MEMORANDUM 2/2024

The Finnish Economic Policy Council

THE FINNISH ECONOMIC POLICY COUNCIL

The urban wage premium in Finland

Cristina Bratu
Teemu Lyytikäinen

MEMORANDUM 2/2024

The urban wage premium in Finland

Cristina Bratu
Teemu Lyytikäinen

The Finnish Economic Policy Council
VATT Institute for Economic Research

Helsinki 2024

MEMORANDUM 2/2024

Cristina Bratu, VATT Institute for Economic Research, Uppsala Center for Labor Studies (UCLS). Email: cristina.bratu@vatt.fi

Teemu Lyytikäinen, VATT Institute for Economic Research. Email: teemu.lyytikainen@vatt.fi

The Finnish Economic Policy Council
Address:
VATT Institute for Economic Research
Arkadiankatu 7, 00100 Helsinki, Finland

Helsinki, December 2024

The urban wage premium in Finland

Cristina Bratu* Teemu Lyytikäinen†

Abstract

We analyze the urban wage premium in Finland using population-wide administrative data. We find that sorting is an important explanation for higher average wages in bigger cities, but the urban wage premium persists after we account for sorting. The elasticity of private sector wages with respect to city size is roughly 2.4%. Similar workers earn substantially higher wages in the Helsinki travel-to-work area than in other areas, and slightly higher wages in Turku and Tampere. Workers moving to Helsinki experience an immediate wage increase compared to moving to other areas, but also more rapid wage growth in later years in Helsinki. Wage premium due to work experience in Helsinki seems to be partly portable when people move to other regions. These results suggest that the spatial distribution of employment can be an important driver of productivity and output in Finland. Policy measures that lead to relocation of jobs and workers to bigger and denser cities would likely increase overall productivity, but a simultaneous increase in welfare is not guaranteed and distributional goals may be compromised.

Key words: Urban wage premium, agglomeration economies
JEL Codes: R10, R23, J31

*VATT Institute for Economic Research, Uppsala Center for Labor Studies (UCLS). Email: cristina.bratu@vatt.fi
†VATT Institute for Economic Research. Email: teemu.lyytikainen@vatt.fi

1 Introduction

Workers in larger urban areas earn more than workers in smaller urban areas or in non-urban areas, an empirical fact known as the urban wage premium (UWP). These differences across space most likely reflect productivity differences, otherwise firms would relocate to lower-wage areas (Roback, 1982). Quantifying these productivity differences and understanding the sources of these differences is important in designing effective policies aimed at fostering economic growth.

In this report, we study the urban wage premium in Finland using individual-level matched employer-employee data that allows us to follow workers over time and across space. We follow recent advances in the literature (e.g. De la Roca and Puga, 2017) and aim to distinguish between three potential sources of the UWP: i) high-productive workers are more likely to locate in larger areas (*sorting*); ii) workers benefit from working in a city but lose these benefits if they relocate (known as *static benefits* or agglomeration economies) and iii) cities offer more opportunities for learning and human capital accumulation which the worker does not lose upon relocation (known as *dynamic benefits*).

We have five main findings.[1] First, the raw elasticity of mean monthly earnings with respect to city size is 4.4%, which implies that a doubling of the city size is associated with a 4.4% increase in earnings. While this is an important correlation to be aware of, it is not informative about the mechanisms we wish to distinguish between. In particular, based on this number alone, we cannot assess whether cities simply *attract* more productive workers, if they *make* workers more productive or if they facilitate the accumulation of portable human capital.

We therefore move on to a more complex specification where we account for both job characteristics and a rich set of observed and unobserved worker traits, the latter captured by individual fixed effects. Our second main finding is that when accounting for worker sorting (both observable and unobservable traits), the UWP drops by roughly 45% to 2.4%. Moreover, observable characteristics capture a great deal of selection into urban areas.

We have so far implicitly assumed a linear effect of city size. We relax this assumption in the next set of analyses and group cities in four categories based on density of jobs: i) Helsinki, ii) Tampere and Turku, iii) a group of four regional centers and iv) a reference group of other smaller cities. This complementary analysis reveals our third finding: workers in Helsinki earn 8% more than workers in other smaller cities, even after accounting for the sorting of workers across locations. The Helsinki premium is substantially larger than the premium gained by workers in Tampere and Turku

[1] We perform our analyses separately by gender; here, we report the findings for men. We report the findings for women in the appendix.

(1.4%).

Our estimates of the UWP may still be biased if dynamic effects are present. We therefore next control for experience gained in Helsinki and its interaction with workers' current locations and see that, for example, the Helsinki UWP goes down by about 9%. This drop is due to the fact that experience earned in Helsinki is both valuable and portable. In particular, a year of experience increases earnings by 1.9%, relative to gaining it in other smaller areas. More importantly, a year of working in Helsinki for those currently in, for example, Tampere or Turku raises earnings by 0.4%. These results suggest that Helsinki provides workers with opportunities to learn and increase their human capital, which they can then take with them wherever they decide to relocate.

Finally, we find heterogeneous effects by gender. The elasticity of earnings with respect to city size is larger for women than for men (2.9% compared to 2.4%) and the Helsinki premium is even larger for women than it is for men (9.2% compared to 8% for men). These findings echo recent findings from France (Elass et al., 2024).

Our results are in line with the findings of previous studies that have tried to separate the effects of worker sorting from the productivity benefits of cities in explaining the urban wage premium (see, e.g. Glaeser and Maré, 2001, Combes et al., 2008, De la Roca and Puga, 2017).[2] We show that patterns found in countries with large metropolitan areas such as the US and France are present also in Finland, which has a very different urban structure, with one large capital area and few other densely populated areas. We also contribute to the more recent strand of the literature investigating the dynamic advantages of working in cities and provide evidence that work experience gained in larger cities is more valuable than work experience gained elsewhere (De la Roca and Puga, 2017, Eliasson and Westerlund, 2023, Carlsen et al., 2016).

2 Data

2.1 Sample construction

We construct a matched employer-employee panel dataset by combining information from multiple registers collected by Statistics Finland.

We start from the Folk basic data module, including all years from 1995 to 2019. We restrict to people in cohorts born in 1969 or later, who were 18 or older during the observation period 2005-2019 and who were employed at least once during the observation period (but we keep their full histories).[3] We focus on people for whom

[2] Saarimaa et al. (2015) estimate wage differentials between Finnish regions (seutukunta) using cross-sectional data from 2011. We improve on their estimates by using more extensive data and by studying to what extent wage differences are due to sorting, static agglomeration economies or dynamic effects via learning.

[3] We start in 2005 because of missing occupation codes earlier and because there is a change in the way days worked are recorded.

we can observe full histories (i.e. exclude foreigners who arrive in Finland after turning 18). From this register, we save information on demographics (gender, education, immigrant background), but also self-employment status, earnings and months worked during a year. The earnings measure includes cash salary items, compensation for employment-related costs and in-kind benefits. For most of our analyses, we use *monthly earnings* as our dependent variable, which we obtain by dividing yearly earnings by the number of months worked in a year.[4]

To the panel thus created, we link information from the Folk employment data module. In particular, for each employee, we have information on the employer during the last week of the year, which allows us to compute tenure at the firm.[5] We then sum over the tenure at all employers to get labor market experience. We also calculate experience in the Helsinki urban area by summing over the tenure at all employers in the Helsinki urban area.[6]

Finally, we impose a number of row restrictions: we drop the years that are outside the observation period; drop the years when an individual is not employed; drop observations with missing employer identifiers; drop the years when an individual is employed in agriculture, fishing or mining, as they are primarily concentrated in rural areas; drop self-employment spells and spells in the public sector; drop spells not in urban areas as defined below; and drop years when an individual works less than 15 days in a year.

We thus obtain a panel of workers and their job spells in the private sector for 2005-2019. The advantage of using this panel is that it includes the universe of workers we are interested in. The disadvantage is that it only has information on yearly earnings and months worked across all employers during a given year, from which we can at most compute average monthly earnings. Ideally, we would use hourly wages so as to reduce the influence of labor supply. The wage data exists but only for a sample of private sector firms, which means that worker histories are not complete in the wage data. We draw on previous literature that shows that dropping individuals with earnings below a certain threshold in the annual distribution addresses the labor supply issue (Eliasson and Westerlund, 2023). Our final sample restriction is therefore to drop person-years with earnings in the bottom 10% of the national earnings distribution. We refer to this sample as the *main sample*.

For the sample of workers this information is available for, we obtain wages and

[4]Note that the earnings variable in Folk basic sums over all earnings gained in a given year, across all employers; same for the months worked.

[5]The employer is defined at the establishment level for private firms and at the firm level for the public sector. For the public sector, we just need to know whether they have worked in the public sector, so that we can count those years of experience towards the overall experience, but it is less important to know the exact workplace where that happened, since we eventually drop public sector spells.

[6]We explain in greater detail our definition of urban areas in the next subsection.

hours worked at the primary employer during the last week of the year from the structure of earnings register for those with the same primary employer (establishment and firm) across both registers. We refer to this sample as the *SES sample*. We show our main results for this sample as well and contrast it with the results for our *main sample*.

Finally, we conduct our analyses separately by gender; we show results for men in the main text and results for women in the appendix.

2.2 Definition of urban areas

We define cities as travel-to-work areas (TWA). As defined by Statistics Finland, a TWA is formed by a central municipality and surrounding municipalities from which at least 10 percent of the labor force commute to the central municipality. Central municipalities are municipalities from which at most 25 percent commute to other municipalities. A central municipality alone does not constitute a TWA if it lacks surrounding municipalities with the required 10 percent commuter share. We use the TWA classification of Statistics Finland from 2021 and keep the TWA boundaries fixed over time. The map in Figure 1 shows TWAs in gray and the areas that do not belong to any TWA in white. There are a total of 31 TWAs. We assign workers to them according to the location of their workplace.

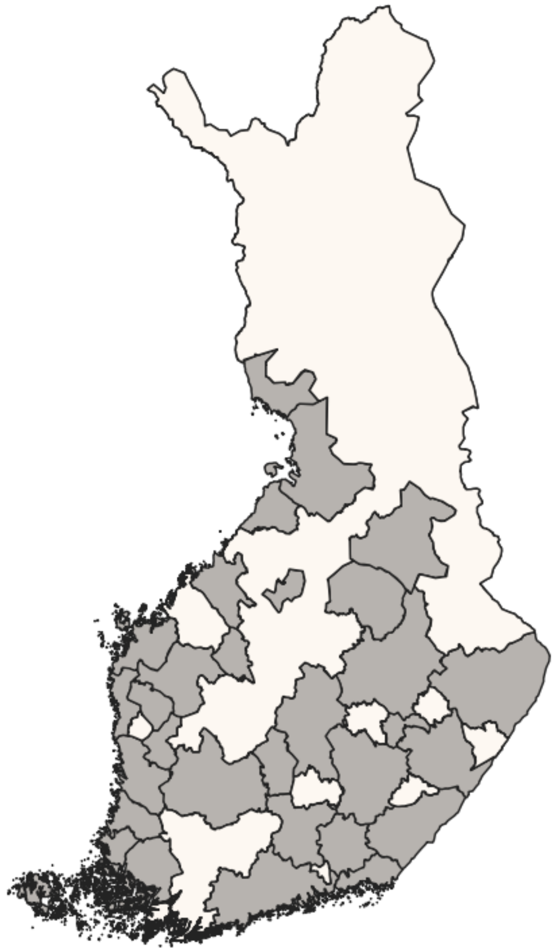


Figure 1: Travel to work areas in 2021

Notes: The figure shows travel to work areas in Finland in 2021 in gray and the areas not belonging to any travel to work area in white.

When estimating the effect of city size on wages, we use a measure of employment density that is not restricted by municipality boundaries. For each TWA, we define TWA density as the number of jobs within 20 km of the center point of the TWA. This measure is based on postcode-level data on the number of jobs in 2019 and the coordinates of postcode centroids. First, we define the center of the TWA as the job count weighted average of coordinates of postcode centroids in the TWA. Then we measure the density of the TWA as the sum of jobs in postcodes with centroids within 20 km of the TWA center. Figure 2 shows the number of jobs at the postcode level in the TWA of Pori as an example. Postcodes within 20 km of the centroid of the TWA are indicated in dark gray. Appendix Table B.1 lists our measure of employment density, total number of jobs and total population by TWA in 2019.

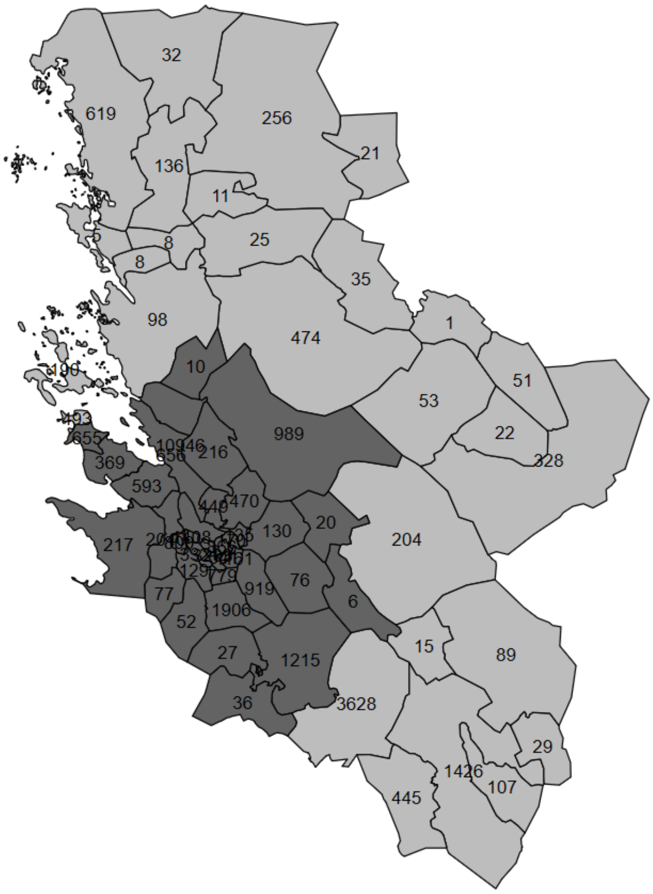


Figure 2: Number of jobs in postcodes within 20 km of TWA centre - TWA of Pori.

Notes: The figure illustrates the calculation of our measure of city size (or employment density) for the TWA of Pori. Postcodes within 20 km of the centroid of the TWA are indicated in dark gray. TWA density is the sum if the number of jobs in these postcodes in 2019.

3 Descriptive statistics

We show summary statistics for the *main sample* of men in Table 1. We can see that Helsinki-based workers earn the most and are the most highly educated. Note that these figures refer both to workers who have always stayed in a given TWA (stayers) and to workers who moved there at some point in time (movers). As we explain in greater detail in the next section, our empirical strategy relies on movers across TWAs to identify differences in TWAs over time, while stayers identify changes over time in their TWA. Hence, we also present summary statistics for movers vs. stayers (not disaggregated by TWA) in Table 2. We see that movers are slightly younger, have fewer years of experience and are significantly more likely to have a university degree. Movers also have fewer years of experience in Helsinki than stayers, suggesting that the movers are more likely to stem from TWAs other than Helsinki. Finally, roughly 12% of the individuals in our sample make at least one move across TWAs during the sample period (not shown in the table).[7]

Table 1: Summary statistics, main sample

	Helsinki	Tampere and Turku	Jyväskylä, Lahti Kuopio and Oulu	Other TWAs
Monthly earnings (log)	8.146	8.028	8.014	8.003
Age	32.566	32.297	32.337	32.159
Firm tenure	3.865	4.406	4.286	4.982
Experience in Helsinki	9.964	0.513	0.536	0.354
Experience	10.733	10.479	10.224	10.339
Compulsory education	0.119	0.097	0.095	0.104
Secondary education	0.541	0.618	0.636	0.704
University education	0.341	0.284	0.269	0.192
No. observations	2,000,955	916,094	866,752	1,375,674

Notes: Monthly earnings are defined as yearly earned income divided by the number of months worked in a year. The income variable consists of cash salary items, compensation for employment-related costs and in-kind benefits. Firm tenure is measured in years. Experience in Helsinki and Experience are calculated before imposing sample restrictions.

Table 2: Summary statistics by mover status

	All	Movers	Stayers
Monthly earnings (log)	8.065	8.074	8.062
Age	32.371	32.021	32.470
Firm tenure	4.330	2.852	4.748
Experience in Helsinki	4.140	3.085	4.438
Experience	10.497	9.908	10.664
Compulsory education	0.107	0.100	0.109
Secondary education	0.614	0.554	0.631
University education	0.279	0.347	0.260
No. observations	5,159,475	1,137,849	4,021,626

Notes: Monthly earnings are defined as yearly earned income divided by the number of months worked in a year. The income variable consists of cash salary items, compensation for employment-related costs and in-kind benefits. Firm tenure is measured in years. Experience in Helsinki and Experience are calculated before imposing sample restrictions.

For completeness, we show descriptive statistics for the *SES sample* in Table 3 and we see that it includes less than half the number of observations in the *main sample*. On average, employees in the *SES sample* earn more, which, however, may be an artifact of how the data is sampled: firms with fewer than five workers are excluded and larger firms generally pay more. As in the *main sample*, we can see that workers in the Helsinki TWA earn the most and are the most likely to have a university degree.

[7] Note that across all person-year observations, this number is 22%, i.e. some individuals move more than once.)

Table 3: Summary statistics, SES sample

	Helsinki	Tampere and Turku	Jyväskylä, Lahti Kuopio and Oulu	Other TWAs
Hourly wages (log)	3.088	2.980	2.951	2.943
Monthly earnings (SES, log)	8.118	8.012	7.993	8.007
Monthly earnings (Folk, log)	8.212	8.103	8.075	8.089
Age	33.348	33.252	33.268	33.215
Firm tenure	4.228	5.062	4.857	5.750
Experience in Helsinki	10.627	0.499	0.531	0.344
Experience	11.366	11.278	10.998	11.134
Compulsory education	0.095	0.073	0.074	0.077
Secondary education	0.501	0.570	0.598	0.677
University education	0.404	0.357	0.327	0.246
No. observations	933,509	414,510	394,765	585,061

Notes: Hourly wages refer to total gross earnings (including overtime) for the reference month divided by the number of all hours paid during the same period, as reported in the SES register. Monthly earnings (SES) represent the numerator in the calculation of hourly wages. Monthly earnings (Folk) are defined as yearly earned income divided by the number of months worked in a year. The income variable consists of cash salary items, compensation for employment-related costs and in-kind benefits. Firm tenure is measured in years. Experience in Helsinki and Experience are calculated before imposing sample restrictions.

3.1 Raw urban wage premium

We start by showing the relationship between mean annual earnings and city size in the raw data. Figure 3 shows that, on average, workers in Helsinki earn around EUR 46,000 per year, which is 15% more than workers in Tampere, the second-largest TWA. Workers in Mikkeli, the median-sized TWA, earn EUR 35,000 per year, or 24% less than workers in Helsinki. The elasticity of earnings with respect to city size is 4.4%, which says that a doubling of the city size is associated with a 4.4% increase in annual earnings. However, as discussed in the introduction, this estimate is plagued by selection bias. In the next section, we address this issue and attempt to get closer to a causal estimate of city size on annual earnings.

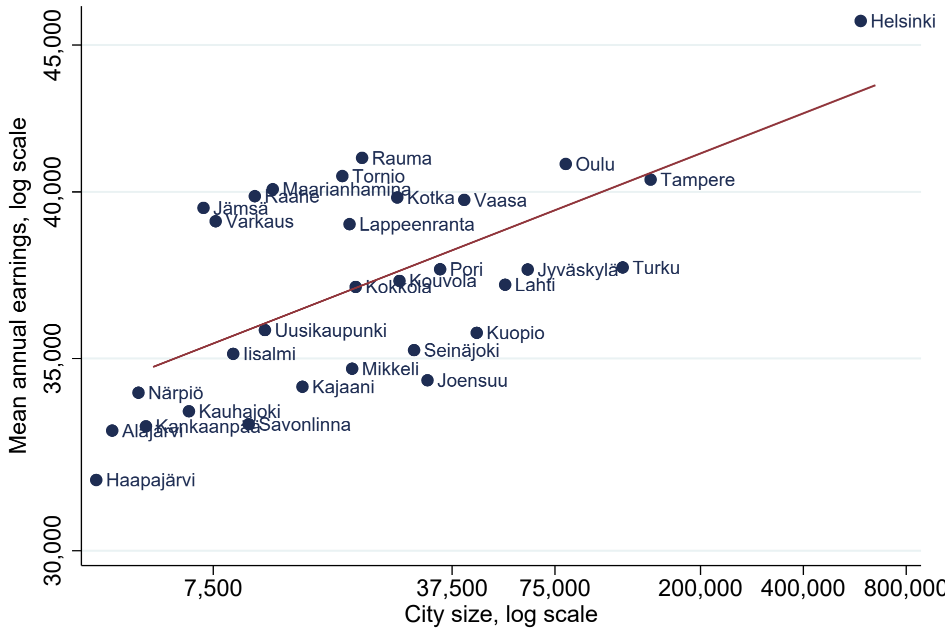


Figure 3: Raw urban wage premium

Notes: The figure plots mean annual earnings of men against city size (or employment density) measured as the number of jobs within 20 km of the center of the city(see Section 2.2).

4 Results

4.1 Static city size earnings premia

We start by estimating a static pooled OLS regression of the form:

$$w_{ict} = \alpha_t + \beta log\_density_c + \mu_i + \mathbf{x}'_{it}\gamma + \eta_{ict} \tag{1}$$

where w_{ict} is the log monthly earnings of worker i in city c at time t;[8]. α_t is a year fixed effect; $log\_density$ is the employment measure we defined above; μ_i is a worker fixed effect; $\mathbf{x}_{it}$ is a vector of time-varying individual and job characteristics (labor market experience and its square, job tenure and its square, education level, 2-digit sector codes, 3-digit occupation codes); γ is a vector of parameters and ν_{ict} is an error term.

We are interested in the parameter β, which gives the elasticity of earnings with respect to city size, i.e. the UWP. β correctly identifies the UWP if, conditional on the time-varying controls and time-fixed unobserved individual fixed effects, sorting across areas is as good as randomly assigned. To the extent that there are unobserved time-varying individual factors that affect both locating in a specific area and earnings (and which we cannot account for), β cannot be interpreted as causal. Finally, while adding individual fixed effects goes a long way towards accounting for worker sorting

[8] We show results for log hourly wages in subsection 4.3

and therefore isolating the causal effect of interest, it also means that identification comes only from individuals who move across TWAs, who, as Table 2 showed, are younger and more educated than the population as a whole.

We show results from progressively more demanding specifications in Table 4. In Column 1, we see, as before in Figure 3, that the raw UWP with respect to city size is 4.4%. Adding controls for experience, firm tenure and education almost halves the UWP, to 2.6% (Column 2). Workers may make their location choices based on the sectoral structure of an urban area; we account for this in Column 3 by adding two-digit-level sector fixed effects, which pushes the elasticity upwards slightly, suggesting the presence of negative omitted variable bias. Column 7 shows the results when we add individual fixed effects in addition to sector fixed effects and we see that the elasticity drops by 7 log points. This drop is larger than the drop between column 4, with occupation fixed effects and column 6, with occupation fixed effects and individual fixed effects. This is somewhat to be expected given that occupations are worker-specific characteristics, whereas we can think of sectors as firm-level characteristics. Column 8, our most complex specification, shows that conditional on covariates, sector, occupation and individual fixed effects, the elasticity of earnings with respect to city size is 2.4%. This elasticity is only 2 log points smaller than in column 5 where we do not add individual fixed effects.

Overall, the main conclusion from this table is that worker sorting (and, if present, dynamic benefits) accounts for roughly 45% $(1 - (0.024/0.044))$ of the raw UWP, and that observable characteristics actually already capture a great deal of selection into urban areas.

Table 4: Estimation of the static city size premium

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log employment density	0.044***	0.026***	0.031***	0.024***	0.026***	0.023***	0.024***	0.024***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Experience		0.062***	0.060***	0.055***	0.053***	0.072***	0.073***	0.071***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Experience ^{2}		-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm tenure		0.015***	0.013***	0.013***	0.012***	0.007***	0.007***	0.007***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tenure ^{2}		-0.001***	-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)
Secondary education		0.064***	0.052***	0.030***	0.026***	0.013***	0.016***	0.013***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
University education		0.401***	0.363***	0.193***	0.180***	0.364***	0.407***	0.360***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
R^2	0.038	0.359	0.411	0.476	0.498	0.787	0.784	0.788
N	5,066,707	5,066,707	5,066,707	5,066,707	5,066,707	5,066,707	5,066,707	5,066,707
Sector fixed effects	No	No	Yes	No	Yes	No	Yes	Yes
Occupation fixed effects	No	No	No	Yes	Yes	Yes	No	Yes
Individual fixed effects	No	No	No	No	No	Yes	Yes	Yes

Notes: Sector fixed effects are at the 2-digit level and occupation fixed effects are at the 3-digit level. Robust standard errors in parentheses and clustered at the individual-level. All specifications include year fixed effects and a constant term.

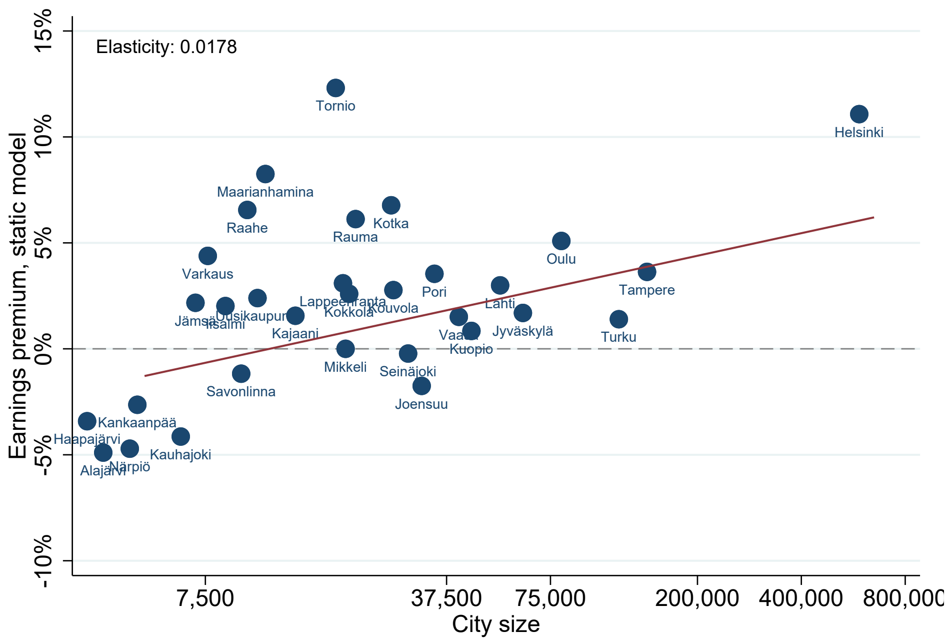
The specification in equation 1 assumes that the effect of density is linear. We relax this assumption in two ways.

First, we take a two-step approach as in, e.g. De la Roca and Puga (2017), where in step one we estimate a regression of the form:

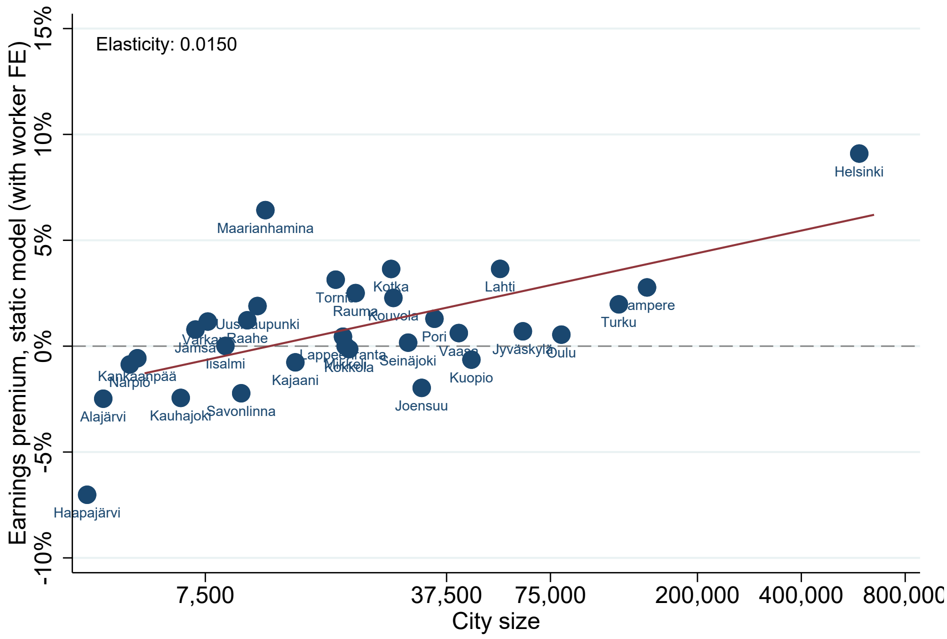
$$w_{ict} = \alpha_t + \sigma_c + \mathbf{x}'_{it}\gamma + \mu_i + \varepsilon_{ict} \tag{2}$$

Here, σ_c is a city fixed effect and everything else is the same as before. Our reference category for the city indicators in Mikkeli, the median-sized TWA.

In step two, we regress the city fixed effects estimated from equation 2 on the density measure. We first show the results from this approach graphically, by plotting the city fixed effects against city size in Figure 4, similarly to how Figure 3 was plotted, so as to get a sense of the functional form. Panel (a) plots the city fixed effects against city size from the specification with covariates only, whereas panel (b) shows how the graph changes when we add worker fixed effects. Although the slope is much flatter than what we saw in Figure 3, we still see large geographic differences in earnings even for observationally similar workers. The urban hierarchy whereby workers in Helsinki earn the most is maintained.



(a) With covariates



(b) With covariates and person FE

Figure 4: Static urban wage premium estimates

Notes: The figure plots earnings premium in TWAs against city size (or employment density). In panel (a) we control for time-varying covariates, and in panel (b) we also add worker fixed effects.

Column 2 in Table 5 shows that only accounting for observable characteristics results in an elasticity with respect to density of 1.8%, which is slightly lower than the corresponding coefficient of 2.6% from equation 1 (Column 5 in Table 4. Here, again we recover the result that the estimated elasticity goes down only slightly, to 1.5%, if we also account for unobserved heterogeneity. Note, however, that the number of observations we can use for implementing the second step of this approach is rather small (31 observations). In addition, in the two-step approach all TWAs get equal weights in the second step, whereas in the one-step approach larger TWAs get a bigger weight.

Table 5: Estimation of the static city size premium (using city indicators)

	(1)	(2)	(3)	(4)
Dependent variable	Log earnings	City FEs column 1	Log earnings	City FEs column 3
Experience	0.053***		0.071***	
	(0.000)		(0.000)	
Experience ^{2}	-0.001***		-0.001***	
	(0.000)		(0.000)	
Firm tenure	0.012***		0.007***	
	(0.000)		(0.000)	
Tenure ^{2}	-0.001***		-0.000***	
	(0.000)		(0.000)	
Secondary education	0.028***		0.013***	
	(0.001)		(0.002)	
University education	0.184***		0.359***	
	(0.001)		(0.003)	
Log employment density		0.018***		0.015***
		(0.005)		(0.004)
R^2	0.501	0.247	0.789	0.374
N	5,066,707	31	5,066,707	31
City indicators	Yes		Yes	
Sector fixed effects	Yes		Yes	
Occupation fixed effects	Yes		Yes	
Individual fixed effects	No		Yes	

Notes: Sector fixed effects are at the 2-digit level and occupation fixed effects are at the 3-digit level. Robust standard errors in parentheses and clustered at the individual-level. All specifications include a constant term.

The second way in which we relax the linearity assumption is by grouping urban areas in four categories based on the density measure: Helsinki TWA, Tampere and Turku TWA, Jyväskylä, Lahti, Kuopio and Oulu TWA and Other TWAs. We use this categorical variable as our explanatory variable, with Other TWAs as the reference category. We otherwise use the same specifications as in Table 4. This approach captures the Finnish urban hierarchy well, while allowing us to directly analyze the magnitude of the coefficients without having to resort to a two-step approach that may be problematic because of the small sample size.

Table 6 presents the results.[9] Column 1 reveals that Helsinki has the largest raw UWP, seven times larger than the next category which groups the Tampere and Turku together. Comparing this number to the number in Column 5, where we control for observable worker-level and employer-level characteristics that may affect sorting, we see that the UWP in Helsinki is reduced by 40%, to 8.6%, and is all but eliminated in Tampere and Turku (0.2%). Additionally accounting for sorting on time-fixed unobserved factors, the UWP goes down slightly in Helsinki (to 8%) and slightly up in Tampere and Turku (to 1.4%), suggesting negative selection on unobservables among those choosing Tampere and Turku.

Our overall conclusion from this section is that, regardless of whether we maintain or relax the linearity assumption, worker sorting (along with any potential dynamic benefits of cities) accounts for a significant share of the raw UWP. Perhaps somewhat surprisingly (though in line with previous work), once observable job and worker characteristics are controlled for, unobserved worker traits explain little of the selection into larger urban areas. Relaxing the linearity assumption has the advantage that it allows us to see how different cities fare and a second conclusion is that the Helsinki premium by far stands out, at 8% relative to Other TWAs, compared to, e.g. the Turku/Tampere premium at 1.4%. This result is in line with studies from other Nordic countries. Carlsen et al. (2016) find that the Oslo static effect is 6.5% and Eliasson and Westerlund (2023) find the Stockholm static effect to be 5% in a sample of university graduates. Our two estimates for the elasticity with respect to city size (2.4% and 1.5%, depending on the specification) are also in line with studies from non-Nordic countries, such as Germany (Dauth et al., 2022, 1.7%) or Spain (De la Roca and Puga, 2017, 2.4%).

[9] Note that we first estimate the most demanding specification, save the sample it was estimated for and then use the same sample throughout, to facilitate comparison across different specifications.

Table 6: Estimation of the static city size premium (grouping TWAs in four categories)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Helsinki	0.143***	0.084***	0.105***	0.076***	0.086***	0.078***	0.082***	0.080***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)
Tampere, Turku	0.025***	-0.010***	0.004***	-0.005***	0.002***	0.010***	0.013***	0.014***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Jyväskylä, Lahti, Kuopio, Oulu	0.010***	-0.012***	0.008***	-0.008***	0.005***	-0.001	0.003**	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Experience		0.062***	0.060***	0.055***	0.053***	0.072***	0.073***	0.071***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Experience ^{2}		-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm tenure		0.016***	0.013***	0.013***	0.012***	0.007***	0.007***	0.007***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tenure ^{2}		-0.001***	-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)
Secondary education		0.066***	0.054***	0.032***	0.028***	0.014***	0.017***	0.013***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
University education		0.404***	0.366***	0.196***	0.183***	0.363***	0.406***	0.359***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
R^2	0.040	0.362	0.413	0.478	0.500	0.787	0.784	0.788
N	5,066,707	5,066,707	5,066,707	5,066,707	5,066,707	5,066,707	5,066,707	5,066,707
Sector fixed effects	No	No	Yes	No	Yes	No	Yes	Yes
Occupation fixed effects	No	No	No	Yes	Yes	Yes	No	Yes
Individual fixed effects	No	No	No	No	No	Yes	Yes	Yes

Notes: Sector fixed effects are at the 2-digit level and occupation fixed effects are at the 3-digit level. Robust standard errors in parentheses and clustered at the individual-level. All specifications include year fixed effects and a constant term.

4.2 Dynamic benefits of cities

In order to understand the relative importance of worker sorting, static and dynamic effects, we estimate the following specification:

$$w_{ict} = \alpha_t + TWA_c + \mu_i + \gamma_1 exp_{it}^{HEL} + \gamma_2 (exp_{it}^{HEL})^2 + \delta_1(exp_{it}^{HEL} \times TT_{it}) + \delta_2(exp_{it}^{HEL} \times JLKO_{it}) + \delta_3(exp_{it}^{HEL} \times Other_{it}) + \mathbf{x}_{it}'\beta + \varepsilon_{ict} \quad (3)$$

where exp_{it}^{HEL} denotes the experience accumulated in Helsinki by worker i by time t. We then interact this term with whether the worker is currently located in Tampere or Turku (TT_{it}), Jyväskylä, Lahti, Kuopio or Oulu ($JLKO_{it}$) or Other TWAs ($Other_{it}$).

We estimate equation 4.2 for all workers and also separately for low-skilled (compulsory education only), medium-skilled (secondary education) and high-skilled workers (university education or above). We note the following caveat: to the extent that living in an urban area affects educational attainment, we are potentially introducing selection bias by looking separately by education status.[10]

Table 7 presents the results. In Column 1, we see that the estimated static effects for the TWA categories are slightly smaller than in Column 8, Table 6. A year of experience in Helsinki raises earnings by 1.9%, compared to working in Other TWAs during that year. Importantly, the experience accumulated in Helsinki is portable: for example, a year of working in Helsinki for those that are currently in Tampere or Turku raises earnings by 0.4%.

We further highlight two main findings from Columns 2-4. First, the static Helsinki effect is highest for those with secondary education and lowest for those with university education. However, the value of experience in Helsinki is actually highest for those with university degrees.

[10] This is what is known in the literature as a “bad control" problem.

Table 7: Estimation of the dynamic city size premium

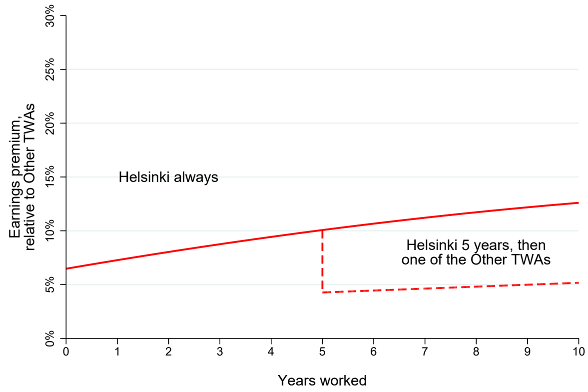
	(1) All	(2) Compulsory	(3) Secondary	(4) University
Helsinki	0.073***	0.063***	0.072***	0.058***
	(0.002)	(0.006)	(0.002)	(0.003)
Tampere, Turku	0.011***	0.020***	0.018***	0.007**
	(0.002)	(0.006)	(0.002)	(0.003)
Jyväskylä, Lahti, Kuopio, Oulu	0.003*	0.004	0.003	0.002
	(0.002)	(0.005)	(0.002)	(0.003)
Experience	0.064***	0.050***	0.058***	0.080***
	(0.000)	(0.001)	(0.001)	(0.001)
Experience ^{2}	-0.001***	-0.001***	-0.001***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Firm tenure	0.007***	0.009***	0.007***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)
Tenure ^{2}	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Experience in Helsinki	0.019***	0.008***	0.014***	0.025***
	(0.000)	(0.001)	(0.000)	(0.000)
Experience in Helsinki^2	-0.000***	-0.000***	-0.000***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Experience in Helsinki $\times$ Now in Tampere/Turku	0.004***	0.003***	0.002***	0.003***
	(0.000)	(0.001)	(0.000)	(0.001)
Experience in Helsinki $\times$ Now in Jyväskylä/Lahti/Kuopio/Oulu	0.002***	0.001	0.002***	0.001
	(0.000)	(0.001)	(0.000)	(0.001)
Experience in Helsinki $\times$ Now in Other TWAs	0.001***	0.002	0.001*	0.000
	(0.000)	(0.001)	(0.001)	(0.001)
R^2	0.790	0.678	0.763	0.815
N	5,066,707	522,507	3,073,439	1,415,049
Sector fixed effects	Yes	Yes	Yes	Yes
Occupation fixed effects	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes

Notes: Sector fixed effects are at the 2-digit level and occupation fixed effects are at the 3-digit level. Robust standard errors in parentheses and clustered at the individual-level. All specifications include a constant term.

4.2.1 Earnings profiles

Another way of showing our results is by plotting, using the coefficients in Table 7, the evolution of a worker's earnings in Helsinki vs. Other TWAs.

(a) Earnings profiles, all



(b) Earnings profiles, low-skilled

(c) Earnings profiles, medium-skilled

(d) Earnings profiles, high-skilled

Figure 5: Earnings profiles

Notes: The figure shows predicted earnings profiles over time for a worker moving to Helsinki TWA compared to a worker moving to Other TWAs. The solid line shows the earnings of a worker staying in Helsinki for 10 years and the dashed line for a worker moving to Other TWAs after 5 years in Helsinki. Panel (a) presents the earnings profile for all workers, panel (b) for low-skilled workers, panel (c) for medium-skilled workers and panel (d) for high-skilled workers.

In Figure 5a, the solid line shows the evolution of earnings over 10 years for an individual with no prior experience working in Helsinki, *relative* to the earnings of an individual with identical characteristics (in terms of the observables we include, as well as time-invariant unobservables) working in Other TWAs. That is, the line shows how much faster earnings grow for someone who works for 10 years in Helsinki upon entering the labor market, compared to someone in Other TWAs. We see that initially the worker in Helsinki earns 7.3% more than the worker in Other TWAs. At the 10-year mark, this difference almost reaches 25%.

The dashed line conveys the portability of experience accumulated in Helsinki. It shows the evolution of earnings of a worker who spends 5 years in Helsinki, at which point they relocate to Other TWAs. There is an immediate drop in earnings, since the worker does not benefit from the Helsinki premium anymore. However, the value of experience acquired in Helsinki carries over to the Other TWAs, and the worker gets to keep the resulting higher earnings (and even sees a slight increase over the subsequent 5 years).

Figures 5b, 5c and 5d plot the evolution of earnings for low-skilled, medium-skilled and high-skilled workers, respectively. We see that low-skilled workers have the flattest earnings profiles, whereas high-skilled workers have the steepest earnings profiles (with the medium-skilled somewhere in between). Nonetheless, the portability of experience accumulated in Helsinki is apparent across skill levels.

4.3 Results using wages

As discussed in Section 2, we would ideally use wages as our dependent variable to reduce the influence of labor supply. To see why, recall that by construction (Card, 1999):

$$\text{Monthly earnings} = \text{Hourly earnings} \times \text{Hours worked/week} \times \text{Weeks worked/month}$$

Therefore, when we use monthly earnings as our dependent variable, the coefficient on density in, for example, equation 1 is the sum of density coefficients from models run on the three components making up monthly earnings. If individuals in denser areas work more, the coefficient on density for monthly earnings will be higher than the coefficient when using hourly earnings.[11].

We therefore assess how our results change using hourly wages as our dependent variable. We can only do this for a subsample of workers whose firms have been sampled in the SES register. The smaller number of observations and the fact that workers enter the sample only if their firm was sampled means that we may not be able to capture all movements across TWAs. Since identification relies on these movements, results may differ relative to the previous analyses simply for this reason.

We first show results for the three versions of the static model and focus on the most complex specification, including covariates and worker fixed effects. We present these results in Table 8, where column 1 uses log hourly wages as dependent variable, column 2 uses log monthly wages as recorded in the SES register and column 3 uses log monthly earnings, the same variable we have been using up to now.

[11] There is some evidence that indeed there is a positive relationship between density and hours worked, especially among the high-skilled (Rosenthal and Strange, 2008)

In column 1 of Panel A, we see that the estimated elasticity in this subsample is 2%, which is very close to what we obtained in column 8 of Table 4, even if the sample is more than twice as small. The coefficients in columns 2 and 3 of the same panel are virtually identical, which suggests that the measure of monthly earnings we have constructed from the employment register is similar to what is reported in the SES register. The coefficients are larger than what we see in column 1, which seems to suggest an effect of density on hours worked. However, the results from the two-step approach presented in Panel B show no difference in coefficients between columns 1 and 3, which may of course be due to the small number of observations used to run the second-step regression. Note that the elasticity of 1.3% found here is very similar to the 1.5% found in column 4 of Table 5. Finally, in Panel C we again see that the Helsinki premium stands out, and that this is true across the three models. The Helsinki premium is about 43% larger in column 2 than in column 1, which again suggests the presence of an urban hours worked premium. It is also 16% larger than the estimate in Table 6, which may be due to sampling differences.

We now reestimate the model accounting for dynamic benefits using log hourly wages as our dependent variable. We present the results in Table 9. We largely confirm the patterns that we found using monthly earnings: i) the static effects for the TWA categories are smaller than in the static model; ii) experience in Helsinki is valuable: a year of experience in Helsinki raises earnings by 1.5%, compared to working in Other TWAs, iii) experience is portable: a year of working in Helsinki for those that are, for example, currently in Turku or Tampere, raises earnings by 0.4% and iv) there is heterogeneity across education groups.

Table 8: Estimation of the static city size premium using the SES sample

	(1) Hourly wages	(2) Monthly earnings (SES)	(3) Monthly earnings (Folk)
Panel A: Using density as explanatory variable			
Log employment density	0.020***	0.029***	0.028***
	(0.001)	(0.001)	(0.001)
R^2	0.819	0.738	0.848
N	2,198,196	2,188,199	2,224,294
Covariates	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes
Occupation fixed effects	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes
Panel B: Two-step approach			
Log employment density	0.013***	0.013**	0.013**
	(0.004)	(0.006)	(0.005)
R^2	0.350	0.160	0.237
N	31	31	31
Panel C: Grouping TWAs in four categories			
Helsinki	0.065***	0.093***	0.089***
	(0.002)	(0.004)	(0.003)
Tampere, Turku	0.009***	0.011***	0.014***
	(0.002)	(0.004)	(0.003)
Jyväskylä, Lahti, Kuopio, Oulu	0.008***	0.001	0.005*
	(0.002)	(0.004)	(0.003)
R^2	0.819	0.738	0.848
N	2,198,196	2,188,199	2,224,294
Covariates	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes
Occupation fixed effects	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes

Notes: Panel A shows the coefficient on log employment density from estimating equation 1 using hourly wages (Column 1), monthly earnings as reported in the SES register (Column 2) and monthly earnings as constructed from the Folk employment module (Column 3). Panel B shows the coefficient on log employment density from a regression of the city indicators obtained from estimating equation 2 on the three different dependent variables on log employment density. Panel C reports the coefficients on the TWA dummy variables from an equation that replaces the city indicators with four categories (the reference category is Other TWAs). Sector fixed effects are at the 2-digit level and occupation fixed effects are at the 3-digit level. Robust standard errors in parentheses and clustered at the individual-level. All specifications include year fixed effects and a constant term.

Table 9: Estimation of the dynamic city size premium in the SES sample

	(1) All	(2) Compulsory	(3) Secondary	(4) University
Helsinki	0.064***	0.067***	0.063***	0.047***
	(0.003)	(0.015)	(0.004)	(0.004)
Tampere, Turku	0.008***	0.003	0.010***	0.008**
	(0.003)	(0.015)	(0.004)	(0.004)
Jyväskylä, Lahti, Kuopio, Oulu	0.007***	0.012	0.002	0.006*
	(0.002)	(0.014)	(0.003)	(0.004)
Experience	0.037***	0.026***	0.032***	0.048***
	(0.001)	(0.002)	(0.001)	(0.001)
Experience ^{2}	-0.001***	-0.000***	-0.000***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Firm tenure	0.004***	0.005***	0.005***	0.002***
	(0.000)	(0.001)	(0.000)	(0.000)
Tenure ^{2}	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Experience in Helsinki	0.015***	0.007***	0.010***	0.017***
	(0.000)	(0.001)	(0.000)	(0.001)
Experience in Helsinki^2	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Experience in Helsinki × Now in Tampere/Turku	0.004***	0.004***	0.003***	0.002***
	(0.000)	(0.001)	(0.001)	(0.001)
Experience in Helsinki × Now in Jyväskylä/Lahti/Kuopio/Oulu	0.003***	0.006***	0.004***	0.000
	(0.000)	(0.002)	(0.001)	(0.001)
Experience in Helsinki × Now in Other TWAs	0.002***	0.007*	0.001**	0.000
	(0.001)	(0.004)	(0.001)	(0.001)
R^2	0.820	0.723	0.773	0.836
N	2,198,196	165,307	1,234,357	766,674
Sector fixed effects	Yes	Yes	Yes	Yes
Occupation fixed effects	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes

Notes: The dependent variable is log hourly wages. Sector fixed effects are at the 2-digit level and occupation fixed effects are at the 3-digit level. Robust standard errors in parentheses and clustered at the individual-level. All specifications include a constant term.

4.4 Results for women

We present the results for women in section A in the Appendix. Here, we highlight the main takeaways.

The summary statistics in Table A.1 show that on average, women earn less than men, regardless of TWA, even though they are more likely to have a university degree. Women who move actually earn less than women who do not, in contrast with what we saw for men (Table A.2). However, the elasticity of earnings with respect to city size is larger for women than for men (2.9% in the most complex specification, compared to 2.4%). The two-step approach shows that when accounting for worker sorting, the UWP for women actually goes up, which suggests that women who move are negatively selected. However, the coefficient is small (1.1%) and only statistically significant at the 10% level. When we instead divide TWAs in four categories, we see that the Helsinki premium for women is even larger than for men (9.2% compared to 8% for men). When we account for the value of experience in the dynamic specification, the Helsinki premium actually goes up slightly. While experience in Helsinki is valuable also for women, a year of experience in Helsinki amounts to a smaller increase in earnings (1% as opposed to 1.9%) for men.

5 Mover analysis

Since movers are key to our identification strategy, we now focus on them in a more systematic way.

We create a panel of movers in the following way. We first identify individuals who move at least once across TWAs. We define the year when the move happens as $t = 0$. We keep only those individuals whom we can observe at least two years before the move and at least one year beyond $t = 0$ (or four years consecutively, centered around the event year). This means we restrict to moves happening between 2007 and 2018. We also restrict to people who stay in the same TWA for two years consecutively before and after the move. We finally apply the earnings restriction from before (that earnings are above the 10% in the national distribution) in $t = -1$. The panel gives blocks of four years for each individual, depending on the number of moves they make. For example, if someone moves in 2008 and 2010, we'll have: i) block 1: 2006, 2007, 2008, 2009; ii) block 2: 2008, 2009, 2010, 2011.

With the sample computed this way, we have 67,022 movers; of whom 41,169 are men.[12] The total number of unique individuals (i.e. movers and stayers) is 795,818, so 8.4% of the sample are movers.

[12]Note that these are individuals, not individual-year observations.

Table 10: Summary statistics for movers, by destination

	Helsinki	Tampere and Turku	Jyväskylä, Lahti Kuopio and Oulu	Other TWAs
Monthly earnings	8.200	8.179	8.145	8.139
Age	32.394	32.681	32.651	32.626
Number of moves	1.350	1.393	1.393	1.392
Experience in Helsinki	2.820	3.608	3.411	2.948
Experience	10.522	10.784	10.769	10.731
Compulsory education	0.075	0.083	0.091	0.100
Secondary education	0.479	0.504	0.545	0.561
University education	0.446	0.412	0.364	0.339
No. observations	17,926	10,219	10,275	10,636

Notes: Summary statistics refer to the year of the move ($t = 0$). Monthly earnings are defined as yearly earned income divided by the number of months worked in a year. The income variable consists of cash salary items, compensation for employment-related costs and in-kind benefits. Firm tenure is measured in years. Experience in Helsinki and Experience are calculated before imposing sample restrictions.

Table 10 shows summary statistics for these movers in $t = 0$. We see, as before, that also in this sample movers to Helsinki are the most likely to have university degrees and earn the most. Movers to destinations other than Helsinki have between about 3 (to Other TWAs) and 3.6 (to Tampere or Turku) years of experience in Helsinki.

The transition matrix in Figure 6 additionally shows that movers from Helsinki choose the other three destinations with roughly equal probabilities. Movers from Tampere or Turku choose Helsinki in 60% of cases.

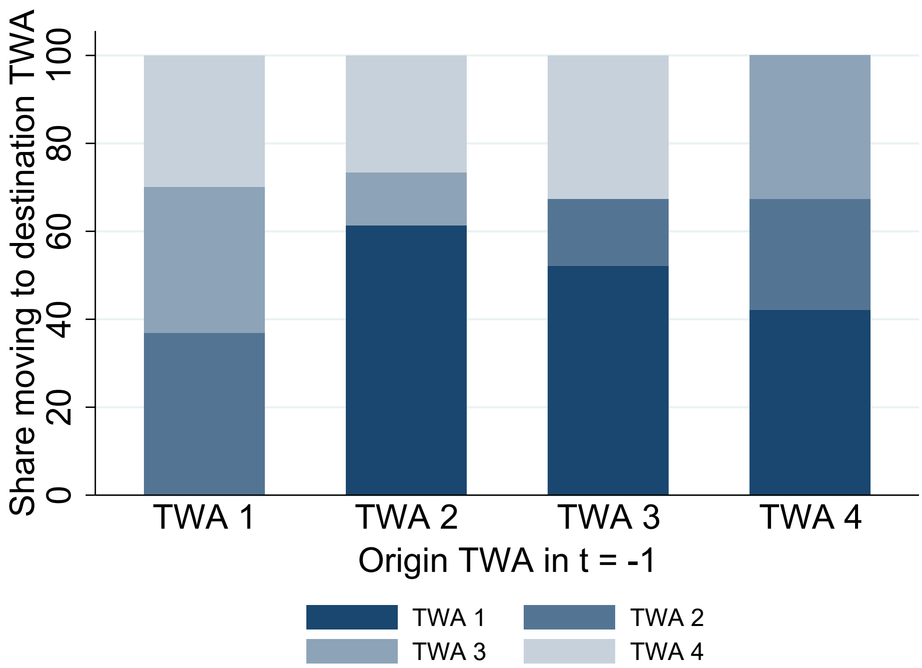


Figure 6: Transition matrix, conditional on moving

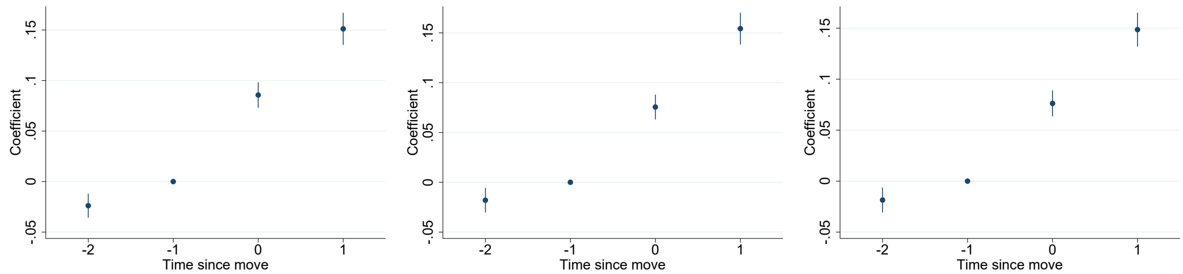
To see how earnings grow before and after a move, we run the following event study-style regression:

$$w_{ict} = \alpha_t + \sum_{k=-2}^{k=2} \lambda_k \mathbb{1}\{t = k\} + \sum_{k=-2}^{k=2} \theta_k \mathbb{1}\{t = k\}\sigma_{od} + \mathbf{x}'_{it}\gamma + \mu_i + \varepsilon_{ict} \tag{4}$$

where σ_{od} are origin-destination dummies, with $t = -1$ and Helsinki-Other TWAs serving as reference categories.

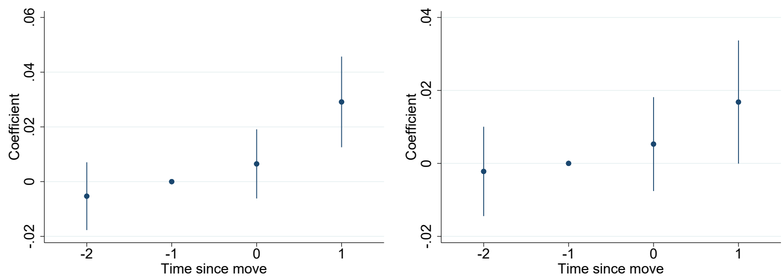
We plot the coefficients on the interactions between the time-to-event dummies and origin-destination dummies in Figures 7 and 8. We only plot coefficients for those dummies with Helsinki either as origin or destination.

We see that all moves, both from and to Helsinki, entail an increase in earnings. However, this increase is particularly high when Helsinki is the destination. Movers to Tampere or Turku see increases larger than movers to Jyväskylä, Lahti, Kuopio or Oulu.



(a) From TT to Helsinki (b) From JLKO to Helsinki (c) From OT to Helsinki

Figure 7: Event study coefficients for movers to Helsinki, by origin



(a) From Helsinki to TT (b) From Helsinki to JLKO

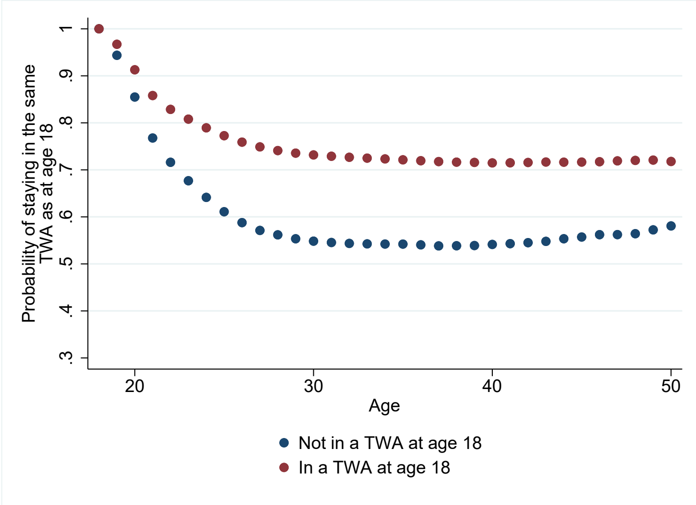
Figure 8: Event study coefficients for movers from Helsinki, by destination

5.1 Mobility behavior over the life cycle

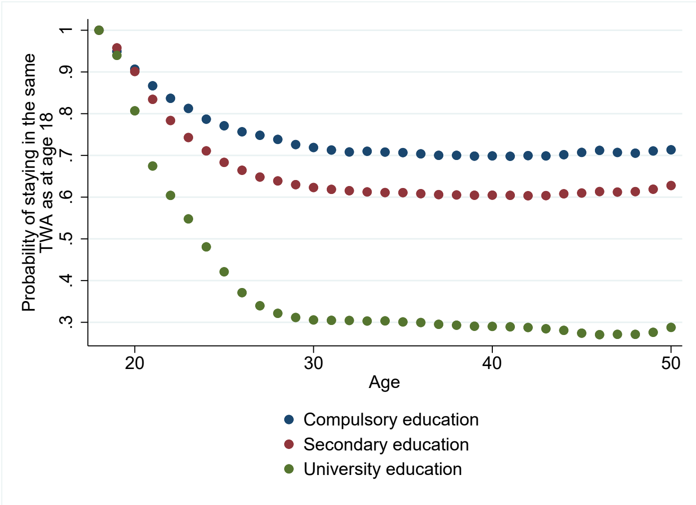
We now take a step back and study mobility patterns from the age of 18 and over the life-cycle. That is, for this exercise, we focus on individuals who were employed at least once during 1987-2019 and whom we can observe from the year they are 18, as long as we can observe them more than once (we drop those whom we observe only once at 18). We make no other restrictions to the sample. We are interested in understanding when people move from the TWA they live in at 18, and how likely they are to make other moves throughout their life.

For this purpose, we plot the probability of being in the same TWA as at age 18 from age 18 till the end of the observation period. Figure 9a shows what this looks like for men, separately by whether the area at birth was classified as a TWA or not. It is important to understand whether the propensity to move to a city is higher among those who start off in a city compared to those who live in a non-urban area.

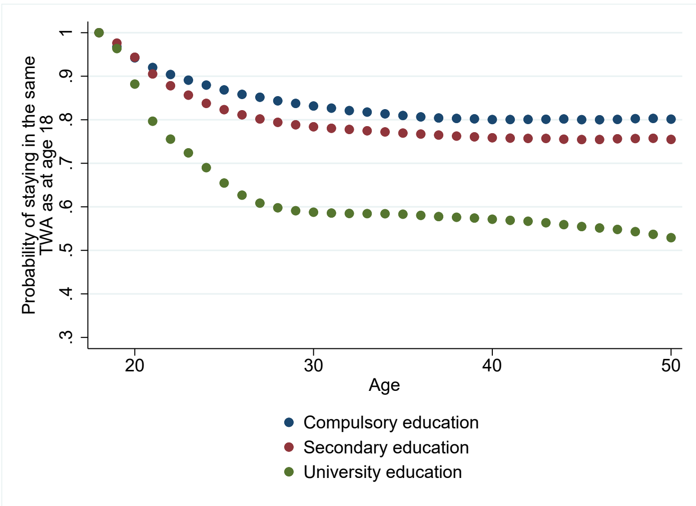
We can first see that the probability of living in the same TWA as at age 18 declines more for those who start off in an area that is not classified as a TWA. For both groups, however, the propensity to live in the same area as at age 18 declines steadily until roughly the age of 30, when it flattens out. This suggests that most moves away from the area at 18 happen up to the age of 30, after which most people settle down in a TWA. Interestingly, for those who start off in a non-TWA, we see a reversal of the pattern starting around the age of 40, when individuals' probability to be in a non-TWA starts increasing (i.e. these individuals leave urban areas in favor of areas not characterized as urban). By the age of 50, around 30% of individuals starting off in a TWA at age 18 are not in that same TWA. The equivalent percentage for those starting off in a non-TWA is 40%. Note that we do not make restrictions on being able to observe everyone for an equal amount of time, so that the number of observations we use at each age may differ (and in general this number will be smaller for the older ages).



(a) Probability of staying in the same area as at age 18, by whether the area at 18 is a TWA or not



(b) Probability of staying in the same area as at age 18, by education, for those in non-TWAs at age 18



(c) Probability of staying in the same area as at age 18, by education, for those in TWAs at age 18

Figure 9: Mobility behavior

Figures 9b and 9c show how these patterns differ depending on completed education by age 30, by area at age 18. We see that those who eventually complete a university degree or higher have much higher propensities to move, regardless of the kind of area they start in. We see also here that among those who start off in a non-urban area, the patterns are stronger.

Appendix Figure A.1 shows the results for women. We note that while the patterns are similar to men's, the magnitudes are larger. Women's propensity to leave the areas they live in at age 18 are even higher than those of men, and especially so among those starting off in a non-TWA.

6 Discussion

Our findings suggest that cities benefit workers above and beyond what would be expected from their skills (observed and unobserved) alone. These benefits are both static, which the worker enjoys while working in a particular area and dynamic, whereby workers with city experience accumulate human capital that does not depreciate when they relocate.

The findings presented here are, however, not informative about the *mechanisms* behind the static benefits. The literature has proposed various explanations (aside from natural advantages that cities might have, such as a warm climate or a favorable location): i) better matching of workers and firms in thicker labor markets; ii) better availability of specialized providers of intermediate inputs (due to economies of scale); and iii) increased knowledge spillovers in denser cities (e.g. Combes and Gobillon, 2015). These productivity advantages of bigger cities, known as agglomeration economies, can be expected to be reflected in the static wage premium of bigger cities. [13]

Regardless of the source, if agglomeration economies are a key driver of productivity differences, policies that move workers from smaller cities to larger cities have indirect effects on productivity in the origin and destination cities, in addition to the direct positive effect on the productivity of those who move. The growth of destination cities further increases productivity in these cities, while there is a negative effect on the productivity of remaining workers in shrinking origin cities.[14] The combined

[13] The design of the national wage bargaining system and differences in the degree of competition across local labor markets may affect the link between productivity and wages. In an imperfectly competitive market, wage differences may also reflect differences in firms' wage setting power. Hirsch et al. (2022) show evidence for thicker markets being more competitive using German data. Boeri et al. (2021) argue that a collective bargaining model that allows for local bargaining can lead to a stronger link between regional productivity and wages than a nationwide bargaining model.

[14] If productivity differences across locations are solely due to natural advantages rather than agglomeration economies, policies that move jobs from low productivity cities to high productivity cities would very likely increase national productivity and output, because there are no indirect effects through changes in city size.

effect on national productivity and output would depend on the functional form of the effect of city size on productivity. Our descriptive plot of city-specific wage effects against city size suggests that the relationship is not far from linear, but considerable uncertainty remains. If the agglomeration economies at the margin are equally strong in all regions, the direct positive effect on the productivity of workers that move dominates the effect on overall productivity.

Naturally, policy makers could and should be concerned with the level of well-being and equity in addition to productivity and output. It is difficult to draw definitive conclusions on what our findings imply for welfare effects of policies that lead to relocation of jobs. The effect on welfare in the origin and destination cities depends not only on productivity effects, but also on congestion externalities, barriers to mobility, and several other things. Analysis of welfare and distributional effects is beyond the scope of this study, but it is important to recognize that wage or productivity effects may not align with welfare effects (see e.g. Moretti, 2011).

Policy measures that can potentially affect the location of firms and workers include place-based policies that reallocate resources between regions, and policies that affect the responsiveness of the supply of housing and commercial real estate to changes in demand. In addition, improvements in transportation infrastructure can connect firms in the affected areas with a new pool of workers and other firms, and thereby increase the effective size or density of the area without directly affecting location of firms and workers. The increase in the possibilities to work from home in certain sectors may also have increased the effective size of the labor market areas (Coskun et al., 2024).

References

Boeri, Tito, Andrea Ichino, Enrico Moretti, and Johanna Posch (2021). “Wage Equalization and Regional Misallocation: Evidence from Italian and German Provinces”. *Journal of the European Economic Association* 19.6, 3249–3292.

Card, David (1999). “Chapter 30 - The Causal Effect of Education on Earnings”. *Handbook of Labor Economics*. Ed. by Orley C. Ashenfelter and David Card. Vol. 3. Elsevier, 1801–1863.

Carlsen, Fredrik, Jørn Rattsø, and Hildegunn E. Stokke (2016). “Education, experience, and urban wage premium”. *Regional Science and Urban Economics* 60, 39–49.

Combes, Pierre-Philippe, Gilles Duranton, and Laurent Gobillon (2008). “Spatial wage disparities: Sorting matters!” *Journal of Urban Economics* 63.2, 723–742.

Combes, Pierre-Philippe and Laurent Gobillon (2015). “The Empirics of Agglomeration Economies”. *Handbook of Regional and Urban Economics*. Vol. 5. Elsevier, 247–348.

Coskun, Sena, Wolfgang Dauth, Hermann Gartner, Michael Stops, and Enzo Weber (2024). “Working from Home Increases Work-Home Distances”. *SSRN Electronic Journal*.

Dauth, Wolfgang, Sebastian Findeisen, Enrico Moretti, and Jens Suedekum (2022). “Matching in Cities”. *Journal of the European Economic Association* 20.4, 1478–1521.

De la Roca, Jorge and Diego Puga (2017). “Learning by Working in Big Cities”. *The Review of Economic Studies* 84.1, 106–142.

Elass, Kenza, Cecilia García-Penalosa, and Christian Schluter (2024). “CESifo Working Paper no. 11374”.

Eliasson, Kent and Olle Westerlund (2023). “The urban wage premium and spatial sorting on observed and unobserved ability”. *Journal of Economic Geography* 23.3, 601–627.

Glaeser, Edward L. and David C. Maré (2001). “Cities and Skills”. *Journal of Labor Economics* 19.2. Publisher: The University of Chicago Press, 316–342.

Hirsch, Boris, Elke J. Jahn, Alan Manning, and Michael Oberfichtner (2022). “The Urban Wage Premium in Imperfect Labor Markets”. *Journal of Human Resources* 57.S. Publisher: University of Wisconsin Press Section: Articles, S111–S136.

Moretti, Enrico (2011). “Local Labor Markets”. *Handbook of Labor Economics*. Vol. 4. Elsevier, 1237–1313.

Roback, Jennifer (1982). “Wages, Rents, and the Quality of Life”. *Journal of Political Economy* 90.6, 1257–1278.

Rosenthal, Stuart S. and William C. Strange (2008). “Agglomeration and Hours Worked”. *Review of Economics and Statistics* 90.1, 105–118.

Saarimaa, Tuukka, Heikki Pursiainen, and Janne Tukiainen (2015). “Hyvän valtionosuusjärjestelmän periaatteet”. Tech. rep. VATT-julkaisuja 70. Valtion taloudellinen tutkimuskeskus VATT.

Appendix

A Results for women

Table A.1: Summary statistics

	Helsinki	Tampere and Turku	Jyväskylä, Lahti Kuopio and Oulu	Other TWAs
Monthly earnings (log)	7.874	7.723	7.697	7.695
Age	31.800	31.573	31.666	31.978
Firm tenure	3.354	3.612	3.566	4.020
Experience in Helsinki	9.750	0.555	0.566	0.422
Experience	10.393	9.901	9.534	9.743
Compulsory education	0.070	0.056	0.053	0.059
Secondary education	0.495	0.596	0.608	0.638
University education	0.435	0.348	0.340	0.303
No. observations	1,547,193	625,408	529,723	788,166

Notes: Monthly earnings are defined as yearly earned income divided by the number of months worked in a year. The income variable consists of cash salary items, compensation for employment-related costs and in-kind benefits. Firm tenure is measured in years. Experience in Helsinki and Experience are calculated before imposing sample restrictions.

Table A.2: Summary statistics by mover status

	All	Movers	Stayers
Monthly earnings (log)	7.780	7.760	7.785
Age	31.779	30.450	32.135
Firm tenure	3.583	2.506	3.871
Experience in Helsinki	4.602	3.167	4.986
Experience	10.028	9.079	10.281
Compulsory education	0.062	0.045	0.067
Secondary education	0.563	0.505	0.578
University education	0.375	0.450	0.355
No. observations	3,490,490	737,002	2,753,488

Notes: Monthly earnings are defined as yearly earned income divided by the number of months worked in a year. The income variable consists of cash salary items, compensation for employment-related costs and in-kind benefits. Firm tenure is measured in years. Experience in Helsinki and Experience are calculated before imposing sample restrictions.

Table A.3: Estimation of the static city size premium

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log employment density	0.057***	0.039***	0.037***	0.027***	0.027***	0.029***	0.030***	0.029***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Experience		0.048***	0.044***	0.040***	0.039***	0.046***	0.047***	0.045***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Experience ^{2}		-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm tenure		0.011***	0.009***	0.009***	0.008***	-0.000	0.000	-0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tenure ^{2}		-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Secondary education		0.043***	0.034***	-0.001	-0.004***	0.010***	0.012***	0.008***
		(0.002)	(0.002)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
University education		0.315***	0.260***	0.120***	0.110***	0.297***	0.327***	0.290***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
R^2	0.055	0.312	0.360	0.425	0.438	0.695	0.692	0.697
N	3,391,020	3,391,020	3,391,020	3,391,020	3,391,020	3,391,020	3,391,020	3,391,020
Sector fixed effects	No	No	Yes	No	Yes	No	Yes	Yes
Occupation fixed effects	No	No	No	Yes	Yes	Yes	No	Yes
Individual fixed effects	No	No	No	No	No	Yes	Yes	Yes

Notes: Sector fixed effects are at the 2-digit level and occupation fixed effects are at the 3-digit level. Robust standard errors in parentheses and clustered at the individual-level. All specifications include year fixed effects and a constant term.

Table A.4: Estimation of the static city size premium (using city indicators)

Experience	0.039***		0.045***	
	(0.000)		(0.001)	
Experience ^{2}	-0.001***		-0.001***	
	(0.000)		(0.000)	
Firm tenure	0.008***		-0.000	
	(0.000)		(0.000)	
Tenure ^{2}	-0.000***		-0.000***	
	(0.000)		(0.000)	
Secondary education	-0.001		0.009***	
	(0.001)		(0.003)	
University education	0.114***		0.289***	
	(0.002)		(0.003)	
Log employment density		0.009		0.011*
		(0.005)		(0.006)
R^2	0.440	0.130	0.697	0.139
N	3,391,020	31	3,391,020	31
Sector fixed effects	Yes		Yes	
Occupation fixed effects	Yes		Yes	
Individual fixed effects	No		Yes	

Notes: Sector fixed effects are at the 2-digit level and occupation fixed effects are at the 3-digit level. Robust standard errors in parentheses and clustered at the individual-level. All specifications include a constant term.

Table A.5: Estimation of the static city size premium (grouping TWAs in four categories)

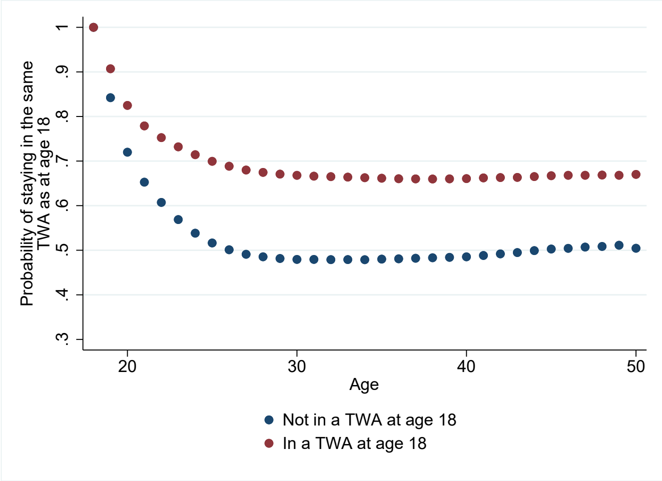
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Helsinki	0.180***	0.126***	0.122***	0.085***	0.087***	0.092***	0.097***	0.092***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Tampere, Turku	0.027***	0.012***	0.010***	0.000	0.003***	0.006***	0.007***	0.009***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Jyväskylä, Lahti, Kuopio, Oulu	0.001	-0.000	0.008***	-0.005***	0.002	-0.005**	-0.003	-0.002
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Experience		0.048***	0.044***	0.040***	0.039***	0.046***	0.047***	0.045***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Experience ^{2}		-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm tenure		0.011***	0.009***	0.009***	0.008***	-0.000	0.000	-0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tenure ^{2}		-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Secondary education		0.046***	0.036***	0.001	-0.002	0.010***	0.013***	0.009***
		(0.002)	(0.002)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
University education		0.316***	0.262***	0.123***	0.113***	0.296***	0.326***	0.290***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
R^2	0.060	0.315	0.363	0.426	0.439	0.695	0.692	0.697
N	3,391,020	3,391,020	3,391,020	3,391,020	3,391,020	3,391,020	3,391,020	3,391,020
Sector fixed effects	No	No	Yes	No	Yes	No	Yes	Yes
Occupation fixed effects	No	No	No	Yes	Yes	Yes	No	Yes
Individual fixed effects	No	No	No	No	No	Yes	Yes	Yes

Notes: Sector fixed effects are at the 2-digit level and occupation fixed effects are at the 3-digit level. Robust standard errors in parentheses and clustered at the individual-level. All specifications include year fixed effects and a constant term.

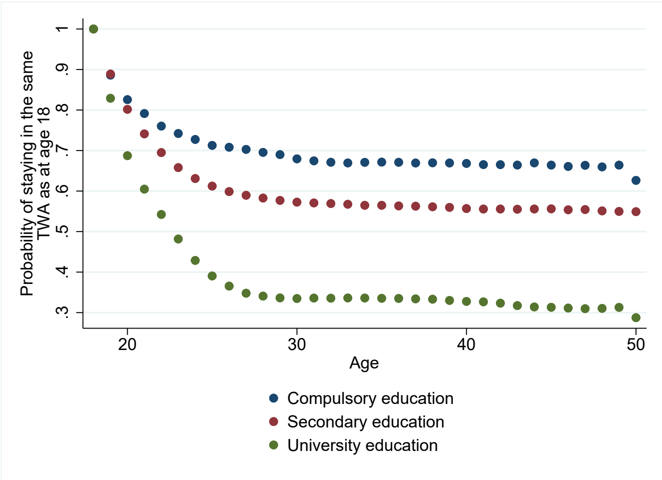
Table A.6: Estimation of the dynamic city size premium

	(1) All	(2) Compulsory	(3) Secondary	(4) University
Helsinki	0.094***	0.074***	0.085***	0.088***
	(0.002)	(0.011)	(0.003)	(0.004)
Tampere, Turku	0.006**	0.014	0.021***	0.003
	(0.002)	(0.012)	(0.003)	(0.004)
Jyväskylä, Lahti, Kuopio, Oulu	-0.005**	0.002	0.001	-0.009**
	(0.002)	(0.011)	(0.003)	(0.004)
Experience	0.041***	0.042***	0.042***	0.039***
	(0.001)	(0.002)	(0.001)	(0.001)
Experience ^{2}	-0.001***	-0.001***	-0.001***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Firm tenure	-0.000	0.005***	0.003***	-0.007***
	(0.000)	(0.001)	(0.000)	(0.000)
Tenure ^{2}	-0.000***	-0.000***	-0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Experience in Helsinki	0.010***	0.001	0.005***	0.010***
	(0.000)	(0.001)	(0.000)	(0.001)
Experience in Helsinki^2	-0.000***	0.000	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Experience in Helsinki × Now in Tampere/Turku	0.004***	0.004**	0.001	0.004***
	(0.001)	(0.002)	(0.001)	(0.001)
Experience in Helsinki × Now in Jyväskylä/Lahti/Kuopio/Oulu	0.004***	-0.001	0.002***	0.004***
	(0.001)	(0.002)	(0.001)	(0.001)
Experience in Helsinki × Now in Other TWAs	0.002***	-0.002	0.001	0.002**
	(0.001)	(0.002)	(0.001)	(0.001)
R^2	0.698	0.629	0.697	0.658
N	3,391,020	196,035	1,866,630	1,268,661
Sector fixed effects	Yes	Yes	Yes	Yes
Occupation fixed effects	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes

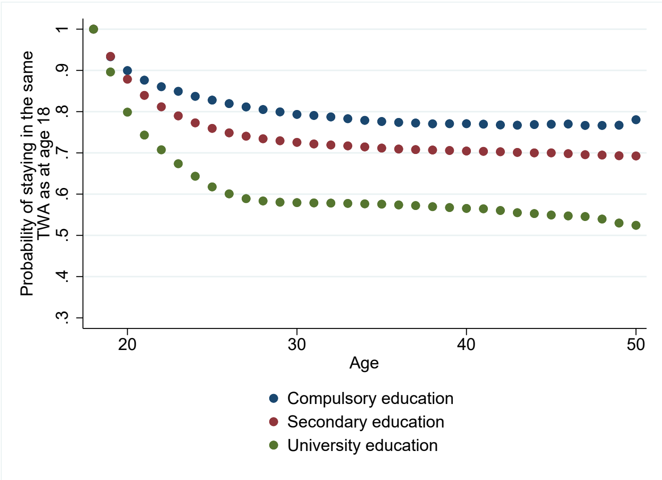
Notes: Sector fixed effects are at the 2-digit level and occupation fixed effects are at the 3-digit level. Robust standard errors in parentheses and clustered at the individual-level. All specifications include a constant term.



(a) Probability of staying in the same area as at age 18, by whether the area at 18 is a TWA or not



(b) Probability of staying in the same area as at age 18, by education, for those in non-TWAs at age 18



(c) Probability of staying in the same area as at age 18, by education, for those in TWAs at age 18

Figure A.1: Mobility behavior, women

B Data

B.1 Industry and occupation codes harmonization

Industry codes

To harmonize 2-digit industry codes across time, we use the classification developed by Joonas Tuhkuri, see here.

Occupation codes

For occupations, we do an empirical crosswalk using the harmonized version of the SES and the non-harmonized SES, along with the correspondence key from Statistics Finland. If according to the key, the 2001 code is associated with only one 2010 code, then we use the associated unique mapping. Otherwise, we use the mapping that is observed with the highest frequency in the harmonized SES (using all years 1992-2009). Finally, if there is no unique correspondence *and* not enough transitions in the harmonized SES, we leave the code unharmonized.

We focus on transitions from 2001 3-digit codes to other 3-digit codes; 4-digit codes to other 4-or 5-digit codes; 5-digit codes to other 4- or 5-digit codes. This means we ignore 1-1 or 2-2 transitions.[15]

Using this method, we can harmonize 48/108 3-digit codes; 332/350 4-digit codes; and 142/148 5-digit codes. In the sample, this translates into 1.86% person-year observations that cannot be harmonized (4.19% are instead "true" missing). Doing the harmonization at a higher level allows us to then bring everything to a lower level (3-digit) in the current analysis.

B.2 Travel-to-work areas

There are 31 travel-to-work areas, as defined by Statistics Finland for the year 2021: Helsinki, Lahti, Kouvola, Kotka, Turku, Rauma, Pori, Kankanpää, Tampere, Lappeenranta, Mikkeli, Savonlinna, Varkaus, Kuopio, Iisalmi, Joensuu, Närpiö, Vaasa, Seinäjoki, Alajärvi, Jämsä, Jyväskylä, Kokkola, Raahe, Oulu, Kajaani, Marianhaamina, Uusikaupunki, Haapajärvi, Kauhajoki, Tornio.

Table B.1 lists our measure of employment density, total number of jobs and total population by TWA in 2019.

[15] In our sample, 95% of person-year observations have occupation coded at the 4- or 5-digit level.

Table B.1: Emplyment density, total employment and population in TWAs in 2019

TWA	Employment density	Total employment	Total population
Helsinki	588621	717804	1620480
Tampere	142872	174463	468805
Turku	118364	135242	356282
Oulu	80666	93600	259058
Jyväskylä	62408	76089	209488
Lahti	53613	67598	192562
Kuopio	44268	63179	172358
Vaasa	40693	46121	113003
Pori	34587	43396	123288
Joensuu	31767	43623	125061
Seinäjoki	29018	43016	113664
Lappeenranta	28787	43971	123829
Kouvola	26300	30784	90252
Kotka	25912	28241	83629
Rauma	20441	26140	69379
Kokkola	19579	25676	67016
Mikkeli	19119	26845	73672
Tornio	17898	19401	54116
Kajaani	13677	19291	54229
Maarianhamina	11198	11802	29033
Uusikaupunki	10621	10656	26327
Raahe	9922	12310	33330
Savonlinna	9526	14994	46596
Iisalmi	8576	16422	47099
Jämsä	7021	8027	24558
Varkaus	6722	6886	20498
Hauhajoki	6365	6715	18790
Kankaanpää	4764	5463	15597
Närpiö	4530	7083	18606
Alajärvi	3795	4601	14774
Haapajärvi	3408	3509	10008
Non-TWA	N.A.	259639	762610