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Work from home and big city out-migration before and after the pandemic

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Work from home and big city out-migration before and after the pandemic*

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Abstract

Many argue that the big and sudden shift to work from home following the pandemic can lead to large and lasting geographical effects in terms of where we choose to live and work. This is one of the first studies that explicitly analyses how the potential for remote work at the individual level affects migration patterns of those living and working in metropolitan city centres. The empirical analysis focuses on Stockholm City and workers who continue to work in the city centre but who may or may not choose to move their residence outside of Stockholm. The analysis is based on detailed population-wide microdata and covers the period 2016–2023. The results indicate that workers in remote work compatible jobs are more inclined to make counter-urban moves after the start of the pandemic. This is particularly true for managers and professionals in occupations that can be done from home and pertains especially for moves to medium-sized cities and small cites/rural areas. Although the estimated marginal effects are small in absolute size, they represent more than a doubling of the baseline probability of making a long-distance move. The findings suggest that the shift to remote work arrangements after the pandemic have enabled managers and professionals with jobs that can be done remotely to move their residence beyond the metropolitan region and combine work from home with occasional long-distance commuting to their city centre workplace.

Keywords: Work from home, Remote work, Migration, Labour mobility, COVID-19

JEL classification: R10, R23, J24, J61

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1. Introduction

Historically, the structure of cities has been shaped by technological change (Glaeser 2020). After World War II, large investments in transport infrastructure and increased commuting by car lead to suburbanisation in metropolitan regions. Baum-Snow (2007) shows that between 1950 and 1990, central city population in the United States decreased by 17 percent despite total metropolitan area population growth of 72 percent. Corresponding figures for Sweden show that between 1960 and 1980, the population in Stockholm City declined by 20 percent while suburban population in Stockholm County grew by 90 percent.

The pandemic triggered a big and sudden shift to work from home (WFH). Remote work can be regarded as a decoupling technology, allowing a second wave of spatial separation between the place of residence and the physical workplace. International surveys of working arrangements and examinations of job vacancy postings indicate that a substantial part of post-pandemic work will be conducted from home or from other remote work locations (Aksoy et al. 2022, Bick et al. 2023, Hansen et al. 2023). How will this alter the urban landscape? Will we see a new wave of urban exodus? Florida and Kotkin (2021) argue that the effect of the pandemic on how we live and work may lead to the most geographically transformative event since the great migration to the suburbs after World War II. However, while suburbanisation during the era of daily commuting primarily took place within the boundaries of metropolitan regions, post-pandemic remote work arrangements may also allow central city workers to relocate beyond metropolitan areas and combine work from home with occasional long-distance commuting to their original city centre jobs.

The aim of this study is to analyse how the major shift to work from home has affected the migration pattern of individuals who reside and work in metropolitan area city centres. The empirical analysis focuses on Stockholm City and workers who keep their jobs in the city but who may or may not choose to move out of the city. The potential effect of remote work on the spatial decoupling between the place of residence and the place of work is thus at the centre of the analysis. Stockholm is by far Sweden's largest city, with a population of approximately 1 million and 700,000 employees at workplaces located in the city. There are two primary reasons why new residential patterns as a result of work from home can first be expected to be observed in a city like Stockholm (or other metropolitan centres). First, Stockholm has a high share of jobs that can potentially be performed remotely (above 50 percent). Second, like many other big cities, Stockholm struggles with increasing unaffordability due to high costs of housing (see Eliasson and Westerlund 2023).

The paper specifically seeks to address the following questions: Have workers become more inclined to leave the city centre after the pandemic? Where do they choose to relocate? What role does the possibility of working from home play in the mobility decision? Does the effect of remote work potential vary across destinations and occupational groups and has the effect changed after the pandemic?

The analysis is based on a number of population-wide longitudinal registers administrated by Statistics Sweden. The data include detailed occupational statistics used to classify remote work potential at the individual level and a rich set of other individual and household characteristics influencing workers' mobility decisions. Moreover, a new register provides a unique opportunity for an up-to-date analysis of how the big shift to work from home has affected the migration pattern of city centre workers. The data cover the period 2016–2023 (data for 2023 refers to the first two quarters), which makes it possible to analyse mobility patterns several years before and several years after the start of the pandemic.

Contrary to previous research based on microdata, this study finds that workers in remote work compatible jobs are more inclined to make counter-urban moves after the start of the pandemic. This is particularly true for managers and professionals in occupations that can be done from home and pertains especially for moves to medium-sized cities and small cites/rural areas, but it is also apparent for moves to other metropolitan areas. Although the estimated average marginal effects are small in absolute size, they correspond to more than a doubling of the baseline probability of making a long-distance move. The reported results suggest that the shift to work-from-home arrangements after the pandemic have enabled managers and professionals with occupations that can be done remotely to move their residence away from the metropolitan region and combine work from home with occasional long-distance commuting to their city centre workplace.

This paper relates to a small pre-pandemic literature on how remote work arrangements can affect people's location decisions. Studies focusing on telework show that telecommuting enables employees to live further away from their place of work by allowing longer but less frequent commuting trips (Mokhtarian et al. 2004, Zhu 2012, 2013).

The study also builds on a growing body of literature on how the pandemic and the large-scale adoption of remote work has affected migration patterns at different geographical scales. Early empirical results, based on various data sources for the United States and focusing on the first year of the pandemic, indicate that big city centres have lost in attractiveness, primarily in relation to suburban locations but also relative to smaller and less costly cities and towns.[1] Ramani and Bloom (2021) use U.S. Postal Service change-of-address data and data on residential property rental rates and home values. They find falling rents and values in the city centres and increasing rents and values in the low-density outskirts of cities. Similarly, they find net population outflows from the city centres and net population inflows to the suburbs. The authors also show that net population outflows are higher in ZIP codes with a higher share of residents in jobs that can be done from home.

Liu and Su (2021) find that the demand for housing has shifted from dense central city locations towards the suburbs and that ZIP codes with a higher share of telework-compatible jobs and higher pre-pandemic home prices experience a relative decline in home and rental prices. Brown and Tousey (2021) use change-of-address data reported to financial institutions and find substantial negative net migration in very large urban areas and positive net migration in small and medium urban areas. Althoff et al. (2022) use cell phone data to study population change and find that ZIP codes with a higher share of residents in jobs that can be done remotely experience larger population outflows. Haslag

[1] Recent theoretical contributions predict that a permanent increase in remote work will cause similar within and between city adjustments (Brueckner et al. 2021, Davis et al. 2022, Delventhal et al. 2022, Gupta et al. 2022, Delventhal and Parkhomenko 2023, Brueckner and Sayantani 2023).

and Weagley (2022) use cross-state moving data from a moving company and find a significant shift in migration from larger, costly cities towards smaller, more affordable areas. Ozimek and Carlson (2023) use microdata from the American Community Survey and find a negative effect of remote work exposure on population growth in the most dense and expensive locations.

There is also an emerging international literature using more traditional migration data to analyse how the first year of the pandemic has affected internal migration patterns (including Fielding and Ishikawa (2021) on Japan; Tønnessen (2021) on Norway; Gonzáles-Leonardo et al. (2022) on Spain; Stawarz et al. (2022) on Germany; and Vogiazides and Kawalerowicz (2022) on Sweden). These studies confirm the early findings for the United States and report negative net migration in large metropolitan regions like Barcelona, Madrid, Oslo, Stockholm and Tokyo and positive net migration in smaller cities, towns and rural areas. The outflows from big cities during the early phase of the pandemic represent an acceleration of already existing migration trends in the countries in question. The more rural locations receiving net in-migration tend to be popular tourist destinations, with rich outdoor amenities and many second homes. Frey (2022) use Census Bureau population statistics for the United States and report a record number of big cities with population losses during the first year of the pandemic (51 out of 88), but also signs of declining suburban growth due to metropolitan-wide growth slowdowns. The exodus from large U.S. metros was already underway before the pandemic and is associated with rising prices for housing and other forms of urban discontent (Ganong and Shoag 2017, Glaeser 2020, Hoxie et al. 2023).

In terms of analyses of effects of remote work based on microdata, Tønnessen (2021) reports a substantial increase in out-migration from Oslo among individuals with telework-compatible jobs (based on descriptive statistics), while Vogiazides and Kawalerowicz (2022) find a negative effect of telework potential on out-migration from Stockholm. Sandow and Lundholm (2020) study families moving away from metropolitan regions in Sweden. Although the analysis is based on pre-pandemic data and does not explicitly focus on the effects of remote work, the reported results are relevant for this study. The paper pays particular attention to the role that the type of occupation or profession has on the mobility decision. Contrary to expectations, the authors find that knowledge sector professionals are not more likely to move out from metropolitan areas, despite having jobs that presumably are relatively flexible in working hours and place of work.

Many moves during the peak of the pandemic may prove to be temporary. Studies covering post-pandemic migration patterns are still very scarce due to data availability. Frey (2023) use Census Bureau population data up to July 2022 and find signs of recovery in big U.S. cities. This particularly holds for the largest cities. 31 of the 37 cities with populations over 500,000 show increased gains or reduced losses from July 2021 to July 2022.

This paper makes three main contributions to the existing literature.

First, and most importantly, the paper explicitly analyses how remote work potential at the individual level enables workers to move their residence while keeping their original city centre jobs through work-from-home arrangements. The potential effect of remote work on the spatial decoupling between the place of residence and the place of work is thus at the heart of the analysis. Previous studies have primarily relied on aggregate measures of telework-compatible jobs and only focused on how such measures affect migration patterns in general without considering the location of the physical workplace. Extensive research shows that metropolitan areas offer productive advantages but are also increasingly expensive places in which to live (e.g., Glaeser and Maré 2001, De la Roca and Puga 2017, Eliasson and Westerlund 2023a). Remote work arrangements provide an opportunity to separate productive big city work from big city living.

Second, the analysis considers the whole spectrum of potential residential locations for city centre workers, including suburban areas at various distances from the city centre as well as cities, towns and rural areas outside of the metropolitan region.

Third, the analysis is based on data with an unusually short time lag. The data cover the period 2016–2023 (data for 2023 refers to the first two quarters), allowing for an analysis of mobility patterns several years before and several years after the start of the pandemic. Previous studies have almost exclusively focused on how remote work has affected migration during the first year of the pandemic (i.e., during 2020).

2. Classification of working from home

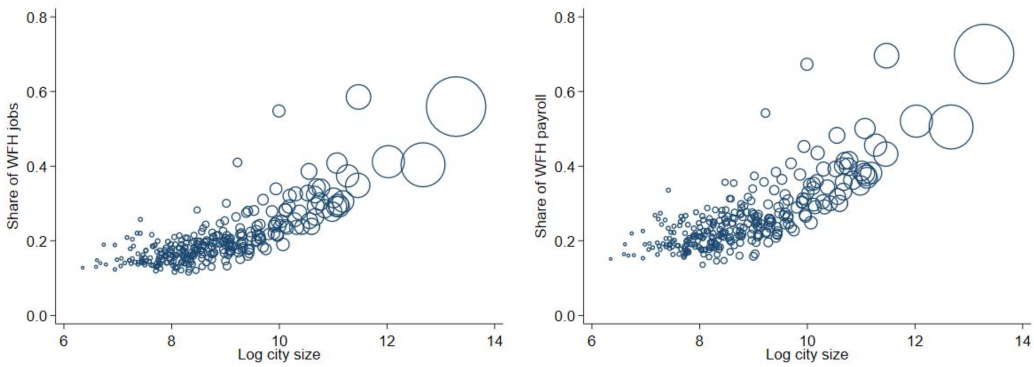
In order to classify remote work potential at the individual level, the occupation-based work-from-home classification developed by Dingel and Neiman (2020) is used. Their classification involves identifying occupation characteristics that rule out the possibility of working from home based on simple yes/no responses to questions in two work-related surveys in the US Department of Labor's O*Net database. For example, occupations where respondents say they use email less than once per month, work outdoors, operate vehicles, controls machines and processes, or work directly for or with the public are classified as ones that cannot be performed from home. Jobs that do not include any of these, and approximately a dozen other characteristics, are considered possible to do entirely from home. The authors acknowledge that this somewhat simplistic approach is likely to result in an upper bound on occupations that can be performed entirely from home.

Two crosswalks are used to translate Dingel and Neiman's (2020) US classification of about 1,000 Standard Occupational Classification (SOC) codes to 436 International Standard Classification of Occupations 2008 (ISCO-08) codes and 429 Swedish Standard Classification of Occupations 2012 (SSYK 2012) codes. In many cases, one SSYK 2012 occupation map to several SOC occupations. If more than half of these are classified as work-from-home occupations, the Swedish occupation is coded as a work-from-home occupation (an unweighted mapping). As an alternative, if more than half of those working in these occupations are employed in work-from-home jobs (according to US Bureau of Labor Statistics' 2018 Occupational Employment Statistics), the Swedish occupation is classified as a work-from-home occupation (a weighted mapping). The forthcoming analyses will primarily be based on the latter approach.[2]

During the pandemic, the Swedish Labour Force Survey (SLFS) began including data on the actual number of people working from home at the regional level (data for 21 counties). This provides an opportunity to compare the share of jobs that can be performed from home according to Dingel and Neiman's (2020) approach with the actual share of remote workers at the regional level as reported in the SLFS. It turns out that the correlation between the two measures is strong (the correlation coefficient is 0.95), suggesting that Dingel and Neiman's (2020) theoretical approach is likely a good predictor of actual work from home.[3]

Figure 1 plots remote work potential against city size for Sweden's 290 municipalities. There is a clear correlation between city size and the share of jobs that potentially can be done from home (the correlation coefficient is 0.76). In Stockholm, Sweden's largest city and the city of focus in this analysis, the share of jobs that can be performed remotely is 56 percent. The corresponding figures for medium-sized cities and the smallest cities are approximately 20 percent and 15 percent, respectively. A comparison of work-from-home potential in terms of jobs and payroll indicates that jobs that can be done from home pay higher wages on average. The share of payroll from jobs that can be performed remotely is 70 percent in Stockholm.

Figure 1 Work-from-home potential and city size



Notes: Data for 2021 and refer to employed workers aged 20–64 in Sweden's 290 municipalities based on the location of the workplace. Share of work from home is based on Dingel and Neiman's (2020) classification and city size in terms of number of employed workers. Each bubble is proportional to city size.

Among the occupations that are classified as possible to do from home, there can be considerable heterogeneity in the ability to realize this potential depending on factors such as employees' influence over when and where job tasks are performed. Adams-Prassl et al. (2022) find that workers with higher earnings can perform a large portion of their job tasks from home and that within occupations, the share of tasks that can be done from home increases with workers' level of education. To account for possible heterogeneity along

[2] Contrary to Dingel and Neiman's (2020) original classification, all teaching professionals, apart from university and higher education teachers, are classified as occupations that cannot be performed from home. This is also the case for child care workers and teachers' aides.

[3] The correlation is based on shares at the regional level according to SLFS during Q3 2020 to Q2 2021 and corresponding shares using Dingel and Neiman's (2020) classification and the crosswalks described above on Swedish occupational statistics for 2021.

these dimensions, occupations that are classified as those that can/cannot be performed from home are grouped into five broad occupational fields (major occupational group in parenthesis): managers (1), professionals (2), technicians and associate professionals (3), clerical support workers (4), other occupations (5-9)[4]. Although this is a relatively coarse division, it captures important differences between the occupational groups in terms of education and wages. For instance, workers in the group professionals have on average nearly three years more education than workers in the group clerical support workers (15.1 years compared to 12.3 years) and 47 percent higher annual gross earnings (SEK 489,000 compared to SEK 332,000).[5]

An alternative to Dingel and Neiman's (2020) classification of remote work potential is to use data on actual work from home at occupational level. The Swedish Labour Force Survey (SLFS) reports work from home at SSYK 2012 two-digit level during Q3 2020 to Q2 2021 (not for all, but for many two-digit occupational groups). As a robustness test, empirical results where SLFS data are used to classify remote work potential will be presented.

3. Data and methods

The analysis is based on population-wide longitudinal microdata from different registers administrated by Statistics Sweden. The Swedish register data is known to be highly reliable and to have nearly complete coverage. The data include a wide range of demographic and socioeconomic variables together with information on place of residence and workplace location. The data is available both for the individual and for the spouse if the individual is married or cohabiting. The data cover the period 2016–2023 (data for 2023 refers to the first two quarters) and is, with a few exceptions, updated annually.

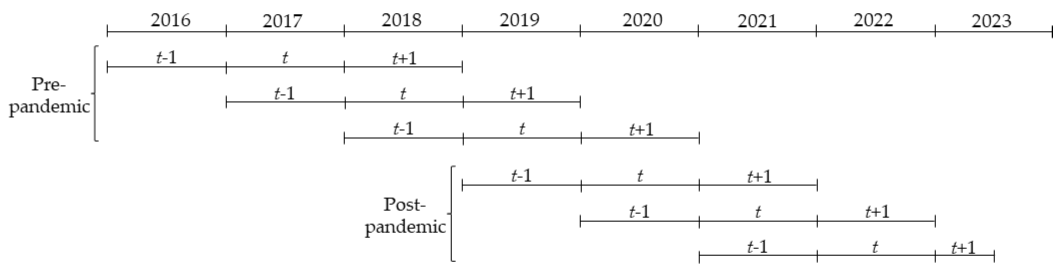
The paper focuses on Stockholm City (i.e., Stockholm municipality) and workers who keep their jobs in the city but who may or may not choose to move out of Stockholm. Given this, the following empirical approach is employed. Each individual is followed over a three-year period $t-1$ to $t+1$. The location of residence and workplace is measured at the end of each year. The analysis focuses on employed workers aged 20-59 in year $t-1$ and who at the end of year $t-1$ both reside and work in Stockholm City and continue to work there during year t and $t+1$. Individuals that move from Stockholm City in year t are classified as migrants, whereas those who continue to reside there in year t are classified as stayers. To avoid picking up temporary moves, migrants are not allowed to have returned to Stockholm in year $t+1$. Further, to avoid including young people moving primarily for educational purposes, the analysis is restricted to individuals with a strong attachment to the labour market, i.e., workers receiving annual gross earnings above SEK 100,000 during each year $t-1$ to $t+1$.

[4] Two occupational categories have been excluded from the empirical analysis because the number of observations is too small. The first is managers in occupations that are classified as those that cannot be performed from home (0.6 percent of the estimation sample). The second is workers in the category of other occupations having jobs that are classified as possible to do from home (0.9 percent of the estimation sample).

[5] Data for 2021 and refer to employed workers aged 20–64.

Given that the data cover the period 2016–2023 and the definitions described above, the data is organised into three pre-pandemic and three post-pandemic cohorts (see Figure 2). The pre-pandemic cohorts include individuals followed during the time-periods 2016–2018, 2017–2019, and 2018–2020 (with potential migration occurring during years 2017, 2018, and 2019). The post-pandemic cohorts include individuals followed during the time-periods 2019–2021, 2020–2022, and 2021–2023 (with potential migration occurring during years 2020, 2021, and 2022).[6] In the analysis, the mobility patterns during the post-pandemic period will be compared with the mobility patterns during the pre-pandemic phase.[7]

Figure 2 Schematic illustration of included cohorts



Two data sources are central to the unusually up-to-date analysis of mobility patterns in this study. The first is having access to monthly information on place of residence from the Total Population Register (RTB in Swedish). The second is having access to monthly information on earnings from the individual level Employer Statement of Earnings (AGI in Swedish). Both data sources currently cover the period up to and including June 2023. Until recently, the Register-Based Labour Market Statistics (RAMS in Swedish) has been the only available source for population-wide statistics on earnings. RAMS contains annually updated information on earnings and location of the workplace; however, it does have a time lag of about 18 months (RAMS is currently available for 2021).

Thanks to access to AGI data, this study can use information on gross earnings for 2022 and the first two quarters of 2023. Data on workplace location at the end of 2022 and at the end of the second quarter of 2023 has been derived from information on workplace location in RAMS for 2021. This is done by linking the unique identification number of the firm where the individual was employed at the end of 2022 and at the end of the second quarter of 2023 (found in AGI data) to the corresponding identification number in RAMS for 2021. This approach obviously rests on the assumption that if the individual is employed at the same firm during all three years, the location of the workplace is also the same (in this case, Stockholm City). The analysis, therefore, is restricted to individuals who are employed by the same firm during each year $t-1$ to $t+1$. This restriction is used for all cohorts (also for the first four cohorts, for which information on workplace location is directly available in RAMS). Note that the described derivation of workplace location concerns only the last two cohorts. For cohort 2021, the derivation has been applied for workplace location in year $t+1$ (workplace location in years $t-1$ and t is taken directly from RAMS). For

[6] For the last cohort, year $t+1$ includes only the first two quarters. Consequently, the earnings restriction in $t+1$ for this cohort is set at SEK 50,000 and those classified as migrants in this cohort are not allowed to have returned to Stockholm City by the end of the second quarter of year $t+1$.

[7] The term post-pandemic refers to the period after the start of the pandemic (i.e., not after the pandemic was declared ended).

cohort 2022, the derivation has been applied for workplace location in years t and $t + 1$ (workplace location in year $t - 1$ is taken directly from RAMS). For the first four cohorts, information on workplace location for all time-periods ($t - 1$ to $t + 1$) is directly available in RAMS. The described approach introduces some degree of oversampling of individuals in cohort 2021 and 2022. In the econometric analysis, as well as in the presentation of descriptive statistics, destination choice specific sample weights (based on the benchmark comparison) are applied to adjust for the oversampling.[8] As a robustness test, empirical results where cohorts 2021 and 2022 have been excluded from the analysis will be presented.

The following set of potential destinations are considered in the analysis: 1) Stockholm City, 2) adjacent suburbs in the Stockholm metropolitan region, 3) semi-adjacent suburbs in the Stockholm metropolitan region, 4) fringe suburbs in the Stockholm metropolitan region, 5) other metropolitan areas, 6) medium-sized cities, 7) small cities and rural areas. The Stockholm metropolitan region consists of municipalities that are functionally tied together by commuting flows and follows Statistics Sweden's definition of functional labour market areas for 2015. The classification of destinations outside of the Stockholm metropolitan region follows the Swedish Association of Local Authorities and Regions grouping of municipalities.[9] In total, the applied destination choice set includes the option to continue residing in Stockholm City as well as changing residence to a different type of location within or beyond the borders of the Stockholm metropolitan region.

The explanatory variables used to analyse the mobility decisions of workers in Stockholm City can broadly be grouped into personal characteristics (sex, age, place of birth, level of education), family and household characteristics (marital status, children younger than 16 years, homeownership), and job related characteristics (earnings, type of occupation). The analysis particularly focuses on the impact of having an occupation that is possible to do from home. The explanatory variables are measured either during or at the end of year $t - 1$.

In the econometric analysis, the mobility decisions are modelled using a multinominal logit model (MNL), and the relation between the explanatory variables and the destination choices will be presented in terms of relative risk ratios and average marginal effects. The MNL model is usually derived from an assumption of utility maximisation (Train 2009). In this particular case, the individual faces a choice set consisting of seven potential destinations. The individual is assumed to choose the alternative providing the greatest utility. The utilities are known by the decision maker, but not by the researcher. From the point of view of the researcher, the utility of a specific choice can be expressed as the sum of an observed part, which is a function of the attributes described above, and an unobserved part that is treated as random. Although utility is not fully observed by the

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[8] A validation of the described approach, using actual workplace location from RAMS for the period 2019-2021 as a benchmark, indicates that a high share of those assumed to work in Stockholm City actually do so according to information on workplace location in RAMS. However, the derivation of workplace location for the periods in question ($t + 1$ for cohort 2021; t and $t + 1$ for cohort 2022) leads to some degree of oversampling of individuals in cohort 2021 and 2022 (individuals for whom the condition of working in Stockholm City is likely not fulfilled in the periods in question, and these individuals should, therefore, not be included in the analysis). Based on the benchmark comparison, the oversampling is on average 1.4 percent for cohort 2021 and 3.7 percent for cohort 2022, and varies by destination choice (it is higher for migrants than for stayers).

[9] This grouping is primarily based on population size and commuting patterns.

researcher, the individual's choice among the alternatives in the choice set reveals which one provides the greatest utility.

Table 1 presents sample means for migrants (irrespective of destination) and stayers in the pre- and post-pandemic cohorts.

Table 1 Sample means

	2017–2019		2020–2022	
	Migrants	Stayers	Migrants	Stayers
Female	0.45	0.52	0.46	0.52
Male	0.55	0.48	0.54	0.48
Age 20–29	0.31	0.16	0.27	0.15
Age 30–39	0.44	0.29	0.47	0.30
Age 40–49	0.16	0.28	0.17	0.28
Age 50–59	0.09	0.26	0.10	0.27
Born in Stockholm County	0.40	0.45	0.38	0.44
Born in the rest of Sweden	0.32	0.33	0.32	0.32
Born outside of Sweden	0.28	0.22	0.30	0.23
Primary or upper-secondary education	0.35	0.35	0.31	0.32
Post-secondary education ≤ 3 years	0.39	0.40	0.42	0.41
Post-secondary education ≥ 4 years	0.26	0.25	0.27	0.27
Single	0.61	0.55	0.60	0.54
Married: spouse WFH occupation	0.21	0.24	0.23	0.25
Married: spouse non-WFH occupation	0.14	0.16	0.12	0.15
Married: spouse not employed	0.04	0.05	0.05	0.05
Young children (age 0–15)	0.32	0.36	0.34	0.37
Renter	0.41	0.37	0.40	0.36
Apartment owner	0.55	0.50	0.56	0.51
House owner	0.04	0.13	0.04	0.13
Annual earnings 1st quartile	0.30	0.23	0.28	0.23
Annual earnings 2nd quartile	0.27	0.25	0.26	0.25
Annual earnings 3rd quartile	0.24	0.26	0.24	0.26
Annual earnings 4th quartile	0.19	0.26	0.22	0.26
Manager WFH occupation	0.08	0.09	0.08	0.10
Professional WFH occupation	0.31	0.31	0.35	0.33
Professional non-WFH occupation	0.08	0.11	0.08	0.11
Associate professional WFH occupation	0.14	0.12	0.14	0.12
Associate professional non-WFH occupation	0.06	0.05	0.05	0.04
Clerical support WFH occupation	0.05	0.05	0.04	0.04
Clerical support non-WFH occupation	0.04	0.03	0.03	0.03
Other non-WFH occupation	0.26	0.24	0.22	0.23
Number of observations	13,211	409,321	17,401	441,566

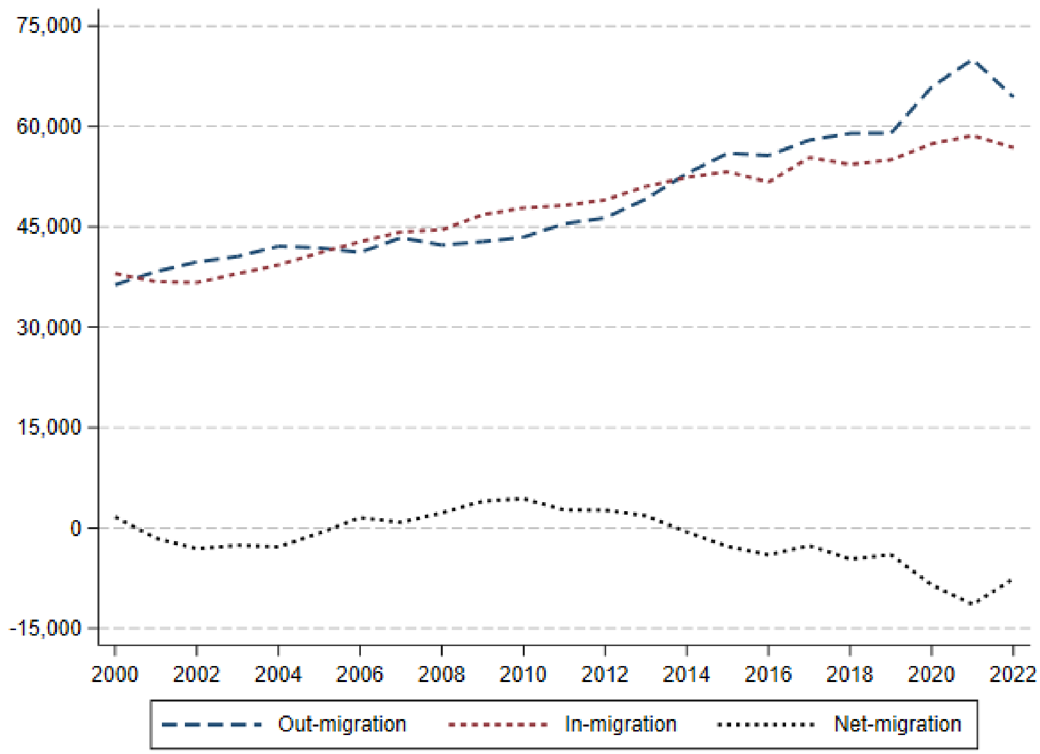
Notes: All variables are measured either during or at the end of year $t-1$.

The total number of migrants is about 13,200 in the pre-pandemic period and about 17,400 in the post-pandemic period. The number of stayers is around 409,300 and 441,600 in the two periods, respectively. Migrants are e.g., more likely to be younger, born outside of Stockholm County and less likely to be house owners. In terms of remote work potential, it is worth noting that the share of individuals with professional work-from-home occupations among migrants has increased from 31 to 35 percent. The following section will present more details on the mobility patterns of workers in Stockholm City.

4. Migration patterns before and after the pandemic

Before focusing on the geographical mobility of workers who continue to hold jobs in Stockholm City, it might be interesting to start with the general migration pattern for the entire population of Stockholm (i.e., without any of the sample restrictions discussed in the previous section). As mentioned in the literature review, earlier studies have found that the outflow of people from big cities during the first year of the pandemic in many cases was an acceleration of already existing mobility patterns. Figure 3 shows that this is also the case for Stockholm City.

Figure 3 Annual domestic migration flows for Stockholm City

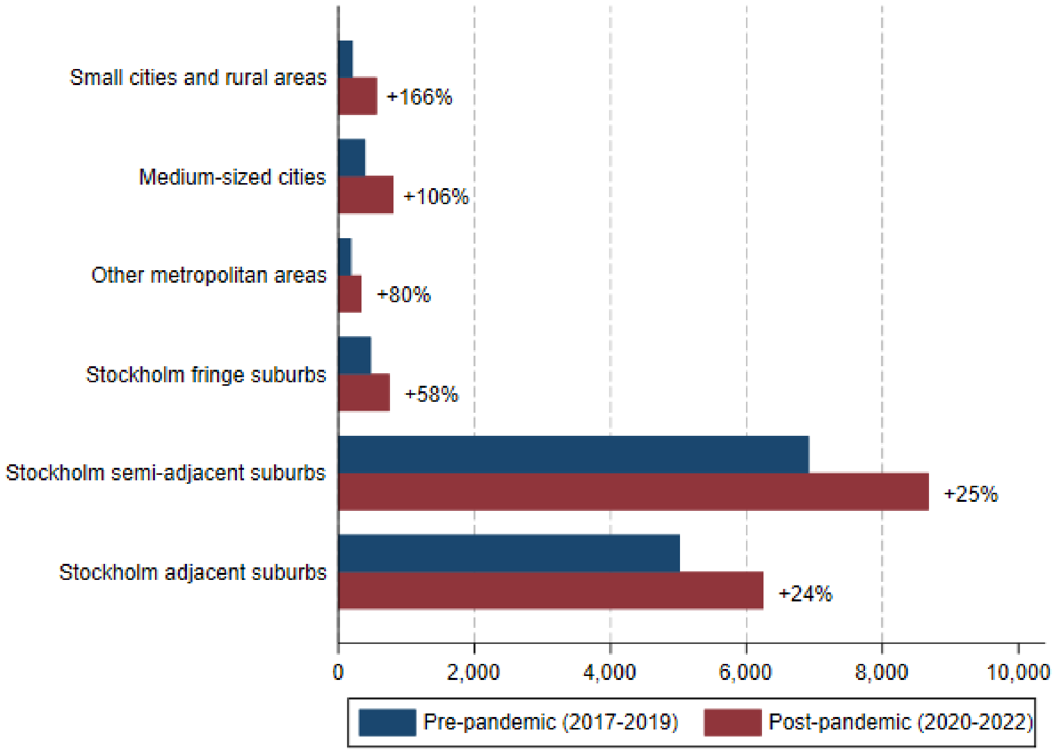


Notes: Domestic migration flows for the entire population (i.e., without any of the sample restrictions discussed in the previous section).

Stockholm has experienced negative net domestic migration since 2014. However, the net losses increased significantly in connection with the pandemic. During the period 2020–2022, the annual net losses are in the range 8,000 to 11,000 persons, corresponding to a negative annual net migration rate of 0.8 to 1.2 percent. It is worth noting that the domestic migration deficit after the pandemic is primarily driven by a sharp increase in out-migration from Stockholm City.

We now turn our attention to the specific sample of workers who initially reside and work in Stockholm City and continue to work in Stockholm. Figure 4 presents the number of workers moving out of the city by destination region before and after the pandemic. The majority of workers who moved their residence relocated to the suburbs of the Stockholm region. This is the case both before and after the start of the pandemic. However, it is destinations outside of the region that experienced the largest relative increase in residential in-migration of workers from the city centre. Compared to the pre-pandemic phase, the number of Stockholm City workers moving to medium-sized cities and small cities/rural areas has more than doubled in the years after the start of the pandemic (+106% and +166%, respectively). The relative increase in worker flows to other metropolitan areas is also significantly larger than the residential relocation to the suburbs of the Stockholm region.

Figure 4 Residential out-migration of workers in Stockholm City, by destination region and period



In terms of migration distances, residential moves away from the Stockholm region are quite long.[10] The median (Euclidean) distance of moves to medium-sized cities and small cities/rural areas during the post-pandemic period is 190 km and 258 km, respectively. This is a slight increase from the pre-pandemic median distance (169 km and 247 km,

[10] The reported distances are based on coordinates of the residences (at 500x500 metres geographical resolution).

respectively). Moves to other metropolitan areas are even longer with a median distance of about 400 km in both periods. Residential relocation to the suburbs of the Stockholm region is short; for both periods, the median distance is about 7 km for moves to the adjacent suburbs and 50 km for moves to the fringe suburbs.

5. Results

To explore the association between the different explanatory variables and the mobility decisions of workers in Stockholm City, this section provides empirical results from multinominal logit model analyses. The choice set consists of seven potential destinations, including staying in Stockholm City. Separate results for the pre- and post-pandemic period will be presented. The focus is particularly on the association between type of occupation and the destination choices. Remember that the empirical analysis focuses on workers who continue to work in the city but who may or may not choose to move their residence from Stockholm City.

The multinominal logit model assumes that adding or deleting alternatives does not affect the ratio of probabilities among the remaining alternatives, the so-called independence of irrelevant alternatives assumption (IIA). Formal tests of IIA are based on comparing the parameter estimates from a full model including all alternatives to those from a restricted model that excludes at least one of the alternatives. If IIA holds, there should be no significant differences in the estimated parameters. Long and Freese (2014) are sceptical about existing tests and instead argue that the model should only be used in cases where the alternatives can be plausibly considered as distinct and do not constitute substitutes for each other. Nevertheless, a Hausman and McFadden (1984) type of test has been performed. The parameter estimates from the full model with all destinations have been compared to those from a series of restricted models, where one destination at a time (except the reference category; see below) has been excluded. In none of the cases, either in the pre- or post-pandemic period, was the assumption of IIA rejected.

The association between the different explanatory variables and the destination choices will be presented in terms of two different measures: relative risk ratios and average marginal effects.

The interpretation of the relative risk is that for a one-unit change in a given independent variable, the relative risk of choosing a specific destination relative to the reference category changes according to the parameter estimate, holding all other independent variables in the model constant. Staying in Stockholm City will be used as the reference category. A parameter greater than 1 increases the relative risk and a parameter less than 1 decreases the relative risk.

Since the interpretation of the relative risk is done in relation to the reference category, these estimates can be somewhat difficult to digest. Moreover, the relative risk says nothing about the magnitude or size of the effect of a particular independent variable on an outcome of interest. The interpretation of the average marginal effect is more straightforward and provides more information, particularly given that all of the explanatory variables are categorical variables. For a given independent variable, the average marginal effect shows the effect in percentage points on the probability of choosing a specific destination as the independent variable changes from 0 to 1, holding all other independent variables in the model constant. The average marginal effects are thus expressed in the metrics of probabilities and refer directly to each of the seven potential destinations (including staying in Stockholm City).

Table 2 reports estimated relative risk ratios for the pre-pandemic period, while Table 3 reports on the post-pandemic period. Starting with the influence of the individual and family characteristics, we see that women, compared to men, have a slightly lower relative risk of moving rather than staying in Stockholm City. Those in the younger age groups have a higher relative risk of making any type of move away from Stockholm City compared to the older reference group. This particularly holds for moving to destinations outside of the Stockholm region. The same is true for individuals born elsewhere in Sweden. Compared to the Stockholm-born, they have a much higher relative risk of making a long-distance move away from the Stockholm area.

The influence of the level of education varies. Compared to individuals with fewer years of education, those with post-secondary education have a higher relative risk of moving to adjacent suburbs in the Stockholm region and to other metropolitan areas. For all other destinations, the reverse is true. The influence of marital status on mobility inside the Stockholm region is a bit mixed, whereas there seem to be no association between marital status and migration away from the region. Those with young children generally tend to have a slightly lower relative risk of moving.

For all variables above, the pattern of influence is more or less the same in the pre- and post-pandemic period. The findings are generally in line with previous studies focusing on out-migration from urban areas in Sweden (e.g., Vogiazides and Kawalerowicz 2022).

Looking at the influence of homeownership, it is evident that house owners, compared to renters, have a substantially lower relative risk of moving rather than staying in Stockholm City. Also in this case, the pattern is similar in the pre- and post-pandemic era. The result confirms the finding in Eliasson and Westerlund (2023b) that house owners are more constrained than renters in terms of geographical mobility. For apartment owners, the result is more mixed. This is also the case regarding annual earnings, although the results generally indicate that individuals with earnings above the lowest quartile have a slightly lower relative risk of leaving Stockholm City.

Regarding the association between type of occupation and destination choices, several interesting patterns can be observed. While the influence on mobility inside the Stockholm region tend to be similar in the pre- and post-pandemic periods, the results indicate some particularly noteworthy differences in the case of long-distance moves away from the Stockholm region. This applies not least to professionals and managers with occupations that can be done remotely.

Before the pandemic, there tend to be relatively small differences in the relative risk of moving to medium-sized cities or small cities/rural areas, rather than staying in Stockholm City, between managers and professionals with WFH occupations and the reference group with non-WFH occupations. After the pandemic, however, the relative risk of making a long-distance move to medium-sized cities or small cities/rural areas is two to three times higher for managers and professionals with WFH occupations compared to the reference group. A Wald test allowing for cross-model covariance (i.e., covariance between the estimated parameters in the pre- and post-pandemic periods) shows that the estimated parameters for managers and professionals with occupations that can be done remotely are statistically different in the pre- and post-pandemic periods.[11]

Interestingly, for professionals with non-WFH occupations, we find no evidence of a change of similar magnitude. In both periods, there are fairly small differences in the relative risk of moving to medium-sized cities or small cities/rural areas between professionals with non-WFH occupations and the reference group with non-WFH occupations.

The results also show that associate professionals and clerical support workers have a higher relative risk compared to the reference group of moving to medium-sized cities or small cities/rural areas after the pandemic. This holds for both workers with WFH and non-WFH occupations. However, there is generally no support for the hypothesis that the estimated parameters are different in the pre- and post-pandemic periods.

The results further indicate that managers and professionals with WFH occupations have a higher relative risk of making a long-distance move to other metropolitan regions compared to the reference group with non-WFH occupations. This is true both before and after the pandemic. Associate professionals and clerical support workers are also more likely than the reference group to move to other metropolitan regions after the pandemic. Again, this holds for both workers with WFH and non-WFH occupations. In none of these cases are the estimated parameters statistically different in the pre- and post-pandemic periods.

Regarding the influence of type of occupation on intra-regional mobility, the results tend to be similar before and after the pandemic. The hypothesis that the estimated parameters are different in the pre- and post-pandemic periods are rejected in all cases. In both periods, all occupational categories show a higher relative risk compared to the reference group of moving to adjacent suburbs of Stockholm City. Managers and professionals are slightly less likely than the reference group to move to semi-adjacent suburbs in the Stockholm region. For moves to the fringe suburbs, there tend to be no differences between the different occupational categories and the reference group.

[11] The Wald statistic to test $H_0: \pi_1 = \pi_2$ is

$$z = \frac{\hat{\pi}_1 - \hat{\pi}_2}{\sqrt{\hat{\sigma}_1^2 + \hat{\sigma}_2^2 - 2\hat{\sigma}_{1,2}}}$$

Where $\hat{\pi}_1$ and $\hat{\pi}_2$ are the estimated parameters in the pre- and post-pandemic periods, $\hat{\sigma}_1^2$ and $\hat{\sigma}_2^2$ are their standard errors, and $\hat{\sigma}_{1,2}$ is the covariance between the estimated parameters. The null hypothesis is rejected if z exceeds the critical value. For moving to medium-sized cities, the χ^2 ($p > \chi^2$) is 2.57 (0.109) and 10.20 (0.001), respectively, for managers and professionals with WFH occupations. For moving to small cities/rural areas, the corresponding statistics are 5.10 (0.024) and 4.40 (0.036), respectively.

Table 2 MNL estimates of out-migration from Stockholm City during the pre-pandemic period (2017–2019)

Destination (ref. staying in Stockholm City)	Stockholm adjacent suburbs	Stockholm semi-adj. suburbs	Stockholm fringe suburbs	Other metropol. areas	Medium-sized cities	Small cities & rural areas
Female	0.894***	0.759***	0.802**	0.851	0.648***	0.650***
Male (ref.)						
Age 20–29	6.057***	5.300***	1.891***	4.364***	5.626***	1.909***
Age 30–39	4.055***	4.330***	1.918***	4.367***	4.326***	2.361***
Age 40–49	1.484***	1.787***	0.913	1.545	1.533**	1.263
Age 50–59 (ref.)						
Born in Stockholm County (ref.)						
Born in the rest of Sweden	1.148***	0.950*	0.916	6.507***	5.062***	4.044***
Born outside of Sweden	1.527***	1.686***	0.645***	3.069***	1.601***	1.283
Primary or upper-sec. education (ref.)						
Post-sec. education ≤3 years	1.120***	0.883***	0.757**	2.194***	0.789*	0.813
Post-sec. education ≥4 years	1.331***	0.827***	0.768*	2.132***	0.671**	0.431***
Single	1.059	0.712***	0.656***	1.197	0.916	0.838
Married: spouse WFH occ.	1.476***	0.998	0.804	1.125	0.874	0.950
Married: spouse non-WFH occ. (ref.)						
Married: spouse not employed	1.049	0.837***	1.027	1.635	2.273***	1.504
Young children (age 0–15)	0.818***	0.978	0.845	1.053	0.742**	0.651**
Renter (ref.)						
Apartment owner	0.934**	1.048*	1.184	0.722**	0.869	1.210
House owner	0.352***	0.518***	0.780	0.303***	0.420***	0.732
Annual earnings 1st quartile (ref.)						
Annual earnings 2nd quartile	0.972	0.955	1.082	0.818	1.006	0.657**
Annual earnings 3rd quartile	0.896**	0.885***	1.126	1.151	0.970	0.770
Annual earnings 4th quartile	1.050	0.703***	0.816	1.287	1.037	0.872
Manager WFH occupation	1.719***	0.870**	1.246	3.239***	1.498*	0.864
Professional WFH occupation	1.419***	0.744***	0.937	3.020***	1.224	1.541
Professional non-WFH occupation	1.152**	0.725***	0.768	1.229	0.832	0.286**
Ass. prof. WFH occupation	1.648***	1.003	1.292	3.093***	1.391*	1.877**
Ass. prof. non-WFH occupation	1.510***	1.064	1.084	2.456**	1.380	1.792*
Clerical supp. WFH occupation	1.498***	0.924	1.137	1.466	1.316	1.892*
Clerical supp. non-WFH occupation	1.511***	0.994	1.109	1.255	1.304	0.973
Other non-WFH occupation (ref.)						
Cohort 2017 (ref.)						
Cohort 2018	1.031	1.009	1.178	1.244	1.052	0.964
Cohort 2019	1.042	0.972	1.019	1.233	1.142	1.071
Number of observations	422,532					

Notes: The estimates are expressed as relative risk ratios. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively (based on robust standard errors).

Table 3 MNL estimates of out-migration from Stockholm City during the post-pandemic period (2020–2022)

Destination (ref. staying in Stockholm City)	Stockholm adjacent suburbs	Stockholm semi-adj. suburbs	Stockholm fringe suburbs	Other metropol. areas	Medium-sized cities	Small cities & rural areas
Female	0.914***	0.814***	0.887*	0.848	0.813***	0.845**
Male (ref.)						
Age 20–29	6.642***	4.986***	1.645***	7.764***	4.511***	2.079***
Age 30–39	4.569***	4.157***	2.002***	6.882***	4.587***	3.182***
Age 40–49	1.632***	1.846***	1.154	1.893**	1.623***	1.118
Age 50–59 (ref.)						
Born in Stockholm County (ref.)						
Born in the rest of Sweden	1.104***	0.969	1.031	6.351***	4.636***	3.461***
Born outside of Sweden	1.632***	1.734***	0.695***	2.304***	1.298**	0.857
Primary or upper-sec. education (ref.)						
Post-sec. education ≤3 years	1.118***	0.852***	0.879	1.689***	0.761***	0.739***
Post-sec. education ≥4 years	1.230***	0.745***	0.615***	1.674***	0.657***	0.530***
Single	1.154**	0.798***	0.730**	0.793	0.873	0.870
Married: spouse WFH occ.	1.619***	1.164***	1.101	1.287	0.866	1.000
Married: spouse non-WFH occ. (ref.)						
Married: spouse not employed	1.197**	0.936	1.209	1.044	1.227	1.327
Young children (age 0–15)	0.821***	1.016	0.834*	0.720**	1.210*	0.935
Renter (ref.)						
Apartment owner	0.876***	0.989	0.897	1.320**	1.154*	1.003
House owner	0.319***	0.458***	0.457***	0.639*	0.505***	0.511***
Annual earnings 1st quartile (ref.)						
Annual earnings 2nd quartile	0.959	0.918***	0.982	0.845	0.873	1.278*
Annual earnings 3rd quartile	1.020	0.917**	1.073	0.780	0.825*	1.116
Annual earnings 4th quartile	1.204***	0.887***	0.962	1.002	0.788**	1.036
Manager WFH occupation	1.855***	0.904*	1.132	2.826***	2.415***	2.347***
Professional WFH occupation	1.546***	0.810***	1.120	3.283***	2.580***	3.109***
Professional non-WFH occupation	1.176**	0.783***	0.604***	1.028	1.420*	1.451
Ass. prof. WFH occupation	1.787***	0.954	1.237	3.190***	2.784***	2.690***
Ass. prof. non-WFH occupation	1.620***	1.132**	0.983	2.318**	1.870***	2.125***
Clerical supp. WFH occupation	1.612***	0.930	0.987	1.981*	2.152***	2.959***
Clerical supp. non-WFH occupation	1.343***	1.032	0.609*	3.605***	2.583***	1.529
Other non-WFH occupation (ref.)						
Cohort 2020 (ref.)						
Cohort 2021	1.036	1.138***	1.572***	1.229	1.328***	1.441***
Cohort 2022	0.974	0.999	1.177*	0.980	1.386***	1.152
Number of observations	458,967					

Notes: The estimates are expressed as relative risk ratios. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively (based on robust standard errors).

Tables 4 and 5 report the estimated average marginal effects of the type of occupation on destination choices in the pre- and post-pandemic periods. Broadly speaking, the estimates reveal the same qualitative pattern as above. However, since the marginal effects are expressed in terms of probabilities and refer directly to each of the seven potential destinations, they allow for a more straightforward interpretation.

Prior to the pandemic, there are with few exceptions, no statistically significant differences in the estimated probabilities of making a long-distance move between the different occupational categories and the reference group with non-WFH occupations. After the pandemic, the results reveal increased probabilities of long-distance migration, especially among managers and professionals with occupations that can be done remotely. In the post-pandemic period, managers and professionals with WFH occupations are about 0.2 percentage points more likely to move to medium-sized cities or small cities/rural areas than workers in the reference group and about 0.1 percentage points more likely to move to other metropolitan areas. This may seem as rather small effects, but they represent more than a doubling of the baseline probabilities of making a long-distance move.[12] For instance, the estimated marginal effects for managers and professionals with WFH occupations of moving to medium-sized cities – 0.23 and 0.20 percentage points, respectively – correspond to an increase of 135 percent and 118 percent relative to the baseline probability.

Contrary to professionals and managers that can work remotely, professionals with non-WFH occupations do not seem to be more inclined than the reference group to move away from the Stockholm region, neither before nor after the pandemic.

The results further indicate that associate professionals and clerical support workers are in general more likely than the reference group to make a long-distance move after the pandemic. This tends to be the case both for workers with WFH and non-WFH occupations.

Turning to the estimated marginal effects on mobility within the Stockholm region, the overall pattern tends to be similar before and after the pandemic. All occupational groups (except professionals with non-WFH occupations) are less likely than the reference group to stay in Stockholm City. The opposite is true with regard to migration to adjacent suburbs of Stockholm City. Managers and professionals seem to be less inclined than the reference group to move to semi-adjacent suburbs in the Stockholm region, whereas there tend to be no differences between the occupational categories when it comes to moving to the fringe suburbs. When evaluated in relation to the baseline probabilities, the estimated average marginal effects on intra-regional mobility are smaller in magnitude compared to the estimated effects on long-distance migration.

[12] The baseline probability is equal to the relative frequency of the destination choices.

Table 4 Average marginal effect of type of occupation on destination choice during the pre-pandemic period (2017–2019)

Destination	Stockholm City (stayer)	Stockholm adjacent suburbs	Stockholm semi-adj. suburbs	Stockholm fringe suburbs	Other metropol. areas	Medium-sized cities	Small cities & rural areas
Manager WFH	-0.0072*** (0.0017)	0.0080*** (0.0013)	-0.0023*** (0.0009)	0.0003 (0.0003)	0.0009* (0.0005)	0.0004 (0.0003)	-0.0001 (0.0002)
Professional WFH	-0.0008 (0.0010)	0.0044*** (0.0007)	-0.0046*** (0.0006)	-0.0001 (0.0002)	0.0006** (0.0003)	0.0002 (0.0002)	0.0002 (0.0002)
Professional non-WFH	0.0034*** (0.0012)	0.0018** (0.0009)	-0.0046*** (0.0007)	-0.0003 (0.0002)	0.0001 (0.0002)	-0.0002 (0.0002)	-0.0004*** (0.0001)
Ass. professional WFH	-0.0087*** (0.0013)	0.0070*** (0.0010)	-0.0001 (0.0007)	0.0003 (0.0002)	0.0008* (0.0004)	0.0003 (0.0002)	0.0004* (0.0002)
Ass. professional non-WFH	-0.0080*** (0.0017)	0.0057*** (0.0013)	0.0008 (0.0010)	0.0001 (0.0003)	0.0006 (0.0005)	0.0003 (0.0003)	0.0004 (0.0003)
Clerical support WFH	-0.0054*** (0.0017)	0.0057*** (0.0013)	-0.0014 (0.0009)	0.0001 (0.0003)	0.0002 (0.0004)	0.0003 (0.0003)	0.0004 (0.0003)
Clerical support non-WFH	-0.0061*** (0.0019)	0.0058*** (0.0014)	-0.0002 (0.0011)	0.0001 (0.0003)	0.0001 (0.0004)	0.0003 (0.0003)	-0.0000 (0.0002)
Baseline probability	0.9676	0.0123	0.0170	0.0011	0.0004	0.0009	0.0005

Notes: The marginal effects are based on the MNL estimates in Table 2 and are expressed in percentage points. Robust standard errors are given in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. The last line reports the baseline probability (which is equal to the relative frequency) of choosing a particular destination and is expressed in percentage points.

Table 5 Average marginal effect of type of occupation on destination choice during the post-pandemic period (2020–2022)

Destination	Stockholm City (stayer)	Stockholm adjacent suburbs	Stockholm semi-adj. suburbs	Stockholm fringe suburbs	Other metropol. areas	Medium-sized cities	Small cities & rural areas
Manager WFH	-0.0136*** (0.0019)	0.0106*** (0.0014)	-0.0022** (0.0009)	0.0002 (0.0003)	0.0012** (0.0006)	0.0023*** (0.0007)	0.0015*** (0.0006)
Professional WFH	-0.0070*** (0.0012)	0.0062*** (0.0008)	-0.0040*** (0.0006)	0.0002 (0.0002)	0.0010*** (0.0003)	0.0020*** (0.0004)	0.0017*** (0.0004)
Professional non-WFH	0.0012 (0.0014)	0.0024** (0.0010)	-0.0042*** (0.0007)	-0.0007*** (0.0002)	0.0000 (0.0003)	0.0007 (0.0005)	0.0005 (0.0004)
Ass. professional WFH	-0.0144*** (0.0016)	0.0095*** (0.0011)	-0.0012* (0.0007)	0.0003 (0.0002)	0.0014** (0.0005)	0.0027*** (0.0006)	0.0018*** (0.0005)
Ass. professional non-WFH	-0.0135*** (0.0020)	0.0078*** (0.0014)	0.0021** (0.0011)	-0.0001 (0.0003)	0.0009 (0.0006)	0.0014** (0.0006)	0.0013** (0.0006)
Clerical support WFH	-0.0110*** (0.0020)	0.0078*** (0.0014)	-0.0016 (0.0010)	-0.0000 (0.0003)	0.0007 (0.0005)	0.0019*** (0.0007)	0.0022*** (0.0007)
Clerical support non-WFH	-0.0091*** (0.0022)	0.0044*** (0.0014)	0.0004 (0.0011)	-0.0007** (0.0003)	0.0018** (0.0009)	0.0026*** (0.0008)	0.0006 (0.0006)
Baseline probability	0.9602	0.0142	0.0202	0.0016	0.0007	0.0017	0.0012

Notes: The marginal effects are based on the MNL estimates in Table 3 and are expressed in percentage points. Robust standard errors are given in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. The last line reports the baseline probability (which is equal to the relative frequency) of choosing a particular destination and is expressed in percentage points.

The main takeaway from the empirical analysis is that while the pattern of mobility inside the Stockholm region tends to be the same before and after the pandemic, the probabilities of long-distance migration away from the Stockholm area have increased after the pandemic. This is particularly true for managers and professionals in occupations that can be done from home and pertain especially for moves to medium-sized cities and small cites/rural areas.

Looking into the details of the occupational groups in question, sales and marketing managers and administration and service managers are the two largest groups among managers with WFH occupations. Software and system developers and management and organisation analysts dominates among professionals with WFH occupations.

6. Robustness analyses

This section present results from two type of robustness analyses.

The first concerns the applied derivation of workplace location for cohorts 2021 and 2022. As discussed in Section 3, workplace location in year $t + 1$ for cohort 2021 and years t and $t + 1$ for cohort 2022 has been derived from information on workplace location in year 2021. As a robustness test, Table A1 in the Appendix reports estimated relative risk ratios for the post-pandemic period, where cohorts 2021 and 2022 have been excluded from the analysis. Thus, the results are only based on cohort 2020. For this cohort, information on workplace location for all time periods ($t - 1$ to $t + 1$) is directly available in RAMS.

Generally, the estimates based on cohort 2020 reveal a similar qualitative pattern as those based on all three post-pandemic cohorts (compare Table A1 with Table 3). This is true both regarding the influence of type of occupation as well as the other explanatory variables.

The second robustness analysis concerns the applied classification of occupations that can/cannot be performed from home. This is based on the classification developed by Dingel and Neiman (2020). An advantage of their approach is that it can be applied to the most detailed occupational level (429 SSYK 2012 codes). A potential weakness is that it is not based on actual work from home, but is derived from a number of occupational characteristics that can be assumed to enable/prevent remote work.

An alternative is to base the classification of remote work potential on information on actual work from home at occupational level. The Swedish Labour Force Survey (SLFS) reports the share of employed individuals working from home at the SSYK 2012 two-digit level during Q3 2020 to Q2 2021. For the major occupational groups, managers, professionals, technicians and associate professionals, as well as clerical support workers, data is available for 21 out of 22 two-digit occupations. For major occupational groups 5–9, data is only available for 8 out of 21 two-digit occupations. Based on the SFLS data, occupations are classified as ones that can/cannot be done from home, and these are, in turn, grouped into the same five broad occupational fields as indicated previously. Note, however, that the reference category in this case will be all two-digit occupations in major occupational groups 5–9 (here it is not possible to separate between two-digit WFH and non-WFH occupations, but the ones included in the SLFS indicate low shares of work from home).

Tables A2 and A3 report empirical results where the SLFS data are used to classify remote work potential. Overall, the influence of type of occupation tends to be similar regardless whether the Dingel and Neiman (2020) classification or the classification based on SLFS data is used (compare Tables A2 and A3 with Tables 2 and 3).

7. Summary and discussion

In the popular debate as well as in the scientific literature, many argue that the major shift to work from home following the pandemic can lead to large and lasting geographical effects in terms of where we choose to live and work. This is one of the first studies that explicitly analyses how remote work potential at the individual level affects destination choices of individuals living and working in metropolitan city centres. The empirical analysis focuses on Stockholm City and workers who continue to work in the city centre but who may or may not decide to move their residences outside of Stockholm. The analysis is based on detailed population-wide microdata and covers the period 2016–2023 (data for 2023 refers to the first two quarters).

Like many other large cities across the world, Stockholm experienced increasing negative net domestic migration during the pandemic. This was driven by a sharp rise in out-migration from Stockholm City. Focusing specifically on the mobility pattern of workers who continue to work in the city centre, the descriptive statistics show that the majority of individuals changing their place of residence relocated to the suburbs of the Stockholm region. This is the case both before and after the start of the pandemic. However, it is destinations outside of the region that have experienced the largest relative increase in worker flows from the city centre. Compared to the pre-pandemic period, the number of city centre workers relocating to medium-sized cities and small cities/rural areas more than doubled in the years after the start of the pandemic. The counter-urban flows of city centre workers to smaller locations are fairly small in absolute terms, but the increase has been quite substantial.

Concerning the association between type of occupation and the destination choices, the analysis reveals several interesting results. Whereas the influence of occupation on mobility inside the Stockholm region is fairly similar in the pre- and post-pandemic periods, the results indicate some particularly noteworthy differences in the case of long-distance migration. Prior to the pandemic, there tend to be no statistically significant differences in the estimated probabilities of making a long-distance move between the different occupational categories. After the pandemic, however, the results show increased probabilities of long-distance migration among managers and professionals with occupations that can be done remotely. This is particularly the case for moves to medium-sized cities and small cities/rural areas, but is also evident for moves to other metropolitan areas. The estimated marginal effects are small in absolute magnitude. However, when evaluated in relation to the baseline probabilities, they correspond to more than a doubling of the probability of making a long-distance move. Looking more closely at these two occupational categories, we find that software and system developers and management and organisation analysts dominates among professionals with WFH occupations, whereas sales and marketing managers and administration and service managers dominates among managers with WFH occupations.

Previous research based on microdata has found no evidence that workers in knowledge-intensive jobs or occupations with a high degree of remote work are more inclined to make counterurban moves, neither during periods before the pandemic (Sandow and Lundholm 2020) nor after the pandemic (Vogiazides and Kawalerowicz 2022). This is despite the focus on occupations that presumably are relatively flexible in working hours and place of work. This study differs in so far that it explicitly treats remote work as a decoupling technology, allowing the place of residence to be chosen more freely with regard to the location of the physical workplace. The findings in this study suggest that changing work arrangements after the pandemic have enabled managers and professionals with occupations that can be done remotely to move their residence beyond the metropolitan region and combine work from home with occasional long-distance commuting to their city centre workplace. For professionals who are unable to work from home, as well as workers in the reference group with remote work incompatible jobs, this is a less attainable location strategy.

The finding that remote work arrangements give workers in certain professions the opportunity to separate big city work from big city living can have potentially important implications. Cities experiencing residential out-migration of remote workers lose taxrevenue and consumer spending power. But the outflow of remote workers may on the other hand reduce the pressure on the housing market and make the cities more affordable for remaining residents and future in-migrants. The places receiving residential in-migration of remote workers can look forward to an increased tax base and a strengthening of the local economy. These processes are amplified by the fact that remote workers tend to be high earners. Whether the observed mobility pattern impose a serious challenge for urban centres, and a renaissance for cities and rural areas outside of the metropolitan regions, is of course too early to say. Potential consequences such as those discussed will in any event not appear overnight. They will rather materialize gradually, if the observed pattern of mobility among remote workers persists over time.

There are many topics related to work-from-home arrangements that merit additional research. One is to study in more detail the characteristics of places receiving residential in-migration of remote workers. This paper has focused on how the ability to work from home affects out-migration from big cities. It would be interesting to reverse this perspective and study how remote work might enable non-metropolitan residents to take up work in urban areas. By allowing a looser connection between residences and workplaces, remote work arrangements may affect intra- and inter-regional job matching – and related location and mobility patterns – more generally. This is an important avenue for future research.

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Appendix

Table A1 MNL estimates of out-migration from Stockholm City during the post-pandemic period. Based on cohort 2020 (i.e., cohort 2021 and 2022 are excluded)

Destination (ref. staying in Stockholm City)	Stockholm adjacent suburbs	Stockholm semi-adj. suburbs	Stockholm fringe suburbs	Other metropol. areas	Medium-sized cities	Small cities & rural areas
Female	0.887***	0.831***	1.028	0.839	0.657***	0.806
Male (ref.)						
Age 20–29	6.297***	5.155***	1.714**	6.009***	4.506***	1.973**
Age 30–39	4.138***	3.999***	2.006***	8.177***	4.135***	2.781***
Age 40–49	1.622***	1.956***	1.186	1.605	1.641*	1.043
Age 50–59 (ref.)						
Born in Stockholm County (ref.)						
Born in the rest of Sweden	1.136**	1.020	0.915	8.652***	4.661***	4.221***
Born outside of Sweden	1.754***	1.813***	0.848	3.302***	1.786**	1.139
Primary or upper-sec. education (ref.)						
Post-sec. education ≤3 years	1.178**	0.785***	0.801	1.342	0.728*	0.859
Post-sec. education ≥4 years	1.333***	0.671***	0.426***	1.445	0.657**	0.570**
Single	1.263**	0.806***	0.909	0.846	1.104	0.858
Married: spouse WFH occ.	1.851***	1.174**	1.384	1.308	0.757	0.860
Married: spouse non-WFH occ. (ref.)						
Married: spouse not employed	1.425***	0.960	1.648	1.015	1.989**	1.593
Young children (age 0–15)	0.802***	0.957	0.702	0.724	1.127	0.786
Renter (ref.)						
Apartment owner	0.872***	0.945	0.900	1.064	1.088	1.057
House owner	0.354***	0.487***	0.383**	0.386*	0.658	0.532
Annual earnings 1st quartile (ref.)						
Annual earnings 2nd quartile	0.905	0.929	0.821	0.633	0.984	1.119
Annual earnings 3rd quartile	0.944	0.909	0.938	0.500**	0.886	0.956
Annual earnings 4th quartile	1.040	0.892	0.942	0.689	0.712	0.874
Manager WFH occupation	2.124***	0.933	1.239	5.123***	3.201***	0.799
Professional WFH occupation	1.598***	0.843**	1.222	4.283***	3.548***	3.066***
Professional non-WFH occupation	1.176	0.791***	0.803	0.756	1.671	1.542
Ass. prof. WFH occupation	1.728***	0.955	1.123	3.246**	2.973***	2.356**
Ass. prof. non-WFH occupation	1.807***	1.166	1.260	2.158	1.300	2.718**
Clerical supp. WFH occupation	1.800***	0.820*	0.846	1.421	2.653**	2.555**
Clerical supp. non-WFH occupation	1.362**	0.964	0.592	0.000***	3.058***	0.831
Other non-WFH occupation (ref.)						
Number of observations	153,996					

Notes: The estimates are expressed as relative risk ratios. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively (based on robust standard errors).

Table A2 MNL estimates of out-migration from Stockholm City during the pre-pandemic period (2017–2019). Classification of occupations based on data on actual work from home in the Swedish Labour Force Survey

Destination (ref. staying in Stockholm City)	Stockholm adjacent suburbs	Stockholm semi-adj. suburbs	Stockholm fringe suburbs	Other metropol. areas	Medium-sized cities	Small cities & rural areas
Female	0.894***	0.763***	0.809**	0.856	0.646***	0.646***
Male (ref.)						
Age 20–29	6.244***	5.276***	1.856***	4.352***	5.354***	1.931***
Age 30–39	4.123***	4.310***	1.894***	4.410***	4.128***	2.341***
Age 40–49	1.486***	1.772***	0.929	1.459	1.528*	1.238
Age 50–59 (ref.)						
Born in Stockholm County (ref.)						
Born in the rest of Sweden	1.149***	0.955	0.935	6.723***	4.995***	4.061***
Born outside of Sweden	1.521***	1.708***	0.668***	3.210***	1.573**	1.339
Primary or upper-sec. education (ref.)						
Post-sec. education ≤3 years	1.110**	0.893***	0.760**	2.169***	0.809	0.897
Post-sec. education ≥4 years	1.324***	0.835***	0.786	2.145***	0.697**	0.496***
Single	1.056	0.705***	0.675**	1.332	0.923	0.830
Married: spouse WFH occ.	1.506***	1.001	0.849	1.206	0.851	1.035
Married: spouse non-WFH occ. (ref.)						
Married: spouse not employed	1.056	0.808***	1.013	1.750	2.341***	1.640
Young children (age 0–15)	0.812***	0.975	0.847	1.183	0.768*	0.662**
Renter (ref.)						
Apartment owner	0.941*	1.046*	1.147	0.704**	0.838	1.219
House owner	0.352***	0.529***	0.710	0.264***	0.411***	0.714
Annual earnings 1st quartile (ref.)						
Annual earnings 2nd quartile	0.982	0.954	1.048	0.826	1.000	0.679*
Annual earnings 3rd quartile	0.910**	0.883***	1.093	1.164	0.952	0.773
Annual earnings 4th quartile	1.072	0.697***	0.785	1.326	1.012	0.857
Manager WFH occupation	1.736***	0.867**	1.364	3.050***	1.670**	0.861
Professional WFH occupation	1.357***	0.744***	0.994	2.801***	1.274	1.327
Professional non-WFH occupation	1.203***	0.711***	0.671*	1.309	0.629	0.217**
Ass. prof. WFH occupation	1.621***	1.032	1.356*	2.986***	1.446*	1.675*
Ass. prof. non-WFH occupation	1.418***	0.990	1.053	2.184	1.309	1.731
Clerical supp. WFH occupation	1.501***	0.869**	1.181	1.431	1.226	1.530
Clerical supp. non-WFH occupation	1.435***	1.055	1.130	1.189	1.448	1.217
Other WFH occupation (ref.)						
Cohort 2017 (ref.)						
Cohort 2018	1.040	1.003	1.184	1.188	1.062	0.979
Cohort 2019	1.040	0.974	1.057	1.233	1.136	1.055
Number of observations	418,982					

Notes: The estimates are expressed as relative risk ratios. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively (based on robust standard errors).

Table A3 MNL estimates of out-migration from Stockholm City during the post-pandemic period (2020–2022). Classification of occupations based on data on actual work from home in the Swedish Labour Force Survey

Destination (ref. staying in Stockholm City)	Stockholm adjacent suburbs	Stockholm semi-adj. suburbs	Stockholm fringe suburbs	Other metropol. areas	Medium-sized cities	Small cities & rural areas
Female	0.911***	0.815***	0.901	0.846	0.813***	0.848**
Male (ref.)						
Age 20–29	6.675***	5.007***	1.678***	7.955***	4.437***	2.009***
Age 30–39	4.555***	4.143***	1.976***	7.011***	4.527***	3.046***
Age 40–49	1.623***	1.862***	1.153	1.893**	1.638***	1.080
Age 50–59 (ref.)						
Born in Stockholm County (ref.)						
Born in the rest of Sweden	1.110***	0.966	1.004	6.429***	4.689***	3.401***
Born outside of Sweden	1.656***	1.752***	0.697***	2.290***	1.326**	0.864
Primary or upper-sec. education (ref.)						
Post-sec. education ≤3 years	1.121***	0.867***	0.897	1.838***	0.771***	0.750***
Post-sec. education ≥4 years	1.244***	0.767***	0.649***	1.902***	0.688***	0.569***
Single	1.140**	0.791***	0.707***	0.723	0.851	0.846
Married: spouse WFH occ.	1.610***	1.150***	1.076	1.211	0.844	0.974
Married: spouse non-WFH occ. (ref.)						
Married: spouse not employed	1.175**	0.936	1.208	0.967	1.217	1.378
Young children (age 0–15)	0.817***	1.017	0.840	0.737*	1.206*	0.931
Renter (ref.)						
Apartment owner	0.875***	0.992	0.903	1.271*	1.121	0.994
House owner	0.326***	0.469***	0.455***	0.626*	0.492***	0.527***
Annual earnings 1st quartile (ref.)						
Annual earnings 2nd quartile	0.965	0.907***	0.998	0.866	0.867	1.246*
Annual earnings 3rd quartile	1.023	0.902***	1.111	0.763	0.806**	1.049
Annual earnings 4th quartile	1.217***	0.871***	1.011	0.980	0.737***	0.972
Manager WFH occupation	1.896***	0.924	1.081	2.074**	2.415***	2.445***
Professional WFH occupation	1.480***	0.811***	1.047	2.502***	2.535***	3.095***
Professional non-WFH occupation	1.285***	0.723***	0.640**	0.498*	0.802	0.717
Ass. prof. WFH occupation	1.782***	0.952	1.234	2.409***	2.657***	2.757***
Ass. prof. non-WFH occupation	1.526***	1.100*	0.878	1.864*	1.732***	1.552*
Clerical supp. WFH occupation	1.678***	0.927	0.940	1.419	2.315***	2.947***
Clerical supp. non-WFH occupation	1.231**	1.008	0.670	2.941***	2.030***	1.385
Other WFH occupation (ref.)						
Cohort 2020 (ref.)						
Cohort 2021	1.036	1.133***	1.536***	1.286*	1.345***	1.444***
Cohort 2022	0.976	0.999	1.170*	1.018	1.387***	1.152
Number of observations	455,875					

Notes: The estimates are expressed as relative risk ratios. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively (based on robust standard errors).

Growth analysis

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