Occupational Gender Segregation in the Czech Republic[*]

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Abstract

We use labor force survey data to provide a detailed description and an international comparison of the level and structure of occupational gender segregation in the Czech Republic during 1994–2004. Based on 1999 data, we find Czech occupational segregation to be close to the EU average, with the exception of young, highly educated Czech workers, who faced relatively high segregation. However, segregation has declined rapidly for young workers since 1999, mainly due to the increased representation of women within occupations, not the changing occupational structure.

1. Introduction

One of the most clearly established labor-market 'gender' facts is that women and men tend to concentrate in different occupations and industries. This is an important concern because those occupations and industries staffed mainly with female workers typically pay lower wages to both men and women compared to predominantly 'male' occupations and industries. The observed persistent concentration of women in low-paid groups of workers, referred to as *gender segregation*, is therefore a key explanation for the existence of the gender wage gap.

The differential concentration of women in certain types of employment could be a matter of gender-specific preferences and choice. It could also be the result of gender stereotyping or discrimination. To the extent that the observed unbalanced gender employment pattern is the consequence of unequal access to certain types of occupations, anti-discrimination legislation is aimed at reducing it. Standard equal employment opportunity clauses now aim to reduce all forms of segregation resulting from potentially discriminatory hiring, firing, and promotion practices even in post-communist countries, where such legislation has been introduced only recently.

However, there is only little evidence available on the extent, structure and evolution of gender segregation in post-communist economies. In this paper, we fill this knowledge gap for the Czech Republic. We do not attempt to differentiate between the discrimination-related and choice-driven explanations of segregation. Still, descriptive evidence on segregation is an important first step towards such under-

standing and for guiding anti-discrimination policies. Measuring occupational se-gregation provides us with an important indicator of women's economic status in the labor market.

We start the exposition in the next section by briefly going over the main hy-potheses offered for the existence of gender segregation and by summarizing the exist-ing empirical research on this topic. Next, we provide gender employment accounting based on the Labor Force Survey that allows us to (a) shed light on the gender-specific sources of the relatively high employment level in the Czech Republic, (b) compa-re the level of Czech occupational segregation to that of the EU-15 countries, and (c) study the demographic structure of segregation. Our analysis is perhaps particularly interesting when focused on the group of young workers who have started their careers since the fall of communism and could therefore be facing a different set of gender attitudes.

2. Background

There are now several studies documenting the extent, structure and evolution of gender segregation in many developed and some developing economies.[1] How-ever, most of the evidence comes from the US, where Blau et al. (1998) find a de-creasing degree of gender differences in employment patters during the 1980s and early 1990s. The main source of this decline in segregation is the changing repre-sentation of women within occupations, not a diminishing importance of typically 'male' occupations.

Dolado et al. (2002) offer the first comprehensive comparison of US segrega-tion patterns to those present in the EU-15 countries. They find that segregation in Europe is decreasing among workers with higher education while it is stable for the less educated. Looking across the Atlantic, segregation appears to be somewhat higher in Europe than in the US for highly educated workers.

Two fundamentally different hypotheses are offered in the economics lite-rature for why women concentrate in certain occupations. Both also aim to explain why predominantly 'female' occupations pay less.[2] First, discriminating employers may prevent women from working in high-wage occupations.[3] Second, 'female' oc-cupations may offer costly non-wage characteristics preferred (mainly) by women, such as flexible working hours.

Little economics research explores the second explanation directly.[4] However, there are several studies that try to differentiate between the two hypotheses indi-rectly, based on estimating models of wage determination. Wage-structure research

[1] Fortin and Huberman (2002) cover Canada, Oliveira (2001) Brazil, Lewis (1985) Australia. Typically, the evolution of gender segregation is measured on the background of increasing female labor-market par-ticipation.
[2] For a broader discussion of the alternative theories of segregation, see (Anker, 1997) or (Miller et al., 2004).
[3] Why then are wages lower for men in 'female' occupations? One theory contends that workers of both genders employed in 'female' occupations may be less productive. If women are discouraged from enter-ing high-wage occupations by discriminatory barriers, then only highly productive women will enter the ty-pically 'male' occupations. The proportion of the female workforce then becomes an index of labor quality and only less productive men join the 'female' occupations.
[4] However, see (Filer, 1986) for an early study.

based on US and Canadian data established the existence of a 'penalty' for working in 'female' occupations and has also shown that the size of the 'penalty' decreases significantly after controlling for occupational attributes and/or unmeasured worker preferences and productivity (Macpherson, Hirsh, 1995), (Baker, Fortin, 2001). This would suggest that occupational gender segregation in the US is to a large extent driven by preferences, not discrimination.

Recently, the importance of occupational segregation for the wages of both men and women has been quantified even in post-communist economies. Unfortunately, these studies typically do not attempt to disentangle the two fundamental causes of segregation.[5] Jurajda and Harmgart (2007) are an exception in this regard; their results are consistent with the presence of little discriminatory segregation in east Germany in the early 1990s.

3. Gender Structure of the Czech Population and Employment

Before we focus on the Czech occupational gender segregation patterns, it is useful to put the gender structure of Czech employment into international perspective.[6] In this section, we therefore first compare the gender composition of the Czech population and employment to those of the EU-15 and the US and ask to what extent such compositional differences account for the aggregate employment differences between the Czech Republic and developed countries.[7]

Specifically, we use the Czech Labor Force Survey and divide the population into groups defined by gender, age (16–24, 25–54, and 55–64) and education (less than tertiary level and tertiary level[8]). We then compare the population shares and employment rates of these groups in the Czech Republic to those estimated based on similar data for the EU and US by Dolado et al. (2002). These comparisons are based on 1999 data. Not surprisingly, the Czech population is unusual in its low share of those with tertiary education in the age groups 16–24 and 25–54. Comparing genders, there is a somewhat lower population share of Czech females with tertiary education compared to Czech males within older groups. The international comparison of employment rates of demographic groups suggests that the employment rate of women aged 55–64 with less than a tertiary level of education is lower in the Czech Republic (at 20 %) than in both the EU-15 (25 %) and especially the US (48 %). On the other hand, the employment rate of women aged 25–54 with less than tertiary education is higher in the Czech Republic (73 %) than both in the EU (60 %) and the US (71 %).[9]

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[5] While Ogloblin (1999) suggests that much of the observed gender wage gap in Russia in the early 1990s can be linked to occupational segregation, Jurajda (2003) implies that only about one-third of the Czech and Slovak employee gender pay gap is related to the unequal representation of women across occupations and firms.

[6] See, e.g., (OECD, 2002) and (Jurajda, Harmgart, 2007) for arguments why cross-country differences in employment rates of less-educated women may be driving much of the observed cross-country difference in gender wage gaps, occupational segregation, and the wage 'penalty' for working in 'female' occupations.

[7] The employment level is captured using the employment rate, i.e. the share of employed workers in the total population size in working age (16-–64).

[8] Tertiary education corresponds to ISCED levels 5 and 6.

[9] Detailed results can be found in (Jurajda, Franta, 2006).

TABLE 1 Decomposition of the 5.24 Percentage Point Difference in Aggregate Employ-
ment Rates between the Czech Republic (67.1 %) and the EU (61.9 %), 1999

Age/	Contribution of differences in population shares (%)		Contribution of differences in employment rates (%)	
Educational attainment	**Males**	**Females**	**Males**	**Females**
16–24				
Tertiary level	-3.8	-5.7	0.2	0.4
Less than tertiary level	15.6	11.2	17.4	6.9
25–54				
Tertiary level	-54.7	-54.5	3.3	0.5
Less than tertiary level	48.2	33.1	22.1	72.5
55–64				
Tertiary level	-6.6	-2.43	2.3	0.9
Less than tertiary level	-5.57	-2.9	7.7	-5.9
Total of the gap explained				
% explained	-6.87	-21.23	53.0	75.3
gap explained	-0.36	-1.11	2.78	3.95

Note: EU denotes the EU-15, excluding Ireland.

Sources: Dolado et al. (2002) and the authors' own calculations based on the Czech Labor Force Survey

To quantify the role of these gender patterns for the aggregate employment dif-
ferential across countries, we follow Dolado et al. (2002) and decompose the employ-
ment rate differential between the Czech Republic and the EU in the following way:

$$e^{CZ} - e^{EU} = \sum_i e_i^{EU} \left(s_i^{CZ} - s_i^{EU} \right) + \sum_i s_i^{CZ} \left(e_i^{CZ} - e_i^{EU} \right)$$

where e^{CZ} and e^{EU} are the aggregate employment rates in the Czech Republic and in
the EU, respectively. The decomposition sums employment rates over the demo-
graphic groups, indexed by i, and weights the group-specific employment rates e_i with
the group-specific population share s_i. The decomposition allows us to distinguish a *po-
pulation composition effect*, which is driven by differences in population weights
(given the EU employment rates), and an *employment incidence effect*, which reflects
differences in employment rates (given the Czech population weights).

The decomposition of the employment rate differential between the Czech Re-
public and the EU-15 average is presented in *Table 1*. The 1999 Czech aggregate em-
ployment rate is over 5 percentage points higher than that of the EU-15 area from
the same year. The numbers in *Table 1* express the percentage share of a particular
effect on this aggregate differential. For example, the difference in the size of the male
population aged 25–54 with less than tertiary education between the Czech Republic
and the EU, given the EU employment rate for this subgroup, is responsible for
48.2 % of the total employment rate differential.

The bottom two rows of *Table 1* give the percentage and percentage point
summaries of each of the effects. The population-composition effects imply that if
the EU-15 and Czech population shares of demographic groups were to be equalized,
this would make the Czech/EU employment-rate gap increase by over 1.11 percen-
tage points for women and by 0.4 of a percentage point for men. The major part of
the observed aggregate difference between the EU-15 and Czech employment rates

can therefore be attributed to differences in employment rates of demographic groups, as the right panel of *Table 1* testifies. The most important source of the higher overall employment rate in the Czech Republic in comparison with the EU is then the higher employment rate of women aged 25–54 with less than a tertiary level of education, which alone 'explains' almost three-quarters of the aggregate gap. In sum, the main reason why the Czech Republic displays a higher employment level in 1999 than the EU-15 is because Czech men and particularly Czech women were more likely to be employed, not because the country had higher population shares of generally more employable workers.

In (Jurajda, Franta, 2006) we also provide a similar decomposition for the 1.7 percentage point drop in the Czech aggregate employment rate between 1999 and 2004. That is, we ask to what extent this drop is attributable to changes in population structure as opposed to employment rates of specific demographic groups. We find the gender gap in tertiary education to be somewhat narrowing during this period. Further, it is apparent that only the group of workers aged 55–64 with less than tertiary education managed to defy the overall trend of decreasing employment rates, which is particularly visible for women. The decomposition results imply that were employment rates of demographic groups to stay constant, the Czech aggregate employment rate would increase by 0.7 of a percentage point between 1999 and 2004 due to the increasing share of tertiary educated population. The single most important factor behind the observed drop in the aggregate employment rate then has to do with the rapidly declining employment rates for those aged 16–24 with less than a tertiary level of education, and this effect is stronger for men than for women. The bulk of this drop in employment in the youngest group is then related to increasing participation in education, especially for men.

4. "Female" and "Male" Occupations

In this section, we present a simple descriptive identification of the extent of gender-specific concentration of employment in specific occupations. It is not surprising that Czech females are more likely to be employed in clerical or sales and elementary occupations, while Czech males are more likely to be employed in manual or craft occupations and also in managerial occupations. In *Table 2a*, we offer more insight by providing an international comparison of the proportion of women on the employment of detailed occupational categories.[10]

Specifically, we compare the situation in the Czech Republic in 1994, 1999 and 2004 with the corresponding picture as of 2000 in Spain, Ireland, Belgium, Finland, Germany, and Switzerland. The occupational grouping corresponds to the ISCO-88 classification. Compared to these highly developed European countries, the proportion of women on an occupation's total workforce is much higher in the Czech Republic for craft workers, operators and laborers. This is not surprising given that the Czech labor force is relatively abundant in less-educated women (see the previous section). On the other hand, our international comparison suggests that Czech women are relatively under-represented among legislators and senior officials, and among general managers (managers of smaller companies).

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[10] The international data are based on country-specific Labor Force Surveys harmonized by and retrieved from www.lisproject.org. The choice of countries is dictated by data availability.

TABLE 2a International Comparison of the Percentage Share of Females in ISCO 88 Occupational Categories

	ISCO-88	Czech Republic			Spain	Ireland	Belgium	Finland	Germany	Switz.
		1994	1999	2004						
11	Legislators and senior officials	23	23	22	2	33	33	53	48	25
12	Corporate managers	23	30	31	36	19	15	26	25	29
13	General managers	26	22	27	42	30	9	54	29	78
21	Physical, mathematical and engineering professionals	22	20	19	15	28	21	18	13	8
22	Life science and health professionals	52	54	52	45	60	69	67	79	31
23	Teaching professionals	72	75	72	67	62	65	68	67	51
24	Other professionals	53	55	54	39	47	33	61	47	48
31	Physical and engineering associate professionals	26	18	19	29	16	10	11	30	25
32	Life science and health associate professionals	85	85	84	80	63	81	90	95	86
33	Teaching associate professionals	69	68	82	78	48	77		63	68
34	Other associate professionals	68	62	59	55	48	33	61	45	39
41	Office clerks	81	78	78	65	59	61	80	76	69
42	Customer service clerks	89	87	86	77	68	65	86	76	63
51	Personal and protective services workers	58	56	55	71	60	71	83	68	64
52	Models, salespersons and demonstrators	82	78	77	83	60	61	70	78	73
61	Market-oriented skilled agricultural workers	56	45	40	38	25	10	37	7	31
71	Extraction and building trade workers	2	1	1	5	2		3	1	4
72	Metal, machinery and related trades workers	7	6	5	4	3	1	6		9
73	Precision, handicraft, and printing trades workers	53	42	50	34	21	25	44	31	37
74	Other craft and related trades workers	68	64	54	31	48	24	44	5	28
81	Stationary plant and related operators	21	24	28	9	9	13	13	26	8
82	Machine operators and assemblers	61	53	55	32	25	16	50	45	32
83	Drivers and mobile plant operators	7	5	4	4	1	3	2	0	4
91	Sales and services elementary occupations	71	70	68	69	78	72	76	52	73
92	Agricultural and fishery laborers	61	57	53	41	35	21	33	13	44
93	Other Laborers	51	50	52	34	20	35	23	2	44

Notes: The figures correspond to the year 2000 except those for the Czech Republic.
An empty cell indicates that there were no data recorded in a particular occupational category of a national dataset.
Source: the authors' own calculations based on the Luxembourg Income Study and Czech Labor Force Survey

TABLE 2b International Comparison of the Percentage Share of Females in ISCO 88 Occupational Categories for the Employed Population Younger than 35

	ISCO-88	Czech Republic			Spain	Ireland	Belgium	Finland	Germany	Switz.
		1994	**1999**	**2004**						
11	Legislators and senior officials	27	30	43	35	38	38	28	51	23
12	Corporate managers	21	38	37	23	39	16	74	38	38
13	General managers	27	18	29				18		
21	Physical, mathematical and engineering professionals	25	16	12	41	28	20	72	24	9
22	Life science and health professionals	53	60	53	69	77	73	75	44	52
23	Teaching professionals	77	77	67	65	71	79	62	68	54
24	Other professionals	56	56	53	57	46	53	14	51	58
31	Physical and engineering associate professionals	28	18	16	21	44	27	90	34	26
32	Life science and health associate professionals	89	89	87	59		78		77	91
33	Teaching associate professionals	78	65	83	63		88		74	81
34	Other associate professionals	63	53	55	61	46	41	57	57	46
41	Office clerks	81	77	73	72	79	69	71	62	70
42	Customer service clerks	86	82	84	77	84	73	76	71	51
51	Personal and protective services workers	51	49	46	61	64	73	75	72	62
52	Models, salespersons and demonstrators	81	73	73	64	76	62	70	83	70
61	Market-oriented skilled agricultural workers	52	31	31	16	5	20	47	50	35
71	Extraction and building trade workers	1	1	0	2	2	2	4	6	3
72	Metal, machinery and related trades workers	7	5	5	5			7	4	9
73	Precision, handicraft, and printing trades workers	53	39	51	15	13	0	52	23	56
74	Other craft and related trades workers	69	59	47	60	4	20	47	34	30
81	Stationary plant and related operators	17	19	26	20	27	27	8	3	
82	Machine operators and assemblers	59	48	46	25	45	15	37	18	24
83	Drivers and mobile plant operators	6	3	2	1		10	2	2	6
91	Sales and services elementary occupations	75	67	61	72	44	78	65	47	66
92	Agricultural and fishery laborers	50	37	36	38	5		28	66	
93	Other Laborers	39	40	42	18	2	41	17	36	

Notes: The figures correspond to the year 2000 except those for the Czech Republic.
An empty cell indicates there were no data recorded in a particular occupational category of a national dataset.

Source: the authors' own calculations based on the Luxembourg Income Study and Czech Labor Force Survey

We are particularly interested in the experience of younger cohorts as these men and women started their careers after the breakdown of central planning and could therefore be facing a different set of factors and gender stereotypes in their occupational choices. Focusing on workers under the age of 35 in *Table 2b*, we again compare results across countries and find that the percentage shares of Czech women in the number of officials and general managers is now both higher and more comparable to the EU values than was the case with all age groups.[11] The share of Czech females in several low-skill occupations remains high even for young workers, however, except for drivers, even if it is lower than that observed for the older cohorts – a pattern similar to the EU-15 countries. When we shift attention from all workers to only the young ones, there is also a large drop in the relative share of Czech women (relative to the selected EU countries) on the group of physical, mathematical and engineering professionals.

An important caveat to these international comparisons is that female employment rates in the EU-15 countries are often propped up by a high incidence of part-time employment among women, while part-time work remains relatively rare in the Czech Republic.[12] Restating female labor-force participation in full-time equivalents would therefore make the high 1999 Czech level of female participation appear even higher in comparison to the EU-15; this may affect the occupation-specific comparisons as well.

5. Measures of Occupational Gender Segregation

Although the simple descriptive comparisons offered above are interesting, they do not allow us to make general quantified statements about the degree to which men and women are concentrated in different occupations. In order to compare the extent of segregation at the aggregate level over time as well as across countries, one obviously needs a composite summarizing index of segregation. In this study, we employ the Duncan segregation index, also referred to as the *Duncan index of dissimilarity,* introduced in (Duncan, Duncan, 1955). For a given year *t,* the index is defined as follows:

$$D_t = \frac{100}{2} * \sum_i \left| \frac{M_{i,t}}{M_t} - \frac{F_{i,t}}{F_t} \right|$$

where M_i denotes the number of males in an employment category *i*, F_i, is the corresponding number of females in group *i*, and where *M* and *F* represent the total number of males and females employed, respectively. The index consists of the sum of the group-specific absolute differences in the fraction of each gender employed in a given group, taken over all employment groups (in our case occupations). The index

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[11] The size of each data cell (of the number of young workers in each occupation group) is now sometimes small, possibly leading to imprecise estimates of the share of women in occupational employment. In (Jurajda, Franta, 2006) we therefore calculate 95% confidence intervals for the estimated 'female' shares and we conclude that the data still allow for a useful cross-country as well as time comparison. It is interesting to note that the share of Czech women among corporate managers in 2004 among those under the age of 35 is higher than the corresponding share estimated for workers of all age categories with more than 95% probability.

[12] The share of part-time jobs is above 2 % for Czech men and below 10 % for Czech women during 1994–2004.

TABLE 3 Duncan Segregation Index by Educational Level and Age Category, 1999 (%)

	Tertiary education			Less-than-tertiary education		
	25–34 years	35–44 years	45–54 years	25–34 years	35–44 years	45–54 years
Czech Republic (12)	39,3	39,4	42,9	47,4	51,8	49,1
EU-15	35,2	40,9	41,9	46,9	48,6	48,2
Portugal (9)	36,4	42,2	42,8	43,5	47,2	48,2
Italy (10)	30,3	34,3	46,1	39,8	40,3	41,4
Austria (14)	38,9	44,1	47,1	52,6	52,5	52,1
Greece (18)	32,4	33,2	31,8	43,5	42,8	44,7
Germany (23)	41,1	44,3	43,3	51,2	51,6	49,3
France (24)	35,7	39,1	39,5	52,1	52,5	51,6
Netherlands (24)	33,1	38,5	32,3	49,3	56,4	54,5
Spain (24)	37,0	43,1	49,5	50,2	47,2	51,7
UK (27)	35,3	47,6	51,1	49,9	56,7	57,8
Belgium (28)	35,1	34,6	43,3	44,7	55,7	56,3
Denmark (28)	44,5	56,4	53,3	50,1	57,3	58,0
Finland (33)	44,3	51,2	50,1	50,3	58,7	58,5
Sweden (33)	46,4	49,0	49,6	49,1	60,1	63,3
US (38)	31,4	36,0	42,3	49,6	49,1	50,9

Note: The numbers in parentheses indicate the percentage of the population which has attained tertiary education (2002).

Sources: Dolado et al. (2002), OECD and the authors' own calculations based on the Czech Labor Force Survey.

can be interpreted as reflecting the percentage share of the total workforce that would have to reallocate (change occupations) in order to equalize the gender composition across groups (occupations); it ranges between 100 (complete segregation) and 0 (complete integration).[13] Over time, both changes in the occupational mix of employment and changes in the gender composition of each occupation affect the overall degree of segregation captured by the index.

Table 3 offers our main international comparison of the overall level of segregation in the Czech Republic. *Table 3* lists the Duncan segregation index calculated for the Czech Republic and other EU countries in 1999, separately for those with tertiary and less-than-tertiary educational attainment and also by age group. The EU-15 estimates are taken from Dolado et al. (2002). In the interest of cross-country comparability, we follow the categorization of employment used in their study when calculating the Czech index of gender employment dissimilarity.[14] *Table 3* suggests that Czech segregation patterns are similar to those typical of an EU economy or the US: there is a higher level of segregation among older workers and for those with lower educational attainment.

[13] More discussion on the properties and interpretation of the Duncan index can be found in Tzannatos (1990).

[14] Dolado et al. (2002) consider 108 occupations by combining nine occupational groups and 12 industrial sectors. The occupations considered are executives, officials and managers; professionals; technicians and associate professionals; clerical personnel; sales and service workers; craft and related trade workers; manual workers; elementary occupations; and agricultural workers. The industrial sectors are agriculture; mining and quarrying; manufacturing; utilities; construction; trade and personal and social services; transportation; finance and real estate; public administration; education; health and social work; and household and domestic services.

However, the Czech structure of segregation is different from that of the EU-15 and the US in that it displays unusually high gender employment dissimilarity for those with a tertiary level of education aged 25–34 (as of 1999). While in most EU-15 countries, the extent of gender segregation is much lower for the younger tertiary educated than for middle-aged workers with tertiary education degrees, the Czech level of segregation across these two groups is almost identical. This is surprising also because the cross-country variability of segregation within the EU-15 is much lower for younger cohorts.[15]

We note that it may not be fully natural to compare the Czech aggregate segregation level to those of some of the EU-15 countries because these countries feature a different degree of employment participation among less-educated women. OECD (2002), an extensive cross-country study based largely on the European Community Household Panel, suggests that cross-country differences in female employment rates are mainly accounted for by the degree of integration of less--educated, lower-paid women into employment and that such compositional effects are important for explaining international differences in the gender pay gap as well as in the extent of segregation. Along similar lines, Dolado et al. (2002) suggest that the reason why gender segregation is highest in the Nordic countries is that they feature an unusually high female share on employment in traditionally 'female' occupations in education, health care, and social services; however, the fact that many women work in these occupations supports the high labor market participation of women in these countries. Countries with a higher degree of participation of less-educated women in employment, such as the Czech Republic, would therefore be expected to feature higher levels of a segregation index. This makes the Czech-EU segregation comparison somewhat more favorable for the Czech Republic.

Now that we have placed the Czech extent of segregation into international perspective, we ask about its evolution over time at the aggregate level, i.e. combining all of our main demographic groups. We present alternative segregation indices based on different types of employment categorization in order to assess the sensitivity of the estimated time change. As a matter of definition, segregation indices signal a higher level of gender dissimilarity when more detailed categories of employment (occupations) are considered. On the other hand, it is important to check whether different levels of aggregation signal different time evolution of segregation because a crude occupational classification could hide gender-related changes in employment across meaningfully different occupations in terms of detailed job description.

Table 4, which covers the time period 1994–2004, provides four calculations of the Duncan index based on four types of employment categorization. *Table 4* implies that occupational gender segregation in the Czech Republic has been declining slowly but steadily during the past decade, irrespective of how we categorize occupations. The degree of overall worker reallocation required to balance the gender composition of the chosen employment categories has declined by about 1 to 3 per-

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[15] We note that Jurajda and Harmgart (2007) also find that occupational gender segregation is relatively high for young workers in a post-communist economy when comparing east Germany to west Germany as of 1995.

TABLE 4 Duncan Segregation Index for the Czech Republic, 1994–2004 (%)

	1994	1995	1999	2000	2003	2004
Categorization 1	42,2	41,8	42,0	41,2	40,3	41,0
Categorization 2	54,4	53,7	53,4	52,7	51,9	51,4
Categorization 3	61,8	61,3	61,4	61,0	60,0	59,2
Categorization 4	53,7	52,9	53,0	52,4	51,8	51,0

Notes: Categorization 1: 4types of education (primary, secondary without maturita*, secondary with maturita, higher)
1-digit ISCO-88 occupational categorization

Categorization 2: 2types of education (less than tertiary and tertiary level)
2-digit ISCO-88 occupational categorization

Categorization 3: 2types of education (less than tertiary and tertiary level)
3-digit ISCO-88 occupational categorization

Categorization 4: 2-digit ISCO-88 occupational categorization

*Maturita is a secondary-school-leaving exam similar to the German Abitur or the British CGSE.

Source: the authors' own calculations based on the Czech Labor Force Survey

centage points. For example, if we measure the gender dissimilarity of employment using the 2-digit ISCO-88 (KZAM) categorization, the Duncan index of dissimilarity declines from 53.7 in 1994 to 51.0 in 2004.[16]

Next, we ask whether the small aggregate improvement in the gender balance of employment composition measured above is the result of an increase in the size of more gender-balanced occupations or whether it is the consequence of gender equalization within occupations. To this effect, we decompose the change in the segregation index between two years into a *gender-composition effect* within occupations, holding constant the size of occupations, and an *occupation-mix effect* (structural shift effect) due to changes in the occupational mix of the economy, holding gender composition within occupations constant.

Technically, this is carried out as follows. In order to distinguish between these two types of effects we compute a *standardized index of dissimilarity* (Das Gupta, 1987), which controls for the changing size of occupations. The index is defined for two years, denoted by *t* and *s,* as:

$$D_t^{\text{stand}} = 50 \sum_i \frac{\dfrac{T_{i,t}}{T_t} + \dfrac{T_{i,s}}{T_s}}{2} \left| \frac{P_{i,t}}{P_t} - \frac{Q_{i,t}}{Q_t} \right|$$

[16] When using very detailed occupational categories, such as a 3-digit occupational classification combined with two types of education, as we did in Table 4, the interpretation of the index as measuring the extent of worker reallocation required to reach a full gender balance is potentially compromised. This is because the measured proportion of men and women employed in these detailed categories becomes affected by sampling error as the size of the data in each employment cell decreases. As a consequence, the segregation index may not reach a value near zero (corresponding to complete integration) even if workers were assigned to occupations randomly. To appropriately benchmark the indices we present in *Table 4*, we therefore assigned the employees in our data their gender at random and calculated the resulting value of the index. We obtained near-zero index values and concluded that the finite size of occupational cells used in our study does not significantly affect the interpretation of the calculated segregation indices.

$$D_s^{\text{stand}} = 50\sum_i \frac{\dfrac{T_{i,t}}{T_t} + \dfrac{T_{i,s}}{T_s}}{2}\left|\frac{P_{i,s}}{P_s} - \frac{Q_{i,s}}{Q_s}\right|$$

$$T_{i,t} = M_{i,t} + F_{i,t} \qquad T_t = \sum_i T_{i,t} \qquad P_{i,t} = \frac{M_{i,t}}{T_{i,t}} \qquad Q_{i,t} = \frac{F_{i,t}}{T_{i,t}} = 1 - P_{i,t}$$

$$P_t = \frac{M_t}{T_t} \qquad Q_t = \frac{F_t}{T_t} = 1 - P_t$$

where M_{it} and F_{it} denote the number of males and females in an occupation category i for date t. The definition of formulas with the time subscript s is analogical.

To interpret the observed change in the Duncan index between 1999 and 1994 using the standardized index of dissimilarity, we decompose the time differential of the Duncan index in the following way:

$$D_{99} - D_{94} = 50\sum_i\left(\left|\frac{M_{i,99}}{M_{99}} - \frac{F_{i,99}}{F_{99}}\right| - \left|\frac{M_{i,94}}{M_{94}} - \frac{F_{i,94}}{F_{94}}\right|\right) =$$

$$= 50\sum_i\left(\frac{T_{i,99}}{T_{99}}\left|\frac{P_{i,99}}{P_{99}} - \frac{Q_{i,99}}{Q_{99}}\right| - \frac{T_{i,94}}{T_{94}}\left|\frac{P_{i,94}}{P_{94}} - \frac{Q_{i,94}}{Q_{i,94}}\right|\right) =$$

$$= 50\sum_i \frac{\left|\dfrac{P_{i,94}}{P_{94}} - \dfrac{Q_{i,94}}{Q_{94}}\right| + \left|\dfrac{P_{i,99}}{P_{99}} - \dfrac{Q_{i,99}}{Q_{99}}\right|}{2}\left(\frac{T_{i,99}}{T_{99}} - \frac{T_{i,94}}{T_{94}}\right)$$

$$+ 50\sum_i \frac{\dfrac{T_{i,94}}{T_{94}} + \dfrac{T_{i,99}}{T_{99}}}{2}\left(\left|\frac{P_{i,99}}{P_{99}} - \frac{Q_{i,99}}{Q_{99}}\right| - \left|\frac{P_{i,94}}{P_{94}} - \frac{Q_{i,94}}{Q_{94}}\right|\right)$$

The first term in the last formula represents the structural shift effect – the change in the Duncan index that results from changes in the size of occupations. The second term captures the composition effect – the change of the Duncan index due to changes in the gender structure of employment within occupations, given an occupational structure equal to the average of occupational composition in the two years, 1994 and 1999.

The resulting decomposition of the Duncan index, based on the 2-digit ISCO-88 classification, is given in *Table 5* for the time periods 1994–1999 and 1999–2004. About two-thirds of the observed change in occupational gender dissimilarity at the aggregate level is due to the changing gender composition within occupations. This gender composition effect increases in importance from 62 % during 1999–2004 to 71 % during 1999–2004.

To detect the demographic groups that contribute the most to the slowly declining degree of Czech occupational gender segregation, we next calculate segre-

TABLE 5 Decomposition of Changes in the Duncan Segregation Index, Czech Republic

Period	Gender composition effect		Occupation-mix effect		Total	
1999–1994	-0,4	62 %	-0,3	38%	-0,7	100%
2004–1999	-1,4	71 %	-0,6	30 %	-2,0	100 %

Note: Duncan segregation index based on 2-digit ISCO-88 occupational categorization

Source: the authors' own calculations based on the Czech Labor Force Survey

TABLE 6 Duncan Segregation Index for the Czech Republic by Education, 1994–2004 (%)

Occupational categorization/ *Educational attainment*	1994	1995	1999	2000	2003	2004
1-digit ISCO-88	42,2	41,8	42,0	41,2	40,3	41,0
Primary	29,7	27,8	27,6	29,8	25,3	22,4
Secondary without maturita	46,4	46,8	47,6	46,2	47,1	47,9
Secondary with maturita	34,6	33,4	32,7	30,7	28,2	27,9
Higher	25,0	25,5	23,9	23,6	17,7	19,5
2-digit ISCO-88	54,4	53,7	53,4	52,7	51,9	51,4
Less than tertiary	55,5	54,9	55,0	54,2	54,5	53,7
Tertiary	39,3	39,2	39,6	40,5	35,8	36,0
3-digit ISCO-88	61,8	61,3	61,4	61,0	60,0	59,2
Less than tertiary	63,4	63,0	63,3	63,0	62,2	61,6
Tertiary	44,9	44,8	45,5	45,8	45,1	43,8

Note: Maturita is a secondary-school-leaving exam similar to the German Abitur or the British CGSE.

Source: the authors' own calculations based on the Czech Labor Force Survey

gation indices for specific education and age groups. First, *Table 6* explores the relationship between education and occupational gender segregation change and suggests that almost all educational categories contribute to the declining segregation trend. Second, *Table 7* studies occupational gender segregation separately for those under the age of 35 and for older workers. *Table 7* and the corresponding *Graph 1* show that the declining trend of Czech occupational gender segregation concerns mainly those workers who are under 35 years of age. The extent of occupational gender dissimilarity changes little for those over 35. Segregation for young workers decreases by about 4 percentage points between 1999 and 2004, which likely closes much of the Czech/EU-15 gap in the degree of segregation for the young tertiary educated, noted earlier (in *Table 3*) using a different categorization of employment.

The finding of decreasing segregation for young workers is corroborated by the more detailed results by age *cohorts* given in *Table 8*. Each row of the table follows a group of workers over time, where the group is defined by age in 1994. The drop in segregation is more pronounced for younger cohorts and is preserved as these groups age.

6. Subject of Study and Segregation

Section 5 suggests that Czech occupational segregation was particularly high in 1999, relative to the EU-15 situation, for young tertiary educated workers. In order to shed light on the sources of occupational segregation among young workers entering
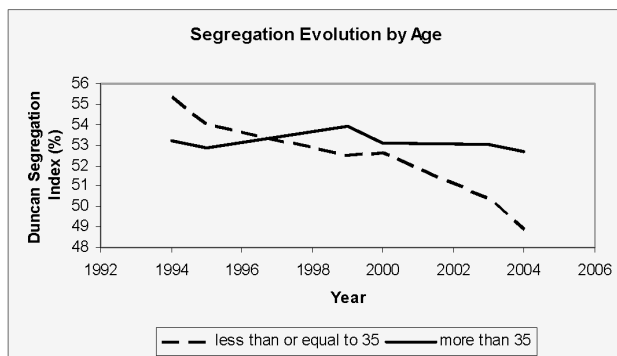
GRAPH 1 Segregation Evolution by Age

TABLE 7 Duncan Segregation Index for the Czech Republic by Age, 1994–2004 (%)

Age category	1994	1995	1999	2000	2003	2004
Less than or equal to 35 years	55,33	53,97	52,48	52,63	50,39	48,86
More than 35 years	53,23	52,85	53,92	53,09	53,03	52,7

Note: Duncan segregation index based on 2-digit ISCO-88 occupational categorization
Source: the authors' own calculations based on the Czech Labor Force Survey

TABLE 8 Duncan Segregation Index for the Czech Republic by Age Cohorts, 1994–2004 (%)

Age cohort in 1994	1994	1999	2004
15–19	66,26	48,87	48,72
20–24	55,32	50,48	51,03
25–29	51,68	53,03	54,72
30–34	55,60	56,05	54,55
35–39	56,47	55,84	53,46
40–44	54,85	55,59	53,39
45–49	54,43	54,74	51,45

Note: Duncan segregation index based on 2-digit ISCO-88 occupational categorization
Source: the authors' own calculations based on the Czech Labor Force Survey

the labor market, it is useful to ask about pre-market sorting of men and women, namely gender segregation in terms of fields of study.[17] Such pre-market segregation is important to the extent that occupational choice is driven by the choice of the field of study (major) in college.

   Table 9 shows the percentage shares of females for main types of subject of study in college or other tertiary education[18] and compares these 'femaleness' indicators between the whole population and those under the age of 35. The results suggest a pronounced increase in the share of women in almost all categories. The increase is

[17] For example, Machin and Puhani (2003) show that a major part of the gender wage gap among recent graduates in Germany and the U.K. can be explained by gender differences in the field of study.
[18] The considered educational levels correspond to ISCED 5 and ISCED 6.

TABLE 9 Percentage Share of Females by Subject of Tertiary Education, Czech Republic 2004

Subject of education	Percentage share of females	
	All	Younger than 35
Medical & Related	64	72
Agricultural & Related	30	45
Natural Sciences	39	57
Mathematical & Computing	33	27
Engineering & Technology	13	16
Architecture & Related	26	32
Social Sciences	48	54
Business & Information	54	58
Librarianship & Information	48	49
Humanities & Languages	63	68
Arts	44	39
Education	74	74

Source: the authors' own calculations based on the Czech Labor Force Survey 2004

particularly visible for natural sciences and agricultural fields of study, which were traditionally highly 'male' subjects. On the other hand, there is a decline in the 'female' share in mathematical and computer-science fields of study. Finally, in *Table 10* we compare the percentage share of degree subjects in 2000 for males and females in Germany, Great Britain and the Czech Republic.[19] While there are differences in the over-all shares of specific fields of study (i.e., the Czech share of social science and mathematics degrees for both males and females is relatively low in international comparison), the gender differences within each field of study are strikingly similar. For instance, the correlation of the Czech and German gender differences taken across all 13 subjects is 0.97. The different share of each subject in total graduates then makes the Czech Duncan segregation index of subject of study (at 42.3) much higher than those of both Germany and the UK (at 33.0 and 33.9, respectively). Finally, we calculate the segregation index for the group of Czech university graduates who were under 35 years of age as of 2004. We find that the overall degree of gender differences in the choice of field of study for these more recent graduates is lower (at 35.3) than that corresponding to all graduates (at 39.7). This finding is consistent with the presence of a declining trend in pre-market segregation, which could then correspond to the declining occupational segregation for young workers found in Section 5.

7. Conclusions

In this paper we provide a detailed description of Czech occupational gender segregation and carry out several international comparisons. We point out that the relatively high employment rate of Czech women aged 25–54 with less than tertiary education is the main reason why the aggregate employment rate in the Czech Republic was higher than that of the EU-15 in 1999. Our segregation measurements suggest that the overall level of occupational gender segregation declined somewhat in the Czech

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[19] The non-Czech figures are taken from (Machin, Puhani, 2003).

TABLE 10 Shares of Degree Subjects by Gender and Country (Year 2000)

	Czech Republic			Germany			UK		
	men (%)	women (%)	diffe- rence	men (%)	women (%)	diffe- rence	men (%)	women (%)	diffe- rence
Medical & Related	6,6	11,9	-5,4	7,3	10,1	-2,8	5,7	11,3	-5,6
Agricultural & Related	9,6	5,3	4,3	2,8	3,1	-0,3	0,9	0,5	0,4
Natural Sciences	4,0	4,2	-0,2	6,9	4,7	2,2	14,5	9,1	5,4
Mathematical & Computing	2,7	1,4	1,3	5,7	3,2	2,5	10,2	4,9	5,3
Engineering & Technology	39,2	8,8	30,4	32,6	7,3	25,3	17,6	1,6	16,0
Architecture & Related	10,9	5,2	5,7	3,3	2,0	1,3	3,9	1,4	2,5
Social Sciences	3,1	4,0	-1,0	13,1	15,1	-2,0	11,6	17,1	-5,5
Business & Information	9,7	13,7	-4,0	11,3	9,8	1,5	16,3	12,0	4,3
Librarianship & Information	0,6	0,7	0,0	0,4	1,2	-0,8	0,5	1,4	-0,9
Languages	0,2	1,7	-1,5	1,6	5,3	-3,7	3,9	10,7	-6,8
Humanities	2,0	3,3	-1,3	2,3	2,1	0,2	4,9	6,1	-1,2
Arts	1,6	1,0	0,6	2,1	3,3	-1,2	3,5	6,7	-3,2
Education	9,7	38,6	-29,0	10,7	32,8	-22,1	6,6	17,3	-10,7

Notes: We consider the 25–64 age group with a university degree. Northern Ireland is excluded from the UK.
Sources: the authors' own calculations based on the Czech Labor Force Survey 2000 and (Machin, Puhani, 2003)

Republic between 1994 and 2004, which is attributable mainly to changes in the gender composition of occupations, not a changing occupational structure of the economy. Most importantly, we find that occupational gender segregation decreased rapidly among Czech workers under the age of 35. For tertiary educated workers, this decline is likely to be related to a decreasing level of segregation in terms of fields of study. Accounting for the decrease in occupational segregation among young workers, we conclude that the Czech level as well as structure of occupational gender segregation is now highly similar to that of the EU-15.

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