

Commuting time and job satisfaction among urban employees in China: evidence from three waves of the China Family Panel Studies

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Sensitivity analyses using alternative definitions of formal employment

The baseline measure classifies respondents as formally employed when they have a labor or employment contract and their current workplace provides both pension insurance and medical insurance. To assess whether the observed moderation pattern depends on this composite definition, the moderation model was re-estimated using two alternative operationalizations of employment protection.

The first specification uses the presence of a labor or employment contract as a single indicator of formal employment. The second specification constructs a cumulative employment-protection score by summing three binary indicators: having a labor or employment contract, receiving pension insurance through the current workplace, and receiving medical insurance through the current workplace. The resulting score ranges from 0 to 3, with higher values indicating that more employment-protection conditions are satisfied.

Supplementary Table S1. Sensitivity analyses using alternative definitions of formal employment

Variable	Model 1:	Model 2
Commuting time	−0.057*** (0.016)	−0.053*** (0.017)
Employment contract	0.428 (0.553)	
Commuting time × employment contract	0.042** (0.020)	
Employment-protection score = 1		0.837 (0.687)
Employment-protection score = 2		4.739*** (0.852)
Employment-protection score = 3		1.836*** (0.664)
Commuting time × score = 1		0.024

		(0.025)
Commuting time × score = 2		−0.019
		(0.035)
Commuting time × score = 3		0.046**
		(0.022)
Province FE	Yes	Yes
Survey-wave FE	Yes	Yes
Constant	50.263***	50.621***
	(1.594)	(1.596)
N	12,885	12,885

Notes: Model 1 uses the presence of a labor or employment contract as the alternative employment-protection indicator. Model 2 uses a cumulative employment-protection score ranging from 0 to 3, constructed as the sum of three binary indicators: having a labor or employment contract, receiving pension insurance through the current workplace, and receiving medical insurance through the current workplace. In Model 2, respondents satisfying none of the three conditions (score = 0) constitute the reference group. All models include gender, age, hukou status, marital status, self-rated health, and years of education, together with province and survey-wave fixed effects. Standard errors are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

The contract-only specification yielded a positive and statistically significant interaction between commuting time and employment-contract status ($\beta = 0.042$, $SE = 0.020$, $p < 0.05$). In the cumulative-score specification, the interaction was also positive and statistically significant among respondents satisfying all three employment-protection conditions ($\beta = 0.046$, $SE = 0.022$, $p < 0.05$), whereas the corresponding interactions for respondents satisfying only one or two conditions were not statistically significant. Overall, these supplementary results are consistent with the baseline finding that stronger employment protection is associated with an attenuation of the negative commuting–job satisfaction association, although the pattern is not uniform across intermediate levels of employment protection.

Heterogeneity in the commuting–working time pathway

To provide a more complete and structurally consistent examination of the two potential indirect pathways, we conducted subgroup analyses of the association between commuting time and weekly working time according to marital status, hukou status, regional location, gender, and formal-employment status. Weekly working time was measured in minutes, and all models used the same commuting-time measure, control variables, province fixed effects, survey-wave fixed effects, and respondent-clustered standard errors as the baseline working-time model.

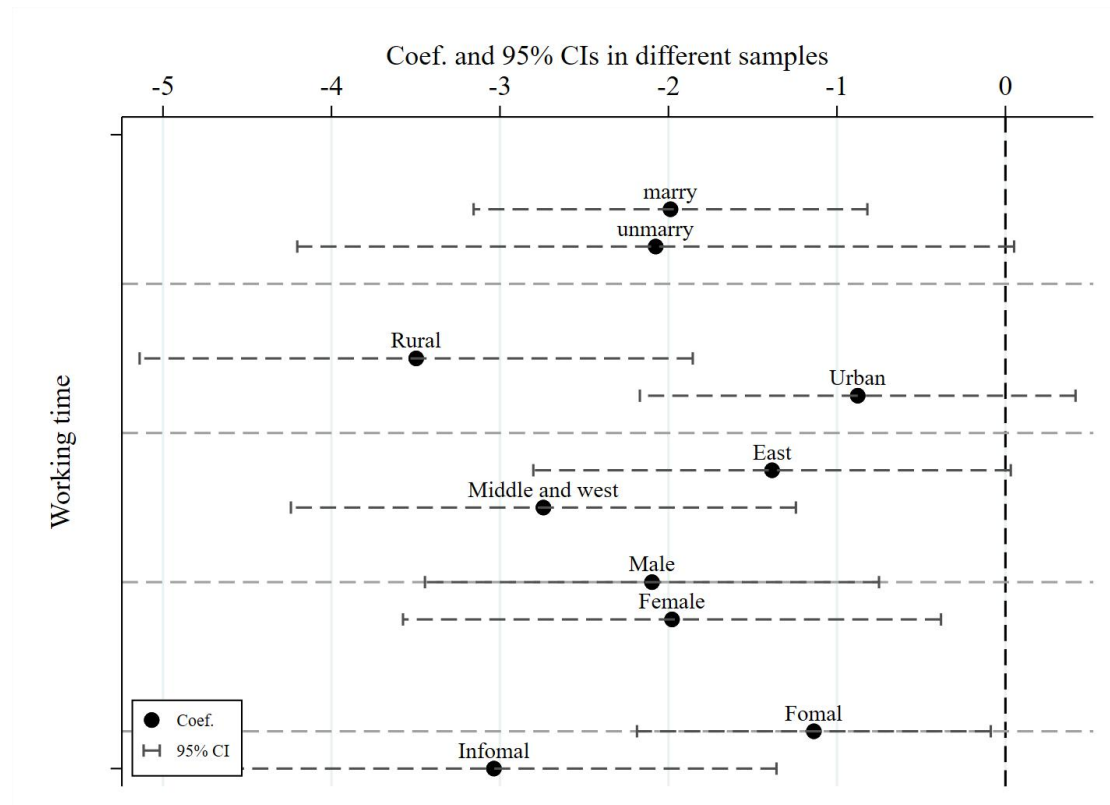
As shown in Supplementary Figure S1, the point estimates of the association between commuting time and weekly working time were negative across all examined subgroups, although their magnitude and statistical precision varied. Because these analyses compare subgroup-specific coefficients rather than formal between-group interaction tests, differences in coefficient magnitude are interpreted descriptively.

The negative point estimate was somewhat larger among unmarried employees than among married employees, although the confidence interval for unmarried employees included zero. By hukou status, the negative point estimate was larger among rural-hukou employees than among urban-hukou employees, while the confidence interval for the urban-hukou group overlapped zero.

Regional variation was also observed. The negative point estimate was larger among employees in the central and western regions than among those in the eastern region, although the confidence interval for the eastern group overlapped zero. This pattern provides descriptive evidence of heterogeneity in the commuting–working time association across regions.

The estimates for male and female employees were relatively similar in magnitude, suggesting limited descriptive gender variation in this pathway. By contrast, the negative point estimate was larger among informally employed workers than among formally employed workers. This pattern is consistent with heterogeneity in working-time arrangements across employment groups, although it does not establish a statistically significant difference between the two coefficients.

Overall, the subgroup results indicate that the negative association between commuting time and weekly working time tended to be larger in magnitude among rural-hukou employees, workers in the central and western regions, and informally employed workers, whereas gender differences were comparatively modest. These findings provide supplementary descriptive evidence that the working-time adjustment pathway may vary across employee groups.



Supplementary Figure S1. Heterogeneity in the association between commuting time and weekly working time across employee groups

Notes: The figure presents subgroup-specific coefficients and 95% confidence intervals for the association between one-way commuting time and weekly working time measured in minutes. The subgroup dimensions include marital status, hukou status, regional location, gender, and formal-employment status. All models include the same individual-level covariates, province fixed effects, and survey-wave fixed effects as the baseline working-time model, with standard errors clustered at the respondent level.

Heterogeneity in the commuting–income compensation pathway

To examine whether the association between commuting time and work income

varies across employee groups, we conducted subgroup analyses according to marital status, hukou status, regional location, gender, and formal-employment status. The dependent variable was the natural logarithm of monthly work income, and the models used the same commuting-time measure, control variables, province fixed effects, survey-wave fixed effects, and respondent-clustered standard errors as the baseline income model.

As shown in Supplementary Figure S2, the point estimates of the association between commuting time and work income were positive across all examined subgroups, although their magnitude and statistical precision varied. The confidence interval for employees in the central and western regions overlapped zero, while the estimates for the other examined subgroups were more precisely estimated. As in Supplementary Figure S1, differences in coefficient magnitude are interpreted descriptively rather than as formal evidence of between-group differences.

The positive point estimate was larger among married employees than among unmarried employees. Similarly, the positive point estimate was larger among rural-hukou employees than among urban-hukou employees. These patterns suggest descriptive heterogeneity in the commuting–income association by marital and hukou status.

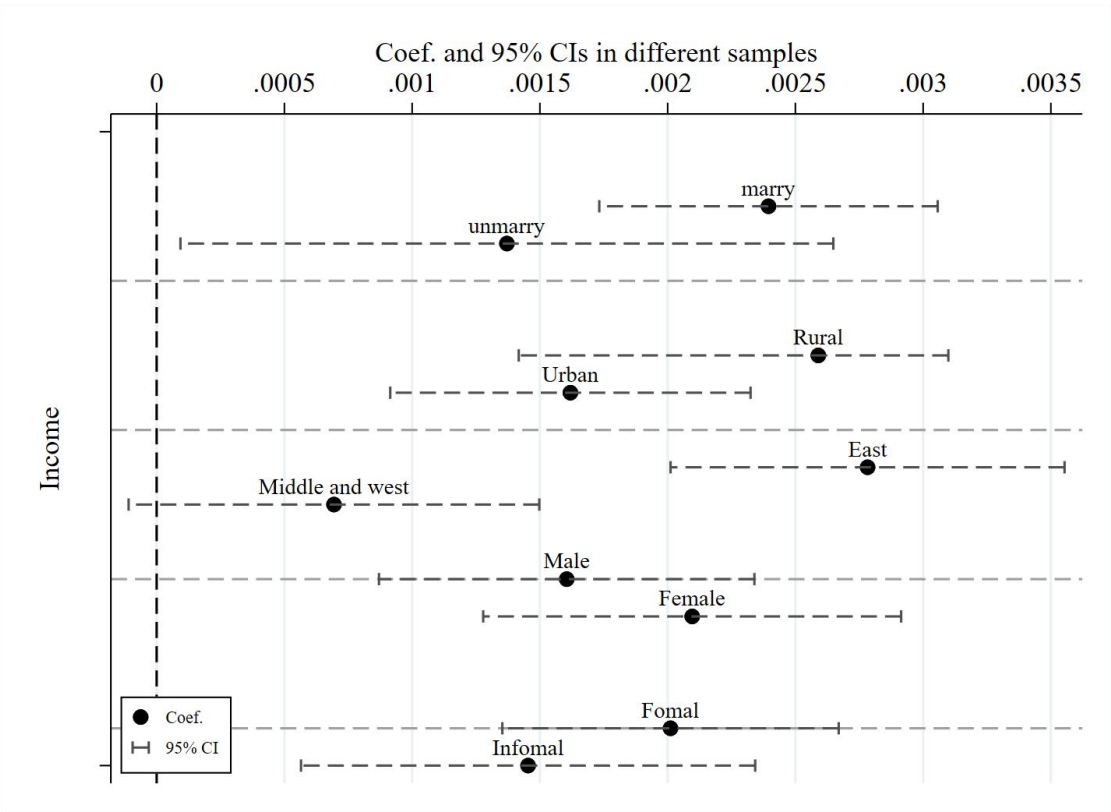
Regional differences were also evident in the point estimates. The positive association was larger among employees in the eastern region than among those in the central and western regions. However, because the confidence interval for the central and western group included zero and no formal between-region test was conducted, this difference should be interpreted cautiously.

The estimated positive association was also larger among female employees than among male employees. This pattern suggests descriptive gender variation in the commuting–income association, but it does not establish a statistically significant difference between the two groups.

Finally, the commuting–income association was positive among both formally and informally employed workers. The point estimate was somewhat larger among

formally employed workers, although the difference between the two groups was modest. This suggests that the positive commuting–income association is observed in both employment groups, while its magnitude may vary descriptively by formal-employment status.

Overall, the subgroup results suggest that the commuting–income association is not completely uniform across employee groups. Larger positive point estimates were observed among married employees, rural-hukou employees, workers in the eastern region, female employees, and, to a lesser extent, formally employed workers. Because these comparisons are based on subgroup-specific coefficient magnitudes rather than formal between-group tests, they should be interpreted as descriptive heterogeneity. These findings provide supplementary evidence on variation in the income-compensation pathway across employee groups.



Supplementary Figure S2. Heterogeneity in the association between commuting time and work income across employee groups

Notes: The figure presents subgroup-specific coefficients and 95% confidence intervals for the association between one-way commuting time and the natural logarithm of work income. The subgroup dimensions include marital

status, hukou status, regional location, gender, and formal-employment status. All models include the same individual-level covariates, province fixed effects, and survey-wave fixed effects as the baseline income model, with standard errors clustered at the respondent level.