that of 2009. The time periods are chosen so as to encompass the business cycle, as 2005 preceded the recession, 2009 was during the recession and 2014 was the post-recession period. This enables us to examine the nature of the changes that occurred in the wage gap over the recession and the subsequent recovery.

The results of the decomposition of the change in the gender wage gap from 2005 to 2009 are presented in Table 3. The overall log wage gap was smaller in the recession year than it was before the recession. The largest change in the different components of the wage gap was the decrease in the part of the wage gap attributable to the coefficients of characteristics, i.e. the unexplained gap. This contrasts with the single-equation estimates (**Figure 18** on p. 68) and with the results of the Oaxaca-Blinder decomposition (Figure 19 on p. 69), which do not indicate a decrease in the unexplained part of the gender wage gap. This is probably due to differences in the decomposition method, as the gap here is decomposed into three components – the endowment (explained), coefficient (unexplained) and interactive (both endowments and coefficients) components.

Further, the dE, dC and dEC components of the changes in the original components E and C indicate that changes in both the explained and unexplained gaps were primarily due to the changes in the coefficients. This indicates that the change in the gender wage gap in the recession from the pre-recession period is due to changes in returns to characteristics rather than in the composition of those characteristics among the employed.

Table 3. Smith-Welch decomposition of the change in the gender wage gap, 2009 compared to 2005.

Decompositions of individual differentials:				
	D	E	C	EC
2005	2.450	–0.002	2.448	0.004
2009	0.833	–0.009	0.867	–0.026
Difference in (components of) differentials:				
	–1.617	–0.007	–1.581	–0.029
Decomposition of difference in differentials:				
	D	E	C	
dE	–0.0071	0.0026	–0.0096	
dC	–1.5808	0.0243	–1.6051	
dEC	–0.0294	–0.0152	–0.0142	

Source: Estonian Labour Force Survey, author's calculations.

The changes from 2009 to 2014 mirror those from 2005 to 2009 (see Table 4): the overall gender wage gap increased and the change occurred mostly in the unexplained component. As above, the changes in the unexplained component were mostly due to changes in returns to characteristics.

These results suggest that the changes in the gender wage gap that occur over the business cycle operate through differential changes in the remuneration of men's and women's characteristics, rather than through changes in employment resulting in fewer differences in men's and women's average characteristics. It would therefore be interesting to study further what the phenomena are that lie behind such changes. One possible explanation would be that there are differences in men's and women's acceptance of proposed wage reductions during the recession, perhaps due to gender differences in tolerating the risk of losing a job, confidence in the ability to find a new job, or some other reason. The differences in men's and women's downward nominal wage rigidity during the recession will be explored further in Study III.

Table 4. Smith-Welch decomposition of the change in the gender wage gap, 2014 compared to 2009.

Decompositions of individual differentials:				
	D	E	C	EC
2009	0.833	–0.009	0.867	–0.026
2014	2.170	–0.017	2.184	0.003
Difference in (components of) differentials:				
	1.337	–0.008	1.317	0.028
Decomposition of difference in differentials:				
	D	E	C	
dE	–0.0077	–0.0135	0.0058	
dC	1.3169	–0.0055	1.3224	
dEC	0.0281	0.0050	0.0231	

Source: Estonian Labour Force Survey, author's calculations.

2.3.4. Quantile decomposition

Next, going beyond the decomposition of the wage gap at the mean, the gender wage gap at different points of the wage distribution will be examined. As has often been found in previous studies (e.g. Albrecht *et al* 2003), the wage differential may be different at the top end of the wage distribution (e.g. the 90th percentile) and at the bottom end (e.g. the 10th percentile). Some studies have used the term "glass ceiling" to describe a situation in which the wage gap is higher at the top end of the situation than at lower quantiles, indicating that gender inequality increases higher up the pay distribution (see e.g. Arulampalam *et al* 2007). Conversely, situations in which the wage gap is higher at the bottom of the distribution are termed "sticky floors", indicating the differential difficulty for men and women of advancing along the pay distribution, with the result that workers of one gender are "stuck" to lower levels of pay than the other.[12] It should be kept in mind that this use of the terms may differ from study to study: in research focusing on pay differentials, these terms refer to differences across the wage distribution, while studies focusing on career advancement may define them in terms of the probabilities of occupational attainment; strictly speaking, the different uses of the terms do not imply one another.

[12] Alternatively, Taagepera (2007) has proposed the term *rubber ceiling* to more appropriately describe situations in which obstacles to women's career advancement are not absolute (as implied by the term *glass ceiling* which suggests an invisible but firm barrier) but offer increasingly stronger resistance the further upward a woman moves on the career ladder.

Among previous studies, Arulampalam *et al*. (2007) have found glass ceiling effects in most of the 11 European countries they looked at for the years 1995–2001, with the sticky floor effect also present in a number of countries. Albrecht *et al*. (2003) confirmed the existence of the glass ceiling effect in Sweden. Some studies have found differential ceiling effects for different groups in the labour market: for example, de la Rica *et al*. (2005) found evidence of the glass ceiling for Spanish workers with higher levels of education but not for those with lower levels of education. Kee (2006), using data for Australia, found evidence of the glass ceiling effect in the private sector but not the public sector. Chi and Li (2008) suggest that while the glass ceiling effect may be more common in developed countries, sticky floors may be more common in developing countries. They find evidence of the sticky floor effect in the Chinese urban labour market. Sticky floors are also found by Sakellariou (2004a) in the Philippines, Sakellariou (2004b) in Singapore, Gunewardena *et al* (2008) in Sri Lanka, and Fang and Sakellariou (2011) in Thailand. The sticky floor effect in China is also found by Xiu and Gunderson (2014), who also find more limited evidence of a glass ceiling.

As with the mean wage gap, the wage gap across the wage distribution can be decomposed into "explained" and "unexplained" components. The interpretation of the components is the same as with the Oaxaca-Blinder method: the explained part of the wage gap is that due to differences in the various measured characteristics between men and women, while the unexplained part is that due to differential returns to those characteristics. The difference is that what is being decomposed is not the mean but various quantiles of the wage gap, such as the 10th, 50th, 90th or some other percentile.

As the method of decomposition, the unconditional decomposition of the wage distribution of Firpo, Fortin and Lemieux (2009) based on recentered influence function regressions is used. This method uses not the dependent variable, which in our case is the natural logarithm of wage, but rather the recentered influence function (RIF) of the dependent variable, defined as

$$RIF(y; Q_\tau) = Q_\tau + \frac{\tau - \mathbb{1}\{y \leq Q_\tau\}}{f_Y(Q_\tau)} = c_{1,\tau} \cdot \mathbb{1}\{y \leq Q_\tau\} + c_{2,\tau}$$

where Q_τ is the quantile τ of the unconditional distribution of the variable *Y*, $f_Y(\cdot)$ is the density of the marginal distribution of the variable *Y* evaluated at Q_τ, $c_{1,\tau} = 1/f_Y(Q_\tau)$, $c_{2,\tau} = Q_\tau - c_{1,\tau} \cdot (1 - \tau)$, and $\mathbb{1}\{\}$ is the indicator function. In this equation, the second additive component is the influence function $\tau - 1\{y \leq Q_\tau\}/f_Y(Q_\tau)$ describing the influence of an individual observation on a distributional statistic, e.g. a quantile. The "recentered" influence function is obtained by adding the respective quantile, Q_τ, to its influence function (*ibid.*).

Firpo, Fortin and Lemieux (*ibid.*) show that using the RIF of a quantile of the original dependent variable in a regression is equivalent to an unconditional quantile regression, demonstrating that $E[RIF(y; Q_\tau)|X] = X\beta^{Q_\tau}$, where Q_τ is

the statistic (quantile) of the dependent variable y and the coefficient β^{Q_τ} is the marginal effect of X on Q_τ. Here, unconditionality is a particularly desirable property of the regression: it allows estimates to be obtained for the effects of explanatory variables on the dependent variable in a population of individuals with different characteristics, not just the variable for a population with a specific set of characteristics.

Firpo *et al* (*ibid.*) show that their method is not only usable in quantile regressions, but it also extends easily to decompositions such as Oaxaca-Blinder. Essentially, it permits estimation of a counterfactual density describing the distribution of women's wages if women were paid like men. A comparison between women's actual and counterfactual wage distribution then reflects the different returns to characteristics for men and women.

In the following, the male coefficient is first estimated using a single-equation approach and the RIF regression method. The other covariates included in the equation are the same as those used in subsection 0. The parameter of the male dummy is estimated for the 10th to 90th percentiles with a step of 5. The results are presented in **Figure 22**.

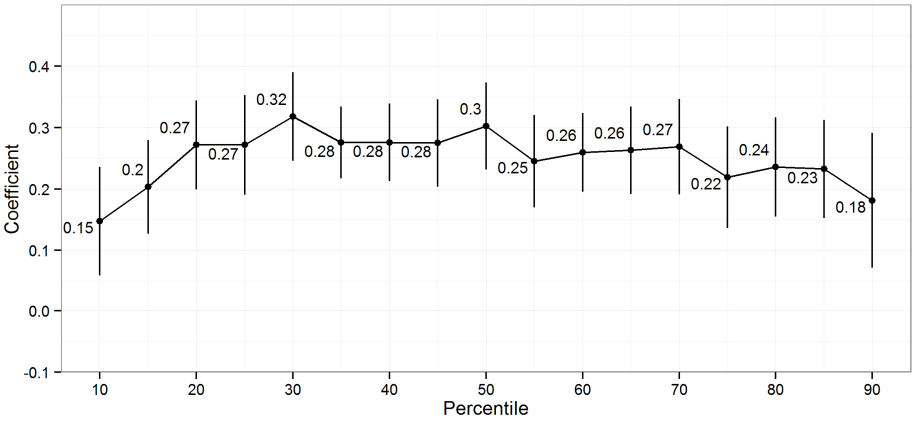

Figure 22. The male coefficient from the RIF regressions by percentile, 2013.
Source: The Estonian Labour Force Survey, author's calculations

Remarkably, the results from the unconditional quantile regression do not confirm the results from previous studies that estimate the conditional quantile regression (e.g. Halapuu 2015 or Anspal, Kraut and Rõõm 2010). Those studies found that the adjusted gender wage gap increased monotonically with progress up the wage distribution. In contrast, the adjusted wage gap is relatively low here at the 10th percentile, reaches a plateau by the 20th percentile and then remains relatively stable, before declining somewhat at the 90th percentile. Of course, this characterisation is merely suggestive since the differences between the adjusted gender wage gaps at various quantiles are nowhere statistically

significant, the confidence intervals around the point estimates being fairly wide. In any case, the glass ceiling effect is not evident from the results. These differences from the conclusions of previous studies appear to be due to differences in the methodology used: the RIF regression approach estimates the unconditional wage gap, while the conditional wage gap was estimated in previous studies. In other words, the interpretation of the results differs in that estimates from the unconditional regression describe the relationship between gender and wage in a population of individuals with different characteristics, rather than within a specific subgroup.

Next, the quantile decomposition is carried out, using a Oaxaca-Blinder decomposition based on the RIF regressions. Here, as in the Smith-Welch decomposition, the gender wage gap at various quantiles has been decomposed into three components: one due to gender differences in the endowments of productive characteristics (the explained part of the wage gap); one due to differences in the returns to those characteristics (the unexplained component); and an interactive component due to differences in both endowments and characteristics.

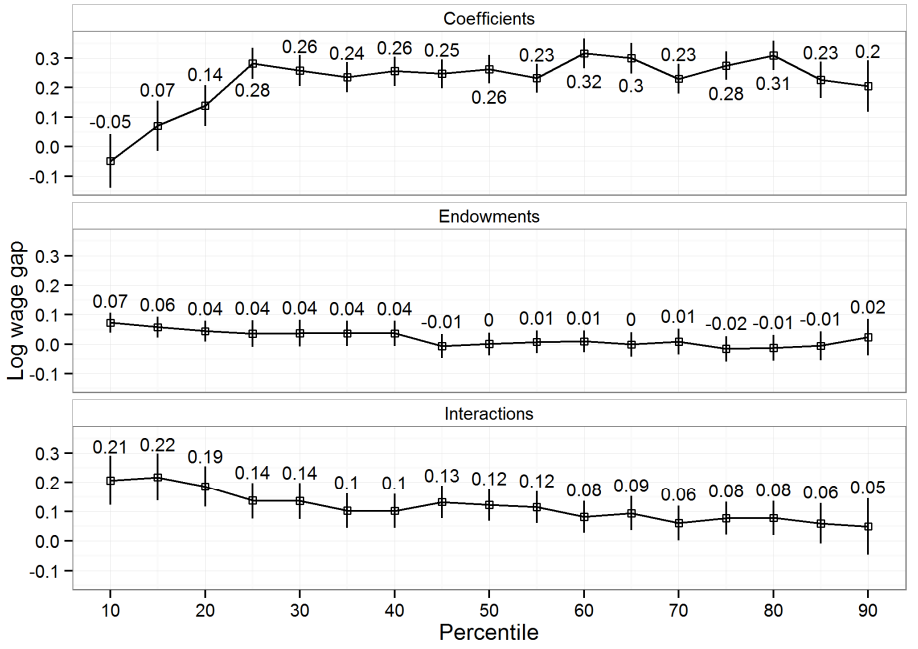

Figure 23. RIF decomposition by quantile, 2013 data.

The results, presented in **Figure 23**, indicate similar behaviour for the unexplained gap due to coefficients to that of the adjusted wage gap from the previous figure; the gap is lower, and increasing, throughout the lower

percentiles (here the 10^{th} to the 20^{th}), then it reaches a plateau at the 25^{th} percentile and remains at approximately that same level without any statistically significant changes throughout the wage distribution.

Here again, the results are in contrast to the previous findings of Anspal, Kraut and Rõõm (2010) who found, using the Melly (2006) quantile decomposition method, that the unexplained part of the gender wage gap was increasing over the wage distribution, indicating a possible glass ceiling effect. The results here do not find either a glass ceiling or a sticky floor effect. As for the overall shape of the unexplained wage gap over the distribution, the results are broadly in line with Meriküll and Mõtsmees (2014) and Christofides *et al* (2013), who also find that it is low at the lower quantiles and at a stable, high level for most of the distribution. The results of the latter study differ in that their estimate for the unexplained gap is higher, approaching 0.4 for the middle and higher quantiles.

2.4. Conclusions

Estonia's labour market is characterised by high participation and employment rates for women despite generous maternity leave policies that lead women to take substantial amounts of time off from their careers around childbirth. The gender wage gap is persistently high, but exhibits significant variation over the business cycle.

A descriptive analysis of men's and women's personal and job characteristics reveals substantial differences by gender. There is significant gender segregation by occupation and industry, and women's average work experience is somewhat lower than that of men at prime working age. Women's level of educational attainment is, on average, higher than that of men. Women's and men's choices in terms of fields of study also differ markedly. Women are more likely to work in the public sector and less likely to work at foreign-owned companies. These differences are not always clearly to women's disadvantage, notably the level of education, while some fields of study dominated by women are associated with high levels of pay. However, the gender wage gap can be observed across all occupational, educational, and other categories of those characteristics.

Decompositions of the gender wage gap indicate that most of the gender wage gap remains unexplained by such characteristics as are observable given the available data. A hypothesis was tested that the unavailability of actual work experience could be behind this low explanatory power, but it was found that the inclusion of work experience does not increase the explained part of the gender wage gap. Another hypothesis is that the level of aggregation of the data used was too high, grouping together people with characteristics that are dissimilar from the point of view of their earnings potential. This hypothesis will be further addressed in Study I in the following chapter.

It is also possible that there are problems with the comparability of male and female workers, as there may be some particular combinations of characteristics that are found for one gender but not for the other, or that may be significantly more likely for one gender but not the other. The question of how far this matters, and the methodological aspects of addressing this issue, are considered in Studies I and II in the following chapter.

The decompositions also indicated that there are differences over the business cycle in the extent to which the gender wage gap is explainable by gender differences in characteristics. Looking further into this, it was found that the overall gender wage gap shrank during the recession because of a decrease in the unexplained part, and this decrease was accounted for by changes in the remuneration of productive characteristics. The nature of those changes will be further explored in Study III in the following chapter.

Looking at the gender wage gap over the wage distribution, it was found that most of the gender wage gap remains unexplained at all quantiles. However, in contrast to some previous studies, it was found that the gender wage gap is remarkably uniform over most of the wage distribution, and no evidence was found for either the glass ceiling or sticky floor effects.

3. EMPIRICAL STUDIES

Anspal, S. “Gender wage gap in Estonia: a non-parametric decomposition.” Baltic Journal of Economics 15.1 (2015): 1–15.

Anspal, S. “Non-parametric wage gap decomposition and the choice of reference group: a study of the gender pay gap in 15 OECD countries.” International Journal of Manpower, forthcoming.

Anspal, S., and Järve, J. “Downward nominal wage rigidity and gender.” Labour 25.3 (2011): 370–385.

4. CONCLUSION

The gender wage gap in Estonia is very high, and most of it cannot be explained by differences in men's and women's personal and job characteristics. The aim of this research was to test some hypotheses about the reasons why the unexplained gender wage gap has been found to be so high in previous studies. Specifically it examined how far the unexplained gap could be reduced by using more detailed occupation and industry classifications than are traditionally used, what estimation methods should be used to ensure comparability of the men and women in the sample, and whether the downward nominal wage rigidity is different for men and women, entailing different wage outcomes in recessions.

The core of this thesis consists of three original research articles which study the issue of the gender wage gap, with a focus on Estonia. A summary of the studies is given below, followed by a discussion of their implications.

4.3. Summary of the studies

Gender wage gap in Estonia: a non-parametric decomposition (Study I)
The aim of this study was to see how much Estonia's high and largely unexplained gender wage gap could be explained by using more detailed occupational and industry variables than have been used in previous studies. Studies estimating wage regressions or carrying out gender wage gap decompositions usually use occupation and industry variables at a very aggregated level, where all occupations are classified into nine or ten groups, and industries into fifteen. This may result in very different occupations or industries being grouped together under the same category. Since segregation by occupation and industry is very high in Estonia (European Commission 2012), it is possible that there is also gender segregation within those broadly defined groupings of occupations and industries. The question thus arises of the extent to which the unexplained part of the gender wage gap would be smaller if more detailed data were used.

More broadly stated, the issue addressed in this paper is that of comparability of male and female workers: there is a need to ensure that once their individual characteristics are controlled for, the comparison is between the wages of comparable workers. In addition to more detailed data, a non-parametric method (Ñopo 2008) based on exact matching is used in this study. The unexplained gap is estimated from those workers who have a match among the opposite sex in terms of the exact combination of their characteristics. The data used are the Structure of Earnings company survey for 2011.

The main result is that the unexplained gender wage gap does not disappear when more detailed occupational and industry variables are used and comparability of workers accounted for, and 16.5 percentage points, or more than half of the overall 30.6% wage gap still remains unexplained.

Another finding is that although the share of workers in the sample who had a match with the same exact combination of characteristics among the opposite

sex was small at 32.5% of men and 39% of women, this subgroup of workers accounted for the unexplained part of gender wage gap. The contributions to the gender wage gap by men and women outside this support, for whom no match could be found among the opposite sex, largely cancelled each other out and on average did not account for much of the wage gap.

The decomposition of the gender wage gap was also carried out for various segments of the labour market, taking different industries, occupational groups, educational levels and establishment size groups. The findings indicate that there are large differences, with the unexplained gap being smallest for professionals and higher for blue-collar workers such as craft workers. The industry with the largest unexplained gap is manufacturing. The unexplained gender wage gap is higher among people in the first stage of tertiary education than at lower levels, but is highest among people in the second stage of tertiary education. In agreement with findings from previous studies, it is found that the wage gap is larger in large enterprises and smaller micro-enterprises. These results for the different segments of the labour market deserve further research.

Non-parametric decomposition and the reference group problem (Study II)
This study examines the properties of the non-parametric matching-based decomposition method that was also used in Study I (the method of Ñopo 2008). Like Oaxaca-Blinder and related parametric methods, this method is subject to the "index number problem", whereby the results of the decomposition are sensitive to whether men or women are chosen as the reference group. This issue has received a lot of attention with parametric methods (e.g. Cotton 1988, Neumark 1988, Oaxaca and Ransom 1994), but this is not the case in the context of non-parametric, matching-based methods.

This study considers the problem and its implications using the Ñopo (2008) method. Using international data from the OECD's Programme for the International Assessment of Adult Competencies (PIAAC), it is demonstrated that the choice of reference group can result in significantly different, and in some cases opposing, results for the size and sign of the unexplained wage gap. Moreover, these differences vary significantly depending on the set of covariates used in the decomposition.

The study proposes an extension of the Ñopo method analogous to that of Neumark (1988) or Oaxaca and Ransom (1994) but based on matching. Instead of the wage gap being decomposed into explained and unexplained components, it is decomposed into the unexplained and explained gaps between men's and women's average wages and the overall average wage. In other words, the average worker is the reference category, compared to which men's or women's advantage or disadvantage is estimated.

Essentially, the reference group problem in this case arises because with exact matching, the sample is divided into small cells containing male and female workers with identical combinations of characteristics, and those cells themselves can be unbalanced in terms of their gender composition. For example, if a cell contains one male and ten female workers, and the male

worker's wage is higher than the average of the female workers, the contribution of this cell's wage inequality to the overall estimate of the unexplained gap would be different depending on whether it was the weights of ten females who are discriminated against or one male who is overpaid that was contributed. Which of the two groups would be an appropriate reference category is essentially arbitrary in the absence of any otherwise known standard or benchmark for the non-discriminatory wage structure. The average worker, which in this example would be the average wage of all workers in this cell, would also constitute an arbitrary category. However, expressing the gender wage gap as separate components of male advantage and female disadvantage (or vice versa, as the case may be) has the advantage of exposing the possible asymmetry and reflecting the within-cell imbalance.

The proposed extension of the matching-based decomposition method is then illustrated with its application to the PIAAC dataset for 15 OECD countries. The results confirm the relevance of the proposed method as there is wide variation in the degree of asymmetry of male advantage and female disadvantage, depending on the country and the specification used. For Estonia, the asymmetry ranges between 11% and 16% of the total unexplained gap, depending on the specification as the male advantage ranges between 17% and 23% of the overall average wage, and the female disadvantage between 12% and 19%.

Downward nominal wage rigidity and gender (Study III)

This study tests whether there is a difference in how likely women and men are to accept wage cuts during a recession. This issue is connected with two strands of the literature, covering the gender wage gap and downward nominal wage rigidity. The question of whether and to what extent nominal wages are downwardly rigid has been studied extensively, as it is an important issue in macroeconomic policy. The issue of whether there are differences in the degree of downward nominal wage rigidity between the different groups in the labour market has received less attention. Indeed to the authors' knowledge there have been no prior treatments of gender differences in downward nominal wage rigidity in the literature.

The method employed in this study is Kahn's (1997) histogram-location method. This method is based on the idea that nominal wage cuts are more common during periods of low inflation than in periods of high inflation, because when inflation is high, wage cuts can be made in real terms without nominal wage rates changing. This property of the wage distribution is then exploited to estimate whether wages are downwardly rigid: if nominal wages were not rigid, the shape of the distribution would not be significantly different during periods of low and high inflation.

The data used in this study are longitudinal registry data from the Estonian Tax and Customs Board on all people formally employed in the private sector in 2002–2008. The period thus encompasses both the high-inflation period of the

construction boom that peaked in 2007, and a year of the subsequent deep recession in 2008.

The results show that women are less likely to resist pay cuts than men. Furthermore, in times when unemployment is increasing, a substantial decrease in women's opposition to pay cuts can be observed. In contrast, the likelihood of men taking a pay cut is not significantly affected by labour market conditions. Thus men's nominal wages exhibit a greater degree of downward rigidity than women's, and this rigidity varies less over the business cycle.

There may be various explanations for this result. The first is that the observed differences in the likelihood of receiving a pay cut are actually due to changes in working time, as women may be more likely to be offered reduced working time instead of a pay cut. However, this is not consistent with evidence from the Estonian Labour Force Survey, which does not indicate such differences. Another possibility is that the result of this study is driven by gender segregation by industry; if women worked more in cycle-sensitive industries, this could be reflected in their higher likelihood of receiving a cut in pay. Again, the Estonian Labour Force Survey indicates that it is in fact men who work more in more cycle-sensitive industries.

Another possibility is that the higher likelihood that women will accept a pay cut rather than risk a potential layoff reflects differences in women's non-cognitive characteristics such as risk aversion. Although it was not possible to test this hypothesis directly using the available data, this would be consistent with studies demonstrating the existence of such differences in experimental settings (see the studies reviewed in Chapter 1). Indeed, it can be observed that the risks involved in the labour market situation studied were substantial, because the number of male wage earners in 2009 was 15.3% lower than in 2008, while the number of females fell by 11.8%. Whether these figures are indeed related to the likelihood of people accepting a reduction in pay, and whether this likelihood is in turn related to risk aversion, is a question for future research. However, the study points to the possibility that gender differences in risk aversion, which have been demonstrated experimentally but the real world significance of which has been unclear, may have substantial labour market effects, at least in periods of recession.

4.4. Discussion of the results

The results of Study I indicate that including detailed data on occupation and industry allows the unexplained part of the gender wage gap to be reduced by 5.7 percentage points from 22.2% to 16.5%. Although this is a substantial reduction, this result needs care in interpretation. Counterarguments can be made against including occupation and industry variables in the decompositions at all as it is debatable how far the ability to "explain" the gender wage gap with differences in these job characteristics constitutes a true explanation. After all, discrimination may take the form not only of direct pay discrimination between

men and women in comparable jobs, but of barriers to entry and segregation by industry and occupation. So a substantial reduction in the unexplained part of the gender wage gap following the inclusion of these variables would not constitute proof of the absence of discrimination. Moreover, the result that using more precise classifications in explanatory variables increases the explanatory power of the model is entirely expected. However, this does not mean that dividing occupations and industries into ever smaller cells results in divisions that are really meaningful from the point of view of pay equality. It may be that pay differentials are seemingly explained by the distribution of workers of different gender into occupational sub-groups that are actually quite similar.

These potential criticisms of using detailed occupational and industry categories are valid from the point of view of carrying out the decompositions with the explicit aim of estimating the extent of discrimination, i.e. interpreting the unexplained part of the gender wage gap as discrimination. It is entirely possible that discrimination through barriers to entry into occupations and industries exists, transferring some of the true effect of discrimination on wages into the "explained" component of the wage gap. Nevertheless, this is not the only possible aim of wage gap decompositions, and even if it is accepted that segregation may be discriminatory, it is useful to estimate the extent to which the gender wage gap can be accounted for by segregation. Even if the gender wage gap due to segregation by occupation or industry becomes part of the "explained" gap, it is useful to quantify the role of segregation when considering the value of further studies or policy measures.

The significance of the result of Study I is not so much the reduction, albeit substantial, of the unexplained part of the gender wage gap when more detailed occupational and industry variables are included, but the fact that the inclusion of those variables reduced the gap so little, as the remaining unexplained gap is still 16.5%, which is higher than the entire unadjusted gender wage gap in most European countries. This means that there is a substantial gap between the wages of men and women with fairly comparable characteristics, and it is not an artefact of imprecise statistical data.

In addition to detailed occupation and industry variables, an advantage that the dataset used has over the commonly used Estonian Labour Force Survey data is that the data were reported as hourly wages by companies, instead of self-reported wages that are subject to recollection error. A limitation of the dataset is that it has relatively little in the way of human capital variables, compared to employee surveys, as it has the level of education but no field of study or work experience. However, it could be argued that the occupation variable in a detailed form also gives considerable information about human capital, to the extent that working in a profession is an indication of possessing the necessary qualifications for the job. The same is not true for occupation measured by major occupational groups. As for work experience, it was shown in Chapter 2 that using age instead of work experience did not appear to affect the results of the decomposition.

Using more detailed data, resulting in a large number of variables, also made it necessary to consider carefully the estimation strategy, in particular regarding the need to address the problem of support, or the existence of men and women with similar combinations of characteristics. The large number of variables makes it more likely that some cells corresponding to specific combinations of characteristics are populated by men or women only. The approach taken in this study was to consider this issue explicitly, to delineate the part of the sample in which fully comparable men and women exist for all combinations of characteristics, and to estimate the contribution of this sub-sample to the gender wage gap. The method suited for such a task is the non-parametric decomposition based on exact matching, proposed by Ñopo (2008). An interesting result of using this method was the finding that although the share of observations for which men and women had an exact match among the opposite sex was small, this matched group accounted for more than half of the overall gender wage gap.

The use of the matching-based decomposition method raised other issues regarding the properties of the method, which were pursued in Study II. As described in the above summary, it was demonstrated that the matching-based decomposition method gives different results depending on whether males or females are taken as the reference group. The proposed modification of the method expresses the gender wage gap's explained and unexplained components as male and female advantages and disadvantages compared to the average worker. This could potentially be useful not only in decompositions of the gender wage gap in the labour market as a whole, but also in pay equity audits at the company level. At the level of a single organisation, there could well be situations in which jobs have been evaluated, their various characteristics such as required qualifications or level of responsibility have been described, and there is a need to evaluate whether there are differences in pay between men and women with comparable characteristics. If the sample is divided into small cells consisting of workers with identical characteristics, a situation may well arise where the cells are unbalanced by gender, and thus the problem arises of how to measure the wage gap and what weights to use when aggregating the gaps over the cells. Where there are cells with pay differences but unbalanced gender composition, their contribution to the company-level pay gap may vary widely depending on whether the pay gap is interpreted as large numbers of overpaid males or a few underpaid females (or vice versa), for example. In this situation, taking the weighted average worker as the reference group could be a useful choice since it would indicate whether the problem of pay differentials in the organisation is a widespread problem of symmetric male and female advantage or disadvantage, or due to small outlying groups creating asymmetric advantage or disadvantage. Naturally, the method can be applied not only to differences between men and women, but also to those between other groups such as ethnic majority/minority workers.

Study III is relevant for understanding the behaviour of men's and women's wages in the particular situation of periods of low inflation such as a demand-

side recession. While the method employed enabled us to identify significant differences in pay changes during the recession, it was not a wage decomposition method and thus did not allow us to estimate the share of the wage gap attributable to this effect. Furthermore, the results of this study are limited in terms of understanding why the level of the gender wage gap is so high in Estonia, since it concerns pay changes in fairly specific situations. Nevertheless, knowledge of gender differences in downward wage rigidity is helpful in interpreting the observed changes in the gender wage gap during recessions.

In addition to Studies I–III, some results also emerged from the decomposition exercises in Chapter 2. A hypothesis was tested that one reason for the large unexplained wage gap was that age instead of actual work experience was used in wage gap decompositions. It was found that using actual work experience does not increase the explained part of the gender wage gap. Regarding the developments of the wage gap over the business cycle, it was found that the wage gap decreased during the recession and the change was due to changes in the returns to workers' characteristics. As for the wage gap at various quantiles of the wage distribution, it was found that most of the gap is unexplained at all quantiles. Contrary to some previous studies, it was found that the unexplained wage gap does not exhibit either a glass ceiling or a sticky floor effect.

A summary of the propositions involved in the research tasks described in the Introduction and their results is given in Table 5.

The results of both the present and earlier studies indicate questions that deserve further research. For example, it was found in Study I that there are large differences in the unexplained gender wage gap by occupation, education level, and company size. It was also found that the gender wage gap differs significantly by region. The reasons for such differences deserve more focus in future research.

One possible interpretation of the results of Study III is that the differences in men's and women's downward nominal wage rigidity are due to gender differences in non-cognitive characteristics such as risk aversion. However, the data used in this study did not permit this hypothesis to be tested explicitly. The relationship between non-cognitive characteristics and real world labour market outcomes such as pay would be a worthwhile topic for future research.

The unexplained component of the gender wage gap remained high after the various decompositions in this study were carried out. Although one possible interpretation of this component is discrimination, the data used in this study were insufficient to exclude other possibilities definitively. Discrimination as one of the possible causes of the gender wage gap thus continues to be a relevant research question.

Furthermore, the present study did not explicitly address the question of why Estonia's gender wage gap is high compared to those of other countries. Such a question entails a focus on cross-country differences in the various labour market and other institutions and policies, and in their effects on the gender wage gap. Studying the causes of the gender wage gap from this point of view will also be an important task for future research.

Table 5. Overview of propositions and results.

Proposition	**Result**
Research task 3. To carry out decompositions of the gender wage gap	
Proposition 1: The omitted work experience variable is a significant factor behind the unexplained part of the gender wage gap	Not supported
Proposition 2: The unexplained gender wage gap exhibits a "glass ceiling" effect	Not supported
Proposition 3: Changes in the gender wage gap over the business cycle are related to changes in the valuation of characteristics	Supported
Research task 4. To evaluate the hypothesis that a substantial factor behind the large unexplained part of the gender wage gap is that the data on occupation and industry are insufficiently detailed	
Proposition 4: a substantial factor behind the large unexplained part of the gender wage gap is that the data on occupation and industry are insufficiently detailed	Supported
Research task 5. To evaluate the hypothesis that a substantial factor behind the large unexplained part of the gender wage gap is the problem of support, i.e. the incomparability of the particular combinations of characteristics of male and female workers	
Proposition 5: a substantial factor behind the large unexplained part of the gender wage gap is the problem of support, i.e. the incomparability of the particular combinations of characteristics of male and female workers	Not supported
Research task 6: To examine the extent to which non-parametric decomposition methods may be sensitive to the choice of reference category, and to propose an alternative method that makes the asymmetry of male and female advantage and disadvantage explicit	
Proposition 6: non-parametric, matching-based decomposition methods are sensitive to the choice of reference category	Supported
Research task 7: To examine the reasons behind the observed changes in the gender wage gap during the Great Recession, specifically testing the hypothesis that downward nominal wage rigidity is different for men and women.	
Proposition 7: downward nominal wage rigidity is different for men and women	Supported

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APPENDIX 1.
TABLES OF REGRESSION ESTIMATES

Table A. 1. Wage regression estimates, 2005–2014.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Male	0.220*** (0.0277)	0.156*** (0.0293)	0.224*** (0.0237)	0.241*** (0.0224)	0.241*** (0.0302)	0.246*** (0.0328)	0.198*** (0.0357)	0.220*** (0.0304)	0.234*** (0.0266)	0.189*** (0.0264)
Age	–0.00342*** (0.000657)	–0.00379*** (0.000566)	–0.00262*** (0.000551)	–0.00239*** (0.000514)	–0.00367*** (0.000663)	–0.00320*** (0.000689)	–0.00221** (0.000690)	–0.00267*** (0.000592)	–0.00348*** (0.000530)	–0.00347*** (0.000610)
Age^2	–0.0283*** (0.00492)	–0.0231*** (0.00458)	–0.0253*** (0.00395)	–0.0291*** (0.00356)	–0.0348*** (0.00459)	–0.0265*** (0.00477)	–0.0357*** (0.00580)	–0.0350*** (0.00434)	–0.0346*** (0.00400)	–0.0342*** (0.00423)
Level of education:										
Primary	–0.0531* (0.0241)	–0.0513 (0.0273)	–0.0264 (0.0217)	–0.0269 (0.0215)	–0.0217 (0.0262)	–0.0603* (0.0263)	–0.0688* (0.0280)	–0.0214 (0.0274)	–0.0467 (0.0253)	–0.0603* (0.0242)
Tertiary	0.121*** (0.0209)	0.145*** (0.0171)	0.0915*** (0.0155)	0.0889*** (0.0155)	0.120*** (0.0182)	0.111*** (0.0207)	0.114*** (0.0197)	0.131*** (0.0188)	0.128*** (0.0175)	0.135*** (0.0174)
Field of study (reference group: general education)										
Teacher training	–0.0303 (0.0379)	–0.00629 (0.0322)	0.0441 (0.0312)	0.0183 (0.0314)	–0.0143 (0.0322)	–0.0262 (0.0337)	–0.00955 (0.0393)	–0.0683 (0.0362)	–0.0293 (0.0316)	–0.0148 (0.0320)
Humanities	0.0948 (0.0546)	0.00836 (0.0560)	–0.0230 (0.0420)	–0.0203 (0.0432)	0.0125 (0.0493)	0.0311 (0.0446)	0.0118 (0.0440)	–0.00346 (0.0397)	–0.00959 (0.0357)	–0.136*** (0.0351)
Social sciences, business and law	–0.000323 (0.0281)	0.0395 (0.0246)	0.0528* (0.0221)	0.0296 (0.0216)	0.0362 (0.0266)	0.0308 (0.0281)	0.0518 (0.0300)	0.0736** (0.0261)	0.0583* (0.0240)	0.00540 (0.0237)
Natural and exact Sciences	0.111 (0.0833)	0.223* (0.0968)	0.102 (0.0675)	0.107 (0.0719)	0.0959 (0.0953)	0.00653 (0.0689)	0.264** (0.0938)	0.135 (0.0798)	0.137 (0.0739)	0.0393 (0.0448)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Mathematics and Statistics	0.102 (0.0762)	0.0397 (0.0590)	0.0663 (0.0636)	0.0192 (0.0386)	0.0380 (0.0570)	0.0317 (0.0552)	0.117 (0.0620)	0.0535 (0.0477)	0.0123 (0.0509)	0.0545 (0.0455)
Technology, production and construction	–0.0265 (0.0206)	–0.0345* (0.0164)	–0.0128 (0.0177)	–0.0336* (0.0168)	–0.0266 (0.0205)	–0.0305 (0.0225)	–0.0139 (0.0223)	0.00707 (0.0200)	0.0155 (0.0195)	–0.0289 (0.0207)
Agriculture, forestry and fishing	–0.0354 (0.0324)	–0.0513 (0.0384)	–0.00620 (0.0340)	–0.0121 (0.0294)	0.0163 (0.0377)	–0.0197 (0.0395)	–0.0216 (0.0324)	0.00567 (0.0356)	0.0763* (0.0318)	0.0443 (0.0294)
Health and well-being	0.0434 (0.0423)	0.0567 (0.0421)	0.105** (0.0392)	0.156*** (0.0357)	0.160*** (0.0423)	0.0958 (0.0491)	0.0830 (0.0683)	0.105* (0.0459)	0.102** (0.0393)	0.0209 (0.0351)
Services	0.0254 (0.0241)	0.000108 (0.0235)	0.00711 (0.0213)	0.0112 (0.0210)	0.0236 (0.0252)	–0.0185 (0.0262)	0.0190 (0.0268)	0.0335 (0.0257)	0.0391 (0.0243)	0.0402 (0.0224)
Married	0.0588* (0.0265)	0.107*** (0.0269)	0.0625** (0.0224)	0.0355 (0.0212)	0.0767** (0.0274)	0.0820** (0.0312)	0.0764* (0.0329)	0.0999*** (0.0278)	0.0898*** (0.0242)	0.0846*** (0.0253)
Female * married	–0.0641* (0.0302)	–0.146*** (0.0303)	–0.0933*** (0.0258)	–0.0780** (0.0244)	–0.0963** (0.0308)	–0.0983** (0.0348)	–0.115** (0.0370)	–0.107*** (0.0317)	–0.0812** (0.0283)	–0.0855** (0.0289)
Children aged 0–2 in the household	0.125*** (0.0340)	0.0952** (0.0326)	0.0737* (0.0295)	0.0735* (0.0289)	0.0215 (0.0259)	0.0264 (0.0310)	0.0507 (0.0315)	0.0499 (0.0278)	0.0178 (0.0267)	0.0601* (0.0267)
Children aged 3–6 in the household	0.0159 (0.0328)	0.0430 (0.0259)	0.0609** (0.0210)	0.0203 (0.0218)	0.0237 (0.0216)	–0.0312 (0.0229)	0.0473* (0.0224)	0.0224 (0.0212)	0.0408* (0.0192)	–0.00697 (0.0194)
Children aged 7–17 In the household	0.0299 (0.0192)	0.0402* (0.0159)	0.0663*** (0.0154)	0.0424** (0.0146)	–0.0173 (0.0153)	0.0246 (0.0173)	0.0153 (0.0174)	–0.000329 (0.0167)	0.00896 (0.0152)	0.0107 (0.0147)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Region (reference group: Tallinn)										
Harju	0.0218 (0.0362)	0.0714** (0.0220)		0.0255 (0.0238)	–0.00988 (0.0286)	0.0218 (0.0272)	0.0111 (0.0249)	0.00509 (0.0232)	0.00239 (0.0226)	–0.0227 (0.0221)
Hiiu	–0.192*** (0.0311)	–0.196*** (0.0297)	–0.267*** (0.0315)	–0.282*** (0.0339)	–0.215*** (0.0405)	–0.104* (0.0417)	–0.0611 (0.0518)	–0.181*** (0.0453)	–0.113* (0.0442)	–0.0855 (0.0447)
Ida-Viru	–0.299*** (0.0215)	–0.269*** (0.0207)	–0.292*** (0.0209)	–0.287*** (0.0188)	–0.258*** (0.0242)	–0.234*** (0.0275)	–0.167*** (0.0324)	–0.196*** (0.0275)	–0.197*** (0.0232)	–0.234*** (0.0210)
Jõgeva	–0.148*** (0.0358)	–0.140*** (0.0374)	–0.182*** (0.0352)	–0.199*** (0.0288)	–0.156*** (0.0345)	–0.195*** (0.0361)	–0.118*** (0.0355)	–0.105* (0.0411)	–0.116** (0.0433)	–0.152*** (0.0335)
Järva	–0.0923** (0.0314)	–0.0513 (0.0338)	–0.0755* (0.0328)	–0.148*** (0.0264)	–0.110*** (0.0281)	–0.157*** (0.0348)	–0.117** (0.0439)	–0.112** (0.0342)	–0.0107 (0.0314)	–0.108** (0.0333)
Lääne	–0.174*** (0.0384)	–0.128*** (0.0368)	–0.100* (0.0392)	–0.136*** (0.0336)	–0.113*** (0.0331)	–0.106** (0.0361)	–0.0869 (0.0482)	–0.0909 (0.0476)	–0.109** (0.0393)	–0.151*** (0.0341)
Lääne-Viru	–0.0598* (0.0246)	–0.107*** (0.0270)	–0.119*** (0.0285)	–0.101*** (0.0240)	–0.113*** (0.0293)	–0.0999*** (0.0262)	–0.103*** (0.0271)	–0.123*** (0.0275)	–0.161*** (0.0292)	–0.173*** (0.0293)
Põlva	–0.209*** (0.0321)	–0.187*** (0.0308)	–0.247*** (0.0345)	–0.223*** (0.0313)	–0.192*** (0.0366)	–0.146*** (0.0317)	–0.169*** (0.0304)	–0.129*** (0.0364)	–0.103*** (0.0290)	–0.182*** (0.0278)
Pärnu	–0.126*** (0.0254)	–0.109*** (0.0305)	–0.115*** (0.0215)	–0.147*** (0.0210)	–0.129*** (0.0294)	–0.115*** (0.0327)	–0.113*** (0.0304)	–0.175*** (0.0300)	–0.0995** (0.0305)	–0.135*** (0.0299)
Rapla	–0.165*** (0.0396)	–0.0790* (0.0368)	–0.126*** (0.0347)	–0.0974** (0.0346)	–0.0904** (0.0342)	–0.0588 (0.0406)	–0.0799* (0.0340)	–0.0676* (0.0325)	–0.0848* (0.0402)	–0.0784* (0.0335)
Saare	–0.203*** (0.0335)	–0.161*** (0.0366)	–0.108*** (0.0315)	–0.111** (0.0365)	–0.108*** (0.0313)	–0.0699* (0.0334)	–0.128*** (0.0359)	–0.104** (0.0336)	–0.121*** (0.0289)	–0.192*** (0.0306)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Tartu	–0.0273 (0.0233)	–0.00288 (0.0245)	–0.0329 (0.0210)	–0.0749** (0.0230)	–0.0562* (0.0253)	–0.0724** (0.0260)	–0.0437 (0.0297)	–0.0540 (0.0327)	–0.0725** (0.0228)	–0.125*** (0.0240)
Valga	–0.315*** (0.0352)	–0.237*** (0.0316)	–0.267*** (0.0310)	–0.298*** (0.0337)	–0.322*** (0.0487)	–0.270*** (0.0343)	–0.245*** (0.0409)	–0.167*** (0.0449)	–0.192*** (0.0343)	–0.287*** (0.0350)
Viljandi	–0.197*** (0.0289)	–0.0733** (0.0283)	–0.129*** (0.0232)	–0.127*** (0.0285)	–0.149*** (0.0267)	–0.0392 (0.0301)	–0.0657* (0.0309)	–0.0839** (0.0317)	–0.0998*** (0.0261)	–0.135*** (0.0246)
Võru	–0.162*** (0.0278)	–0.129*** (0.0303)	–0.185*** (0.0258)	–0.201*** (0.0287)	–0.173*** (0.0342)	–0.110* (0.0518)	–0.108** (0.0338)	–0.0503 (0.0313)	–0.111*** (0.0325)	–0.208*** (0.0366)
Public owned establishment	0.0207 (0.0246)	0.00130 (0.0248)	–0.0626** (0.0213)	–0.0537* (0.0225)	0.00134 (0.0298)	0.0259 (0.0302)	0.0593* (0.0290)	0.0230 (0.0273)	0.0190 (0.0237)	–0.0484* (0.0236)
Foreign owned establishment	0.144*** (0.0230)	0.105*** (0.0185)	0.0917*** (0.0167)	0.0791*** (0.0152)	0.135*** (0.0199)	0.169*** (0.0242)	0.0944*** (0.0214)	0.149*** (0.0186)	0.112*** (0.0182)	0.107*** (0.0170)
Less than than 10 workers	–0.0874*** (0.0188)	–0.112*** (0.0199)	–0.119*** (0.0168)	–0.148*** (0.0180)	–0.112*** (0.0207)	–0.136*** (0.0233)	–0.148*** (0.0226)	–0.126*** (0.0197)	–0.136*** (0.0193)	–0.167*** (0.0197)
Occupation (reference group: managers)										
Professionals	–0.137*** (0.0362)	–0.144*** (0.0292)	–0.0866*** (0.0257)	–0.107*** (0.0264)	–0.0845** (0.0322)	–0.106** (0.0347)	–0.106** (0.0341)	–0.00422 (0.0367)	–0.0573 (0.0322)	–0.0653* (0.0291)
Technicians and associate professionals	–0.299*** (0.0347)	–0.230*** (0.0276)	–0.247*** (0.0247)	–0.296*** (0.0268)	–0.275*** (0.0319)	–0.254*** (0.0355)	–0.268*** (0.0361)	–0.185*** (0.0382)	–0.254*** (0.0330)	–0.216*** (0.0297)
Clerical support workers	–0.474*** (0.0428)	–0.399*** (0.0334)	–0.397*** (0.0276)	–0.440*** (0.0297)	–0.429*** (0.0369)	–0.449*** (0.0397)	–0.492*** (0.0395)	–0.299*** (0.0424)	–0.392*** (0.0378)	–0.348*** (0.0319)
Service and sales workers	–0.578*** (0.0351)	–0.528*** (0.0278)	–0.462*** (0.0248)	–0.500*** (0.0251)	–0.535*** (0.0324)	–0.545*** (0.0351)	–0.525*** (0.0345)	–0.457*** (0.0384)	–0.518*** (0.0322)	–0.525*** (0.0299)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Skilled agricultural, forestry and fishery workers	–0.447*** (0.0661)	–0.414*** (0.0612)	–0.380*** (0.0521)	–0.427*** (0.0585)	–0.318*** (0.0638)	–0.297*** (0.0680)	–0.378*** (0.0698)	–0.423*** (0.0628)	–0.413*** (0.0686)	–0.438*** (0.0634)
Craft and related trades workers	–0.456*** (0.0344)	–0.364*** (0.0296)	–0.359*** (0.0250)	–0.381*** (0.0249)	–0.450*** (0.0330)	–0.406*** (0.0380)	–0.444*** (0.0355)	–0.382*** (0.0392)	–0.429*** (0.0355)	–0.372*** (0.0324)
Plant and machine operators	–0.510*** (0.0348)	–0.388*** (0.0274)	–0.395*** (0.0247)	–0.432*** (0.0246)	–0.491*** (0.0319)	–0.501*** (0.0339)	–0.484*** (0.0346)	–0.417*** (0.0389)	–0.502*** (0.0342)	–0.431*** (0.0302)
Elementary Occupations	–0.675*** (0.0347)	–0.614*** (0.0329)	–0.630*** (0.0259)	–0.664*** (0.0264)	–0.659*** (0.0310)	–0.664*** (0.0348)	–0.714*** (0.0365)	–0.636*** (0.0391)	–0.651*** (0.0351)	–0.624*** (0.0308)
Armed forces	–0.374*** (0.0622)	–0.402*** (0.0606)	–0.265*** (0.0357)	–0.303*** (0.0644)	–0.296*** (0.0568)	–0.368*** (0.0778)	–0.313** (0.102)	–0.128* (0.0563)	–0.303*** (0.0522)	–0.140** (0.0515)
Industry (reference group: agriculture, forestry and fishing)										
Mining	0.299*** (0.0666)	0.181** (0.0590)	0.214*** (0.0621)	0.178* (0.0721)	0.342*** (0.0688)	0.406*** (0.0726)	0.277*** (0.0777)	0.0761 (0.112)	0.251*** (0.0719)	0.357*** (0.0886)
Manufacturing	0.144*** (0.0374)	0.0232 (0.0422)	0.0696 (0.0362)	–0.0156 (0.0484)	0.0282 (0.0409)	–0.00324 (0.0419)	0.00873 (0.0414)	–0.0664 (0.0375)	0.0191 (0.0417)	–0.0201 (0.0409)
Electricity, gas and water supply	0.194*** (0.0489)	0.0571 (0.0577)	0.103 (0.0571)	0.0915 (0.0595)	0.127* (0.0560)	0.104 (0.0581)	0.136* (0.0675)	0.0536 (0.0539)	0.0786 (0.0568)	0.0975 (0.0599)
Construction	0.172*** (0.0449)	0.150** (0.0475)	0.207*** (0.0403)	0.131* (0.0511)	0.0814 (0.0437)	0.0198 (0.0520)	0.0234 (0.0482)	–0.00497 (0.0445)	0.0704 (0.0466)	0.00204 (0.0481)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Wholesale and retail trade	0.121** (0.0400)	0.0823 (0.0420)	0.101** (0.0379)	0.0569 (0.0498)	0.0368 (0.0424)	0.0542 (0.0451)	0.0282 (0.0459)	–0.0672 (0.0420)	–0.00343 (0.0430)	–0.0177 (0.0434)
Hotels and restaurants	0.111* (0.0445)	0.0628 (0.0524)	0.0898 (0.0474)	–0.0118 (0.0569)	–0.0363 (0.0544)	0.0418 (0.0518)	0.0678 (0.0680)	–0.180*** (0.0478)	–0.0865 (0.0467)	–0.0892 (0.0491)
Transport, warehousing and communication	0.170*** (0.0440)	0.0927* (0.0448)	0.185*** (0.0383)	0.117* (0.0517)	0.113* (0.0449)	0.0987* (0.0462)	0.119** (0.0459)	–0.0131 (0.0435)	0.0906* (0.0453)	0.0435 (0.0435)
Financial intermediation	0.206 (0.161)	0.198** (0.0657)	0.209** (0.0704)	0.158* (0.0747)	0.241*** (0.0646)	0.192** (0.0715)	0.116 (0.0686)	0.0801 (0.0616)	0.200** (0.0762)	0.0979 (0.0705)
Real estate, renting and business activities	0.00534 (0.0484)	–0.00474 (0.0480)	0.0901* (0.0419)	0.00551 (0.0537)	–0.0678 (0.0529)	–0.0441 (0.0521)	0.0572 (0.0578)	–0.105* (0.0474)	–0.0862 (0.0484)	–0.0487 (0.0508)
Public administration and defense	0.190*** (0.0476)	0.110* (0.0504)	0.225*** (0.0443)	0.175** (0.0565)	0.212*** (0.0515)	0.186*** (0.0522)	0.0742 (0.0530)	0.0249 (0.0495)	0.103* (0.0494)	0.168*** (0.0499)
Education	0.0599 (0.0464)	–0.0382 (0.0498)	0.00536 (0.0423)	–0.0534 (0.0534)	–0.0113 (0.0499)	–0.0127 (0.0503)	–0.140** (0.0510)	–0.196*** (0.0480)	–0.160*** (0.0485)	–0.118* (0.0487)
Health and social care	0.0506 (0.0455)	0.0308 (0.0510)	0.0858 (0.0459)	–0.0110 (0.0536)	0.0881 (0.0515)	0.0565 (0.0554)	–0.0498 (0.0562)	–0.0904 (0.0500)	–0.0477 (0.0494)	–0.0140 (0.0506)
Other	0.0403 (0.0530)	–0.0208 (0.0501)	0.0609 (0.0422)	–0.0109 (0.0558)	–0.0418 (0.0617)	0.0108 (0.0613)	–0.0906 (0.0541)	–0.186*** (0.0483)	–0.212*** (0.0512)	–0.101 (0.0544)
Hours	0.00890*** (0.00165)	0.00914*** (0.00204)	0.0112*** (0.00158)	0.00933*** (0.00195)	0.0104*** (0.00259)	0.00964*** (0.00198)	0.00679* (0.00289)	0.00789** (0.00249)	0.0109*** (0.00174)	0.0150*** (0.00207)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Union member	0.0519*	0.0348	0.0196	0.0160	0.0568*	0.0266	0.0211	0.0421	0.0544*	0.0325
	(0.0208)	(0.0200)	(0.0185)	(0.0203)	(0.0232)	(0.0227)	(0.0258)	(0.0268)	(0.0249)	(0.0240)
Constant	5.534***	5.654***	5.619***	5.900***	5.807***	5.770***	5.904***	5.844***	5.801***	5.785***
	(0.0924)	(0.102)	(0.0826)	(0.0995)	(0.125)	(0.103)	(0.132)	(0.120)	(0.0947)	(0.109)
Observations	6219	7935	9159	8779	6860	6357	6901	7768	7977	8314

Source: Estonian Labour Force Survey, author's calculations. Standard errors in parentheses.

Table A. 2. Oaxaca-Blinder decomposition of the gender wage gap, pooled data 2005–2014.

Variable	**Estimate (standard error)**
Ln(wage):	
Men	5.849*** (0.00428)
Women	5.567*** (0.00342)
Unadjusted difference	0.281*** (0.00548)
Explained component	0.113*** (0.00393)
Unexplained component	0.168*** (0.00406)
Contribution to the explained component:	
Age	0.00750*** (0.000648)
Age^2	–0.00382*** (0.000436)
Education	–0.0210*** (0.00147)
Field of study	0.0108*** (0.00258)
Married	0.00260*** (0.000558)
Children	0.0166*** (0.000997)
Region	0.00298*** (0.000905)
Public owned	–0.00190 (0.00173)
Foreign owned	0.000968* (0.000428)
Micro enterprise	0.00296*** (0.000434)
Occupation	0.0315*** (0.00343)
Industry	0.0535*** (0.00325)
Hours	0.0108*** (0.000879)
Union member	–0.000561 (0.000380)
Contribution to the unexplained gap:	
Age	–0.114*** (0.0193)
Age^2	–0.0186*** (0.00530)
Education	–0.00378 (0.00519)
Field of study	–0.0635*** (0.0118)
Married	0.0606*** (0.00831)

Variable	Estimate (standard error)
Children	–0.0116*** (0.00291)
Region	0.00787 (0.00480)
Public owned	0.0291*** (0.00513)
Foreign owned	0.00745** (0.00251)
Micro enterprise	–0.000384 (0.00254)
Occupation	–0.0434*** (0.00850)
Industry	–0.0139 (0.00970)
Hours	0.139* (0.0598)
Union member	0.00180 (0.00130)
Constant	0.192** (0.0668)
Observations	59374

Source: Estonian Labour Force Survey, author's calculations.

Table A. 3. Results of the unconditional quantile regression, 2013 data.

	Percentile				
	10	**25**	**50**	**75**	**90**
Male	0.147** (0.0450)	0.272*** (0.0432)	0.302*** (0.0349)	0.219*** (0.0422)	0.181*** (0.0549)
Age	–0.00381*** (0.000851)	–0.00493*** (0.000883)	–0.00367*** (0.000730)	–0.00178* (0.000763)	0.000672 (0.000927)
Age^2	–0.0177 (0.00959)	–0.0217** (0.00816)	–0.0351*** (0.00510)	–0.0366*** (0.00599)	–0.0511*** (0.00690)
Ethnic Estonian	0.0875*** (0.0255)	0.108** (0.0362)	0.190*** (0.0200)	0.193*** (0.0224)	0.168*** (0.0295)
Primary education	1.547 (0.870)	0.935 (0.480)	0.401 (0.258)	–0.0524 (0.182)	–0.239 (0.164)
Primary education with vocational education or basic education	1.568 (0.861)	1.124* (0.465)	0.520* (0.239)	0.162 (0.167)	–0.0133 (0.152)
Basic and vocational education	1.803* (0.849)	1.116* (0.485)	0.544* (0.253)	0.319 (0.180)	0.113 (0.173)
Secondary education	1.575 (0.859)	1.167* (0.467)	0.655** (0.240)	0.222 (0.167)	–0.00386 (0.151)
Secondary with vocational education	1.792* (0.851)	1.124* (0.489)	0.573* (0.252)	0.253 (0.178)	0.208 (0.180)
Secondary education and vocational education	1.740* (0.850)	1.083* (0.492)	0.593* (0.253)	0.238 (0.176)	0.164 (0.180)
Secondary specialized education after basic education	1.827* (0.850)	1.216* (0.489)	0.605* (0.254)	0.300 (0.178)	0.239 (0.184)
Secondary specialized education after secondary education	1.850* (0.850)	1.212* (0.489)	0.644* (0.253)	0.324 (0.182)	0.204 (0.184)
Bachelor's degree	1.821* (0.850)	1.264** (0.489)	0.769** (0.253)	0.482** (0.183)	0.453* (0.183)
Doctoral degree	1.829* (0.850)	1.265** (0.490)	0.797** (0.256)	0.640*** (0.181)	0.665** (0.204)
Teacher training	0.0301 (0.202)	0.281 (0.164)	–0.0436 (0.0968)	–0.287*** (0.0851)	–0.561*** (0.144)
Arts and humanities	–0.0952 (0.195)	0.137 (0.165)	0.0432 (0.0961)	–0.167 (0.0975)	–0.430** (0.162)
Foreign languages and cultures	–0.153	0.0186	0.0648	0.0536	–0.0898

	Percentile				
	10	**25**	**50**	**75**	**90**
Social sciences, business and law	–0.0839	0.0719	0.174	0.0244	0.0109
Mathematics and statistics	–0.209 (0.199)	–0.0665 (0.173)	0.0314 (0.100)	0.00607 (0.107)	0.0476 (0.190)
Technology, production and construction	–0.167 (0.191)	0.0187 (0.159)	0.0787 (0.0915)	–0.0211 (0.0820)	–0.184 (0.130)
Agriculture, forestry, fishing, veterinary medicine	–0.167 (0.198)	0.00490 (0.171)	0.0920 (0.0968)	–0.0569 (0.0820)	–0.249 (0.142)
Health and recreation	–0.0401 (0.199)	0.237 (0.170)	0.178 (0.104)	–0.0587 (0.0903)	–0.291 (0.149)
Service	–0.162 (0.202)	0.0733 (0.166)	0.0824 (0.0947)	0.0324 (0.0822)	–0.195 (0.128)
Married	0.0203 (0.0252)	0.0305 (0.0286)	0.0845** (0.0309)	0.0911* (0.0368)	0.0339 (0.0537)
Female × married	–0.0156 (0.0344)	0.0452 (0.0397)	–0.0375 (0.0363)	–0.0755 (0.0432)	–0.0963 (0.0665)
Presence of children aged 0…2 in household	–0.0199 (0.0248)	–0.0714* (0.0355)	0.0208 (0.0335)	0.0749 (0.0449)	0.102 (0.0684)
Presence of children aged 3…6 in household	0.00802 (0.0193)	0.0284 (0.0267)	0.0811** (0.0290)	0.0796* (0.0398)	0.193** (0.0645)
Presence of children aged 7…17 in household	–0.0395 (0.0277)	–0.0286 (0.0230)	–0.0102 (0.0246)	0.0641* (0.0325)	0.0842 (0.0498)
Female × Presence of children aged 0…2 in household	0.0243 (0.0474)	0.0447 (0.0703)	–0.0581 (0.0538)	–0.0469 (0.0690)	–0.0363 (0.106)
Female × Presence of children aged 3…6 in household	–0.0549 (0.0346)	–0.0701 (0.0402)	–0.0663 (0.0381)	–0.0428 (0.0488)	–0.106 (0.0820)
Female × Presence of children aged 7…17 in household	0.0842* (0.0371)	0.0344 (0.0354)	–0.0127 (0.0302)	–0.0516 (0.0406)	–0.0416 (0.0672)
Harju, excl. Tallinn	0.0207 (0.0253)	0.0343 (0.0272)	0.0533* (0.0263)	–0.0503 (0.0349)	–0.0694 (0.0442)
Hiiu	–0.0571 (0.0641)	–0.214** (0.0733)	–0.228*** (0.0537)	–0.178** (0.0567)	–0.0755 (0.0716)

	Percentile				
	10	**25**	**50**	**75**	**90**
Ida-Viru	–0.144*** (0.0367)	–0.186*** (0.0368)	–0.126*** (0.0310)	–0.0875** (0.0309)	–0.0804* (0.0369)
Jõgeva	–0.0837 (0.0649)	–0.164** (0.0634)	–0.118* (0.0532)	–0.170*** (0.0461)	–0.190** (0.0597)
Järva	–0.0478 (0.0485)	–0.0381 (0.0446)	–0.0423 (0.0448)	–0.165*** (0.0474)	–0.140* (0.0583)
Lääne	–0.0501 (0.0562)	–0.0684 (0.0804)	–0.238*** (0.0477)	–0.208*** (0.0425)	–0.171*** (0.0482)
Lääne-Viru	–0.104* (0.0519)	–0.144*** (0.0371)	–0.156*** (0.0350)	–0.259*** (0.0441)	–0.274*** (0.0386)
Põlva	0.0307 (0.0487)	0.0674 (0.0503)	–0.186*** (0.0508)	–0.264*** (0.0416)	–0.259*** (0.0404)
Pärnu	–0.141** (0.0484)	–0.175*** (0.0511)	–0.118** (0.0422)	–0.179*** (0.0480)	–0.161*** (0.0435)
Rapla	–0.0509 (0.0528)	–0.0804 (0.0505)	–0.128** (0.0394)	–0.138** (0.0430)	–0.0689 (0.0625)
Saare	–0.0302 (0.0385)	–0.0197 (0.0506)	–0.214*** (0.0391)	–0.220*** (0.0467)	–0.289*** (0.0408)
Tartu	–0.139*** (0.0386)	–0.0951** (0.0327)	–0.102*** (0.0281)	–0.144*** (0.0384)	–0.133** (0.0510)
Valga	–0.159* (0.0716)	–0.188** (0.0621)	–0.239*** (0.0492)	–0.291*** (0.0607)	–0.228*** (0.0453)
Viljandi	–0.0149 (0.0418)	–0.143* (0.0581)	–0.193*** (0.0373)	–0.175*** (0.0359)	–0.123** (0.0424)
Võru	–0.106 (0.0598)	–0.116* (0.0548)	–0.162*** (0.0420)	–0.257*** (0.0406)	–0.134 (0.0683)
Employer is central or local government owned enterprise or institution	0.0167 (0.0360)	0.0124 (0.0325)	–0.00712 (0.0288)	–0.0164 (0.0377)	0.00310 (0.0512)
Foreign owned enterprise	0.0858*** (0.0219)	0.126*** (0.0230)	0.0822*** (0.0205)	0.144*** (0.0243)	0.180*** (0.0370)
More than 10 employees in enterprise	0.205*** (0.0514)	0.208*** (0.0282)	0.142*** (0.0203)	0.0970*** (0.0237)	0.0812* (0.0342)
Professionals	0.0861** (0.0269)	0.0966*** (0.0253)	0.0295 (0.0288)	–0.127** (0.0449)	–0.224* (0.0960)
Technicians and associate professionals	–0.00219 (0.0232)	–0.00470 (0.0280)	–0.0924** (0.0312)	–0.350*** (0.0526)	–0.543*** (0.0986)

	Percentile				
	10	**25**	**50**	**75**	**90**
Clerical support workers	–0.0319 (0.0351)	–0.0694 (0.0512)	–0.298*** (0.0431)	–0.481*** (0.0704)	–0.688*** (0.106)
Service and sales workers	–0.132** (0.0474)	–0.344*** (0.0648)	–0.456*** (0.0339)	–0.535*** (0.0500)	–0.648*** (0.0972)
Skilled agricultural, forestry and fishery workers	–0.186 (0.110)	–0.0990 (0.105)	–0.312*** (0.0760)	–0.406*** (0.0730)	–0.529*** (0.102)
Craft and related trades workers	–0.0516 (0.0292)	–0.0868* (0.0368)	–0.243*** (0.0358)	–0.497*** (0.0587)	–0.702*** (0.103)
Plant and machine operators	–0.0895** (0.0308)	–0.221*** (0.0439)	–0.347*** (0.0343)	–0.549*** (0.0526)	–0.733*** (0.111)
Elementary occupations	–0.517*** (0.112)	–0.636*** (0.0494)	–0.512*** (0.0374)	–0.515*** (0.0476)	–0.622*** (0.0962)
Armed forces	–0.0412 (0.0364)	–0.133* (0.0535)	–0.170* (0.0776)	0.0267 (0.167)	–0.868*** (0.248)
Mining	0.158* (0.0701)	0.271** (0.103)	0.352*** (0.0864)	0.330** (0.111)	0.339* (0.134)
Manufacturing	0.0275 (0.0611)	0.00994 (0.0685)	–0.00307 (0.0502)	0.0442 (0.0450)	0.0628 (0.0453)
Electricity, gas and water supply	0.138* (0.0701)	0.179* (0.0881)	0.192* (0.0800)	0.0978 (0.0736)	–0.0702 (0.0843)
Construction	0.0586 (0.0658)	0.0657 (0.0696)	0.0852 (0.0570)	0.123* (0.0551)	0.137* (0.0581)
Wholesale and retail trade	0.0129 (0.0665)	0.00611 (0.0653)	0.0119 (0.0501)	0.0296 (0.0501)	0.0513 (0.0479)
Hotels and restaurants	–0.177* (0.0898)	–0.123 (0.0863)	–0.102 (0.0601)	–0.0359 (0.0506)	0.0317 (0.0511)
Transport and communication	–0.0137 (0.0587)	0.00420 (0.0747)	0.158** (0.0541)	0.192*** (0.0536)	0.166** (0.0598)
Financial intermediation	0.00627 (0.0668)	–0.00709 (0.0952)	0.249*** (0.0737)	0.195* (0.0897)	0.252 (0.146)
Real estate, renting and business activities	–0.171** (0.0646)	–0.169* (0.0758)	–0.0403 (0.0516)	–0.00276 (0.0522)	0.0327 (0.0593)
Public administration and defense	–0.00892 (0.0571)	0.0450 (0.0847)	0.210*** (0.0594)	0.172* (0.0826)	0.100 (0.0912)
Education	–0.201** (0.0664)	–0.265** (0.0808)	–0.141* (0.0579)	–0.0834 (0.0617)	–0.0597 (0.0698)
Health and social care	–0.0555 (0.0629)	–0.158* (0.0761)	–0.0124 (0.0608)	0.0420 (0.0667)	0.0977 (0.0767)

	Percentile				
	10	**25**	**50**	**75**	**90**
Other	–0.198* (0.0787)	–0.214** (0.0795)	–0.230*** (0.0610)	–0.171** (0.0604)	–0.215** (0.0684)
Hours	0.00316 (0.00189)	0.00188 (0.00196)	0.00645*** (0.00193)	0.0132*** (0.00236)	0.0233*** (0.00434)
Trade union member	0.0806** (0.0251)	0.137*** (0.0348)	0.183*** (0.0304)	–0.0366 (0.0371)	–0.0673 (0.0514)
Constant	3.436*** (0.862)	4.292*** (0.484)	4.944*** (0.256)	5.486*** (0.204)	5.735*** (0.229)
Observations	6826	6826	6826	6826	6826

Source: Estonian Labour Force Survey, author's calculations. Standard errors in parentheses.

Table A. 4. Results of the quantile decomposition, 2013.

	Percentile				
	10	**25**	**50**	**75**	**90**
Contribution of differences in endowments					
Age	0.00259 (0.00283)	0.00794** (0.00262)	0.00775** (0.00241)	–0.00125 (0.00280)	–0.00513 (0.00350)
Age^2	–0.000897 (0.00154)	–0.000678 (0.00117)	–0.000551 (0.000956)	–0.000840 (0.00144)	–0.00101 (0.00174)
Ethnic Estonian	0.000728 (0.000664)	–0.00126 (0.000886)	–0.00301 (0.00174)	–0.00537 (0.00304)	–0.00495 (0.00288)
Education	0.00405 (0.0122)	0.00747 (0.0146)	–0.0240* (0.0114)	–0.0517*** (0.0132)	–0.0584*** (0.0106)
Field of study	–0.0197 (0.0137)	–0.0378* (0.0164)	–0.0270* (0.0132)	0.000719 (0.0152)	0.0289 (0.0168)
Married	0.000879 (0.00167)	0.00107 (0.00169)	0.00381* (0.00163)	0.00224 (0.00205)	–0.000266 (0.00310)
Children aged 0–2 in household	–0.000393 (0.00271)	–0.00111 (0.00256)	–0.00397 (0.00291)	–0.000635 (0.00391)	0.00666 (0.00734)
Children aged 3–6 in household	–0.000858 (0.000623)	–0.000795 (0.000608)	–0.000265 (0.000457)	0.000839 (0.000718)	0.00149 (0.00128)
Children aged 7–17 in household	0.0000205 (0.000520)	–0.00104 (0.000683)	0.000476 (0.000558)	0.000324 (0.000689)	–0.00142 (0.00124)
Region	–0.00241 (0.00233)	0.00219 (0.00283)	0.00507 (0.00303)	0.00276 (0.00353)	0.00171 (0.00390)
Public owned establisment	–0.0126 (0.00737)	–0.00360 (0.00551)	–0.00251 (0.00587)	0.00337 (0.00834)	0.0220 (0.0130)
Foreign owned establisment	–0.00000956 (0.000569)	–0.0000177 (0.000998)	–0.0000121 (0.000703)	–0.0000262 (0.00146)	–0.0000307 (0.00173)
Less than 10 employees	0.00158 (0.000970)	0.00604** (0.00199)	0.00441** (0.00149)	0.00266* (0.00115)	0.00406* (0.00170)
Occupation	–0.0128 (0.0134)	–0.0390* (0.0182)	–0.0462** (0.0165)	–0.0525** (0.0168)	–0.0326 (0.0197)
Industry	0.0304* (0.0133)	0.0439* (0.0175)	0.0477*** (0.0141)	0.0569** (0.0183)	0.0437 (0.0280)

	Percentile				
	10	**25**	**50**	**75**	**90**
Hours	0.0831*** (0.00787)	0.0528*** (0.00511)	0.0366*** (0.00365)	0.0282*** (0.00334)	0.0222*** (0.00387)
Total	0.0736*** (0.0171)	0.0361 (0.0230)	–0.00177 (0.0196)	–0.0143 (0.0219)	0.0268 (0.0318)
Contribution of differences in coefficients					
Age	–0.248** (0.0874)	–0.161** (0.0608)	–0.145** (0.0540)	–0.142* (0.0590)	–0.162 (0.0826)
Age^2	–0.0215 (0.0244)	–0.0184 (0.0166)	–0.0181 (0.0139)	0.0174 (0.0152)	–0.00594 (0.0210)
Ethnic Estonian	0.112** (0.0343)	0.0815** (0.0251)	–0.00517 (0.0231)	–0.0780** (0.0269)	–0.0818 (0.0423)
Education	0.263*** (0.0752)	0.0744 (0.0508)	0.0228 (0.0365)	–0.00412 (0.0345)	0.0224 (0.0390)
Field of study	0.0564 (0.0642)	0.0401 (0.0444)	0.0200 (0.0318)	0.00827 (0.0371)	–0.0747 (0.0575)
Married	0.0206 (0.0321)	0.0374 (0.0227)	0.0324 (0.0210)	0.0224 (0.0239)	0.0898* (0.0366)
Children aged 0–2 in household	–0.000847 (0.00263)	0.000645 (0.00205)	0.00454* (0.00223)	0.00297 (0.00282)	0.00233 (0.00534)
Children aged 3–6 in household	0.0172** (0.00654)	0.0127* (0.00530)	0.00734 (0.00556)	–0.00248 (0.00676)	0.0139 (0.0130)
Children aged 7–17 in household	–0.0188 (0.0117)	–0.0132 (0.00856)	0.00304 (0.00848)	0.0166 (0.0103)	–0.0118 (0.0183)
Region	0.0123 (0.0269)	0.00344 (0.0188)	–0.0102 (0.0162)	–0.0469** (0.0181)	–0.0592* (0.0289)
Public owned establisment	0.0398 (0.0298)	0.0170 (0.0213)	–0.0117 (0.0192)	–0.00127 (0.0240)	0.0569 (0.0423)
Foreign owned establisment	–0.00259 (0.00903)	–0.00178 (0.00723)	–0.000268 (0.00746)	–0.00907 (0.00853)	0.00355 (0.0149)
Less than 10 employees	–0.0384** (0.0134)	–0.00390 (0.00902)	–0.00153 (0.00716)	0.00886 (0.00819)	0.00737 (0.0126)

	Percentile				
	10	**25**	**50**	**75**	**90**
Occupation	–0.0636 (0.0326)	–0.0553** (0.0209)	0.0114 (0.0178)	0.0377 (0.0227)	0.181*** (0.0381)
Industry	–0.0405 (0.0253)	–0.0153 (0.0195)	0.0260 (0.0186)	0.0323 (0.0241)	–0.0748* (0.0353)
Hours	0.0520 (0.213)	–0.248* (0.107)	–0.210** (0.0729)	–0.0627 (0.0704)	–0.00556 (0.127)
Constant	–0.188 (0.290)	0.533** (0.165)	0.537*** (0.122)	0.477*** (0.129)	0.305 (0.205)
Total	–0.0483 (0.0468)	0.283*** (0.0268)	0.264*** (0.0247)	0.276*** (0.0249)	0.206*** (0.0442)
Interactive contribution of endowments and coefficients					
Age	0.0164** (0.00606)	0.0107* (0.00419)	0.00959* (0.00373)	0.00944* (0.00405)	0.0107 (0.00561)
Age^2	–0.000306 (0.000847)	–0.000262 (0.000634)	–0.000258 (0.000578)	0.000247 (0.000590)	–0.0000844 (0.000598)
Ethnic Estonian	–0.00329 (0.00215)	–0.00239 (0.00157)	0.000151 (0.000778)	0.00228 (0.00155)	0.00239 (0.00194)
Education	–0.0549 (0.0284)	–0.0306 (0.0193)	–0.00788 (0.0142)	0.0215 (0.0155)	0.00422 (0.0204)
Field of study	0.0913* (0.0450)	0.0579* (0.0271)	0.0375 (0.0233)	–0.00227 (0.0240)	0.00440 (0.0456)
Married	0.00293 (0.00462)	0.00533 (0.00332)	0.00462 (0.00307)	0.00320 (0.00345)	0.0128* (0.00548)
Children aged 0–2 in household	–0.00148 (0.00459)	0.00113 (0.00358)	0.00793* (0.00390)	0.00518 (0.00494)	0.00407 (0.00934)
Children aged 3–6 in household	0.00192 (0.00128)	0.00142 (0.000985)	0.000818 (0.000812)	–0.000276 (0.000858)	0.00155 (0.00181)
Children aged 7–17 in household	0.00171 (0.00133)	0.00120 (0.000965)	–0.000276 (0.000837)	–0.00151 (0.00117)	0.00108 (0.00184)
Region	0.0126** (0.00486)	0.00815* (0.00362)	0.00365 (0.00319)	0.00207 (0.00334)	–0.00360 (0.00470)
Public owned establisment	–0.0185 (0.0139)	–0.00787 (0.00991)	0.00543 (0.00891)	0.000590 (0.0112)	–0.0264 (0.0197)

	Percentile				
	10	**25**	**50**	**75**	**90**
Foreign owned establisment	0.00000223 (0.000442)	0.00000153 (0.000350)	0.000000231 (0.000351)	0.00000780 (0.000586)	–0.00000306 (0.000720)
Less than 10 employees	0.00576* (0.00271)	0.000586 (0.00142)	0.000230 (0.00112)	–0.00133 (0.00134)	–0.00111 (0.00200)
Occupation	0.0570* (0.0225)	0.0774*** (0.0215)	0.0522** (0.0193)	0.0517** (0.0196)	0.0242 (0.0282)
Industry	0.0920** (0.0288)	0.0268 (0.0229)	0.0211 (0.0197)	–0.0133 (0.0246)	0.0104 (0.0414)
Hours	0.00278 (0.0114)	–0.0132* (0.00582)	–0.0112** (0.00401)	–0.00335 (0.00378)	–0.000297 (0.00679)
Total	0.206*** (0.0428)	0.136*** (0.0311)	0.124*** (0.0276)	0.0743** (0.0285)	0.0443 (0.0491)
Observations	7503	7503	7503	7503	7503

Source: Estonian Labour Force Survey, author's calculations. Standard errors in parentheses.

SUMMARY IN ESTONIAN – KOKKUVÕTE

Uurimusi palkade soolisest ebavõrdsusest Eesti tööturul

Töö aktuaalsus

Meeste ja naiste keskmiste palkade erinevus on indikaator, mida sageli kasutatakse soolise võrdõiguslikkuse hindamiseks. Keskmiste palkade erinevus võib olla tingitud soolisest diskrimineerimisest, aga ka reast muudest teguritest nagu näiteks meeste ja naiste erinevad hariduslikud või tööalased valikud, kas puhtisiklikud või ühiskondlikest mõjudest tingitud. Sooline diskrimineerimine kujutab endast probleemi nii eetilises kui juriidilises mõttes. Sooline palgalõhe ei ole aga aktuaalne üksnes diskrimineerimise kontekstis: laiemalt on olulise soolise palgalõhe esinemine märk sellest, et meeste ja naiste majanduslik potentsiaal on ära kasutatud erineval määral ning et ühtlustumine selles osas tooks potentsiaalset kasu nii üksikisiku kui ühiskonna seisukohalt. Võimalike sekkumismeetmete kavandamine eeldab aga arusaamist sellest, mis teguritest on sooline palgalõhe tingitud.

Kuigi sooline palgalõhe Eestis on väiksem kui 1980. aastate lõpus, on see püsinud kõrgel tasemel taasiseseisvumisaja algusest alates. Aastaks 2013 oli Eurostati metoodika alusel arvutatav sooline palgalõhe Eestis 28,2%, olles kõrgeim Euroopa Liidus ning ületades pingereas järgmise riigi vastavat näitajat 7 protsendipunkti võrra. Sealjuures on tähelepanuväärne, et sooline palgalõhe on kõrgem mitte ainult võrreldes nt Lõuna-Euroopa riikidega, kus meeste ja naiste palkade erinevus võib olla madal tingituna naiste madalamast tööhõivemäärast ja kõrgema teenimispotentsiaaliga naiste suuremast selektsioonist hõivesse, vaid ka Põhja-Euroopa riikidega, kus naiste tööhõive määr on kõrge. Samuti ilmnevad erinevused võrreldes teiste Balti riikidega, kelle lähiajalooline ja majanduslik taust on Eestiga sarnane.

Millega on selgitatav sooline palgalõhe Eestis? Mitmetes varasemates uuringutes on üritatud sellele küsimusele vastust leida hinnates, kui suur osa meeste ja naiste keskmiste palkade vahelisest erinevustest on tingitud erinevustest meeste ja naiste tunnustes nagu nt omandatud hariduse tase ja valdkond, ameti- ja tegevusala jm. On leitud, et suurem osa soolisest palgaerinevusest ei ole meeste ja naiste taustatunnuste erinevusega selgitatav. Noorkõiv *et al.* (1998), uurides tööhõive ja palkade dünaamikat Eestis perioodil 1989–1995, leidis, et kohandatud sooline palgalõhe ehk soo koefitsient võrrandis, mis sisaldab erinevaid inimkapitali ja töökoha karakteristikuid, varieerus vaatlusaluse perioodi jooksul 0,365 ja 0,288 vahel. Rõõm ja Kallaste (2004) kasutasid andmeid ajaperioodist 1998–2000 ning suutsid selgitada ligikaudu kolmandiku soolisest palgalõhest, hinnates selgitamata palgalõhe suuruseks 20–21 protsenti. Anspal, Kraut ja Rõõm (2010) vaatlesid ajaperioodi 2000–2008 ning leidsid, et sõltuvalt kasutatavast meetodist moodustas selgitatav palgalõhe vaid 10–15% kogu erinevusest meeste ja naiste keskmiste palkade vahel. Masso ja Krillo (2011) vaatlesid perioode 2005–2007, 2008 ja 2009 ning leidsid, et sõltuvalt ajaperioodist ulatus meeste ja naiste taustatunnuste erinevustega selgitatav

palgalõhe –10 protsendist 26 protsendini. Christofides *et al.* (2013) suutsid erinevaid meetodeid kasutades selgitada vaid 31–44% soolisest palgalõhest.

Sedavõrd suur mitteselgitatav sooline palgalõhe on probleem, kuna see jätab selgusetuks, mis nähtust see endast kujutab. Teaduskirjanduses tõlgendatakse mitteselgitatavat palgalõhet sageli diskrimineerimisest tuleneva palgalõhena, kuid ei ole kaugeltki selge, et see väljendab palgadiskrimineerimise ulatust. Kuigi on täiesti võimalik, et mitteselgitatava soolise palgalõhe taga võib peituda diskrimineerimine, leidub ka teisi tegureid, mis võivad samuti panustada mitteselgitatava soolise palgalõhe kujunemisse. Näiteks väidavad Anspal, Rõõm ja Kraut (2010), et palgalõhe dekomponeerimiseks tavapäraselt kasutatavates andmestikes on ameti- ja tegevusala mõõdetud ebapiisava detailsusega, mis ei võimalda piisaval määral tagada, et võrreldakse võrreldavate karakteristikutega mees- ja naistöötajaid. Samuti osutavad nad sellele, et üks tegur mitteselgitatava palgalõhe taga võib olla asjaolu, et inimkapitali mudeli üks võtmemuutujaid, tööstaaž, puudub kasutatavatest andmestikest. Käesolevas töös analüüsitakse nende potentsiaalsete täiendavate mitteselgitatava soolise palgalõhe taga peituvate tegurite rolli.

Samuti on erinevad autorid (Anspal, Kraut ja Rõõm 2010, Masso and Krillo 2011) leidnud, et sooline palgalõhe on Eestis varieerunud koos majandustsükliga, suurenedes buumiaastatel ja vähenenud majanduslanguse ajal. Majandustsükli vältel toimuvate muutuste analüüs võib samuti anda täiendavat teadmist soolise palgalõhe tekkepõhjuste kohta.

Uuringu eesmärk, uurimisülesanded ja väited

Käesoleva uurimuse eesmärgiks on hinnata, mil määral varemkasutatutest erinevate hindamismeetodite ja andmete kasutamine aitab paremini selgitada soolise palgalõhe kujunemist Eestis. Konkreetsemalt on uurimuse lähtepunktiks on mõningad probleemsed aspektid selgitatava ja mitteselgitatava soolise palgalõhe hindamisel, mis on ilmnenud varasemates uuringutes ja mida on võimalik adresseerida teistsuguste hindamismeetodite ja andmete kasutamise kaudu.

Üks sellistest aspektidest on vajadus tagada, et soolise palgalõhe dekomponeerimisel ja taustatunnuste arvessevõtmisel võrreldakse mehi ja naisi, kes on võrreldavad. Nagu ülalpool mainitud, võetakse vaatluse alla küsimus, mil määral on soolise palgalõhe suur mitteselgitatav komponent tingitud ebapiisavalt detailsetest andmetest ning mil määral seda vähendaks detailsemate andmete kasutamine. Näiteks kui 1-kohalise ametialade klassifikaatori kasutamisel grupeeritakse tippspetsialistide kategoorias kokku raamatukoguhoidjad ja neurokirurgid, võib õigustatult tekkida küsimus, kas ametikoha karakteristikud on analüüsis adekvaatselt arvesse võetud. Lisaks taustatunnuste mõõtmise detailsusele tekib küsimus ka taustatunnuste erinevate kombinatsioonide rolli kohta – on mõeldav, et tööturuväljundite seisukohast on olulised mitte ainult taustatunnused, vaid nende spetsiifilised kombinatsioonid (nt ametikoha ja tegevusala vms). Samuti on võimalik, et mõned taustatunnuste kombinatsioonid esinevad

erineval määral mees- ja naistöötajate hulgas, mis võib omakorda vähendada nende kahe grupi võrreldavust. Seetõttu on uurimuse üheks alaeesmärgiks analüüsida, mil määral soolise palgalõhe selgitatavus sõltub kasutatavate andmete detailsusastmest ning taustatunnuste kombinatsioone arvessevõtvast analüüsimetoodikast.

Uurimuse teiseks alaeesmärgiks on analüüsida soolise palgalõhe dünaamikat majandustsükli vältel. Sellega seonduvalt on konkreetseks uurimisülesandeks testida hüpoteesi mehhanismi kohta, mis võib viia meeste ja naiste karakteristikute erineva väärtustamiseni majandustsükli erinevates faasides –hüpoteesi, et meeste ja naiste nominaalpalkade allapoole jäikus on erinev. Tegemist on teemaga, mis ei ole leidnud käsitlemist ei varasemas soolist palgalõhet ega nominaalpalkade allapoole jäikust käsitlevas kirjanduses.

Ajaperioodiks, mida uurimus käsitleb, on viimane kümnend ehk aastad 2005–2014.[13] Seega ei vaadelda soolise palgalõhe kujunemist siirdeprotsessi vältel. Ajaperiood on valitud selliselt, et see sisaldaks kõige hiljutisemaid buumi- ja majanduslanguse aastaid.

Uurimiseesmärgi täitmiseks seatud uurimisülesanded ja neile vastavad väited on alljärgnevad:

1. Anda ülevaade soolise palgalõhe peamistest teoreetilistest selgitustest, loomaks raamistiku käesoleva uurimuste tõlgendamiseks;
2. Koostada deskriptiivne analüüs meeste ja naiste olukorra kohta Eesti tööturul, loomaks konteksti empiirilistele uurimustele;
3. Viia läbi soolise palgalõhe dekompositsioon selgitatavaks ja mitteselgitatavaks palgalõheks erinevaid tavapäraseid meetodeid kasutades, toomaks välja nende problemaatilisi aspekte ja motiveerimaks empiirilisi uurimusi;
4. Testida hüpoteesi, et oluliseks teguriks suure mitteselgitatava soolise palgalõhe kujunemisel on ebapiisavalt detailsed andmed ameti- ja tegevusala kohta;
5. Testida hüpoteesi, et oluliseks teguriks suure mitteselgitatava soolise palgalõhe kujunemisel on taustatunnuste spetsiifiliste kombinatsioonide osas mittevõrreldavate mees- ja naistöötajate suur osakaal;
6. Analüüsida, mil määral on mitteparameetrilised dekompositsioonimeetodid tundlikud baaskategooria valiku suhtes, ning pakkuda välja alternatiivne meetod, mis eristaks meeste ja naiste palgaeelist ja palga mahajäämust keskmise palgaga võrreldes;
7. Testida hüpoteesi, et nominaalpalkade allapoole jäikus on meeste ja naiste puhul erinev.

Metoodika ja struktuur

Uurimus koosneb kolmest originaalartiklist (Uurimused I–III), mille seoseid uurimisküsimustega on kirjeldatud allpool. Artiklitele eelneb ülevaade soolise

[13] Nagu allpool kirjeldatud, katab deskriptiivne analüüs 2. peatükis kogu nimetatud perioodi, samas kui kaks empiirilist uurimust (Uurimused I ja II) põhinevad kumbki ühe aasta andmete analüüsil ning Uurimus III 2001–2008 aegrea analüüsil.

palgalõhe teoreetilistest selgitustest (peatükk 1) ning meeste ja naiste tööturuolukorra deskriptiivne analüüs (peatükk 2).

Esimene peatükk annab ülevaate soolise palgalõhe peamistest teoreetilistest selgitusi ning valitud empiirilistest tulemustest. Kuna soolise palgalõhe alane kirjandus on väga mahukas, ei ole eesmärgiks anda sellest ammendavat ülevaadet, vaid kirjeldada peamisi teoreetilisi lähenemisi, mis on relevantsed käesoleva too raames valminud empiiriliste uurimuste seisukohast. Esimene kirjeldatud lähenemine on inimkapitali teoorial põhinev lähenemine, millele pani aluse Mincer (1958). Kuigi inimkapitali teooria selgitusjõud soolise palgalõhe kirjeldamisel on meeste ja naiste inimkapitali tasemete ühtlustudes võrreldes teooria algusaastatega vähenenud, on sellel teoorial põhinevad mudelite spetsifikatsioonid empiirilises töös jätkuvalt kasutatavad ja asjakohased. Samuti on inimkapitali teooria raamistik kasutatav ka lähtekohana teiste teoreetiliste selgituste modelleerimisel: näiteks ka teooriates, mis selgitavad palgaerinevusi diskrimineerimisega, tuleb arvestada mõjumehhanismidega, mis toimivad läbi diskrimineerimise mõju inimkapitali omandamisele.

Teise käsitletud teoreetiliste selgituste grupi moodustavad erinevad diskrimineerimise teooriad, nt maitse-eelistustel põhinev diskrimineerimine (Becker 1957), statistiline diskrimineerimine (Phelps 1972) ning nn "määrimise" efektil põhinev diskrimineerimine (Goldin 2013). Kuigi käesolevas uurimistöös ei käsitleta spetsiifiliselt diskrimineerimise ulatuse hindamist, on taustana oluline kirjeldada diskrimineerimise erinevaid võimalikke vorme ning seda, mis kujutab endast diskrimineerimise empiirilist tõestust ja mis mitte.

Kolmas käsitletud teoreetiliste selgituste grupp koosneb uuematest lähenemistest, mis ei selgita soolisi erinevusi tööturul läbi inimkapitali erineva akumulatsiooni ega diskrimineerimise. Selle asemel keskenduvad need selgitused mittekognitiivsetele karakteristikutele nagu riskikartlikkus, konkurentsialtisus ja sooline identiteet. Kuigi pole veel konsensust selles osas, kas soolised erinevused nende karakteristikute osas on kaasasündinud või tingitud kultuurilisest keskkonnast, on tegu karakteristikutega, mis kujutavad endast potentsiaalset täiendavat selgitust sellele, miks erinevad isikud teevad erinevaid valikuid hariduses ja tööturul, erinevad töösoorituse osas jne. Kuigi praeguse seisuga on suur osa vastavast kirjandusest pigem empiiriline (sealjuures sageli eksperimentaalne) kui teoreetiline ning seos soolise palgalõhega pigem eeldatav kui otseselt hinnatud, on sellest siiski käesolevas töös antud lühike ülevaade, kuna see on relevantne uurimuse III tulemuste valguses. Kuna selles uurimuses leiti, et meeste ja naiste palkade allapoole jäikus on erinev meeste omast, pakub mittekognitiivsete karakteristikute sooliste erinevuste alane kirjandus sellele tulemusele võimalikke tõlgendusvõimalusi.

Teise peatüki eesmärgiks on pakkuda konteksti käesolevas töös sisalduvale kolmele empiirilisele uurimusele, andes deskriptiivse ülevaate meeste ja naiste olukorrast Eesti tööturul. Samuti motiveeritakse empiirilisi uurimusi, demonstreerides suure mitteselgitatava palgalõhe olemasolu, mis jääb järele pärast erinevate Eesti Tööjõu-uuringus kasutada olevate isiklike ja töökoha karakteristikute arvessevõtmist. See tõstatab küsimuse, mil määral mitteselgitatav palgalõhe on

tingitud ebapiisava detailsusega andmetest ameti- ja tegevusala kohta, mis ei võimalda võrrelda võrreldavaid mees- ja naistöötajaid. Peatükis analüüsitakse ka soolise palgalõhe arenguid viimase kümnendi jooksul ja majandustsükli erinevates faasides. Tulemused näitavad, et soolise palgalõhe mitteselgitatav komponent kasvab majanduslanguse ajal, osutades hüpoteesile, et meeste ja naiste palkade allapoole jäikus võib olla erinev. Kasutades uuemaid empiirilisi meetodeid testitakse uuesti ka varasemates uuringutes saadud tulemust, mille kohaselt mitteselgitatava palgalõhe osas ilmneb nn. "klaaslae efekt" ehk mitteselgitatav palgalõhe on suurem palgajaotuse ülemises osas.

Teises peatükis kasutatakse Eesti Tööjõu-uuringu andmeid aastate 2005–2014 kohta ning OECD täiskasvanute oskuste uuringu (PIAAC) andmeid perioodi 2011 lõpp–2012 algus kohta. Meetoditena kasutatakse regressioonanalüüsi, Oaxaca-Blinderi ning Smith-Welchi (1986, 1989) dekompositsioonimeetodeid ning Firpo, Fortini ja Lemieux' (2009) mittetingimusliku kvantiilregressiooni meetodeid.

Kolmas peatükk koosneb kolmest uurimusest:
Uurimus I testib hüpoteesi, et meeste ja naiste keskmiste palkade erinevuse mitteselgitatav komponent võib olulisel määral olla tingitud ebapiisava detailsusega andmete kasutamisest. Samuti võib mitteselgitatavat komponenti mõjutada meeste ja naiste erinev jaotus nende taustatunnuste spetsiifiliste kombinatsioonide lõikes, mis samuti takistab võrreldavate meeste ja naiste palkade võrdlemist. Taustatunnuste spetsiifiliste kombinatsioonide lõikes võrdlemist võimaldab sobitamispõhine hindamismeetod, mida antud uurimuses kasutatakse. Andmetena kasutatakse Statistikaameti Töötasu struktuuri andmestikku 2011. aasta kohta, mis sisaldab detailseid ameti- ja tegevusala andmeid, samuti andmeid tunnipalkade ja haridustaseme kohta.

Uurimus II adresseerib metodoloogilist küsimust, mis tekib Uurimuses I kasutatud sobitamispõhise dekompositsioonimeetodi kasutamisel. Vaatluse alla võetakse meetodi tundlikkus referentskategooria valiku suhtes (st kas analüüsitakse meeste palgalisa võrreldes naistega või naiste palga puudujääki võrreldes meestega) ning uuritakse võimalusi meetodi edasiarenduseks selliselt, et referentskategooria valik ei oleks tulemusi oluliselt mõjutav otsus. Meetodina võetakse lähtepunktiks Ñopo (2008) meetod, mida arendatakse edasi. Modifitseeritud meetodi kasutamist illustreeritakse OECD täiskasvanute oskuste uuringu (PIAAC) rahvusvahelise andmestiku baasil 15 riigi näitel.

Uurimuses III testitakse, kas nominaalpalkade allapoole jäikus on meeste ja naiste jaoks erinev. Selliste erinevuste tuvastamine on hõlpsam majanduslanguse tingimustes, kus surve palgalangetamiseks on tugevam. Seega on palkade allapoole jäikuse sooliste erinevuste tuvastamine oluline palgaerinevuste tsüklilise käitumise selgitamise seisukohast. Kasutatakse Eesti Maksu- ja Tolliameti andmeid aastate 2001–2008 kohta, hõlmates kõik Äriregistris sisalduvate ettevõtete andmed. Meetodina nominaalpalkade allapoole jäikuse erinevuse tuvastamiseks kasutati Kahn'i (1997) histogrammi asukoha meetodit.

Peatükkidele I–III järgneb kokkuvõte.
Ülevaate ülalkirjeldatud uurimisülesannetest, nendega seotud väidetest, tulemustest ning nende paiknemisest uurimistöö struktuuris annab Tabel 1.

Tabel 1. Ülevaade doktoritöö uurimisülesannetest, väidetest ning kasutatavatest meetoditest.

Uurimisülesanne, väide	**Meetod**	**Tulemus**	**Peatükk**
1. Anda ülevaade soolise palgalõhe peamistest teoreetilistest selgitustest	Kirjanduse ülevaade		1
2. Koostada deskriptiivne analüüs meeste ja naiste olukorra kohta Eesti tööturul	Deskriptiivne analüüs		2.2
3. Viia läbi soolise palgalõhe dekompositsioon selgitatavaks ja mitteselgitatavaks palgalõheks	Regressioonanalüüs, Oaxaca-Blinderi dekompositsioon, Smith-Welchi dekompositsioon, Firpo-Fortin-Lemieux' dekompositsioon		2.3
Väide 1: Tööstaaži muutuja väljajätmine spetsifikatsioonist on oluline mitteselgitatavat palgalõhet mõjutav tegur	Oaxaca-Blinderi dekompositsioon	Ei leidnud kinnitust	2.3.2.
Väide 2: Mitteselgitatava soolise palgalõhe juures ilmneb nn. "klaaslae" efekt	Firpo-Fortin-Lemieux' dekompositsioon	Ei leidnud kinnitust	2.3.4.
Väide 3: Tsüklilised muutused soolises palgalõhes on tingitud muutustest mees- ja naistöötajate karakteristikute väärtustamises	Smith-Welchi dekompositsioon	Kinnitatud	2.3.3.
4. Testida hüpoteesi, et oluliseks teguriks suure mitteselgitatava soolise palgalõhe kujunemisel on ebapiisavalt detailsed andmed ameti- ja tegevusala kohta	Ñopo (2008) dekompositsioon		3.1.
Väide 4: oluliseks teguriks suure mitteselgitatava soolise palgalõhe kujunemisel on ebapiisavalt detailsed andmed ameti- ja tegevusala kohta	Ñopo (2008) dekompositsioon	Kinnitatud	3.1.

Uurimisülesanne, väide	Meetod	Tulemus	Peatükk
5. Testida hüpoteesi, et oluliseks teguriks suure mitteselgitatava soolise palgalõhe kujunemisel on taustatunnuste spetsiifiliste kombinatsioonide osas mitte-võrreldavate mees- ja naistöötajate suur osakaal;	Ñopo (2008) dekompositsioon		3.1.
Väide 5: oluliseks teguriks mitteselgitatava soolise palgalõhe kujunemisel on taustatunnuste spetsiifiliste kombinatsioonide osas mittevõrreldavate mees- ja nais-töötajate suur osakaal	Ñopo (2008) dekompositsioon	Ei leidnud kinnitust	3.1.
6. Analüüsida, mil määral on mitteparameetrilised dekomposit-sioonimeetodid tundlikud baaskategooria valiku suhtes, ning pakkuda välja alternatiivne meetod, mis eristaks meeste ja naiste palgaeelist ja palga mahajäämust keskmise palgaga võrreldes;	Ñopo (2008) dekompositsioon ja selle edasiarendus		3.2.
Väide 6: Mitteparameetrilised sobitamispõhised dekompositsiooni-meetodid on tundlikud võrdluskategooria valiku suhtes	Ñopo (2008) dekompositsioon ja selle edasiarendus	Kinnitatud	3.2.
7. Testida hüpoteesi, et nomi-naalpalkade allapoole jäikus on meeste ja naiste puhul erinev	Histogrammi asukoha meetod		3.3.
Väide 7: Nominaalpalkade allapoole jäikus on meeste ja naiste puhul erinev	Histogrammi asukoha meetod	Kinnitatud	3.3.

Analüüsi tulemused

Uurimus I. Sooline palgalõhe Eestis: mitteparameetriline dekompositsioon *(Gender wage gap in Estonia: a non-parametric decomposition)*

Uurimuse eesmärgiks oli hinnata, mil määral Eesti kõrget ja valdavas osas mitteselgitatavat soolist palgalõhet oleks täiendavalt võimalik selgitada, kasutades detailsemaid andmeid ameti- ja tegevusala kohta kui on kasutatud varasemates uuringutes. Varasemates uuringutes on kasutatud väga agregeeritud andmeid, määratledes ametiala 9 või 10 kategooria ning tegevusala 15 kategooria kaudu. See võib tuua kaasa mittevõrreldavate mees- ja naistöötajate võrdlemise ning viia kõrge mitteselgitatava palgalõheni dekompositsioon-

analüüsides. Uurimuse fookus on mees- ja naistöötajate võrreldavusele ka laiemalt kui ainult andmestiku detailsust silmas pidades: kasutatakse ka meetodit, mis tagab mees- ja naissoost töötajate võrreldavuse mitte ainult taustatunnuste, vaid ka nende spetsiifiliste kombinatsioonide osas. Selgitatav ja mitteselgitatav palgalõhe hinnatakse vaid nende töötajate baasil, kelle jaoks leidub vastassoost isikute hulgas identse taustatunnuste kombinatsiooniga võrdlusisik. Kasutati Statistikaameti uuringu "Töötasu struktuur" andmeid 2011. aasta kohta.

Uurimuse peamine tulemus on, et kuigi detailsemate andmete kasutamine aitab mitteselgitatavat palgalõhet vähendada, jääb see ikkagi üpris kõrgeks. Detailseid ameti- ja tegevusala klassifikaatoreid kasutades ning töötajaid kõigi taustatunnuste kombinatsioonide lõikes võrreldes jääb selgitamata palgalõhe ikkagi 16,5 protsendi tasemele.

Kuigi töötajaid, kelle jaoks vastassoost isikute hulgas leidus identse tunnuste kombinatsiooniga võrdlusisik, oli vaid ligikaudu kolmandik töötajate üldarvust, moodustas meeste ja naiste palkade mitteselgitatav erinevus selle grupi hulgas üldisest soolisest palgalõhest (30,6%) veidi enam kui poole. Palgaerinevused nende meeste ja naiste hulgas, kelle jaoks vastassoost võrdlusisikut ei leidunud, ei panustanud sisuliselt olulisel määral soolise palgalõhe kujunemisse.

Soolise palgalõhe dekompositsioon viidi läbi ka erinevate tööturu segmentide ja töötajagruppide kohta (erinevate tegevusalade, ametialade gruppide, haridustasemete ja ettevõtete suurusgruppide lõikes). Tulemused näitavaid märkimisväärseid erinevusi: mitteselgitatav palgalõhe on kõrgem sinikraeliste kui valgekraeliste töötajate hulgas, tegevusaladest kõrgeim töötlevas tööstuses ning haridustasemetest kõrgharidusega töötajate hulgas võrreldes madalama haridustasemega töötajatega. Samuti leiti sarnaselt varasemate uuringutega, et palgalõhe on suurem suurettevõtetes kui mikroettevõtetes. Nende tulemuste tõlgendamine ja põhjuste väljaselgitamine väärib käsitlust tulevastes uuringutes.

Uurimus II. Mitteparameetriline dekompositsioon ja võrdlusgrupi probleem *(Non-parametric decomposition and the reference group problem).*

Selles uuringus vaadeldakse uurimuses I kasutatud mitteparameetrilise sobitamispõhise dekompositsioonimeetodi (Ñopo 2008) omadusi. Nagu ka Oaxaca-Blinderi meetod ja sellega seotud parameetrilised meetodid, on see meetod tundlik võrdlusgrupi valiku suhtes. Parameetriliste meetodite puhul on see küsimus kirjanduses pälvinud palju tähelepanu (nt Cotton 1988, Neumark 1988, Oaxaca and Ransom 1994), mitteparameetriliste meetodite puhul aga mitte.

Uurimuses kasutatakse rahvusvahelist OECD täiskasvanute oskuste uuringu andmestikku OECD's (PIAAC) ning demonstreeritakse, et võrdlusgrupi valik mõjutab dekompositsiooni tulemusi oluliselt ning võib mõningatel juhtudel viia vastupidiste järeldusteni mitteselgitatava palgalõhe suuruse ja märgi osas.

Uurimuses pakutakse välja Ñopo meetodi edasiarendus, mis on analoogne Neumark (1988) või Oaxaca ja Ransomi (1994) meetoditele, kuid sobitamispõhine. Selle kohaselt dekomponeeritakse palgalõhe mitte selgitatavaks ja mitteselgitatavaks komponendiks, vaid meeste ja naiste palkade selgitatavateks ja mitteselgitavateks erinevusteks üldisest keskmisest palgast. Teiste sõnadega

on võrdluskategooriaks keskmine palk, mille suhtes hinnatakse meeste ja naiste palgaeelist või palga mahajäämust.

Sisuliselt tekib võrdlusgrupi probleem antud juhul asjaolust, et täppis-sobitamise korral jaotub valim väikesteks lahtriteks, mis sisaldavad identsete tunnuste kombinatsioonidega mehi ja naisi. Nende lahtrite sees võivad aga meeste ja naiste osakaalud olla väga erinevad. Sellises olukorras sõltuvad mitteselgitatava palgalõhe hinnangud sellest, kas lahtrid kaalutakse kokku mees- või naistöötajate arvude baasil. Näiteks kui lahtris on üks mees- ja kümme naistöötajat ning meestöötaja palk on kõrgem, sõltub selle lahtri panus mitteselgitatava palgalõhe hinnangusse sellest, kas seda käsitletakse kui palga-diskrimineerimist kümne naistöötaja suhtes või ühe meestöötaja ülemaksmist. Kui pole objektiivset infot n-ö objektiivselt "õige" palgataseme kohta, pole ka *a priori* reeglit, kumb valik oleks õigem – sisuliselt tegu võib olla nii ühe või teise situatsiooni või nende kahe kombinatsiooniga. Võrdluskategooriana üldise keskmise palga kasutamisel on aga see eelis, et see toob nähtavale asümmeetria meeste mitteselgitatava palgaeelise ja naiste palga mahajäämuse vahel, peegeldades lahtritesisest tasakaalustamatust.

Väljapakutavat sobitamispõhise dekompositsioonimeetodi edasiarendust illustreeritakse 15 OECD riigi näitel PIAAC andmeid kasutades. Tulemused kinnitavad ka empiiriliselt meetodi asjakohasust, näidates riigiti suurt varieeruvust meeste ja naiste selgitatava ja mitteselgitatava palgaerinevuse asümmeetria osas. Eesti puhul varieerub meeste palgaeelis keskmise palgaga võrreldes sõltuvalt mudeli spetsifikatsioonist 17% ja 23% vahel, naiste palga mahajäämus keskmisest palgast 12% ja 19% vahel (protsendina keskmisest palgast).

Uurimus III: Palkade allapoole jäikus ja sugu (*Downward nominal wage rigidity and gender*)

Uurimuses testitakse, kas eksisteerib soolisi erinevusi meeste ja naiste palgalangetuste aktsepteerimise tõenäosuses. See küsimus on relevantne kahe uurimisvaldkonna – soolise palgalõhe ja palkade allpoole jäikuse – seisukohast. Küsimust, kas ja mil määral nominaalpalgad on allapoole jäigad, on uuritud palju, kuna tegemist on makroökonoomika ja majanduspoliitika seisukohast olulise küsimusega. Vähem on tähelepanu pälvinud küsimus, mil määral palkade allapoole jäikus erineb erinevate töötajagruppide lõikes ning soolisi erinevusi palkade allapoole jäikuses teadaolevalt varem käsitletud ei ole.

Uuringus kasutatavaks meetodiks on Kahn'i (1997) histogrammi asukoha meetod. See põhineb ideel, et nominaalpalga langetamise juhtumeid esineb tõenäolisemalt madala kui kõrge inflatsiooni tingimustes (sest kõrge inflatsiooni korral on reaalpalka võimalik langetada ka nominaalpalka langetamata). Sellest järeldub, et nominaalpalkade jäikust on võimalik testida, võrreldes palga-muutuste jaotusi madala ja kõrge inflatsiooni tingimustes: jäikuse puudumise korral ei tohiks olulisi erinevusi histogrammi kujus olla.

Andmetena kasutatakse Maksu- ja Tolliameti andmeid kõigi Äriregistris sisalduvates ettevõtetes hõivatute kohta aastatel 2002-2008. Periood hõlmab seega nii kõrge inflatsiooniga buumiaastaid kuni 2007 ning sügava majanduslanguse aastat 2008.

Tulemustest nähtub, et naised aktsepteerivad palgalangetust tõenäolisemalt kui mehed. Samuti selgub, et töötuse määra kasvades naiste palkade allapoole jäikus väheneb, meeste puhul aga sellist efekti ei ilmne. Meeste nominaalpalgad on allapoole jäigemad kui naiste omad ning see jäikus varieerub tsükliliselt vähem kui naistel.

Sellele efektile võib olla erinevaid selgitusi. Näiteks võib töise tulu summa langus olla tingitud pigem tööaja vähendamisest kui palgamäära langetamisest. Samas ei näita Tööjõu-uuringu andmed soolisi erinevusi tööaja vähenemises vaatlusalusel perioodil. Teine võimalus on, et naised töötavad enam tegevusaladel, mida majanduskriis mõjutas rohkem. Tööjõu-uuringu andmed näitavad aga, et pigem töötavad mehed suurema tõenäosusega kui naised majandustsüklist enam mõjutatud tegevusaladel.

Üks võimalik selgitus on see, et naiste suurem tõenäosus pigem aktsepteerida palga langetamise ettepanekut kui kõrgemat koondamisriski peegeldab soolisi erinevusi mittekognitiivsetes karakteristikutes nagu riskikartlikkus. Kuigi seda hüpoteesi ei olnud kasutada olevate andmete baasil otseselt testida, on see kooskõlas nii uuringu tulemustega kui varasemate eksperimentaaluuringute tulemustega.

Soovitused edasisteks uuringuteks

Nii käesolevast kui varasematest uuringutest on tulnud välja mitmeid aspekte, mis väärivad sügavuti edasi uurimist. Näiteks selgus uurimusest I, et eksisteerivad suured erinevused mitteselgitatavas palgalõhes ametialade, haridustasemete ning ettevõtete suurusgruppide lõikes. Samuti erineb sooline palgalõhe märkimisväärselt regiooniti. Millest sellised erinevused tingitud on, väärib täiendavat analüüsi.

Uurimuse III tulemuste üks tõlgendusvõimalus on, et meeste ja naiste nominaalpalkade erinev allapoole jäikus on tingitud soolistest erinevustest mittekognitiivsetes karakteristikutes, nt riskikartlikkuses. Uurimuses kasutatud andmestik ei võimaldanud aga selle hüpoteesi testimist. Täiendavat analüüsi väärib küsimus, kas ja mil määral on soolised erinevused mittekognitiivsetes karakteristikutes seotud tööturuväljunditega, sh palkade erinevustega.

Ka käesolevas uurimuses läbi viidud dekompositsioonide tulemusena jäi soolise palgalõhe mitteselgitatav komponent kõrgeks. Kuigi üks võimalik tõlgendus sellele komponendile on omistada see diskrimineerimisele, ei võimalda käesolevas uuringus kasutatud andmed välistada muid põhjuseid. Diskrimineerimine kui üks võimalik soolise palgalõhe põhjus väärib seetõttu jätkuvalt käsitlemist tulevastes uuringutes.

Käesolevas uurimuses ei adresseeritud otseselt küsimust, miks Eesti sooline palgalõhe on kõrge rahvusvahelises võrdluses. Selline küsimusepüstitus toob kaasa ka küsimuse riigiti erinevate tööturu- ja muude institutsioonide mõju kohta palkade soolisele erinevusele. Seetõttu oleks oluline analüüsida soolise palgalõhe põhjuseid ka sellest vaatenurgast.

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