The Gender Gap in Commuting Distance: Why do Women Commute Shorter Distances than Men?

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Abstract

We examine the gender gap in commuting distance over time. We show that the gender gap in commuting distance has decreased less than the wage earnings gap. This holds true also for singles without children, where an uneven division of household duties should not be a factor. In 1998, the lion's share of the gender gap in commuting distance could be explained by job specialization and women's higher marginal cost of commuting due to their higher share of unpaid work. However, by 2017, the influence of these factors has diminished, resulting in a growing "unexplained" gender gap in commuting distance.

1 INTRODUCTION

It is well established that women commute shorter than men, which is one reason for the gender pay gap (Mulalic et al., 2022). Mulalic et al. shows that women with children commute shorter because they have higher marginal cost of commuting and a lower wage compensation for commuting. The higher marginal cost of commuting is often hypothesized to be a result of more caregiving responsibilities and unpaid household work, even if there could be other reasons too. Lower wage compensation is often hypothesized to result from women self-selecting into less specialized jobs or as a result of discrimination. Moreover, several studies finds that the gender gap in commuting distances decrease in the core of the city, even if the mechanism is unclear.

The literature on gender gaps in commuting distance primarily focuses on married women with children. This reduces the possibility of understanding the mechanisms driving gender differences in commuting distances. Moreover, there is little evidence on how and why the gender gap in commuting has changed over time, despite the increasing progress in gender equality. Therefore, this paper examines how the gender gap in commuting distances has changed among singles and couples, both with and without children, over a 20-year period using registry data. As Sweden is a frontrunner in gender equality, it serves as an interesting subject for study.

We examine how the gender gap in commuting has developed over time and how different factors have impacted it. Using register data, we analyze the full working population in the Swedish macro-region Mälardalen, with nearly 4 million inhabitants and including Stockholm. We test three, not mutually exclusive, hypotheses: *the gender gap in commuting distance (i) is caused by women working in less specialized job sectors with lower levels of compensation for commuting*; (*ii) is caused by women's higher marginal cost of commuting due to their higher share of unpaid household work and responsibility for children*; and *(iii) decreases in denser labor market areas*.

2 MODEL

2.1 Model specification

In our analysis, the baseline model is defined as

$$y_i = \beta_0 + \beta_F F_i + \beta_{FC} F_i C_i + \beta_C C_i + \beta_Z Z_i + \beta_{Z^2} Z_i^2 + \beta_A A_i + \varepsilon_i \qquad (1)$$

where y_i is the Euclidian distance between the home and job location of individual *i*. F_i is a dummy variable taking the value 1 if individual *i* is female, and C_i is a dummy variable taking the value 1 if individual *i* have at least one child below age 18 in the household. Z_i is the age. The index A_i quantifies the effective job density at the residence location. ε_i is the error term.

Estimating the baseline model (1) yields the crude gender gap in commuting distance by age and household type. To test hypothesis (i), we start by comparing β_F and β_{FC} of model (1) with the corresponding parameters from the specification

$$y_i = \beta_0 + \beta_F F_i + \beta_{FC} F_i C_i + \beta_C C_i + \beta_Z Z_i + \beta_{Z^2} Z_i^2 + \boldsymbol{\beta_X X_i} + \beta_A A_i + v_i \quad (2)$$

where $\boldsymbol{X}$ includes the labor market indicator variables education level, job sector, foreign born, and access to a company car (defined as car owned by the company that the employee can be used for private trips). **X** also includes a dummy variable for being foreign born (not born in Sweden) since foreign born may face other labor market opportunities than native Swedes.

To test hypothesis (ii), stating that *the gender gap in commuting distance is caused by women's higher marginal cost of commuting due to their higher share of unpaid household work and responsibility for children,* we estimate the specifications (1) and (2) separately for single and couple workers. We assume that for singles, the unpaid work is shared equally by men and women.

Specification (3) interacts the effective job density with the gender dummy to test hypothesis (iii), stating that *increased labor market density reduces the gender gap in commuting distance*,

$$y_i = \beta_0 + \beta_F F_i + \beta_{FC} F_i C_i + \beta_C C_i + \beta_Z Z_i + \beta_{Z^2} Z_i^2 + \boldsymbol{\beta_X X_i} + \beta_A A_i + \beta_{FA} F_i A_i + \omega_i. \quad (3)$$

In a deeper analysis of hypothesis (i), we test whether women working in jobs with lower wage compensation can explain why women commute shorter distances than men. We conduct this test by employing a hedonic wage regression model similar to Mulalic et al. (2022), but allowing for different wage compensations in female-dominated and non-female-dominated job sectors

$$\log(w_{it}) = \alpha_y y_{it} + \boldsymbol{\alpha_I I_i} + \boldsymbol{\alpha_H H_{it}} + \alpha_{FD} FD_{it} + \alpha_{yFD} y_{it} FD_{it} + T_t + \mu_{it}, \quad (4)$$

where w_{it} and y_{it} is the annual (real) full-time equivalent wage earnings and commuting distance of individual *i* in year *t*, respectively. $\boldsymbol{I_i}$ is a vector of individual time-invariant controls: gender, educational level. $\boldsymbol{H}_{it}$ is a vector of individual time-variant controls: children, gender*children, age, age^2, job tenure, and firm size and average annual wage earnings at the firm where individual *i* is employed. FD_i is a dummy variable equal to 1 if individual *I* works in a female-dominated job sector in year *t*, and $y_{it}FD_{it}$ is an interaction term between commuting distance and female-dominated job sector. T_t is year fixed effects and μ_{it} is the error term.

Female-dominated job sectors are defined as job sectors with at least 70% women (based on the entire working population of Sweden), stratified by year *t* and low education (up to secondary school) and high education (post-secondary school or higher).

To account for time-invariant unobserved household characteristics such as residential location, living conditions, family situation, and shared social networks, we include household fixed effects in (4).

3 DATA

We use multiple registry data bases provided by Statistics Sweden. They cover all individuals registered in Sweden for the years 1998, 2005, and 2017. We define a couple either as a married couple or as partners living together and having at least one mutual child. An individual that is not member of a couple household, and above 18 years of age, is defined as a single household. Individuals under the age of 18 are excluded from the analysis but are counted as household members.

4 RESULTS

4.1 Base model: the crude gender gap in commuting distance

Table 2 presents OLS-estimates of specification (1)–(3) for the years 1998 (columns 1–3), 2005 (columns 4–6), and 2017 (columns 7–9).

4.2 Hypothesis i: the gender gap in commuting distance, job sector, and compensation for commuting

We now turn to specification (2) in Table 2. To test hypothesis (i), this specification controls for the labor-market indicator variables educational level, job sector, foreign born, and company car. Going from specification (1) to (2), the gender gap in commuting distance among female and male without children (i.e., the coefficient *female)* decreases by 43% in 1998, 32% in 2005, and 30% in 2017. The corresponding decline for female and male workers with children (*female* + *female*children*) is 41% in 1998, 33% in 2005 and 33% in 2017. This means that, in 1998, more than 40% of the gender gap in commuting distance was explained by differences in these labor-market indicators. However, less of the gender gap is explained by differences in the labor market indicators in the later years. This analysis lends some support to hypothesis (i), but it has a weakening explanatory power over time. However, an alternative interpretation of these findings is that the coefficients for job sectors contribute significantly to the observed effect of shorter commuting distances for women, since workers in female-dominated sectors tend to have shorter commutes.

To further explore if women commute shorter because they receive lower wage compensation for commuting, we next explore the wage compensation of male and female workers in female-dominated and non-female dominated job sectors.

We estimate the hedonic wage specification (4) on an unbalanced panel of all workers in Sweden in couple households, where the working hours of both partners are known, and they are working at least 50% of full-time. Part-time wage earnings were recalculated to their full-time wage equivalent. This analysis covers the years 2003–2017. Specification (4) includes household fixed effects and, to examine the importance of unobserved time-invariant individual factors, we also estimate (4) including individual fixed effects (and simultaneously excluding $\boldsymbol{I_i}$ and the variable age). The results are presented in Table 3.

Table 2. The gender gap in commuting distance, specifications 1–3

	1998			**2005**			**2017**		
Dependent variable:	Spec. 1	Spec. 2	Spec.3	Spec.1	Spec. 2	Spec.3	Spec.1	Spec. 2	Spec.3
commuting dist. (km)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Female	-2.427***	-1.387***	-12.465***	-2.590***	-1.758***	-10.738***	-2.590***	-1.805***	-10.401***
	(0.072)	(0.060)	(0.697)	(0.073)	(0.059)	(0.778)	(0.066)	(0.055)	(0.584)
Female*children	-1.489***	-0.912***	-0.723***	-1.262***	-0.833***	-0.742***	-0.827***	-0.484***	-0.467***
	(0.085)	(0.080)	(0.079)	(0.079)	(0.075)	(0.073)	(0.077)	(0.073)	(0.072)
Children	-0.311***	-0.526***	-0.630***	-0.072	-0.307***	-0.355***	-0.339***	-0.674***	-0.687***
	(0.090)	(0.089)	(0.088)	(0.086)	(0.085)	(0.083)	(0.081)	(0.079)	(0.079)
Age	-0.162***	-0.223***	-0.222***	0.089***	0.006	0.010	0.039**	-0.080***	-0.078***
	(0.022)	(0.024)	(0.024)	(0.018)	(0.018)	(0.018)	(0.019)	(0.020)	(0.020)
Age^2	0.001***	0.002***	0.002***	-0.002***	-0.001***	-0.001***	-0.001***	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Foreign born		0.556***	0.564***		0.328***	0.330***		0.601***	0.601***
		(0.080)	(0.080)		(0.083)	(0.084)		(0.082)	(0.082)
Company car		3.339***	3.477***		3.773***	3.865***		3.953***	3.986***
		(0.162)	(0.160)		(0.162)	(0.161)		(0.144)	(0.143)
Effective job density	-2.420***	-2.868***	-3.364***	-1.791***	-2.184***	-2.574***	-2.409***	-2.819***	-3.171***
	(0.096)	(0.097)	(0.111)	(0.115)	(0.124)	(0.149)	(0.098)	(0.099)	(0.110)
Eff. job density *female			0.991***			0.792***			0.739***
			(0.060)			(0.066)			(0.048)
ln(distance to centroid)	1.382***	1.439***	1.434***	1.607***	1.694***	1.689***	1.522***	1.555***	1.558***
	(0.073)	(0.072)	(0.072)	(0.081)	(0.082)	(0.082)	(0.066)	(0.067)	(0.067)
Education-level FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Job-sector FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Constant	37.898***	43.966***	49.442***	24.876***	31.630***	35.916***	34.527***	45.057***	49.060***
	(1.431)	(1.431)	(1.555)	(1.513)	(1.598)	(1.846)	(1.354)	(1.367)	(1.471)
Observations		*1,113,593*			*1,181,412*			*1,394,945*	

Notes: Table 2 presents the coefficients and standard errors obtained from OLS-estimation of specifications 1–3. Standard errors in parentheses, clustered by residential centroid. Sample includes individuals 18–64 years old with non-missing values of all included variables. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

We first focus on specification (1), not including the labor market indicators level of education, job sector, or having a company car. The coefficient for the dummy variable *female* represents the crude conditional mean of the difference in commuting distance between male and female workers without children. Two initial observations can be made: first, female workers without children commute on average 2.5 km shorter than their male counterparts, conditional on age and effective job density. Second, this gender gap remains similar over the 20-year period, just as the unconditional difference in commuting distances.

The coefficient *female×children* represents the additional gender difference in conditional mean in commuting distance for parents. Female workers with children commuted roughly 4 km shorter than male workers with children in 1998, given age and effective job density. Interestingly, this additional gender gap among parents decreased by almost 50% between 1998 and 2017. For male

workers, the impact of children on their commuting distance is similar in the first and last year, 0.3 kilometers, but is for some reason smaller in 2005.

In 1998, commuting distance decreases with age given gender, children, and effective job density. In 2005 and 2017 the age coefficients are, on the contrary, positive. The coefficients for effective job density are negative for all three years, indicating shorter commutes the higher effective job density.

Table 3. Wage compensation for commuting among couples in female-dominated and non-female-dominated job sectors, 2003–2017

Dependent variable: *logarithm of annual wage earnings*	OLS (1)	HH FE (2)	Ind. FE (3)	HH & Ind. FE (4)
Commuting distance (km)	0.00132***	0.00123***	0.00053***	0.00054***
	(0.00001)	(0.00001)	(0.00001)	(0.00001)
Commuting distance*	-0.00030***	-0.00110***	-0.00034***	-0.00033***
female-dominated job sector	(0.00003)	(0.00003)	(0.00003)	(0.00003)
Commuting distance*	-0.00129***	-0.00136***	-0.00101***	-0.00101***
female	(0.00001)	(0.00001)	(0.00002)	(0.00002)
Commuting distance*female-	-0.00072***	0.00081***	-0.00077***	-0.00076***
dominated job sector*female	(0.00003)	(0.00003)	(0.00004)	(0.00004)
Female	-0.15323***	-0.18573***		
	(0.00053)	(0.00050)		
Female*children	-0.14883***	-0.14862***	-0.12156***	-0.11964***
	(0.00056)	(0.00050)	(0.00075)	(0.00075)
Children	0.00597***	-0.02347***	-0.03967***	-0.04119***
	(0.00045)	(0.00055)	(0.00056)	(0.00056)
Job tenure	0.01650***	0.01072***	0.00206***	0.00196***
	(0.00012)	(0.00011)	(0.00009)	(0.00009)
Job tenure >= 6 yrs	0.01644***	0.01020***	-0.00118***	-0.00113***
	(0.00046)	(0.00043)	(0.00038)	(0.00038)
Age	0.10267***	0.11443***		
	(0.00012)	(0.00016)		
Age^2	-0.00103***	-0.00128***	-0.00134***	-0.00137***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Average wage earnings at firm	0.00022***	0.00021***	0.00017***	0.00017***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Firm size	-0.00001***	-0.00000***	-0.00000***	-0.00000***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Female-dominated job sector	0.05763***	0.04710***	0.07161***	0.07164***
	(0.00036)	(0.00043)	(0.00070)	(0.00071)
Educational-level FE	Yes	Yes	No	No
Household fixed effects	No	Yes	No	Yes
Individual fixed effects	No	No	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Constant	4.63303***	4.70809***	9.26757***	9.30899***
	(0.00257)	(0.00396)	(0.00271)	(0.00273)
Observations	*21,026,200*	*21,026,200*	*21,026,200*	*21,026,200*

Including household fixed effects, controlling for the fact that both spouses in the household have the same location, has a large impact on the results. This indicates that the location of the household and other household-specific characteristics, as expected, impacts the wage premium.

Our preferred model is column four, including household and individual fixed effects. The coefficient *commuting distance* shows that male workers in non-female dominated sectors have a statistically significant wage compensation (one standard deviation increase in commuting distance increases the annual wage by 1%). The second coefficient (*commuting distance*female-dominated job sector*)

shows that for male workers, this wage compensation is heavily reduced in female-dominated sectors (one standard deviation increase in commuting distance increases the annual wage by 0.3%). Comparing the first (*commuting distance)* and the third coefficient (*commuting distance*female*) shows that for women in non-female dominated sectors, the wage compensation is negative. The fourth coefficient (*commuting distance*female-dominated job sector*female*) shows that in female-dominated sectors the wage compensation is even more negative for women than men.

The lower wage compensation among men and women in female dominated sectors are consistent with shorter commuting distances for men and women working in these sectors.

A possible reason for the lack of wage compensation for female workers could be discrimination. However, another possible mechanism is that well-educated women in more specialized jobs to a large extent self-select into central locations in large metropolitan areas. Well-educated career women often have well-educated career partners, while the reverse is not true to the same extent. Costa and Kahn (2000) show that such couples (denoted as 'power couples,' with both spouses holding college degrees) are more likely to move to the largest cities than part-power couples or power singles. A similar finding is made by Compton and Pollack (2007), except that they find that the large share of power couples in large metropolitan areas is a result of more power couples *being formed* in those areas.

The tendency of couples with two well-educated and specialized workers to locate in the large metropolitan areas is not controlled for in (4) by the fixed effects, if the workers have already self-selected into the cites when the household is formed as found by Compton and Pollack (2007). The hypothesis that well-educated and specialized female workers have a stronger tendency to locate in the large metropolitan areas than their male counterparts is consistent with the finding in Section 4.4, that the gender difference in commuting decrease with higher labour market density at the location of residence. This hypothesis could at least partly explain why the wage gender pay gap has deceased faster than the gender gap in commuting distance.

4.3 Hypothesis ii: the gender gap in commuting distance and (un)even division of unpaid household work and responsibility of children

To summarize, we find evidence that in partner negotiations on the division of paid and unpaid work, the woman may be in a weaker position leading to a gender gap in commuting. However, the presence of children in the household has no impact on the gender gap in commuting distance. And for workers without children, slightly over half of the gender gap in commuting distance persists even for singles in later years, suggesting an unexplained factor beyond an unequal distribution of unpaid work. Notably, this remaining, unexplained, factor was smaller in 1998. A possible contributing factor could be that well-educated single career women have an increasing tendency to self-select into large metropolitan areas in the later years, reducing their commuting distances, as discussed in Section 2.3. This is consistent with the finding that women have higher marginal cost of commuting, but also with the fact that large metropolitan areas embrace more progressive values.

4.4 Hypothesis iii: the gender gap in commuting distance and effective job density

Returning to Table 2, the coefficient for effective job density (*A*) is negative and significant in specifications (1) and (2), suggesting that workers with higher job density have shorter commutes. Columns 3, 6, and 9 present the coefficients for specification (3), including interactions between female and *A*. The gender gap in commuting distance decreases with higher job density. This effect has slightly diminished over time but remains substantial in 2017. The correlation between effective job density and commuting distances is stronger among single workers than among couple workers. However, the impact of job density on the gender gap in commuting distance is more than twice as large for couple workers than for single workers in all years, even if the effect has weakened slightly over time. This again demonstrates that the smaller gender gap in commuting distances in denser labour markets is not only present, but stronger, among "power couples".

Hence, as job density decreases, male workers' commutes become longer, but the commuting distance among female workers increases more slowly with lower job density, particularly among coupled women. There are several possible mechanisms at play. One possibility is that women's higher marginal cost of commuting, particularly among partnered women, dampens commuting distances among women residing lower density compared to men. However, the closing gender gap in commuting in large metropolitan areas also aligns with the hypotheses tested in Sections 5.2 and 5.3, suggesting that well-educated women, whether coupled or single, working in specialized sectors, self-select into large metropolitan areas. In any case, specification (3) confirms hypothesis (iii): *the gender gap in commuting distance decreases for residents of denser labor market areas*.

5 CONCLUSION

The gender income gap has considerably decreased in Sweden over the studied period 1998–2017. However, the unconditional (mean) gender gap in commuting distance has remained virtually unchanged, signaling a rise in the persistent gender gap in commuting distance.

We find that the gender gap in commuting distance decreases when controlling for variables such as job sector and other labor market indicators. But the effect of these indicators has weakened over time. Moreover, the hedonic wage equation reveals that women have no wage compensation in either male or female-dominated job sectors, even if controlling for household-specific effects. One potential contributing factor is discrimination. However, another contributing factor could be an increasing tendency of well-educated single and couple career women to self-select into large metropolitan areas, possible from early age, thereby reducing their commuting distances. Such self-selection may be attributed to the higher marginal cost of commuting of (single and partner) women or the presence of more progressive gender norms in large metropolitan areas. This explanation would be consistent with our fining that the gender gap in commuting diminishes with a higher effective job density at the location of

residence, aligning with smaller gender gap in commuting distance in large metropolitan centers identified by earlier studies.

Moreover, our evidence suggests that the gender gap can be explained by women's weak position in negotiations of paid and unpaid work within couples: we find a negative conditional correlation between the commuting distance of the female worker and her partner's, but a positive correlation between the male worker's commuting distance and that of his partner. This effect has only slightly attenuated between 1998 and 2017. However, the gender gap in commuting distance persists even among singles without children, and notably, this gap has increased over time. These findings are again consistent with an increasingly stronger selection of well-educated single and partnered career women, compared to their male counterparts, into residential areas with high labor market density (shortening commuting distances and wage compensation).

6 REFERENCES

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