SEX SEGREGATION AND GENDER WAGE DIFFERENCES IN HUNGARY

by
Eszter Nagy

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Central European University
Department of Economics

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Supervisor: Professor Álmos Telegdy

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Abstract

My thesis focuses on different factors determining the gender wage gap in Hungary between 1986 and 2007. My research question is: to what extent the gender wage difference can be explained by segregation and demographic characteristics, and how much of the gap remains unexplained after controlling for these effects. I use a decomposition method based on Bayard et al (2003) for 15 years of the Harmonized Hungarian Wage Survey between 1986 and 2007.

According to my results segregation plays a big and increasing role (20-40%) in the Hungarian gender wage difference during the examined period, but the majority (60-80%) of the wage gap remains unexplained after controlling for demographic characteristics and segregation. The two most important segregation effects are occupational and within firm-occupation cell segregations. My results are consistent with similar estimates for other post transition countries (Csillag 2004, Jurajda 2003) and there are similarities with results for the United States (Bayard et al 2003) as well.

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Introduction

Although the difference seems to decrease over time, women have always earned less than men (Blau and Kahn 2000). Therefore the gender wage gap has been an important issue in economic research.

In my paper I am focusing on the role of different types of segregation in the gender wage gap in Hungary between 1986 and 2007. To be more precise, using a similar methodology that presented in Bayard et al (2003), I am decomposing the total wage difference between women and men to parts explained by the difference in terms of demographic characteristics between the two sexes; and to parts explained by occupational, industrial, firm and within firm-occupation cell segregation. My research question is: to what extent the gender wage difference can be explained by segregation and demographic characteristics, and how much of the gap remains unexplained after controlling for these effects.

My aim is to separate the effect of segregation, i.e. the effect of the fact, that women tend to work in different occupations, industries and firms from men; from the effect of discrimination, i.e. two people with equal productivity get different wages based on some observable characteristics such as race and gender. My hypothesis is, that the economic transition in Hungary might had a positive effect on discrimination, because economic competition could decrease discrimination against women in the labor market (Becker 1957, Lovász 2008). The effect of segregation also could change with the transition.

According to my results, segregation plays a significant role in the gender wage gap in Hungary, and its magnitude increased significantly (from 20% to 40% of the total gender wage difference) after the economic transition. The role of demographic factors is not very large, and they actually contribute to the decreasing trend of the total gender wage difference. However, there is still a large (60-80%) unexplained part of the earning difference in every

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year, which can be an upper bound for the effect of discrimination. Besides the effect of discrimination, this unexplained part contains all unobserved group differences in productivity and tastes between men and women that we cannot control for (Altonji and Blank 1999).

In the next chapter I briefly summarize the previous literature dealing with similar questions, and place my study in the context of international research. In chapter 2, I describe the used dataset and variables in detail and explain the used econometric methods. Chapter 3 presents the results and then I summarize my findings in the conclusion.

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1 Previous Literature

Most papers dealing with the effect of occupational, firm and/or industrial segregation on the female-male gender wage difference use data for the United States. The majority of these papers are using household survey data (usually the US Current Population Survey), which does not allow to control for segregation of women across and within firms (for example Fields and Wolff 1995, Macpherson and Hirsh 1995), because they do not contain information regarding firm characteristics.

The first exception, Groshen (1991), who uses a matched employer-employee dataset, only has data for 5 special industries, so her findings are not representative for the whole population. Bayard et al. (2003) were the first who used a matched employer-employee dataset containing observations for several industries when they tried to measure the effect of segregation of women on the gender wage gap. Their results indicated that even after controlling for segregation (proportion of female workers) in occupation, industry, across firms and within firm-occupational cells (workers with the same occupation in the same firm) there is a substantially large unexplained gender wage difference. This result contradicts the previous findings of Groshen (1991).

Following the methodology of Bayard et al (2003) there are two studies examining similar questions for Western-European countries, but their results are very different. Datta Gupta and Rothstein (2005) used a matched employer-employee dataset for Denmark from 1983 and 1995, and they found that the majority (more than two third) of the gender wage difference is due to segregation effects. Amuardo-Dorantes and De la Rica (2006) used data for Spain from 1995 and 2002, and their results suggest that segregation explains a smaller proportion (14-19%) of the wage gap in both years.

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Examining the same problem in a transition country can serve as an interesting comparison to the US and Western-European results. Although there are several studies dealing with the situation of women during and after the transition to market economy (for example Brainerd 2000), there are a small number of studies that focus on the role of segregation effects. Ogloblin (1999) used household survey data (the RLMS) between 1992 and 1994 to examine the role of occupational segregation in Russia after the transition. He found that occupational segregation explains a huge part, around 56% from the female-male wage gap. Jurajda (2003) followed the methodology of Bayard et al (2003) using 1998 data for the private and public sector in the Czech Republic and Slovakia. His findings are consistent with the US results and share of wage difference explained by segregation for the public sector is similar to my result for Hungary[1].

To my best knowledge there is no study on Hungary using recent data, that exploit all the advantages of matched employer-employee datasets. However, Galasi (2000) examined the dynamics of the gender wage gap between 1986 and 1996 using the TÁRKI Household Panel and the Harmonized Hungarian Wage Survey, but he only examined the effect of some, much broadly defined occupations and with simpler methods. My results are totally different from his findings. In addition, Csillag (2004) in his working paper deals with the effect of occupational and firm segregation using the Harmonized Hungarian Wage Survey from 1986, 1993, 1995 and 2002. The main difference between his paper and this one is that he did not take into account the effect of industries and firm-occupation cells. My decomposition methods were different as well. These methodological differences yielded much higher estimates for occupation and firm segregations than my results presented in this paper.

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[1] I only used public sector data for my analysis.

2 Empirical Strategy

In this chapter first I describe the used dataset and variables. Then I explain the econometric method used for estimating the gender wage gap in Hungary and the different decomposition techniques that helped separating the components of the whole gap.

2.1 Data description

For my analysis I used waves of the Harmonized Hungarian Wage Survey collected by the National Employment Office[2] from 1986, 1989 and from every year between 1994 and 2007. For the detailed results (presented in Table 2 and 3) I used data from 1986, 1996 and 2006. This way it was possible to follow the evolution of wage differences and the composition of the wage gap throughout the whole period covered by the data. To illustrate the main direction of changes between 1986 and 2007 I constructed some figures (Figures 1, 2 and 3) using all the available years except 1992 and 1993 (these years are excluded because of data problems). Presenting more detailed tables for all the available years, however, would not add too much to what follows.

The Harmonized Hungarian Wage Survey is a matched employer-employee dataset containing approximately 600 000 observations per year for 1986 and 1989 and around 100 000-200 000 observations for every year after 1992, for both the private and public sector. The data are collected on the establishment level. It contains information for all large firms and a random sample of their workers. Large firms are the ones which had more than 20 employees between 1986 and 2001, and more than 50 after 2002. First in 1986 and 1989 workers were selected into the sample based on their rank in the list of employees, and from

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[2] I received the dataset from the Economic Institute of the Hungarian Academy of Sciences. I used the cleaned and harmonized version made by IE-HAS Data Sources Department and the Central European University Labor Project.

1992 based on their day of birth. From 1992 a random sample of small firms is also included, with data available for all of their workers, but the sample of small enterprises changes from one year to another. To ensure the representativeness of my results, I used individual weights for all my calculations. The weights measure the probability of each worker being included in the sample.[3]

I restricted my analysis to full time workers in the public sector. To examine only prime aged earners, I only used the sample of 18-55 years old women and 18-60 years old men (retirement age differed between men and women in Hungary during this period). And finally, because I had to construct the ratio of female workers in the firm and in a firm-occupation cell (see details later); I dropped firms with less than ten observed workers from the analysis.

Table 1 shows the descriptive statistics of the used variables in 1986, 1996 and 2006. *Real wage* is the gross real monthly wage (in the regression equations I used the natural logarithm of it). The variable is computed as a gross monthly base wage plus premium. For every year the real wage is expressed in 2007 HUFs. From the table it is easy to see that real wages increased between 1986 and 2006, and the average wage of women was significantly lower in every year compared to the average wage of men.

Female is a dummy variable for women. In all three years around 40% of the sample is female, but the ratio of female workers slightly decreased. *Experience* is the predicted experience of the individual in years, constructed as: age minus years of education minus 6. From the table we can see that women have slightly lower estimated experience in all three years on average, but the difference is not very large.

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[3] I used individual weights constructed by the CEU Labor Project.

Table 1. Descriptive Statistics - Full time employees, males aged 18-60, females aged 18-55

	1986			1996			2006		
	whole sample	**female**	**male**	**whole sample**	**female**	**male**	**whole sample**	**female**	**male**
real wage	108228.9	87686.2	123503.2	131579.3	116098.2	142553.7	181391	163684.8	192756.9
	(56633.54)	(36638.52)	(63615.78)	(123201.00)	(95933.85)	(138290.1)	(201715.8)	(158461.1)	(224409.9)
log real wage	11.500	11.318	11.637	11.577	11.478	11.647	11.853	11.801	11.886
	(0.407)	(0.343)	(0.397)	(0.602)	(0.567)	(0.616)	(0.633)	(0.574)	(0.666)
Demographic controls									
female	0.426	1	0	0.415	1	0	0.391	1	0
age	38.333	37.362	39.055	38.586	38.258	38.819	39.142	38.607	39.485
	(10.474)	(9.738)	(10.934)	(10.261)	(9.768)	(10.590)	(10.401)	(9.912)	(10.690)
experience	21.988	21.134	22.622	21.293	21.114	21.420	21.323	20.677	21.737
	(11.179)	(10.590)	(11.557)	(10.400)	(10.029)	(10.653)	(10.784)	(10.522)	(10.929)
experience squared/100	6.084	5.588	6.453	5.616	5.464	5.723	5.709	5.382	5.919
	(5.250)	(4.651)	(5.626)	(4.458)	(4.055)	(4.720)	(4.839)	(4.481)	(5.045)
vocational school dummy	0.213	0.125	0.278	0.314	0.195	0.398	0.338	0.216	0.417
high school dummy	0.291	0.395	0.214	0.351	0.466	0.270	0.348	0.450	0.283
university dummy	0.089	0.053	0.115	0.116	0.088	0.137	0.181	0.195	0.172
Budapest dummy	0.224	0.247	0.206	0.280	0.305	0.262	0.285	0.304	0.272
Segregation									
Proportion female in occupation	0.428	0.557	0.333	0.416	0.531	0.334	0.402	0.509	0.333
	(0.234)	(0.267)	(0.144)	(0.218)	(0.257)	(0.137)	(0.205)	(0.217)	(0.163)
Proportion female in industry	0.428	0.482	0.388	0.416	0.500	0.356	0.403	0.498	0.343
	(0 .151)	(0.153)	(0.137)	(0.187)	(0.197)	(0.154)	(0.192)	(0.186)	(0.170)
Proportion female in firm	0.428	0.500	0.375	0.415	0.552	0.319	0.400	0.585	0.282
	(0.175)	(0.177)	(0.153)	(0.238)	(0..233)	(0.189)	(0.269)	(0.248)	(0.207)
Proportion female in firm-occupation cell	0.428	0.641	0.269	0.415	0.715	0.203	0.396	0.739	0.176
	(0.301)	(0.275)	(0.208)	(0.353)	(0.267)	(0.230)	(0.366)	(0.256)	(0..234)
Number of firms	3668	3368	3367	2802	2714	2766	6267	5695	5842
Number of Observations	604441	257766	346675	83954	34826	49128	122851	48029	74822

Note: Means are reported. Standard deviations in the parentheses.

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The *vocational school, high school and university dummy variables* indicate the highest completed level of education of the individual. The reference category is workers with less than or equal to eight years of education (maximum finished primary school).

From the table it is clear, that the educational composition of the sample changed during this 20 year period significantly. The ratio of college graduates in the sample doubled: it increased from 8.9% in 1986 to 18.1% in 2006. The share of high school graduates also increased, by around 5% on average, while the ratio of people who completed vocational school remained approximately the same. Besides these trends, there is also a clear difference between the educational composition of the female and the male sample. Women became more educated than men during the examined period on average. In 1986 and 1996 the share of university graduates was lower among women than men, but by 2006 this changed. Besides this switch, there are significantly more high school graduates in the female sample in all three years. It is important to note that the labor force participation rate of women dropped by about 20% after the transition (KSH 1987, KSH 2010b), so there can be a strong selection effect in the sample of working women, which could also cause this change in the educational composition.

The *Budapest dummy* is 1 if the individual works in Budapest. In all years there are more people working in the capital in sample of women.

The last section of Table 1 shows the variables that I used to measure the effect of different types of segregations of women. *Proportion female in occupation* is the share of female workers in an occupation category computed from the sample. I considered a group with the same two digit FEOR code as one occupation. (FEOR is the Hungarian classification system of occupations.) The classification changed in 1993, but I used a two digit level harmonized version (everything expressed in the 1993 system for all years).

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Proportion female in industry is the share of female workers in the same industry. Industry categories are determined by the first two digits of the TEAOR codes (the Hungarian classification system for industries). I also used a harmonized version of it made by the CEU Labor Project for 1986 and 1989 (from 1992 to 2007 the classification system did not change at the two digit level).

Proportion female in firm is the share of female workers in a given firm (determined by its identification number, firms with multiple plants considered as one). Finally, proportion *female in firm-occupation cell* is the share of women in a given firm with the same occupation (two digit FEOR code).

The descriptive statistics in Table 1 show that in all the examined years the average of all four variables measuring segregation was significantly higher for women than for men, so it is reasonable to say that female workers are segregated at least to some degree. Maybe the most significant difference between men and women is in terms of proportion female in firm-occupation cell. Women are clustered into "female occupations" within firms and this tendency increased significantly after the transition.

2.2 Methodology

To measure the gender wage gap in Hungary and for the static decomposition I follow the method used by Bayard et al. (2003). First I ran Mincer-type regressions with and without control variables. Besides simply computing the male-female wage gap, my aim was to determine the share of the gender wage gap which can be explained by occupational, industrial, between firms- and within firm-occupation cell segregation together with some demographic factors. I estimated the following equation:

$$w_{poiej} = \alpha + \beta F_p + \gamma OCC\%F_o + \delta IND\%F_i + \lambda EST\%F_e + \theta JOB\%F_j + \Phi X_{poiej} + \epsilon_{poiej} \quad (1)$$

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Where w is the natural logarithm of the gross real monthly wage, F is the female dummy for individual p, $OCC\%F$ is the proportion female in occupation o, $IND\%F$ is the proportion female in industry i, $EST\%F$ is the proportion female in firm e, $JOB\%F$ is the proportion female in firm-occupation cell j, X is a vector control variables (experience, experience squared/100, dummies for highest completed level of education and a Budapest dummy) and ϵ is the error term. When I estimated equation (1) I used individual probability weights to ensure the representativeness of the results for the whole population.

With the estimated coefficients resulted from the above equation (marked with $'$) it is possible to decompose the difference of the log real wages (Bayard et al 2003):

$$\bar{w}_f - \bar{w}_m = \beta' + \gamma'\left(\overline{OCC\%F_f} - \overline{OCC\%F_m}\right) + \delta'\left(\overline{IND\%F_f} - \overline{IND\%F_m}\right) + \lambda'\left(\overline{EST\%F_f} - \overline{EST\%F_m}\right) + \theta'\left(\overline{JOB\%F_f} - \overline{JOB\%F_m}\right) + \Phi'(\bar{X}_f - \bar{X}_m) \quad (2)$$

Where the subscripts f and m indicate the mean for females and males respectively.

With this equation it is possible to measure the absolute and relative share explained by occupational, industrial, firm and within firm-occupation cell segregation from the raw male-female wage differential. The raw wage differential is the simple difference of means (the left hand side of equation (2)) estimated by the same equation as (1) but without demographic variables and controls for segregation. The relative share of the β' coefficient will measure, how much wage difference remains unexplained after controlling for segregation and some basic demographical characteristics.

It is possible to do the above decomposition method for all years, and using the results I was able to do a further, dynamic decomposition to examine the change of the whole and decomposed effects over time.

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I used the following Smith-Welch (1989) type of decomposition method:

$$\Delta\overline{w}^2 - \Delta\overline{w}^1 = (\beta'^2 - \beta'^1) + \gamma'^2(\Delta\overline{OCC\%F}^2 - \Delta\overline{OCC\%F}^1) + (\gamma'^2 - \gamma'^1)\Delta\overline{OCC\%F}^1 \qquad (3)$$
$$+ \delta'^2(\Delta\overline{IND\%F}^2 - \Delta\overline{IND\%F}^1) + (\delta'^2 - \delta'^1)\Delta\overline{IND\%F}^1 +$$
$$+ \lambda'^2(\Delta\overline{EST\%F}^2 - \Delta\overline{EST\%F}^1) + (\lambda'^2 - \lambda'^1)\Delta\overline{EST\%F}^1 +$$
$$+ \theta'^2(\Delta\overline{JOB\%F}^2 - \Delta\overline{JOB\%F}^1) + (\theta'^2 - \theta'^1)\Delta\overline{JOB\%F}^1 +$$
$$+ \Phi'^2(\Delta\overline{X}^2 - \Delta\overline{X}^1) + (\Phi'^2 - \Phi'^1)\Delta\overline{X}^1$$

Where the Δ is the mean difference between women and men in a given period[4], and superscripts 1 and 2 indicate the first and the second period, respectively. This way it is possible to differentiate between the change due to the change of composition, i.e. the change of mean difference between women and men, and due to the change in the estimated coefficients.

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[4] For example: $\Delta\overline{w}^2 = \overline{w}_f^2 - \overline{w}_m^2$

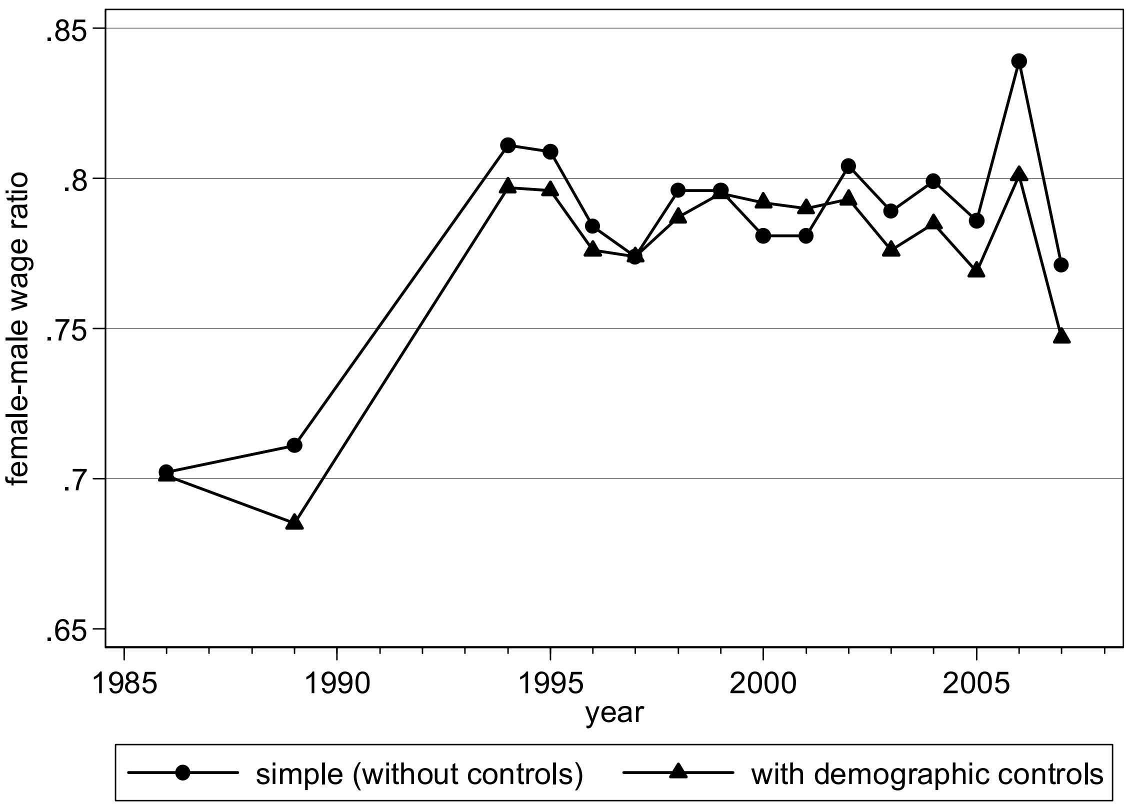
3 Results

In this chapter I present the results of the estimation methods described in the previous section.

3.1 Basic results

Figure 1 illustrates the dynamics of the gender wage gap between 1986 and 2007. The male-female wage ratio is computed as $1 + \beta'$, where β' is the estimated coefficient of the female dummy in variations of equation (1). (β' is negative.) All the estimated coefficients are significant at the one percent significance level and are reported in Appendix 1.

Figure 1. The Gender Wage Gap in Hungary 1986-2007



Source: Own calculations

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For the simple line I used the coefficient from an equation with only a female dummy:

$$w_p = \alpha + \beta F_p + \epsilon_p \qquad (4)$$

The coefficient from equation (4) measures the simple difference between the mean of the logarithm of the real wage of women and men $\left(\frac{\bar{w}_f}{\bar{w}_m}\right)$. From the graph we can see that the gender wage gap decreased significantly after the transition from a socialist system to market economy, although between 1994 and 2007 it followed a slightly increasing trend.

My results are very similar to those reported by Csillag (2004) in Table 1. Interestingly, compared to the same results for the US, these female-male wage ratios are significantly higher in all examined years. In the United States the gender wage gap decreased since the mid 70's, but in 1999 the female-male wage ratio was still 76.5% (Blau and Kahn 2000, Figure 1, page 76.) A possible explanation for this difference can be that, during the socialist system the Hungarian wage distribution was artificially compressed, and after the transition many women exited from the labor force, so labor force participation rates of women differ between Hungary and the US (KSH 2010a and BLS 2010). Lower labor force participation rate in Hungary means that women with potential lower wages exited from the labor market, so the decrease of the wage gap is partially due to selection of working women. This trend was observed in other transition countries as well (Hunt 2002).

For computing the line with demographic controls, I used the coefficient from a wage equation with simple demographic controls (experience, experience squared/100, highest education and Budapest dummies):

$$w_p = \alpha + \beta F_p + \Phi X_p + \epsilon_p \qquad (5)$$

This line represents the ratio of mean wage between men and women with the same educational level, experience and location (Budapest or not). This line follows exactly the same dynamics as the simple line, but the wage gap measured this way is higher in most cases (the female-male wage ratio is lower except in 2000 and 2001). These results mean that the

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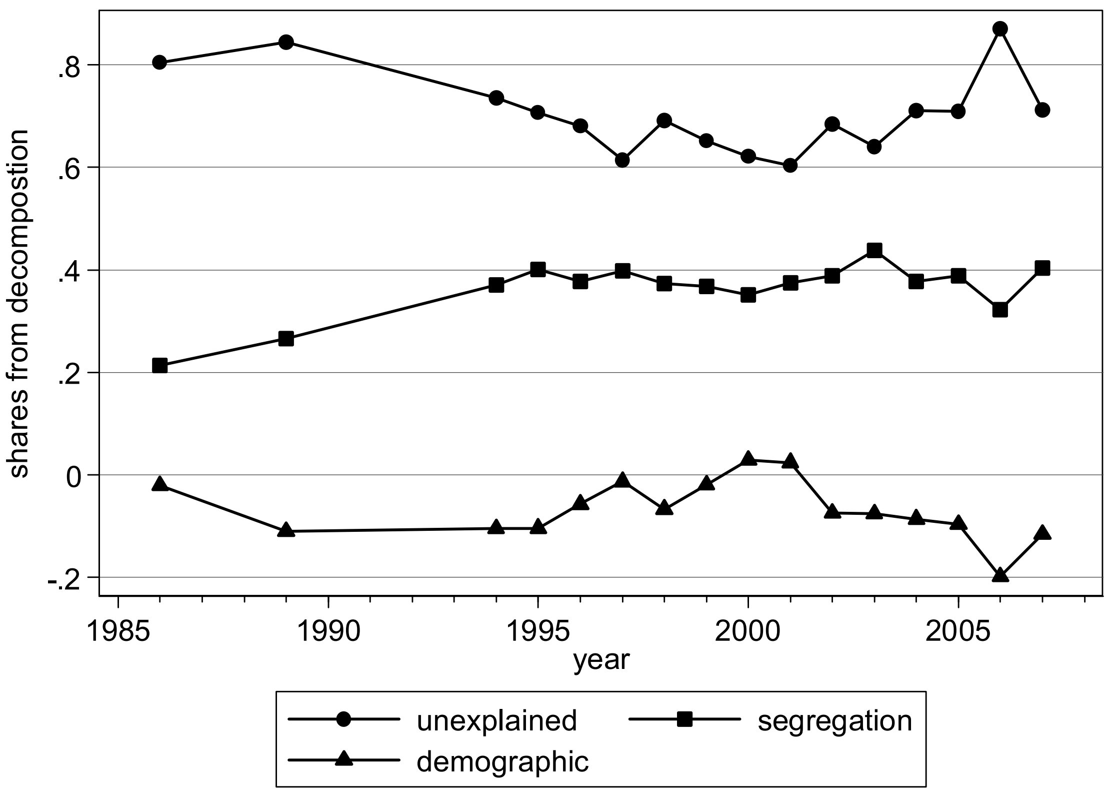
demographic composition of women actually lowers the wage difference. Women are more educated on average, and there are more women in Budapest where wages are higher. I will show this in the next section quantitatively as well using decomposition. This result is also consistent with the findings of Csillag (2004) and Galasi (2000).

3.2 Static decomposition

Using the estimated coefficients from equation (4) and equation (1) I calculated the relative share of the demographic and segregation variables for every year with the method described by equation (2) in Chapter 2. The results are shown in Figure 2. (The actual relative shares used to construct Figure 2 and 3 can be found in Appendix 2.)

Figure 2. The Decomposition of the Gender Wage Gap 1986-2007



Source: Own calculations

The *segregation* line represents the relative share of the total gender wage gap which is explained by the four variables that I used as measures of segregation. The relative share is

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computed as a ratio of the absolute share (the product of the estimated coefficient and the mean difference between women and men) and the raw wage gap [5]. From the graph it is easy to see that the effect of segregation increased significantly after the transition. In 1986 and 1989 the four different types of segregations explained around 20% from the gender wage difference, which increased to 40% and remained approximately constant between 1994 and 2007.

The *demographic* line shows the same relative shares of all the used demographic variables from the total wage difference. For most of the years the relative share is negative, which means that, as I mentioned it in the basic results section, in most years if we control for the demographic composition of women the gender wage difference decreases.

The third line represents the *unexplained* part of the total wage gap after controlling for segregation and the demographic factors. The graph shows that 60-80% of the total gender wage difference remains unexplained after controlling for segregation and some basic personal characteristics. This unexplained part is an upper bound measure of discrimination and is very high in all examined years. As suggested by the theory (Becker 1957), the unexplained part seem to decrease after the transition with the increase of market competition.

Besides labor market discrimination, this unexplained share of the gender wage gap contains all unobserved differences in productivity and in tastes between men and women (Altonji and Blank 1999). Because of limitations of the data, for example we can only use predicted workforce experience of the individuals. If we expect that women spend more time out of the labor force and their turnover is higher (they spend less time in the same firm), because they stay home with their children, then this difference will be included in the measured residual wage gap. Another problem with the data results from the fact that we cannot really measure hours of work for most occupations, because firms only include the

[5] For example the absolute share of the proportion female in the occupation is $\gamma'\left(\overline{OCC\%F_f} - \overline{OCC\%F_m}\right)$ and the relative share of it is computed as $\gamma'\left(\overline{OCC\%F_f} - \overline{OCC\%F_m}\right)/(\overline{w}_f - \overline{w}_m)$.

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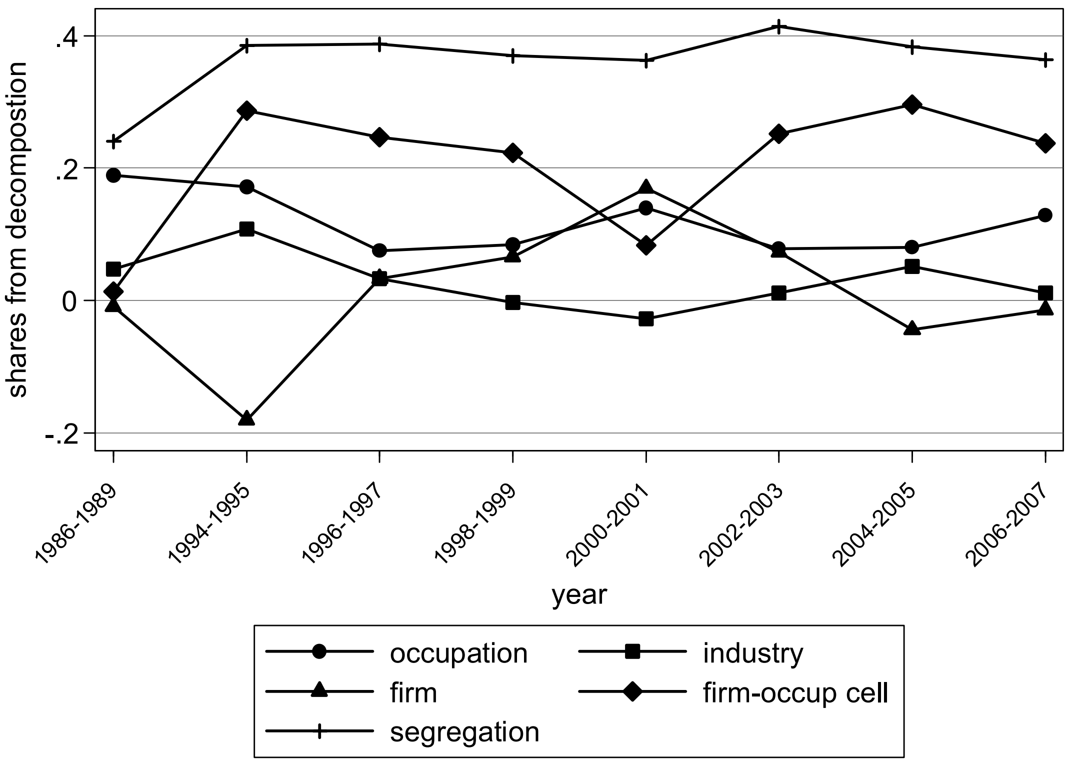
official or contracted hours in the questionnaire. If we assume that women tend to work less, then this difference can also be present in the unexplained share of the wage gap.

Figure 3 shows the decomposition of the total segregation effect (the *segregation* line in Figure 2 and in Figure 3). *Occupation* is the relative share of the proportion female in occupation variable from the total wage gap. *Industry* is the relative share of proportion female in the industry; *firm* is the relative contribution of the proportion female in firm and *firm-occup cell* shows the dynamics of the relative share of the proportion female in firm-occupation cell variable.

Figure 3. The Decomposition of the Segregation Effect (two year means) 1986-2007



Source: Own calculations

Unfortunately, the relative shares of the four different types of segregation variables, especially the effect of firm segregation, are quite heterogeneous across the years, so the figure is easier to read if data are grouped into two year intervals. (The original graph can be found in Appendix 3.) A possible explanation for the big variance can be that the sample of

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small firms included in the data change in every year, which can bring noise to the estimation results.

The graph shows that after the transition, the most important source of the total segregation effect is the firm-occupation cell segregation. This means that women are clustered in certain occupations *within* firms. It explains around 20-30% of the total gender wage difference, which is more than half of the whole segregation effect. This tendency is also supported by the descriptive statistics in Table 1.

The second most important factor is occupational segregation. It has a substantial effect in every year (at least 10%), including the socialist period as well. Industrial segregation seems to play a bigger role shortly after the transition and have a relatively smaller effect later on. Finally firm segregation changes in every period.

Table 2 shows the detailed results of the decomposition for the three selected years 1986, 1996 and 2006. In column 1 there is the estimated raw gender wage gap calculated from equation (4). In column 2 there are the results of estimating equation (1), the wage equation with demographic controls and the four segregation variables.

Column 3 shows the mean difference of the given variable between women and men. Column 4 is the absolute contribution of the variable to the total wage gap and Column 5 shows the relative contribution (column 4 divided by the raw wage gap).

The raw gender wage gap decreased from 1986 to 1996 and from 1996 to 2006 as well. While in 1986 women earned 29.8% less on average than men, this difference decreased to 16.1% by 2006. The decrease of the overall wage gap can be due to several factors. As I discussed it before, the composition change in terms of demographic factors actually favored women.

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Table 2. Results of the Decomposition for 1986, 1996 and 2006

	Coefficient estimate (1)	Coefficient estimate (2)	Mean difference Women-Men (3)	Absolute contribution to wage gap, (2)*(3) (4)	Relative contribution to wage gap (5)
1986					
Female	-0.298 (0.001)	-0.240 (0.001)	1.000	-0.240	0.805
Proportion female in occupation		-0.210 (0.004)	0.214	-0.045	0.151
Proportion female in industry		-0.131 (0.006)	0.093	-0.012	0.041
Proportion female in firm		0.022 (0.006)	0.123	0.003	-0.009
Proportion female in firm-occupation cell		-0.027 (0.004)	0.357	-0.009	0.032
Total segregation				*-0.063*	*0.215*
Experience		0.030 (0.000)	-1.075	-0.033	0.110
Experience squared/100		-0.048 (0.000)	-0.693	0.033	-0.111
Vocational school dummy		0.134 (0.001)	-0.177	-0.024	0.080
High school dummy		0.250 (0.001)	0.157	0.039	-0.132
University dummy		0.564 (0.002)	-0.026	-0.015	0.049
Budapest dummy		0.142 (0.001)	0.034	0.005	-0.016
Total demographic				*0.005*	*-0.020*
adjusted R^2	0.153	0.374			
1996					
Female	-0.216 (0.004)	-0.147 (0.005)	1.000	-0.147	0.681
Proportion female in occupation		-0.122 (0.012)	0.168	-0.020	0.095
Proportion female in industry		-0.091 (0.017)	0.146	-0.013	0.061
Proportion female in firm		0.006 (0.016)	0.218	0.001	-0.006
Proportion female in firm-occupation cell		-0.103 (0.011)	0.475	-0.049	0.227
Total segregation				*-0.081*	*0.377*

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Experience		0.026	-0.220	-0.006	0.027
		(0.001)			
Experience squared/100		-0.038	-0.206	0.008	-0.036
		(0.002)			
Vocational school dummy		0.159	-0.204	-0.032	0.150
		(0.004)			
High school dummy		0.444	0.153	0.068	-0.315
		(0.005)			
University dummy		1.039	-0.031	-0.033	0.151
		(0.008)			
Budapest dummy		0.194	0.038	0.007	-0.034
		(0.004)			
Total demographic				*0.012*	*-0.057*
adjusted R^2	0.037	0.379			
2006					
Female	-0.161	-0.140	1.000	-0.140	0.870
	(0.005)	(0.006)			
Proportion female in occupation		-0.200	0.143	-0.029	0.178
		(0.014)			
Proportion female in industry		-0.110	0.140	-0.015	0.096
		(0.018)			
Proportion female in firm		0.091	0.271	0.025	-0.153
		(0.016)			
Proportion female in firm-occupation cell		-0.085	0.514	-0.044	0.203
		(0.012)			
Total segregation				*-0.063*	*0.324*
experience		0.026	-0.698	-0.018	0.084
		(0.001)			
experience squared/100		-0.044	-0.366	0.016	-0.075
		(0.002)			
vocational school dummy		0.103	-0.175	-0.018	0.083
		(0.005)			
high school dummy		0.428	0.116	0.050	-0.230
		(0.006)			
university dummy		1.112	0.008	0.009	-0.041
		(0.008)			
Budapest dummy		0.135	0.031	0.004	-0.020
		(0.006)			
Total demographic				*0.043*	*-0.199*
adjusted R^2	0.016	0.357			

Source: Own calculations

Note: All reported coefficients are significant at a 1% level except the share of women in the firm in 1996. Robust standard errors in parentheses.

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Another possible cause can be that, as I mentioned before, after the transition many female workers became inactive. In 1986 the labor force participation rate among working age women was 74,6% (based on KSH 1987 table 4.1 page 51), in 1996 it was 57.6% (based on KSH 2006 table 1.2 page 25 and table 4.1 page 179) and for 2006 it declined to 54.5% (KSH 2010b).

The decrease of the female workforce was not random; women with lower wages were more likely to choose to stay at home (Hunt 2002). This selection can explain at least part of the decrease in the wage gap. To be able to control for the bias caused by this selection, I need some variables connected to the participation decision on the labor market, such as number of (small) children and marital status. Unfortunately my dataset has a limited number of demographic variables, so I could not control for labor force participation in my analysis.

The unexplained part of the gender wage gap (the effect of the female dummy) is very high in all three years. Even in 2006 87% of the total wage difference remains unexplained after controlling for the demographic characteristics and segregation. These high unexplained shares mean that the main source of the wage difference is not segregation in Hungary, and definitely not explained by demographical differences between men and women (the total demographic effect decreases the wage gap in all three years). We cannot claim that all of the unexplained difference is due to discrimination in the labor market against women, but the effects of possible discriminative practices are included in this unexplained part.

These estimated high unexplained shares are consistent with results reported for the US, Bayard et al (2003) got a 51.4% unexplained share for 1990 (Table 4 panel B, page 903); and for Hungary, Csillag (2004) got 64.1% for 1986, 58.5% for 1995 and 61.2% for 2002 (computed from Table 5, page 14). Jurajda (2003) also got similarly large unexplained shares for the Czech Republic (40% for 1998 in the public sector) and for Slovakia as well (60% for

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1998 in the public sector). (The estimated gender wage gap is also similar to the Hungarian results.) However, my estimated unexplained shares are significantly higher for all years.

Studies using similar methodology to the one presented in this paper for Western-European countries got contradicting results. Datta Gupta and Rothstein (2005) got much lower unexplained shares using 1983 and 1995 data for Denmark. According to their results the majority (more than two third) of the gender wage gap is due to the different segregation effects. (The estimated wage gaps are also much higher, than the ones observed in other countries. The female-male wage gap is 38.6% in 1983, and 34.1% in 1995.) On the other hand, Amuardo-Dorantes and De la Rica (2006), who did similar analysis for Spain using data from 1995 and 2002, found that segregation only explains a small part of the gender wage difference, 19% in 1995 and 14% in 2002. (The total wage gap is lower in Spain in both years, than the one observed in Hungary.) This heterogeneity of the results suggests that there are big differences between countries. There are only a limited number of studies on the topic, but it seems to be the case that the results for the post transition region are quite similar to each other, and they are closer to the US results, than the estimates for Western-European countries.

The dynamics of the four segregation variables are the same as discussed bellow Figure 3. The share of female workers in the occupation explains 15.1% in 1986, 9.5% in 1996 and 17.8% in 2006 from the total wage difference. In terms of absolute contribution, this means that women earn 4.5%, 2% and 2.9% less on average than men, because they tend to work in occupations where the ratio of female workers is higher.

According to this result, occupations where females are overrepresented tend pay lower wages. This segregation effect does not necessarily means, that women and men do not have same opportunities on the labor market. One possible explanation can be that women simply *choose* to work in these occupations for some reason other than wages. For example,

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these occupations might mean more flexible hours or better working conditions. This explanation is based on the theory of compensating wage differences (Filer 1985, Altonji and Blank 1999), which says that people are willing to accept lower paid jobs with better working conditions. Using this argument, segregation can be explained by differences in tastes regarding working conditions between the sexes. Macpherson and Hirsh (1995) found that after controlling for several occupational characteristics, the negative effect of the share of female workers in the occupation decreased significantly (about one third). This finding supports the compensating wage differences argument.

Another interesting possible cause is the “differences in comparative advantage” between men and women (Altonji and Blank 1999). For example, men are stronger, so they can have a comparative advantage in some occupations which require physical strength, therefore more men will work in these occupations than women. The above arguments can be valid explanations for all four types of segregations.

The relative share of the proportion female in industry variable is relatively small and increasing (from 4.1-9.6%), while the absolute contribution remains very similar around 1-1.5% in all three years. The relative share of firm segregation effect is *decreasing* the gender wage gap with a very small amount in all three years.

Finally the share of the proportion female in the firm-occupation cell variable is small in 1986, but the highest in 1996 and 2006. According to the estimation results within firms women are clustered in occupations with a 4.9% and 4.4% lower average wage in 1996 and 2006.

My estimations for the relative share of the different types of segregations are quite different from the US results. Occupational and within firm-occupation cell segregation plays a much higher role in Hungary than in the United States. Bayard et al (2003) got a relative

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share of 5% for occupational and 14.1% for job cell segregation for 1990, while industrial and firm level segregation account for a much higher share of the gender wage gap in their results.

My estimated shares for occupational and firm segregation are much lower than the results of Csillag (2004), but we used different methods for the decomposition and he totally neglected the effect of industries in his paper.

Occupational and within job cell segregation seem to be the most important factors in all examined European countries (Datta Gupta and Rothstein, 2005, Amuardo-Dorantes and De la Rica 2006, Jurajda 2003), and the estimated relative effects are close in magnitude to the results for the Czech Republic and for Slovakia. Jurajda (2003) got a relative share for occupational segregation of 11.8% for the Czech Republic, and 10.9% for Slovakia in 1998. The same numbers for segregation within a firm-occupation cell were 29.2% and 13% respectively. In comparison, in 1998 in Hungary the relative share of occupational segregation was 9.1% and the relative effect of firm-occupation cell segregation was 19.6% (Appendix 2).

The effects of the demographic variables are discussed in detail above, and we can see the similar results from Table 2 as well. In 1986 and 1996 the high school dummy and the Budapest dummy lowers the gender wage difference (the other demographic controls increase it, but the overall effect is still negative on the gap.) In these two years there are more high school graduates among women therefore their wages are higher and there are more women working in the capital which also means higher wages. In addition to these two effects, in 2006 the share of female university graduates exceeds the same share of males. This educational composition change also lowers the gender wage difference. If we add up the relative contribution of all demographic variables, we get that these factors together *decrease* the total wage gap by 2% in 1986, by 5.7% in 1996 and by 19.9% in 2006. This tendency can explain partially the decreasing female-male relative wage during this period.

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3.3 Dynamic decomposition

In Table 3, I present the results of the dynamic decomposition using the method discussed in the second chapter (equation (3)). I will only present the results for the unexplained part and the four segregation variables, but the detailed results with all computed changes can be found in Appendix 4.

In the first column there is the change of the gender wage gap between the two examined years $\Delta\bar{w}^{1996} - \Delta\bar{w}^{1986}$ and $\Delta\bar{w}^{2006} - \Delta\bar{w}^{1996}$ respectively. Because the wage gap is negative, a positive change actually means a decrease in the gender wage difference in absolute terms. We can see (consistently with the previous results) that the raw wage gap decreased between every two years. The following columns contain information about the factors behind this change.

Column 2 contains the absolute share of the total gender wage gap change, which is explained by the change of the estimated coefficients from equation (1). The absolute share of the coefficient change is for example $(\gamma'^2 - \gamma'^1)\Delta\overline{OCC\%F}^1$ for the *proportion female in occupation* variable (the two separate parts of the product are not included in the table, see Appendix 4. for details). Column 3 shows the same absolute effect explained by the change of the mean difference between women and men, where the absolute share of the mean difference change is for example $\gamma'^2(\Delta\overline{OCC\%F}^2 - \Delta\overline{OCC\%F}^1)$. Finally Columns 5 and 6 contain the relative contribution of the change in the coefficient, $\frac{(\gamma'^2-\gamma'^1)\Delta\overline{OCC\%F}^1}{\Delta\bar{w}^2-\Delta\bar{w}^1}$ (to follow the previous example), and the relative contribution of the change in the mean difference, $\frac{\gamma'^2(\Delta\overline{OCC\%F}^2-\Delta\overline{OCC\%F}^1)}{\Delta\bar{w}^2-\Delta\bar{w}^1}$, respectively.

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Table 3. Decomposition of change

	Change of the wage gap (1)	Absolute: explained by coefficient change (2)	Absolute: explained by change of mean difference (3)	Absolute: total (2)+(3) (4)	Relative: explained by coefficient change (5)	Relative: explained by change of mean difference (6)	Relative: total (5)+(6) (7)
1986-1996							
Female	0.082	0.093			1.134		
Proportion female in occupation		0.019	0.006	0.025	0.230	0.068	0.298
Proportion female in industry		0.004	-0.005	-0.001	0.046	-0.059	-0.013
Proportion female in firm		-0.002	0.001	-0.001	-0.025	0.006	-0.019
Proportion female in firm-occupation cell		-0.027	-0.012	-0.039	-0.333	-0.148	-0.481
Total segregation		*-0.006*	*-0.010*	*-0.016*	*-0.082*	*-0.133*	*-0.215*
1996-2006							
Female	0.055	0.007			0.127		
Proportion female in occupation		-0.013	0.005	-0.008	-0.238	0.091	-0.147
Proportion female in industry		-0.003	0.001	-0.002	-0.051	0.012	-0.039
Proportion female in firm		0.019	0.005	0.024	0.338	0.087	0.425
Proportion female in firm-occupation cell		0.008	-0.003	0.005	0.153	-0.060	0.093
Total segregation		*0.011*	*0.008*	*0.019*	*0.202*	*0.13*	*0.332*

Source: Own calculations

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A positive absolute and relative contribution means that the change of the coefficient "increased the decline" of the wage gap. The variable with a *positive absolute and relative share* actually *decreased* the female-male wage difference. From the table we can see, that between 1986 and 1996 all the effects of the proportion female in occupation variable are positive, so both the change in the "price" (effect of coefficient change) of occupational segregation and the change of the difference between women and men contributed to the decline of the gender wage difference in this period.

The effects of the other three variables are negative, so between 1986 and 1996 industrial, firm and firm-occupation segregation narrowed the gender wage difference. The negative share in the case of the proportion female in industry is driven by the change in the mean difference and in the case of proportion female in firm by the change in the coefficient. For proportion female in the firm-occupation cell both effects are negative and it has a largest relative contribution (in absolute terms) -48.1% among all the segregation variables. The unexplained part (the effect of the female dummy) is more than the simple wage gap change which means, that if the segregation and the demographic composition of the population had remained unchanged, the wage gap would have decreased more between these two years.

The above results for 1986 and 1996 contradict the findings of Galasi (2000), who found that broadly defined occupation actually decreased the gender wage gap during this same period. This contradiction can be due to the different definition of occupation and to the differences in the used methodology and data.

The results for the change between 1996 and 2006 are very different. The signs of the measured effects changed in almost every case, and the magnitudes are different as well. The most striking difference of all is that the joint effect of the segregation variables actually contributes to the decline of the gender wage difference between these two years.

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Conclusion

In my thesis I examined the change and composition of the female-male wage differences in Hungary between 1986 and 2007. Using similar methodology to Bayard et al (2003) I decomposed the total gender wage difference into the effect of occupational, industrial, firm and firm-occupation cell segregation and the effect of demographical differences between the two sexes.

The main drawback of my analysis is, that due to unavailable data, I was not able to control for selection of women into the labor market. In transition countries the labor force participation rate of women dropped significantly after the transition (KSH 1987, KSH 2010b, Hunt 2002), which lead to the selection of working women (only women with higher potential wage remained in the labor market). It is also possible, that at least a part of the cross-country differences of the results can be explained by the different labor force participation rates of women across countries (for illustration see Datta Gupta and Rothstein Figure 1 in page 4).

According to my results demographical characteristics, such as education, potential experience and location, only explain a relatively small part of the total wage difference; and the aggregated demographical effect actually decreases the total wage gap in most years. These results are consistent with the findings of Galasi (2000) and Csillag (2004).

My estimations also suggest that segregation has a significant and increasing role in the gender wage difference in Hungary. During the socialist system about 20% of the total wage gap was explained by the four types of segregation effect, while after the transition this ratio increased to 40% and remained approximately constant across the years. These findings are similar to the ones from Jurajda (2003) for the Czech Republic and Slovakia and there are similarities with the US results as well. However the two studies using similar methodology for Spain (Amuardo-Dorantes and De la Rica 2006) and Denmark (Datta Gupta and D. S.

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Rothstein 2005) have very different conclusions. Csillag (2004) measured much higher effects for occupational and firm segregation for Hungary.

After controlling for demographic variables and segregation, still a large part (60-80%) of the Hungarian gender wage gap remains unexplained. This unexplained part can be an upper bound measure of discrimination, although it is true that besides labor market discrimination, it contains all the unobserved group differences in tastes and in productivity between men and women as well (Altonji and Blank1999). Because of some problems with the data discussed above, gender differences in actual experience, tenure and hours worked can also be reflected in this unexplained gap.

Nevertheless even if we handle the results of this paper with caution, we can conclude that "equal pay for equal job policies" could improve the situation of women in the Hungarian labor market and, although its importance is large, the main factor behind the gender wage gap is not segregation of women.

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Appendices

Appendix 1. Coefficients used in Figure 1

year	just female dummy	demographic controls
1986	-0.298	-0.299
1989	-0.289	-0.315
1994	-0.189	-0.203
1995	-0.191	-0.204
1996	-0.216	-0.224
1997	-0.226	-0.226
1998	-0.204	-0.213
1999	-0.204	-0.205
2000	-0.219	-0.208
2001	-0.219	-0.210
2002	-0.196	-0.207
2003	-0.211	-0.224
2004	-0.201	-0.215
2005	-0.214	-0.231
2006	-0.161	-0.199
2007	-0.229	-0.253

Source: Own calculations

Appendix 2. Shares shown in Figure 2 and 3

year	unexplained	demographic	segregation				
			occupation	industry	firm	firm-occupation cell	total
1986	0.805	-0.021	0.151	0.041	-0.009	0.032	0.214
1989	0.844	-0.110	0.227	0.053	-0.009	-0.005	0.266
1994	0.735	-0.105	0.144	0.088	-0.198	0.337	0.370
1995	0.707	-0.104	0.200	0.127	-0.163	0.236	0.401
1996	0.681	-0.057	0.095	0.061	-0.006	0.227	0.377
1997	0.615	-0.013	0.054	0.005	0.072	0.267	0.398
1998	0.691	-0.067	0.091	0.019	0.067	0.196	0.373
1999	0.652	-0.019	0.077	-0.025	0.066	0.250	0.368
2000	0.621	0.029	0.161	-0.043	0.178	0.055	0.351
2001	0.603	0.024	0.117	-0.014	0.161	0.110	0.375
2002	0.684	-0.074	0.081	0.026	0.021	0.261	0.389
2003	0.640	-0.076	0.075	-0.004	0.125	0.241	0.438
2004	0.711	-0.086	0.059	0.091	-0.088	0.317	0.378
2005	0.711	-0.096	0.101	0.012	0.000	0.275	0.388
2006	0.710	-0.198	0.178	0.096	-0.153	0.203	0.323
2007	0.870	-0.116	0.080	-0.073	0.125	0.271	0.403

Source: Own calculations

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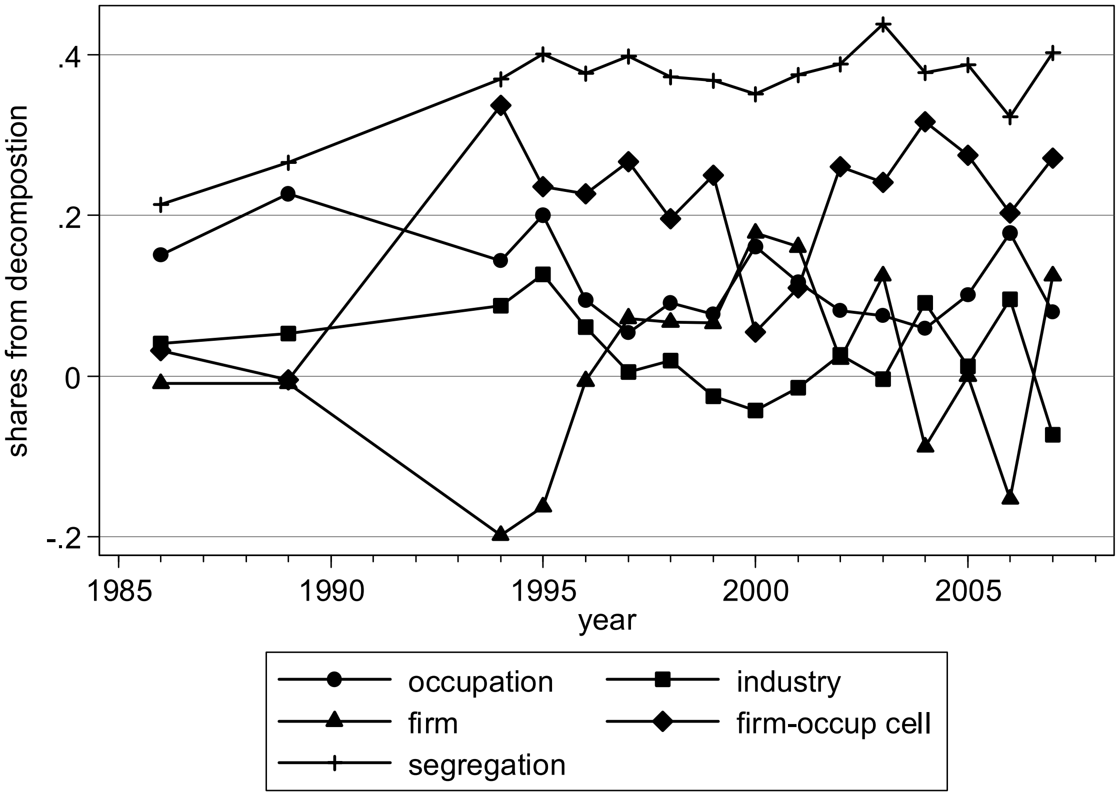
Appendix 3. The decomposition of the segregation effect 1986-2007



Source: Own calculations

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Appendix 4. Decomposition of change, detailed results

	change of the wage gap	change of coefficient	mean difference in the base period	explained by coefficient change		change of the mean difference	coefficient in the second period	explained by change of mean difference	
				absolute	relative			absolute	relative
	(1)	(2)	(3)	(2)*(3)=(4)	(5)	(6)	(7)	(6)*(7)=(8)	(9)
1986-1996									
Female	0.082	0.093		0.093	1.134				
Proportion female in occupation		0.088	0.214	0.019	0.230	-0.046	-0.122	0.006	0.068
Proportion female in industry		0.040	0.093	0.004	0.046	0.053	-0.091	-0.005	-0.059
Proportion female in firm		-0.016	0.123	-0.002	-0.025	0.095	0.005	0.001	0.006
Proportion female in firm-occup. cell		-0.076	0.357	-0.027	-0.333	0.118	-0.103	-0.012	-0.148
Experience		-0.004	-1.075	0.005	0.056	0.855	0.026	0.022	0.272
Experience squared/100		0.010	-0.693	-0.007	-0.083	0.487	-0.038	-0.018	-0.225
Vocational school dummy		0.025	-0.177	-0.004	-0.054	-0.027	0.159	-0.004	-0.052
High school dummy		0.194	0.157	0.030	0.371	-0.004	0.444	-0.002	-0.022
University dummy		0.475	-0.026	-0.012	-0.149	-0.006	1.039	-0.006	-0.071
Budapest dummy		0.052	0.034	0.002	0.021	0.004	0.194	0.001	0.010
1996-2006									
Female	0.055	0.007		0.007	0.127				
Proportion female in occupation		-0.078	0.168	-0.013	-0.238	-0.025	-0.200	0.005	0.091
Proportion female in industry		-0.019	0.146	-0.003	-0.051	-0.006	-0.110	0.001	0.012
Proportion female in firm		0.085	0.218	0.019	0.338	0.053	0.091	0.005	0.087
Proportion female in firm-occup. cell		0.018	0.475	0.008	0.153	0.039	-0.085	-0.003	-0.060
Experience		0.000	-0.220	0.000	0.000	-0.478	0.026	-0.012	-0.226
Experience squared/100		-0.006	-0.206	0.001	0.023	-0.16	-0.044	0.007	0.128
Vocational school dummy		-0.056	-0.204	0.011	0.208	0.029	0.103	0.003	0.054
High school dummy		-0.016	0.153	-0.002	-0.045	-0.037	0.428	-0.016	-0.288
University dummy		0.073	-0.031	-0.002	-0.042	0.039	1.112	0.044	0.796
Budapest dummy		-0.059	0.038	-0.002	-0.041	-0.007	0.135	-0.001	-0.016

Source: Own calculations

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