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BACHELOR THESIS

Measuring and explaining the extent of occupational gender segregation

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Bibliographic note

Abstract

Occupational gender segregation is one of the most visible characteristics of labour markets all over the world, the Czech Republic is not an exception. In 2013 more than 57% of employed men or women would have to change their job so that the proportion of each gender could be the same in each occupation. The measure increases to 60.19% when housework is treated as another occupation. Moreover, men are often almost completely isolated from women – more than 18% of them work in an occupation with less than one percent of female colleagues. Unexpectedly, the youngest cohorts in the sample experience higher segregation than men and women in their thirties and forties. In the second half of the thesis occupations are characterised by their demanded abilities and work styles, contexts, values and interests (utilizing the O*NET database). It is tested which of these characteristics actually matter for the concentration of men or women in an occupation. Altogether, eighteen characteristics proved significant. The most surprising result is that higher demanded levels of mathematics and memorization attract the opposite gender than is assumed in the literature.

| **Keywords** | Occupational gender segregation, Characteristics of occupations, Biological differences, Stereotypes, Czech Republic |

Abstrakt

Genderová segregace v zaměstnání je jednou z nejviditelnějších charakteristik trhu práce po celém světě, Česká republika není výjimkou. V roce 2013 by více než 57% všech žen nebo všech mužů muselo změnit práci, aby mohl být poměr obou pohlaví stejný v každém zaměstnání. Pokud přidáme péči o děti a práci v domácnosti mezi ostatní povolání, muselo by se přemístit více než 60% žen nebo mužů. V porovnání s ženami jsou navíc muži na trhu práce více izolováni – 18% z nich pracuje v zaměstnání s méně než jedním procentem žen. Proti všem očekáváním jsou navíc nejmladší kohorty vystaveny silnější segregaci než generace dnešních třicátníků a čtyřicátníků. V druhé polovině práce jsou zaměstnání charakterizována podle toho, jaké vyžadují schopnosti a způsoby, v jakém se odehrávají kontextu, či jaké jsou jejich zájmy a hodnoty (s využitím databáze O*NET). Celkem 18 z těchto charakteristik prokázalo statisticky významný efekt na výsledný poměr mužů a žen v jednotlivých zaměstnáních. Nejpřekvapivějším výsledkem je fakt, že vyšší nároky na matematické uvažování zvyšují koncentraci žen, zatímco schopnost zapamatovat si větší množství informací zdá se straní mužům.

Klíčová slova   Genderová segregace v zaměstnání, Charakteristiky zaměstnání, Biologické rozdíly, Stereotypy, Česká republika

Declaration of Authorship

The author hereby declares that he compiled this thesis independently, using only the listed resources and literature. The author hereby declares that all the sources and literature used have been properly cited. The author hereby declares that the thesis has not been used to obtain a different or the same degree.

Prague, February 15, 2017

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Signature

Acknowledgments

Bachelor Thesis Proposal

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Proposed topic	Measuring and explaining the extent of occupational gender segregation

Preliminary topic characteristics Occupational gender segregation (or the tendency of men and women to be concentrated in different occupations) is one of the topics discussed heavily in connection with discrimination on the labour market and the role of men and women in the economy in general. It is understood to be one of the determinants of the wage gap between man and women. In my thesis segregation will be approached from the perspective of characteristics of the (most segregated) occupations. After reviewing how occupation gender segregation is analysed in the literature, data from 2013 will be used to measure and interpret the extent of it in the Czech Republic. Subsequently, it will be examined how certain jobs characteristics (which could be said to be connected more easily with a specific gender) influence segregation. The goal is to analyse what proportion of segregation in the Czech Republic can be attributed to occupations with high requirements on specific skills or abilities (such as muscle strength, mathematical reasoning etc.), which are typically on a higher level among men or women, or specific working conditions (such as hazardous environment etc.).

Occupational gender segregation in the Czech Republic will be analysed using the SILC data from 2013 and measured by the standard Index of dissimilarity (Duncan & Duncan, 1955). Characteristics of occupations will be taken from the occupational dictionary O*NET and adjusted on the ISCO-88 classification of occupations.

Outline

1. Literature review – methods and explanations
2. Measuring occupational gender segregation for 2013 in the Czech Republic
3. Occupational characteristics as explanatory factors
4. Conclusion

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Chapter 1

Introduction

One of the most persistent features of the labour market is the tendency of men and women to be employed in different occupations - usually described by the term occupational gender segregation. Unlike gender pay gap, lower labour force participation of women or the disproportionate representation in politics, management or academia, occupational gender segregation in the EU does not seem to follow a declining trend (Bettio & Veraschchagina, 2009). Moreover, it is more complicated than the other gender issues. Its horizontal component does not necessarily have only negative implications in the labour market and in some cases the fact that there are more men or women in an occupation can have a purely natural and rational explanation (for example a wet nurse can hardly be a career for men). On the other hand, it can be a representation of irrational stereotypes, caused by discrimination of men or women in certain jobs or ostracism of the minority. It is therefore clear that to evaluate occupational gender segregation, we need to analyse its causes. This thesis aims to quantify the extent of gender segregation in the Czech Republic and investigate the link between characteristics of occupations and the percentage of men and women in these occupations. The Occupational Information Network (O*NET) database is used to characterize occupations in terms of their demand for abilities and personality traits, their work contexts, interests and values. The results can guide politicians who want to reduce gender segregation to target their effort to specific differences or stereotypes. In addition, it should provoke further research on reasons why a specific job characteristic does or does not have the expected effect on the labour market.

The thesis is divided into two chapters. Chapter 2 introduces the concept of occupational gender segregation and summarizes the main empirical findings

about it. In the second half of the chapter, the status of men and women in the Czech labour market is characterized and finally occupational gender segregation is quantified with the use of the index of dissimilarity. Chapter 3 aims to dig deeper into the causes of gender segregation. Firstly, the main theoretical findings are put together into one scheme. One of the conclusions is that no matter what the root sources, a necessary precondition of occupational gender segregation is that occupations (as well as genders) must differ in their characteristics. The last section aims to test what job characteristics matter in today's labour market. Various demanded abilities, work values, contexts and styles are tested. The results bring several surprising conclusions that are a clear call for more thorough research of the sources of occupational gender segregation.

Chapter 2

Describing occupational gender segregation in the Czech Republic

2.1 Motivation and literature

2.1.1 Introducing the concept of occupational segregation by gender

One of the most visible as well as most persistent characteristics of the market for labour is that men and women tend to be concentrated in different occupations. This general tendency can be summarized under the term *occupational gender segregation*[1].

To assess its practical consequences it is convenient to distinguish (at least theoretically) its horizontal and vertical component. Horizontal segregation describes the under/over representation of a given group in occupations not ordered by any qualitative criterion. On the other hand, vertical segregation describes the situation when men and women are disproportionately distributed in occupations ordered by a chosen desirable attribute. This is most typically pay, but possibly also prestige or power. One of the questions discussed in the literature is then whether the segregation we observe is only of the horizontal

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[1] This is an established term. Nonetheless, the word segregation might cause substantial confusion in this context. In common language the word can have negative connotations of forcing individuals to separate in different groups (as for example with racial segregation under the apartheid regime in South Africa). However, in discussions about labour markets it is used to describe situations of disproportional concentration according to a given characteristic without necessarily implying any involuntary or irrational behaviour of market participants. A good example may be the discussion about segregation according to hours of work in Sparreboom (2014).

nature or whether "men's work, whatever it is, tends to be most highly regarded in most societies, and that highly regarded work seems to be reserved for men" (Epstein, 1970, p. 162). This distinction obviously opens up the debate about choosing the desirable criterion. Moreover, it is questionable whether it is even possible to rank all occupations or just those where the order is visible in real life interactions (such as with doctors and nurses). Sometimes this hierarchical component can be distinguished from vertical segregation as a separate category. This is a situation when men and women are concentrated on different parts of the hierarchical ladders within occupational groups (Bettio & Veraschchagina, 2009, p. 30).

The above presented categorization points to an important clarification. Although they are often discussed together, occupational gender segregation must be distinguished from gender inequality (as stressed out e.g. by Anker (1997)). This is especially important since various factors or external shocks can have opposite effects on the two phenomenons. For example the boom of the service industry in the twentieth century created new opportunities for women entering the labour market, since some of the booming jobs made it possible to utilize skills possessed by housewives. While these possibilities suppressed wealth inequalities between men and women, they also facilitated occupational gender segregation (Semuonov, 1999). Whether occupational gender segregation is a symptom of gender inequality depends crucially on what actually caused the disproportionate concentration. A great deal of possible causes and their interactions is discussed in the literature. They are a subject of a separate subsection in Chapter 3. As a result, there is an ongoing debate about the possibility of women being "equal, but separate" (Charles & Bradley, 2002) in the labour market. This also brings up the question of whether we can speak of a specific group being segregated (typically women), or whether occupational gender segregation should be analyzed symmetrically to both sexes. Since the latter seems to be the trend, it will also be the approach of this thesis. However, sometimes it is apparent that not all phenomena related to occupational gender segregation can be understood as completely symmetric.

Segregation and inequality are often discussed together, because segregation is understood to actually facilitate some of the unequal outcomes of men and women in the labour market (Sparreboom, 2014). When men and women work separately (performing different tasks for different employers), their negotiations regarding wage and other job parameters are also more independent. Therefore if there is a systematic tendency of female wages to be lower than

wages of men (which is not caused by difference in productivity and is therefore an inefficiency on the labour market), occupational gender segregation helps to protect the status quo. Segregated labour market is an environment, where the pressure to close the gender pay gap is much weaker. In addition, if it is more difficult for men or women to access certain occupations, this mechanism limits their individual choice. Even with zero effect on pay gap, occupational gender segregation decreases workers' utility by leaving them with lower variety of careers to pick from. Last but not least, systematic fragmentation of occupations between men and women interferes with an efficient functioning of the labour market. It makes the market less flexible. The demand for certain categories of jobs can change rapidly in time (because of a new technology available or a change in the consumer demand structure) and distribution of men and women needs to adjust. When the shift in demand on the labour market occurs, excluding part of the labour force from access to occupations reduces the pool of talent. As a result, it is almost inevitable that labour and skill shortages take longer to be resolved. The situation would be most severe in strongly sex-typed occupations. European Commision's Expert Group on Gender and Employment analyzed in which occupations this is a real danger for the EU in the foreseeable future. The results suggest that significant shortages are expected in both male and female dominated occupations. Only female dominated occupations will be most probably in demand of low skilled labour, while male dominated occupations will seek high skilled workers (Bettio & Veraschchagina, 2009, p. 55). To sum up, even if the distribution of men and women over occupations was perfectly efficient today, occupational gender segregation might cause significant dynamic inefficiencies in the future. However, it would be nearsighted to interpret occupational gender segregation as purely harmful to women (or men). As a labour market rigidity, it can keep outcomes from being efficient. On the other hand, it can sometimes shield certain vulnerable groups from harmful effects of negative external shocks. For example, concentration of low skilled women in public sector service jobs protected some of them from layoffs during the 2008 crisis (Burchel *et al.*, 2014).

Men and women tend to be disproportionately concentrated not only in different occupations, but also in other categories describing the labour market outcomes. Therefore we speak also about segregation according to sectors of the economy, employment contracts, hours of work or workplaces (Burchel *et al.*, 2014). Whether segregation should be analyzed primarily on the occupational or rather on the sectoral level depends mostly on our belief about

how employment decisions are made. It seems that people primarily care about what occupation they have rather then in which sector they work. The reason is that tasks performed in a job are usually closer within occupations than within sectors (for example office clerks can quite easily find a job in many sectors, but it is not easy to switch from a an IT specialist to a payroll accountant within one firm) (Bettio & Veraschchagina, 2009). Therefore it seems reasonable to focus on the occupational structure.

To assess the extent of occupational gender segregation in the Czech Republic, we must choose an appropriate measure. To do that, it is necessary to define, what is understood by zero segregation. There are two conflicting approaches (Burchel *et al.*, 2014). The first understands segregation in absolute terms. An occupation is completely integrated, if half of the workers are men and half are women. However, this interpretation is rather inconvenient if the two groups are of a different size. Then the zero segregation level could never be attained[2]. The second and most frequently used approach is to understand segregation as relative – zero occupational segregation means that in each occupation the proportion of men and women is the same as in the whole labour force (or as in the whole employed population). Most measures are based on this definition. Despite its convenience for groups of a different size, this understanding of zero occupational segregation might lead to some counterintuitive results. Let us imagine two economies – one has a very low participation rate of women (most of them are taking care of households), in the other all the additional women are employed in completely segregated female dominated occupations. The percentage of women in most of the occupations is exactly the same in both economies. However, the second one will look much more segregated according to the measures based on the relative definition of zero segregation. It is therefore crucial to understand that almost all measures of occupational gender segregation capture only the segregation within the working population in the labour market. They omit entirely the preceding process of sorting between housework and paid jobs.

The most frequently used measure is the Index of Dissimilarity (ID) (Duncan & Duncan, 1955) given by the formula[3]:

$$ID = \sum_{i=1}^{k} |M_i/M - F_i/F|/2$$

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[2]And so it is almost never used for other categories than gender, such as race or religion.

[3] Where k is the number of occupations, M_i is the number of men working in an occupation i and M is the total number of working men (symmetrically for women).

ID ranges from 0 to 1. Multiplied by one hundred it can be interpreted as a percentage of men (or women) who would have to change their occupation, so that there would be zero (relative) segregation. As was already mentioned, the advantage of such measure is that it can be used to compare levels of segregation in economies with different proportions of men and women currently employed. However, when tracking the trends in time, it seems quite sensitive to the participation rates (Blackburn *et al.*, 1995). Moreover, the index of dissimilarity is very sensitive to the occupational classification and the level of disaggregation used. In general, every aggregation of occupational categories hides some segregation. By combining male and female dominated tasks in one occupational category, it underestimates the level of segregation in an economy. Increasing the level of aggregation magnifies the extent of such measurement error. By definition ID cannot increase when occupations are more aggregated. On the other hand, it is a very convenient measure, because of its intuitive interpretation. To conclude, the index of dissimilarity seems to be an appropriate measure of determining the extent of occupational gender segregation in an economy, but other possibilities should be considered when trying to explain cross-country difference or changes in time.

To deal with some of the weaknesses of ID, other measures were suggested. The IP index proposed by Karmel & Maclachlan (1988) and used recently by Bettio & Veraschchagina (2009) is algebraically similar to the ID (and therefore also shares its weaknesses being even more explicitly dependent on women employment rate). It is interpreted as the share of employed population, who would have to change occupations in order to bring about zero relative segregation. It ranges from zero to twice the male share of employment multiplied by the female share. The maximum 0.5 is possible only when the number of men and women employed is the same. Other indices include Hakim's *Sex ratio* or *Somer's D* (Bridges, 2003), the τ measure which allows for more than two groups (Baunach, 2002) and the method of *marginal matching* (Blackburn *et al.*, 1995). Some of the authors decide to avoid indices altogether and employ softer descriptions of the labour market, such as defining male and female dominated occupations and observe how they grow or shrink over time (Baunach, 2002). Burchel *et al.* (2014) define three categories – female and male dominated as well as mixed occupations (between 40% and 60% of women) – and observe the outcomes of men and women in them. One of the advantages of such approaches is the flexibility of switching between absolute and relative definitions of segregation. Measures of OGS are often complemented by anal-

ysis of related phenomena, such as concentration and isolation. Concentration on the labour market happens when many men or women are employed in relatively few occupations. Moreover, if the two groups are not of the same size, it can happen that part of the labour force is completely isolated from the other gender. Isolation can be measured as a probability that a man shares his occupation with a woman (or the other way around) and concentration can be described as a proportion of men or women who would have to change occupations to be evenly distributed across categories (Baunach, 2002). It is crucial to notice that unlike segregation neither of the phenomena is symmetric. With the same level of segregation, one gender can be more isolated or more concentrated than the other. Some authors also try to measure the vertical component of segregation by ranking occupations according to wage, education or prestige (e.g. by the *Index od net differences* in Semuonov (1999)).

2.1.2 Empirical findings about occupational gender segregation

As other phenomena describing the interaction of men and women in the labour market, occupational gender segregation has been changing rather dramatically in the modern history. As for now, we restrict ourselves to the USA and Western Europe, since there the process is most thoroughly described. Although it is expected that there has always been division of labour between men and women, it makes little sense to speak about occupational segregation before a formal labour market is developed. This process started with the industrial revolution. Preston (1999) describes how industrialization created many new jobs, which became either predominantly male or predominantly female very quickly. The first formal measures she reports are from 1870 to 1900 and they show a rapid decline in the late nineteenth century. However, this decline might be rather artificial. When women started to work as factory workers, indices of segregation decreased. But that does not mean that men and women were working together. It seems that most of the factories were strictly segregated and some sectors (such as textiles) were female dominated while others were occupied by men (Preston, 1999). This example points back to the discussion of sectoral versus occupational segregation and shows, how sectoral differences within occupations can becloud the picture.

Most studies start with the beginning of the twentieth century and they conclude that occupational gender segregation changed very little between 1900

and the 1970s (e.g. Reskin, 1993). This happened despite the fact that the rate of women participating in the labour force increased significantly during the world wars. However, after the wars were over, participation rates dropped again and the level of segregation remained stable (with ID around 67 as computed by Preston (1999) and Reskin (1993)). On the other hand, after the late 1960s, which marked the beginning of what is sometimes called the second wave of feminism, the situation changed rapidly. Women labour force participation rates increased (including now also married mothers) and women started to enter previously male dominated occupations (Blau, 2013). However, there seems to be a significant slowdown of desegregation in the 1980s and especially after 1990 (Reskin, 1993).

The explanation behind such dynamic changes lays in the way how desegregation in the 1970s took place. Firstly, the process was triggered primarily by women entering male dominated occupations (not the other way around). With low participation rate of women, most occupations are male dominated and segregation is decreased more easily. There is a lot to choose from. Naturally, women entered occupations that were closest to what they have been doing as housewives – white-collar and clustered in the service sectors. Blue-collar jobs (e.g. in construction) stayed segregated. However, when additional women were joining the labour force, they were not entering male dominated occupations anymore. The service sector (especially care taking or educating jobs) were already dominated by women. Therefore by joining such professions, women were actually increasing segregation. Charles (2005) describes how jobs that were "functionally and symbolically similar to women's traditional domestic activities" became "pink-collar" in the late twentieth century and created sometimes strictly segregated occupational ghettos.

When analyzing changes segregation, two forces might be the reason. Firstly, current occupations might hire higher or lower proportions of employed men compared to the proportion of employed women (here we see how increased labour participation might affect the measure without most occupation actually hiring or laying off). Secondly, segregated or integrated occupations might employ higher or lower shares of the labour force. Even if construction stays male dominated, segregation can decrease if construction becomes less important. Both of the streams are behind the decline in measures of OGS in the 1970s. Service occupations were desegregating as well as booming (Blau, 2013). Nevertheless, once those occupations started to resegregate again (only this time they were female dominated), further boom of the service industry was

pushing segregation indices up. This might be at least a partial explanation of why empirical cross-country studies find a positive link between occupational gender segregation and economic development (Blackburn *et al.*, 2002) or technical progress (Racko & Burchell, 2013). In such discussions, it is especially important to distinguish occupational gender segregation from gender inequality.

The description above holds also for the European Union after 1992. Bettio & Veraschchagina (2009) report that between 1992 and 2000 segregation stagnated on average at the EU-15 level, and even increased slightly between 2000 and 2007 in the EU-27. In addition, segregation is stronger in Nordic countries (such as Finland) and some of the post-socialist countries (such as the Baltics, Slovakia, Hungary and Bulgaria). On the other hand, the seemingly least segregated countries are in Southern Europe (Greece, Romania, Malta and Italy). This might be quite surprising, since Scandinavian countries are usually regarded as having the most equal environment for men and women.

The division in Europe brings additional insight. Not only are often more developed countries also more segregated. But also countries, were the position of women is closer to the position of men in terms of pay and especially labour force participation, seem to be more segregated. Even though it seems reasonable to expect that more liberal values, low levels of fertility and an achievement-based system should push segregation and inequality in the same direction. Empirically observed positive relationship between segregation and labour force participation has been tested many times in the literature. Charles (1992), Sparreboom (2014) and Bettio & Veraschchagina (2009) confirm it, while Preston (1999) claims that it holds only in the short-run, but in the long run the relationship is negative. Racko & Burchell (2013) show that the positive link holds only for industrialized countries. The explanations point to the mechanism already mentioned above. Some of the housework and other services performed in the past often by women are in the process of marketization and professionalization. Women entering the labour force who would otherwise stay at home are hired primarily in such occupations and the measures of segregation increase, while the labour force participation increases as well (Charles, 2005). Some of the authors speculate about other mechanisms, such as men leaving routinized tasks for better jobs and women filling those low skilled positions (Charles, 1992), or social policies such as paid maternity leave which encourage women to enter the labour market while discouraging firms to hire women for high level occupations (Sparreboom, 2014). The question

remains whether there is a policy trade-off between encouraging labour force participation of women and decreasing segregation, or whether the boom in services is an omitted third factor.

Closely related is the observed link between percentage of part-time contracts and gendering of occupations. Part-time jobs are more common among women than among men. Moreover, part-time jobs are mostly female dominated and part-timers mostly work in female dominated jobs. This holds also for men with the exception of a few blue-collar occupations (Burchel *et al.*, 2014). The question is whether in some occupations it is intrinsically easier to offer part-time contracts and this attracts women, or whether occupations are female dominated for other reasons and simply offer part-time contracts to their employees because those employees are women. The fact that also men with part-time contracts are concentrated in female dominated occupations supports the first possibility.

If we measure occupational gender segregation separately in part-time and full-time contracts, the indices are lower for part-time workers (Sparreboom, 2014, e.g.). This should not come as a surprise since this segment of the market consists of fewer categories which are mostly female dominated. However, penetration of part-time contracts is also positively correlated with the level of segregation (Dolado *et al.*, 2003). This fact might seem in contradiction with the previous observation. If part-time occupations are less segregated, how can their higher concentration increase segregation? The crucial point is the huge difference between the percentage of men and women among part-timers as well as their concentration in female dominated occupations. If more women enter the labor market on a part-time contract and are hired in a female dominated occupation, it undoubtedly increases segregation. The mechanism is similar to the one explaining the link to female participation. To put it another way, segregation happens also on the level of choosing the type of the contract.

Women also tend to work in the public sector proportionally more often than men even for usually male-dominated occupations and similarly they are usually underrepresented among the self-employed (Wharton, 1989). In addition, when they enter male dominated education-intensive occupations (such as engineering), they tend to be more educated than their male collegues (Burchel *et al.*, 2014). Younger cohorts tend to experience lower levels of segregation (e.g. Blau, 2013). It is however not clear whether we should conclude that new generations are going to experience more gender-neutral outcomes then their parents. For it also seems to hold that with age segregation becomes stronger

as women lag behind due to motherhood responsibilities (and men concentrate even more in male dominated occupations when they have families) (Burchel *et al.*, 2014).

2.2 Gender segregation in the Czech Republic

2.2.1 Summary of the Czech labour market

Before computing and interpreting the level of occupational gender segregation in the Czech Republic, it is necessary to characterize the Czech labour market and to put it in the context of the rest of the EU. Own computations, Eurostat statistics as well as evidence from the literature is used.

The data on which all own computation is based are from the Czech Labour Force Survey (LFS) for 2013 collected by the Czech Statistical Office. The data contain 224 001 observations, but not all of them are unique. The survey is collected four times a year and each household stays in the sample for five consecutive quarters. Each time the survey is taken, one fifth of the sample changes. To maximize the number of observations, all quarters were combined and the latest record was used for each individual[4]. The final dataset contains 99 773 individuals representing the whole population of the Czech Republic in 2013.

All Central and Eastern European countries started their modern histories after 1989 with a labour market that treated the gender issues with considerable ambiguity. The communist legacy of compulsory participation in the labour market caused relatively high labour force participation of women (and low unemployment) compared to the West. Similarly, education levels of women were close to men and the state provided generous support for childcare. After 1989 these started to converge to the western level. However, Pollert (2005) reports that this legacy still causes structural differences. For example, the shares of women in finance and manufacturing are higher than is common in the West. On the other hand, gender issues were almost completely missing in the public debate before 1989 and the traditional distribution of roles in the household was not challenged. Whether this aspect of the society also converged to the western standard is difficult to assess. However, the wider

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[4] In addition, each person is assigned a weight so that the data for each quarter would be representative of the whole population. To make use of these weights properly, they were multiplied by 5/8 (because our sample is approximately 8/5 times larger than each selected quarter).

pay gap reported below suggests that the Czech Republic remained rather conservative.

When we examine the labour force participation rate of women in the Czech Republic today, we find a gender gap of over 17 percentage points in 2013 (see Table 2.1). It falls by 3 percentage points when only population younger than fifty-five is used (due to higher shares of living women in the oldest cohorts). Still the employment gap in the Czech Republic is reported as one of the highest in the EU (Eurostat, 2016) and analyzed as an harmful rigidity of the labour market (e.g. Kaliskova & Munich, 2012). Not only the level, but also the trend is troubling. Araujo & Malecek (2015) report that the participation rate of women between 30 and 35 years old was even lower in 2013 than in 2003. Apart from the difference in employment rates, women also suffer from higher unemployment rates than men.

Table 2.1: Czech labour market – statistics

Statistic	Men	Women	All
Labour force participation rate	68.11%	51.05%	59.36%
Participation rate for population 15-55	84.01%	70.55%	77.43%
Employment rate	64.15%	46.99%	55.36%
Unemployment rate	5.81%	7.94%	6.75%

Note: Labour participation rate is defined as the percentage of the population 15+ participating in the labour force. Employment rate as the percentage of the population 15+ being employed. Unemployment rate as the percentage of the labour force reported as unemployed. *Source:* author's computations based on the Czech LFS for 2013.

The natural explanation of lower labour force participation rates is the impact of motherhood on employment possibilities of women. According to Araujo & Malecek (2015), women in the Czech Republic in the fertile age with children up to 6 years old have employment rate 40 percentage points lower than those without young children. In addition, only 4% of children under the age of three were enrolled in formal childcare in 2010 (as opposed to the OECD average of 32.6%). It is truly the most common practice in the Czech Republic that women take a paternity leave of three years. The last row of Table 2.2 confirms that dropping out of the labour force to take care of children is truly almost exclusively the issue of women.[5] Pertold-Gebicka &

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[5] Table B.2 describes the employment decisions of men and women based on their marital status. Among married women, higher share is working than among single women, a result robust to excluding students. However, the jumps for married men and divorced women show the importance of bread-winners.

Husek (2015) actually show that employment rates of women are quite high compared to the rest of the EU, if population in childbearing ages is excluded. On the contrary, the drop from employment due to taking care of children is the highest in the EU.

Table 2.2: Summary of the Czech labour market

Category	Men	Women
Population 15+	4 499 586	4 729 409
Employed – full time	30.30%	21.51%
Employed – part time	0.98%	2.57%
Unemployed	1.93%	2.08%
Out of labor force – in retirement	10.94%	16.56%
Out of labor force – educating themselves	4.20%	4.51%
Out of labor force – Other	0.41%	4.02%

The whole population 15+ represents the 100%.

Source: author's computations based on the Czech LFS for 2013.

Table 2.2 shows that the penetration of part-time contracts in the Czech labour market is very low (and more frequent among women). This goes hand in hand with the finding of Eurostat (2016) that workers in the Czech labour market spend the highest mean monthly hours at their jobs (170 hours per month). Moreover, the difference between average hours of men and women is only two hours per month (one of the lowest in the EU-28).

Last but not least, Eurostat (2016) compares the gender pay gap (the difference between mean hourly earnings of men and women) throughout the EU. In 2010 the gap in the Czech Republic was 21.6%, the fourth largest in the EU[6]. Similarly to the gap in employment rates, the wage gap differs among age groups and is the largest among men and women between 35 and 44 (Pertold-Gebicka & Husek, 2015, p. 27). This is often the time when women return back from their paternity leaves. When comparing overall earnings of men and women, the difference increases to 41%, which is actually close to the EU-28 average. It is quite surprising that even thought most of the characteristics of the Czech market are far away from the average, the actual earnings outcome

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[6] The pay gap is even more alarming when put into the context of average educational levels of employed men and women. Table B.1 shows the distribution of employed workers according to their levels of education. Among the employed population, women are on average more educated, although in absolute terms they represent a smaller share in each category due to their lower participation rate.

of women and men is close to other EU countries. The reason is that some of the extremes cancel out. Eurostat (2016) decomposed the earnings gap among contributions of the pay gap, the gap between mean hours at work and the difference in employment rates. On the EU-28 average the effect of the hours gap is 28%, while in the Czech Republic it is only 3% (since part-time contracts are not common). On the other hand, the low employment rates and bigger pay gap push the earnings of men and women apart more in the Czech Republic than is common in the EU. To sum it up, the share of women who are working in the Czech Republic is lower and they work longer hours for lower wage. But at the end, the overall earnings gap is on the EU-28 average.

2.2.2 Patterns of occupational segregation by gender in the Czech Republic

Occupational gender segregation is definitely present in the Czech Republic. First preliminary confirmation of such a statement is presented in Table 2.3. Here we see the five most common occupations for men and women. Both groups employ around 45% of the respective gender. Nevertheless, the selections overlap in one category only – Business and administration associate professionals. Other occupations made it to the list for only one of the sexes. Even from this snapshot of the labour market, we can observe the tendency of men to concentrate in blue-collar occupations, while the most common female occupations are all in services.

The second column of Table 2.3 reveals another irregularity in the gender composition of occupations. When looking at the share of men in the most common occupations for women, we can observe that even though all of them are predominantly female, this dominance is not extreme. This shows that most women are actually not completely isolated from men at work. On the other hand, the three most common occupations of men are almost exclusively male. It seems that men are much more isolated in the labour market. This suspicion is confirmed by inspecting Figure 2.1, which shows the distribution of both sexes in occupations characterized by the share of women in them (ranging from 0 for occupations with no women to 100 for completely female dominated occupations). The peak of men at zero (or almost zero) is not accompanied by a symmetric peak of women at one hundred. Indeed almost 18.5% of employed men work in an occupation with less than one percent of women. Simultaneously, only 2% of women work in occupations where they

Table 2.3: Most common occupations for men and women

Occupations employing 45.9% of working men	Share of Women
Metal, machinery and related trades workers	0.03
Drivers and mobile plant operators	0.06
Building and related trades workers, excluding electricians	0.01
Science and engineering associate professionals	0.18
Business and administration associate professionals	0.55
Occupations employing 44.34% of working women	Share of Men
Sales workers	0.25
Business and administration associate professionals	0.45
Numerical and material recording clerks	0.27
Teaching professionals	0.25
Personal service workers	0.32

Source: author's computations based on the Czech LFS for 2013 using the 2-digits ISCO-08 classification.

represent such a strong majority. Even though from now on the situation in the labour market is going to be treated as symmetric, some caution should remain. Men indeed are much more isolated from the opposite sex. Moreover, women are completely shut down from many occupations, which is not the case for men.

Finally, the index of dissimilarity for the Czech Republic (for 2013) is reported in Table 2.4. As is typical for this measure, the result depends on what

Table 2.4: Index of dissimilarity for the Czech Republic

Occupational Classification	ID
ISCO-08 2 digits	52.62%
ISCO-08 3 digits	57.76%
ISCO-08 4 digits	60.75%
ISCO-08 3 digits with housework	60.19%

Source: author's computations based on the Czech LFS for 2013.

occupational classification is used. When 2-digits ISCO-08 is used, the ID tells us that 52.62% of men or women would need to change their occupation in order for segregation to disappear. This classification includes 43 occupational categories and all except one include at least 22 observations in our dataset. However, some of the categories combine occupations that are quite different
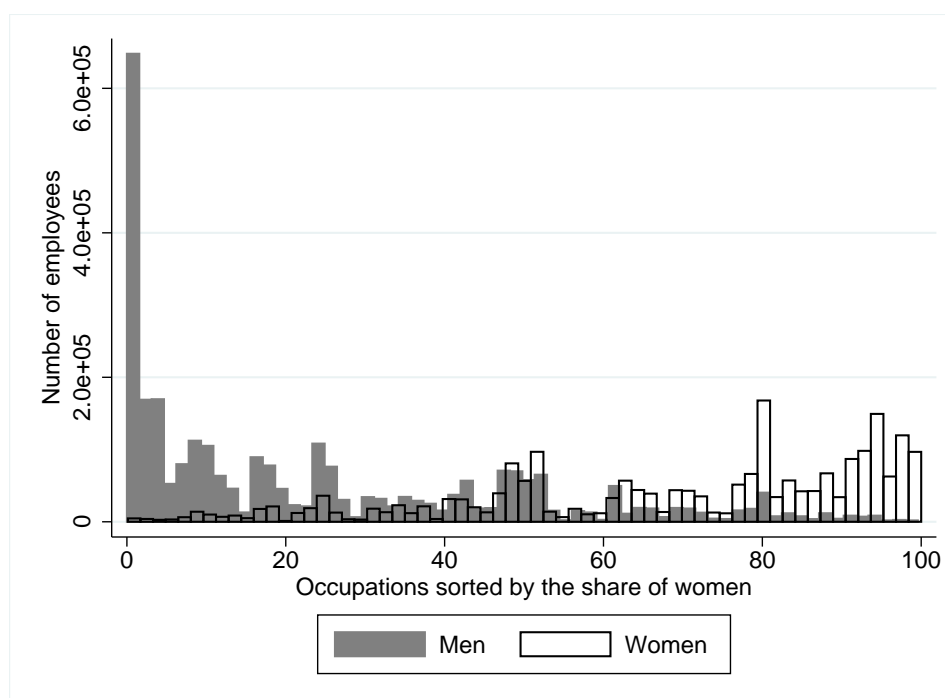
Figure 2.1: Distribution of men and women into occupations sorted
            by the percentage of women

Source: author's computations based on the Czech LFS.

from each other. For example, Refuse workers and other elementary workers
include typically male dominated garbage collecting or package delivery, as well
as female dominated occupations such as cloakroom attendants. Therefore, this
level of aggregation definitely hides a substantial portion of segregation.

The index increases to 57.76%, when 3-digits ISCO is used, and even to
60.75% with 4-digits classification. With more specificity, additional segre-
gation is discovered. On the other hand, the measurement error definitely
increases. On the most disaggregated level 111 out of 498 occupations have 5
or less observation in our sample. To conclude, it seems most reasonable to
interpret the 3-digit classification when giving statements about occupational
gender segregation in the Czech Republic. However, for deeper analysis of spe-
cific subgroups of the population, the 2-digits level is used to avoid excessive
measurement error in smaller subsamples.

Based on the snapshots from 1997, 2001 and 2007, Bettio & Veraschchagina
(2009) claim that the Czech Republic is "one of the fastest in desegregation".
This no longer seems to be the case. While ID (based on ISCO 3-digits) de-
creased from 60.3% in 1997 to 58% in 2007, our reported level for 2013 is
57.76%. Actually, when our results are compared with older computations by

Jurajda & Franta (2007), we conclude that measured on the more aggregated 2-digits level OGS might have increased in recent years. They report an ID of 51% for 2004, while our results show that this statistic increased to 52.67%. Aside from the apparent ambiguity in the trend, the most reasonable conclusion is that occupational gender segregation has not changed much in the past years. It is stagnating. There is no clear convergence of this labour market characteristic to the average EU-27 level, which was 50.99% in 2007 (Bettio & Veraschchagina, 2009), 51.79% in 2010 and over 54% in 2012 (Humpert, 2015) based on the 3-digits classification[7].

In the introductory chapter a difference between relative and absolute understanding of segregation was mentioned. The index of dissimilarity is designed to give meaningful results even if the two groups (men and women) are not of the same size in the labour market. However, when the reason for their difference is that a share of women is segregated to housework (which does not appear in the index), the measure can give counterintuitive results. One possibility to take this weakness into account is to really think of housework as another occupation. In the LFS respondents are asked what their usual status in the labour market is. One of the possible answers is to say to be at home doing housework and/or taking care of children. Therefore whenever a person claimed such a status and simultaneously reported to be out of the labour force, he or she is coded as being employed in a 'housework occupation'. This is the case for a part of the dataset representing around 350 000 people out of which 99% are women. In other words, housework can be thought of as a highly segregated occupation which should be at the top of the table of common occupations for women. When housework was added to the computation of ID, the index jumped to 60.19% in the 3-digits classification. The new category accounted for more than 6 percentage points in the sum of the index.

Even though the Czech Republic is a rather small country, its regions are not exactly homogeneous. The difference between Prague and the poorest parts of the country is significant. This variation also translates into different segregation outcomes in individual regions. Figure 2.2 shows this result graphically. The level of segregation ranges between 47% in Prague and 58% in North Moravia (which is famous for its heavy industry). Therefore it roughly holds that rich parts of the country are less segregated. In Prague segregation

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[7] The results of Jurajda & Franta (2007), Bettio & Veraschchagina (2009) and Humpert (2015) for ID up to 2010 are based on an the older occupational classification – ISCO-88. Although the classifications are very similar, there are small differences that might complicate the comparison.
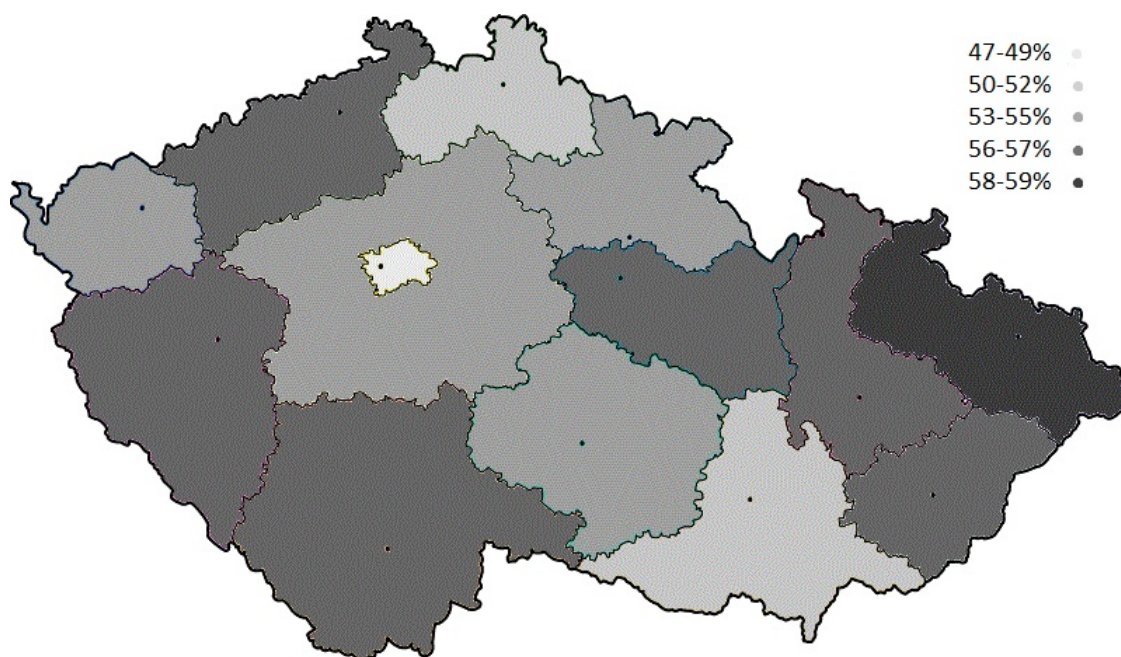
Figure 2.2: Regions of the Czech Republic by the index of dissimilarity measure of gender segregation

Source: author's elaboration based on the Czech LFS for 2013 using the 2-digits ISCO-08 classification.

is even lower than is the EU average. Also as Figure B.1 shows, segregation in the Czech Republic does not seem to correlate negatively with labour participation. On the contrary, even though there are too few regions for any statistically solid claim, poorer regions seem to have lower participation rates and seem to be more segregated.

Table 2.5: Index of dissimilarity by age, education and hours of work

Specification	ID
Less than or equal to 35 years	51.34%
Older than 35	54.346%
Less than tertiary level of education	55.95%
Tertiary level of education	40.13%
Full-time	52.69%
Part-time	42.80%

Source: author's computations based on the Czech LFS for 2013 using the 2-digits ISCO-08 classification.

It is also interesting to compare segregation across various socio-demographic

subgroups. Table 2.5 summarizes the results. The most logical choice is to compare segregation across age groups. Lower levels of segregation in younger cohorts suggest that new incomers into the labour market might have different attitudes towards gender stereotypes and could opt for more gender neutral choices. On the other hand, as was presented in the empirical literature summary, segregation generally tends to increase with age and it is not possible to distinguish these two effects. Moreover, the difference between employees bellow and above 35 is not drastic. Even more surprising pattern is revealed when smaller groups are compared. Table 2.6 shows that the youngest 5 year cohort in our sample (20-24) is actually more segregated then all others up to the age of 45. Such a result suggests that this new generation might actually be even more conservative and no decline is to be expected in the future. Jurajda & Franta (2007) also analyzed five year cohorts and their latest results are from 2004. By then the lowest ID was computed for the youngest groups (15-25). These generations kept their moderate segregation levels until now - cohorts of the age of 25-34 are still the least segregated. A possible explanation is that women in these generations postponed their motherhood and therefore the effect of age is still weak for them.

Table 2.6: Index of dissimilarity by 5-years cohorts

Age group	20-24	25-29	30-34	35-39	40-44	45-49	50-54
ID	55.59%	51.84%	51.66%	52.60%	53.34%	55.87%	56.87%

Source: author's elaboration based on the Czech LFS for 2013 using the 2-digits ISCO-08 classification.

Unsurprisingly, workers with a tertiary level of education are less segregated than those who concluded their studies in a secondary school or less. However, again the detail reveals a more interesting pattern (see Table B.3 in the appendix). By far the highest levels of segregation can be found among workers who completed their secondary school with a final exam[8]. Less demanding secondary schools produce workers whose occupational attainment is more gender neutral and those who did not manage to continue studying after their primary school are even less segregated.

Occupational gender segregation is stronger among married workers than among those who are single (see Table B.4 in the appendix). And the level is

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[8] This exam is called Maturita in the Czech Republic and it is similar to the Abitur in Germany.

even higher among employers who got a divorce (a result robust to excluding students and people in retirement). Moreover, people living in bigger cities (in more densely populated locations) are working in less segregated occupations. In consistence with results from other countries, segregation seems to be lower among part-timers (which are mostly women).

To conclude this chapter, occupational gender segregation, similarly to other phenomena describing the relationship of men and women in the labour market, is very persistent in the Czech Republic. Although it was decreasing at least until 2007, the current level shows a turnover (or at least a pull-back) in the trend. Moreover, the youngest generations exhibit higher levels of segregation than the preceding cohorts. Concentration of men and women in different occupations is strongest among people with secondary level of education, who live in sparsely populated areas, and in poorer regions, and among those who are married or divorced. Concentration (and therefore isolation) seems to be stronger among men, especially in blue-collar occupations. All of these characteristics look at what people end up in segregated occupations. Building on that, the next chapter is looking in depth into what occupations are actually those which are most segregated.

Chapter 3

Social stereotypes and biological differences shaping occupational gender segregation

3.1 Motivation and literature

One of the most persistent features of the labour market is the tendency of men and women to be employed in different occupations (as was confirmed in the previous chapter). Unlike gender pay gap, lower labour force participation of women or the disproportionate representation in politics, management or academia, occupational gender segregation in the EU does not seem to follow a clear declining trend. Moreover, it is much more complicated than the other gender issues. Its horizontal component does not necessarily have only negative implications in the labour market and in some cases the fact that there are more men or women in an occupation can have a purely natural and rational explanation (for example a wet nurse can hardly be a career for men). On the other hand, it can be a representation of irrational stereotypes, caused by discrimination of men or women in certain jobs or ostracism of the minority. It is therefore clear that to evaluate occupational gender segregation we need to analyse its causes. This chapter aims to investigate the link between characteristics of occupations and the percentage of men and women in these occupations. The results can guide politicians who want to reduce gender segregation to target their effort to specific abilities or stereotypes. In addition, it should provoke further research on deeper causes of why a specific job characteristic does or does not have the expected effect. It also shows what part of

gender segregation can be explained by occupational characteristics and what is therefore left and open to further investigation.

3.1.1   Building blocks and root causes of gender segregation

When explaining occupational gender segregation, economists and sociologists mention many causes based on several seemingly conflicting theories. A summary of the debate can be found e.g. in Anker (1997), Reskin (1993), Bettio & Veraschchagina (2009), Blackburn *et al.* (2002), Burchel *et al.* (2014) or Sparreboom (2014). Usually, we can distinguish whether the causes work through the decision making on the part of the employee (a labour supply side) or the employer (a labour demand side).

The classical microeconomic explanation is based on the idea of human capital and the rational choice theory, assuming perfect competition and perfect information. It simply states that men and women differ on average in occupation-specific productivity variables (endowments, abilities, learnt skills, acquired education, personality traits and therefore preferred work styles and also job preferences). These supply side differences are of course reflected by employers who always pay their employees at maximum their marginal product. When differences in pay are discussed the idea of compensating differentials is often mentioned among the neoclassical explanations. Because of different family roles and preferences in general, women value different aspects of a job than men (pleasant environment or flexible hours versus career advancement possibilities and a higher salary). These other values a job can bring bear costs that push wages down. Moreover, sometimes there can be gender-related costs that an employer has to bear. Nowadays these are mostly costs related to maternity leave (training of new employees etc.), but in the past these included also costs of protective regulations (e.g. higher safety standards for women). However, for gender-related costs to contribute to OGS they need to be at least to some extent occupation-specific. Otherwise they would materialise only in a wider pay gap. Lastly, even discrimination can be discussed in the neoclassical framework if we assume that there is some rationality in employers having some preference for discrimination. Then discriminating behaviour would increase their utility and compensate them for lower profits caused by excluding half of the labour force from their considerations (but with perfect competition such employers would need to eventually leave the market). Neoclassical theories end the discussion with claiming that gender segregation is an outcome of rational choice

in a competitive environment and therefore it is efficient and there is no need to do anything about it. It omits institutional settings, imperfect competition consequences and especially the debate about how the gender differences came to be [1]. These weaknesses are reflected in the subsequent theories.

To reflect the fact that markets are not perfectly competitive, several institutional theories amend the neoclassical explanations. Probably the most influential is the idea of statistical discrimination (applicable broadly to discrimination by race, religion or any other factor). Assuming that male and female workers do differ in their productivity characteristics, but employers do not have perfect information about individual abilities of the applicants, they can use known average gender-related abilities as a rule of thumb. This behaviour can be perfectly rational while resulting in a distorted market. Employees are not hired according to their individual marginal product, but according to the average marginal product of their gender. Another contribution of the institutionalists is the dual labour market theory. It explains that according to several qualitative characteristics of the occupation the labour market is in some aspects divided into two segments: primary and secondary, progressive and static, formal and informal etc. The two segments differ in aspects of pay and career advancement possibilities, they function more or less independently. The institutionalist explanation behind such segmentation includes the fact that companies in the primary sector have substantial market power while the secondary sector works under fierce competition. Similarly it can sometimes seem to be that the labour market has its male and female segments which somewhat coincide with the above describes division. In addition, institutional theories also discuss the role of labour unions, hiring procedures and other structural aspects of the labour market.

The last stream of explanations are built on theories of gender and the feminist legacy. They describe how stereotypes about appropriate gender roles, types of behaviour and abilities cause discrimination on the labour demand side, but also influence education and career choices, household roles and preferences of employees. Regarding vertical segregation feminists claim that the historically subordinate position of women shape the labour market even today. A specific example of this is the theory of queueing by Barbara Reskin (Reskin,

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[1] The idea that gender differences are solely biologically determined is challenged mostly by the fact that characteristics of both genders as well as their labor market outcomes are not always consistent in time and place. For example, occupations like clerical work, teaching or banktelling were at first almost exclusively male, but are now strongly female-dominated (Preston, 1999).

1993). She describes that labour market works like a queue with women at the
end, once men are allocated to the more desirable occupations, women take
the rest. She supports this claim by observing that occupations became female
dominated after men left them for more attractive alternatives (e.g. teachers,
office clerks). On the labour demand side, stereotypes about appropriate gender
roles cause irrational discrimination and ostracism of the minority (a current
majority gender in an occupation can protect its position against an incoming
minority). On the labour supply side, gender theories criticise the preceding
two streams for not going deep enough in explaining occupational gender segre-
gation. Especially human capital theories fail to provide any discussion about
where the differences in productivity variables and preferences come from and
whether there might be a scope for efficiency improving change at least in the
long run. Gender theories describe many mechanisms through which labour
outcome differences can appear. Biased educational and family influence (sup-
ported by empirical evidence e.g. in Lawson *et al.* (2015) or Busch-Heizmann
(2015)), lack of diverse role models, traditional and religious beliefs, available
opportunities influencing human capital investment decisions or stereotyped
culture and public debate are just a beginning of the list (some of them are
more thoroughly described in Ridgeway & Smith-Lovin (1999)). A very inter-
esting and fairly disturbing question is whether occupations became male or
female dominated because of their characteristics (e.g. demanded abilities) or
whether it could be that gendering of occupations (maybe due to traditions)
shape their characteristics (e.g. making hours more flexible). In my analysis
I will omit this mechanism and assume that job characteristics are inherent
to occupations and the gender distribution is shaped by them. However, we
should keep in mind that there is a possibility of a reversed causality.

Probably the most complex stream shaping labour market outcomes is the
persisting difference in family roles. It not only affects preferences and cre-
ates gender-related costs, but also influences education choices and distributes
skills acquired through the parenting experience that can be later marketed[2].
Similarly complex is the question of to what extent it is a result of the bio-
logical fact of giving birth or of any streams of social pressure. Resolving this
debate seems impossible. Among other factors that can increase occupational

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[2] An interesting piece of qualitative research by Crompton & Harris (1998) shows that
it is too simplistic to classify women between those who put family first and those who put
their career first (as e.g. in Hakim (1991)). Most women in their sample actually tried to
have both and struggled with this objective through the labour market. Some of them also
described becoming careerist by necessity in order to support the family.

gender segregation is the statistically observed fact that people tend to prefer
the company of the same gender as friends. Given that an important factor in
finding a new job is a network of friends who can give recommendations, this
increases the probability of being employed in a company of the same gender
(Ridgeway & Smith-Lovin, 1999). It is also important to realize that some of
the outcomes cannot be blamed on current social pressures or institutions, but
that they are outcomes of choices made possibly many years ago and should
be therefore viewed simply as a relict of the past.

When summarizing the debate it has become quite clear that the above
described theories are mostly not in conflict. Rather they amend each other
describing decisions and motivations often in different stages of the process
which results in the observed labour outcome. Secondly, it is necessary to
realize that if we observe different outcomes for men and women, then either
men and women differ or their surroundings think they do. In either way the
primary cause must be a biological difference between men and women or a
social pressure which assumes them to be different (and often causes them to
turn out different). Either men are on average more talented for mathematics or
there is an irrational stereotype about it. Either women do naturally prefer and
are better at taking care of children as their primary role or the society pushes
them to. All the above described causes grouped together by all the theories
of occupational gender segregation are rooted either in biological differences
between genders or in the social pressure (or rarely in institutional settings like
law etc.). The process leading to the observed situation in the labour market
is summarised in Figure 3.1[3]. The ultimate question of which root is more
important is mostly impossible to resolve and will not be a topic of the rest of
this paper.

Throughout the process resulting in occupational gender segregation a few
of the effects automatically strengthen themselves when they appear. Discrim-
ination reduces opportunities for employees, rational actors will take it into
account when choosing a career and will not bother fighting the system. As
a result they will choose a gender appropriate occupation without being ever
discriminated against. Even a small difference in endowments (or a small pres-
sure in childhood) can discourage children and young adults from developing
certain skills, effectively making the differences in abilities much stronger. One
women manager in an IT company can encourage more women to work for her,

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[3] Width of arrows suggests where the role of biology might be stronger and where it
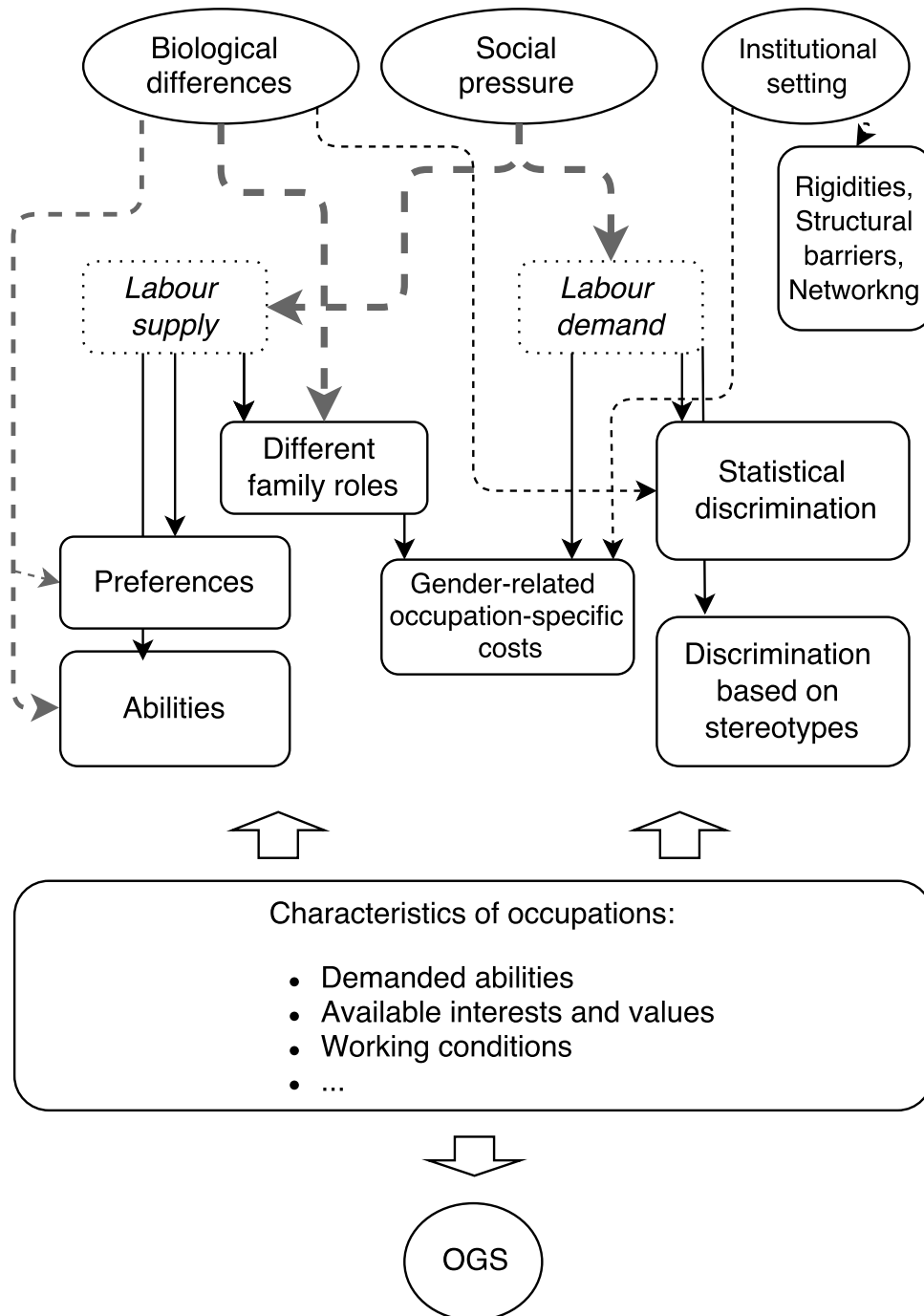might be rather weak.

Figure 3.1: Causes of occupational gender segregation

Source: author's elaboration.

attracting even more women in the future to an environment where they would
not be such a slim minority any more. On the other hand, a men who assumes
taking care of children to be a women's work will act as a role model for his
sons, greatly increasing their chance to do the same. If women are segregated
in less demanding occupation with lower pay, they end up having more time
and energy than their spouses to take care of the household. The domestic
division of labour then becomes perfectly rational. Similarly, when women are
under-represented in positions of power in business, they also tend to be under-
represented in the public and political debate. These self-strengthening effects
are a crucial point in explaining while the occupational gender segregation is
so persistent.

Last but not least, for occupational gender segregation to occur it is not
enough for people to differ. It is equally necessary that occupations differ as
well. This is the last link between biological differences or social pressure and
unequal distribution of genders in the labour market. And occupations indeed
do require different skills, abilities and personal traits, perform different tasks,
occur in different environments, attract different interests and offer different
values. Which of these many characteristics are the most important is precisely
the question investigated in this paper.

3.1.2   Gender role differences in abilities and preferences

Firstly, we need to summarise what might be the abilities and preferences in
which men and women differ or about which there exists a social stereotype.
Probably the most visible and certainly biologically given difference is that
men are on average physically stronger. It seems to be an almost equally
undeniable fact that people have a sexually dimorphic mind (Browne, 2006).
However, it is not at all straightforward how to describe, quantify or interpret
these differences to evaluate whether they have effect on the labour market
outcomes. When evolutionary biologists think about sex differences in human
behaviour, they point out what we know about the hunter gatherer society.
If men and women faced different circumstances, their gene-carriers adapted
(Jones, 2008). It seems probable that male members of the groups had to
compete with other males (just as many other mammals do) and therefore
we could expect men to be more competitive, dominant, status-striving and
risk-taking. Women, who probably took care of children, should be more nur-
turing. However, these characteristics are hardly testable and closely coincide

with stereotyped gender roles (Anker, 1997) which makes the biological and
social effects hardly distinguishable. Apart from competing for status, the role
of men was also to hunt. As a result men should be better at targeting and
spatial orientation. There actually seem to be very significant differences in
these abilities (Browne, 2006) and unlike with nurturing there is no reason to
suspect any social pressure influencing them. Testing individuals for cognitive
abilities also revealed differences in verbal comprehension and memory (bet-
ter among women) or mechanical and mathematical reasoning (Jones, 2008).
However, these results (when adults are tested) can be interpreted not only
as biologically determined, but also as shaped by stereotypes about appropri-
ate talents and activities. Predisposition to mathematics is a widely discussed
topic and due to methodological problems the results are ambiguous (Spelke,
2005). Despite the existing stereotype that men are better at concentrating at
one thing at once while women can do more things together, there seems to be
no statistical evidence of differences in selective attention (Teleb & Awamleh,
2012). Among other characteristics mentioned in the literature as different in
men and women (mostly without any thorough discussion about why it might
be the case or interpreted as stereotypes) are preference for safe and clean
environment (Browne, 2006), agreeableness, conscientiousness (Jones, 2008),
greater manual dexterity, honesty, disinclination to supervise others, willing-
ness to take orders (Anker, 1997), extroversion, agreeableness or emotional sta-
bility (Clark, 2011) among women and aggressiveness (Jones, 2008), willingness
to work hard, impulsiveness, high self esteem, analytical approach to problem
solving, low conflict avoidance (Antecol, 2013), systematizing approach (in con-
trast to empathizing) (Wright, 2015), lower interpersonal skills, external locus
of control (higher goals, ambitions) (Clark, 2011), and even stronger inclination
to greed (Fortin, 2005) among men.

Different preferences of men and women are discussed usually with the
connection to the household division of labour. Women who expect their careers
to be interrupted by a maternity leave have a motivation to opt for careers
where a longer break does not bear extreme costs (which is not the case e.g.
for computer experts or other fast developing sectors). Similarly women can
prefer occupations with more flexible time schedules, so they can take care
of children when they are sick. One of the most recent contributions to this
debate is a study by Goldin (2014), which reveals that occupations requiring
strict time schedules and work under time pressure show higher gender pay
gaps. Lastly, when asked about what they value most about their jobs, men

and women answer differently. Men tend to appreciate especially promotion
prospects, job security and higher pay (Busch-Heizmann, 2015). On the other
hand, women put a little more value on good relations, actual content of the
work and flexible hours (Clark, 1997).

Women also seem to be interested in different topics (or are pushed to have
different interests) as shown by what fields of study they choose. The divide
between humanistic and scientific fields, but also between care and technical
fields, tends to correspond to the divide between female and male dominated
areas of interest (Barone, 2011). Again, the origin of these differences is not
known. Similarly, women seem to care about social aspects of work more
than men (Busch-Heizmann, 2015). Lippa (1998) describes differences between
men and women regarding occupational interests. Men seem to have more
investigative, realistic and enterprising interests, while women prefer social and
artistic environments.[4]

A fairly recent finding of Peto & Reizer (2015) is that women use their
skills less than men. More specifically, they seem to perform tasks with less
skill content within the same jobs (when actual skills are controlled for). This
may lead to a situation when skills and abilities are stronger determinants
of concentration of men, while concentration of women is triggered mostly by
other job characteristics. If an occupation requires an ability and men use their
abilities more than women, such a requirement would lead to concentration of
men.

3.2   Model building and data available

3.2.1   Data structuring

The main aim of this thesis is to analyse which of the above mentioned differ-
ences between men and women (or stereotypes about them) shape the occupa-
tional gender segregation in the Czech Republic. To compute the percentage of
man and women in each occupational category, the Labour Force Survey (LFS)
for 2013 collected by the Czech Statistical Office is used. In this data set occu-
pations are classified according to the International Standard Classification of
Occupations (ISCO-08) and were aggregated to the four digits level. Categories

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[4]This is actually the same classification of occupational interests that is included in
O*NET and tested bellow in the estimation section. It was defined by an American psychol-
ogist John Lewis Holland and is called the RAISEC as an acronym of the five categories.

which had less than 15 observations (altogether representing roughly 2.5% of
the working population) were excluded.

To characterize occupations, the Occupational Information Network (O*NET)
database[5] is used. O*NET assigns each occupational category a number rang-
ing from 0 to 7 (sometimes from 1 to 5) for each characteristic describing what
level of an ability, a skill or a particular piece of knowledge an occupation
requires, what importance it puts on a work style, to what extent it offers a
certain value, what occupational interests it deals with, to what extent it can
be described by a work context characteristic and many others. The database
is very extensive and all analyzed characteristics are well described (including
scale anchors explaining what the levels mean on real world examples)[6]. The
only complication is that O*NET uses a different occupational classification –
the Standard Occupational Classification (SOC). Fortunately, the Bureau of
Labor Statistics of the U.S. Department of Labor provides a crosswalk[7] be-
tween the European and the US systems. Still there is some information lost
in transferring the characteristics to a different classification. The US system
is more detailed and therefore values needed to be averaged to match the four
digits ISCO-08 characteristics. Also some of the ISCO categories were not in-
cluded in the crosswalk and some of the SOC categories were excluded from
the O*NET analysis (for example occupations in armed forces)[8]. Eventually
our data set describes 98% of the working population in 2013 in the Czech
Republic in 311 occupational categories.

3.2.2 Selecting explanatory variables

The dependent variable has the form of a fraction between the number of men
in an occupation and the total number of employees ($M_i/(M_i + F_i)$). Summary
statistics for all of the variables (as well as their correlations) are reported in
Table B.6 and Table B.7 in the appendix.

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[5] http://www.onetcenter.org/ The Occupational Information Network (O*NET) is being
developed under the sponsorship of the US Department of Labor/Employment and Training
Administration (USDOL/ETA). It is available for free: http://www.onetcenter.org/

[6] Despite that the database is rarely used in the literature explaining gender differences
in labour outcomes. The few exceptions include Goldin (2014), and Yamaguchi (2014), who
used the predecessor of O*NET – the Dictionary of Occupational Titles (DOT).

[7] http://www.bls.gov/soc/soccrosswalks.htm

[8] Moreover, not all ISCO occupations can be easily matched with a SOC category. For
example, the crosswalk matches driving instructors with self-enrichment teachers. Such oc-
cupations are expected to have very different gender distributions and this observation has
also the largest estimated residual in our estimation.

When choosing what job characteristics could cause an occupation to be male dominated, I have started with *abilities* (defined by O*NET as enduring attributes that influence the acquisition and application of knowledge in problem solving and quantified by their required level on a scale from 0 to 7). Abilities are differentiated from learnt skills and knowledge and therefore they are often the closest we can get to being caused by biological predispositions. Although distinguishing among the effects of an ability, a skill or a stereotype belief is often impossible, static strength, rate control (close to targeting a moving object) and spatial orientation seem to be almost strictly biological. There is probably no significant social pressure that could influence them, there is an evolutionary logic behind them and there are statistically significant differences in performance measured. All three of them are positively correlated with the concentration of men in an occupation, as was expected. Testing cognitive abilities revealed differences in oral comprehension, memorization and mathematical reasoning, but as was already discussed in this case the effect of social pressure cannot be omitted. Surprisingly, correlations between the concentration of men and requirements of verbal abilities and memorization are almost zero in our sample. Mathematical reasoning is positively correlated with the share of men. In addition, the abilities of selective attention, time sharing (being able to do more things at once) and manual dexterity are included. They were all mentioned in the literature as possible biologically influenced differences between men and women, even though there is no clear proof of it. Nonetheless, they can still influence the labour market as widespread stereotypes. Selective attention has the expected positive correlation with concentration of men, but manual dexterity and time sharing are positively correlated too, even though they are expected in the literature to favour women. Unfortunately, O*NET does not describe any ability close to mechanical reasoning (which is measured to differ by gender when testing individuals). To supplement this missing ability, I included a variable describing mechanical knowledge as a proxy (it is positively correlated with concentration of men, as expected).

Second set of variables is grouped by O*NET as *work contexts* (defined as characteristics of the organization that influence how people do their work and measured on a scale from 1 to 5). They describe the conditions under which employees do their job and can be sometimes directly connected with the characteristics described in the literature review. I experimented with working with hazardous equipment, working under competitive pressure, having responsibility for results and working under time pressure. Hazardous and

competitive environment should be favoured by men according to the evolutionary reasoning. Even if they were wrong, these characteristics can discourage women through being stereotypically attributed more to men. Among the often described stereotypes about women is an idea that they do not like to lead others, that they prefer to take orders. Therefore we could expect that responsibility for results and outcomes is more common in male occupations. Family responsibilities seem to discourage women from time demanding occupations (Goldin, 2014). All work contexts mentioned have the expected correlation with $(M_i/(M_i + F_i))$.

To perform well in a particular occupation one must also behave in a certain way. Since men and women are often described by different personality traits, there might be a significant effect of required *work styles* (defined as personal characteristics that can affect how well someone performs a job and measured by their importance on a scale from 1 to 5) on whether an occupation is male dominated or female dominate. The stereotype regarding who is more suitable to supervise motivated the inclusion of leadership and dependability work styles (their correlation with concentration of men has the expected sign). Evolutionary biologists expect women to be more nurturing, but there are also stereotypes about men having lower interpersonal skills. Therefore I include the work style described as concern for others (the expected negative correlation is present). There also seems to be a stereotype about women being more conscientious and (apart from already included dependability) the styles described as attention to detail and integrity are grouped by O*NET under this label. Both have the expected negative sign of their correlation with the concentration of men, but it is not statistically significant attention to detail. If men do not need their careers to reflect their disproportionately smaller family responsibilities, they might opt for jobs requiring more stress tolerance and more adaptability to new conditions (however both show negative correlations with the dependent variable). Similarly, men could perform well in occupations which require them to put more effort to it by setting more challenging tasks. Therefore, the work style summarized as effort and achievement is tested (almost zero correlation with the share of men).

As was already mentioned, women seem to value different aspects of a job, which can be reflected in their preferences. *Work values* are defined by O*NET as global aspects of work composed of specific needs that are important to a person's satisfaction and are measured by their extent on a scale from 1 to 7. I experiment with relationships with co-workers, achievement, independence

and favourable working conditions (job security and good working conditions including being well paid). Relationships are negatively correlated with the dependant variable, working conditions and independence show positive correlation, but there seems to be no relationship between the value of achievement and the majority gender. *Occupational interests* are defined as preferences for work environments and measured on a scale from 1 to 5. Social, artistic, enterprising, investigative and realistic[9] interests are tested. The correlation signs are as would be expected. The only exception is being in an enterprising environment, here the correlation is almost zero. Finally, I experiment with including *skills* (measured on a scale from 0 to 7) instead of (or together with) abilities, namely the learnt skill of being service oriented, social perceptiveness and the skill of mathematics.

Additional three variables are tested at the end, the share of jobs in a public sector, the share of part-time contracts and the share of self-employment. They are motivated by empirical observations. Women tend to be overrepresented in the public sector. However we do not know whether the reason is that female dominated occupations simply provide public services more often or whether there is something substantially different about having the public sector as an employer, what could attract women. In the first case the variable should not bring any additional information, while in the second case it is a characteristic of occupations that facilitates segregation. The process behind women concentrating in the public sector could be a pressure for affirmative action towards women (such as internal quotas of e.g. political parties), more formal hiring processes preventing discrimination or shorter hours due to less pressure on productivity. Flexible hours (allowing women to spent more time on their household responsibilities) is also the reasoning behind the concentration of women in part-time jobs. However, it is not clear whether this actually is an additional reason for segregation or whether occupations simply offer more part-time contracts because they employ more women. To put it differently, we test whether the ability to offer a part-time contract is an inherent characteristic of occupations that triggers segregation. Similarly women may avoid self-employment because it does not have to provide them with paid parental leave. Again our hypothesis is that the convenience of self-employment is an inherent characteristic of occupations which facilitates segregation.

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[9] Defined as working on practical hands-on real world problems, rather than abstract or people-oriented situations.

3.3   Testing characteristics of occupations – estimation and results

The method used throughout the whole analysis is a quasi-likelihood estimation proposed by Papke & Wooldridge (1993) and then again recommended by Kieschnick (2003) for fractional response variables. The method assumes a logit link between the dependent variable and the explanatory factors:

$$E(y|X) = \frac{exp(X\beta)}{1 + exp(X\beta)}$$

and maximizes the Bernoulli log-likellyhood function. The logit link was used for a very similar dependent variable in Busch-Heizmann (2015)[10]. The reason why simple ordinary least squares are avoided is the special character of our dependent variable. Firstly, since the share of men in an occupation is by definition bounded on $[0, 1]$, the relationship between X and y cannot be linear. The percentage of men cannot grow forever. Secondly, given the boundaries the variance of the error term should approach zero as the conditional mean approaches zero or one, and is therefore heteroscedastic. Both of these flaws of OLS are dealt with by the proposed method. Fortunately, this estimation approach was incorporated into the generalized linear models (*glm*) command in STATA®, using logit link, Bernoulli distribution and robust standard errors (Baum, 2008).

In addition, occupations are being weighted by their size in the economy. This must be reflected in the interpretation of coefficients. We are asking, how various characteristics contribute to the proportion of each gender in an occupation given the current state of the economy (our time and place). Or described on the individual level, how the share of men among my colleagues is likely to change if I switch to an occupation with different characteristics. Therefore if a characteristic turns out to be significant in shaping the gender distribution, it does not mean that it was always the case or that it will continue to do so in the future. For deeper discussion on both the estimation method and the effect of weighting occupations, see the Appendix A.

Firstly, a model with only abilities is estimated. The reason for preferring abilities is that at least some of them can be described as rooted in biological differences between men and women and so they explain a part of the occupa-

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[10] Although they only transformed the variable and continued with OLS, which is not an option here.

	(1) M_to_both		(2) M_to_both	
Spatial_Orientation	1.525***	(6.04)	1.293***	(5.29)
Rate_Control	0.388*	(1.84)	0.217	(0.98)
Static_Strength	-0.135	(-0.66)	-0.256	(-1.37)
Mathematical_Reasoning	0.240	(1.27)	-0.0848	(-0.44)
Oral_Comprehension	0.559	(1.48)	0.535*	(1.67)
Memorization	0.154	(0.41)	0.0825	(0.22)
Manual_Dexterity	-0.0193	(-0.10)	-0.290	(-1.52)
Selective_Attention	1.561***	(3.81)	1.353**	(3.02)
Time_Sharing	-1.620***	(-3.45)	-1.291**	(-2.92)
Knowledge_Mechanical			0.548***	(5.47)
N	311		311	

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$

Table 3.1: The role of abilities in occupation gender-segregation, point estimates

tional gender segregation that is predicted to be fairly stable, altered possibly only by significant shifts in demand for these abilities. The results are reported in the first and second columns of Table 3.1. The difference between the two specifications is only that in the first column mechanical knowledge is omitted. The purpose is to see how the other coefficients change when it is controlled for. Gender differences in the first three abilities were assumed in the literature to be biologically determined. Out of those three only spatial orientation has a statistically significant[11] positive effect on concentration of men. The effect of static muscle strength is too small to be statistically significant (as is the case also for rate control), and more importantly it has an unintuitive negative sign. Therefore even if the exclusion of armed forces causes a substantial bias, it is unlikely that strength could prove as a relevant factor causing concentration of men. Mathematical reasoning seems more important in male dominated occupations only when mechanical knowledge is omitted. Once we control for mechanics, mathematics does not make an occupation more male dominated. This happens despite the fact that the correlation between mathematical reasoning and mechanical knowledge in the sample is only 0.03. Surprisingly, the stereotype about women being able to concentrate at more things at once (and men being more able to focus on just one) do have the expected effect

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[11] Using the 5% significant level.

in this specification of the model. Although the literature did not show any
proof of gender difference in these abilities. Neither oral comprehension nor
memorization seem to favour women.

From all tested work styles, work contexts, occupational interests or values,
quite a few has a significant influence on the occupational gender segregation
in the Czech Republic. The estimated coefficients as well as the computed
average marginal effects are reported in Table 3.2[12]. Firstly, it is obvious that
such occupational characteristics should not be omitted from the analysis, since
some of the coefficients on abilities changed markedly. For example, mechan-
ical knowledge dropped out of the model and the effect of spatial orientation
diminished (though it remained significant). The most probable reason is their
high correlation with hazardous equipment. The practical interpretation is
straightforward. Women do not avoid (or are not offered) jobs requiring me-
chanics and orientation in space, because they lack the abilities. They tend
to avoid it, because it is dangerous and they are (or they are believed to be)
more risk averse. Manual dexterity now favours women. The coefficient on
time sharing is two times smaller and the effect of selective attention almost
disappeared. Therefore the stereotype about women multitasking has only a
modest effect on the labour market. And most importantly, memorization now
seems to favour men while mathematical reasoning actually seems to make an
occupation more female dominated. Both abilities are correlated with many of
the included characteristics (and also with each other), so it is difficult to say
what caused such a shift. Nonetheless, the result is unexpected and should not
be overlooked.

Out of the five tested occupational interests, only realistic and social en-
vironments have the expected effect. This finding coincides with the notion
about women caring more about people and men prioritizing things. However,
it is difficult to assess whether there is a biological reason for such a difference
or whether this is only a result of social pressure and stereotypes. Work styles
(that should reflect workers personality traits) are measured on a narrower scale
and are also less variable than other characteristics. This should be taken into
account when interpreting the large coefficient on the work style of showing
effort (the variable ranges only from 2.9 to 4.6). Still the effect is practically
and statistically significant and definitely unexpected. When the demand for
showing effort in an occupation is higher by 1 on the O*NET scale, the share of

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[12] Insignificant variables are omitted unless they were significant in the previous specifica-
tions with only abilities. In such case they are reported so the change is highlighted.

	(3)		(4)	
	Point esimates	AME	Point estimates	AME
Spatial_Orientation	0.698***	0.105***	0.596***	0.0886***
	(4.38)	(4.65)	(3.77)	(3.96)
Mathematical_Reasoning	-0.527***	-0.0793***	-0.682***	-0.101***
	(-3.41)	(-3.40)	(-4.51)	(-4.59)
Memorization	0.953***	0.143***	1.122***	0.167***
	(3.44)	(3.48)	(4.50)	(4.59)
Manual_Dexterity	-0.303**	-0.0455**	-0.364**	-0.0541**
	(-2.11)	(-2.10)	(-2.63)	(-2.62)
Selective_Attention	-0.0894	-0.0134	-0.245	-0.0364
	(-0.22)	(-0.22)	(-0.64)	(-0.64)
Time_Sharing	-0.606*	-0.0912*	-0.610*	-0.0906*
	(-1.70)	(-1.71)	(-1.88)	(-1.90)
Knowledge_Mechanical	-0.0417	-0.00628	-0.0515	-0.00765
	(-0.41)	(-0.41)	(-0.56)	(-0.56)
Interest_Realistic	0.344***	0.0518***	0.393***	0.0584***
	(4.40)	(4.36)	(5.19)	(5.20)
Interest_Social	-0.169**	-0.0254**	-0.152**	-0.0225**
	(-2.11)	(-2.11)	(-2.07)	(-2.08)
Style_Leadership	0.834**	0.125**	0.659**	0.0980**
	(2.56)	(2.57)	(2.08)	(2.08)
Style_Effort	-1.418***	-0.213***	-1.293***	-0.192***
	(-3.64)	(-3.74)	(-3.52)	(-3.58)
Style_Stress_Tolerance	1.004**	0.151**	0.841**	0.125**
	(2.74)	(2.78)	(2.25)	(2.27)
Style_Concern_for_Others	-0.687**	-0.103**	-0.676**	-0.100**
	(-2.15)	(-2.16)	(-2.23)	(-2.23)
Style_Integrity	-0.765*	-0.115*	-0.714*	-0.106*
	(-1.86)	(-1.87)	(-1.74)	(-1.74)
Hazardeous_Equipment	0.460**	0.0692**	0.447**	0.0665**
	(2.67)	(2.68)	(2.72)	(2.72)
Competition	0.803***	0.121***	0.682**	0.101**
	(3.73)	(3.82)	(3.22)	(3.28)
Responsibility_for_results	-0.576**	-0.0866**	-0.502**	-0.0746**
	(-2.82)	(-2.89)	(-2.57)	(-2.61)
Value_Working_Condition	0.727***	0.109***	0.687***	0.102***
	(4.53)	(4.56)	(4.47)	(4.44)
parttime_perc			-0.0396***	-0.00588***
			(-3.37)	(-3.46)
selfempl_perc			0.0102**	0.00151**
			(2.40)	(2.40)

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$

Table 3.2: The role of job characteristics in occupational gender-segregation – point estimates and average marginal effects

women should be higher by more than 20 percentage points. A hasty conclusion
might be that despite their household responsibilities women actually put more
effort to their work. However, this contrasts with the findings of Peto & Reizer
(2015) that women perform less skill intensive tasks in their jobs. Behaving
like a leader and enduring stress has the expected effect of favouring men. On
the other hand, integrity favours women. When combined with the effect of
having responsibility for results, it actually seems that women are perceived as
more trustworthy. In addition, men seem to avoid occupations where concern
for others is needed. Neither dependability, nor being socially oriented, being
flexible or putting attention to detail show any effect on concentration of men
or women in an occupation.

Among work contexts, the effect of working with hazardous equipment was
already mentioned. As expected, it increases the share of men. There is an
even stronger effect of competition. Responsibility for results favours women,
not men as expected. Time pressure has no effect. This is quite surprising.
It gives the impression that women preferring flexible hours does not play as
important a role in gender segregation as it probably does in widening the
gender pay gap (as described e.g. in Goldin (2014))[13]. The only work value
that proved significant in shaping the share of men in an occupation is good
working conditions. Relationships and independence show the expected effect,
but it is too small to be statistically significant. Similarly, neither achievement
nor recognition seem to attract men more than women (as was expected).
One possible interpretation is that men are not irrational achievement seekers.
Rather they are practical, and since they are usually the primary breadwinners,
they want their job to be stable and well paid. Therefore it is probable that
this effect is strongly dependent on the asymmetric distribution of family roles.

The last two columns of Table 3.2 show the coefficients and average marginal
effects of our estimation after public sector, availability of part time contracts
and self-employment was included. The percentage of public sector positions
in an occupation does not by itself attract more women. The fact that public
sector is female dominated seems to be caused by characteristics of the occu-
pations themselves rather than by the nature of the employer. On the other
hand, availability of part-time contracts (even though it is now only a small
fraction of the labour market) really seems to be an inherent characteristic of
an occupation that is demanded more by women. The effect is statistically and

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[13]Alternatively the effect just does not show up, because time pressure among occupations
may be different in the Czech Republic than in the USA.

practically significant. When the share of part time contracts in an occupation is 10 percentage points higher, the share of women should be higher by 5.9 percentage points on average. The penetration of part-time contracts may work as a proxy for less demanding time requirements. Similarly, the share of self-employment increases the share of men in an occupation, even though factors such as the value of working independently are controlled for. After adding part-timers and self employment to the model, the effects of abilities get slightly stronger, while coefficients on all other characteristics decrease a little bit. This again shows the many indirect effects that the distribution of family roles has on the labour market.

When examining simply the correlation of demanded abilities and skills with the share of men, the positive sign comes up suspiciously more frequently than the negative (see Table B.6). This gives rise to a hypothesis that for men their skills are more important for their occupational attainment than for women, while women are attracted more by other characteristics of occupations (such as work styles which should reflect personality traits). Such a suspicion is strengthened by the finding of Pollert (2005) that women are assigned with less skill intensive tasks within occupations. However, a quick look through the results does not support such a hypothesis. All categories of occupational characteristics include some that favour both men and women. Besides the coefficients themselves, it is also interesting to see, how much of the variation in the share of men in an occupation is actually captured by all these factors. A rough estimate is provided by computing the squared correlation between real and predicted values (an analogy of an R^2 statistic in OLS). The value is 0.6650 and therefore roughly 30% of the variation in the dependent variable is left unexplained.

Lastly, a few essential cautions are needed about how the above presented results can be interpreted. It was already noted that our estimation is a description of the 2013 Czech labour market. The effects could be different in different times and places. Although the differences between men and women as well as various stereotypes about them are similar across countries and change very slowly, the demand for various abilities or personality traits as well as the preferences of workers can differ markedly. Secondly, the coefficients cannot by no means be used to predict the effects of substantial shifts in demand for characteristics that happen across the whole labour market. For example, if the demand for mathematical reasoning increased in all the occupations (due to a technological shift), the distribution of men and women should not change.

There is no motivation for anyone to move. Therefore, the shifts in job characteristics always need to be understood as relative to the average. As a matter of fact, that is exactly what the regression method does. It evaluates the change of the dependent variable connected with a shift in an independent variable, holding other factors as well as the average level of the independent variable fixed. If all explanatory variables were demeaned before running the regression, the results would be exactly the same. Last but not least, it is not reasonable to use the results for predictions of any kind. The estimation should be understood as descriptive. The most obvious drawback of any prediction is, that when a change decreases the share of men in one occupation, it most probably increases the share in another. The substitution effect is not captured by our model.

3.4   Interpretation and conclusion

When interpreting the overall results, it is tempting to rush to simplified conclusions. At first glance, most of the occupational gender segregation is caused by differences between men and women and so there is nothing inefficient or unjust about it. However, it must be remembered that for most of the characteristics we are simply not able to distinguish the role of real differences from the role of stereotypes. Moreover, it is not at all clear whether the real differences are caused by biology or whether they are socially constructed. And even if all the included occupational characteristics reflected only biological differences, we are left with more than 30% of the variation in $M_i/(M_i + F_i)$ unexplained.

One of the main outcomes of this thesis is a call for being specific when trying to address occupational gender segregation. The results clearly show which aspects of occupations are determinant and which are not (at least in the Czech Republic in 2013, broader data sets would certainly be useful for robustness checks). For example, the debates about too few women in fields demanding mathematical or mechanical reasoning or boys not reading enough seem to overshadow the differences and stereotypes with stronger impact. More attention should be devoted to differences in interests and work styles. We have now only a very limited idea about whether these effects are caused by stereotypes or biological differences. Many of the characteristics that proved significant point to an indirect effect of the uneven distribution of family roles (part-time contracts and self-employment, competition, or the value of good

working conditions). The impacts of a leadership work style and a competitive environment also suggests an existing vertical dimension of occupational gender segregation. More research is needed to answer the questions of whether there are differences in manual dexterity or time-sharing. In addition it is not clear why women tend to work in occupations where it is necessary to show more effort and where responsibility for results and integrity is demanded. Also the unexpected effects of mathematics and memorization provide us with more questions than answers. Last but not least, the impacts of spatial orientation or hazardous environment show that physical differences still matter in the labour market. As long as these abilities are demanded by employers, it is unreasonable to expect occupational gender segregation to disappear (although its level could decrease substantially). Rather there may be an optimal level of occupational gender segregation above zero (possibly varying with time and place), completely consistent with an efficient labour market. This optimal level would materialise in a positive optimal index of dissimilarity and would be decreased only by changes in demand for biologically determined characteristics (as happened with muscular strength).

Chapter 4

Conclusion

The concentration of men and women in different occupations seems to be one of the most persistent features of the labour market. This is undoubtedly the case for the Czech Republic. Based on the data from 2013, over 57% of all employed men or women would have to change their occupation so that the proportions of men versus women would be the same throughout the whole labour market. The level of occupational gender segregation in the Czech Republic has been stagnating in the last ten years and it is still way above the EU-27 average. Moreover, men are often almost completely isolated from women – more than 18% of them work in an occupation with less than one percent of female colleagues.

At least in the Czech Republic, it is almost exclusively the mother who stay at home to take care of small children. When this element of segregation (prior entry to the labour market) is omitted, measures such as the index of dissimilarity provide counter-intuitive cross-country comparisons. Because of the differences in labour participation, Scandinavian countries seem much more segregated than the countries of South Europe. The proposed approach of this thesis is simply to treat housework as an occupation, and include it in the measures. As a result the percentage of men or women, who would have to change their occupation for segregation to disappear, jumps to 60.19%. The modified approach could help to resolve the political dilemma of promoting either lower segregation or higher labour market participation of women. Although the oldest cohorts experience the highest levels of segregation in our sample, the youngest generations seem to be more segregated than men and women in their thirties and forties. This pattern is new and surprising compared to the results of Jurajda & Franta (2007). Concentration of men and women in different

occupations is the strongest among people with secondary level of education, people who live in sparsely populated areas and in poorer regions, and among those who are married or divorced.

To assess to what extent the current outcome is inefficient or how segregation could be reduced, it is necessary to understand its causes. There are many theories of occupational gender segregation. Nonetheless, it is argued in this thesis that they are not in conflict. Rather they describe different stages of the process. All streams of explanations are at the end rooted in either biological differences between men and women or in stereotypes and the resulting social pressure to end up differently. Which of the two roots is more important is generally impossible to resolve. Lastly, for occupational gender segregation to happen it is equally necessary that occupations differ in their characteristics. This last link between root causes and the actual shares of men and women in occupations is the main target of this thesis. It enables us to see which differences and stereotypes actually matter in the current Czech labour market. Occupations are characterized by their demanded abilities and work styles, their typical work contexts and interests, by and the work values they offer. The information is taken from the Occupational Information Network (O*NET). The importance of each characteristic is tested after estimating a model of the share of men in an occupation depending on work characteristics. The chosen method is a quasi-likelihood estimation assuming a logit link between the dependent variable an the explanatory factors, and an underlying binomial distribution. Although the method seems to be a reasonable choice compared to other options, Appendix A shows that it is far from perfect. More econometric discussion about modelling proportions is therefore encouraged.

Many of the tested variables proved both practically and statistically significant in shaping occupational gender segregation in the Czech Republic. Higher required levels of spatial orientation favour men, while manual dexterity and the ability of time sharing attract women. One of the most shocking results is that when all the tested characteristics are controlled for, mathematical reasoning and memorization actually have the opposite effects than what is assumed in the literature. Mathematics seems to favour women and the ability to memorize is stronger in male dominated occupations. There is no statistically significant effect of mechanical reasoning or muscle strength, once hazardous equipment is controlled for. Moreover, men work in occupations with realistic interests, while social topics and concern for others attract more women. Many of the characteristics that proved significant point to an indirect effect

of the uneven distribution of family roles (the share of part-time contracts and self-employment, stronger competition, required stress tolerance or the value of good working conditions such as pay and stability). The importance of a leadership work style also suggests an existing vertical dimension of occupational gender segregation. In addition, women tend to dominate when integrity and responsibility of results is required. Surprisingly, the work style of showing effort in your job seems to have a strong effect on attracting women into an occupation. Overall, many of the results are unexpected and so they provide us with more questions than answers.

As summarized in the first chapter, the treatment of men and women is fairly specific in the Czech labour market. The gaps in labour participation and wage might influence the overall level of segregation as well as the importance of each characteristic. It would be extremely interesting to see whether the effects estimated in this thesis are robust across other countries. When interpreting the results, it is tempting to rush to simplified conclusions – most of the gender segregation can be explained by characteristics of occupations and therefore by differences between men and women. But it must not be forgotten that we provide no conclusions about what caused these differences, or whether there are none and employers just use stereotypes to discriminate against men or women. One of the main outcomes of this thesis is a call for being specific when trying to address occupational gender segregation. The results clearly show which aspects of occupations are determinant and which are not (at least in the Czech Republic in 2013). The significant role of stereotypes and biological differences, and especially of the resulting unequal household burden, shows once again the importance of social and institutional factors for market outcomes. Consequently, it proves the need for an interdisciplinary overlap among social sciences, in order to truly understand the labour market.

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Appendix A

Choosing the right estimation method

Having the proportion of men in an occupation as a dependent variable brings several complications to the analysis. As was already pointed out, the relationship behind the model is necessarily non-linear. Secondly, a decision has to be made whether to weight occupations by their size in the economy. The subsequent paragraphs aim to address these issues.

There are two main reasons why ordinary least squares are not suitable for modelling proportions. Firstly, the dependent variable is bounded on $[0, 1]$. Therefore the relationship between characteristics of occupations and the share of men cannot be linear. OLS is likely to produce insensible predictions about certain occupations having more than 100% or less than 0% of men. Secondly, the variance of the error term is inherently heteroscedastic. When the expected value of the dependent variable moves to one of its bounds, the variance goes to zero (though heteroscedasticity could be dealt with by computing robust standard errors).

An easy way to address these issues is to transform the dependent variable, so it would range over the whole real line. Then the model can be estimated by OLS. The logit transformations (logarithm of the odds ratio) is often used (e.g. by Busch-Heizmann (2015) for modelling the share of men in an occupation). However, this approach is usable only for data on $(0, 1)$, zeros and ones cannot be transformed. But our data contain many boundary observations (see Figure A.1 for both unweighted and weighted distributions). Kieschnick (2003) suggest utilizing the Beta function. However, Papke & Wooldridge (1993) warn that such methods assume that each value on $[0, 1]$ comes with a probability
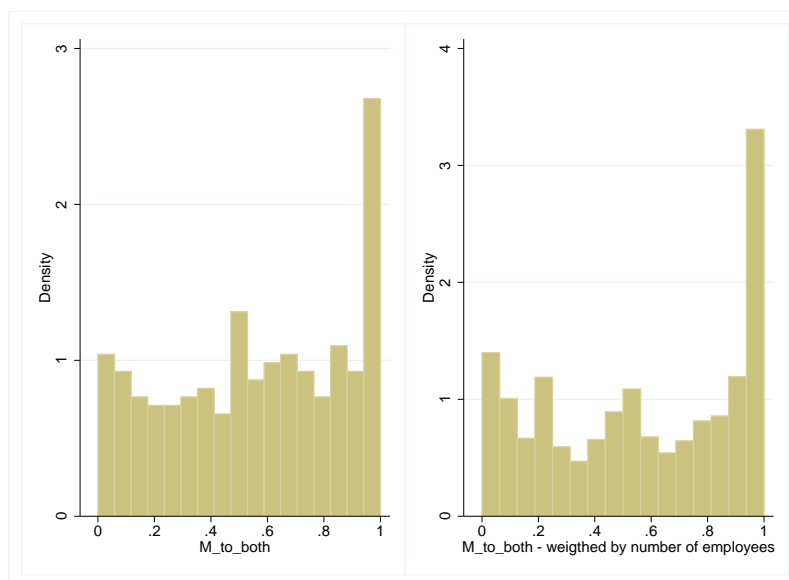
Figure A.1: Distribution of the dependent variable (the share of men
in an occupation)

Source: author's elaboration.

of zero. Assuming this seems unjustified given the peak at 100% of men in our
sample.

The Tobit model can also be considered. It assumes that there is a latent
variable behind the estimated relationship, ranging possibly on the whole real
line. If the latent variable had been observed, the relationship with explanatory
variables would have been linear. But for a reason the ideal values are censored
and therefore the observed values are bounded. However, it is quite unintuitive
to think of an ideal share of men in an occupation that could be negative
or above 1. By rejecting the alternatives, it seems reasonable to follow the
approach recommended by Papke & Wooldridge (1993) as well as Kieschnick
(2003). A logit link was assumed, and a quasi maximum likelihood approach
was utilized to make use of the boundary observations.

Weighting the observations by the number of employees is not exactly in-
tuitive. If we tried to find out, how many more women would be employed
in an occupation after increasing its demand for a particular ability, there is
no straightforward justification for prioritizing some observations. However,
the purpose of our empirical analysis is not to predict changes. It is to find
out, which factors matter on the labour market. It is to compare which occu-
pational characteristics are significant in shaping the distribution of men and
women on the labour market. For this purpose it is reasonable to put more

weight on those occupations who employ more people. Thanks to that our results are not driven by occupations that are marginal. A second practical reason for weighting is to mitigate the effects of possible measurement errors in computing the share of men. In the beginning all occupations with less than 15 observations were excluded from our analysis. Still evaluating the share of men from just 16 observations is problematic. Table A.1 compares the results for weighted and unweighted observations. The biggest difference is for stress tolerance and the value of good relationships. Most effects actually seem stronger when observations are weighted.

	(1 - without weight) M_to_both		(2 - occupations weighted) M_to_both	
Spatial_Orientation	0.533***	(4.17)	0.698***	(4.38)
Mathematical_Reasoning	-0.605***	(-4.90)	-0.527***	(-3.41)
Memorization	0.840***	(3.40)	0.953***	(3.44)
Manual_Dexterity	-0.240**	(-2.13)	-0.303**	(-2.11)
Selective_Attention	0.400	(1.27)	-0.0894	(-0.22)
Time_Sharing	-0.649**	(-2.46)	-0.606*	(-1.70)
Knowledge_Mechanical	0.0416	(0.48)	-0.0417	(-0.41)
Interest_Realistic	0.244***	(3.56)	0.344***	(4.40)
Interest_Social	-0.211**	(-2.93)	-0.169**	(-2.11)
Style_Leadership	0.860**	(3.25)	0.834**	(2.56)
Style_Effort	-1.142***	(-3.67)	-1.418***	(-3.64)
Style_Stress_Tolerance	0.485*	(1.80)	1.004**	(2.74)
Style_Concern_for_Others	-0.695**	(-2.54)	-0.687**	(-2.15)
Style_Integrity	-0.336	(-1.17)	-0.765*	(-1.86)
Hazardous_Equipment	0.321**	(2.25)	0.460**	(2.67)
Competition	0.721***	(4.19)	0.803***	(3.73)
Responsibility_for_results	-0.397**	(-2.48)	-0.576**	(-2.82)
Value_Relationship	0.0419	(0.34)	-0.209	(-1.44)
Value_Working_Condition	0.546***	(3.54)	0.727***	(4.53)
Value_Independence	0.116	(0.85)	0.206	(1.29)
N	311		311	

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$

Table A.1: The effect of weights

Figure A.2 shows the predicted distributions for OLS, Tobit and GLM, both without and with weights. It seems that our selected method is the best at capturing the non-linear nature of the relationship between the share of men and occupational characteristics. However, Figure A.3 shows that the

results are far from perfect. All methods show a positive relationship between estimated residuals and values of the dependent variable. Such a pattern is problematic and suggests that none of the methods is able to capture all the non-linearity. All of them predict the share of men to be closer to the average than it actually is. All methods underestimate it when it is truly close to 1 and overestimate it when it is close to zero. These results represent a call for new ideas beyond the already used about how to model fractions.

In addition, a possible interpretation is that all of the variables included in the model are not enough to justify the concentration of men and women in different occupations. Even when various differences between occupations are taken into account, the resulting distribution is still too extreme to be explained by these differences. Other forces must play a role. Some of the circular mechanisms strengthening initial causes or rigidities caused by factors that are no longer relevant could be those forces.
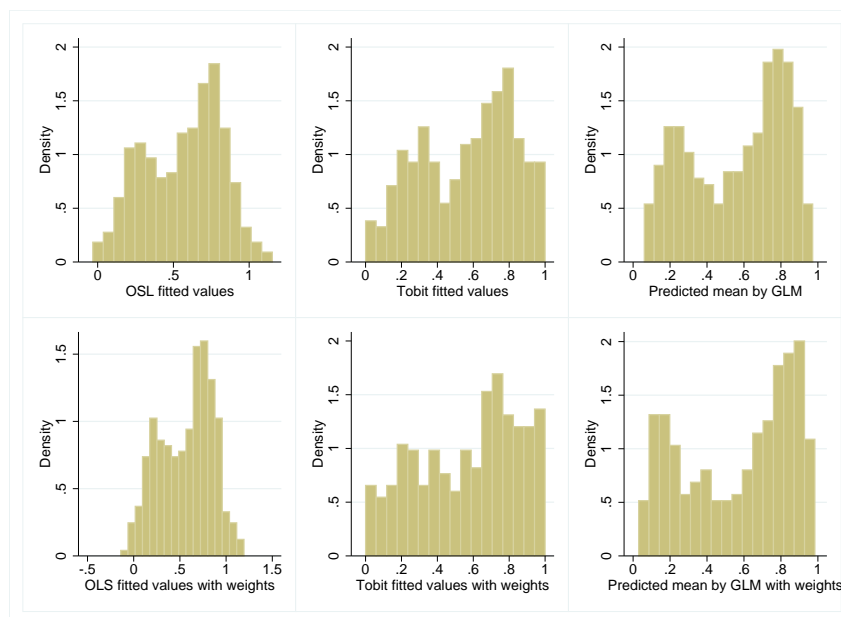

Figure A.2: Comparison of predicted means from 3 regression methods - OLS, Tobit and GLM with logit link with and without using weights

Source: author's elaboration.
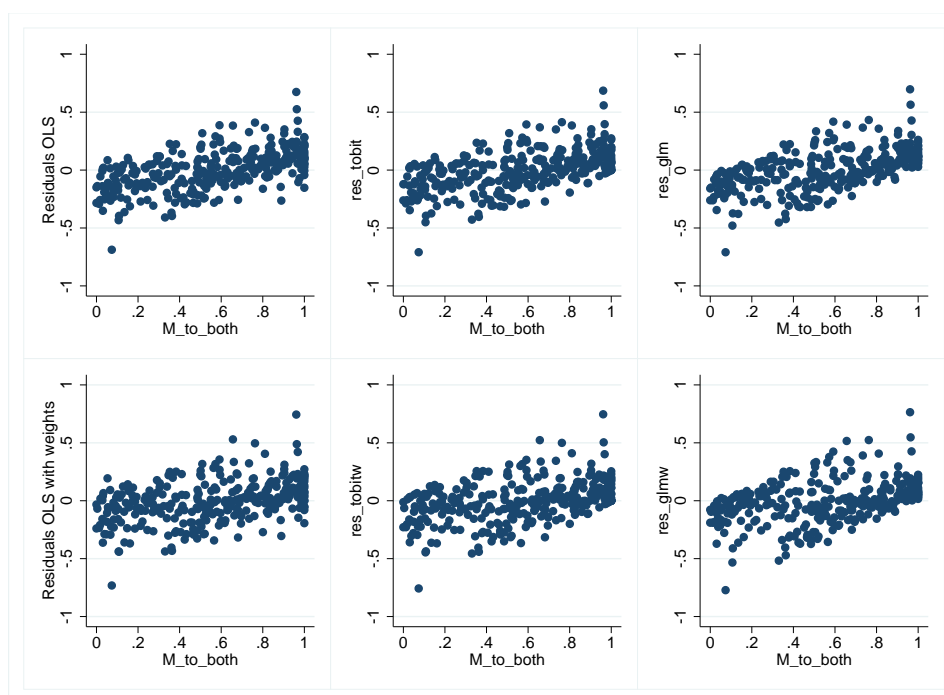
Figure A.3: Comparison of failing to capture non-linearity by OLS, Tobit and GLM with logit link (with or without weights)

Source: author's elaboration.

Appendix B

Supportive tables

Table B.1: Employed population – the level of education

Level of Education	Men	Women	All
Finished primary school or lower	3.53%	5.07%	4.22%
Secondary school finished without the final exams	42.36%	27.77%	36.01%
Secondary school finished with the final exams	31.65%	40.56%	35.52%
Tertiary education without PhD	21.68%	26.16%	23.63%
PhD or similar	0.78%	0.43%	0.63%

All men employed as well as all women employed represent the 100%.
Among the employed population, women are on average more educated, although in absolute terms they represent a smaller share in each category due to their lower participation rate.
Source: author's computations based on the Czech LFS for 2013.

Table B.2: Employment among men/women 15-59 excluding students

Marital Status	Men	Women
Single	84.39%	72.69%
Married	93.48%	75.54%
Divorced	86.89%	80.24%
Widowed	85.42%	72.06%

Among married women, higher share is working than among single women, a result robust to excluding students. However, the jumps for married men and divorced women show the importance of bread-winners.
Source: author's computations based on the Czech LFS for 2013.

Table B.3: Index of dissimilarity by the level of education

Level	ID
Primary school or lower	46.46%
Secondary school finished without the final exam	53.09%
Secondary school finished with the final exam	61.10%
Higher	40.89%

In the first category a predominantly role is played by cleaners and helpers with 90% of women. In the second and third group segregation is driven by various blue-collar jobs as well as clerks and health associate professionals such as nurses. In the highest group occupations contributing most to segregation are teachers and medical doctors on one side and IT specialists and engineers on the other.
Source: author's elaboration based on the Czech LFS for 2013 using the 2-digits ISCO-08 classification.

Table B.4: Index of dissimilarity by marital status

Marital Status	ID	ID restricted (1)
Single	51.85%	52.21%
Married	54.38%	54.89%
Divorced	55.01%	55.93%
Widowed	61.76%	

(1) In the last column, people who reported to be in retirement or educating themselves, as well as people above 60 were excluded. The widowed category has now too few observations.
Source: author's elaboration based on the Czech LFS for 2013 using the 2-digits ISCO-08 classification..

Table B.5: Index of dissimilarity by the degree of urbanization

Level	ID
Densely populated area	50.59%
Intermediate density area	53.30%
Thinly populated area	56.37%

DEGURBA (Degree of Urbanization) is an Eurostat classification of the density of population.
Source: author's elaboration based on the Czech LFS for 2013 using the 2-digits ISCO-08 classification..

Table B.6: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
M_to_both	0.564	0.311	0	1
Mathematical_Reasoning	2.321	0.837	0.13	4.63
Memorization	2.206	0.527	0.5	3.38
Spatial_Orientation	0.79	0.77	0	3.25
Selective_Attention	2.93	0.304	2.12	4
Time_Sharing	2.482	0.354	0.38	3.438
Rate_Control	1.227	1.014	0	3.2
Static_Strength	1.734	1.186	0	4.065
Oral_Comprehension	3.811	0.527	1.88	5.185
Manual_Dexterity	2.16	1.064	0	4.408
Interest_Artistic	2.056	1.315	1	7
Interest_Conventional	4.361	1.326	1.165	7
Interest_Enterprising	3.875	1.794	1	7
Interest_Investigative	2.823	1.551	1	7
Interest_Realistic	4.747	1.99	1	7
Interest_Social	2.66	1.678	1	7
Style_Leadership	3.631	0.508	2.356	4.83
Style_Dependability	4.395	0.243	3.41	4.9
Style_Concern_for_Others	3.775	0.447	2.49	4.775
Style_Social_Orientation	3.402	0.5	1.73	4.51
Style_Effort	3.762	0.336	2.9	4.59
Style_Stress_Tolerance	3.965	0.415	2.94	4.770
Style_Flexibility_Adaptability	3.93	0.341	3	4.71
Style_Attention_to_detail	4.363	0.278	3.25	4.884
Style_Integrity	4.25	0.405	2.895	4.98
Hazardeous_Equipment	2.184	1.051	1	4.91
Competition	3.028	0.498	1.59	4.76
Skill_Reading_Comprehension	3.439	0.72	1.75	5.227
Skill_Mathematics	2.385	0.796	0	4.88
Skill_Social_Perceptiveness	3.026	0.59	1.62	5.064
Skill_Service_Orientation	2.815	0.561	1.38	4.092
Value_Achievment	3.903	1.276	1.557	7
Value_Independence	4.229	1.135	1.67	6.835
Value_Recognition	3.409	1.21	1	6.5
Value_Relationship	4.433	1.019	1.67	7
Value_Support	4.379	0.774	2	6
Value_Working_Condition	3.868	1.095	1.5	6.5
Responsibility_for_results	3.298	0.548	1.65	4.743
Time_pressure	3.835	0.411	1.91	4.8
Knowledge_Mechanical	2.292	1.397	0.125	6.12
parttime_perc	7.376	8.645	0	55.511
public_perc	8.289	20.536	0	100
selfempl_perc	15.586	18.702	0	81.458
N		277		

Table B.7: Cross-correlation table

| Variables	M_to_both	Spatial_or	Rate_cont	Strength	Math	Oral_Com	Memory	Man_Dex	Sel_att	Time_sh	Know_M	Int_Real	In_Soc	Leader	Effort	Stress_T	Concern	Integr	Hazard	Comp	Resp_res	Relation	Work_Con
M_to_both	1.00																						
Spatial_or	0.54	1.00																					
Rate_cont	0.41	0.69	1.00																				
Strength	0.28	0.68	0.82	1.00																			
Math	0.10	-0.18	-0.44	-0.56	1.00																		
Oral_Com	0.00	-0.27	-0.56	-0.60	0.76	1.00																	
Memory	0.06	-0.13	-0.45	-0.48	0.76	0.79	1.00																
Man_Dex	0.25	0.48	0.81	0.83	-0.48	-0.60	-0.49	1.00															
Sel_att	0.44	0.27	0.26	0.12	0.32	0.33	0.44	0.14	1.00														
Time_sh	0.20	0.40	0.10	0.13	0.34	0.40	0.56	0.01	0.52	1.00													
Know_M	0.60	0.55	0.65	0.51	0.03	-0.18	-0.13	0.58	0.37	0.16	1.00												
Int_Real	0.42	0.55	0.78	0.74	-0.40	-0.56	-0.52	0.82	0.20	-0.07	0.69	1.00											
In_Soc	-0.46	-0.33	-0.50	-0.28	0.10	0.43	0.40	-0.42	-0.14	0.25	-0.55	-0.63	1.00										
Leader	0.12	-0.00	-0.32	-0.26	0.47	0.59	0.55	-0.41	0.18	0.47	-0.06	-0.46	0.48	1.00									
Effort	0.03	-0.31	-0.44	-0.49	0.56	0.64	0.55	-0.42	0.17	0.21	-0.10	-0.44	0.29	0.61	1.00								
Stress_T	-0.15	-0.23	-0.43	-0.36	0.32	0.53	0.50	-0.42	0.14	0.35	-0.33	-0.54	0.58	0.65	0.50	1.00							
Concern	-0.38	-0.14	-0.30	-0.13	0.00	0.31	0.27	-0.24	-0.06	0.32	-0.40	-0.45	0.76	0.52	0.21	0.68	1.00						
Integr	-0.28	-0.39	-0.66	-0.59	0.54	0.70	0.61	-0.61	0.04	0.28	-0.42	-0.67	0.60	0.59	0.60	0.67	0.57	1.00					
Hazard	0.56	0.68	0.82	0.70	-0.23	-0.42	-0.32	0.66	0.32	0.12	0.81	0.73	-0.57	-0.21	-0.32	-0.42	-0.40	-0.60	1.00				
Comp	0.31	-0.07	-0.18	-0.26	0.40	0.35	0.28	-0.19	0.13	0.18	0.07	-0.18	-0.05	0.40	0.59	0.25	-0.08	0.25	-0.07	1.00			
Resp_res	0.32	0.31	0.23	0.17	0.31	0.20	0.23	0.12	0.25	0.45	0.33	0.10	-0.07	0.55	0.22	0.24	0.09	0.06	0.28	0.28	1.00		
Relation	-0.36	-0.25	-0.50	-0.31	0.16	0.43	0.39	-0.44	-0.10	0.29	-0.48	-0.62	0.79	0.57	0.31	0.65	0.80	0.61	-0.52	0.04	0.04	1.00	
Work_Con	0.20	-0.17	-0.43	-0.53	0.77	0.82	0.72	-0.48	0.35	0.39	-0.00	-0.47	0.31	0.70	0.73	0.48	0.19	0.62	-0.28	0.50	0.36	0.36	1.00
Indep	0.17	-0.11	-0.38	-0.44	0.66	0.74	0.66	-0.44	0.29	0.45	-0.02	-0.48	0.39	0.73	0.70	0.49	0.24	0.61	-0.27	0.53	0.39	0.36	0.88
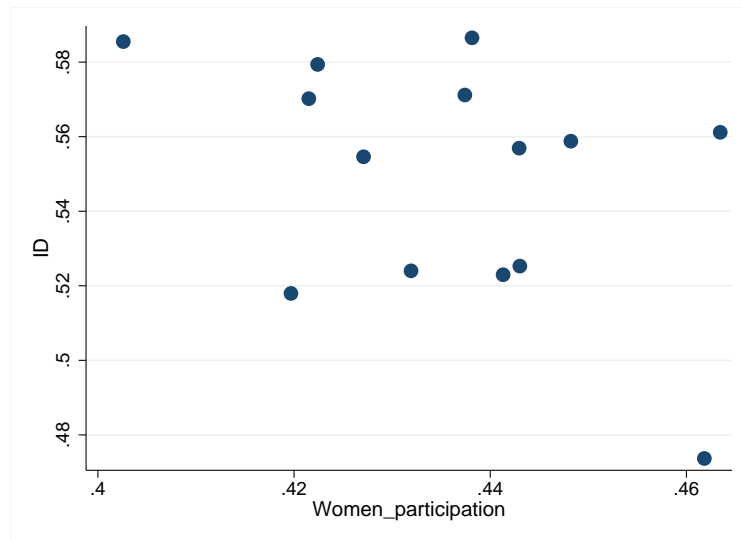
Figure B.1: Scatter plot of regions of the Czech Republic – women labour force participation versus the index of dissimilarity

Source: author's elaboration based on the Czech LFS for 2013 using the 2-digits ISCO-08 classification.