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# A study of job polarization in Sweden from an urban-rural perspective

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## Abstract

This study is an explorative examination of changes in employment, revenue, and firm structure for low, mid, and high-skill firms in urban and rural areas in Sweden from 2007 to 2019, using skill groups based on education levels. For employment in Sweden in general, we find evidence of job upgrading. In the city of Stockholm we also document job polarization in the sense that employment in both low-skill and high-skill industries increased. We discuss various reasons why job polarization might be an urban phenomenon. We also document some consolidation towards larger firms in the low-skill sector and note that the revenue share of high-skill industries was constant during the period. Even though Swedish labour market institutions differ substantially from those of other OECD countries, the patterns of job polarization are strikingly similar.

**Keywords** Job polarization, Rural, Urban, Profits, Wage share, Capital taxes

**JEL classification** J23, J24, J31, L25, O33

## 1 Introduction

Job polarization (or labour market polarization) refers to the phenomenon in labour markets where employment growth occurs primarily in high-wage, high-skill jobs and low-wage, low-skill jobs (Autor et al. 2003; Goos and Manning 2007; Berglund et al. 2020). As noted by Oesch and Piccitto (2019), several countries have seen employment growth in high-skill sectors combined with falling employment in both low and middle-skill sectors.<sup>1</sup> In many cases, the decrease has been faster in the middle of the skill distribution which means that the share of jobs in this part of the skill distribution falls, even though the

underlying pattern is better described as job upgrading. In other cases (e.g., the US labour market 1990 to 2000, studied by Autor et al. 2006), both high-skill and low-skill employment has been growing.<sup>2</sup>

Several different explanations of job polarization have been suggested. The useful surveys by Franc (2024) and Berglund et al. (2020) suggest that explanations can be grouped into technological, economic, and institutional/political factors. In particular, explanations related to technological change and economic globalization are often suggested.

Automatization and computerization create strong incentives for firms to replace relatively expensive routine tasks with information- and communication technology and robots, resulting in a decreased demand for mid-skill

<sup>1</sup> Oesch and Piccitto studied Germany, Spain, Sweden, and the UK from 1992 to 2015.

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<sup>2</sup> In the job-polarization literature, it is not obvious how to describe a situation where middle-skill jobs decrease, and high-skill jobs increase but low-skill jobs are roughly constant as a share of all jobs. A possible solution would be to use the terms weak polarization to describe any situation where the share of middle skill jobs decreases, and strong polarization for the case when the share of low-skill jobs is also increasing.

labour. For high-skill labour, which complements technology, both productivity and demand increases. Mid-skilled workers may find it difficult to adapt to the new requirements and technologies, and as a result, they may have to look for jobs in low-skill occupations (Acemoglu and Autor 2011; Autor and Dorn 2013).

As an alternative (or complement) to automatization, routine-intensive firms may have incentives to offshore parts of their production. Economic globalization and trade in general may thus decrease the number of mid-skill jobs in many developed countries. Another explanation in the economical category is that increased purchasing power among high-income earners will raise the demand for personal services, and as a result, low-skill employment will increase (Mazzolari and Ragusa 2013).

While few dispute that job polarization, where it occurs, is related to technological change, the role of economic globalization is more debatable. Several studies have failed to find evidence that globalization is responsible for job polarization (Blinder 2009; Blinder and Krueger 2013; Goos et al. 2014; Adermon and Gustavsson 2015). An exception is Egger et al. (2024) who find offshoring to drive job polarization in Germany.

We contribute to the literature by examining job polarization in Sweden from an urban-rural perspective. Our aim is descriptive and exploratory: understanding where polarization occurs can shed light on why it occurs. A geographical dimension of job polarization has been studied before, but the within-country literature is much smaller than the country-level literature. In a study complementing ours, Henning and Eriksson (2021) analysed job polarization from a spatial perspective in Sweden and found (as expected) that job polarization is most pronounced in manufacturing-dominated municipalities. As shown by Nordin (2020) incomes in Stockholm have developed much more strongly compared to the rest of Sweden, whereas incomes in more rural parts of Sweden have been lagging— but we do not know if there are similar geographical differences in job polarization.

The urban-rural perspective is of interest because several reasons have been suggested why job polarization may be more pronounced in cities. For example, cities may have a larger share of routine based jobs (Autor and Dorn 2013; Rossi-Hansberg et al. 2019). As shown by Autor and Dorn (2013), many US cities are routine occupation-intensive, including industrial cities such as Detroit or Newark, but also cities with higher average education levels such as New York City and San Francisco. As a result of urban firms having more routine jobs and also higher cost of living and higher wages (compared to rural firms), urban firms face stronger incentives to invest in labour-saving technologies. These technologies

affect the change in job distribution between cities and rural areas, as documented by Eeckhout et al. (2021).

To our knowledge job polarization in Sweden has so far not been studied from an urban-rural perspective, but a few studies in other countries exist. Dauth (2014) analysed the German labour market 1980–2010 and concluded that job polarization almost exclusively occurs in urban areas. Another related study is Autor (2020) who concluded that both middle-class blue-collar jobs and white-collar administrative support jobs are disappearing from US cities. These used to supplement high-skill jobs in cities.

We also contribute by looking at labour market polarization from three different perspectives. Typically, the polarization literature has focused on employment in different skill sectors. But polarization could also mean that low-skill and high-skill firms are becoming more common and/or that revenues grow faster in low-skill and high-skill industries. Our paper examines job polarization in terms of employment and also examines changes in market structure and firm size using revenues and firm shares at the industry level.

Examining the urban-rural pattern of job polarization in Sweden is motivated because Sweden differs from other countries in several ways. Sweden has a more compressed wage and income distribution, a higher unionization rate, a larger share of the labour market covered by collective bargaining agreements than most other countries, and an above average proportion of temporary employees (Steinmo 2010; Bergh 2014; Berglund et al. 2022).<sup>3</sup> As a result, the Swedish situation is very different from the US, where many studies of job polarization have been made so far. Given these institutional characteristics, it is of interest to examine job polarization in Sweden: If patterns observed in less regulated and more flexible labor markets are visible also in Sweden, they are likely to appear in most OECD countries.

The paper proceeds as follows. Section 2 describes the data we use, explains how low, middle and high skilled jobs are defined and describes the national development of skill-shares for workers, firms, and revenues over the period 2007–2019. Section 3 the changes between 2007 and 2019 are studied from an urban-rural perspective. Section 4 concludes the paper and discusses how the patterns observed could potentially be explained.

## 2 Data

We use register data on private limited firms in Sweden, a common type of firm that were responsible for almost 54% of total employment in Sweden in 2019 (and 79% of

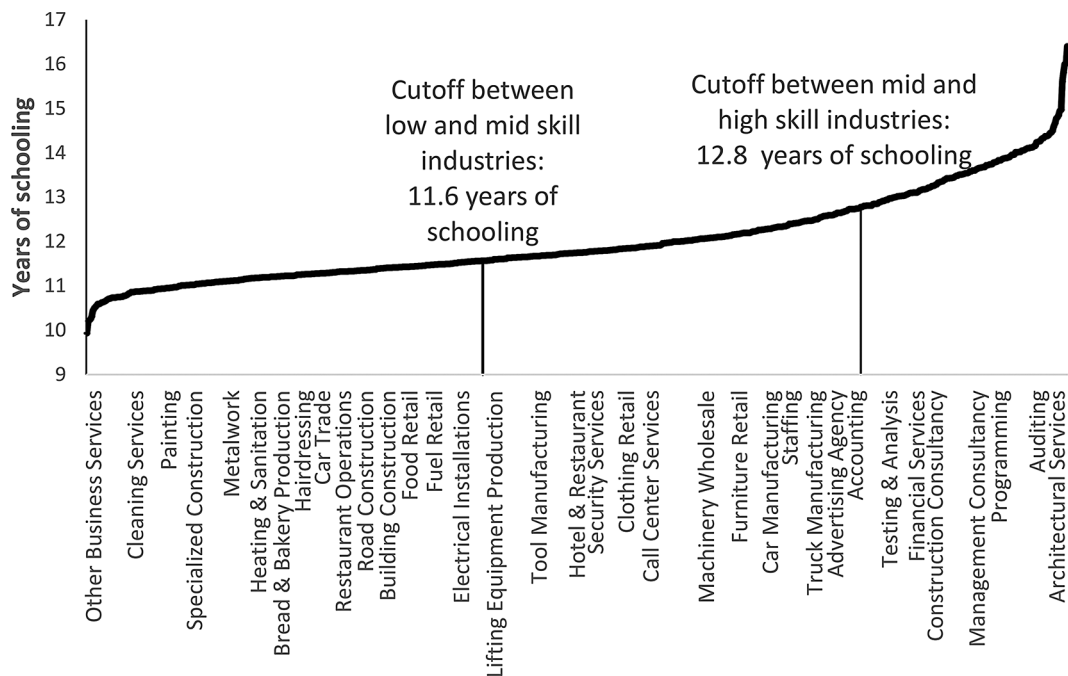
<sup>3</sup> For a recent and detailed description of the Swedish labour market, we refer the reader to Berglund et al. 2022.

the employment in the private sector).<sup>4</sup> Annual data for the full sample of such firms are taken from the database FRIDA (FöretagsRegister och IndividDatabas) for the period 2007–2019. A firm is a distinct entity or workplace that may be part of a larger company, which can include multiple firms or locations. At the firm level we have information on their specific location (municipality), number of employees, and revenues. Firms with a revenue below SEK 100,000 (about €10,000) are excluded. Doing so excludes 38% of all firms but only 1.5% of the workers in private limited firms. We also exclude firms with extreme net margins (about 2% of all firms).<sup>5</sup>

All Swedish private limited firms are classified as low-, mid-, or high-skill firms based on the average education level of all employees at industry level. We do so to classify firms based on what they do rather than on their firm-specific labour force composition. The classification is made using the Longitudinal Integration Database for Health Insurance and Labour Market Studies (LISA) which includes all individuals 16 years of age and older. We use education because it is arguably a better measure

often missing). More specifically, we use worker years of schooling level and workplace coding (from The Swedish Standard Industrial Classification, SNI) to calculate the mean industry years of schooling for 2007 for more than 800 industries (at the five-digit level of the SNI code).<sup>6</sup> To provide a concrete illustration of our data, Fig. 1 shows the two cutoffs (11.6 and 12.8 years of schooling) and examples of industries in the three skill categories.<sup>7</sup> As can be seen, our classification mirrors patterns found in occupational-level analyses. Typical low-skill jobs are cleaning services, restaurant operations and food retail. Mid-skill jobs include different types of manufacturing, clothing and furniture retail. Finally, examples of high-skill jobs include financial services, architecture and programming. Table 1 summarizes our data using mean values for the period 2007–2019.

As illustrated in Fig. 2a, private limited firms are over-represented in the low-skill group and under-represented in the high-skill group. Thus, even if the groups are of equal size at the population level (where public workers and private workers in other types of firms are included),



**Fig. 1** The years of schooling cutoffs between skill categories, and examples of firms in the different skill categories. Classification made using data from the beginning of the studied period, i.e. in 2007. In Sweden, primary school is 9 years, secondary school is an additional 2 to 4 years and more than 12 years of schooling typically means at least some tertiary education

of qualifications than wages or occupations (which are often used in similar studies where data on education is

<sup>4</sup> These figures are marginally inflated because some may work in more than one firm.

<sup>5</sup> Another 2% of firms are removed because of extreme events affecting their finances, mainly firms with very low revenues (close to the revenue threshold).

<sup>6</sup> SNI is identical to the classification of economic activities in the European Community (NACE).

<sup>7</sup> Using a later year (2019, which is the last year we have individual-register data) has some impact on the classification, though 83% of industries remain unchanged. The shifts primarily occur in sectors with few employees, likely due to noise, with no clear systematic pattern of higher or lower-educated industries changing more often. Over time, a general increase in education raises the cut-off years of schooling to 11.9 and 13.3 years, respectively.

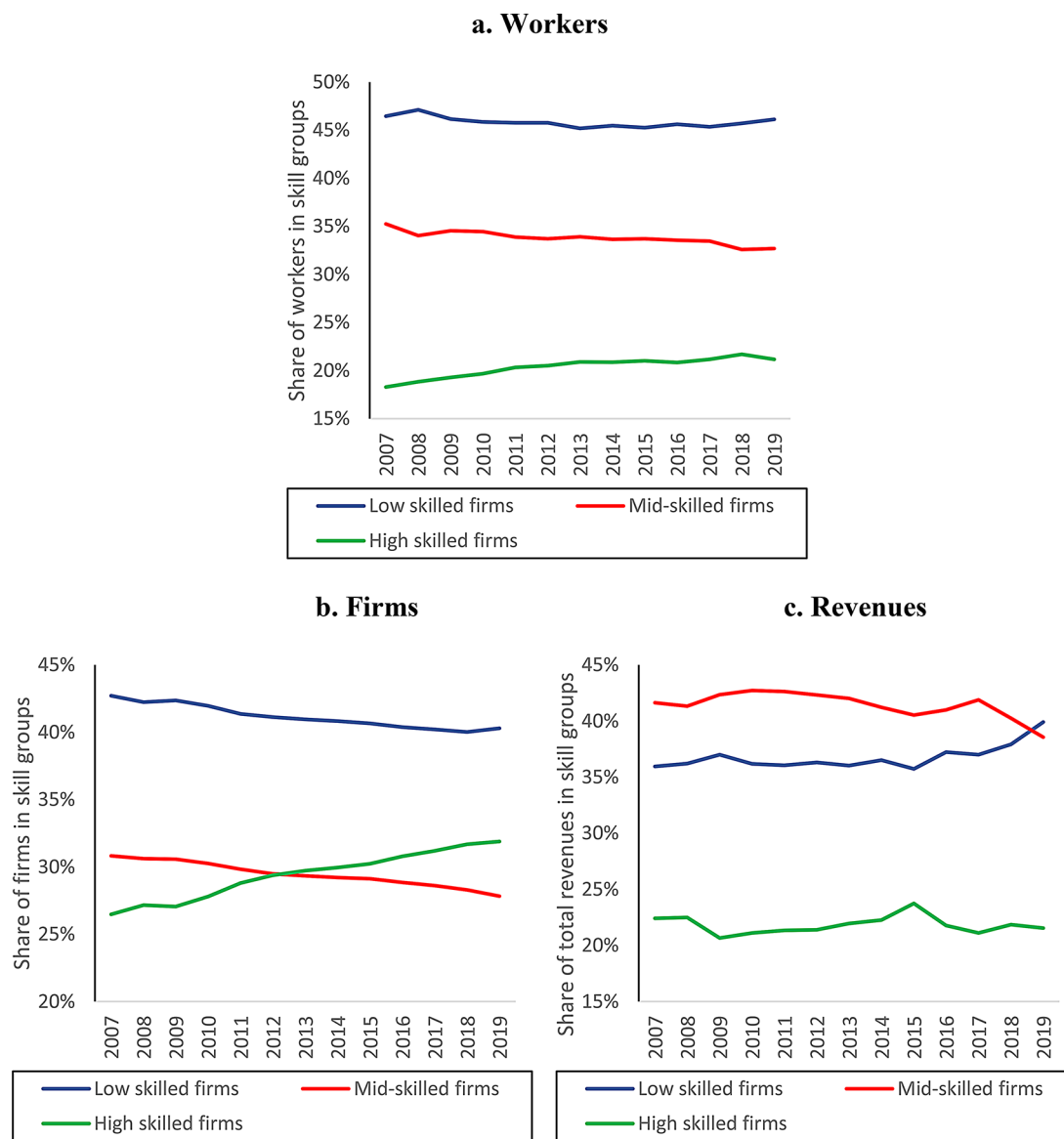
**Table 1** Descriptive statistics (mean values for the period 2007–2019)

	Firms	Mean employment (no. workers)	Mean revenues (SEK)	Population share
Remote rural areas	21 848	6.64	14 888 468	8.6%
Rural areas near cities	29 377	6.56	15 090 320	12.0%
Remote urban areas	16 395	7.55	32 519 406	7.4%
Urban areas	91 127	7.29	19 932 211	39.7%
Metropolitan areas	60 547	10.23	36 838 804	22.9%
Stockholm	40 567	12.42	26 459 221	9.4%

the skill structure is different for private limited firms. Figure 2a also shows how the distribution of private limited firms with different skill levels developed 2007–2019.

The share of workers in high-skill industries increases with 2.9%, the share in mid-skill industries decreases with -2.6%, and the share in low-skill industries increases by 0.3%. The finding that not much is happening in low-skill industries is in line with the findings of Oesch and Piccitto (2019). Our results are also similar to those reported by Gustavsson (2019) for 2000–2013.

As already noted, the development of the skill-based market structure is theoretically uncertain: even if employment in mid-skill industries falls, the industry size – measured as the share of firms or share of revenues – may develop differently. Figure 2b and c depict the share of firms and the share of total revenues for the three industry skill groups. Consistent with the employment findings, Fig. 2b shows that low-skill firms are the most



**Fig. 2** The development of skill-shares of workers (a), firms (b) and revenues (c) in the limited firms. 2007–2019

common type of firm. In other words, low skill industries employ more workers than the other skill groups.

More importantly, the share of both low-skill and mid-skill firms decreased 2–3% points during the period, and over the same period, we see a marked increase of 5.4% points in the share of high-skill firms. Thus, limited liability firms are becoming more common in high-skill industries and less common in low-skill and mid-skill industries. Early in the period, the share of high-skill firms is lower than the share of mid-skill firms; after 2012, the opposite is true.<sup>8</sup>

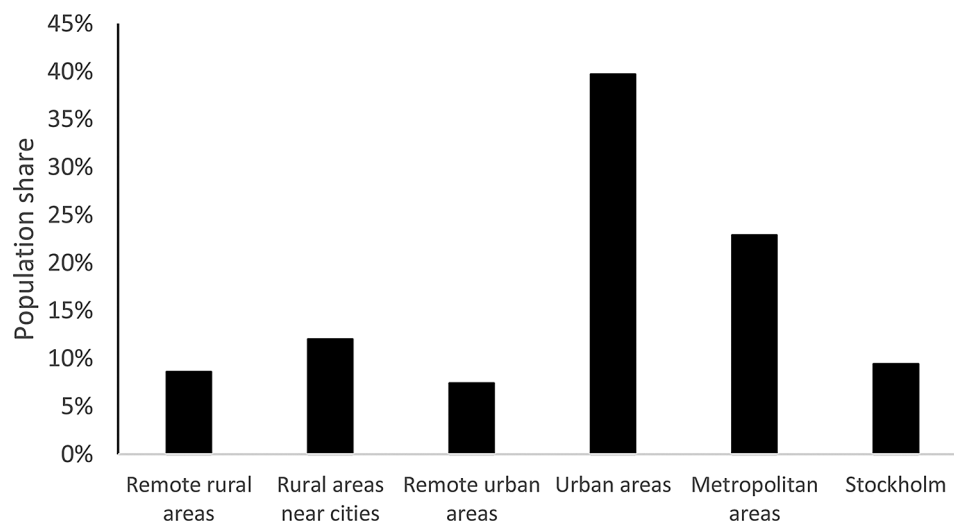
Figure 2c, lastly, shows the share of revenues for the three skill groups. In contrast to the measures based on the number of workers and firms, the mid-skill sector is the largest in terms of revenue share, except for 2019. The combination of few firms and high revenues implies that firms in the mid-skill sector are relatively large on average. The revenue share in the high-skill sector is low and approximately constant during the period. It is also noteworthy that low-skill firms increased their share of revenues by 4% towards the end of the period despite a decreasing share of firms, suggesting that business consolidation has been taking place. Also, increasing revenues probably reflects the increase in the share of workers for low-skill industries towards the end of the period seen in Fig. 2a.

To summarize, there is no clear evidence of job polarization in Sweden as a whole. We now turn to the urban-rural perspective.

### 3 The urban-rural perspective

To examine how the pattern described above varies between urban and rural parts of Sweden, we use firm location at the municipality level and the classification of rural and urban areas developed by the Swedish Agency for Economic and Regional Growth (Tillväxtverket), which contains six different types of areas depending on rurality-urbanity.<sup>9</sup> We prefer this classification as it is better suited than, e.g., NUTS- zones for capturing urban-rural differences. Still, the classification uses the same methods as those used in Eurostat's and the OECD's NUTS III level classifications, facilitating international comparisons.

As noted in the introduction, we study Stockholm separately because previous studies have shown that incomes in Stockholm have increased substantially compared to the rest of the country (Nordin 2020). Appendix A describes in more detail how the Swedish Agency for Economic and Regional Growth classifies these areas. To facilitate interpretation, we merge the two most rural categories into *remote rural areas* (together containing 8.6% of the Swedish population) and divide the most urban areas into *Stockholm* (9.4%) and *other metropolitan areas* (22.9%).<sup>10</sup> Ranked from rural to urban, the other regional categories are: rural areas near cities (12.0%), remote urban areas (7.4%), and *urban areas* (39.7%). Figure 3 depicts the distribution of the Swedish population in the urban-rural dimension



**Fig. 3** The distribution of the Swedish population in the urban-rural dimension

<sup>8</sup> Because the total number of firms increase from 197,000 to 331,000 between 2007 and 2019, the absolute number of firms increases in all three skill groups.

<sup>9</sup> For firms with several places of work the location is based on the location of the central office. However, it should be noted that most firms with several places of work are divided into separate firms, and this is particularly true for limited firms. See further Nordin (2022).

<sup>10</sup> *Other metropolitan areas* include Stockholm County (except Stockholm), Gothenburg, Malmö and some sub-municipalities to Gothenburg and Malmö.

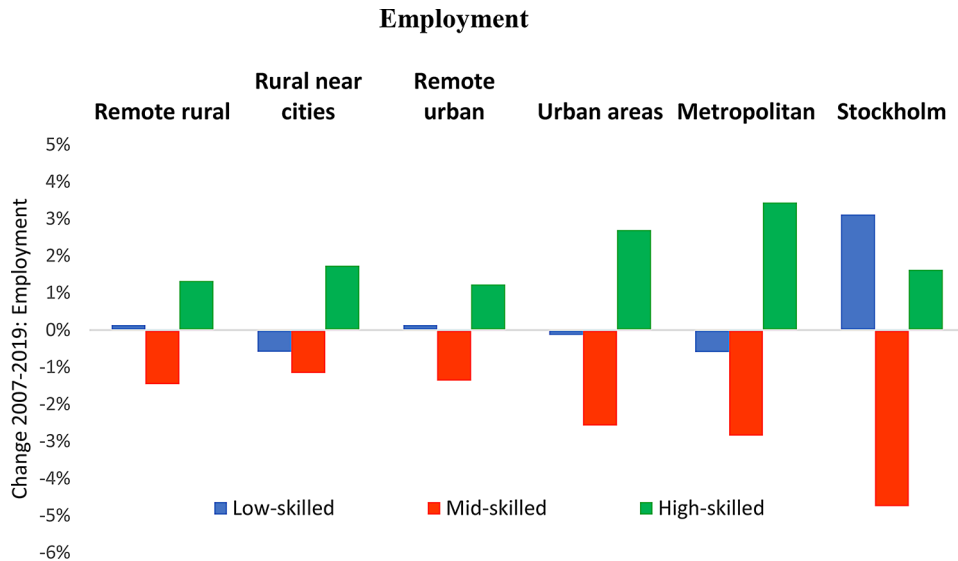


Fig. 4 Regional changes in employment for low, mid, and high-skill industries, 2007–2019

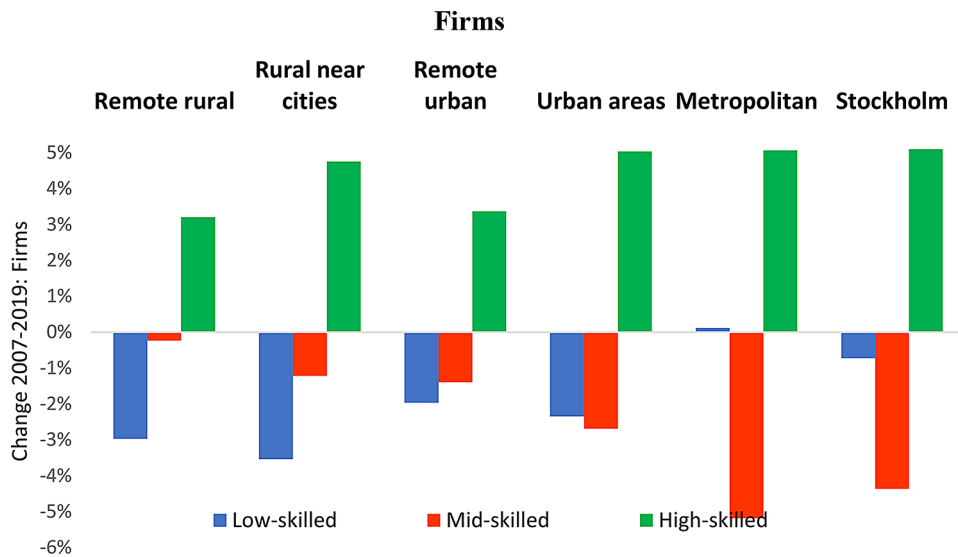


Fig. 5 Regional changes in number of firms for low, mid, and high-skill industries, 2007–2019

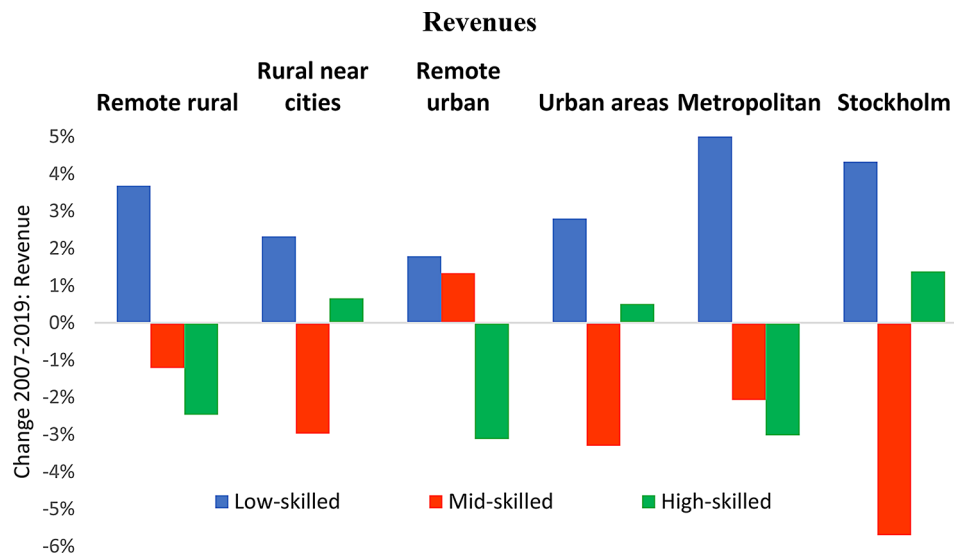
### 3.1 Employment and revenues

If job polarization is mainly an urban phenomenon important changes may be masked on the national level. We therefore calculate, for each skill group, within-region changes in employment, firms, and revenues over the 2007–2019 period for each of the areas (from remote rural areas to Stockholm). Figure 4 depicts the changes in employment for low, mid, and high-skill industries, respectively. Figures 5 and 6 show the development of firms and revenues.

Figure 4 shows that employment in Stockholm in low-skill industries grew much more than other industries in Stockholm over the period 2007–2019. Thus, compared to the rest of Sweden, Stockholm has experienced a significant increase in employment in low-skill

industries. In contrast, employment in low-skill industries has remained relatively unchanged across the rest of the country, even in other metropolitan areas (excluding Stockholm), which is somewhat unexpected.

The other trends in Fig. 4 are more expected. Employment in mid-skill industries is decreasing across all regions (Fig. 4b), with a more pronounced decline in densely populated areas. Conversely, employment in high-skill industries is rising in all regions (Fig. 4c), particularly in urban and other metropolitan areas. In summary, Stockholm has experienced job polarization in employment. In contrast, the rest of the country has experienced job upgrading: Falling employment in mid-skill industries, rising employment in high combined and roughly constant employment in low-skill industries.



**Fig. 6** Regional change in revenues for low, mid, and high-skill industries, 2007–2019

Next, we analyse firms and revenues together. Doing so gives us information on market structure and firm size. In low-skill industries, the number of firms have decreased in almost all areas, especially in rural and remote areas (Fig. 5). But revenues in low-skill industries increased in all regions, with no obvious urban-rural pattern and remote rural municipalities doing surprisingly well (Fig. 6). Taken together, these patterns mean that there has been consolidation in low-skill industries towards fewer and larger firms (in terms of both revenues and employment).

For mid-skill industries, a general decrease in both firms and revenues is observed. Similar to the employment trend, the decline is more pronounced in denser areas. Mid-skill industries are therefore clearly shrinking across all measures, with a particular bias towards cities and (especially) Stockholm.

Lastly, we see a tendency towards the number of high-skill firm growing less in remote areas. Still, when looking at the trends in Figs. 4, 5 and 6 combined, the most striking pattern when it comes to employment, firms and revenues for high-skill firms is arguably the absence of a clear urban-rural pattern.

#### 4 Discussion

We have examined job polarization among limited firms in Sweden between 2007 and 2019. By the end of the period, fewer workers were employed in mid-skill industries, while high-skill industries saw a notable increase in employment. Employment in low-skill industries increased substantially during this period, but only in Stockholm. While Sweden in general has experienced job-upgrading as described by Oesch and Piccitto (2019), in Stockholm there has been job polarization in the strong sense that employment has been growing in both

high-skill and low-skill industries (with employment growth in the latter being higher).

Our ambition in this paper is mainly descriptive, but it is worth discussing how the growth of low-skill employment in Stockholm could be explained. One candidate is found in the literature on urban agglomeration economies (e.g. Glaeser 2011; Duranton & Puga, 2004), suggesting that cities provide businesses with cost advantages from proximity to infrastructure and services, and that low-skill industries in particular benefit from the dense consumer base found in cities. Similarly, the structural shift from manufacturing to service-oriented economies tend to concentrate low-skill jobs in urban areas, where demand for services like food, personal care, and transportation is higher due to larger, wealthier populations (Autor and Dorn 2013; Moretti 2012; Mazzolari and Ragusa 2013). Autor (2020) explains the development as high-skill industries in cities being complemented by a low-wage service sector that provides the services demanded by the high-tech sector's personnel.

The period studied also saw the rise of non-traditional work arrangements, such as the gig economy (Abraham et al. 2019), the sharing economy (Sunandarajan, 2016; Bergh et al. 2021) and the platform economy (Webster and Zhang 2020). Many of these new forms of labour relations thrive in urban environments (Davidson and Infranca, 2015).

As documented by Nordin (2020), incomes in Stockholm have increased during the studied period both compared to rural areas and compared to other metropolitan areas in Sweden, which has plausibly led to a particularly large increase in demand for low-skill services.

Finally, cities tend to attract immigrant workers, who often take up low-skill jobs (Card 2005; Peri 2016). In Sweden, the share of foreign born in Stockholm is

indeed higher than the national average, but the increase over the studied period was actually smaller in Stockholm: Between 2007 and 2019 the share of foreign born increased from 21 to 26% in Stockholm, compared to the national average that increased from 13 to 20%.<sup>11</sup> A possibility worth exploring further, is that Stockholm has attracted migrants, both domestic and international, who are (at least initially) taking low-skill jobs. As noted by Gustavsson (2019), immigration may to some extent have *prevented* job polarization in Sweden, because the increase in the low skilled labour supply in Sweden has come mainly from low skilled immigration and not from the pool of mid-skilled workers.

Turning to high-skill employment, one of the more surprising results is that Stockholm did not experience a significantly greater increase in high-skill employment or the number of high-skill firms than other urban or metropolitan areas. This may seem counterintuitive, given Stockholm's status as the capital, its concentration of knowledge-intensive firms, and its stronger income growth (Nordin 2020). Several explanations are possible.

One reason could be that Stockholm had already undergone substantial structural transformation prior to the study period. As shown in work on regional economic restructuring (Henning and Eriksson 2021), the Swedish economy has gradually transitioned from industrial production toward services, and this transformation has been spatially uneven. While de-industrialization has been especially marked in smaller industrial towns, the transition to a service economy in Stockholm may have plateaued earlier. Consequently, growth in high-skill industries may now be taking place more rapidly in second-tier urban regions where the shift is still ongoing.

Another possibility is that Stockholm's labour and real estate markets have become congested or saturated, with high housing prices and limited space for business expansion acting as constraints. Finally, government efforts to support smart specialization, regional innovation and business development (cf. Balland et al. 2019) may have contributed to a more even distribution of high-skill firm development.

We also studied how the Swedish labour market developed in terms of revenues and firms. Perhaps most interesting is the fact that revenues in high skill industries is not increasing as expected. Towards the end of the studied period, revenues of low skill industries have grown at the expense of mid-skill industries. We also concluded that there has been some consolidation resulting in larger firms in the low-skill sector.

In summary, at least until 2019 when our data end, job polarization was an urban phenomenon: Only in

Stockholm did employment in low-skill industries increase substantially. Further studies with more recent data are motivated to examine if the development continues after 2019 and if it spreads to other parts of the country. If it does, it suggests that the low-skill part of the Swedish labour market, that has traditionally been small, is growing despite Sweden's compressed wage structure and high-income taxes.

Finally, a critical question for the future is whether AI technology, with its potential to influence the demand for mid- and high-skill jobs, is altering the prevailing trend of job polarization in cities. Recent studies have found that mid-skilled workers benefit the most from large language models such as ChatGPT (Dell'Acqua et al. 2023; Noy and Zhang 2023), which could potentially counteract the job polarization trend.

## Appendix

The classification of urban and rural areas is suggested by the Swedish Agency for Economic and Regional Growth and is as follows:<sup>12</sup>

**Metropolitan areas** are municipalities with more than 80% of the population in urban areas, and together with neighboring municipalities, they have a combined population of at least 500,000 inhabitants. Note that we separate between Stockholm and other metropolitan areas in the paper.

**Urban areas** are municipalities with more than 50% of the population living in urban areas. Most of the population has a commute of less than 45 min by car to an urban area with at least 50,000 inhabitants.

**Remote urban areas** are municipalities where more than 50% of the population lives in urban areas. Most of the municipality's population must commute more than 45 min by car to reach an urban area with at least 50,000 inhabitants.

**Rural areas near cities** include municipalities where more than 50% of the population lives in rural areas. The majority of the population has a commute of less than 45 min by car to an urban area with at least 50,000 inhabitants.

**Remote rural areas** are where more than 50% of the population lives in rural areas. Most of the population has a commute of more than 45 min by car to an urban area with at least 50,000 inhabitants.

<sup>11</sup> Data from Statistics Sweden. Stockholm refers to Stockholm municipality (for the Stockholm region the increase was from 20 to 26%).

<sup>12</sup> Source: <https://tillvaxtverket.se/tillvaxtverket/statistikochanalys/statistiko/mregionalutveckling/regionalaindelningar/staderochlandsbygder.1844.html>.

**Very remote rural areas** are where the entire population lives in rural areas. The population has a commute of more than 90 min by car to an urban area with at least 50,000 inhabitants. We combine remote rural areas and very remote rural areas into one category in our analysis.

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#### Author contributions

The authors have contributed equally to the paper.

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#### Data availability

The data that support the findings of this study are available from Statistics Sweden but restrictions apply to the availability of these data, which were used under license for the current study. Guidance on how to replicate the findings is available from the authors upon reasonable request and with permission of Statistics Sweden.

#### Declarations

#### Competing interests

The authors have no financial or non-financial competing interests to declare.

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