Aalto University
School of Economics

Explaining Gender Gap in Labor Force Participation

Economics

Master's thesis

Tuomo Jääskeläinen

2011

Department of Economics
Aalto University
School of Economics

AALTO UNIVERSITY SCHOOL OF ECONOMICS
Department of Economics
Master's Thesis

ABSTRACT
April 21, 2011

Tuomo Jääskeläinen

EXPLAINING GENDER GAP IN LABOR FORCE PARTICIPATION

Gender gap in labor force participation has varied strongly between countries and time. Despite constant narrowing of the gap over the last 40 years, it still persists in practically everywhere. Closing the gender gap in participation should be seen as an important goal, as working and gaining income can empower women both within their households and in the society. It can also improve children's welfare and the efficiency of the economy as a whole. The purpose of this study is thus to assess both the theoretical and empirical literature conducted on the topic and to evaluate the role and importance of different factors with empirical analysis.

Changes in women's labor force participation, and consequently in the gender gap in participation, have been tried to explain in a multitude of ways. Models of labor market discrimination see the gap mainly as a result of employer discrimination which can take place in the form of dislike or using group proxies to maximize profits. Discrimination can lead to a situation where the disadvantaged group lowers its human capital investment, therefore perpetuating their position. Detecting discrimination empirically remains difficult. Classic models of labor supply see participation mainly as a matter of gaining sufficient wages. Although the narrowing of the gender gap in wages can historically explain some of the narrowing of the gap in participation, its impact seems to be in decline in the OECD countries. Household models explain labor market differences between men and women by either utility maximization for the whole household, or by the result of a bargaining game within the household. Participation choices at a certain point of time can have ramifications for the future participation, as well as on decisions concerning fertility or divorce. Government policy can also influence gender gap in participation through the system of taxation, parental leave policies or by subsidizing child care. Moving from a system of family taxation to individual taxation seems empirically the most efficient way of doing this. The advancement of technology in various fields has also served to improve women's participation by improving household productivity, control over lifetime employment and maternal health. Finally, recent research suggests that identity and culture are also important determinants of participation decisions.

Empirical work, based on country-level data provided by OECD and Eurostat, requires us to take both heteroskedasticity and autocorrelation into account when conducting regression analysis. Clustering standard errors for countries is the best way to do this in this case. Results from the regression analysis indicate that gender gap in primary education, availability of part-time work, government spending on day care, as well as marriage and divorce rates are the most important factors explaining variation in gender gap for a group of European countries between the years 1994 and 2006. Closing the gender gap in primary education by supporting women's educational attainment is the most important measure to be used in closing the gender gap in participation.

KEYWORDS: gender, women, labor supply, discrimination

Table of Contents

Index of Tables

Index of Figures

1 Introduction

Men and women have historically been seen as having different tasks in the household and in the paid labor market. Women have been held responsible for taking care of the household chores, causing them to work mainly within the confines of their homes. Men, on the other hand, have been more likely to work outside the household for monetary compensation. In the course of the 20th century, these differences have begun to disappear. Even though women have become more prominent in the labor markets, a marked difference in the labor force participation rates (LFPRs) still persists between the two genders. Furthermore, despite the nearly universal narrowing of the gender gap in the last 30 years or so, the gap still varies considerably across counties. Therefore, this paper will seek to explain what has driven the gender gap down, what factors are behind its variation across countries, and why it still persists almost everywhere. A better understanding of the factors behind the gender gap will allow us to pursue greater gender equality in the future.

The potential benefits from closing the gender gap in LFPRs are numerous, especially if it is done by increasing women's participation. For example Blau (1998) gives three reasons why increased labor force participation can be seen as advantageous for the women themselves. First, an increase in the number of female-headed families and single person female households has created a group of households whose well-being is strongly dependent on their participation in the labor markets. Second, earning an income increases women's bargaining position inside the household, thereby affecting the distribution of resources. Thus, making women less dependent on their husbands' income can also give them a more equal footing in making other household decisions. Third, the level of participation is related to the accumulation of work experience which is an important determinant of the wage. Increasing participation could therefore be an important factor in closing down the gender wage gap.

Besides individual benefits, increasing women's participation can also have implications for the society. First, there is some evidence that enhancing women's economic position through access to paid labor could bring benefits in the form of better nutrition and welfare for their children (Duflo 2003, 2005). Increased presence in the labor markets could also lead to an increase in the proportion of women taking part in political representation (Iversen and Rosenbluth 2008). Increasing women's labor market participation could increase economic efficiency, assuming that their skills are underutilized at the present time (Dollar & Gatti

1999). Besides instrumental benefits one can also argue that equal access to labor markets is a goal worth pursuing by itself, as it is related to gender equality in general.

It should be remembered, however, that an increase in women's labor force participation is not necessarily beneficial for women. For example, increased working in young age can prevent access to education, decreasing the future earnings potential (Sundaram and Vanneman 2008). Extended market work can also strongly decrease women's leisure time, if the increasing work time does not decrease the time spent on household work. It is also possible that women are not able to keep hold of the income they earn, but instead are forced to turn it over to their husbands. Women would thus carry the costs of working without enjoying its benefits. Furthermore, participating in the labor markets can incur significant costs and risks, such as traveling costs or entitlement risks, which are not visible in labor force participation figures (Elson 1999).

If the benefits from closing the gender gap in participation are seen as greater than the potential problems, looking into the factors behind the gap is clearly desirable. Gaining a better understanding of the reasons behind the gender gap in LFPRs will give us a better idea on how to close the gap, and what is the most efficient way of doing so. A better understanding of how labor markets are gendered will also give us insight on how changes in policy instruments can affect the gender gap without actually meaning to do so. For example, understanding the relationship between maternal leave policies and mother's employment allows us to assess the impact of the proposed extension of minimum maternity leave in the European Union (e.g. European Parliament 2010) on mothers' labor supply.

The objective of this thesis is thus to explain the variation of the gender gap in labor force participation rate. Three main questions arise related to certain trends in the gender gap which will be presented in the second chapter of this thesis. First, how can we explain changes in the gender gap over time? Second, how can we explain difference in the gender gap across countries? Third and finally, why does the gender gap still persist in almost all countries of the world? We will seek to answer these questions by considering a wide variety of theoretical and empirical research related to the topic. To assess the findings from the literature, empirical estimation will also be conducted on the evolution of the gender gap in participation for a group of OECD countries. The main contribution of this piece of research is thus twofold. First, it will seek bring together topics from different branches of economic research, all

relating to the gender gap in labor force participation. Labor economics has mostly been interested on how topics such as labor market discrimination, wage differentials or human capital affect the labor market equilibrium. These topics will be complemented by research from issues relating especially to women's position in the labor markets such as how having children affects labor supply, or whether the government can influence the gap through policy instruments. We will also consider recent research concerning the impact technology and preferences have on labor supply. Besides drawing together a diverse field of research, the second major contribution of this paper will be in looking at these issues in a cross-country perspective, as opposed to the more usual concentration on a single country.

As this paper seeks to cover a wide range of factors relating to the gender gap in LFPRs, it is clear that all the research cannot be discussed to the level of smallest detail. Therefore, when commenting on the previous empirical research we will be mainly concerned with results. Only if the results from different pieces of research are contradictory, we will pay closer attention to the methodology. Another limitation to this paper is its concentration on the gender gap in highly industrialized countries which lie mostly in the North America or in the Western Europe. After the second chapter, little is said about the situation in developing countries or countries in transition. This limitation is mainly caused by the availability of former research, and in the empirical estimation by the availability of data. Within the highly industrialized countries, research conducted in the United States is most prevalent, and we should remember that these results are not necessarily generalizable to the different institutional settings in Europe. Furthermore, this paper is time-wise rather limited, mainly dealing with research and data from the 1980s onwards. Again, this is mainly caused by the unavailability of data from the time periods further back[1].

The structure of the study is as follows. In the second chapter, I will present some trends on the gender gap in LFPRs, disaggregating the data both geographically and with respect to income. This should help to illustrate how large the differences in labor market participation are between men and women, as well as give some information as to what types of countries tend to have especially wide or narrow gaps. Chapter three begins by presenting economic models of discrimination in the labor markets. These models seek to explain the circumstances under which employers will prefer to hire employees from a certain group over

[1] This is an issue in most of the other empirical research as well. The comprehensive research conducted by Goldin (1990) on women in the United States can be singled out as one of the rare exceptions in this respect, as it reaches out back to the 19th century.

some other group, such as men over women. Both models of taste for discrimination and statistical discrimination are dealt with. Whereas theories of discrimination are more concerned with demand for labor, we will next move on to look at the possible reasons behind the differences in supply for labor between men and women. Models concerning wages, non-labor income and human capital will open up this chapter, to be followed by discussion on how division of labor within the household can be an important factor in determining the gender gap in LFPRs. The effect of fertility on women's labor supply will also be considered here, as it is arguably the only non-social factor differentiating men from women. Fifth chapter will consider how policy instruments, technology and informal institutions can affect the gender gap. Empirical analysis on the gender gap will be conducted in the sixth chapter, to be followed by some final conclusions.

2 Differences in Gender Gap in Labor Force Participation Rates

This chapter will briefly look into how gender gap in labor force participation differs across countries, regions, and over time. We shall begin by defining the term. Formally, labor force participation rate describes the ratio of employed and unemployed of working age people to the whole working age population. When we want to look at the difference in labor force participation between men and women, we simply extract the female LFPR from the male LFPR, thus giving us the gender gap in LFPRs.

Although we will in later chapters concentrate mainly on high-income countries, it is still useful to have a general idea of the global trends. However, it should be first noted that statistics on labor force participation are far from perfect. There are at least two reasons for this. First, statistics themselves might be unreliable, especially in poorer countries where the gathering of labor force data is not necessarily up to Western standards. Second, the concept of market work varies between countries and over time, causing problems with both longitudinal and cross-country comparisons. It has been suggested that there might be overemphasis on the narrowing of the gender gap over time as more and more work done by women is considered as market work[2] (Elson 1999; Tzannatos 1999).

According to data gathered by the World Bank from the year 2007, we can see that there is great variation in the gender gap in LFPRs across countries themselves and with respect to both geographical regions and income levels (World Bank 2009). For people over the age of

[2] For example, statistics show the number of female farmers increased in Sweden from 751 in 1930 to 58,283 in 1965, all the while the number of male farmers approximately halved (Tzannatos 1999).

15, the gender gap is positive in almost all countries, meaning that men's labor force participation rate is higher than women's. Only Rwanda and Mozambique have negative gaps but, as noted earlier, this data might not be totally reliable. Cross-country variation in the gender gap is extremely large: The size of the gap ranges from Mozambique's negative gap of -10.1 percentage points to Pakistan's positive gap of 64.1 percentage points. As can be seen from Table 1, there is also considerable variation across the income levels of countries, although the variation is not linear. The gender gap is lowest in the high income countries with an average of 17.71 percentage points, mainly resulting from the lowest male participation rate across income groups. High levels of education and relatively early transition from work to pension could be some of the reasons behind this phenomenon. For the low income countries, both the male and female labor force participation rates are high, also resulting in a relatively low average gap of 18.28 percentage points. Scarce opportunities for education and little state support for those outside the labor market could partly explain these high participation rates. Largest gender gaps can be found in the group of middle income countries, with an average gap of 27.98 percentage points. This group of countries has a relatively high male participation rate and a relatively low female participation rate.

Group	Gender Gap (% points)	Male LFPR (%)	Female LFPR (%)
Low income countries	18.28	82.92	64.64
Middle income countries	27.98	78.58	50.61
High income countries	17.71	69.84	52.13

Table 1: Cross-Country Variation in LFPRs Across Income in 2007
Source: World Bank (2009).

We can see from figure 1 that the gender gap has been in decline over time in all of the income groups. The narrowing has been strongest in high income countries (HIC) where the average gender gap in LFPRs was over 30 percentage points in 1980. However, the gender gap has decreased constantly ever since, with the overall decrease from 1980 to 2007 being around 13 percentage points. When comparing gender gap in 1980 and 2007 for low income countries (LIC), we can see that there has been an overall decrease of around 4 percentage points. There is no clear trend for this decline: The gender gap decreased in the 1980s, increased in the early 1990s with a peak of 20.82 percentage points in 1996, and has been in slow decline ever since. The gender gap has also been slowly narrowing for the middle income countries (MIC), with a decline of around 5.5 percentage points during the time period in question.

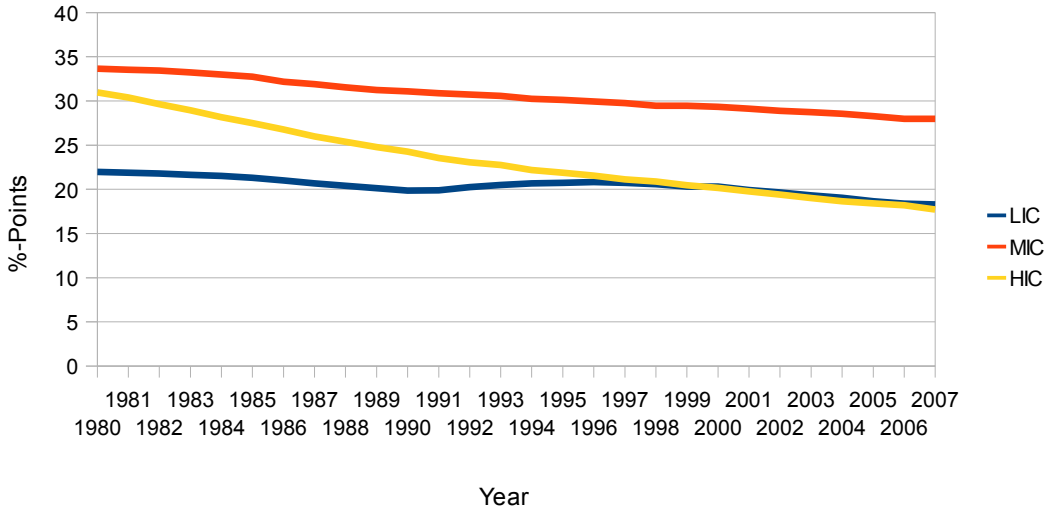

Figure 1: Cross-Country Variation in Gender Gap in LFPRs Across Countries Aggregated by Income 1980-2007

Source: World Bank (2009).

Geographical variation in gender gap is even larger[3], as can be seen from table 2. The lowest gaps are in the regions of East Asia and Pacific (13.7 percentage points), Europe and Central Asia (17.3 percentage points), and Sub-Saharan Africa (20.2 percentage points). For the first and third of these regions, the low gap is the result of high female participation rate, whereas for the second it is more due to a low male participation rate. The highest gender gaps are in the regions of Middle East and North Africa (47.6 percentage points) and South Asia (46.2 percentage points). For both of these regions, the large gender gap is mainly due to a low female participation rate. The region of Latin America and Caribbean (26.9 percentage points) has a gap which is close to the world average, with also average participation rates for both genders (World Bank 2009).

Group	Gender Gap (% points)	Male LFPR (%)	Female LFPR (%)
East Asia & Pacific	13.65	80.30	66.65
Europe & Central Asia	17.34	67.34	50.00
Latin America & Caribbean	26.88	79.89	53.01
Middle East & North Africa	47.56	73.76	26.20
South Asia	46.24	82.07	35.83
Sub-Saharan Africa	20.19	79.91	59.71
World	24.95	77.57	52.63

Table 2: Geographical Variation in LFPRs in 2007

Source: World Bank (2009).

When looking at geographical variation over time in figure 2, we can see that the gender gap has seen its biggest decreases in the region of Latin America and Caribbean (LAC). The

[3] It should be noted that this geographical data is only from developing countries, which could skew the results especially for the regions of Europe and Central Asia. OECD countries will be discussed in more detail when presenting data for the empirical estimation in chapter 6.

decrease has been especially intensive since the beginning of the 1990s: The gender gap was 44.4 percentage points in 1990, but only 26.9 percentage points in 2007. The gender gap has also narrowed considerably in the region of Middle East and North Africa (MNA), where the decrease has been around 12 percentage points over the time period covered in the figure. For the regions with high initial gaps, South Asia (SAS) has seen only meager narrowing. For the regions with relatively low gender gaps in 1980, Sub-Saharan Africa (SSA) and East Asia and Pacific (EAP) have seen a slow narrowing of the gap over the time period, whereas the gap has remained rather stagnant in Europe and Central Asia (ECA). Overall in the world (WLD), the gender gap in LFPRs has decreased from the value of 31.2 percentage points in 1980 to 24.9 percentage points in 2007.

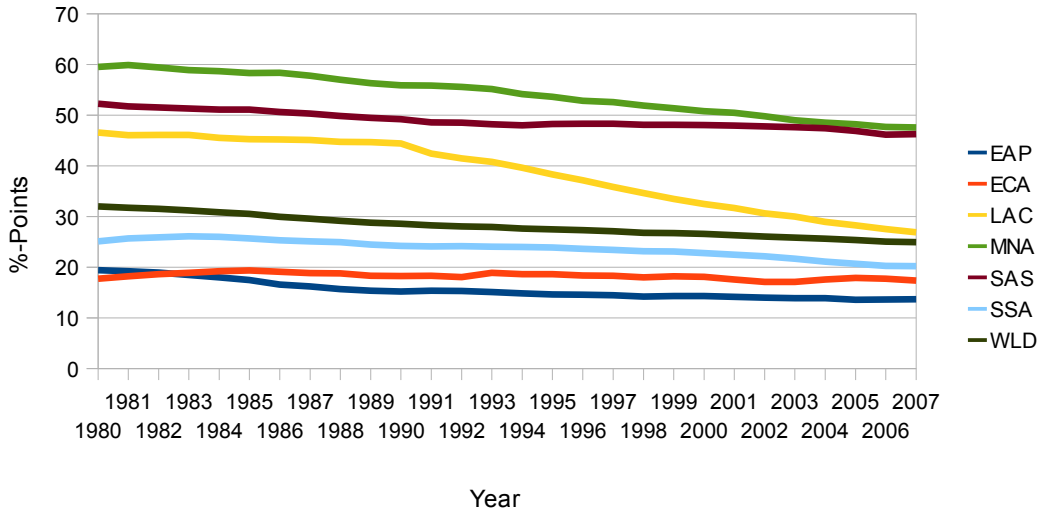

Figure 2: Geographical Variation in Gender Gap in LFPRs 1980-2007
Source: World Bank (2009).

Besides variation across geography and income groups, it is also beneficial to look how gender gap in labor force participation differs across age groups. Due to the availability of data, this is assessed only on OECD countries. Figure 3 gives us this figure from the late 1960s to the year 2009. As can be seen from the figure, gender gap in LFPRs is smallest for people between the ages of 15 and 24 with a relatively stable figure of 10 percentage points. For other age groups, there has been a considerable decrease in the gender gap over the time period covered here: Whereas in 1968 the gender gap in these older age groups ranged from around 40 percentage points to around 50 percentage points, nowadays the gender gap is around 20 percentage points. When looking at how the gap is constructed with respect to the two genders, we can divide the trends into three groups (see Appendix I for the figures disaggregated by gender). First, the stable level of the youngest age groups comes from a similar decrease of around 5 percentage points for the two genders. Second, for the age group

of 55-to-64-year-olds, there has been a slight decrease in men's labor force participation and an increase in women's participation. For the age groups between these two extremes, the overall decrease in the gender gap can mainly be attributed to a significant increase in women's participation.

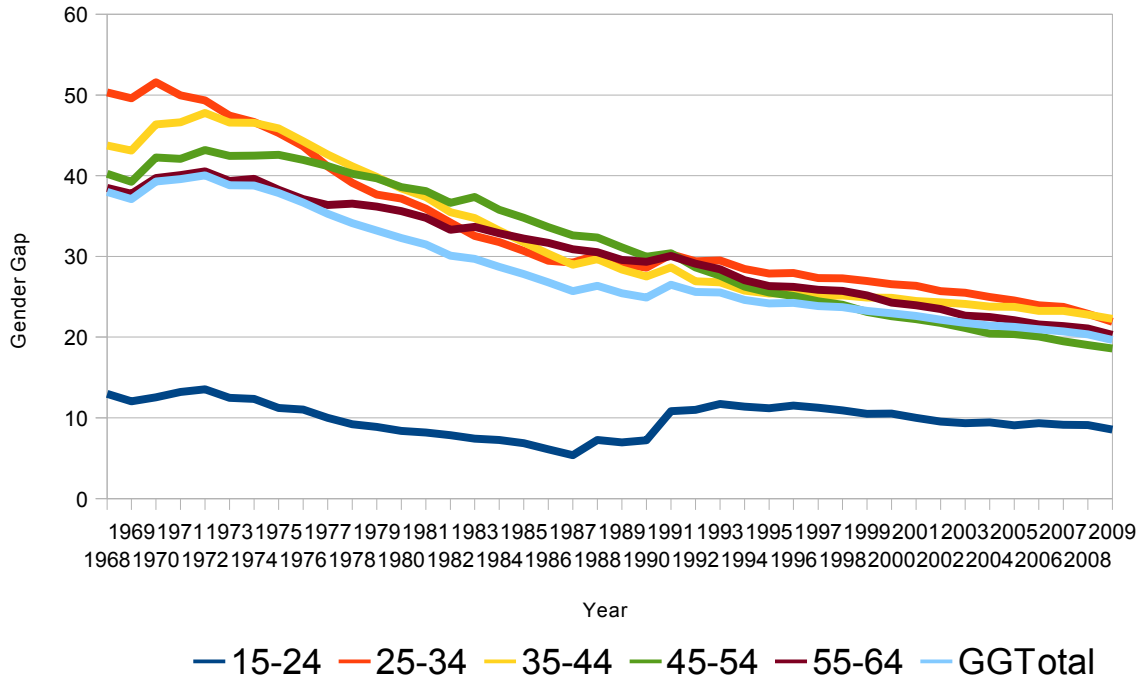

Figure 3: Gender Gap in LFPRs across Age Groups 1968-2009
Source: OECD 2010/I.

To conclude, we can state three rough facts about the gender gap in labor force participation across countries and time. First, the gender gap has clearly decreased over time, and this decrease is mainly driven by the increase in participation for the women in prime working age. In none of the geographical regions or groups of countries considered here has there been an increase in the gender gap over the past 30 years. Although some of this decline could be attributed to more work done by women becoming official, it seems likely that real progress has been made as well. Second, we can see that the levels of gender gap still vary greatly across countries. This implies that different policies and institutional structures have different effects on the gap. Third and finally, despite the decrease, it is also clear that the gender gap persists to some extent in almost all of the countries. We shall keep these trends in mind when assessing the merits of different theories seeking to explain labor markets. To begin this assessment, we will next move on to consider to what extent the difference in labor force participation rates between the two genders could be attributed to discrimination.

3 Gender Discrimination in Labor Markets

This chapter will present models and empirical work related to employer discrimination in the labor markets. Discrimination takes place when employers make a hiring decision at least partly based on the group of the prospective employee, such as being woman or black. Models of discrimination can be roughly divided into two different schools. On the one hand, models of taste for discrimination describe a situation where an employer dislikes a certain group and refuses to hire them or alternatively pays them lower wages. Crucially, employers are here willing to pay for the possibility to discriminate. On the other hand, in models of statistical discrimination employers utilize group proxies to assess unknown worker qualities in order to maximize profits. Besides differences in employer preferences, the two groups of models also differ so that the former assumes perfect information in the hiring process whereas the latter assumes imperfect information. We will first go through some models of taste for discrimination, with a specific focus on the work conducted by Arrow (1971) and Black (1995). Afterwards, we will move to models of statistical discrimination where Coate and Loury's (1993) work will be looked into with greatest detail. Assessment of the rather meager amount of empirical work concerning gender discrimination will follow the presentation of the theoretical models. Results from the empirical work imply that discrimination might still be present in the labor markets.

3.1 Taste for Discrimination

Although discrimination in the labor markets is nowadays largely illegal, it can still exist in the labor markets. The discrimination conducted by employers can roughly be divided to two parts: Hiring decisions and decisions concerning employees within the firm. First, the employer can discriminate while hiring for new workforce by either choosing not to hire people from a certain group or, alternatively, they can give them lower wages when the hiring decision has been done. Even if such discrimination was illegal, its prevention might be difficult. As the hiring decisions are often somewhat ambiguous, it might be hard to explicitly show that a person from a given group would clearly have been more competent than the one who got the job due to discrimination. According to Krug (1997), there are also numerous possibilities for discrimination within the firm which are mainly caused by the nature of the work contracts as relatively open concerning the exact job description. For example, employers can move employees from one position to another, allowing them to give unwanted tasks to people or groups they dislike. Discrimination can also take place when making decisions for promotions or wage increases. When discrimination takes place within a firm, it

can continue over a long period of time, as arguably employees face higher transaction costs than employers in securing a new work contract[4]. This could slow the outflow of people from firms with discriminating practices. As opposed to discrimination in hiring, discrimination within a firm is less likely to affect participation figures considerably.

Gary Becker was one of the first economists to theorize how discrimination could work in the labor markets. An individual is seen to have a "taste for discrimination", if they act as if they were willing to pay something, either directly or in the form of reduced income, to be associated with some persons instead of others (Becker 1957, 6). This may take place either because of a prejudice against a group, or because of wrong estimates concerning the productivity of the said group. A way to measure the strength of the taste for discrimination is to introduce a discrimination coefficient. For example, a discriminating employer facing a money wage rate of π will act as if they were facing a net wage rate of $\pi(1+d_i)$, where d_i is the discrimination coefficient and is larger than zero. If the coefficient were smaller than zero, we could talk about nepotism, where one group is favored over the others. Besides measuring employer discrimination, discrimination coefficient can also easily be used in the cases of employee or consumer discrimination (Becker 1957). However, I will subsequently concentrate on the case of employer discrimination.

A simple model of employer discrimination based on taste is given by Arrow (1971). First, let us assume a large number of homogeneous firms. There are two groups of workers: B, who are valued negatively and W, who are valued positively despite the fact that the groups are equally productive and therefore perfect substitutes in production. Full employment is in place, and discrimination is reflected in the wage differences. When an employer discriminates, they are maximizing a utility function $U(\pi, B, W)$ instead of maximizing just their profits π. There is only one type of labor, and capital is taken as given. Therefore, the choice of labor is the only one affecting profits and thus the profit function is:

$$\pi = f(W+B) - w_W W - w_B B \quad (3.1)$$

where w_W and w_B are the wage rates, taken as given by the employers. The employer equates marginal productivities of the labor of different groups to price them. However, the marginal productivity of B includes the discrimination coefficient so that:

$$MP_B = w_B + d_B, d_b > 0 \quad (3.2)$$

[4] Krug (1997) suggests that employees' higher sunk costs are due to high requirements of firm-specific know-how in the labor markets. However, employers also face the costs of searching, hiring and training a new employee which should decrease their ability to sustain high worker turnover.

Similarly, the marginal productivity for group W is:

$$MP_W = w_W + d_W, d_W \leq 0 \quad (3.3)$$

As the two types of labor are interchangeable, i.e., the productivities of employees are constant regardless of their group, the employer will choose employees so that the marginal productivities of both groups are equal. Thus we receive the equation:

$$w_W - w_B = d_B - d_W > 0 \quad (3.4)$$

As the discrimination coefficient for group B is larger than the one for group W, this implies higher wages for group W. If we further assume completely homogeneous firms in the markets, meaning that every firm has the same taste for discrimination, the effect of discrimination is purely distributive from B to W. Change in firms profits when compared to a system with no discrimination will be:

$$\pi - \pi_0 = (f(L) - (MP_L)L + d_W W + d_B B) - (f(L) - (MP_L)L) = d_W W + d_B B \quad (3.5)$$

If we assume that the employers' discriminatory satisfaction depends only on the ratio of B to W workers, $d_w W + d_B B$ will equal zero and there are no profit losses for the firm; there will only be a transfer of wages from the group B to the group W (Arrow 1971). As lower wages reduce the incentive to enter labor markets, discrimination is likely to lower the participation rate of group B.

To change the analysis, let us now assume disparate utility functions to the firms, meaning that some employers have a stronger taste for discrimination than others. Now, the firm chooses the composition of its workforce so that it must satisfy equation 3.4 and the fact that $d_w W + d_B B$ will equal zero. This gives us:

$$\frac{W}{L} = \frac{d_B}{(w_W - w_B)}; \frac{B}{L} = \frac{-d_W}{(w_W - w_B)} \quad (3.6)$$

As $d_B > 0$, this would imply that firms with more taste for discrimination would have a larger proportion of workers belonging to the group W, while still holding that the group W gets higher wages. However, assuming diminishing marginal productivity for labor, this would put discriminating firms at a disadvantage in competitive markets as the marginal productivities of the two groups are the same. Therefore, the discriminating firms would become extinct in the long run, assuming that there would be some firms who do not discriminate (Arrow 1971). Thus, there would be no effect on the participation in the long run.

The model of taste for discrimination is to some extent consistent with what has actually taken place with respect to the gender gap in labor force participation: The narrowing of the gender

gap in labor force participation could be interpreted as being a proof of a change in employer preferences which would be represented in changes in the discrimination coefficient. This would be driven by competitive pressure where discriminating firms are pushed off the markets by the profit maximizing firms. Following this theory, the gender gap should in the long run be related to the level of competition in the corresponding markets as competition drives discriminating firms off the markets. However, the actual cross-country variation in the gender gaps can be seen as undermining this simple model of taste for discrimination. As the economies of the countries within the European Union, for example, should be rather well integrated with one another, we should be able to see relatively similar levels of competition in all of these countries. This would result in similar levels of discrimination, and therefore similar levels for the gender gap in LFPRs (assuming discrimination were the only thing affecting LFPRs). As clear differences remain in the gender gaps within the European Union, we can see that such a simple model of taste for discrimination is unable to explain the majority of differences. Finally, Arrow's model of taste for discrimination is unable to explain the persistence of discrimination in the labor markets: If we assume markets to work perfectly, the existence of just one discriminating firm should drive the markets to a non-discriminating equilibrium.

As noted above, competition should drive discriminating firms off the markets. However, as perfect competition rarely exists in the real world, it should be useful to look into how discrimination would work in a system where some parties have more bargaining power than others in the labor markets. Black (1995) has formulated a model for taste for discrimination in labor markets where firms have monopsonistic power coming from the fact that workers face higher transaction costs than firms in the labor markets. Black shows that the existence of prejudiced firms in such markets can result in a situation where the discriminated group receives lower wages even from the unprejudiced employers.

More formally, let us assume that there are $(1-\gamma)$ workers who belong to a group A and who do not face discrimination. Consequently, there are γ workers belonging to group B who face discrimination. All the workers have the same marginal productivity V. A worker may either stay out of the labor market and receive utility U_h from household production, or they can look for a job. The workers know that there are two types of firms in the labor market: prejudiced firms (p) hire workers only from group A and pay a wage of w^a_p, whereas unprejudiced firms (u) hire both workers and pays wages of w^a_u and w^b_u for groups A and B

respectively. Prejudiced firms constitute a fraction θ of the markets and unprejudiced firms a fraction (1-θ). Besides wages, workers draw utility from job satisfaction α, which is a match-specific random variable with a distribution function F(α), and a probability density function f(α). As the distribution function is assumed to be strictly log concave, the inverse hazard function m(α) = [1-F(α)]/f(α) is strictly decreasing (Black 1995).

A worker from group A accepts a work offer when the wages and the utility derived from work exceed their reservation utility u^a_r so that $\alpha \geq u^a_r - w^a_j$ (j = u,p). With κ being the cost of a search and using standard dynamic programming approach, the value of the search (U^a) can be written as:

$$U^a = \frac{\theta \int_{\alpha^a_p}^{\infty} (w^a_p + \alpha) f(\alpha) d\alpha + (1-\theta) \int_{\alpha^a_u}^{\infty} (w^a_u + \alpha) f(\alpha) d\alpha - \kappa}{1 - \theta F(\alpha^a_p) - (1-\theta) F(\alpha^a_u)} \quad (3.7)$$

As the worker is indifferent with continuing the search and accepting a job at the reservation utility level ($u^a_r = U^a$), we can rewrite the equation as:

$$\kappa = \int_{u^a_p}^{\infty} (w^a_p + \alpha - u^a_r) f(\alpha) d\alpha + (1-\theta) \int_{u^a_u}^{\infty} (w^a_u + \alpha - u^a_r) f(\alpha) d\alpha \quad (3.8)$$

Now, the LHS of the equation 3.8 represents the cost of additional search, whereas the RHS represents the potential gains from continued search. Furthermore, we can see the reservation utility of type A workers increases if there is an increase in the wages offered by either type of employers, or if the number of prejudiced employers increases. For the type B workers the corresponding equations are:

$$U^b = \frac{(1-\theta) \int_{a^b}^{\infty} (w^b_u + \alpha) f(\alpha) d(\alpha) - \kappa}{(1-\theta)(1 - F(\alpha^b))} \quad (3.9), \text{ and}$$

$$\kappa/(1-\theta) = \int_{a^b}^{\infty} (w^b_u + \alpha - u^b_r) f(\alpha) d(\alpha) \quad (3.10)$$

In the equation 3.10, the LHS represents the cost for a type B worker of finding an unprejudiced firm and RHS the expected gain of finding such an employer. Therefore, an increase in the number of prejudiced firms increases the search costs, and therefore lowers the reservation utility for type B workers. In addition, the lowering of reservation utility allows the unprejudiced firms to lower their wage offers for type B workers (Black 1995).

For the employer's problem, let there be M potential employers, of who ρ refuse to hire

minority workers whereas (1-ρ) do not have a problem with this. In equilibrium ρ may or may not be equal to θ, the total number of prejudiced employers. If τ represents the entrepreneurial ability, the fixed costs of operating a firm are defined as a decreasing function $\Phi(\tau)$. Let $G(\Phi)$ be the distribution function of fixed costs and $g(\Phi)$ the density function. Furthermore, assume that the distribution of fixed costs is identical across prejudiced and unprejudiced firms. Now, differences in fixed costs will determine the number and composition of firms operating in the market. With a critical value of $\Phi=\Phi_i$ (i=u,p), the firm earns zero profits. Then the zero-profit function for a prejudiced firm will be:

$$\Pi_p(\phi_p)=(M(\rho G(\phi_p)+(1-\rho)G(\phi_u)))^{-1} N((1-\gamma)v^a\pi^a)-\phi_p=0 \quad (3.11)$$

And for the unprejudiced firm:

$$\Pi_u(\phi_u)=(M(\rho G(\phi_p)+(1-\rho)G(\phi_u)))^{-1} N(\gamma v^b\pi^b+(1-\gamma)v^a\pi^a)-\phi_u=0 \quad (3.12)$$

The zero-profit functions determine the number of prejudiced firms (θ) on the market so that:

$$\theta=\frac{\rho G(\phi_p)}{\rho G(\phi_p)+(1-\rho)G(\phi_u)} \quad (3.13)$$

The two profit functions indicate that the fixed costs of unprejudiced firms are lower than those of prejudiced firms ($\Phi_u>\Phi_p$), and therefore the actual number of discriminating firms is lower in the markets than their potential number ($\theta<\rho$). This means that the competitive pressure inducted by the unprejudiced firms limits the number of prejudiced firms that can survive. However, some prejudiced firms from the high end of ability distribution will remain, as their high abilities compensate for the losses occurring from discrimination. A prejudiced firm will earn lower profits than an unprejudiced firm when they have similar abilities (Black 1995).

Black (1995) draws three more conclusions from the model. First, it should be noted that an increase in the reservation utility of the type B worker will increase the number of prejudiced firms on the market as the wage costs of the unprejudiced firms increase. Second, if the fraction of potential prejudiced employers increases, the actual number of prejudiced employers also increases and the reservation utility for minority workers decreases as it becomes harder for them to find work. This also leads to a decrease in their wages and thus employment. Third and finally, an increase in the fraction of workers belonging to the discriminated minority results in an increase in the profits of the unprejudiced firms and a fall of profits for the prejudiced firms, further leading to an increase in wages and reservation utility for the minority.

Black's discrimination has some clear advantages when compared to Arrow's model of taste for discrimination. Whereas Arrow's model predicted that unprejudiced firms would drive prejudiced firms out of the markets, Black's model shows how some prejudiced firms with higher abilities could remain in the markets despite the competitive pressures. Therefore, the latter model can explain the persistence of the gender gap in LFPRs. Black's model can also explain the decline in the gender gap in LFPRs over time with two contributing factors, whereas Arrow's model attributed this only to competition. First, an increase in the number of people in the group that is discriminated against drives down profits for the discriminating firms, allowing unprejudiced firms to prosper. An exogenous increase in the number of women willing to work in the labor markets, caused by for example improvements in home appliances, would thus result in an increase in wages, tempting more and more women to enter the labor markets. Second, as the number of potential prejudiced firms has an impact on the outcomes of the model, increasing tolerance among employers towards female employees helps to drive up female labor force participation. Finally, Black's model can also to some extent explain the cross-country variation by differences in the reservation utilities for women. In some countries the reservation utility would be high, resulting in low female labor force participation. This leaves just the variation in reservation utilities to be explained. Overall, Black's model is thus consistent with the observed trends in the gender gap in LFPRs.

3.2 Statistical Discrimination

Statistical discrimination takes place when employers prefer to hire people with a certain visible characteristic for economic reasons instead of a “pure” taste for discrimination. Whereas taste for discrimination caused a decline in employer profits, statistical discrimination is used in order to maximize profits. There are three main assumptions which are common for models of statistical discrimination. First, employers must be able to distinguish the groups in question easily, since otherwise the costs of using a group proxy to discriminate would be larger than its monetary benefits. For example, gender or race could be relatively easily used as such proxies. Second, there must be a sufficiently high cost for the employer in getting to know an individual worker's productivity to make discrimination profitable, as otherwise they would just use employee evaluation in their hiring decisions. Finally, the employer must have some idea of the distribution of productivity within each group used as a proxy. This perception of the distribution could come from employer's prior statistical experience of hiring from different groups, or from a sociological belief that some groups grow up disadvantaged due to prejudice in the society and are therefore less

productive (Arrow 1971; Phelps 1972).

Phelps (1972) presents a simple model for of statistical discrimination[5] where employers can use a test to measure the quality of each applicant when making a hiring decision. After a test has been conducted, employers then assess the reliability of the results based on their prior experience with different groups. According to the model, there are three different factors the employers can consider when assessing the test scores between people from different groups: distribution of skills, perceived difference in mean ability, and the difference in the reliability of the test for different groups. On the first account, the employers may believe that the distribution of skills between the groups is different, even though the mean values of the skills are the same. It makes no difference to the model whether this is actually true or not. Let us assume that the employers were to believe that men have a larger variance in skills. Assuming a man and a woman scored equally well in a test, the hiring decision would now depend on the level of the test score. If the score was relatively high, the employer would hire the male applicant as the result of the female applicant's test score would not seem credible due to the narrow distribution of women's skills in general. However, if the test scores were sufficiently low, the employer would prefer the female applicant for the same reason: her low test score would seem more unlikely. The logic is similar in the case where the employer believes that the test is more reliable in the case of one group: If the scores from the test were high, hire from the group for which the test is more reliable. If the test scores were low, hire from the other group[6]. The possible perceived difference in mean ability works similarly to the idea of taste for discrimination presented before, as there is no mechanism to correct for this false perception. All in all, there would be no consistent discrimination against any single group. Instead, some people in both groups would better off, and some would be worse off due to statistical discrimination.

Aigner and Cain (1977) criticize the view that differences in variance in abilities in Phelps' model would even constitute as an actual case of discrimination. Whereas Phelps thinks discrimination means different pay for different test scores, Aigner and Cain define discrimination as different pay for different abilities. According to the authors, if both groups are paid in accordance with their expected productivities based on an unbiased predictor, and

[5] For an alternative early model of statistical discrimination, see Arrow (1971).

[6] The difference in the reliability of test scores seems somewhat trivial in practice: As the problem would already acknowledged by the employers, development of a non-biased test should not be an overwhelming problem.

if both groups receive same mean wages (assuming equal abilities), the practice described above cannot constitute discrimination[7]. According to the authors, an exception for this could be a case, where employers focus their hiring on the top range of the test scores. Consequently, it would not really matter whether one has mediocre or low test score as only people with high scores would be hired. If men were to be seen as having a higher variance in skills, they would be hired for jobs requiring high test scores. The advantage held by women in the lower range of scores would then be offset by the fact that no one with a low score gets hired. This requires a reserve of unemployed people, as otherwise top employees would gradually be picked for employment until everyone would be employed. As full employment is non-existent in the real world, this is a fair point to make.

The main limitation in Phelps's formulation even with the extension of a reserve of unemployed people is that it does not allow potential employers to gain new information about the applicants and adjust their hiring practices accordingly. As there is a clear incentive to develop techniques for applicant assessment, it seems unlikely that group proxies would have to be used extensively in the long run. Thus, the model is not well suited to explain discrimination and consequently differences in participation. This problem is partly solved by Spence (1973) who has applied a signaling model into the labor markets. Under imperfect information, employers hire people based on visible attributes as their individual productivities cannot be known. Spence divides visible attributes into two forms: Unalterable attributes, which he calls indices, and alterable attributes, which he calls signals. The model works as a loop in which applicants make signaling decisions under signaling costs, which in turn affects employers' hiring decisions (see figure 4). As employers then observe the relationship between attributes and marginal productivity, they adjust their conditional probabilistic beliefs on the relationship. This causes changes in the wage structure as a function of signaling and indices which then affects the signaling decisions of the applicants.

Let us now assume two groups of people, for example men and women. Within each group the distribution of productive capabilities and the signaling costs are the same. Therefore, gender and productivity are uncorrelated in the population. The crucial idea of the model is that the opportunity sets of men and women with comparable productivities are not necessarily the same. If employers' distribution settings are conditional on gender (as well as

[7] Personally, I would side with Phelps on this issue and define that discrimination takes place if one's belonging to a certain group unrelated to the work in question affects hiring decision in any way.

on education), different genders could face different signaling incentives. Therefore their signaling decisions are made independently of each other, possibly resulting in a stable equilibrium in which different groups have different levels of education, wages and/or employment, and the differences persist indefinitely (Spence 1973). As women have historically invested less in education for various reasons, such as lack of opportunities in the labor markets due to taste for discrimination, Spence's model shows how the inequality can persist even though preferences for taste for discrimination have already disappeared.

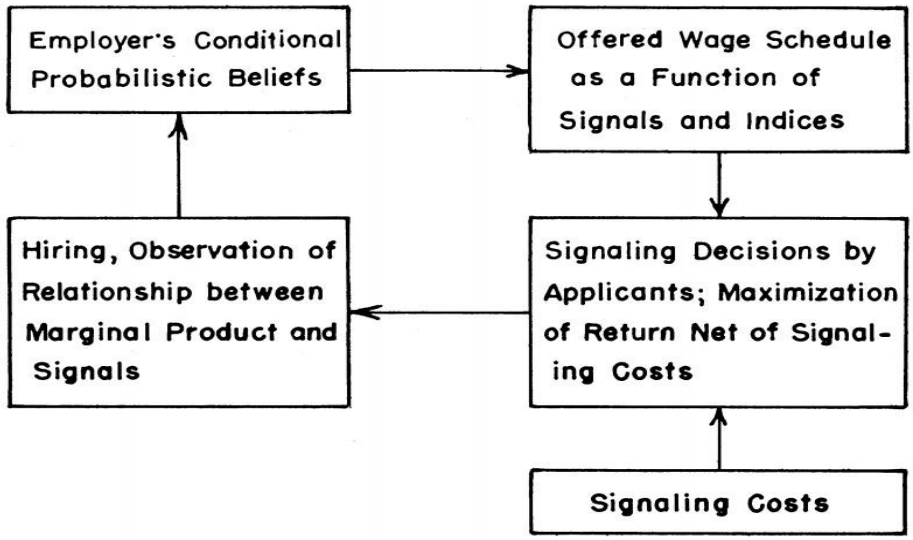

Figure 4: Signaling and Hiring Feedback in the Job Market
Source: Spence 1973, 359.

Coate and Loury (1993) have constructed a more complex model of self-fulfilling negative stereotypes. In line with Spence, their model shows how differences in expected payoffs between groups can lead to a stable equilibrium in which the relevant position of the groups are different, even though their initial abilities are exactly the same. The main advantage of the model is in formally showing how employer expectations can create different equilibria in educational and work patterns for different groups. Furthermore, Coate and Loury allow employers to hire from both groups despite the differences in education and productivities. Finally, this model allows the existence of different tasks in the labor markets.

The basic components of the model are as follows. There is a large number of identical employers and a large population of workers. Each employer is randomly matched with many workers. Workers belong to one of the two differing groups, B or W. λ is the fraction of W's in the population. Employers assign workers into one of the two possible tasks, “zero” or “one”. Task one is both more demanding and more rewarding. All the workers can perform task zero in a satisfactory manner, whereas task one requires more skills. As firing is not possible, every

worker would naturally like to be assigned to task one irrespective of whether they have the required qualifications or not. A worker assigned to task one will receive a gross benefit of ω compared to being assigned to task zero. An employer will gain a net return of $x_q > 0$ if they assign a qualified person to task one and $-x_u < 0$ if they assign an unqualified worker. Ratio of the net gain to loss is defined by $r \equiv (x_q / x_u)$. Workers' and employers' net returns for task zero are normalized to zero (Coate & Loury 1993).

Employers are unable to observe whether a person is qualified prior to assigning them to task one. Instead, employers observe each worker's group identity and a noisy signal θ which takes values between zero and one. The distribution of θ depends on whether a worker is qualified in a similar manner for both groups. Let $F_q(\theta)$ [$F_u(\theta)$] be the probability that signal does not exceed *θ*, stating that the worker is qualified [unqualified]. Then let $f_q(\theta)$ and $f_u(\theta)$ be the related density functions. Define $\varphi(\theta) \equiv f_q(\theta)/f_u(\theta)$ for all θ. Also assume that $\varphi(\theta)$ is non-increasing on [0,1], implying that higher values of the signal are more probable if the worker is qualified. Employers' assignment problem is in choosing a threshold value for θ in order to maximize their profits. Workers' problem is in choosing whether or not to make an investment in acquiring qualifications for task one (Coate & Loury 1993).

Now assume a worker belonging to a group whose representative member has, according to an employer's prior belief, a probability of π for being qualified. If the worker emits the signal θ, then the employer's posterior probability that they will be qualified is the number $\xi(\pi,\theta)$ given by:

$$\xi(\pi,\theta)=\frac{\pi f_q(\theta)}{\pi f_q(\theta)+(1-\pi)f_u(\theta)}=\frac{1}{(1+((1-\pi)/\pi)\varphi(\theta))} \quad (3.14)$$

Employer's expected payoff from assigning a worker to task one is therefore:

$$\xi(\pi,\theta)x_q-(1-\xi(\pi,\theta))x_u \quad (3.15)$$

As the return from task zero was set to zero, employer's best policy is to assign a worker to task one if and only if the ratio of the net gain is such that:

$$r\geq(\frac{(1-\pi)}{\pi})\varphi(\theta) \quad (3.16)$$

The employer does best to choose a threshold value for the signal s so that:

$$s(\pi)\equiv\min(\theta\in[0,1]\, r\geqslant\frac{1-\pi}{\pi}\varphi(\theta)) \quad (3.17)$$

Thus, a prior belief on the probability of being qualified (π) for a group has an impact on the

level of the signal required for assigning worker from that group to task one. A more optimistic belief, signified by a high value of π, will decrease the threshold value of hiring and vice versa (Coate & Loury 1993).

Workers investment decision consists of two components: the gross return from being assigned to task one (ω) and the increased probability of assignment due to investing in education. The latter depends on the standards they expect to face. Let $\beta \equiv \omega[F_u(s)-F_q(s)]$ be the expected benefit for investment for worker facing the threshold value of hiring s. Let also there be an investment cost c for education. The worker invests if and only if the costs are smaller than the expected benefits [$c \leq \beta(s)$] and thus for all workers facing standard s, the proportion that becomes qualified is G(β(s)). The expected benefit function is single-peaked and increasing [decreasing] whenever φ(s)>1 [φ(s)<1] and satisfying β(0)=β(1)=0. Provided that G has a positive density over the relevant range and that G(0)=0, also G(β(s)) is single-peaked and rising [falling] with s as φ(s)>1 [φ(s)<1], with G(β(0))=G(β(1))=0 (Coate & Loury 1993).

Employers' beliefs will become self-confirming if those beliefs induce workers to become qualified at exactly the rate postulated by the prior beliefs. Equilibrium can thus be defined as:

$$\pi_i = G(\beta(s(\pi_i))); i = b, w \quad (3.18)$$

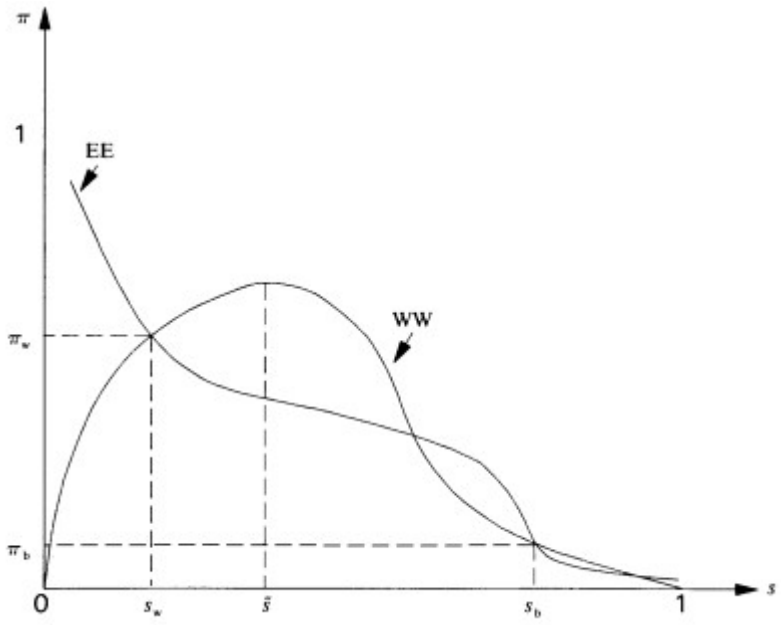

Figure 5: Equilibrium with Negative Stereotypes Against B's

Source: Coate & Loury 1993, 1225.

A discriminatory equilibrium can take place whenever the above equation has multiple solutions. Coate and Loury show that under certain conditions[8] there can be multiple equilibria which may or may not be locally stable. Figure 5 illustrates the model graphically. The horizontal axis depicts assignment standards and the vertical axis measures beliefs. The EE curve shows the standard-belief pairs that are consistent with employer optimization, whereas the WW curve represents pairs of standards and proportions of a group investing consistent with optimal worker behavior (Coate & Loury 1993). In this system of multiple equilibria, the employers are skeptical as to group B's suitability to perform task one (low value for π), which results in higher hiring standards (a high value of s). At the same time, group W faces much lower hiring standards. Thus, groups end up in different positions in the labor markets despite being initially equally gifted.

The main advantage of Coate and Loury's model over the other models presented above is that it can be used to explain the persistence of different labor force participation rates for the two genders in the long run. Because the equilibria can be stable in the competitive markets with profit maximizing firms, there is no apparent mechanism that would automatically get rid of the gender gap in LFPRs. In addition, the model is consistent with different levels of the gender gap in different countries, as the functions defining the labor force equilibria for different groups can vary across economies. Finally, the model can explain the decrease in the gender gap in movement towards a new equilibrium which might have been caused by exogenous increases in women's education. Such an exogenous change is possible if people view education as having other advantages besides accumulation of human capital.

Coate and Loury (1993) suggest two main ways of moving away from discriminating equilibrium. First, one can subsidize employers to hire more people from the disadvantaged group. However, this is potentially counterproductive as it can under certain conditions increase the actual differences in productivities by changing the ways the two groups invest in their abilities. Thus, subsidies are unlikely to get rid of the problem in the long term. A better option would be to subsidize the skill acquisition of the disadvantaged group which, according to the authors, lacks the potential problems of hiring subsidies. Therefore, investment in women's education would be the best way to close down the gender gap in labor force participation rates.

[8] 1) $\varphi(\theta)$ must be continuous, strictly decreasing, and strictly positive on [0,1]
2)G(c) is continuous and satisfies G(0) = 0
3) There is an s within (0,1), for which G(β(s) > φ(s)/(r+φ(s))

3.3 Empirical Studies in Gender Discrimination

Detecting discrimination empirically can be rather difficult, as people are unlikely to voluntarily affirm discriminating practices. Even though the gaps in labor market performance between the two genders are consistent with the presence of discrimination, they do not provide clear support for its presence by themselves. One way to assess the impact of discrimination would be to use a set of independent variables in regression analysis to explain a gap in labor market outcomes, and treat the unexplained gap as showing the level of discrimination. However, Altonji and Blank (1999) give two ways in which the estimates obtained this way could be biased. First, if discrimination affects, besides market behavior, the pre-market choices of education, it is possible that the unexplained gap understates discrimination. On the other hand, it is also possible that regressive models omit some relevant variables, making them overstate the impact of discrimination. The authors go on to present certain empirical approaches which can overcome this problem[9]. One approach is to send résumés that are identical except for the race, gender or the ethnicity of the applicant to potential employers, and see whether an equal proportion of people are invited to the follow-up interview. A more sophisticated approach of this kind is to first send résumés, and afterwards actually send auditors to company interviews. The auditors would be paired up across gender or racial lines so that the two people in one pair have similar characteristics and résumés. One could then compare the results of getting an interview or getting the job across group lines and across pairs. However, the problem with this method is that it is difficult to find auditors whose characteristics and resumes match well enough in relevant factors required for the job. Furthermore, taking up firms' time without asking them to participate in research could be seen as unethical. Finally, this method requires lots of work, resulting in relatively small samples.

Despite the potential problems of the résumé-method, there have been some attempts to use it in practice. Neumark, Bank and Van Nort (1996) have used the audit method in studying the occupational discrimination between waiters and waitresses in the US. The low number of auditors and their lack of training, however, invoke some questions over the validity of this piece of research. As empirical research on the topic is scarce, however, the results should be worth looking into. As a result of the auditing process, the authors concluded that women's probability of getting an interview or a job offer was 46% lower than that of men for high-

[9] For an extensive review on the methods and results of field experiments in assessing racial or sexual discrimination in the labor, housing and product markets, see Riach & Rich (2002). We will concentrate here on sexual discrimination in the labor markets.

priced restaurants, and the results were statistically significant. In contrast, women were slightly more likely to receive an interview or a job offer in the low-priced restaurants. These results are consistent with the model of statistical discrimination where employers think that men have a higher variance in their skill levels although the mean of skills were the same for both genders. Another possible explanation for the results would be that discrimination would be related to customer tastes differing across the quality of the restaurant. In a similar manner, Riach and Rich (1987) sent applications to various firms operating in different fields in Australia and compared whether men and women were equally likely to be invited to an interview in a given occupation. The authors found some evidence that women were discriminated against in both physical (approximately 24% of cases compared with 6% for men) and high-paying occupations (17% of cases compared with 8% for men). No discrimination against men was found in low-paying occupations, implying that the lowly skilled part of the group with small variance of skills is unable to exert gains from statistical discrimination due to the reserve of unemployed people willing to work.

Goldin and Rouse (2000) have studied the presence of discrimination with the help of a "natural" experiment by looking at the gendered hiring patterns for symphony orchestras before and after the institution of "blind" auditions. In a "blind" audition, the identity of prospective employee is hidden from the selectors so that the latter do not know the gender of the former. Therefore, discrimination by a visible attribute becomes impossible. The authors found that women were more likely to advance in the selection process when blind auditions were applied. Overall, it is estimated that blind auditions increased the likelihood for women to be hired by 25 percent, and also that they can explain around 30 percent of the increase in the proportion of females among the new players. Although this implies strong discrimination in the labor markets, we should be cautious in drawing general conclusions as symphony orchestras are probably not representative of the labor markets as a whole.

The three pieces of research presented above give us some proof that discrimination against women can still exist in hiring decisions. However, it remains unclear whether this is based on malevolent taste for discrimination, or on statistical discrimination where employers try to maximize their profits. In order to solve this problem, Petersen, Saporta and Seidel (2005) have compared the hiring decisions with work ratings. As this was done in a single firm, generalizations should again be avoided. The authors found out that there is no difference in the proportion of different genders being hired from the pool of applicants even though

women tended to do slightly better than men in working performance ratings. Thus, no evidence of taste for discrimination or statistical discrimination was found. Another way to confirm the existence of discrimination is to compare wages to productivity at the aggregate level. Hellerstein, Neumark and Troske (2002) do this by using firm- and plant-level data to study relationships between profitability, growth, ownership changes, product market power and the sex composition of the firm's workforce. The results indicate that the percentage of women in a firm's workforce is positively related to profitability among firms with market power. This supports the idea that there is discrimination, and that the discrimination has an adverse effect on firm's ability to compete: Only firms with market power can sustain the losses from discrimination[10]. However, the authors find no relationship between firm growth or ownership change and the percentage of women in the workforce. Therefore, there is no direct evidence that discriminating firms would be driven off the market at least in the relatively short five year period from which data was available.

In this chapter we have presented model of both taste for discrimination and statistical discrimination. The concept of taste for discrimination was shown to be problematic in a system of perfect competition, as discriminating firms would be driven off the markets. In order to accommodate this, we must assume some extensions to the model such as different abilities among employers. Discrimination was, however, shown to be a viable concept if there are frictions in the labor markets. We showed how imperfect information may cause employers to use easily visible proxies when making hiring decisions which could lead to discrimination against certain groups. Furthermore, it was shown how initial images of worker productivities can be perpetuated in a feedback of educational investment, signaling and hiring. In our discussion of the empirical literature, we found some proof as to the existence of sexual discrimination in at least some parts of the labor markets. The low number of research, however, prevents us from making far reaching conclusions from these results. The relative importance of discrimination in determining differences in the labor force participation rates between men and women remains therefore unclear.

4 Wages, Human Capital and Household Economics

The previous chapter on discrimination touched on the idea that employee investment in education affects labor market participation. Among others, this notion of human capital impacting labor supply will be developed further here as this chapter focuses on models

[10] However, Altonji and Blank (1999) note that worker composition including the percentage of female workers could be correlated with heterogeneity in production technology, and therefore endogenous to the model.

concerning labor supply. We are interested in how different factors can have a different impact on male and female labor supply, thus contributing to the gender gap in labor force participation. A number of different models are relevant here. We will begin by going through the general model of labor supply where supply decisions are made based on wages and other available sources of income. The gender gap in participation could thus be explained by differences in wage and non-labor income levels between women and men. This will be followed by a short presentation of human capital models which seek to explain gender gaps in labor markets by differences in skill levels and in types of skills the two genders have. Because women often spend some time outside the labor force due to childbearing and -rearing, they face a higher risk of skill depreciation which could impact their future work opportunities as well as earnings. Afterwards, we will present two types of household models which could help us to understand why especially married women are less likely than their husbands to participate in the labor markets. In models of altruistic households, household members maximize their collective utility. In contrast, household members are seen to maximize their individual utilities in household bargaining models. Of the two, household bargaining models will be shown to be more relevant in assessing contemporary differences in LFPRs. Related to household models, we will finish this chapter by considering how fertility decisions impact labor supply.

4.1 Wages, Non-Labor Income and Labor Supply

The hours, days and years a person chooses to work over a specific time period constitutes one's labor supply. People are assumed to choose their labor supply by considering their real wages per unit of time in relation to the value of their time which could be used in other activities such as leisure, household labor, or education. Labor is supplied in order to gain access to wage income which can subsequently be used to buy commodities. However, available assets and access to non-labor income also affect supply decisions by making people less dependent on wage labor. Figure 6 shows this participation decision. If a person is not working, they have T hours of leisure. We can see that they are then at the endowment point E with a utility of U_0. With a low wage offer (w_{low}), working does not pay off as the worker would end up at the endowment point X with a lower utility U_G. If the offered wage rate was high enough (w_{high}), working would be beneficial as the worker would gain enough utility from additional consumption to offset the loss of leisure. The worker would then be at the endowment point Y, with the utility of U_H. The reservation wage $\tilde{w}$ gives the minimum increase in income which would prompt the worker to move from endowment point E to

working the first hour. Following this definition, it is clear that a higher wage will always increase the probability of participation[11]. The reservation wage depends on the person's tastes which determine the slope of the indifference curve. If we assume that leisure is a normal good, it is clear that an increase in non-labor income will result in an increase in the reservation wage as workers want to consume more leisure (Borjas 2010). Thus, changes and variation in the gender gap in LFPRs would be caused by differences in wages and access to non-labor income between the two genders. The observed decrease in the gap in participation would thus most likely be related to decrease in the gap in wages.

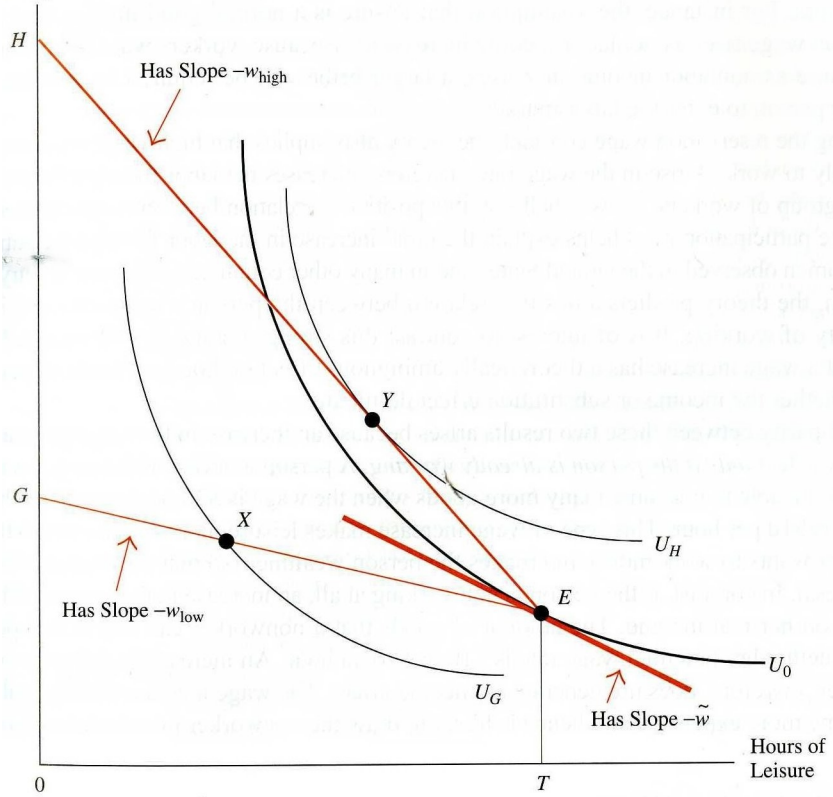

Figure 6: Reservation Wage
Source: Borjas 2010, 41.

Although most of the research on the effect of wages on labor supply is concerned with the amount of working hours, there have also been some papers dealing explicitly with participation. For example Macunovich (1996) has found that both male relative income and female average wages affect participation in the United States: Large differences in income levels between the two genders with men having higher wages will decrease female participation, implying that male wages should partly be considered as non-labor income for women. High average wages for women will logically increase their participation, as wage labor becomes more desirable. Similar results concerning the gender wage gap in the US have

[11] The case might be different for labor supply in general. If the worker already worked some hours, higher hourly wage could increase the income of the worker so much that they would decrease their labor supply.

also been found by Attanasio, Low and Sánchez-Marcos (2008). A cross-country comparison done by Mincer (1985) also confirms this trend. This study, covering thirteen industrialized countries from 1960 to 1980, gives an average participation wage elasticity of 1.02 for women. The elasticity varies strongly across countries, with Britain having the lowest elasticity (0.35 or 0.49 depending on the model specifications), and the Netherlands having the highest (2.02). The importance of wage on participation seems, however, to be in decline. Covering the period from 1978 to 2002 in the United States, Heim (2007) estimates that the participation wage elasticity has decreased by 95 percent, from 0.66 to 0.03. Therefore, even if the historical decline in the gender gap in participation could at least partly be attributed to the decrease in the gender wage gap, it is unlikely to have such a strong impact in the future.

The effect of non-labor income on married women's participation has been reported to have been rather small even as far back as 1970s, and it has been in constant decline ever since (Heim 2007). Furthermore, research suggests that the wives of men with high income seem to have actually increased their labor force participation more than wives of low-income men, at the same time as slowdown in male earnings was weakest for the former and strongest for the latter (Juhn & Murphy 1997). Therefore, one's husband's income is unlikely to be a significant factor in explaining the late rise in women's participation at least in the United States.

There are a number of reasons which can be used to explain the aforementioned declines in both married women's participation wage elasticity, and their participation non-labor income elasticity. Concerning the responsiveness to a change in wages, women's jobs may have become more similar to those of men's in terms of training required or the type of work that women are likely to participate in. Furthermore, women's careers could have gained in symbolic value whereas before taking care of the household was seen as women's foremost responsibility. As women's work has thus began to more and more resemble that of men, the wage elasticities of the two genders have also converged. On the other hand, changes in marital behavior are perhaps the most important factor explaining the decline in the non-labor income effect. As divorce rates have soared, women have begun to place less trust on being able to tap into family income in the future, decreasing the power of the income effect. Wage labor is thus seen as insurance for the future (Goldin 1990; Heim 2007), a line of thought which will be developed further in the chapter presenting household bargaining models.

The research presented above was mainly concerned about changes in women's employment with respect to wages and non-labor income at the micro-level. It is interesting, however, that things seem to be different when comparing countries at the aggregate level: Countries with low gender wage gaps seem to actually have high gender participation gaps. For example, the aggregate gender wage gaps are relatively wide in the US and the UK, but gender gaps in LFPRs are relatively narrow in these countries. This situation is largely reversed in Southern European countries. One possible explanation for this could be that low wages incur higher demand from the employers, resulting in higher participation. However, this seems somewhat unlikely as it would require large-scale wage discrimination which is illegal. Selection bias is therefore a more likely factor to explain this phenomenon. By using alternative imputation techniques, Olivetti and Petrongolo (2008) have sought to recover wages of unemployed workers, allowing them to compare the implied human capital differences between the employed and the unemployed. As only employed people contribute to forming wage estimates, nonrandom selection in the employment process can severely bias the estimation. According to the authors' conservative estimations, the selection bias could explain around 45% of the observed negative correlation between wages and employment levels between different countries. They also note that correcting for this bias brings women's wages in many Southern European countries in line with the likes of United States and Northern European countries. The idea of the role of selection bias in the workforce is also supported by Hunt (1997) who has studied changes in employment levels after the German unification. In the five years after the unification, the wages for female East German workers rose from being 74% of male wages to a figure of 84%. At the same time women's employment rate decreased from 84% to 63%, whereas the same figure for men decreased only from 94% to 78%. The author shows that 40% of the increase in female wages can be attributed to the selective withdrawal of East German women from employment. After the unification, low-earning East German workers were more likely to be laid off when the wages began to converge towards West German levels. As women were more likely than men to have low wages, this resulted in relative an increase in aggregate wages and a decrease in aggregate employment.

To conclude, it seems that historically the decreasing gender wage gap has had a significant impact on the declining gender participation gap by increasing the incentive to work for women. Thus, classic labor supply theory is to some extent consistent with the narrowing of the gap. Furthermore, the persistence of the gap in participation could be seen as a logical consequence of the persisting gap in wages. However, the model runs into trouble in

explaining recent decreases in the gender gap in participation, as the wage elasticity for participation for women is nowadays close to zero. Furthermore, the use of this model is problematic at the macro-level, as selection of the work force overrides the wage effect. Even when this is accounted for, we can observe different participation gaps with similar wage gaps. Thus, other factors must be used to explain variation in participation gaps.

4.2 Human Capital

According to the human capital approach, differences in the labor force participation rates, or the wage rates, between genders are at least partly due to differences in human capital investments between genders. Usually human capital investment is seen to take two forms. First, human capital can be accumulated through formal education. Therefore, differences in labor market performances between genders could be explained through differences in educational attainment. However, assuming that both genders have similar initial abilities, this brings us to the question why there are differences in educational levels. A number of explanations are possible here. For example, the two genders could just different preferences concerning education and their future working life. It is also possible that the returns to education are different between genders, which would result in different educational levels. We saw with the models of statistical discrimination how such a situation could become self-fulfilling. Finally, differences in educational levels between genders could also be the result of discrimination: Parents could be more reluctant to put girls in the school, or teachers could be more supportive for male students. Besides formal education, human capital can also be accumulated through on-the-job training. Again, differences in the training levels could emerge because of discrimination. Another, and perhaps more credible, way of explaining differences in training levels between the two genders is that women are more likely than men to experience gaps in their lifetime working time due to childbearing and childrearing. Because of this, employers might be reluctant to invest in women's training as the returns for this investment would be smaller.

Polachek (1981) presents a model on how human capital approach can explain gender differences in occupational structure but it can be just as well be utilized in explaining the gender gap in labor force participation rates by denoting household work as one of the occupations. In his model, an individual faces an optimization problem:

$$\max_{s,\delta} (T-H-S)W(\delta,I)K(S,\delta) \quad (4.1)$$

where T is the age of retirement minus five (potential lifetime spent on production), H is the

number of years spent on domestic work, S is the lifetime investment measured by years spent in school, **δ** is a vector characteristics describing type of human capital K, and hence occupation, **I** is a vector of individual characteristics, W(**δ**,**I**) is the rental rate per unit of type δ human capital for and individual of characteristics **I** and K(S,**δ**) is lifetime amount of human capital.

For simplicity's sake, Polachek narrows the notion of occupational structure **δ** to one component, atrophy (δ), which tells us the loss of earnings potential when skills are not continuously used. Occupations with quick technological progress would have a high atrophy rate, as it would be hard to return to such a field after a period of absence. If losses of human capital stock truly yield lower earnings, it is necessary for the employers to compensate this possibility by giving higher wages in fields where this phenomenon is strong. Therefore, wages should be increasing with increasing levels of atrophy. Therefore, let us specify the rental rate for different occupation so that:

$$\frac{\partial W}{\partial \delta}>0;\frac{\partial^2 W}{\partial \delta^2}<0;\frac{\partial W}{\partial I}\neq 0;\frac{\partial^2 W}{\partial \delta \partial I}\neq 0 \quad (4.2)$$

Polachek also assumes that human capital can be accumulated with investments and that high rates of atrophy tend to decrease human capital. Thus, lifetime human capital when **δ** is defined as atrophy can be defined as:

$$K(S,\delta)=(1-\delta)^H \kappa(S);\frac{\partial \kappa(S)}{\partial S}>0 \quad (4.3)$$

Now, the maximization of lifetime income comes from the function:

$$\max_{s,\delta} Y=(T-H-S)W(\delta,I)(1-\delta)^H \kappa(S) \quad (4.4)$$

This yields the following first order conditions:

$$Y_S=-W(\delta,I)K(S,\delta)+(T-H-S)W(\delta,I)\frac{\partial \kappa}{\partial S}=0 \quad (4.5)$$

$$Y_\delta=(1-\delta)^H \kappa(s)\frac{\partial W}{\partial \delta}-W(\delta,I)\kappa(S)H(1-\delta)^{H-1}=0 \quad (4.6)$$

Now, we can look how the time used on childbearing and -rearing affects one's occupational choice. From the first order conditions we get:

$$\frac{d\delta}{dH}=\frac{Y_{\delta s}Y_{sH}-Y_{\delta H}Y_{SS}}{Y_{\delta\delta}Y_{SS}-Y_{\delta s}Y_{s\delta}}<0 \quad (4.7)$$

Thus, as the time spent outside the labor force or education increases in one's lifetime, there is a change in preferred occupation towards those where the depreciation of work experience is

smaller. Therefore, women are more likely to be employed to sectors where there is less need for sector specific skills. Alternatively, they could remain outside of the formal labor force altogether and work at home. As wages are highest in sectors needing specific skills, women also experience a gender gap in earnings. According to the model, women will end up investing less into human capital, assuming that they take the structure of the labor market into account when making investment decisions (Polachek 1981). Following the idea that women would be less likely to work at highly specialized fields, human capital theory predicts that the gender gap in labor force participation rate would be narrower in countries with little extremely specialized industries: As the depreciation rate for highly specialized skills is large, women would have more trouble of getting and holding formal employment in these fields. Conversely, if a country mainly relied on simpler forms of production where no specific human capital was needed, women would be equally equipped as men to hold an occupation despite spending time away from work due to childbearing. Having measured the skill specificity by vocational training intensity and firm tenure rates, Iversen and Rosenbluth (2006) report that the labor force participation rate for women is statistically significantly lower in countries with highly skill specific industrial structures. The same relationship does not hold for men, implying that women are more susceptible to human capital attrition due to their family responsibilities. Finally, human capital theory implies that facilitation of continuous careers for women should decrease gender gap in participation, as women would face smaller attrition rates for human capital. Maternal leave policies are one way of doing this, as they allow women to retain their jobs when giving birth. We will look into this issue with more detail in chapter 5.2 where the effect of maternal leave policies on participation is assessed in more detail.

One further note to make concerning the human capital theory above is that it can easily lead to statistical discrimination if we assume that part of the human capital is accumulated as on-the-job-training. Assuming at least some women are willing to temporarily exit the labor market to give birth, employers could be inclined to concentrate their investment into men to minimize the human capital attrition among their workforce. As employers would be unable separate women who are going to give birth in the future from those who are not, women would suffer irrespective of their personal preferences.

The effect of human capital on the probability of labor force participation has also been assessed empirically. A high amount of human capital should increase participation as it

makes a person competent for a wider range of jobs. As noted before, human capital can be operationalized as years spent at school or as previous work experience, with the former being most commonly used in empirical work. There seems to be a clear connection between the level of education and the probability of labor force participation, holding in many different Western countries. For example, for Jewish women in Israel, and extra year of schooling has increased the probability of female labor force participation by around 3.5% (Ben-Porath & Gronau 1985). In Holland the impact is also strong, as the probabilities of the labor force participation for a woman with only primary education, with extended primary education, with secondary education and with higher education being 64%, 70%, 81% and 95% respectively (Hartog & Theeuwes 1985). In Spain the participation rates for women with primary education, secondary education and university education were 19%, 40% and 73% respectively (Hernandez, Iglesisas & Riboud 1985). In the United States, increases in the educational attainment can be seen as explaining around a quarter of the increase in women's LFPR (Michael 1985)[12]. However, the problem with the studies mentioned above is that they all fail to account for the potential endogeneity of educational and labor force participation choices: It is entirely possible, and even quite likely, that women who plan to participate actively in the labor markets in the future will decide to seek higher education, as this will probably give them greater options and higher rewards later on. Therefore, we cannot establish a causal link between the level of human capital and the labor force participation rate.

4.3 Household Models

For the supply of labor, the gendered division of work within the household is perhaps the most important factor in explaining the gender gap in labor force participation rates. For the purpose of this study, it is useful to assume that there is one adult male and one adult female in the household, with addition of an unspecified number of children. If all adult members of the household are not working in the labor markets, women are far more likely than men to stay at home in order to take of childrearing and other household chores. Therefore, the labor force participation rate for married women is considerably lower than that of women living alone (Goldin 1990).

Ott (1995) defines the role of the households as follows. Households are regarded as production places of basic commodities. It is assumed that they offer a possibility to gain

[12] Besides the research noted above, education is almost always included as a control variable when looking at participation probabilities, implying that its impact is taken almost as a given in labor supply research.

extra profits for the members by enabling pooling of resources, division of labor, and intra-family exchange. We can then show at least three types of family transactions that generate surplus: First, as a production company the family members can use comparative advantage by specializing in either household work or market work in conjunction with intra-household trading. This could be seen as the underlying reason behind the historically strict sexual division of labor: It has been assumed that women have a competitive advantage in household work and men in the market work. Therefore, men have worked outside the household and then supported the upkeep of the household from their wage income. Besides being a productive company, households can be seen as consumer cooperatives where household members can use indivisible resources together and enjoy economies of scale. For example, many modern home appliances, such as washing machines, have relatively high fixed costs creating savings for households of multiple members. Third, households can work as insurance coalitions where family provides security through implicit promises of mutual aid. However, Ott goes on to argue that all of these gains have become less important over time. Specialization is no longer as efficient because most traditional household goods now have market substitutes. Combined with increases in wages, having one member concentrating on household production has become less and less efficient. Furthermore, family gains have been reduced by the evolution of formal insurance as well as by the emerging social security system. Overall this is consistent with the convergence in participation rates between the two genders.

The full realization of potential household gains requires binding long-term contracts within the family. This is especially important when it comes to insurance, as an unpredictable insurance policy is rarely of much use. However, as the marriage is legally considered mostly as a cooperative venture, most of the transactions have no official status. Therefore, the potential advantages gained from marriage depend highly on whether people are altruistically willing to honor the explicit and implicit contracts they have made. Alternatively, household members could seek their personal benefits at all time. In line with this argument, household models are usually divided to altruistic household models and household bargaining models. The former models assume altruistic behavior within the household, which allows its members to fully take advantage of the aforementioned gains. The latter models assume that both time and resource allocation within the household are subject to bargaining and try to depict different factors affecting the bargaining outcome.

4.3.1 Model of Altruistic Households

Becker (1993) gives an account of an altruistic household model and its impact on specialization within households. Assume a household with multiple members and that those members allocate their time between market and household work. There are two types of human capital which affect the productivity of work done in different sectors. Human capital is accumulated by an initial investment and after that is held at a stationary level. Furthermore, assume that members of the household are altruistic and that there are no costs of supervision or fixed costs of allocating time between different sectors of work. We could then formulate the stationary output after the initial investment period for a household of n members as:

$$Z = Z\left(\sum_{i}^{n} x_i, \sum_{i}^{n} t'_{h_i}\right) = Z\left(\frac{\sum_{i}^{n} a\hat{H}_i^1 t_{wi}}{p_x}, \sum_{i}^{n} \psi(\hat{H}_i^2) t_{h_i}\right) \quad (4.8)$$

where $\hat{H}^1_i$ and $\hat{H}^2_i$ are the optimal capital stocks for market and domestic works respectively, t_w is the time allocated to market work, t_h is the time allocated to domestic work, $a\hat{H}^1_i$ is the wage rate, $t_h\psi(\hat{H}^2_i)$ is the effective amount of household time and p_x is the price of market goods. Furthermore, there is a limited amount of time to be spent in market and domestic work so that:

$$t_w + t_h = t' \quad (4.9)$$

From the function 4.8 we can see that if each member of the household had the same amount and distribution of human capital, production would depend only on the aggregate hours supplied to each sector and not on the distribution of hours between members of the household. However, if the human capital levels of the household members were to differ, production would depend also on the distribution of time between members as some members would be more productive in one sector and some on the other sector. Output would then be maximized if the marginal products in the household sector equaled the marginal products in the market sector for members supplying time for both sectors. More formally:

$$\frac{(\partial Z)}{(\partial t_{w_j})} = \frac{(\partial Z)}{(\partial x_j)} \frac{(a\hat{H}^1_j)}{(p_x)} = \frac{(\partial Z)}{(\partial t_{h_j})} = \frac{(\partial Z)}{(\partial t'_{h_j})} \psi(\hat{H}^2_j); t_{w_j}, t_{h_j} > 0 \quad (4.10)$$

We can define the comparative advantage of a household member by comparing the productivities in market and domestic work between the two household members. Function 4.10 shows us that the marginal products for the two kinds of work only differ with respect to relative human capital levels $\psi(H^2)$ and H^1, as all the other variables are common. Therefore, the relative levels of human capital within the household would be the sole determinants of

the division of labor (Becker 1993).

If all the members in a household have different comparative advantages, no more than one person would allocate their time between the market and the household sectors as others would fully concentrate on either type of work. Following from this, if all members have different comparative advantages, only one member of the household will invest in both market and household capital. If we further assume constant or increasing returns for commodity production functions, the specialization becomes more distinct as then all members of the household will specialize in just one of the sectors (Becker 1993). The model can thus be used to explain why women have lower labor force participation rate and lower wage rates than men, assuming people will marry and act efficiently and altruistically. As there is a possibility that women will be spending at least some part of their lives in the domestic sphere due to childbearing, they will have greater incentives than men in accumulating household capital. On the other hand, as men do not have a similar "natural" interruption in their work lives, they will invest more in the accumulation of market capital and consequently have a comparative advantage in that sphere. This effect can be emphasized by the attrition of the human capital, as shown in the human capital model above. Differences in participation levels across countries would thus again be explained by different types of capital needed in production. Overall the model predicts that there will be differences between the genders in the type of accumulated human capital, and therefore also in the allocation of time between markets work and household work, even though there are no differences in initial skill levels.

Becker's idea of altruistic household has drawn some criticism concerning its assumptions about human behavior. The main problem for the critics has been the assumption that members of the household will pool their resources and then distribute them equally. The critics assert that members of the household are more likely to keep at least part of their individual earnings, giving the member specializing in market labor a higher level of utility. Therefore, the acceptance of the model of altruistic households can be seen as having adverse effects on women as it could be used to hide unequal distribution of income within a family (Braunstein & Folbre 2001). There is also some empirical research to support this claim. For example, by studying how inputs are used in family agriculture in Burkina-Faso, Udry (1996) shows that inputs are used much more intensively on husbands' fields. Assuming equal initial productivities for fields and diminishing returns for inputs, this results in a loss of production

for the household. If the household were truly altruistic, inputs would be used in equal measure to maximize production. In a study concerning Thailand, Scuhltz (1990) shows that the owner of the non-labor income matters in labor supply: If this revenue is owned by the wife, it decreases her labor supply six times more than if it is owned by the husband. Furthermore, Lundberg, Pollak and Wales (1997) report that shifting child support payments from husbands to wives in the UK also changed household spending habits. In an altruistic household the owner of the income should not matter as all the income would be pooled. As the utility conclusions derived from the model of altruistic households seem to be false, its usage in describing participation should also be avoided.

4.3.2 Household Bargaining Models

Household bargaining models seek to improve altruistic household models by bringing the possibility of conflicting interests into the mix. Therefore, household bargaining models hold elements of both cooperation and conflict. As in the model of altruistic households, people usually divide their time between market labor and household labor. They can also make human capital investments to influence their future labor profiles. The main difference is that instead of maximizing household utility, individual members of the household maximize their own utility. This also brings the possibility of breaking up the household into the models: Members of the household stay in cooperative arrangements (marriage) as long as they are better-off than in the case of non-cooperation (divorce). However, there are many different cooperative equilibria and, therefore, there is an underlining conflict even when the system of cooperation is pursued. Equilibrium is reached through a bargaining process which is often described through models of game theory.

The main advantage of the household bargaining models is that they allow us to model a system where all household members occupy themselves in both market work and household work. The threat of divorce hinders complete specialization, as household members are reluctant to risk the drastic drop in income for the one specializing in household work. It is clear how the informal nature of the marriage contract thus decreases potential household gains. Bargaining models also allow us to understand labor supply decisions in a much wider context. Besides the question of divorce, it is especially useful in understanding how labor supply is connected to demographic change, namely changes in fertility. Historically, high fertility levels have been associated with wide gender gaps in LFPRs, as women have stayed home to take care of the children. Lately, however, this association has been disappearing, and

there have even been suggestions that narrow gender gaps would be related to high fertility rates[13]. This would be consistent with bargaining models: Working women would be less reluctant to take the risk of giving birth, as they could still support themselves and their children through their own work after a divorce.

Bargaining models have, however, also faced some criticism. Agarwal (1997) raises five issues which are critical to bargaining outcomes, but which are treated as exogenous in the models or are not mentioned at all. First, bargaining power is defined only in terms of fall-back positions which are calculated by the potential income. This definition almost completely excludes the qualitative aspects of power, and is a valid criticism for all of the models covered in this chapter. Second, the relative importance of factors determining the fall-back position is rarely explored. This is important when we consider bargaining in poor conditions where mere subsistence would be crucial for the fall-back position. Agarwal suggests that in such a situation the effective command over landed property should carry a relatively high importance. When considering bargaining in a rich world, as most of the literature covered here does, this is unlikely to be a problem. Third, the role of social norms in determining bargaining power is rarely explored, including the possibility that these norms are themselves subject to bargaining. Although not considered strictly in a bargaining context, we shall assess the impact of norms on labor force outcomes later on. The fourth criticism Agarwal rises is that individuals could have different perceptions about needs and pursuit of self-interest. Following this view, women could end up in a worse position in bargaining if they were not "selfish" enough. This is a somewhat valid criticism of the models covered here, as we assume people to have similar preferences. On the other hand, the difficulty of formulating models with differing preferences forces us to accept this simplification. Finally, the links between intra-household bargaining and bargaining outside the household are rarely covered. There have been some attempts to correct this problem: For example, we mentioned in the introduction a study by Iversen and Rosenbluth (2008), where the authors showed that women's political representation was higher in countries where they are more likely to participate in the labor markets. As participation in the labor markets can be seen to increase bargaining power in the household, this would imply a connection between bargaining power in the household and bargaining power in the society.

[13] See chapter 4.4 for details.

A model by Manser and Brown (1980) is a good example of a classic household bargaining model[14]. In this model, two members of the household bargain in order maximize their respective utilities. They both can either work in the markets to receive wages or enjoy from leisure. Wages are used to buy products from the markets. Products can either be such that both persons can utilize them without a loss, or they can be utilized by only one member of the household. Naturally, each member would like the other member to buy the common goods so that they could use most of their income on individual goods. Threat point is a crucial feature of the model: It depicts the level of utility each person has to get from the marriage in order for it to be made the preferred option as opposed to living alone. The higher the utility level outside the household for a particular member, the higher their bargaining position will be within the marriage as they have less to lose in marriage discharge. Therefore, the model describes how differences in wages and prices can affect the intra-household allocation of time and products, and thus also participation. Furthermore, the model can also be used to estimate under which conditions marriage is likely to break down. However, one problem for this model is that it does not contain human capital. Thus, work decisions made today do not affect future, as is done in more advanced models.

Lundberg and Pollak (1993) have developed a "separate spheres" model of bargaining within marriage. The idea in the model is that, due to gender norms, men and women produce different public goods within the marriage. Differing from the model above, separate spheres model has three possible outcomes: cooperation within marriage, non-cooperation within marriage, and breaking the marriage apart by divorce. The first outcome occurs when the utility gained from marriage is above the threat point, which is naturally determined by the utilities in the other outcomes. As in other models, in the cooperative outcome the equilibrium values of private and public production are those that maximize the gains from cooperation. The divorce outcome is also similar to the model above. The biggest difference comes from the non-cooperative outcome in the marriage where each partner provides public goods by choosing actions maximizing their own utility when other person's decisions are taken as given. This leads to sub-optimal production of public goods without breaking up the marriage. A non-cooperative marriage may most likely take place if divorce involves substantial transaction costs. For example, housing could impact both of these factors. First, looking for a new house invokes transaction costs at least in the short run and can make divorce seem like a bad option. Second, housing prices per area are usually decreasing in size and therefore, a

[14] For another classic model of household bargaining, see McElroy & Horney (1981).

household with multiple members receives scale benefits.

Ott (1995) has presented a more ambitious marriage bargaining model by incorporating a time variant into the bargaining process. Both of the parties would like to work on the markets, as the human capital gained from it increases one's utility in case of a divorce in the future, and therefore one's threat point in bargaining during the marriage. The Nash-solution of the intra-household bargaining is characterized as:

$$\max_x N = (U^m(x) - D^m) * (U^f(x) - D^f)$$
$$\text{s.t.} \; x'p = Y \qquad (4.11)$$
$$U^m(x) > D^m$$
$$U^f(x) > D^f$$

where x is the vector of goods produced in the household, $U^i(x)$ is the individual utility function of a male (i=m) and the female (i=f), D^i is the utility outcome in the case of disagreement (breakup of marriage), Y is the family income and p is the vector of prices.
If the conflict point (threat point) (D^m, D^f) lies within the utility frontier, there are gains to be had from the marriage and it stays intact. Furthermore, let us assume that in case of disagreement people can only live alone. In a single-person household, the indirect utility function is:

$$D^i(p, Y^i) = \max U^i(x) \quad \text{s.t.} \; x'p = Y^i \qquad (4.12)$$

where Y^i is the income of person i living alone. Now, a change in prices in favor of one of the persons in the household can have an effect on the household bargaining outcome, as a person's threat point changes. If bargaining outcome can no longer be reached, marriage breaks down.

Figure 7 shows what will take place if the prices change in the favor of person f. The initial bargaining point A lays at the utility frontier I. The movement from point A to point B represents the compensated substitution effect, and the movement from point B to point C the income effect. The final movement from point C to point D can be interpreted as a change in bargaining outcome caused by the increase in power for the person f. As their bargaining positions change, so does the form of the indifference curve (Ott 1995).

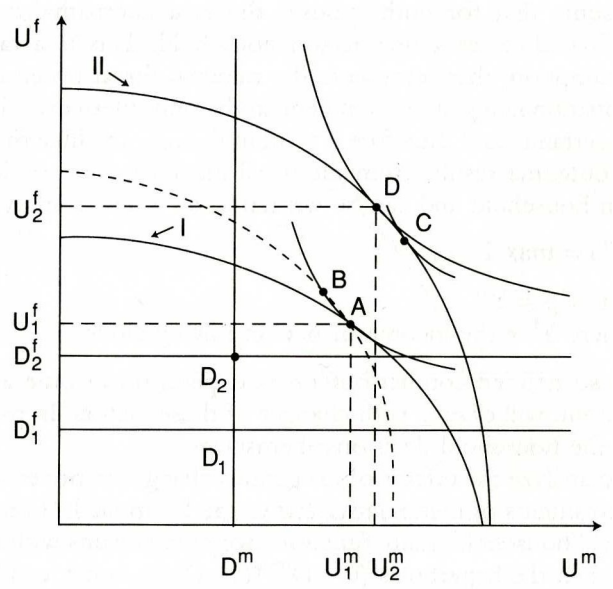

Figure 7: Price change: income, substitution and bargaining effect
Source: Ott 1995, 84.

This approach can also be made to consist of multiple time periods. With the assumptions of individual utility functions that are inter-temporally additive and use of an explicit household production function Z, the intra-household Nash-bargaining model can more formally be described as follows (Ott 1995):

$$\max_{L^{i1},H^{i1},M^{i1}} N=(U^{m1}+U^{m2}-D^{m})*(U^{f1}+U^{f2}-D^{f}) \quad (4.13)$$

$$\max_{L^{i2},H^{i2},M^{i2}} N_2=(U^{m2}-D^{m2})*(U^{f2}-D^{f2}) \quad (4.14)$$

subject to (besides non-negativity constraint):

$C^{mt}+C^{ft}=Z(a^{mt}H^{mt}+a^{ft}H^{ft},X^{t})$ (household production in each period)

$X^{t}=Y(w^{mt}M^{mt}+w^{ft}M^{ft}+I^{mt}+I^{ft})$ (budget constraint in each period)

$T=M^{it}+H^{it}+L^{it}$ (time constraint in each period)

$w^{i2}=f(w^{i1},M^{i1})$ (accumulation of human capital for market work)

$a^{i2}=f(a^{i1},H^{i1})$ (accumulation of human capital for household work)

$D^{i2}(w^{i2},a^{i2},I^{i2})$ (conflict outcome in period 2, which is the solution of utility maximization problem in a single-person household)

In the equations above L^{it} is leisure of person i in period t, H^{it} is hours of work at home of person i in period t, M^{it} is hours of market work of person i in period t, U^{it} is utility of person i in period t and based on consumption and leisure, D^{i} is conflict payoff of person i in period 1, C^{it} is consumption of person i in period t, Z is household production function, a^{it} is productivity of household work of person i in period t, X^{t} is market goods in period t, Y is net

income function, w^{it} is wage of person i in period t and I^{it} is non-wage income of person i in period t. Solving the maximization problem leads to the following condition for the allocation of time:

$$\Psi^{i}_{M} + Z_Y Y_M w^{i1} = Z_H a^{i1} + \Psi^{i}_{H} \quad (4.15)$$

where Ψ^{i}_{m} and Ψ^{i}_{f} stand for weighted sums of marginal utilities of both spouses in period 2, Z_Y stands for change in household production when net income changes, Y_M stands for change in net income when hours of market work change and Z_H stands for change in household production when hours of household work change.

The counterpart for the equation above in the model of altruistic households would be:

$$Z_H a^{i1} = Z_Y Y_M w^{i1} \quad (4.16)$$

As can be seen when comparing functions 4.15 and 4.16, the latter lacks the components of period 2 utility when solving the time allocation problem in period 1. As altruistic models assume that all income will be pooled, there is no need to assess future utilities.

In conjunction with the human capital approach, wages depend partly on exogenous factors and partly on investment in human capital in the form of on-the-job training as can be seen in the constraint describing the wage rate in period 2. Thus, besides bringing actual income today, employment also increases future human capital and therefore future earning potential. In a similar manner, doing household work in period 1 increases one's productivity in household work in period 2. Therefore, intra-household specialization in period 1 affects the future earnings potential of the household members in market work. If one specializes in the household labor, one's potential future earnings decrease due to a lesser accumulation of market human capital. This will result in a decrease in bargaining power within the marriage, as the reservation utility at the threat point of divorce decreases due to smaller earning potential in market work. As household contracts are not binding for a lifetime, rational members of the household are likely to take future changes in the threat point into account when making specialization decisions. Therefore, the time allocation between labor markets and household work within the household is chosen with both maximum household production *and* future bargaining position in mind. When looking at the equation 4.16, we can see that if wages and household skills differ between the spouses, the equation for altruistic households can hold for only one of the spouses, implying complete specialization. In the bargaining model 4.15, the equation can hold for both spouses even with different wages and household skills. Therefore, complete specialization is not the optimal allocation of time in all

cases, making the bargaining model more flexible than the model of altruistic households.

Household bargaining models can be tested by looking at the connection between marriage dissolution and labor force participation. High marriage rates could be connected with high labor force participation for both genders, as people would use work as insurance in case of a divorce. On the other hand, one can think that high employment levels could also cause divorce figures to rise, as neither party of the marriage would be in a severely disadvantaged position if the dissolution of the marriage took place. South (2001) has studied the effects of wives' employment on marital dissolution over time in the United States. The results show that for women the number of hours spent in paid employment is statistically significantly and positively correlated with martial dissolution. With men, the hours worked have no statistical significance which could be interpreted so that men already work outside the household at a sufficient level, and therefore additional working hours have less of an impact on their threat points. South also finds out that the effect of women's hours worked on the divorce risk has grown over time, which might have been caused by changes in institutions such as family-leave policies, child-care facilities, work flexibility, or by the liberalization of gender attitudes. Finally, the risk of marital dissolution is lower for homeowners than for renters. This is consistent with the idea that the transaction costs of breaking up a marriage can hinder the decision to do so. Furthermore, Genadek, Stock and Stoddard (2007) have studied how no-fault divorce laws impact female labor force participation. Theoretically, the presence of a no-fault divorce law should increase participation as women would hedge against the possibility of an easier divorce. This effect should be stronger for women with children, as the adverse effects of a divorce are arguably stronger for them. The authors find that for women with children under the age of six, a no-fault divorce law is associated with a net 0.018 increase in the probability of participation, the result being statistically significant. For women with children over the age of six, the effect is also positive, but no longer statistically significant. Somewhat surprisingly, the presence of a no-fault divorce law has a negative impact on the labor force participation of women with no children. This implies an increase in bargaining power either for women who prefer to stay home, or for men who want their wives to stay home. Furthermore, it should be noted that the effect is rather small in magnitude for all cases. Divorce laws are thus unable to explain much of the variation in the gender gap in participation.

To conclude, high divorce rates are likely to be connected to low gender gaps in participation through two effects. First, high number of divorces decreases the number of married women who are less likely to work than unmarried ones. Second, a high number of divorces increases the incentive for women to work during the marriage, as they cannot indefinitely on their marriages acting as insurance. On the other hand, high levels of employment also allow high number of divorces to take place, as people face smaller losses of income. Again it is difficult to determine what the direction of the causal effect is.

4.4 Fertility

Intuitively having children would be associated with a decrease in female employment levels, as women would be forced to spend at least some time outside the labor force when giving birth. This effect would be strengthened by the tendency of women to take care of the young children at home, manifesting itself in an increase in their reservation wage and a decrease in employment. The association, however, is in truth far from clear. It is possible that fertility decisions are partially influenced by the employment status of women. As we saw with the marriage bargaining models, market work could be seen as a prerequisite for having children by providing insurance towards divorce. Furthermore, fertility and labor force participation decisions could both be related to preferences. If fertility and labor market decisions are made somewhat simultaneously, their exact relationship is hard to pin down.

Two distinct research methods have been used in trying to solve this problem and determine the causal relationship between fertility and female labor supply. First, one can utilize exogenous variation in the number of children to assess the impact of having a child on labor supply, as has been done by Rosenzweig and Wolpin (1980). The authors look at how having twins in the first pregnancy affects future fertility and, more interestingly, later labor market behavior. The results indicate that although having twins as opposed to one child decreases labor force participation in the short run, this effect is likely to reverse in the long run. The results are thus consistent with a model of stable lifetime market participation rate where participation is just adapted to transitory events during the life-cycle: When preferred number of children is reached early on in one's life, there is more time for labor force participation later on. This implies that fertility should have only limited impact on the gender gap in LFPRs. It should also be noted that these results run somewhat against the idea of human capital attrition, as time spent outside of labor force early in the life-cycle does not seem to

have a negative effect on later participation[15]. Using a similar method while studying unwed mothers, Bronars and Grogger (1994) also arrive to the conclusion that fertility mainly affects labor force participation in the short run with little long-term effects. Additional research using this method for married mothers has also yielded similar results (Gangadharan & Rosenbloom 1996; Jacobsen, Pearce & Rosenbloom 1999). Therefore, a higher fertility should increase the gender gap in labor force participation for women close to childbearing age, but the effect should disappear when these women grow older. The problem with this type of research is that it is based on a "special" case of having children, namely having twins. It is therefore not altogether clear whether these results could be generalized to apply for the whole population. For example, there could be efficiency gains in household production for having two children at the same time, which would induce concentration for household labor and thus cause a decrease in women's labor market participation.

Another way to assess the relationship is by using instrumental variables to estimate fertility. Naturally, using this method makes the choice of these variables crucial for the reliability of the research. The early users of the instrumental variable technique in the 1970s and 1980s largely found negative coefficients on labor supply in the fertility equations, albeit not always statistically significant ones. However, the reliability of the instrumental variables used at this time period has seriously been called to question: The instrumental variables were often too weak or by themselves endogenous, or the identifying restrictions were arbitrary leading to sensitivity problems (Lehrer & Nerlove 1986). Lately, some more promising attempts have taken place. For example, Angrist and Evans (1998) utilize parental preference for mixed sibling-sex composition[16] in constructing instrumental variable estimates. As the variation in the sex-composition of a given family is close to random, this should take care of the problems in IV-estimates discussed above. In their estimation on US census data from the years 1980 and 1990, the authors find that fertility seems to have a decreasing effect on female labor supply: Having a third child reduces supply of labor by around 20 to 30 percent. The effect is smaller than when measured in OLS-method implying that simple OLS-estimates might exaggerate the impact of fertility on labor supply. Furthermore, the effect is slightly stronger for the group of married women than for all women. Overall, the authors estimate that decline in the number of families with more than two children could account for an increase of approximately 2 percentage points in employment for women aged 21 to 35

[15] Attrition could still, however, have an effect on wages, but that was not covered in this piece of research.

[16] Parents with two same-sex children are substantially and significantly more likely to have third child than parents with two children of different sex.

from 1970 to 1990. However, as the overall increase in employment over this period was 21.8 percentage points, other explanations must also be sought. Using a similar method, Cruces and Galiani (2007) find that these results hold both qualitatively and quantitatively in Argentina and Mexico.

The method of using same-sex composition as an instrumental variable for fertility has been criticized by Rosenzweig and Wolpin (2000). Based on their data in India, the authors suspect that part of the incentive of having a third child in case of the first two being of the same sex could be attributed to hand-me-down cost savings, which occur if for example clothes can be handed down to younger siblings. However, these savings are more important when children's clothing takes a substantial part of the family income and therefore, it is probably a matter of concern only when studying poor regions.

Another problem with the research presented above is that it only concerns the case of having a third child. This has been overcome by Cristia (2008) who has applied IV-method to assess the effect of having a first child by studying women who are seeking fertility services: As all these women want to have a child, and having one is uncorrelated to their employment status, it is possible to observe changes in their labor supply after giving birth later. The author finds that the labor supply of women who had a child is around 25 percentage points lower 20 months after beginning treatment than those who did not have a child but began the treatment at the same time period. Unfortunately we do not have knowledge of the labor supply after a longer period of time. Therefore, these results could still be consistent with the idea of a set level of lifetime employment. Bloom *et al.* (2009) have used abortion legislation as an instrumental variable when assessing the effect fertility has on female labor force participation. In a 97-country-data with fixed country effects, the authors find that a high fertility has a negative and statistically significant effect on female labor force participation rate.

There have also been a number of aggregate level studies concerning the relationship between fertility and labor supply. Historically there has been an inverse relationship between the total fertility rate and the female labor force participation rate at the country level. Some have suggested, however, that in the 1980s the cross-country correlation between these two variables changed signs, meaning that lately countries with higher female labor force participation rates would also tend to have and higher fertility rates (Brewster & Rindfuss

2000; Ahn & Mira 2002). This would imply decreasing role incompatibility between working and childbearing, probably caused by changes in values as well as by institutional development. For example, availability of child-care, and attitudes towards its utilization, may have changed in this period, allowing more women to combine childrearing with work (Brewster & Rindfuss 2000; Rindfuss, Guzzo & Morgan 2003). Availability of part-time work and the level of unemployment have also been suggested as possible explanations: Increasing availability of part-time work could have facilitated the return of women to the workforce after giving birth. On the other hand, rising levels of unemployment, especially prevalent in Southern Europe, could have led to an increase in "zero-earnings" households which are detrimental to fertility (Ahn & Mira 2002). However, Kögel (2004) suggests that the time-series association between fertility and female labor force participation has not changed as dramatically as the authors above claim. Instead, the observed changes in the cross-country correlation have two reasons. First, the studies have not taken country fixed effects into account and second, there is considerable heterogeneity in the time-series association between the variables. According to Kögel, the negative time-series association has persisted in the Mediterranean countries even after the 1980s, but the association has become insignificant in other parts of Europe covered in the research. Even though there has not been a change in sign per se, it is clear that the negative association between fertility and female labor force participation has overall become less important over time, as was shown be the disappearance of the positive correlation in some cases.

In conclusion, it is likely that having children decreases female labor force participation at the individual level and in the short run. However, it seems that this effect decreases for individuals as time progresses: After sufficient time women tend to reattach themselves to labor markets. Furthermore, research based on aggregate data suggests that while the negative correlation between fertility and female labor supply persists in some countries, the effect is not as consistent as it used to be. Claims of a change towards a positive correlation, however, remain questionable. Remembering Ott's (1995) model, the possibility of lifelong employment could have pushed fertility rates down as women have become more reluctant to forgo future income, and the bargaining power attached to it. Following this, we could assume that the negative correlation between fertility and female employment is somewhat offset by women's stronger position in the labor markets: If women cannot safely bear children without the risk of exclusion from the working life later on, the number of children is likely to go down. On the other hand, if women are strongly attached to the labor markets, this risk is

unlikely to materialize and both the labor force participation rate and the fertility rate can coexist at a relatively high level. Overall the evidence indicates that variation in fertility is unlikely to be the primary reason behind differences in the gender gap across countries. In contrast, the fact that women give birth is the most likely reason for the persistence of gender gap in the long run, as it can be deemed as the only biologically relevant factor in determining labor market participation. Finally, it seems likely that decreases in fertility can explain part of the decreasing trend in the gap, but it is also clear that childbearing and working are not fundamentally incompatible in the modern society. We will therefore next consider the impact certain institutions could have on the gender gap in LFPRs through facilitating continuing market work simultaneously to having children.

5 Policy Instruments, Technology and Informal Institutions

The specific institutional setting in a given country can have a strong impact on the gender gap in labor force participation rate. For example, Jaumotte (2003) found in a cross-country study that state support for child care, high relative tax levels for second earners, level of family allowances, availability of part-time work, length of paid parental leave and level of employment protection all had a statistically significant impact in women's labor force participation rate. Some of these institutions are related to the division of labor within the households: High day care subsidies and low relative tax levels for second-earners and high family allowances decrease the reservation wage rate for a person not participating in the labor markets. On the other hand, the availability of part-time work and parental leave policies are closely connected to the possibility of combining working and childrearing. The importance of institutional structure in determining women's labor force participation rate has also been emphasized by Del Boca & Sauer (2009): According to the simulations conducted by the authors, a favorable institutional structure could alter the female participation rate for as much as over 20 percentage points.

There are thus multiple ways in through which government policies can influence the gender gap in participation. Three of these are looked in more detail in this chapter: system of taxation, maternal leave policies and child care subsidies. Structural features are not, however, constrained solely to state actions. Technological progress has also historically been an important factor in improving women's work possibilities. Finally, informal institutions such as culture can affect women's labor supply decisions by skewing incentive structures for working.

5.1 Household Taxation

Taxation is clearly an important factor when people make decisions concerning their labor force participation as it impacts the final income that can be acquired from working. Taxation is for the most part, however, gender-neutral and therefore should not affect the gender gap in labor force participation. One crucial exception in this respect is the choice on how income within a household is taxed. Two main systems can be separated here. First, under a system of family taxation, income from all family members is pooled and the level of income tax is based on this pooled income. The second option is a system of individual taxation, where the tax level of each person of the household is based on their own income only. When compared to individual taxation, taxing households as one unit is likely to decrease female labor force participation, as it usually creates greater incentives for specialization within the household[17].

The ending of the system of family taxation in the early 1970s in Sweden provides a "natural" experiment for studying its effect on female labor force participation. By studying the labor market positions of working-age women in 1969 and 1975, Selin (2009) estimates that the employment level in 1975 using the old tax system would have been around 10 percentage points lower than it actually was. Gustafsson (1992) has also studied the impact of the introduction of separate taxation on married women's labor supply in Sweden by comparing micro data on wages, hours of work and human capital in Sweden and West Germany. As West Germany had at the time of the study a system of joint income taxation, it can be well used as a comparison for the reform conducted in Sweden. Gustafsson estimates that exchanging the tax systems between the two countries would have had a large impact on their respective women's labor supplies: For Sweden, the author estimates that married women's labor force participation rate would decrease from 80.2% to 60.4% if the West German tax system were to be applied there. In West Germany, the corresponding change would result in an increase of the married women's labor force participation rate from 50.3% to 60.0%. Slightly lower results concerning Germany have also been found by Haan (2010) who estimates that shifting to individual taxation would result in a 7 percent increase in female labor force participation rate. In a similar manner, Smith *et al.* (2003) have studied how taxation affects married women's labor supply in four European countries: Britain, Ireland, Denmark and Germany. Again, the conducted simulations indicate that the taxation scheme could have a strong impact on women's labor force participation. For example, applying the

[17] Assuming a system of progressive taxation, increasing returns for human capital and differences in the human capital between the two spouses.

Irish joint taxation scheme to Denmark would increase the non-participation rate of women from 11% to 74%. Even though a change of this magnitude seems unlikely, the overall results from various studies clearly indicate that the system of taxation can strongly affect the gender gap in labor force participation.

5.2 Maternal Leave Policies

Empirical studies concerning the effects of fertility implied a decrease in women's participation in the short term. This could potentially be alleviated by state policies. However, the effect of formal maternal leave policies on women's labor supply is theoretically ambiguous. On the one hand, these policies could increase participation by allowing women to retain their jobs even if they needed some time off around giving birth. This would help them to reattach themselves to the labor markets after the initial time spent with their children, as the search costs of finding a new job would disappear (Baum 2003/I). This effect could be further reinforced by a lower level of attrition for the human capital coming from a quicker return to the labor market. On the other hand, maternal leave policies could also decrease women's participation by allowing women to stay longer periods outside the labor force without a complete loss of income. Furthermore, maternal leave policies could also induce employers to avoid hiring women of childbearing age in the fear of increased labor costs[18].

Waldfogel (1999) has studied how the introduction of Family and Medical Leave Act in the USA in 1993 has affected labor market outcomes, such as employment and wages. The act allowed qualified employees to have up to 12 weeks of leave for medical or family reasons, providing for the first time a federal maternity leave in the US. The results show that the introduction of the policy had no statistically significant effect on the women's employment. The author offers two ways to explain these results: First, it is possible that the predicted increases following from easier reattachment were offset by some women taking longer leaves. Alternatively, it is also possible that neither of the effects had a significant impact on employment, implying that unofficial systems for maternity absences could already have been in place at the firm level before the implementation of the act. Studying the same act with a different data set, Baum's (2003/II) results concerning employment are largely similar: When controlling for demographic variables, state-specific variables and year-specific variables there is no statistically significant difference in employment between mothers and various

[18] Besides effects on employment, maternal leaves could also have a positive effect on children's development if it allows women to stay at home for some time after giving birth (Baum 2003/I; Tanaka 2005). However, the adverse effects could also be alleviated by other institutional structures (Gregg *et al.* 2005).

control groups[19]. Besides former unofficial arrangements, Baum states two additional reasons which could contribute to the absence of the effect. First, the relatively short length of the maternity leave provided by the act might be insufficient to cause significant changes in employment. Secondly, as the leave is unpaid, women might have to return to work rather quickly after giving birth due to financial reasons.

Somewhat different results have been found from Canada. Baker and Milligan (2008) found that short maternity leaves (around 20 weeks) caused women not to quit their jobs prior to giving birth. On the other hand, there was no indication that the new entitlement would have caused women to change from working to taking parental leave after giving birth. Short maternal leaves should, therefore, increase women's labor force participation. In the case of longer leaves (around 30 weeks), significantly more mothers switched from working to parental leave after giving birth, implying that long parental leaves could decrease women's participation.

There have also been attempts to study how differences in parental leave policies could affect women's employment across countries. Ruhm (1998) has studied the effect of parental leaves in women's employment-to-population (EP) ratios and wage levels in nine European countries by using data from 1969 to 1993. The results indicate that short leaves increase the EP-ratios of women by around 3 to 4 percent while having little effect on wages. On the other hand, longer leaves (over nine months) increase the female EP-ratios by around 4 percent while decreasing the female hourly earnings by around 3 percent. According to Ruhm, around one-quarter to one-half of the increase in the EP-ratios is probably caused by the statistical inclusion of people on parental leave to people who are employed. There are two primary factors accounting for the rest of the effect. First, females who would not otherwise participate in the labor market might obtain a job before giving birth in order to enjoy benefits from parental leave. Second, the parental leave policies can speed up the new mothers' return to the labor market as they do not face the costs of finding new employment. Using a probit-model, Waldfogel, Higuchi and Abe (1999) have additionally estimated that maternity leave coverage has a positive impact on job retention rate in the United States, Britain and Japan, implying a positive effect also on labor force participation.

[19] There is no difference in wages either, when the same variables are controlled.

In conclusion, the empirical research concerning the effect of maternal leave on female employment is not unanimous. The introduction of federal maternal leave policy had little effect on women's employment in the United States whereas in the Western Europe and Canada maternal leave policies seem to have enhanced women's attachment to the labor markets. This difference could perhaps be explained by the difference in monetary compensation during the leave: Whereas the federal maternal leave in the US is unpaid, most European countries and Canada offer at least partly paid leaves. Compared to women from other countries described here, this creates monetary incentives for US women to return to work more quickly after giving birth. Finally, there is no consensus on whether long maternal leaves increase or decrease participation.

5.3 Child Care Costs

Since the late 1980s, there have been a number of studies concerning the relationship between child care costs and female labor force participation. High child care costs should lower the probability of labor force participation for women as the cost of taking care of the children offsets some of the wage gains acquired from working, thus decreasing the reservation wage rate. We should remember from the discussion on wage elasticities, however, that the impact of a change in wages on participation is not necessarily very large. Such a connection probably does not exist for men, as they are unlikely to stay at home and take care of the children in any case. Subsidizing or providing free market child care by the government should therefore increase women's labor force participation through a higher increase in real income when switching from household work to market labor. Naturally, supporting child care at home would have the opposite effect.

The consensus among researchers seems to be that high child care costs have a statistically significantly negative effect on women’s labor force participation. Therefore, subsidies on child care could offer a relatively simple way of supporting women's employment. However, the magnitude of the effect is still under debate as elasticity estimates vary considerably. Two reasons can be thought to contribute to this. First, the differences could be a result of differences in data, i.e., women in different countries could react differently on changes in child care costs. This could be caused by different preferences or by differences in the institutional structures between countries. Secondly, differences could be caused by the methodological choices. For example, Anderson and Levine (1999) present three main methods that have been used in estimating how the cost of child care affects mothers’

employment decisions. First, one can estimate a probit model on the discrete employment decision, on which the child care costs and wage rates are the key covariates. In this method sample corrections need to be made correct for the bias that only those paying for child care or working are observed. This creates some unreliability to the results. A second way to estimate the relationship is to construct a structural model based on utility maximization and assumptions of functional forms. The problem with this approach is that the assumed functional forms may not reflect individual behavior accurately. The third approach utilizes exogenous events to assess the problem. However, generalizations made from such natural experiments remain somewhat unreliable due to the low number of research done with this method.

Blau and Robins (1988) have studied the effect of child care costs on married women's employment in the United States by using a probit model where three child care possibilities exist: women can themselves stay at home; someone else (such as a relative) can take care if the children for free albeit with worse "quality"; or child care can be purchased from the markets. The authors find out that the cost of child care, measured by the site-average weekly cost of market care, has a negative and statistically significant effect on participation. Overall, the average price elasticity of employment over child care costs is estimated to be -0.38. By also using US data, Connelly (1992) has largely reached the same conclusions as Blau and Robins (1988), but with an estimated price elasticity of -0.20 when measured at the mean values of probability and child care costs. Slightly higher price elasticity has been found by Ribar (1992) who reports an elasticity of -0.74 for mothers in the United States. According to Ribar, the smaller elasticities presented in other pieces of research are likely due to the fact that the expenditure on child care is measured per week rather than per hour of care per child. Therefore, the smaller elasticities probably capture a combination of both child care cost and child care utilization effects. Using a probit model, Kimmel (1998) has sought to study whether child care costs have a different effect on the labor supply of single and married mothers in the United States. One could assume that child care costs would have less of an impact on the labor force participation of single mothers, as their household labor would be less likely to be supported by income from other household members, forcing them to work no matter the level of child care costs. As expected, the author concludes that elasticities differ in size: the child care price elasticity for employment is found to be -0.22 for single mothers and -0.92 for married mothers.

Studies have also been conducted outside the US with largely similar results. Cleveland, Gunderson and Hyatt (1996) have estimated the elasticity by using data from Canadian National Child Care Survey conducted in 1988, finding an elasticity of -0.388. Powell (1997) uses the same data set in her study but supplements it the 1988 Labour Market Activity Survey which allows the author to match wage data with child care choice[20]. Also Powell's estimation shows a statistically significantly negative effect between child care costs and the labor force participation, with a very similar elasticity of -0.38. Using Australian data, Doiron and Kalb (2004) find the elasticity in hours of work with respect to child care costs to be -0.15 for single parents, -0.03 for women with partners. Besides being rather small in quantity, it is interesting to note that in Australia single parents are more responsive to child care costs than partnered people. Finally, Gustafsson and Stafford (1992) have studied the phenomenon in Sweden where the quality of child care is relatively constant, as it is mostly provided by the state. The net price elasticity for labor supply is around estimated to be -1.88 when there is no rationing for child care places and -0.063 for all mothers.

Whereas the research above was based on probability models, some authors have estimated the effect of child care costs on women's labor supply with a structural model. In general, these models tend to find much lower child care cost elasticities for employment than the models presented above. For example, Michalopoulos, Robins and Garfinkel (1992) use US data from the Survey of Income and Program Participation to achieve this purpose. They first formulate the mother's maximization problem where mothers seek to maximize such variables for example as wages, child care quality and child care cost under US taxation and subsidy structures. As a result of the estimation, the authors find that the child care subsidy rate elasticity for hours worked is 0.00 for both married and single mothers. Using the same data, Ribar (1995) finds that the uncompensated paid care cost elasticity for employment ranges from -0.024 to -0.088, depending on the model specifications. In a similar manner but using French data, Choné, le Blanc and Robert-Bobée (2003) find the child care cost elasticity for labor force participation to be a meager -0.01, whereas Wrohlich (2004) estimates the corresponding elasticity to be -0.02 in East Germany and -0.03 in West Germany. It is clear that the elasticities obtained from the structural models are smaller than those from the probit-models. Unfortunately, the cause behind these differences remains unclear. It should be noted, however, that child care elasticity figures correspond relatively well to wage elasticities. This

[20] Cleveland, Gunderson and Hyatt (1996) estimated wages based on mother's characteristics such as age and education which creates more imprecision to their model.

is logical, as only the quantity of net income is important for the participation decision, not how it's constituted. Although subsidizing child care cannot harm the narrowing of the gender gap in labor force participation, it seems that it is not necessarily an efficient way to pursue this goal as the elasticities are relatively close to zero. Thus, changes in child care costs are cannot by themselves explain changes and variation in the gender gap in LFPRs.

5.4 Technology

We will next move from policy instruments to discussing the constraints and incentives technology can provide for women's labor supply. We will consider three ways through which technological advances could impact the female labor force participation rate. First, the development of home appliances could increase household productivity which would result in fewer hours needed for household work. This would give women more time to work in the official labor markets. Second, the introduction of more efficient contraceptive technologies could allow women to better control their life-cycle labor supply, as the risk of unwanted pregnancies decreases. Finally, advances in medical sciences could also alleviate the health risks associated with giving birth which could result in an increase in labor supply.

The introduction and cheapening of home appliances has had a significant impact on women's labor supply. If the amount of household work is assumed to be relatively constant, the increased productivity given by these appliances would enable women to combine both household work and market labor at the same time (Greenwood, Seshadri and Yorukoglu 2005). Technological advances in home appliances might also decrease the gap in household productivity between the spouses, lessening the need for specialization and thus increasing women's labor force participation (Borjas 2010). By utilizing a Beckerian model of household production, Greenwood, Seshadri and Yorukoglu (2005) suggest that slightly over a half of the increase in women's labor force participation in the US during the 20th century could be explained by technological advances, measured by the price of household appliances, with the progress having its biggest impact after the 1950s. The authors attribute the rest of the narrowing to the decline in the gender wage gap. Somewhat similar results have been found by Cavalcanti and Tavares (2008) who have studied how the decrease in prices of the home appliances has influenced female labor force participation across a group of OECD countries. The authors find in a simple OLS-test some evidence as to there being some effect: the coefficient of home appliances price index is consistently negative, and remains statistically

significant in nine of the ten specifications used[21]. This is further confirmed by using relative manufacturing price index and an index for the terms of trade adjustment as instrumental variables. The results from IV-estimation indicate that the causal relationship between the price of home appliances and female labor force participation is actually stronger than in the OLS-test. The elasticity of price index for female labor force participation ranges from -0.73 to -0.46. Overall, the authors estimate that the decrease in the price of home appliances could account for 10% to 15% of the total change in female labor force participation from 1975 to 1999 which is relatively similar to the estimation done by Greenwood, Seshadri and Yorukoglu (2005). One could assume that the importance of this particular form of technological progress has become smaller over time at least in the OECD countries, as most of the time gains have already been realized. Therefore, further development of home appliances is unlikely to have a major impact in further narrowing the gap.

On a completely other form of technological progress, Goldin and Katz (2002) have studied the impact of oral birth control pills on college graduate women's career paths. According to the authors, the introduction of the pill, and especially its spread among single women, has allowed women to further invest to their human capital, as the risk of unwanted pregnancy has greatly diminished. Therefore, women have been more able to participate in professional degree programs, giving them better labor opportunities later on. Thus, the pill could have also had an impact on labor supply. At the same time as the introduction of the pill, the age of first marriage increased as the risk of pregnancy no longer needed to be insured against. Using state level variation in the age of legal consent for acquiring the pill in the 1960s and 1970s, Bailey (2006) estimates that access to the pill before the age of 21 increased the labor force participation of 26 to 30 year old women by approximately 8 percent. The increase came mostly through birth timing: The possibility of delaying childbirth with low costs allowed women to remain in school longer, thus allowing them to pursue long-term careers and participate in the labor markets in their 20s.

On our third topic on technology, Albanesi and Olivetti (2009) have studied how technological improvements in maternal health and infant feeding could have contributed to the rise in married women's labor force participation in the United States in the 20th century. Maternal health is measured by approximating how many deaths childbearing is likely to have

[21] The coefficient loses its statistical significance only when all control variables are used with country dummies, year dummies and country-specific time trends.

caused to the population whereas improvements in infant feeding are measured by the time price of infant formula. Price of home appliances is also used as an explaining variable, giving us further knowledge also on that topic. The authors conclude that improvements in maternal health were an important factor in explaining the rise in participation that occurred between 1920 and 1960: Improvement in maternal health could by itself explain the entire rise in married women's labor force participation until 1955. By contrast, improvements in infant feeding seemed to have their strongest effect on participation when both the number of infants is high, and when maternal health is at a sufficiently high level to induce participation in the first place. However, its effect is less strong than that of maternal health: The authors estimate that improvements in infant feeding adds between 5 to 10 percentage points to participation for women at childbearing age between 1940 and 1960, and around 4 percentage points after the 1960s. Finally, the authors conclude that home appliances have seemed to mostly influence participation after 1975 which time-wise contradicts the findings of Greenwood, Seshadri and Yorukoglu (2005). The wider range of variables gives greater credibility to the work done by Albanesi and Olivetti (2009).

5.5 Informal Institutions: Identity and Culture

More informal structures, such as norms or identities, can also have a significant influence on one's decision making, including the decision on whether to work in the official labor markets. There is a reciprocal relationship between norms and identity: Prevalent norms constrain the identities of people along proper lines, but on the other hand norms can also be seen as being constituted from the collection of identities within a society. According to Goldin (1990), for example, aversion towards married women to work was an important factor explaining the low level of female labor force participation in the United States before the Second World War. The use of married women to satisfy the demand for labor during the war, however, changed existing attitudes and paved way for a higher level of participation later on. Therefore, causality can work both ways between values and employment patterns[22]. Despite its explanatory potential, research concerning the impact of culture on economic variables has been rather scarce in the field of economics, as preferences are usually taken as given. One way to approach the issue is to define culture and preferences inherent to it as a type of informal institution. For example, North (1992) states that informal rules, consisting of codes of conduct, norms of behavior, and conventions are a distinct form of institutions. Just as formal institutions like laws, they can both create incentives or constrain action.

[22] The clear majority of the research, however, concentrates on how values affect participation. As an example of the opposite, see Seguino (2007).

However, there are also some crucial differences between formal and informal institutions. Whereas formal institutions can be adjusted relatively easily, the decentralized nature of the informal institutions makes them difficult to change as they are often deeply embedded in culture, and transferred through teaching and imitation.

Akerlof and Kranton (2000) have sought to incorporate identity more formally into economic analysis which could yield at least four potential benefits. First, identity can explain behavior that appears otherwise detrimental. This could be used in explaining why some women may prefer household work even if it makes their bargaining position worse with respect to their market working husbands. Second, identity underlies a new type of externality: For example, early working women could face opposition from other women and men as the breaking of former gendered boundaries challenged their identities. Third, identity reveals a new way in which preferences can be changed. Thus, associating working women with positive values could create a new female identity, changing preferences for working in the long run. Fourth, as identity is important for behavior, the choice of identity may be the most important economic decision one makes. Of course, the choice of one's identity can be strongly constrained, as it often is in the case of gender.

In Akerlof and Kranton's (2000) identity based model, utility function is based on social categories C. Each person j has assigned themselves and every other person to these categories c_j. Prescriptions P indicate the appropriate behavior for each of these categories. In the case of gender, people are generally categorized either as men or women, with varying concepts for appropriate behavioral models. The utility function then becomes:

$$U_j = U_j(a_j, a_{-j}, I_j) \quad (5.1)$$

Here, utility depends on one's actions (a_j), one's self-image (I_j) and other people's actions (a_{-j}). Actions here comprise the usual possibilities considered in utility functions, such as consumption of goods. The self-image can be presented as:

$$I_j = I_j(a_j, a_{-j}; c_j, \epsilon_j, P) \quad (5.2)$$

Thus, one's identity depends on the social category c_j assigned to the actor, how one's personal characteristics (ε_j) fit that social category, indicated by prescriptions P. Furthermore, one's own actions and the actions of others also affect one's identity. Following this definition, increases and decreases in utility related to I_j can be called as gains or losses in identity. It should be noted that social categories and prescriptions can be changed over time through actions, as has somewhat happened concerning the differences between men and women.

Akerlof and Kranton (2000) also create a prototype model on how economic interaction could take place with identity as a factor. In this model, described in figure 8, there are two social categories and two possible activities. Every person prefers one of the activities: Undertaking the preferred activity gives them utility V whereas undertaking the other activity gives them zero utility. Let Person One prefer and choose activity one, and Person Two prefer activity two. This gives the second person two options: Choose activity one and receive zero utility, or choose activity two and receive a utility $V\text{-}I_s$, comprising of the utility gained from activity two and a potential loss in identity. If Person Two chooses the latter, this leaves Person One two choices: They can either not respond and suffer a utility loss I_0, or they can respond at a cost c. If Person One responds, this incurs a utility cost of L to Person Two. There are four possible equilibria in the model:

1) Person One deters person two from engaging in activity two, when $c < I_0$ and $I_s < V < I_s + L$;
2) Person One responds but does not deter Person Two from engaging in activity two, when $c < I_0$ and $I_s + L < V$;
3) Person One does not respond and Person Two engages in activity two, when $c > I_0$ and $I_s < V$;
4) Person Two engages in activity one regardless of Person One, when $I_s > V$.

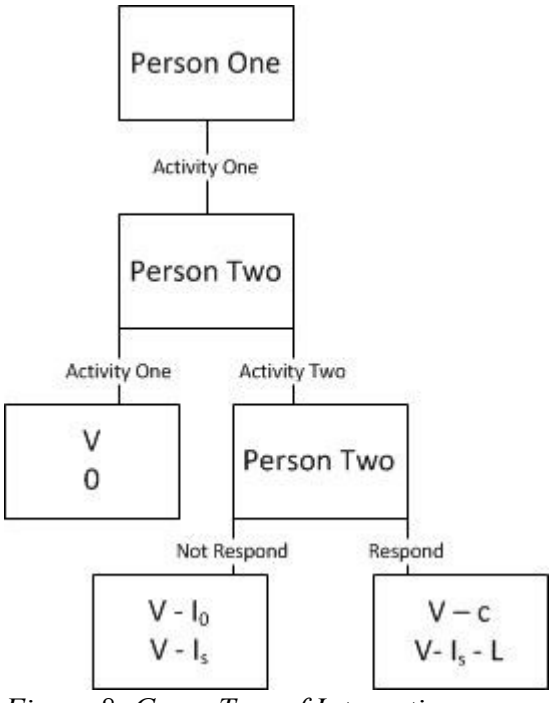

Figure 8: Game Tree of Interaction between Person One and Person Two
Source: Akerlof & Kranton 2000, 729.

The identity-based model can be used to explain the observed changes in the gender gap in LFPRs. The decrease in the gap could be attributed to changes in attitudes concerning proper role for men and women, thus decreasing women's identity gains in homemaking (Akerlof & Kranton 2000). Furthermore, the persistence and variation of the gap could be attributed to persisting gender attitudes and variation in gender attitudes across countries respectively.

The problem with identity based approach, however, is that it is relatively difficult to confirm or falsify as it is difficult to observe and quantify people's identities and relate them to labor market behavior. Recently two main empirical methods have been used to look at culture's, and thus identity's, influence on labor market performance[23]: First, one can look at whether there are differences in female labor force participation between different groups of immigrants in a given country. This method works better when focusing on the children of immigrants, as they have grown in a similar institutional structure. A second way is to utilize value surveys to determine dispositions towards working women at a certain place and time, and then see if these values have an effect on the probability of participation.

As an example of the first way, Fernández and Fogli (2009) have studied the differences in the gender gap in participation between second generation immigrants in the United States[24]. By having the data from a single country, the authors can reasonably argue that differences between groups are unlikely to be attributed to differences in labor market institutions. Furthermore, a single-country study allows the authors to better control human capital differences. Cultural values are derived from the labor force participation rates and the total fertility rates of countries of ancestry. The results from various models indicate that cultural proxies do have an effect on second-generation immigrant women's employment levels in the United States. Notably, the same proxies do not have an impact on men's employment levels, implying that women's employment status is more susceptible to cultural practices. Interestingly for married women, their husbands' cultural background is more important than their own in explaining their labor force participation. This implies that men still have stronger bargaining positions inside the marriage, as their cultural values are more likely to affect women's labor market outcomes. Furthermore, the authors find out that the strength of

[23] A third possibility, used for example by Vlasblom and Schippers (2004), is to denote the residual of change in female labor market participation to a change in values. Research conducted in this fashion is, however, especially susceptible to omitted variables. Therefore, conclusions made from such a piece of research should be taken with some skepticism.

[24] Similar research has also been done by Antecol (2000), but he mixes immigrants from different generations in his study which could technically skew the results. The actual results are, however, largely similar.

the cultural proxies increases when the ethnic group is clustered to same living areas: The higher the average density of living for an ethnic group, the higher the impact of culture on women's labor force outcomes. This could be explained by enhanced transmission of values through role models, or by greater capacity for applying incentives and punishments for behavior.

As noted above, one can also utilize value surveys to determine the effect of values on labor force participation. When using such a strategy one should, however, bear in mind that the institutional structure also differs to some extent across countries. Omitted variable bias could thus become a significant problem here. Fortin (2005) has used data from World Value Surveys to study how attitudes concerning gender and market labor affect women's employment and wages. On an individual level, preferring men to have access to work over women when jobs are scarce is found to have a statistically significant and negative correlation coefficient in the case of female employment with no significant correlation with male employment. Furthermore, attitudes concerning working mothers and working at home are also weakly correlated with women's employment levels so that when household work is seen as suitable for women, their labor force participation is likely to be lower. None of the aforementioned proxies are statistically significantly correlated with men's employment levels, implying that male employment levels are more related to features of the labor markets such as unemployment levels. The impact of values also persists when the comparison is made between countries. One additional note of interest is that the inclusion of proxies for values cuts the impact of public expenditure to child care to half. This implies overestimation of the impact of policy variables in research when differences in values are unaccounted for. By using a similar method, corresponding results have also been found by Algan and Cahuc (2005) and Contreras and Plaza (2010).

Besides studying the impact of society-wide values on women's employment, it is also possible to look more closely how these values are relayed. Fernández, Fogli and Olivetti (2004) conclude that the probability of a man having a working wife is statistically significantly correlated with his mother's working behavior when numerous background variables, such as region and education, are controlled. It is estimated that an exogenous increase of labor supply by one week for women of childbearing age increases the labor supply of the subsequent generation by approximately 1.67 weeks. This gives proof that preferences concerning gender are, at least to some extent, formed during childhood, implying

that large scale changes in values are likely to take some time. Both the constant decrease and the persistence of the gender gap in participation are thus largely consistent with this explanations based on culture.

6 Empirical Analysis: Variation in Gender Gap in Europe 1994-2006

The purpose of the empirical analysis is to assess how policy instruments, labor market institutions and demographic variables affect the gender gap in labor force participation rate across countries and time. Due to the availability of data, the empirical analysis concentrates on a group of European countries and thus somewhat resembles the aforementioned cross-country study conducted by Jaumotte (2003). There are, however, at least three factors which differentiate this study. First, the time period of the study is different: Whereas Jaumotte studied the evolution of women's LFPR from 1985 to 1999, this study comprises more recent data, from 1994 to 2006. Secondly, the group of countries is slightly different: This study contains a number of Eastern European countries within the data, but lacks the few non-European countries present in Jaumotte's study. Third, whereas Jaumotte explicitly looks at female participation levels, we are more interested in the gender gap in participation. Although most of the variation in the gender gap in participation is likely to be caused by changes in women's participation, it is also possible that some of the independent variables considered here could affect participation of both genders in the same direction, but with differing strength. If a policy measure increased the participation rate for both men and women but had a stronger effect on the former, this should be interpreted as being adverse for gender equality although women's participation would also increase. Finally, there are also some differences in methodology, the most notable being that, besides heteroskedasticity, this piece of research also takes the potential autocorrelation into account.

The rest of the chapter will progress as follows. First, data and the set of variables to be used will be presented. Based on former studies, some initial comments concerning the expected effect of the variables will be made. Methodology of the study will follow consequently, with specific importance paid to the potential problems of heteroskedasticity and autocorrelation. Limitations of the data will also be discussed here as far as it impacts the choice of the proper estimation method. After this, estimation results will be presented, to be subsequently followed by a more thorough discussion.

6.1 Data and Variables

The data set consists of data from 20 European countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland and the United Kingdom. Data is in annual form, and comprises the years from 1994 to 2006. The data is in aggregated at the country level, so it is not as accurate as micro data would be. However, the data should be sufficient in highlighting how the gender gap in LFPRs can vary at the country level. As most of the data has been collected by the same source, OECD, it is unlikely to contain significant discrepancies. Furthermore, data concerning a given variable is always from a single source which enhances comparability. Linear interpolation is used to estimate missing values.

Gender gap in labor force participation rate will serve as the dependent variable in most of the estimations. As labor force participation rate describes the ratio of employed and unemployed of working age people to the whole working age population, gender gap in it is the simple extraction of the female LFPR from the male LFPR. In this instance, we will mainly utilize the gender gap in labor force participation rate for 25-to-54-year-old people: This age group is most likely to participate in labor markets, as studying and retirement are probably only a minor issue for this age group. In the course of the analysis we will also shortly look whether the results are similar for different age groups. Finally, data for male and female LFPRs will be used to assess their respective importance in defining the gap. Source: OECD (2010/I).

Figure 9 shows the gender gap in LFPRs from 1994 to 2006. The gap has narrowed in most of the countries during the ten-year-period: only countries with relatively low initial gaps have in some cases experienced widening. In 1994 the average difference in labor force participation rates between the two genders was around 21.6 percentage points, but in 2006 the gap had narrowed down to 14.3 percentage points, meaning that around one third of the gap has disappeared in just over ten years. The gender gap is largest in Mediterranean countries such as Greece, Italy and Spain, whereas it is lowest in Nordic countries such as Finland and Sweden.

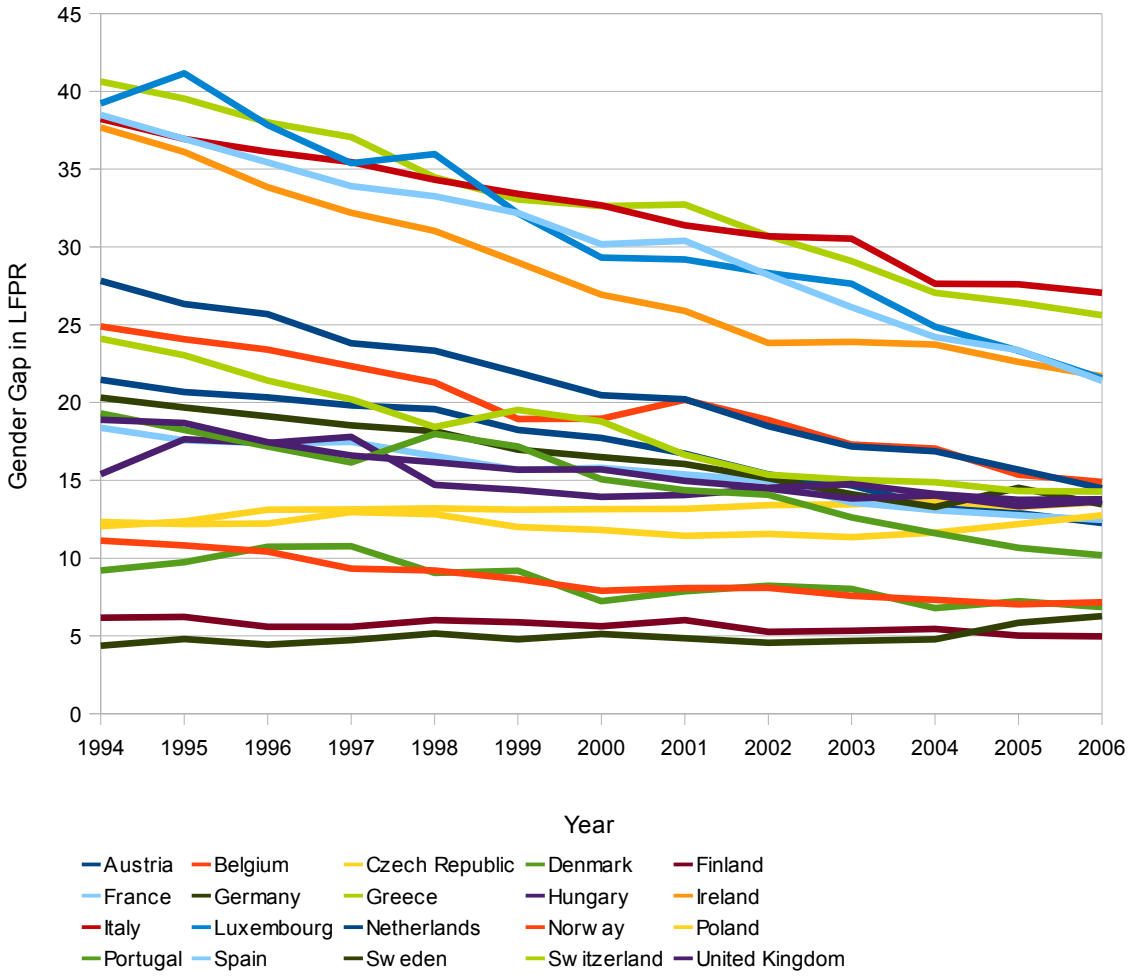

Figure 9: Evolution of Gender Gap in LFPRs in Selected Countries, 1994-2006
Source: OECD 2010/I.

Income tax variable describes how the income tax of a person changes depending on their family status. It is formulated by extracting the average income tax percentage of a single person with no children at 100% of average earnings by the income tax percentage of one earner married couple with two children at 100% of average earnings. The idea behind this variable is in providing a measure for the tax system in a country. As we have seen this can a significant impact on the work incentives for married women. Potential problems with the variable are that it inseparably captures the effects of both marriage (system of taxation) and children (child deductions) on income tax percentage. Furthermore, the measure might be somewhat misleading if the bulk of taxation is done with different forms of taxation. Source: OECD (2010/I).

Values is an indexed constructed from a question in the World Values Survey and is used to assess the extent to which the two genders are seen to have different roles in the economy.

The question more specifically asks, whether men would have more right to employment when jobs are scarce. The question has four possible answers (strongly agree; agree; disagree; strongly disagree), and these have been coded by the author to the values 4, 3, 2, and 1 respectively. By multiplying these with the proportion of people giving a certain answer at a given time and place, we can construct a rough index concerning the values concerning gender roles in the labor markets. We assume that high values of this index are more likely to be associated with a high gender gap in LFPRs. Source: World Values Survey Association (2009).

Human capital differences will be assessed with **gender gap in average years spent at school** for population of 25 years and over, as most of the schooling should be done by this age. Following human capital theory of gender differences, gender gap in human capital implies also a gap in labor force participation. Data is available on gap in primary, secondary and tertiary schooling, as well as on total years of schooling, but initial testing suggests that the gap in average years of primary schooling can best explain variation in the gender gap in participation[25]. Data is based on the data collected by Barro and Lee (2010), who estimate the overall and female average school years in much of the world with five-year-intervals until 2010. For this paper, data from years between 1995 and 2010 has been used and values within the intervals have been interpolated linearly. Source: Barro and Lee (2010).

Unemployment rate gives the unemployment rate of all persons between 15 and 64. A high unemployment rate could result in fewer opportunities for women (and for men) in the labor markets. This could have implications for the gender gap in LFPRs, if women were more likely than men to move outside the labor markets when job opportunities become scarce. A wide age group is chosen for this variable in order to reduce the risk of endogeneity between this variable and the gender gap in LFPRs. Source: OECD (2010/I).

Part-time employment gives us the ratio of part-time workers of all the workers in a given country at a given time. Our hypothesis is that a prevalence of part-time employment opportunities, signified by a high part-time employment ratio, would benefit women as this

[25] For details, see table 7 in Appendix II. The results indicate that gender gap in primary schooling is the only variable to have a statistically significant impact on the gender gap in LFPRs, while also yielding the highest coefficient of determination. It is interesting to note that the lack of variable for the gender gap in primary schooling increases the relevance of both unemployment rate and average job tenure in determining the gender gap. This implies that women with little education are likely to be more susceptible for disturbances in the labor markets.

would give them a better opportunity of combining work and childrearing when their children are young. This would result in a narrower gender gap in LFPRs. Jaumotte (2003) notes that as the choice for part- or full-time employment can be partly simultaneous with the choice of participation which could create bias for the estimated coefficients. The use of the ratio of part-time for all workers as opposed to those between 25 and 54 years old should alleviate this problem to some extent. Source: OECD (2010/I).

Average job tenure describes the average length of job tenures for all employees within a country at a specific period of time. The purpose of the variable is to provide information on the type of skills that are used. A large value for the variable implies that the country is intensive in firm-specific skills, whereas a small value implies reliance on a more general set of skills. A country intensive with general skills would more likely have a narrower gender gap, as interruptions in the working life would not overly inhibit re-entrance to labor markets. Source: OECD (2010/I).

Employment protection ratio measures the procedures and costs involved in dismissing workers and the procedures involved in hiring workers. The idea of the variable is to look at how flexible the labor markets are, however, its impact is not altogether clear *a priori*. On the one hand easier dismissals could result in pregnant women being laid off, but on the other hand easier hiring could ease their re-entrance to the labor markets. It is also possible that a high level of employment protection would deter employers from hiring young women, as they would be forced to hold onto them in case of pregnancy. Thus, employment protection ratio could be used to assess the level of discrimination in the labor markets. Source: OECD (2010/I).

Total fertility rate gives the amount of births per woman for the whole population. It is assumed that a high value for the total fertility rate would result in a high gender gap in LFPRs, as women would spend more time outside the workforce due to childbearing and childrearing. This effect, however, might not materialize as recent research has shown this relationship to have become weaker. It should be noted that the mean age of women at the birth of first child was slightly under 28 in OECD countries in 2008. Source: OECD (2010/II).

Maternal and parental leave gives the amount of public and mandatory private money spent on maternal and parental leaves as a percentage of the GDP. This includes spending on

maternity grants, maternity and parent's allowances, and parental leave benefits. We are assuming here that women are far more likely than men in taking advantage of the parental leave opportunities. On the one hand, a high spending on parental leaves could help mothers in keeping their permanent jobs before and after giving birth, therefore resulting in a lower value for the gender gap. On the other hand, generous policies could also slow the return to wage labor after giving birth. Source: OECD (2010/I).

Day care variable gives the amount of public and mandatory private money spent on child day care and home help services as a percentage of the GDP. High spending could allow women to return to work after giving birth as they would have support in organizing someone to take care of their children. Source: OECD (2010/I).

Marriage rate gives us the number of marriages per 1000 people occurring in a given country in a given year. A high number of marriages is likely to widen the gender gap, as married women are less likely to work in the labor markets. Source: Eurostat (2010).

Divorce rate gives us the number of divorces per 1000 people at a specific country and year. With respect to the gender gap in participation, it should work at the opposite direction than the crude marriage rate, as a high number of divorces should increase the amount of non-married women in the economy. Source: Eurostat (2010).

Gender pay gap is given as difference between average gross hourly earnings of male paid employees and of female paid employees as a percentage of average gross earnings of male paid employees. The data used here has been collected by national sources, and is not therefore completely comparable. Micro-level theory suggests that a wide pay gap should result in a wide participation gap, as the participation wage elasticity should not be negative under any circumstances. As discussed before, however, it is possible that this relationship does not hold at the country level as women with implied lower wages may decide to stay outside the labor markets altogether. We may therefore observe a situation where a wide gender pay gap will be connected with a narrow gap in participation. Source: Eurostat (2010).

Table 3 collects some descriptive statistics concerning the variables. First we note that, not surprisingly, men's labor force participation rate is on average higher than that of women's. Actually, the average participation rate for men is higher than the maximum participation rate

for women in any of the countries at any point of time. In addition, by comparing the standard deviations of the two figures we can see that women's participation rate tends to vary a lot more across countries and time. We should also note that the variables for the ratio for part-time employment and for the gender pay gap vary considerably.

Variable	Mean	Std. Dev.	Minimum	Maximum
Gender gap LFPR 25-54	18.10	9.14	4.37	41.16
LFPR men 25-54	92.22	2.51	82.95	98.26
LFPR women 25-54	74.12	8.84	52.57	87.18
Income tax	5.57	4.94	0.00	21.27
Values	1.54	0.22	1.08	2.11
Gender gap in primary schooling	0.12	0.19	-0.19	0.74
Gender gap in secondary schooling	0.44	0.47	-0.18	1.86
Gender gap in tertiary schooling	0.12	0.14	-0.24	0.53
Gender gap in total schooling	0.68	0.62	-0.41	2.16
Unemployment rate	7.65	3.66	1.90	20.00
Part-time employment	14.35	7.10	2.52	35.57
Average job tenure	10.11	1.14	7.76	12.08
Employment protection ratio	2.21	0.84	0.60	3.85
Total fertility rate	1.55	0.23	1.13	1.98
Maternal and parental leave	0.33	0.25	0.00	1.23
Day care	0.62	0.47	0.00	2.02
Marriage rate	5.06	0.65	3.57	7.19
Divorce rate	2.04	0.76	0.00	3.80
Gender pay gap	0.84	0.05	0.72	0.95

Table 3: Variable Descriptive Statistics

The rough connections between individual variables can be studied by looking at correlation coefficients which are displayed in the table 8 in Appendix II. First point of interest is that the labor force participation rates of men and women are almost uncorrelated. When looking at the correlations between these two variables and the gender gap, we can see that women's labor force participation rate is very strongly correlated (coefficient -0.96) with the gap, whereas the correlation coefficient between the gap and men's LFPR is not nearly as large (coefficient 0.25). This implies that variation in women's participation levels is the main force behind variation in the gap. Furthermore, all but one of the chosen independent variables show at least some statistically significant correlation with the variable of gender gap in LFPRs, justifying their selection.

Finally, it should be noted that some of the correlation coefficients between independent variables are fairly large. For example, the coefficient between the variable for day care and the variable for values is -0.64, and between employment protection ratio and gender gap in primary schooling 0.57. This could potentially lead to the problem of multicollinearity where

the confidence intervals for the coefficients would be overly wide. Thus, the rejection of the null hypotheses would become more difficult than it should be, although the estimates would remain unbiased. Multicollinearity among independent variables can be checked by looking at the so-called Variance Inflation Factor (VIF) which is defined as follows (e.g. O'Brien 2007):

$\mathrm{VIF} = \frac{1}{1 - R_i^2}$, where R_i^2 represents the proportion of variance in the *i*th independent variable that is associated with the other independent variables in the model. More formally it is the coefficient of determination of regression for the variable *i* on all the other independent variables. The term $1 - R_i^2$ is usually referred as tolerance. The VIFs and tolerances for the main independent variables are collected in table 4 below:

Variable	VIF	Tolerance
Income tax	1.18	0.8492
Values	2.37	0.4212
Gender gap in primary schooling	3.97	0.2517
Unemployment rate	1.62	0.6165
Part-time employment	2.69	0.3723
Average job tenure	2.62	0.3812
Employment protection ratio	2.39	0.4176
Total fertility rate	2.15	0.4653
Maternal and parental leave	3.21	0.3117
Day care	3.19	0.3138
Marriage rate	1.83	0.5465
Divorce rate	2.09	0.4790
Gender pay gap	2.16	0.4633

Table 4: Variable Inflation Factors and Tolerances

According to O'Brien (2007) the most commonly used threshold for the value for VIF in the presence of multicollinearity is around 10, although even levels of this magnitude are not necessarily detrimental for the regression results. As the values for all VIFs are comfortably under this threshold, we conclude that multicollinearity should not be a problem in our case.

6.2 Methodology

In the estimation equation we will seek to explain changes in the gender gap in labor force participation rates by changes in other variables. We will assume a model with country fixed effects which should capture most of the impact of country-specific variables which might have been omitted from the specification. It is unlikely, for example, that the variables used in the specification could capture all the informal institutions affecting gender in the labor markets. Thus, we will be estimating an equation of the form:

$y_{it} = \alpha_i + \beta' x_{it} + \epsilon_{it}$ (6.1), where y_{it} is the value of the dependent variable at country i at time t,

α_i is the country-specific coefficient, β is the vector of coefficient estimates, x_{it} is the vector of independent variables at country i at time t, and ε_{it} is the error term.

The data in use for this research can be best described as a longitudinal cross-section data, as it consists of country-level aggregated observations from a number of countries over several time periods. This type of data is susceptible for at least two technical issues which discourage us from relying on a simple OLS-regression in our analysis. First, as the data is cross-sectional, it is possible that the variances of the random variables are different across different countries as the populations of the countries differ, i.e., the data suffers from heteroskedasticity. Or more formally (e.g. Angrist & Pischke 2009; Verbeek 2004):

$\mathrm{Var}(\epsilon_i) = \sigma_i^2$ for i = 1,. . ., n. (6.2)[26]

To test for panel-level heteroskedasticity in data, we can utilize a generalized least squares likelihood-ratio test by comparing the fit of a model with heteroskedasticity-corrected weights with a model without them. The likelihood-ratio test statistic is given as (Verbeek 2004):

$\xi_{LR} = 2(\log L(\hat{\theta}) - \log L(\tilde{\theta}))$ (6.3), where θ is the likelihood parameter vector. Running the test will gives us the following result:

$\mathrm{LR}\ \chi^2(19) = 279.54$
$\mathrm{Prob} > \chi^2 < 0.0001$

As the zero-hypothesis is rejected, the data set is deemed to suffer from heteroskedasticity.

There are at least two major ways of taking care of heteroskedasticity. First, one can use variance-adjusted weights to correct for the heteroskedasticity. Second, one can use specific heteroskedasticity-corrected standard errors when assessing the statistical significance of the estimation. According to Angrist and Pischke (2009), the former method could be somewhat problematic as the variance of the error terms is unknown. As estimating a wrong model for the heteroskedasticity would lead to wrongly chosen weights, the weighted regression could end up having worse finite-sample properties than unweighted estimates. In addition, using the weighted least squares could give us less information in case of non-linearity.

The second problem is related to the time-path of the dependent variable, the gender gap in labor force participation rate. As for example Bertrand, Duflo and Mullainathan (2004) point

[26] Compare with homoskedastic standard errors: $\mathrm{Var}(\epsilon_i) = \sigma^2$ for i = 1,. . ., n.

out, many variables concerning labor markets, such as employment or wages, are typically highly autocorrelated. This means that a country-and-time-specific error term is in some way correlated to its predecessors. As all the unobserved variables crowd into the error term, their impact can create autoregressive tendencies in an OLS-model. Obviously, this is a concern also for this piece of research. This problem can be alleviated by estimating the autocorrelation structure from the data. Unfortunately, without a sufficiently large number of data points the estimation of the autocorrelation structure can be problematic as the OLS-estimation of the AR(1) structure is biased downwards with few data points. This can result in over-rejection of the null hypothesis of no effect, i.e., independent variables would be more likely to show a statistically significant effect on the dependent variable.

Autocorrelation within panels can be tested by using a test developed by Wooldridge (2002) and also reported by Dukker (2003). The idea of the test is to obtain the residuals from the regression estimation and then compare their values. If the specific residuals of each panel ε_{it} were not serially correlated, then we should have $Corr(\Delta\varepsilon_{it}, \Delta\varepsilon_{it.1}) = -.5$.Given this, the procedure regresses the residuals from the regression with first-differenced variables on their lags and tests that the coefficient on the lagged residuals is equal to -.5. The test gives us the following result where the zero-hypothesis is rejected, implying autocorrelation within panels:

$$F(1,19)=73.870$$
$$Prob>F<0.0001$$

Autocorrelation across panels is also a possibility in a setting of longitudinal panel-data, but is rather unlikely when considering the purpose of this particular piece of research. Even though labor force participation levels across countries could be correlated over time[27], a cross-panel autocorrelation in this case would require that changes in the business cycles would affect genders similarly in all the countries. As this would require the rather unlikely scenario of a similar industrial structure with respect to gender across countries, we will assume autocorrelation across panels to be non-existent.

There are a number of methods that can be used to correct for heteroskedasticity and autocorrelation in longitudinal panel data sets. However, these methods could run into problems with dealing relatively small data sets, and it is not altogether clear which one should be used (Angrist & Pischke 2009). Therefore, we will run the model with three

[27] This could take place if the countries are strongly linked by mutual trade which could cause the business cycles to become synchronized.

separate models which should give us a reasonably good idea for the robustness of the results. OLS-estimation will also be offered as a reference point but it is likely to give overly optimistic results concerning the effect of the dependent variables on the independent variable. Of the used models accounting for heteroskedasticity and autocorrelation, the first two do this by adjusting standard errors while the correlation coefficients remain the same as in the OLS-estimation. These two models tend to work best with a large number of clusters. The third model utilized here will assume a certain structure for the process of autocorrelation. Thus, this model will give us coefficients different from those received from simple OLS-estimation. In contrast for the other two models, this type of estimation needs a large number of time periods in order to be able estimate the autocorrelation procedure correctly.

As the first of these models, we will use regression where robust standard errors are further adjusted for country clusters, which should take care of the autocorrelation problem by assuming that with a sufficiently large number of clusters, cluster-specific shocks will average to zero. Following Rogers (1993), let there be p parameters and n observations. Let X be the *nxp* design matrix and y be the *nx1* vector of dependent variable values. The ordinary linear regression is then:

$$(X'X)^{-1}X'y_{it} \quad (6.4)$$

The variance of this estimate will then be:

$$\mathrm{var}(b)=E(X'X)^{-1}X'(y_{it}-Ey_i)(y_{it}-Ey_i)'X(X'X)^{-1} \quad (6.5)$$

With i depicting country cluster and t time. With no autocorrelation or heteroskedasticity, all of the diagonal terms of the matrix X will be assumed to be identical, and all of the off-diagonal terms to be zero. In the presence of heteroskedasticity, the diagonal terms are not assumed to be identical, and the off-diagonal terms will be assumed to be zero only when the observations are from different clusters. Then, all the non-zero elements of the matrix will be represented by the appropriate products of the residuals, giving us better estimates for the standards errors.

A second way to estimate the standard errors for longitudinal panel data has been proposed by Newey and West (1987), as reported by Greene (1993). Now the variance-covariance-matrix can be estimated by:

$$(\frac{1}{n})S=\frac{1}{n}(S_0+\frac{1}{n}\sum_{l=1}^{L} w(l)\sum_{i=l+1}^{n} e_i e_{i-l}(z_i z_i'+z_{i-l}z_i'))=\frac{1}{n}\sum_{l=0}^{L} w(l)S_l \quad (6.6), \text{ where}$$

$$w(l) = 1 - \frac{l}{L+1} \quad (6.7).$$

where L is the maximum lag length. Compared to the method of proposed by Rogers, Newey-West estimation gives us slightly different estimate of the autocorrelation structure, as it is calculated only based a specified number of former error terms. This is manifested in the choice of maximum number of lags (l) used. As it is likely that the gender gap in LFPRs would be a moving average process, a small number of lags is likely to be appropriate. Thus, a maximum lag of 2 will be used in the main estimation[28].

The third way is to estimate an autocorrelation process which will enable us to dissect the part of autocorrelation in the residuals. For a small sample, Prais-Winsten estimation using an AR(1) autocorrelation process is seen to be a relatively good estimator (e.g. Beck and Katz 1995; Greene 1993), and is thus used here. This estimation technique will transform the data so that both autocorrelation and heteroskedasticity are accounted for. Assume a model for the error terms so that (Greene 1993):

$$\epsilon_{it} = \rho_i \epsilon_{it-1} + u_{it} \quad (6.8), \text{ and}$$

$$\text{Var}(\epsilon_{it}) = \sigma_i^2 = \frac{\sigma_{ui}^2}{1-\rho_i^2} \quad (6.9).$$

For a FGLS estimation of the model, and supposing that r_i is a consistent estimate of the ρ_i, we can then transform each time series of dependent variable (y_i) (as well as the independent variables) using Prais-Winsten transformation. For the first time period, the transmorfation is of the form:

$$y_{i1} = \sqrt{1-r_i^2}\, y_{i1} \quad (6.10)$$

For the rest of the time periods, the transformations are of the form:

$$y'_i = y_{iT} - r_i y_{iT-1} \quad (6.11)$$

Giving us a model which is only heteroskedastic. This can then be corrected by weighting the variables by the estimate of the variance of the error terms, which is:

$$\hat{\sigma}_{\epsilon i}^2 = \frac{\hat{\sigma}_{ui}^2}{1-r_i^2} \quad (6.12), \text{ where}$$

$$\hat{\sigma}_{ui}^2 = \frac{e'_i{}' e'_i}{T} \quad (6.13).$$

[28] Lags from one to four were initially tested, and the results were very stable with respect to the lag length.

6.3 Estimation results

It should be first noted that in the initial estimation, gender pay gap gave consistently results in which a high wage gap implied a low participation gap. As this is likely to be due to selection issues and not proper causation, the variable for the wage gap was removed from the specifications. Estimation results with the remaining variables are collected to the table 5 below. We can immediately see that the different models give somewhat similar results. Of special importance is the fact that the signs of the correlation coefficients are the same between Prais-Winsten estimation on the one hand, and the rest of the models on the other. This should alleviate our fears of operating with a slightly constrained data set. Furthermore, the signs of the coefficients are largely as expected which will be discussed further in the next sub-chapter.

Of the twelve independent variables used in this specification, five are statistically significant at least at the 10% level in all of the models. These variables are gender gap in primary schooling, proportion of part-time employment, spending on day care, crude marriage rate and crude divorce rate. In addition, the variable for the ratio of average job tenure is statistically significant in all but one of the models. Of further interest is the fact that the variables describing the system of income taxation and parental leave policies are statistically insignificant in all of the formulations. Of the four models, adjusting robust standard errors for country-clusters seems to be most conservative in accepting the impact of a given independent variable. The coefficient of determination for the first three models is a relatively high figure of 0.71, when looking at how well the models can explain correlation within countries[29]. Thus, the estimation is able to explain 70% of the variation in the gender gap in LFPRs. It is also noteworthy that the coefficients in the Prais-Winsten estimation considerably more often statistically significant than in the other two main models. As was mentioned earlier, this was a problem related to using AR(1) correction for autocorrelation with short time periods. Thus, the models which only adjust standard errors are likely to be more reliable in this case.

[29] The overall coefficients of determination are close to one, as country fixed effects largely take the variation between countries into account.

Dependent variable: Gender gap in LFPRs for the age group of 25-54

	OLS regression		Linear regression, robust standard errors adjusted for country-clusters		Linear regression with Newey-West standard errors		Prais-Winsten regression, robust standard errors, panel-specific AR(1) autocorrelation	
	Coefficient estimate	p-value	Coefficient estimate	p-value	Coefficient estimate	p-value	Coefficient estimate	p-value
Income tax	0.0772	0.401	0.0772	0.556	0.0772	0.453	0.0035	0.958
	[0.0917]		[0.1287]		[0.1028]		[0.0675]	
Values	2.1712	0.254	2.1712	0.306	2.1712	0.198	3.4247**	0.010
	[1.8995]		[2.0620]		[1.6826]		[1.3266]	
Gender gap in primary schooling	22.6888***	p<0.001	22.6888**	0.027	22.6888***	0.001	20.7939***	p<0.001
	[3.4226]		[9.4621]		[6.5501]		[4.3790]	
Unemployment rate	0.2462***	0.004	0.2462	0.128	0.2462**	0.026	0.0887	0.218
	[0.0838]		[0.1549]		[0.1100]		[0.0720]	
Part time employment	-0.6711***	p<0.001	-0.6711**	0.019	-0.6711***	p<0.001	-0.5158***	p<0.001
	[0.1090]		[0.2624]		[0.1629]		[0.0957]	
Average job tenure	-1.3714***	0.003	-1.3714	0.148	-1.3714**	0.024	-0.5858*	0.063
	[0.4514]		[0.9100]		[0.6051]		[0.3147]	
Employment protection ratio	0.5807	0.310	0.5807	0.502	0.5807	0.303	1.1613***	p<0.001
	[0.5707]		[0.8483]		[0.5627]		[0.3207]	
Total fertility rate	-3.6968**	0.080	-3.6969	0.247	-3.6969	0.103	-6.2734***	p<0.001
	[2.1039]		[3.0956]		[2.2585]		[1.5191]	
Maternal and parental leave	1.7111	0.308	1.7111	0.531	1.7111	0.367	1.7672	0.151
	[1.6760]		[2.6816]		[1.8935]		[1.2302]	
Day care	-2.1181**	0.029	-2.1181*	0.093	-2.1181**	0.015	-2.6988***	p<0.001
	[0.9623]		[1.1994]		[0.8640]		[0.5632]	
Marriage rate	1.1893***	0.003	1.1893*	0.094	1.1893**	0.011	0.9742***	p<0.001
	[0.4004]		[0.6739]		[0.4636]		[0.2642]	
Divorce rate	-2.7369***	p<0.001	-2.7369***	0.002	-2.7369***	p<0.001	-1.3889***	0.001
	[0.5393]		[0.7702]		[0.7563]		[0.4160]	
R^2	0.7123		0.7123		0.7123			

Statistical significance: *** 1% level, ** 5% level, * 10% level

Standard errors in brackets below the corresponding correlation coefficients

Table 5: Explaining Gender Gap in LFPRs

To understand better how different variables could have an effect on labor force participation, we also ran the estimation with the labor force participation rate of the each gender as the dependent variable. The results for these two estimations can be seen in tables 9 and 10 in Appendix II. Only few of the variables have a statistically significant impact on men's labor force participation and actually none of the variables are statistically significant at the 1% level. R^2 is also rather low. The proportion of part-time employment is the only variable to be statistically significant in all of the specifications, as it increases men's participation rate. Furthermore, the variables for the average job tenure and for the divorce rate are statistically

significant in three of the models each: Long average job tenure and high divorce rates decrease men's participation.

The set of independent variables seem to be more relevant in explaining women's labor force participation: The coefficient of determination is quite high with 0.68. The gender gap in primary schooling, the availability of part time employment and the divorce rate are statistically significantly in all of the specifications. As expected, a low gender gap in schooling also implies a low gap in participation. The effect of part-time employment on participation is in a similar direction for women as it was for men, but with larger coefficients. In contrast to men a higher divorce rate increases female participation, implying that being married still hinders women's employment. There is also some grounds to argue that the variables for total fertility rate, spending on day care and marriage rate also influence women's participation: They hold consistent correlation coefficients, they are statistically significant in three of the four models, and the p-value for the remaining model is also somewhat low. As with gender gap in participation, the model where standard errors are adjusted for country-clusters is clearly the most conservative of the models used.

We also checked whether the results would be largely the same for different age groups. These results should, however, be taken more as indicative than definitive, because due to data limitations independent variables cannot be differentiated for different cohorts. To keep the number of tables at a manageable level, these estimations were based solely on the model where standard errors were adjusted for country clusters. The choice was based on this being the most conservative model which allows us to minimize the risk of type I error. Results from these estimations can be found in the table 6 below. We can first see that the divorce rate is the sole variable to be statistically significant for all three age groups, with the strongest coefficient for the oldest age group. In addition to this, gender gap in primary schooling statistically significant for the age groups of 25-to-34-year-olds and 45-to-54-year-olds, and fairly close to being statistically significant for the remaining age group. It thus seems that this could be considered as another variable that influences women's labor force participation across age groups. As with divorce rate, the correlation coefficient is largest for the oldest age group. The variable concerning men's right to work shows somewhat similar pattern, with clearly the strongest impact for the oldest age group. The importance of the availability for part-time employment seems to increase with age. The importance of social factors for the gender gap of over 45-year-olds is further emphasized by the variable depicting crude

marriage rate, which is statistically significant only for this group. Finally, day care seems to impact gender gap only with the age group of 35-to-44-year-olds.

Dependent variable: Gender gap in LFPRs for different age groups

	Linear regression, robust standard errors adjusted for country-clusters (age group 25-34)		Linear regression, robust standard errors adjusted for country-clusters (age group 35-44)		Linear regression, robust standard errors adjusted for country-clusters (age group 45-54)	
	Coefficient estimate	p-value	Coefficient estimate	p-value	Coefficient estimate	p-value
Income tax	0.0957	0.498	0.0019	0.991	0.1298	0.370
	[0.1384]		[0.1681]		[0.1412]	
Values	4.3964*	0.079	-2.7071	0.387	8.6489***	0.001
	[2.3684]		[3.0563]		[2.3312]	
Gender gap in primary schooling	22.032**	0.040	18.4446	0.109	27.6849***	0.003
	[9.9728]		[10.9774]		[8.0448]	
Unemployment rate	0.1806	0.194	0.2376	0.242	0.2641	0.170
	[0.1341]		[0.1966]		[0.1851]	
Part time employment	-0.3084	0.195	-0.7527**	0.020	-1.0558***	0.006
	[0.2298]		[0.2966]		[0.3378]	
Average job tenure	-1.5291	0.128	-1.5092	0.157	-1.2595	0.240
	[0.9617]		[1.0232]		[1.0385]	
Employment protection ratio	0.2351	0.823	1.0571	0.317	0.3702	0.732
	[1.0363]		[1.0291]		[1.0650]	
Total fertility rate	-0.2008	0.942	-4.4497	0.205	-8.0238*	0.083
	[2.7389]		[3.3933]		[4.3789]	
Maternal and parental leave	-0.1911	0.930	2.9312	0.468	2.5278	0.526
	[2.1469]		[3.9542]		[3.9163]	
Day care	-1.7061	0.202	-2.727*	0.090	-2.0723	0.222
	[1.2900]		[1.5252]		[1.6412]	
Marriage rate	0.8193	0.205	1.2461	0.106	1.8394*	0.054
	[0.6242]		[0.7341]		[0.8936]	
Divorce rate	-2.2846***	0.005	-2.5412***	0.009	-3.9870***	0.001
	[0.7132]		[0.8758]		[1.0603]	
R^2	0.5778		0.6497		0.7607	

Statistical significance: *** 1% level, ** 5% level, * 10% level

Standard errors in brackets below the corresponding correlation coefficients

Table 6: Explaining Gender Gap in LFPRs for Different Age Groups

6.4 Discussion

We will next discuss the results variable-by-variable and contrast them to our initial hypotheses. Overall, the results obtained from the estimations are mostly consistent with the results from other research. As was mentioned in the beginning of the previous chapter, a wide gender pay gap is associated with a low gender gap in labor force participation. This result should not, however, be seen as implying a causal relationship between the two concepts. Instead, it is likely that only highly productive women participate in the labor

markets in countries with wide gender gaps in participation. When women with relatively low productivities stay outside the labor market altogether whereas men with similarly low productivities enter the market, it is likely to drive the gender pay gap down. This idea is supported by the fact that a wider gender wage gap increased the participation of both genders, but with much larger coefficient for women. These results are consistent with the findings of Olivetti and Petrongolo (2008) and Hunt (1997).

Differing from Jaumotte (2003) as well as other research concerning taxation, we find no effect on participation from the income tax wedge in any of the estimations. It should be noted, however, that the correlation coefficients are of the expected sign in all of the models: A high tax wedge increases men's and decreases women's participation, thus increasing the gender gap, but with statistical insignificance in all cases. A better specification for the variable depicting the income tax wedge could perhaps yield different results in this piece of research, but this was unavailable due to constraints in data. As the data for this study is slightly newer, it is also possible that the importance of taxation could be in decline. This could be caused by the changing role of women's work, where work is seen as a legitimate pursuit in itself instead of just being a source for income. Thus, these results would be consistent with decreasing wage elasticities for participation.

The variable depicting the values concerning men and women showed no consistent effect to gender gap in participation: As the coefficient remained statistically insignificant even at the 10% level in three of the four models, it seems likely that values by themselves do not have a notable effect on the overall gender gap in labor force participation in this formulation, although the signs of correlation estimates were as could be expected. The difference in results between this piece of research and those conducted by Fortin (2005), or Algan and Cahuc (2005) could perhaps partly be explained by the level of analysis: Whereas the two pieces of research named above looked at how values affected participation at the individual level, this study was looking at data from a country level. We could speculate that even though at the individual level the values would have an impact on the choice of participation, this would be overcome by institutional structures at the aggregate level. Finally, if we assume that values change rather slowly, the time frame of this particular piece of research may have been too short to capture a significant change in values, resulting in statistical insignificance in the final estimation results. Although the variable for values was consistently statistically significant for the 25-to-54-year-olds, there were some indications that there might be

differences in this respect if we look at the gender gap for smaller age groups: The variable is statistically significant for the 25-to34-year-olds at the 10% confidence level and for the 45-to-54-year-olds at the 1% level. Although statistically insignificant, the variable displays a negative coefficient estimate for the 35-to-45-year-olds which runs against our intuition[30]. Thus it seems that people in the middle bracket are less likely to adapt their labor market behavior for the persisting values. It is possible that this is caused by a higher relative importance of other constraints, such as taking care of the children. The strong impact for older people is easier to explain. As values change slowly and can be at least partially internalized, older people are less likely to respond to overall change in values. Thus, the traditional gender division of labor will likely persist for the older age groups until they are gradually replaced by new generations.

When looking at the variable concerning human capital, we can see that countries where gender gap in primary education is small also tend to have small gaps in participation. The change in gap in this respect is mainly driven by changes in women's participation, whereas men's participation levels are rather unresponsive. The relationship between gaps in primary school labor force participations, however, does not hold for gender gaps in secondary or tertiary education, or for average schooling years as a whole. These results imply that there is a minimum amount of skills required in the labor markets, and these are satisfied by primary education. Educating oneself further does not yield any additional benefits in participation, although it most likely impacts wages. There are, however, two other possible explanations for this phenomenon. First, young girls or their parents can decide their schooling participation based on future opportunities in the labor markets. With little opportunities, there is no point in attending school. As the future productivities of workers are, however, not well known at young age, this explanation is not necessarily very credible. A second way to explain this effect is to assume that there is a third variable, such as conception about the proper role of women, which affects both primary school attendance and labor force participation. It is also noteworthy that the correlation coefficient for the variable is large: decreasing this gap in education by one year would result in an over 20 percentage point decrease in participation. Thus, gender gap in primary education is a significant factor explaining the gap in participation. As with the variable depicting values, the effect of gap in primary schooling is statistically significant for the youngest and the oldest age groups, with

[30] Additional testing yields that for this age group, the signs of the coefficient estimates are counter-intuitive for both men and women, although remaining statistically insignificant.

the strongest effect for the latter. It should be noted, however, that this variable is very close to being statistically significant at the 10% level also for the groups of 35-to-44-year-olds. The reasons behind this divergence are likely to be similar as well: people from the middle-bracket are more constrained by other matters than the young and the old, and the oldest age group is most responsive because of its higher variance.

The general characteristics of the labor markets can also have an impact on the gender gap in participation. However, the role of unemployment remains somewhat unclear, as its coefficient estimate is statistically significant only in OLS- and Newey-West-estimations. Again, the effect of unemployment rate is mainly driven by changes in women's participation figures. The sign of the coefficient estimates are consistently positive as expected, implying that women are more likely to exit the labor markets in times of economic difficulty. There can be different explanations for this phenomenon. First, women could be more concentrated to such positions and/or fields in the labor market that are more susceptible to layoffs in hard times. Contributing factors here could be women's higher likelihood for working part-time, or the crowding of different genders to different industries. It is also possible that women may face discrimination in layoffs. Another possibility is that women could have more options outside the labor markets, prompting them to leave instead of staying in the labor markets as unemployed. For example, women might be more likely than men to become stay-at-home parents if they become unemployed. In any case, the correlation coefficients are relatively small, implying that only significant changes in unemployment would affect gender gap in participation considerably.

Flexibility of labor market practices, proxied here by the prevalence of part-time employment in a given country, seems to decrease the gender gap in participation as the coefficient estimates are consistently negative in all of the estimations. The coefficient are also fairly large is size, telling us that the availability of part-time employment is important in explaining the gap in participation. High availability of part-time employment drives up the labor force participation of both genders, but its effect is significantly stronger for women. This implies that women remain more responsible for household work, as they still need more flexible arrangements in order to participate in the formal labor markets. When studying different age groups, we can see that the availability of part-time work does not impact the youngest group. This implies that younger people have a more equitable division of household labor. Furthermore, the lower prevalence of children in this age group is probably also a contributing

factor, as it allows both men and women to work without additional arrangements. Again, the importance of the variable continues to increase with age. Thus, it seems that the stickiness of the learned division of labor overrides the actual demand for household labor: Otherwise the age group of 35-to-44-year-olds should be most impacted by the availability of part-time employment, as they are most likely to have young children at home.

There is also some evidence as to the effect of the average job tenure on participation: It has a statistically significant impact on participation in OLS-estimation, Prais-Winsten estimation and estimation with Newey-West standard errors. However, the magnitude of this effect remains fairly small. When disaggregated by gender, we can see that the average length of the job tenure has no statistically significant impact on women's participation with positive coefficient estimates, but decreases men's participation. Thus, the overall effect of high average job tenures on gender gap in participation is negative. The results speak against the idea that women would participate more in countries relying in a less specific set of skills, as this would imply a high participation gaps in countries with high average job tenures. Instead, this connection could be related to the flexibility of labor markets: High average job tenure would imply low flexibility which would allow women to retain their jobs when giving birth. This would also explain why high average job tenure drive down men's participation figures, if inflexible labor markets are likely to discourage participation for men.

Employment protection ratio was found to have a statistically significant impact on the gender gap only in Prais-Winsten estimation, so we should not put too much emphasis on it. Nevertheless, it can be noted that the results imply that strict employment protection discourages participation for both men and women, but with a stronger effect on women. This could be interpreted as weak proof of discrimination in the labor markets, since it is unlikely that the level of employment protection would affect the supply of labor. The results could be caused by employers being reluctant to hire women if the laying them off would be difficult in the case of pregnancy.

The results concerning the effect of fertility on gender gap in participation indicate that high fertility rate either has a decreasing effect, or has no effect on the gender gap in labor force participation: the least conservative estimations (OLS and Prais-Winsten) give statistically significant results for this variable, whereas the other two models remain statistically

insignificant[31]. Although the magnitude of the effect varies considerably across specifications, it remain fairly small in all of them. Overall high fertility seems to be more connected to high levels of female participation, although it seems to also increase men's participation slightly. This would support the theory that for women labor force participation would act as insurance for the economic risks of having children. However, this theory seems less likely when looking at how fertility affects the gender gaps for different age groups: again the effect is by far strongest for the oldest age group. As having children is rather rare for this age group, the connection between fertility and gender gap in participation is not straightforward. It is of course possible that younger age groups have observed the life of women in the older age groups (such as their mothers') while making fertility decisions, which would result in the aforementioned relation. To conclude, it seems clear that at least there is no negative relation between fertility and gender gap in participation. Whether there is a positive relation or no relation remains an open question.

Moving to the variables concerning government policies, it seems that spending on maternal and parental leaves is unlikely to significantly affect the gender gap. We can note that the signs of the coefficient estimates are consistently positive, but the p-values are also consistently rather large. Thus, it seems probable that the positive effect of short leaves on women's labor force participation are offset with the negative effects of longer leaves. Alternatively, it is also possible that the effect of higher spending on leaves is negligible. In this respect the results are similar to other pieces of research conducted on the topic. Finally, the results indicate that men are unlikely to take parental leaves, as the correlation coefficient for the variable when explaining male participation, albeit not statistically significantly.

By contrast, the results indicate that higher spending on day care should decrease gender gap in participation. This effect is a combination of statistically significant increases in women's participation, and statistically insignificant decreases in men's participation. When looking at smaller age groups, we can see that spending on day care has a statistically significant effect only on the group of 35-to-44-year-olds. This is not surprising, as women from this age group are quite likely to have children. Somewhat surprisingly the effect of the day care variable is not statistically significant for the age group of 25-to-34-year-olds. This implies that women most likely to take advantage of day care opportunities also give birth at an older age.

[31] Estimation with Newey-West standard errors is, however, very close to being statistically significant at the 10% level with a p-value of 0.103.

However, it is also possible that the youngest portion of the youngest age group does not have children old enough to participate in day care which would result in a statistical insignificance of the coefficient estimate for the whole group. The overall efficiency of day care spending seems somewhat reasonable in the light of coefficient estimates, assuming that some of the spending is recouped by the increased tax revenue caused by women's higher participation. Overall the results are thus in line with other literature conducted on the topic.

As expected, a high marriage rate increases gender gap in participation mostly by decreasing women's labor force participation. This is consistent with the general pattern where married women's participation figures are lower than those of non-married ones. Thus, the results can be interpreted as further proof of the existence of gendered division of labor. The effect is most visible for the age group of 45-to-54-year-olds, as the coefficient estimates for the two younger groups are not statistically significant at the 10% level. As with a number of variables presented above, this implies stronger preference for traditional gender roles among older people, as the values prevalent in their youth continue to stick.

Finally, a high divorce rate is associated with a low gap in participation. When comparing the coefficient estimates with those of marriage rate, we can see that the prevalence of divorce is the more important factor of the two. The relationship between divorce rates and participation is a combination of decreases in men's participation and increases in women's participation. Changes in women's participation are probably caused by switching household labor under marriage to labor market participation after divorce. We should, however, remember that participation figures themselves could also affect divorce rates, as wage income allows women to keep their standard of living in the case of a divorce. Decreases in men's participation with high divorce rates could be caused by increases in women's participation which could crowd part of the men out of the labor force. The divorce rates are relevant for all age groups but, as with some other variables, the importance is strongest for the oldest age group.

7 Conclusions

The purpose of this study has been to explain the variation in the gender gap in labor force participation across countries and time. Despite the convergence towards lower levels, the gender gap in LFPRs still exists practically throughout the world with considerable variation between the individual countries. It was shown how closing the gap could yield multiple

benefits: Access to labor markets could be seen as a form of empowerment for women, as a steady stream of income could increase women's bargaining power within the household. There is also some evidence that women's access to income could be beneficial for children. Finally, increased participation could lead to an increase in economy-wide efficiency. Understanding the reasons behind the gender gap in participation would allow us to formulate better policies to realize these benefits.

Both theoretical and empirical literature concerning especially variation in women's participation has been vast, but no single factor can by itself explain the phenomenon in question. It was shown that discrimination at its pure form was unlikely to be the main reason behind the gender gap, assuming that the labor markets work efficiently. However, monopsonistic power for employers makes discrimination possible also in the long run. Furthermore, frictions in the labor markets in the form of imperfect information can lead to a stable equilibrium where employers' beliefs of the differences between genders create a self-fulfilling prophecy which could results in a lower participation for women. Empirically observing labor market discrimination remains difficult as employers are unlikely to admit discrimination. The small number of empirical literature conducted on the topic showed us that some form of gender discrimination is still present in some parts of the labor markets. Because of the low quantity of research, making broad generalizations on the topic is not possible.

Besides discrimination, there are a number of models seeking to explain differences in labor supply across the two genders. Conventional models of labor supply assume that differences in wages and non-labor income are the main determinants of participation. Thus, the existence of a gender wage gap would results also in a gap in participation. This was shown to be at least partly true for women: Compared to men they are more inclined to increase their participation with rising wages. However, this difference has been disappearing over time, telling us that other factors must also be considered. The convergence of human capital levels can be seen as being an important factor in narrowing the gender gap, as it allows women access to a wider variety of positions. Decisions within households concerning market work and household work were shown to have implications for bargaining power, work decisions in the future, as well as on fertility. Therefore, access to labor market is important for the gender equality also in a larger sense. It was also shown that having children does not nowadays necessarily impede women's participation.

Different policy measures can also impact women's participation and thus the gender gap. When compared to treating households as a unit of taxation, a system of individual income taxation was shown to significantly increase women's participation. The effect of formal maternal leave policies was shown to depend on the duration of the leave: Short leaves increased participation by allowing women to easily reattach themselves to the labor markets after giving birth. Long leaves, however, decreased women's participation as women would take longer to return to the labor markets. Child care costs also had an impact on participation, allowing governments to support working women with child care subsidies. However, this effect was overall relatively small. It was also shown that certain technological advances have historically been instrumental in the increasing women's participation figures. Such crucial technologies include advanced home appliances, oral contraceptives, infant feeding formula and advances in maternal health. Finally, we showed some evidence as to how cultural norms cam also influence participation decisions.

The empirical part of this study examined how some of the aforementioned factors had influenced the gender gap in LFPRs in a group of European OECD countries from the middle of the 1990s onwards. We showed that the variation in the gender gap in LFPRs is mainly caused by the variation in women's participation levels. At the macro level, variation in the gender gap in primary schooling, the availability of part time work and the government spending on day care were most conclusively shown to have an effect on the gender gap in LFPRs. The results indicate that closing the gender gap in primary education might be the most efficient way in closing the gap in participation. It was also shown that the impact of the various measures are often stronger for older people. This implies that generational shifts should drive gender gap down in the future.

This study offers some ideas as to how the gender gap in LFPRs could be further narrowed in the future. Although childbearing and -rearing no longer means an almost definite exit from the labor markets for women, improving the compatibility between having children and continuing market work would still be beneficial. It seems that subsidizing day care would be the most efficient way of managing this. Promoting education for women would also be extremely useful, especially if women are unlikely to complete their primary education. When applicable, a switch from family taxation to individual taxation could also be used as a budget neutral way of promoting women's participation. Although gender gap in labor force

participation has narrowed almost constantly in the last 30 years, it is unlikely to disappear completely in the near future: The stickiness of values concerning the role of women in the labor markets is likely to make the gender gap persist yet for quite some time.

Despite the vast number of research conducted on the topic, there are still areas where further study is needed. First, more research is needed on the gender gap in non-OECD countries, as they have been seriously underrepresented thus far. The problem of having reliable data is likely, however, to impede this line of inquiry also in the future. Secondly, research looking at the extent of gender discrimination in the labor markets has been rather sparse, leaving us unable to make any reasonable generalizations on the topic. The lack of longitudinal research on discrimination is especially problematic in this respect. Finally, additional research concerning how values and technology can affect the gender gap in LFPRs could also be beneficial, as these topics have just recently been taken up by economists.

References

Agarwal, Bina 1997. “Bargaining” and Gender Relations: Within and Beyond the Household. *Feminist Economics* 3(1), 1-51.

Ahn, Namkee & Mira, Pedro 2002. A Note on the Changing Relationship between Fertility and Female Employment Rates in Developed Countries. *Journal of Population Economics* 15(4), 667-682.

Aigner, Dennis J. & Cain, Glen G. 1977. Statistical Theories of Discrimination in Labor Markets. *Industrial and Labor Relations Review* 30(2), 175-187.

Akerlof, George A. & Kranton, Rachel E. 2000. Economics and Identity. *Quarterly Journal of Economics* 115(3), 715-753.

Albanesi, Stefania & Olivetti, Claudia 2009. Gender Roles and Medical Progress. NBER Working Paper No. 14873. National Bureau of Economic Research.

Algan, Yann & Cahuc, Pierre 2005. The Roots of Low European Employment: Family Culture? In Frankel, Jeffery A. & Pissarides, Christopher A. (eds.) *NBER International Seminar on Macroeconomics 2005.* Cambridge, MA: MIT Press.

Altonji, Joseph G. & Blank, Rebecca M. 1999. Race and Gender in the Labor Market. In Ashenfelter, Orley C. & Card, David (eds.) *Handbook of Labor Economics 3C*. Amsterdam: Elsevier, 3143-3259.

Anderson, Patricia M. & Levine, Phillip B. 1999. Child Care and Mothers' Employment Decisions. NBER Working Paper No. 7058. National Bureau of Economic Research.

Angrist, Joshua D. & Evans, William N. 1998. Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size. *American Economic Review* 88(3), 450-477.

Angrist, Joshua D. & Pischke, Jörn-Steffen 2009. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton, NJ: Princeton University Press.

Antecol, Heather 2000. An Examination of Cross-Country Differences in the Gender Gap in Labor Force Participation Rates. *Labour Economics* 7(4), 409-426.

Arrow, Kenneth 1971. The Theory of Discrimination. Working Paper No. 30A. Industrial Relations Section, Princeton University.

Attanasio, Orazio & Low, Hamish & Sánchez-Marcos, Virginia 2008. Explaining Changes in Female Labor Supply in a Life-Cycle Model. *American Economic Review* 98(4), 1517-1552.

Baker, Michael & Milligan, Kevin 2008. How Does Job-Protected Maternity Leave Affect Mothers’ Employment? *Journal of Labor Economics* 26(4), 655-691.

Bailey, Martha J. 2006. More Power to the Pill: The Impact of Contraceptive Freedom on Women's Life Cycle Labor Supply. *Quarterly Journal of Economics* 121(1), 289-320.

Barro, Robert J. & Lee, Jong-Wha 2010. A New Data Set of Educational Attainment in the World, 1950-2010. NBER Working Paper No. 15902. National Bureau of Economic Research. Data available online at http://www.barrolee.com Accessed 28.10.2010

Baum II, Charles L. 2003/I. Does Early Maternal Employment Harm Child Development? An Analysis of the Potential Benefits of Leave Taking. *Journal of Labor Economics* 21(2), 409-448.

Baum II, Charles L. 2003/II. The Effect of State Maternity Leave Legislation and the 1993 Family and Medical Leave Act on Employment and Wages. *Labour Economics* 10(5), 573-596.

Beck, Nathaniel & Katz, Jonathan N. 1995. What to Do (and not to Do) with Time-Series Cross-Section Data. *American Political Science Review* 89(3), 634-647.

Becker, Gary S. 1957. *The Economics of Discrimination*. Chicago: University of Chicago Press.

Becker, Gary S. 1993. *A Treatise on the Family - Enlarged Edition*. Cambridge, MA: Harvard University Press.

Ben-Porath, Yoram & Gronau, Reuben 1985. Jewish Mother Goes to Work: Trends in the Labor Force Participation of Women in Israel, 1955-1980. *Journal of Labor Economics* 3(1S), S310-S327.

Bertrand, Marianne & Duflo, Esther & Mullainathan, Sendhil 2004. How Much Should We Trust Differences-in-Differences Estimates? *Quarterly Journal of Economics* 119(1), 249-275.

Black, Dan A. 1995. Discrimination in an Equilibrium Search Model. *Journal of Labor Economics* 13(2), 309-334.

Blau, David M. & Robins, Philip K. 1988. Child-Care Costs and Family Labor Supply. *Review of Economics and Statistics* 70(3), 374-381.

Blau, Francine D. 1998. Trends in the Well-Being of American Women, 1970-1995. *Journal of Economic Literature* 36(1), 112-165.

Bloom, David E. & Canning, David & Fink, Günther & Finlay, Jocelyn E. 2009. Fertility, Female Labor Force Participation, and the Demographic Dividend. *Journal of Economic Growth* 14(2), 79-101.

Borjas, George J. 2010. *Labor Economics*. New York, NY: McGraw-Hill.

Braunstein, Elissa & Folbre, Nancy 2001. To Honor and Obey: Efficiency, Inequality, and Patriarchal Property Rights. *Feminist Economics* 7(1), 25-44.

Brewster, Karil L. & Rindfuss, Ronald R. 2000. Fertility and Women's Employment in Industrialized Nations. *Annual Review of Sociology* 26, 271-296.

Bronars, Stephen G. & Grogger, J 1994. The Economic Consequences of Unwed Motherhood: Using Twin Births as a Natural Experiment. *American Economic Review* 84(5), 1141-1156.

Cavalcanti, Tiago V. & Tavares, José 2008. Assessing the “Engines of Liberation”: Home Appliances and Female Labor Force Participation. *Review of Economics and Statistics* 90(1), 81-88.

Choné, Philippe & le Blanc, David & Robert-Bobée, Isabelle 2003. Female Labor Supply and Child Care in France. CESifo Working Paper No. 1059. CESifo.

Cleveland, Gordon & Gunderson, Morley & Hyatt, Douglas 1996. Child Care Costs and the Employment Decision of Women: Canadian Evidence. *Canadian Journal of Economics* 29(1), 132-151.

Coate, Stephen & Loury, Glenn C. 1993. Will Affirmative-Action Policies Eliminate Negative Stereotypes? *American Economic Review* 83(5), 1220-1240.

Connelly, Rachel 1992. The Effect of Child Care Costs on Married Women's Labor Force Participation. *Review of Economics and Statistics* 74(1), 83-90.

Contreras, Dante & Plaza, Gonzalo 2010. Cultural Factors is Women's Labor Force Participation in Chile. *Feminist Economics* 16(2), 27-46.

Cristia, Julian P. 2008. The Effects of a First Child on Female Labor Supply – Evidence from Women Seeking Fertility Services. *Journal of Human Resources* 43(3), 487-510.

Cruces, Guillermo & Galiani, Sebastian 2007. Fertility and Female Labor Supply in Latin America: New Causal Evidence. *Labour Economics* 14(3), 565-573.

Del Boca, Daniela & Sauer, Robert M. 2009. Life Cycle Employment and Fertility across Institutional Environments. *European Economic Review* 53(3), 274-292.

Doiron, Denise & Kalb, Guyonne 2004. Demands for Childcare and Household Labour Supply in Australia. Melbourne Institute Working Paper No. 6/04. Melbourne Institute of Applied Economic and Social Research.

Dollar, David & Gatti, Roberta 1999. Gender Inequality, Income, and Growth: Are Good Times Good for Women? Working Paper No. 1. World Bank Policy Research Report on Gender and Development.

Duflo, Esther 2003. Grandmothers and Granddaughters: Old-Age Pensions and Intrahousehold Allocation in South Africa. *World Bank Economic Review* 17(1), 1-25.

Duflo, Esther 2005. Gender Equality in Development. BREAD Policy Paper No. 011. Bureau for Research in Economic Analysis of Development.

Dukker, David M. 2003. Testing for Serial Correlation in Linear Panel-Data Models. *Stata Journal* 3(2), 168-177.

Elson, Diane 1999. Labor Markets as Gendered Institutions: Equality, Efficiency and Empowerment Issues. *World Development* 27(3), 611-627.

European Parliament 2010. *Extending Maternity Leave to 20 Weeks with Full Pay.* [Online] http://www.europarl.europa.eu/news/public/focus_page/008-86242-281-10-41-901-20101008FCS86210-08-10-2010-2010/default_p001c012_en.htm. Accessed 26.9.2010.

Eurostat 2010. Statistics [Online] ec.europa.eu/eurostat Accessed 14.3.2011

Fernández, Raquel & Fogli, Alessandra 2009. Culture: An Empirical Investigation of Beliefs, Work, and Fertility. *American Economic Journal: Macroeconomics* 1(1), 146-177.

Fernández, Raquel & Fogli, Alessandra & Olivetti, Claudia 2004. Mothers and Sons: Preference Formation and Female Labor Force Dynamics. *Quarterly Journal of Economics* 119(4), 1249-1299.

Fortin, Nicole M. 2005. Gender Role Attitudes and the Labour-Market Outcomes of Women Across OECD Countries. *Oxford Review of Economic Policy* 21(3), 416-438.

Gangadharan, Jaisri & Rosenbloom, Joshua L. 1996. The Effects of Child-Bearing on Married Women's Labor Supply and Earnings: Using Twin Brothers as a Natural Experiment. NBER Working Paper No. 5647. National Bureau of Economic Research.

Genadek, Katie R. & Stock, Wendy A. & Stoddard, Christiana 2007. No-Fault Divorce Laws and the Labor Supply of Women with and without Children. *Journal of Human Resources* 42(1), 247-274.

Goldin, Claudia 1990. *Understanding the Gender Gap - An Economic History of American Women*. New York: Oxford University Press.

Goldin, Claudia & Katz, Lawrence F. 2002. The Power of the Pill: Oral Contraceptives and Women's Career and Marriage Decisions. *Journal of Political Economy* 110(4), 730-770.

Goldin, Claudia & Rouse, Cecilia 2000. Orchestrating Impartiality: The Impact of "Blind" Auditions on Female Musicians. *American Economic Review* 90(4), 715-741.

Greene, William H. 1993. *Econometric Analysis – Second Edition*. New York: Macmillan Publishing Company.

Greenwood, Jeremy & Seshadri, Ananth & Yorukoglu, Mehmet 2005. Engines of Liberation. *Review of Economic Studies* 72(250), 109-133.

Gregg, Paul & Washbrook, Elizabeth & Propper, Carol & Burgess, Simon 2005. The Effects of a Mother's Return to Work Decision on Child Development in the UK. *Economic Journal* 115(501), 48-80.

Gustafsson, Siv 1992. Separate Taxation and Married Women's Labor Supply – A Comparison of West Germany and Sweden. *Journal of Population Economics* 5(1), 61-85.

Gustafsson, Siv & Stafford, Frank 1992. Child Care Subsidies and Labor Supply in Sweden. *Journal of Human Resources* 27(1), 204-230.

Haan, Peter 2010. A Multi-State Model of State Dependence in Labor Supply: Intertemporal Labor Supply Effects of a Shift from Joint to Individual Taxation. *Labour Economics* 17(2), 323-335.

Hartog, Joop & Theeuwes 1985. The Emergence of the Working Wife in Holland. *Journal of Labor Economics* 3(1S), S235-S255.

Heim, Bradley T. 2007. The Incredible Shrinking Elasticities: Married Female Labor Supply, 1978-2002. *Journal of Human Resources* 42(4), 881-918.

Hellerstein, Judith K. & Neumark, David & Troske, Kenneth R. 2002. Market Forces and Sex Discrimination. *Journal of Human Resources* 37(2), 353-380.

Hernandez Iglesias & Feliciano & Riboud, Michelle 1985. Trends in Labor Force Participation of Spanish Women: An Interpretive Essay. *Journal of Labor Economics* 3(1S), S201-S217.

Hunt, Jennifer 1997. The Transition in East Germany: When Is a Ten Point Fall in the Gender Wage Gap Bad News? NBER Working Paper No. 6167. National Bureau of Economic Research.

Iversen, Torben & Rosenbluth, Frances 2006. The Political Economy of Gender: Explaining Cross-National Variation in the Gender Division of Labor and the Gender Voting Gap. *Annual Journal of Political Science* 50(1), 1-19.

Iversen, Torben & Rosenbluth, Frances 2008. The Connection Between Female Labor Force Participation and Female Political Representation. *Annual Review of Political Science* 11(1), 479-495.

Jacobsen, Joyce P. & Pearce, James Wishart III & Rosenbloom, Joshua L. 1999. The Effects of Childbearing on Married Women's Labor Supply and Earnings: Using Twin Births as a Natural Experiment. *Journal of Human Resources* 34(3), 449-474.

Jaumotte, Florence 2003. Labour Force Participation of Women: Empirical Evidence on the Role of Policy and other Determinants in OECD Countries. *OECD Economic Studies* 37(2), 51-108.

Juhn, Chinhui & Murphy, Kevin M. 1997. Wage Inequality and Family Labor Supply. *Journal of Labor Economics* 15(1, Part 1), 72-97.

Kimmel, Jean 1998. Child Care Costs as a Barrier to Employment for Single and Married Mothers. *Review of Economics and Statistics* 80(2), 287-299.

Kögel, Tomas 2004. Did the Association between Fertility and Female Employment within OECD Countries really Change its Sign. *Journal of Population Economics* 17(1), 45-65.

Krug, Barbara 1997. Discrimination Against Women: A Neo-Institutionalist Perspective. In Dijkstra, A. Geske & Plantenga, Janneke (eds.) *Gender and Economics - A European Perspective*. London: Routledge, 54-72.

Lehrer, Evelyn & Nerlove, Marc 1986. Female Labor Force Behavior and Fertility in the United States. *Annual Review of Sociology* 12, 181-204.

Lundberg, Shelly & Pollak, Robert A. 1993. Separate Spheres Bargaining and the Marriage Market. *Journal of Political Economy* 101(6), 988-1010.

Lundberg, Shelly & Pollack, Robert A. & Wales, Terence J. 1997. Do Husbands and Wives Pool Their Resources? Evidence from the United Kingdom Child Benefit. *Journal of Human Resources* 32(3), 463-480.

Macunovich, Diane J. 1996. Relative Income and Price of Time: Exploring Their Effects on US Fertility and Female Labor Force Participation. *Population and Development Review* 22(supplement), 223-257.

Manser, Marilyn & Brown, Murray 1980. Marriage and Household Decision-Making: A Bargaining Analysis. *International Economic Review* 21(1), 31-44.

McElroy, Marjorie B. & Horney, Mary Jean 1981. Nash-Bargained Household Decisions: Toward a Generalization of the Theory of Demand. *International Economic Review* 22(2), 333-349.

Michael, Robert T. 1985. Consequences of the Rise in Female Labor Force Participation Rates: Questions and Probes. *Journal of Labor Economics* 3(1S), S117-S146.

Michalopoulos, Charles & Robins, Philip K. & Garfinkel, Irwin 1992. A Structural Model of Labor Supply and Child Care Demand. *Journal of Human Resources* 27(1), 166-203.

Mincer, Jacob 1985. Intercountry Comparisons of Labor Force Trends and of Related Developments: An Overview. *Journal of Labor Economics* 3(1S), S1-S32.

Neumark, David & Bank, Roy J. & Van Nort, Kyle D. 1996. Sex Discrimination in Restaurant Hiring: An Audit Study. *Quarterly Journal of Economics* 111(3), 915-941.

Newey, Whitney K. & West, Kenneth D. 1987. A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix. *Econometrica* 55(3), 703-708.

North, Douglass C. 1992. *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press.

O'Brien, Robert M. 2007. A Caution Regarding Rules of Thumb for Variance Inflation Factors. *Quality & Quantity* 41(5), 673-690.

OECD 2010/I. OECD.Stat [Online] http://stats.oecd.org/ Accessed 28.10.2010

OECD 2010/II. OECD Family Database [Online] www.oecd.org/els/social/family/database Accessed 28.10.2010.

Olivetti, Claudia & Petrongolo, Barbara 2008. Unequal Pay or Unequal Employment? A Cross-Country Analysis of Gender Gaps. *Journal of Labor Economics* 26(4), 621-654.

Ott, Notburga 1995. Fertility and Division of Work in the Family. In Kuiper, Edith & Sap, Jolande (eds.) *Out of the Margin - Feminist Perspectives on Economics*. London: Routledge, 80-99.

Petersen, Trond & Saporta, Ishak & Seidel, Marc-David L. 2005. Getting Hired: Sex and Race. *Industrial Relations* 44(3), 416-443.

Phelps, Edmund S. 1972. The Statistical Theory of Racism and Sexism. *American Economic Review* 62(4), 659-661.

Polachek, Solomon William 1981. Occupational Self-Selection: A Human Capital Approach to Sex Differences in Occupational Structure. *Review of Economics and Statistics* 63(1), 60-69.

Powell, Lisa M. 1997. The Impact of Child Care Costs on the Labour Supply of Married Mothers: Evidence from Canada. *Canadian Journal of Economics* 30(3), 577-594.

Riach, P.A. & Rich, J. 1987. Testing Sexual Discrimination in the Labour Market. *Australian Economic Papers* 26(49), 165-178.

Riach, P.A. & Rich, J. 2002. Field Experiments of Discrimination in the Market Place. *Economic Journal* 112(483), 480-518

Ribar, David C. 1992. Child Care and the Labor Supply of Married Women. *Journal of Human Resources* 27(1), 134-165.

Ribar, David C. 1995. A Structural Model of Child Care and the Labor Supply of Married Women. *Journal of Labor Economics* 13(3), 558-597.

Rindfuss, Ronald R. & Guzzo, Karen Benjamin & Morgan, S. Philip 2003. The Changing Institutional Context of Low Fertility. *Population Research and Policy Review* 22(5-6), 411-438.

Rogers, William 1993. sg17: Regression Standard Errors in Clustered Samples. *Stata Technical Bulletin* 13, 19-23.

Rosenzweig, Mark R. & Wolpin, Kenneth I. 1980. Life-Cycle Labor Supply and Fertility: Causal Inferences from Household Models. *Journal of Political Economy* 88(2), 328-348.

Rosenzweig, Mark R. & Wolpin, Kenneth I. 2000. Natural "Natural Experiments" in Economics. *Journal of Economic Literature* 38(4), 827-874.

Ruhm, Christopher J. 1998. The Economic Consequences of Parental Leave Mandates: Lessons from Europe. *Quarterly Journal of Economics* 113(1), 285-317.

Schultz, T. Paul 1990. Testing the Neoclassical Model of Family Labor Supply and Fertility. *Journal of Human Resources* 25(4), 599-634.

Seguino, Stephanie 2007. Plus ça change? Evidence on Global Trends in Gender Norms and Stereotypes. *Feminist Economics* 13(2), 1-28.

Selin, Håkan 2009. The Rise in Female Employment and the Role of Tax Incentives – An Empirical Analysis of the Swedish Individual Tax Reform of 1971. CESifo Working Paper No. 2629. CESifo.

Smith, Nina & Dex, Shirley & Vlasblom, Jan Dirk & Callan, Tim 2003. The Effects of Taxation on Married Women's Labour Supply across Four Countries. *Oxford Economic Papers* 55(3), 417-439.

South, Scott J. 2001. Time-Dependent Effects of Wives' Employment on Marital Dissolution. *American Sociological Review* 66(2), 226-245.

Spence, Michael 1973. Job Market Signaling. *Quarterly Journal of Economics* 87(3), 355-374.

Sundaram, Aparna & Vanneman, Reeve 2008. Gender Differentials in Literacy in India: The Intriguing Relationship with Women's Labor Force Participation. *World Development* 36(1), 128-143.

Tanaka, Sakiko 2005. Parental Leave and Child Health across OECD Countries. *Economic Journal* 115(501), 7-28.

Tzannatos, Zafiris 1999. Woman and Labor Market Changes in the Global Economy: Growth Helps, Inequalities Hurt and Public Policy Matters. *World Development* 27(3), 551-569.

Udry, Christopher 1996. Gender, Agricultural Production, and the Theory of the Household. *Journal of Political Economy* 104(5), 1010-1046.

Verbeek, Marno 2004. *A Guide to Modern Econometrics – 2nd Edition*. London: John Wiley & Sons Inc.

Vlasblom, Jan Dirk & Schippers, Joop J. 2004. Increases in Female Labour Force Participation in Europe: Similarities and Differences. *European Journal of Population* 20(4), 375-392.

Waldfogel, Jane 1999. The Impact of the Family and Medical Leave Act. *Journal of Policy Management and Analysis* 18(2), 281-302.

Waldfogel, Jane & Higuchi, Yoshio & Abe, Masahiro 1999. Family Leave Policies and Women's Retention after Childbirth: Evidence from the United States, Britain, and Japan. *Journal of Population Economics* 12(4), 523-545.

Wooldridge, Jeffrey M. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.

World Bank 2009. World Development Indicators [Online] http://www.worldbank.org/ Accessed 27.10.2009.

World Values Survey Association 2009. World Values Survey 1981-2008 Official Aggregate v.20090901. Aggregate Values Survey Association. [Online] www.worldvaluessurvey.org Accessed 28.10.2010.

Wrohlich, Katharina 2004. Child Care Costs and Mothers' Labor Supply: An Empirical Analysis for Germany. Working Paper, DIW Berlin.

Appendix I: Graphs on LFPRs for Men and Women across Age Groups

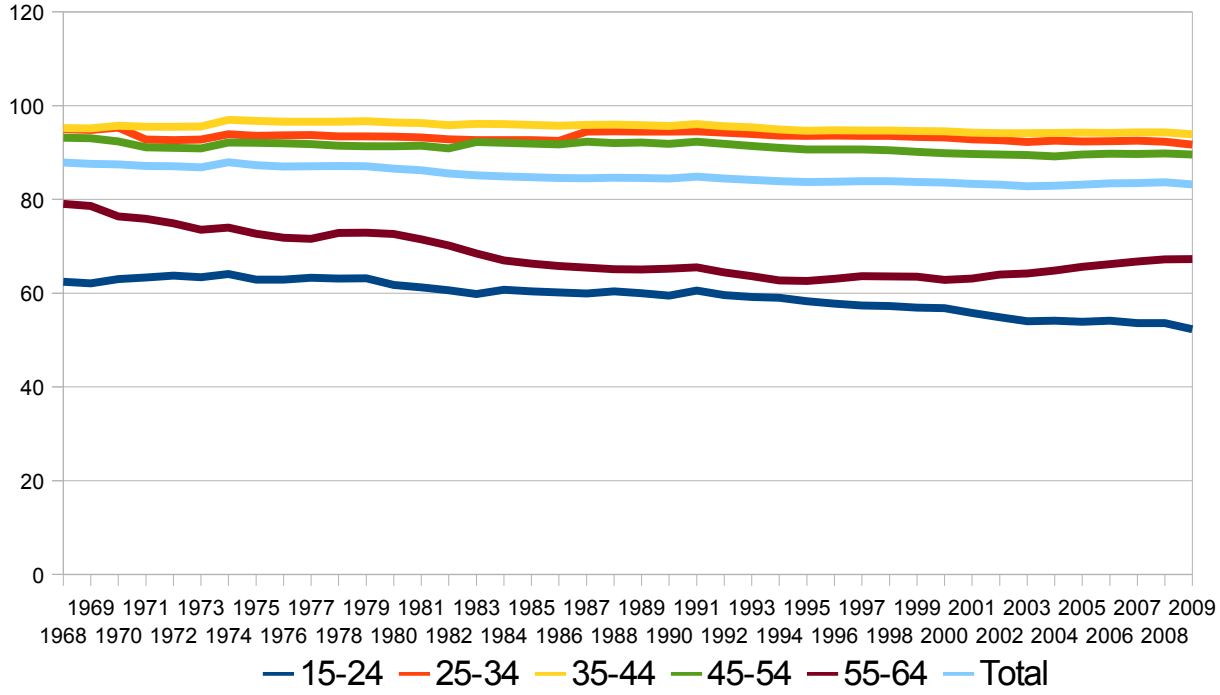

Figure 10: LFPR for Men across Age Groups 1968-2009
Source: OECD 2010/I.

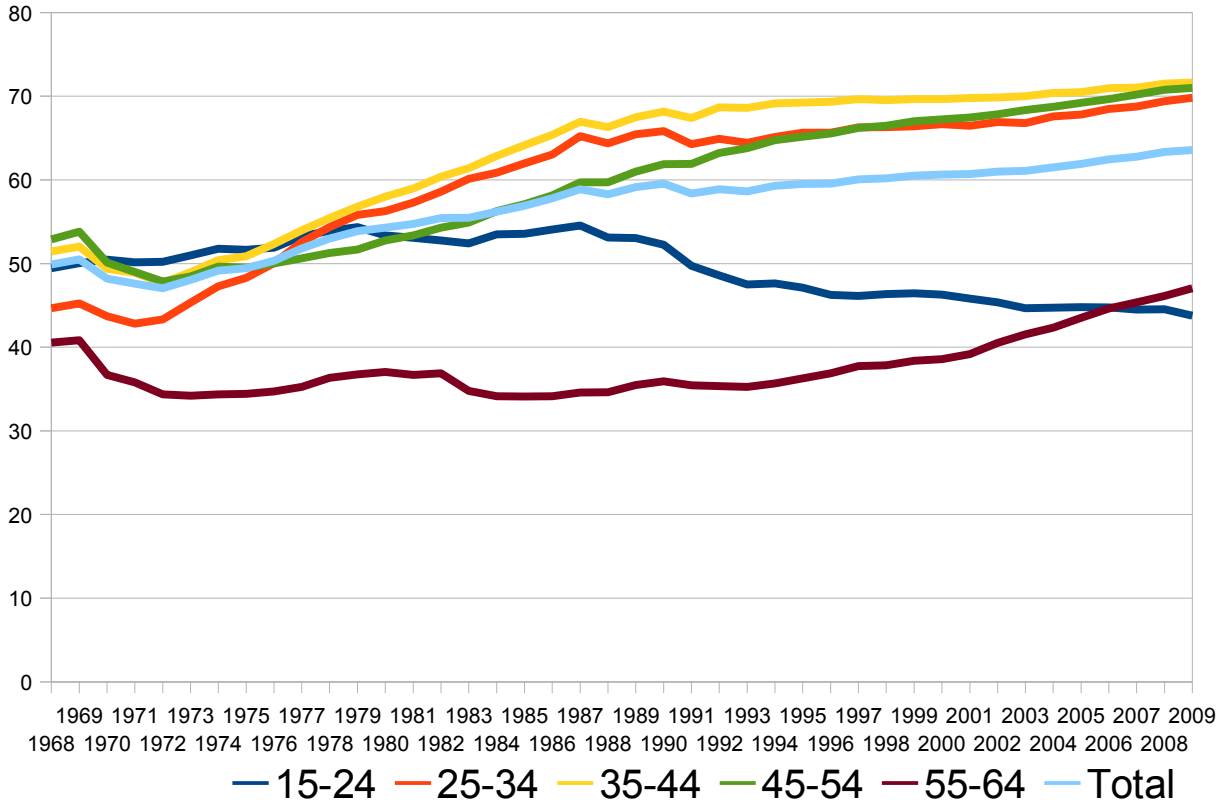

Figure 11: LFPR for Women across Age Groups 1968-2009
Source: OECD 2010/I.

Appendix II: Additional Descriptive Statistics and Regression Results

Dependent variable: Gender gap in LFPRs for the age group of 25-54

	Linear regression, robust standard errors adjusted for country-clusters (#primary)		Linear regression, robust standard errors adjusted for country-clusters (#secondary)		Linear regression, robust standard errors adjusted for country-clusters (#tertiary)		Linear regression, robust standard errors adjusted for country-clusters (#total)	
	Coefficient estimate	p-value	Coefficient estimate	p-value	Coefficient estimate	p-value	Coefficient estimate	p-value
Income tax	0.0772	0.556	0.1588	0.293	0.1727	0.217	0.1282	0.361
	[0.1287]		[0.1468]		[0.1353]		[0.1370]	
Values	2.1712	0.306	2.7610	0.225	1.1577	0.671	1.2049	0.646
	[2.0620]		[2.2039]		[2.6804]		[2.5796]	
Gender gap in schooling #	22.6888**	0.027	2.0277	0.523	9.0000	0.123	3.6527	0.192
	[9.4621]		[3.1123]		[5.5759]		[2.6983]	
Unemployment rate	0.2462	0.128	0.4267***	0.003	0.4259***	0.006	0.4117***	0.005
	[0.1549]		[0.1259]		[0.1362]		[0.1282]	
Part time employment	-0.6711**	0.019	-0.6048*	0.062	-0.6958**	0.036	-0.5887*	0.078
	[0.2624]		[0.3055]		[0.3078]		[0.3163]	
Average job tenure	-1.3714	0.148	-1.9919*	0.081	-2.1286*	0.074	-1.7627*	0.076
	[0.9100]		[1.0803]		[1.1247]		[0.9385]	
Employment protection ratio	0.5807	0.502	1.5429	0.307	1.4812	0.316	1.2115	0.352
	[0.8483]		[1.4687]		[1.4395]		[1.2693]	
Total fertility rate	-3.6969	0.247	-4.3344	0.144	-3.9208	0.184	-3.8615	0.188
	[3.0956]		[2.8440]		[2.8468]		[2.8253]	
Maternal and parental leave	1.7111	0.531	-0.0073	0.998	-0.4117	0.879	0.0644	0.981
	[2.6816]		[2.6387]		[2.6592]		[2.6216]	
Day care	-2.1181*	0.093	-1.0850	0.264	-0.6899	0.574	-1.4778	0.137
	[1.1994]		[0.9434]		[1.2046]		[0.9522]	
Marriage rate	1.1893*	0.094	1.2728*	0.098	1.4358*	0.053	1.3284*	0.069
	[0.6739]		[0.7310]		[0.6958]		[0.6896]	
Divorce rate	-2.7369***	0.002	-3.6992***	0.005	-3.5901***	0.004	-3.3313***	0.005
	[0.7702]		[1.1659]		[1.0936]		[1.0386]	
R^2	0.7123		0.6598		0.6696		0.6763	

Statistical significance: *** 1% level, ** 5% level, * 10% level

Standard errors in brackets below the corresponding correlation coefficients

Table 7: Effects of Gender Gaps in Different Schooling Levels for Gender Gap in LFPRs

Table 8: Variable Correlations

	Gender gap LFPRs 25-54	LFPR men 25-54	LFPR women 25-54	Income tax	Values	Gender gap in primary schooling	Gender gap in secondary schooling	Gender gap in tertiary schooling	Gender gap in total schooling	Unemployment rate	Part-time employment	Average job tenure	Employment protection ratio	Total fertility rate	Maternal and parental leave	Day care	Marriage rate	Divorce rate	Gender pay gap
Gender gap LFPRs 25-54	1																		
LFPR men 25-54	0.2549***	1																	
LFPR women 25-54	-0.9616***	0.0201	1																
Income tax	0.2442***	0.2571***	-0.1795***	1															
Values	0.3271***	-0.0443	-0.3508***	0.1371**	1														
Gender gap in primary schooling	0.3411***	0.1023*	-0.3237***	-0.0430	0.3039***	1													
Gender gap in secondary schooling	0.1837***	0.4181***	-0.0713	0.2768***	0.2511***	0.1035*	1												
Gender gap in tertiary schooling	0.1418**	0.5531***	0.0103	0.3153***	0.2272***	-0.0703	0.6816***	1											
Gender gap in total schooling	0.2773***	0.4756***	-0.1517**	0.2691***	0.3365***	0.3713***	0.9474***	0.7248***	1										
Unemployment rate	0.1239**	-0.3024***	-0.2139***	-0.1111*	0.2400***	0.2031***	-0.2948***	-0.2473***	-0.2177***	1									
Part-time employment	-0.1110**	0.2506***	0.1858***	0.0267	-0.3316***	-0.3682***	0.0685	0.2455***	-0.0054	-0.3957***	1								
Average job tenure	0.3182***	0.0646	-0.3107***	0.0667	0.2481***	0.4421***	0.1130*	-0.1439**	0.1894***	0.3119***	-0.2584***	1							
Employment protection ratio	0.3030***	0.2747***	-0.2354***	0.1503**	0.0064	0.5740***	0.1372**	-0.031	0.2743***	0.0998	-0.2771***	0.5328***	1						
Total fertility rate	-0.2970***	-0.0318	0.2981***	-0.0256	-0.5218***	-0.4172***	-0.3094***	-0.2964***	-0.4317***	-0.3130***	0.4771***	-0.2158***	-0.191***	1					
Maternal and parental leave	-0.5722***	-0.2609***	0.5176***	-0.0769	-0.3023***	-0.3058***	-0.0222	-0.1406**	-0.1435**	-0.0799	-0.3175***	-0.2170***	0.0122	0.2554***	1				
Day care	-0.6224***	-0.2879***	0.5619***	-0.2122***	-0.6443***	-0.3373***	-0.1834***	-0.3114***	-0.3147***	-0.0931	0.1237**	-0.2258***	-0.1327**	0.4625***	0.5881***	1			
Marriage rate	-0.0359	0.1983***	0.0934	-0.0581	-0.0102	0.2910***	0.0473	0.0740	0.1427**	-0.1387**	0.0458	-0.3923***	-0.0581	-0.0133	-0.0702	-0.0013	1		
Divorce rate	-0.6397***	0.0737	0.6823***	0.0517	-0.1847***	-0.4830***	0.1217**	0.2358***	-0.0027	-0.3953***	0.1315**	-0.3317***	-0.1712***	0.1638***	0.4648***	0.3731***	0.0029	1	
Gender pay gap	0.1570**	-0.1304**	-0.1993***	0.0301	0.0679	0.5449***	-0.2391***	-0.4801***	-0.1233**	0.2789***	-0.2479***	0.5570***	0.4617***	-0.0608	-0.1274**	0.0146	-0.0454	-0.3784***	1

Statistical significance: *** 1% level, ** 5% level, * 10% level

Dependent variable: Men's LFPR for the age group of 25-54

	OLS regression		Linear regression, robust standard errors adjusted for country-clusters		Linear regression with Newey-West standard errors		Prais-Winsten regression, robust standard errors, panel-specific AR(1) autocorrelation	
	Coefficient estimate	p-value	Coefficient estimate	p-value	Coefficient estimate	p-value	Coefficient estimate	p-value
Income tax	0.0342	0.236	0.0341	0.477	0.0342	0.361	0.0091	0.722
	[0.0288]		[0.0471]		[0.0373]		[0.0255]	
Values	1.1777*	0.050	1.1777	0.330	1.1777	0.274	0.2351	0.767
	[0.5964]		[1.1770]		[1.0731]		[0.7950]	
Gender Gap in primary schooling	-0.9086	0.399	-0.9086	0.399	-0.9086	0.494	-0.2040	0.808
	[1.0746]		[1.0529]		[1.3259]		[0.8408]	
Unemployment rate	0.0278	0.292	0.0278	0.511	0.0278	0.386	0.0326	0.251
	[0.0263]		[0.0415]		[0.0320]		[0.0285]	
Part time employment	0.0735**	0.033	0.0735*	0.087	0.0735**	0.033	0.0521*	0.075
	[80.0342]		[0.0408]		[0.0343]		[0.0293]	
Average job tenure	-0.3384**	0.018	-0.3384	0.125	-0.3384**	0.044	-0.2418*	0.056
	[0.1417]		[0.2110]		[0.1667]		[0.1266]	
Employment protection ratio	-0.2241	0.212	-0.2241	0.393	-0.2241	0.223	-0.2220	0.201
	[0.1792]		[0.2564]		[0.1833]		[0.1736]	
Total fertility rate	1.4965**	0.024	1.4965	0.169	1.4965*	0.069	1.0035	0.175
	[0.6605]		[1.0462]		[0.8188]		[0.7395]	
Maternal and parental leave	0.4896	0.353	0.4896	0.397	0.4896	0.487	0.3745	0.560
	[0.5262]		[0.5649]		[0.7027]		[0.6426]	
Day care	-0.4271	0.159	-0.4271	0.316	-0.4271	0.248	-0.3379	0.238
	[0.3021]		[0.4149]		[0.3684]		[0.2862]	
Marriage rate	0.1466	0.245	0.1466	0.332	0.1466	0.290	0.1883*	0.099
	[0.1257]		[0.1473]		[0.1383]		[0.1141]	
Divorce rate	-0.3644**	0.032	-0.3644**	0.018	-0.3644**	0.044	-0.1987	0.138
	[0.1693]		[0.1414]		[0.1800]		[0.1340]	
R^2	0.2298		0.2298		0.2298		1.0000	

Statistical significance: *** 1% level, ** 5% level, * 10% level

Standard errors in brackets below the corresponding correlation coefficients

Table 9: Explaining Men's LFPR

Dependent variable: Women's LFPR for the age group of 25-54

	OLS regression		Linear regression, robust standard errors adjusted for country-clusters		Linear regression with Newey-West standard errors		Prais-Winsten regression, robust standard errors, panel-specific AR(1) autocorrelation	
	Coefficient estimate	p-value	Coefficient estimate	p-value	Coefficient estimate	p-value	Coefficient estimate	p-value
Income tax	-0.0430	0.659	-0.0430	0.763	-0.0430	0.697	-0.0665	0.367
	[0.0972]		[0.1405]		[0.1103]		[0.0737]	
Values	-0.9936	0.622	-0.9936	0.583	-0.9936	0.616	-3.8743**	0.014
	[2.0146]		[1.7775]		[1.9778]		[1.5730]	
Gender gap in primary schooling	-23.5974***	p<0.001	-23.5974**	0.020	-23.5974***	p<0.001	-22.1902***	p<0.001
	[3.6299]		[9.2611]		[6.2041]		[4.0977]	
Unemployment rate	-0.2184**	0.015	-0.2184	0.165	-0.2184**	0.044	-0.0803	0.264
	[0.0889]		[0.1514]		[0.1078]		[0.0719]	
Part time employment	0.7446***	p<0.001	0.7446**	0.014	0.7446***	p<0.001	0.5459***	p<0.001
	[0.1156]		[0.2751]		[0.1714]		[0.1006]	
Average job tenure	1.0331**	0.032	1.0331	0.306	1.0331	0.100	0.3618	0.288
	[0.4787]		[0.9816]		[0.6264]		[0.3409]	
Employment protection ratio	-0.8048	0.185	-0.8048	0.415	-0.8048	0.194	-1.1832***	0.005
	[0.6052]		[0.9655]		[0.6178]		[0.4184]	
Total fertility rate	5.1933**	0.021	5.1933	0.176	5.1933**	0.046	8.043***	p<0.001
	[2.2313]		[3.6919]		[2.5866]		[1.6813]	
Maternal and parental leave	-1.2215	0.493	-1.2215	0.657	-1.2215	0.539	-2.1992*	0.086
	[1.7775]		[2.7057]		[1.9847]		[1.2802]	
Day care	1.691*	0.099	1.6910	0.186	1.691*	0.063	2.2224***	p<0.001
	[1.0206]		[1.2323]		[0.9061]		[0.6298]	
Marriage rate	-1.0428**	0.015	-1.0428	0.158	-1.0428**	0.035	-0.8431***	0.002
	[0.4247]		[0.7095]		[0.4924]		[0.2709]	
Divorce rate	2.3725***	p<0.001	2.3725**	0.010	2.3725***	0.002	1.1231***	0.006
	[0.5720]		[0.8234]		[0.7539]		[0.4088]	
R^2	0.6781		0.6781		0.6781		0.9993	

Statistical significance: *** 1% level, ** 5% level, * 10% level

Standard errors in brackets below the corresponding correlation coefficients

Table 10: Explaining Women's LFPR