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Geographies of Low-Income Jobs: The concentration of low-income jobs, the knowledge economy and labor market polarization in Sweden, 1990-2018

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Abstract

In this paper we explore the (changing) spatial concentration of low-income jobs throughout the last 30 years in Sweden, a period that has been characterized by the rise of what has become known as the knowledge economy. In particular, we describe (map) and try to understand what drives the concentration of low-income jobs in certain regions and how that has changed in time. We observe an overall decrease of the prevalence of low-income jobs during the last three decades. Moreover, regions have also converged, meaning that the great differentiator between places is less and less about how many low-income jobs they host, but how many very well paid there are. We also find that labor market polarization does not seem to lead to a greater incidence of low-income jobs when measured against a threshold related to the national income distribution, but, as expected, it does when we move towards a regional threshold, thus accounting for regional income differences. Finally, regions with a larger knowledge economy have tended to have a lower incidence of low-income jobs, both measured with respect to the national and to the regional income. This points towards the knowledge economy being a source of regional prosperity either through the upgrading of jobs or rising the wages of low-income workers. Despite all the discourse about the degradation of the Nordic model, we provide some evidence for it to be still working in Sweden under this new and complex knowledge-dominated era.

Keywords: low-income jobs, regional development, inequality, knowledge economy, labor market polarization,

1 Introduction

Concerns about low-income jobs have increased since the great recession, the migration crises and signs of labor market polarization. The rise of the platform economy and the explosion of gig jobs have also contributed to the relevance of this topic. Furthermore, the segment of the labor market associated with low-income jobs is most clearly related to the much-debated geographies of discontent (McCann, 2020) and the political polarization of the "places that don't matter" (Rodríguez-Pose, 2018).

Although the developments described underline the societal relevance of low-income jobs, the main motivation of this paper is a noticeable lack of attention paid to the lower end of the labor market within economic geography. The literature on low-income jobs has not incorporated a geographical perspective beyond comparisons between different countries (Gautié & Schmitt, 2010). The literature on regional development has most frequently used regional employment growth to proxy economic performance following Glaeser et al. (1992). Although an important indicator, taking employment growth as a measure for regional development risks making invisible diverse realities of workers in different regions. Hypothetically, a region could appear to be doing great if measured in terms of employment growth despite most of the new jobs created being of low quality, insecure, or poorly remunerated.

Recent studies considering employment growth in different sectors of the economy and the polarization of local labor markets provide some insights about the lower end of the labor market (Eriksson & Hansen, 2013; Eriksson, Hansen, & Winther, 2017; Henning & Eriksson, 2020). Yet still, cross-sectional and panel studies that have considered different sectors of the economy have mostly focused on the attractive high value-added sectors. Moreover, the majority of case studies center upon the most attractive new industries that usually – despite high employment growth rates – still employ relatively few people, while largely disregarding those less attractive ones that make up a large proportion of the employment in some regions and at a national level (Bentham et al., 2013). Finally, studies concerned with the polarization of labor markets, by definition, focus on relative changes at both ends of the labor market without paying too much attention to the actual clustering of low-income earners or low-quality jobs (Asplund, Barth, Lundborg, & Nilsen, 2011; Autor & Dorn, 2009).

All this translates into a surprising lack of geographical knowledge about the most vulnerable actors in any economy. The aim of this paper is twofold. First, we elaborate on the literature on low-income jobs and the literature on labor market polarization to discuss the implications for the geography of low-income jobs. Second, we conduct an empirical study in order to investigate the geography of low-income jobs in Sweden, and how it has changed during the last 30 years. This period is characterized by a deep structural transformation of the Swedish economy that established the dominance of what is known as the "knowledge economy" (Westlund & Pichler, 2013). The empirical study will investigate the following research questions:

- What is the spatial distribution of low-income earners and how has it changed during the last 30 years of economic structural transformation?
- How does the prevalence of low-income earners relate to the rise of the knowledge economy, and the size and polarization of local labor markets?

2 Previous Research on Low-Income Jobs and Polarization

2.1 Low-Income Jobs

In the late 2000s the Sage Foundation commissioned a series of studies on low-income work in six countries – the US, the UK, Denmark, Germany, the Netherlands, and France (Bosch & Weinkopf, 2008; Westergaard-Nielsen, 2008). Upon dissecting and comparing the low-income world in these countries, the main finding was that although structural differences could explain some of the variation in the incidence of low-income jobs, the most important factor was institutional: more participatory and inclusive wage-setting institutions led to radically lower levels low-income jobs (Denmark and France), while less inclusive ones, associated with liberal market economies (like the US and the UK) led to much higher figures. This resonates with the argument put forward by Oesch (2013) and Piketty (2014a, 2014b) in relation to the polarization on the labor market discussed in section 2.2.

An interesting case is Germany. Sometimes regarded as the model 'coordinated market economy' it has a large incidence of low-income jobs (on par with a "model" liberal economy like the UK), which seems to be associated with the "modified bread-winner" model, where women are largely still relegated to "mini-jobs" that contribute with a complementary income to the household (Bosch & Weinkopf, 2008). Within Germany, moreover, important differences were also established between (former) west and east Germany in terms of the function of low-income jobs. Whereas in west Germany the poverty risk of low-income workers is quite low, in east Germany that is far from being the case. In the latter, low-income workers are much more likely to be the main earners of the household instead of just providing complementary income.

Further, low-income work seems to serve radically different functions in different countries. In Denmark, low-income (precarious) jobs are a kind of rite-of-passage for young people (Ilsøe, 2016). Either students take up part-time jobs or high-school graduates take full-time low-paid with the expectation of gaining experience and increase their chances to succeed with their desired academic path. In contrast, in the UK and the US (and even Germany as discussed) low-income jobs are much more extended within the 'adult' population, where immigrants and low-educated people are very likely to get 'stuck' in the low-income sector and caught in the low-pay/no-pay cycle (Cai, 2015; Cai, Mavromaras, & Sloane, 2018; Gabe, Jaison, & Florida, 2018).

Now, given that the labor market institutions are largely invariant within a country – especially in one with highly centralized structures like Sweden – what would then explain (persistent or changing) differences in shares of low-income jobs between local labor markets? Owning to the spatial division of labor, how does the character (or function) of low-income jobs vary across regions?

The literature on low-income jobs has so far been silent on the spatial dimension. Yet, there are two important findings from this project that help begin answering this question. First, across all countries studied the same groups of workers seem to be affected by low-pay (young, female, less educated, immigrant and manual workers). Nevertheless, the general trend indicates that the incidence of low-income jobs has been increasing for men working full-time and decreasing for women (Lucifora, McKnight, & Salverda, 2005). Second, in all countries,

the low paying industries also tend to be the same (retailing, hospitality, catering, agriculture, and personal services). The geography of low-income jobs should thus partly be explained by the distribution of workers and sectors. In addition, these findings relate to the skill- and task-based bias transformation of the labor market, which arguably drive the sectoral composition of labor markets and the wage premiums for certain skills, and thereby polarization and potentially the prevalence of low-income jobs.

2.2 Polarization of Labor Markets

The occupational and income structures of labor markets have been a concern for a long time. As Oesch (2013) notes, where Marx (and followers) saw an inexorable tendency towards proletarization others argued that technological advancement should result on a ever-increasing demand for qualified labor and a constant upgrading of skills, job's quality and wages. This latter – rather optimistic – vision dominated the discussion in the post-war wealthy world, when effectively the occupational structure of rich countries experienced a regular upgrading and wages broadly increased on par with productivity. That, nevertheless, changed drastically from the 1980s onwards, that in retrospect is usually signaled as the inflection point when wages started to stagnate, inequalities to increase and the occupational/wage structure to polarize (Christophers, 2018, 2019; Goldin & Katz, 2008; Piketty, 2014a).

The list of factors that could affect the composition of labor markets is virtually endless. Oesch (2013), anyway, proposes that changes should be largely understood as determined by the interaction between a few key demand-side factors (technological changes and globalization), supply-side factors (education and immigration), and mediating factors (labor market institutions).

The way a new technology interacts with different parts of the skill and wage distributions is bound to affect the patterns of change in the labor market structure. The consensus is that technological change associated with the knowledge economy has been skill- and task-biased: explaining both increasing demand for and salaries at the upper segment of the labor market (Oesch, 2013) and polarization of the wage structure (Florida & Mellander, 2016). More concretely, the degree to which technology supplants and/or complements human labor depends on the nature of the tasks involved. Computers and machines are excellent performing routine tasks, while still not very good at those that require cognitive skills for decision making, complex communication skills, or even tasks that require social perceptiveness or hand-eye coordination (Oesch, 2013, p. 15). Tasks that are easily routinized are usually hold by relatively well-paid middle-educated people. Yet, while computers and information technologies increase the demand for professionals and managers, these technologies have little impact (neither substituting nor complementing) on low-skill jobs (Autor & Dorn, 2009), which, again, is consistent with patterns of parallel growth of a well-paid "creative class" and a low-pay service-oriented one (Florida, Mellander, Stolarick, & Ross, 2012; Henning & Eriksson, 2020). The latter largely devoted to meeting the needs and desires of the former.

Although not easily separable from technological changes (Henning & Eriksson, 2020), globalization is also thought to be a major determinant for changes in labor markets composition. For all the talk about automation, the jobs "lost" in the wealthy world by the de-industrialization process were largely offshored to newly industrializing countries. Here, the consensus is that globalization and offshoring should also contribute to the polarization of labor

markets, as most of the higher-value functions (design, R&D, high-management, etc) of multi-national corporations (MNCs) stayed put in their countries of origin, while the jobs offshored were mainly relatively well-paid held by middle-educated people (Autor & Dorn, 2013; B. M. Goos, Manning, & Salomons, 2014; M. Goos & Manning, 2007; Henning & Eriksson, 2020). The empirical evidence, however, has expressed doubt about the role of globalization as the underlying factor explaining polarization (B. M. Goos et al., 2014).

On the supply-side, the main factor thought to affect the occupational structure of labor markets is education. In their influential book, Goldin and Katz (2008) told the story about how up until the 1980s in the US the constant increase in demand for more educated workers (driven by the technological change) was met by an ever-increasing supply of skills. This led to a rather stable skill premium (wage differential between skilled and unskilled workers). During the last four decades, however, the pace of education achievement has decelerated leading to a "mismatch" between the demand and supply of high-skill workers which, in turn, would explain the steady increase in the skill premium.

Immigration also has the potential to affect the skill composition of the labor force. In fact, governments through history have resorted actively on immigration to overcome shortages in different segments of the labor market (Oesch, 2013). Empirical evidence has shown that in the US, low-skilled immigration form Latin America have had an sizeable effect lowering the price of immigrant-intensive services, thus benefiting the native population (Cortes, 2008). More recently, the situation of international migrants to Europe has been subject to extensive academic debate, where most studies find that migrants and refugees are more likely to get trapped into the lower end of the labor market than the native population (Cai, 2015; Gautié & Schmitt, 2010; Grimshaw, 2011; Lichter, Parisi, & Taquino, 2012). However, the observed growth of the low-income sector among many OECD countries could not be explained by immigration, but by the low levels of investment and social mobility (Ottaviano & Peri, 2012).

Finally, the decisive filter that will determine the patterns of occupational change are the labor market institutions.

> *"Which institutions affect prices (wages) and hence probably also quantities (level of employment) in the labour market? To begin with, minimum wages set by the government or enforced in collective bargaining by trade unions influence the extent of low-income employment. Moreover, collectively bargained wage increases and wage indexation clauses affect earnings differentials between low and highly qualified workers. Finally, benefits from unemployment insurance and social assistance schemes determine workers' reservation wages and hence their decision to accept a given job and fill certain vacancies"* (Oesch, 2013, p. 24)

Piketty (2014a), in this regard, argues that the rise of the neoliberal ideology that came with a front attack to labor unions and a sharp reduction of top marginal income tax rates is at the center of both the stagnation of real wages across the wealthy world on the one hand, and the prominent increase in top wages on the other.

2.3 Hypotheses about the Geography of Low-Income Jobs

The literature thus suggests that in particular technological change and globalization affecting the demand on labor markets, as well as institutional change related to neoliberalism should

have led to an increase in polarization. Even though this literature is less explicit about the effects on the lower end of the labor market, the expectation would be that also the prevalence of low-income jobs has increased, and that such prevalence is positively associated with labor market polarization. This results in our first two hypotheses:

> ***Hypothesis 1:*** *The prevalence of low-income jobs has increased over time is the Swedish labor market.*
>
> ***Hypothesis 2:*** *The prevalence of low-income jobs is positively associated with polarization.*

To be sure polarization of the labor market does not equate with the prevalence of low-income jobs, indeed they do not even need to be correlated. For instance, a region could have very few low-income jobs but as long as it experienced an over proportional increase in wages for high-income job holders, polarization would increase too. The other extreme would be a region with only low-income jobs but because of a compressed income structure has low polarization.

There are different mechanisms at work relating to the transformation of the knowledge economy that could affect the relationship between low-income jobs and polarization in either way. Currently the dominant perspective, in our reading, emphasizes that increasing demand for high-skill and high-income jobs in the knowledge economy at the same time increases demand for low-skill and low-income jobs serving what Florida (Florida, 2002, 2005) called the creative class (Fleming & Measham, 2014; Moretti & Thulin, 2013). When at the same time the middle-skill jobs disappear and not all individuals can upgrade to high-skill jobs, it is likely that also the supply for low-skill jobs increase. Hence, both the demand and supply for the low-skill and low-income segment of the labor market might increase, which is also at the heart of the polarization literature. In addition, Florida (2017) finds an increase in polarization in the large urban areas, calling this the new urban crisis where labor markets are highly polarized due to a growth of both the high-skill and low-skill segments, where the former creates a demand for the later. From these arguments, the following two hypotheses are deducted:

> ***Hypothesis 3:*** *The prevalence of low-income jobs is positively associated with the share of knowledge-intensive sectors.*
>
> ***Hypothesis 4:*** *The prevalence of low-income jobs is positively associated with the size of local labor markets.*

Yet, these hypotheses are challenged with the following three arguments. First, an increasing demand for low-skill jobs coupled with higher wage premiums of those who make use of low-skill jobs may also push up the wages at the lower end of the labor market. Further, even when these effects happen to be small (Kemeny & Osman, 2018) they could be just large enough to take workers out from the low-income category. Second, and more importantly, the transformation towards the knowledge economy does not necessarily need to be related to an increase of low-income jobs. From a dynamic perspective, the outcome of this transformation – whether the share of low-income jobs increases or decreases – will depend on whether the job upgrading happens faster than the phasing out low-skill jobs. Third, even though the large and metropolitan regions have grown faster than other regions pushing interregional disparities (Rodriguez-Pose, 2018), this does not necessarily imply a growing low-income segment in these large metropolitan regions. This is because large metropolitan areas should also be faster

in upgrading or creating high-skill jobs than other regions, and firms would be exposed to a higher transformation pressure, thus promoting the phasing out of low-skill occupations (Grillitsch & Nilsson, 2019). This suggests that while the formulated hypotheses are derived from a current academic (and public) discourse, they can also be contested theoretically. We thus investigate the hypotheses in the context of Sweden, which represents one version of the Nordic welfare economy.

3 Data, Measurement, and Methods

3.1 The Data

We use population-based register data obtained through Statistics Sweden (SCB). This rich dataset contains information of all the adult population residing in Sweden, containing personal information like education level, gender (binary), age, gender, municipality of residence, immigration background, income (different sources), employment source (employee/self-employed), and more. In addition, each individual is linked to their employer (if working), which allows identifying the municipality of work, industry, and occupation within the firm. Further, by aggregating this microdata, it is possible to obtain the income structure and structural features for neighborhoods, municipalities, and labor market regions. All information (except for a few variables) is available from 1990 to 2018.

However, we are also faced with some limitations. Whereas most of the literature on low-income work is based on hourly wages or monthly full-time equivalents, neither is possible with our dataset since we lack information about hours worked and the part-time/full-time status of workers. This is why we have to settle with annual incomes and try to correct for the distorting effects of part-time workers by excluding observation with annual incomes lower than the base price level[1].

We have, moreover, restricted our analysis to people in the prime of the working life. This means that we have excluded people younger than 25 and older than 65. In this way we exclude those studying and working part-time jobs and those retired or in the process of retiring.

3.2 Variables

Measures of Low-Income

The main focus of this paper is the incidence of low-income jobs across local labor markets during the last 30 years. There are three basic ways to define the low-income share: 1) a fixed percentile of the income distribution, usually the lowest 3 deciles, 2) an absolute threshold, most famously used to define the poverty headcount at three different levels by the World Bank, and 3) a relative level, usually a percentage of the mean or median wage/income.

All measures have advantages and drawbacks. However, the relative measure is the most common and accepted in the literature. Moreover, the OECD has endorsed it and defines workers at risk of poverty as those earning less than 60% of the median national income.

[1] Base price level (Prisbasbelopp in Swedish): An amount calculated yearly by the government that reflects the price development in society and is used for different purposes like taxation, pension benefits, and fees.

Besides defining the threshold, a second important issue of measurement was raised by Vacas-Soriano (2018) and relates to whether an anchored or rolling threshold is more appropriate. If one is concerned with short term changes due to specific shocks, an anchored threshold is more appropriate since it makes possible isolating wage and compositional effects. However, when studying long periods of time, by using an anchored threshold, changes in the standard of living, that might be considered negligible in shorter periods, are not taken into account even if the threshold is adjusted to the changes in the cost of living.

All things considered, since we are dealing with a long period of time, in this paper we use a rolling relative threshold – at 60% of the median national income – to identify people as holding a low-income job.

Labor Market Polarization, the Knowledge Economy, and Size

Firstly we address polarization of labor markets by comparing the share of the regional income that is accrued by the bottom 20% of earners with the share pf the regional income accrued by the top 5% (VanHeuvelen & Copas, 2019). Then, for the regression analysis, we proxy polarization with an indicator that is usually used in the literature of inequality: the Gini index, which is calculated according to equation 1.

$$Gini = \frac{1}{n}\left(n + 1 - 2\,\frac{\sum_{i=1}^{n}(n+1-i)y_i}{\sum_{i=1}^{n} y_i}\right) \quad (1)$$

We are aware of the fact that this is an imperfect measure for income polarization but it anyway provides an indication of growing differences in the income structure of labor markets. For robustness analysis we use the ratio of the share of income accrued by the top 5% to the share of income accrued by the bottom 20% (95/20 ratio).

The *size* of the labor market is measured as the sum of those employed in any given region plus those residing in the region but not in employment. In all analysis we use the natural logarithm of this indicator.

Finally, our selected measure for the *knowledge economy* is the share of regional employment in knowledge-intensive business services defined according to three-digit sectors in NACE Rev. 1.1. (65.1, 65.2, 67.1, 72.1, 72.2, 72.3, 72.4, 72.6, 73.1, 73.2, 74.1, 74.2, 74.3, and 74.4) from 1990 to 2006, and in NACE Rev. 2.0. (62.0, 63.1, 63.9, 64.1, 64.2, 64.3, 64.9 66.1, 69.1, 69.2, 70.1 ,70.2, 71.1, 71.2, 72.1, 72.2 ,73.1 73.2) from 2007 to 2018. This follows the recommendation by Schnabl and Zenker (2013) intended to minimize the disruption due to changing classifications from NACE 1.1 to NACE 2.0.

Controls

Since, as we have already discussed, geographical sorting of skill and occupations, could be driven by a variety of factors, including demographics, educational attainment, immigration, local institutions, and local industries, we include some key characteristics of local labor market as controls when estimating regression models (VanHeuvelen & Copas, 2019).

- *Human capital:* Share of workers with higher education (Master's degree or higher).
- *Establishments per worker:* The ratio of establishments to workers, intending to account for the level of monopsony power of employers within the region.

- *Employment level:*

$$Emp_r = Employed_r/(Employed_r + Not\_employed_r) \quad (2)$$

- *Self-employment:* Share of self-employed workers.
- *Manufacture employment:* Share of regional employment in manufacture.
- *Public employment:* Share of regional employment in the public sector.
- *Immigration:* Share of people with a direct foreign background.

Table 1 presents the descriptive statistics for all variables, dependent, independent and controls.

Table 1: Descriptive statistics (1990-2018)

Variables	N	Mean	SD	Min	Max
Share of low-income jobs (national)	2,650	0.153	0.0284	0.0874	0.261
Share of high-income jobs	2,650	0.0799	0.0307	0.0236	0.233
Share of low-income jobs (regional)	2,650	0.134	0.0150	0.0915	0.189
Share of income to the bottom 20%	2,650	0.0988	0.00412	0.0811	0.113
Share of income to the top 5%	2,650	0.110	0.00834	0.0886	0.159
Share of workers with a Masters degree or higher	2,650	0.0163	0.00971	0.00220	0.0840
Average age of workers	2,650	42.98	0.972	40.36	46.28
Share of female workers	2,650	0.479	0.0213	0.377	0.574
Share of workers in self-employment	2,650	0.0469	0.0158	0.0142	0.131
Gini index	2,650	0.220	0.0143	0.178	0.301
Employment level	2,650	0.791	0.0478	0.535	0.914
Share of employment in KIBS	2,650	0.0317	0.0219	0.00176	0.216
Share of employment in manufacture	2,650	0.219	0.108	0.00810	0.674
Shae of employment in public sector	2,650	0.433	0.0885	0.170	0.749
Share of workers with direct foreign background	2,650	0.0986	0.0653	0.0181	0.499
Establishments per worker	2,650	0.145	0.0466	0.0642	0.364
Log of labor market size	2,650	9.660	1.383	6.870	14.16

3.3 Methods

The empirical section is divided in two parts. The first part presents an explorative analysis of the overall national evolution of low-income jobs, their relative concentration across the labor market regions, and the relationship between the incidence of low-income jobs with some regional characteristics of interest, like the incidence of high-income earners, income polarization/inequality, and labor market size. Graphs and maps with information at the regional level are presented for four years: 1990, 1999, 2007, 2017. Besides being almost perfectly spaced out, these selected years meet an important criterion: being representative of periods of relative stability in the Swedish economy, as all of them are prior to some important events/crises – the national banking crisis of 1993, the .com crisis of 2000, the great financial crisis of 2009, and the COVID pandemic crisis of 2019 respectively. This is important because, as Vacas-Soriano (2018) points out, low-income shares are sensitive to wage and compositional shocks arising from crises. Surely, understanding the geographically differentiated effects of periods of crisis over low-income jobs is very important for future research but something that is out of scope for this paper.

The second part of the analysis consists of cross-sectional regressions (considering the same years), where we explore how different structural factors correlate with the regional concentration of low-income jobs and its changes for specific critical periods at different scales. For this, models of the forms presented in equation 3 will be estimated.

$$LIE_r = a + b_1 \cdot POL_r + b_2 \cdot SIZE_r + b_3 \cdot KE_r + b_4 \cdot CONT_r + \varepsilon_r \quad (3)$$

Where *LIE* stands for the share of low-income jobs, *POL* stands for the polarization, *SIZE*, stands for the size of the labor market, KE stands for the relative size of the knowledge economy, and CONT stands for the set of control variables mentioned in section 3.3.

It is important to mention that for all analysis the labor market regions used are those relevant for that period according to Statistics Sweden. This means that in 1990 there were 112 labor market regions, 92 in the year 1999, 78 in 2007, and only 70 in 2017.

Since the number of labor market regions change from year to year, the regression results are, strictly speaking, not entirely comparable. We could have worked with constant labor market regions (fixed at the middle of the period for example) but we have decided to work with the defined labor market regions for each year, since it is theoretically more consistent as we understand that differences on the incidence of low-income jobs largely as the result of the workings of the labor market. For the same reason we have decided not to include panel regression despite having the data to do so.

3.4 The Empirical Context of Sweden

The Swedish socio-economic model has for a long time been based on upgrading jobs by staying close to the technological frontier thus increasing the demand for highly skilled employees and out-phasing low-productivity, low-paid and low-skilled jobs (Henning & Eriksson, 2020). However, technological change, globalization and the neo-liberal project have, according to some, degraded the social fabric evidenced by a sharp increase in income inequality and the increasing importance of capital income for the wealthy (Pareliussen, André, Bourrousse, & Koen, 2017; Robling & Pareliussen, 2017).

This degradation seems to have found support in early evidence of labor market polarization (Adermon & Gustavsson, 2015; Asplund et al., 2011; Henning & Eriksson, 2020) attributed precisely to the offshoring and automation in manufacturing industries induced by the relatively high labor costs on the local labor market. Oesch and Piccitto (2019), however, have disputed the idea of polarizing labor markets in Europe, considering four complementary dimensions to characterize the labor market structure (education, earnings, prestige, and job satisfaction) across five countries (Germany, Sweden, Spain, and the UK). They find that in almost all cases, and in particular for the case of Sweden, between 1997 and 2015, the trend is towards a clear upgrading across all measures.

Regarding the sub-national scale, the Swedish regional system, like most European countries, consists of a few very large cities (Stockholm, Göteborg, and Malmö) with a long tail of small towns and villages (Hansen & Winther, 2014). Sweden, however, unlike many European countries is relatively large and, for most of its territory, sparsely populated. Inter-regional inequality, according to Enflo and Henning (2010), has been consistently increasing for the last couple of decades and has now reached levels last recorded previous to the economic boom following the end of WWII (Henning & Eriksson, 2020). Further, while the clear winners of

the last 40 years have been the large metropolitan areas, with Stockholm on the lead, the clear losers have been the small and micro regions (Lundquist, Olander, & Martynovich, 2017).

Moreover, Henning and Eriksson (2020) investigated labor market polarization patterns at the municipal level between 2002 and 2012. It turns out that the most common pattern of occupational change for this period was upgrading (146), followed by polarization (61), downgrading (56) and middling (27). Upgrading was dominant in the more peripheral regions of the country, polarization is mainly observed across the old industrial belt, while downgrades are to be found around Stockholm and in very remote locations.

As for the regional characteristics of the different groups, polarizing regions are characterized by high shares of manufacturing and somewhat lower levels of education. The downgraders also have high shares of manufacturing but have higher shares of services and the highest shares of foreign-born population. The upgraders are an heterogenous group where we find regions with high presence of mining and extractive activities and, more generally, higher share of public-sector jobs.

This previous research provides valuable knowledge about how local labor markets have evolved in Sweden in the recent past but, again, it doesn't tell us much about where low-income jobs have concentrated over time and why. This is the task we take to explore in the next section.

4 Findings

At the national level the last 30 years have witnessed an overall decrease on the incidence of low-income jobs in Sweden (Figure 1). However, the pattern is not uniform across different kinds of places. Figure 1 also disaggregates the pattern based on the classification of SALAR (Swedish Associations of Local Authorities and Regions) that classifies municipalities into a) large cities and municipalities near large cities, b) Medium-sized towns and municipalities near medium-sized towns, and c) Smaller towns/urban areas and rural municipalities. Within the first category we further distinguish Stockholm, Gothenburg and Malmö. In this regard, it is possible to see that both Stockholm and Malmö have increased their shares of low-income jobs, while Gothenburg has stayed roughly the same. The only "places" that have consistently and importantly decreased their shares are the small towns and rural municipalities. Overall, the most noticeable pattern is the strong convergence between different types of regions. Whereas in 1990 the range was from 10.5% to 16.5% in 2018 it was between 12% and 14%. The observed national trend thus rejects **hypothesis one** that the prevalence of low-income jobs has increased during the last 30 years of structural transformation to a knowledge economy. This decreasing national trend goes hand in hand with strong convergence between regions and in particular through decreasing shares of low-income earners in in the lower level of the regional hierarchy.

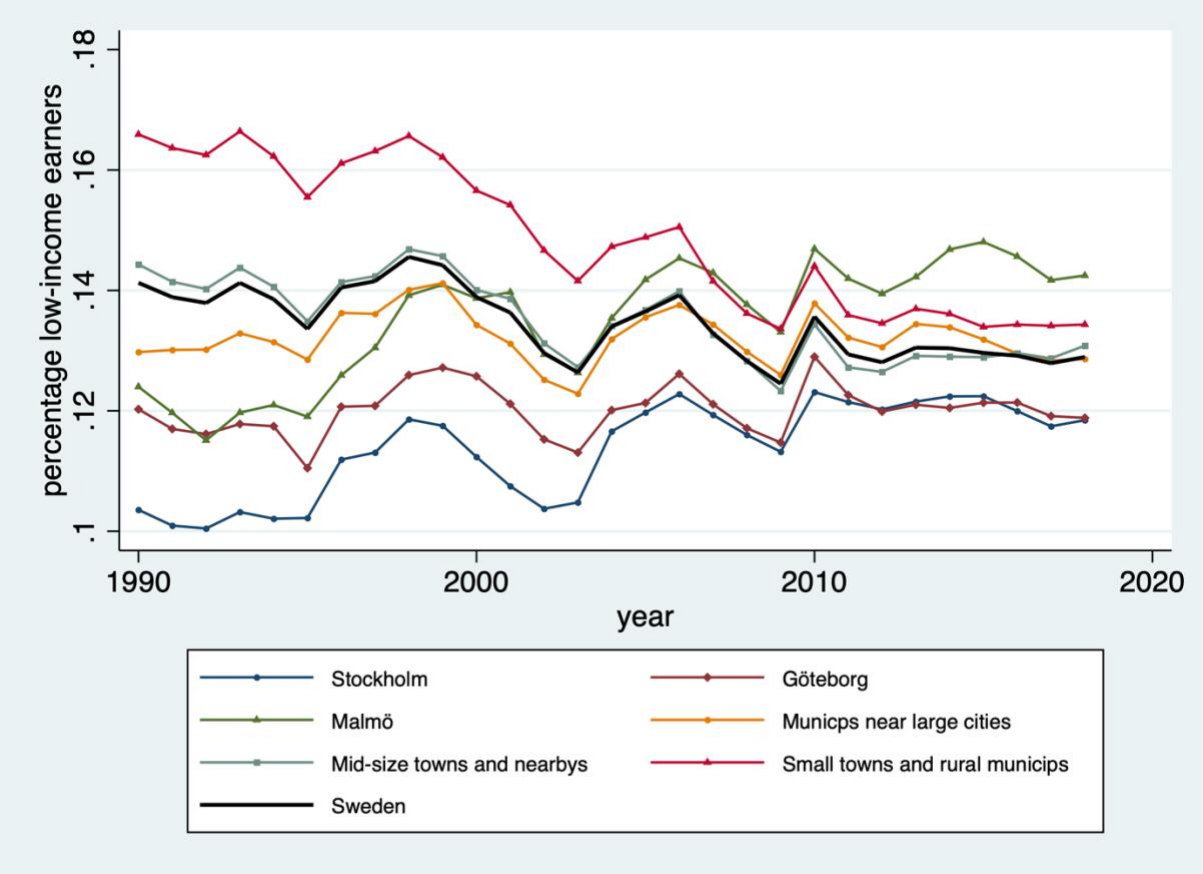

Figure 1: National evolution of the share of low-income jobs, 1990 – 2018

In order to briefly characterize the holders of low-income jobs throughout this period, in Figure 2 we present the evolution of certain demographics and other features for low-, mid-, and high-income jobs. We can observe an increasing generational divide as high-income earners have become progressively older and low-income workers progressively younger. In terms of gender composition, we can see that women are underrepresented in high-income jobs and over represented in low-income ones. Nevertheless, there is a clear trajectory towards convergence, at least in terms of women occupying more and more high-income jobs. In terms of low-income jobs, at the beginning of the period, women accounted for more than 70% of those jobs and roughly 60% in 2018. However, the downtrend seems to have stopped since the early 2000s. People with foreign backgrounds have always been more prevalent in low-income jobs, but the gap with mid- and high-income jobs has only expanded for the last 30 years. Finally, high-educational attainment had expanded almost on par across all three groups until around 2010. Since, the expansion of higher-education shares within the low-income world has kept growing but at a slower pace than among mid- and high-income jobs.

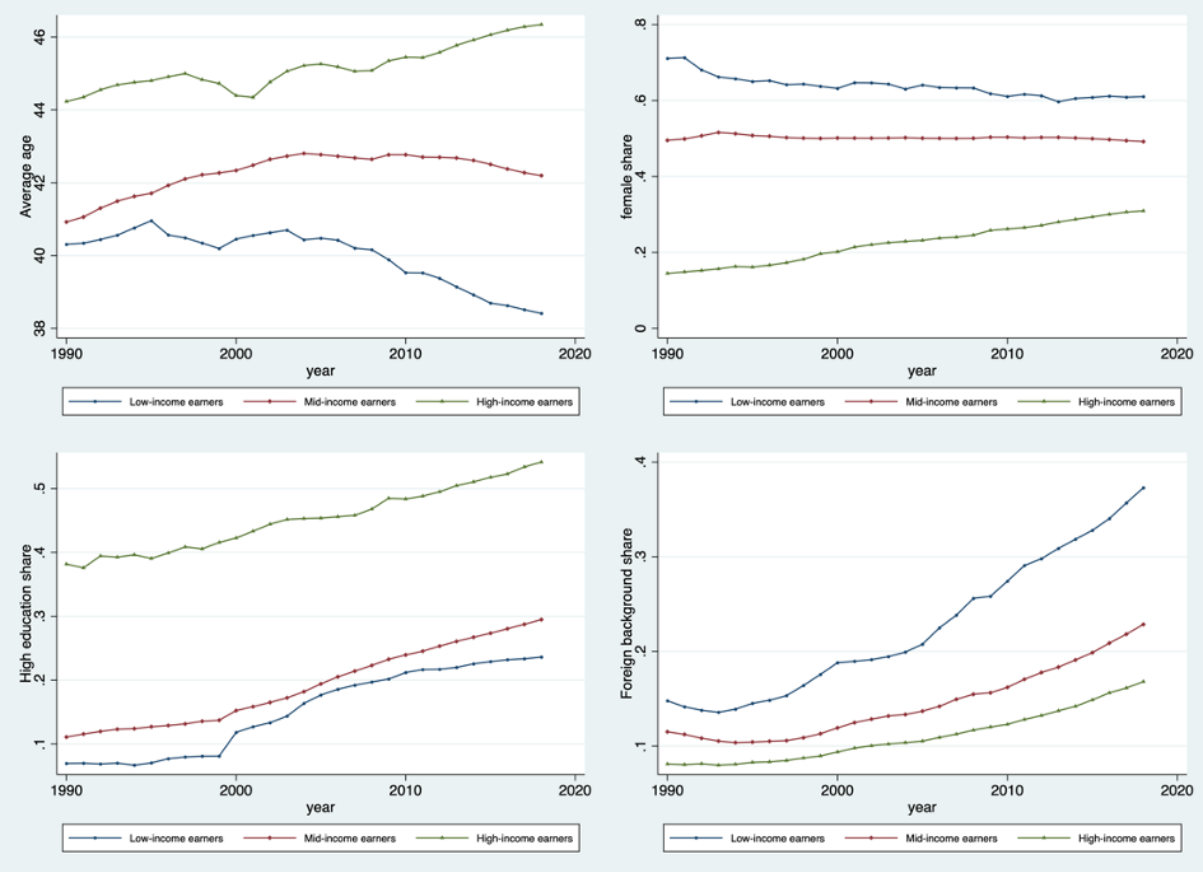

Figure 2: Characterizing low-income job holders, 1990 – 2018.

In terms of labor market regions, in Figure 3, we can see that low-income jobs have tended to concentrate in the western midlands, in the very south and the north, although not in the extreme northern regions characterized by mining (the best-known being Kiruna that hosts the large iron mining operation LKAB). The overall decline and convergence are also evident as both the light orange and dark red regions have tended to disappear more rapidly in previously "darker" areas.

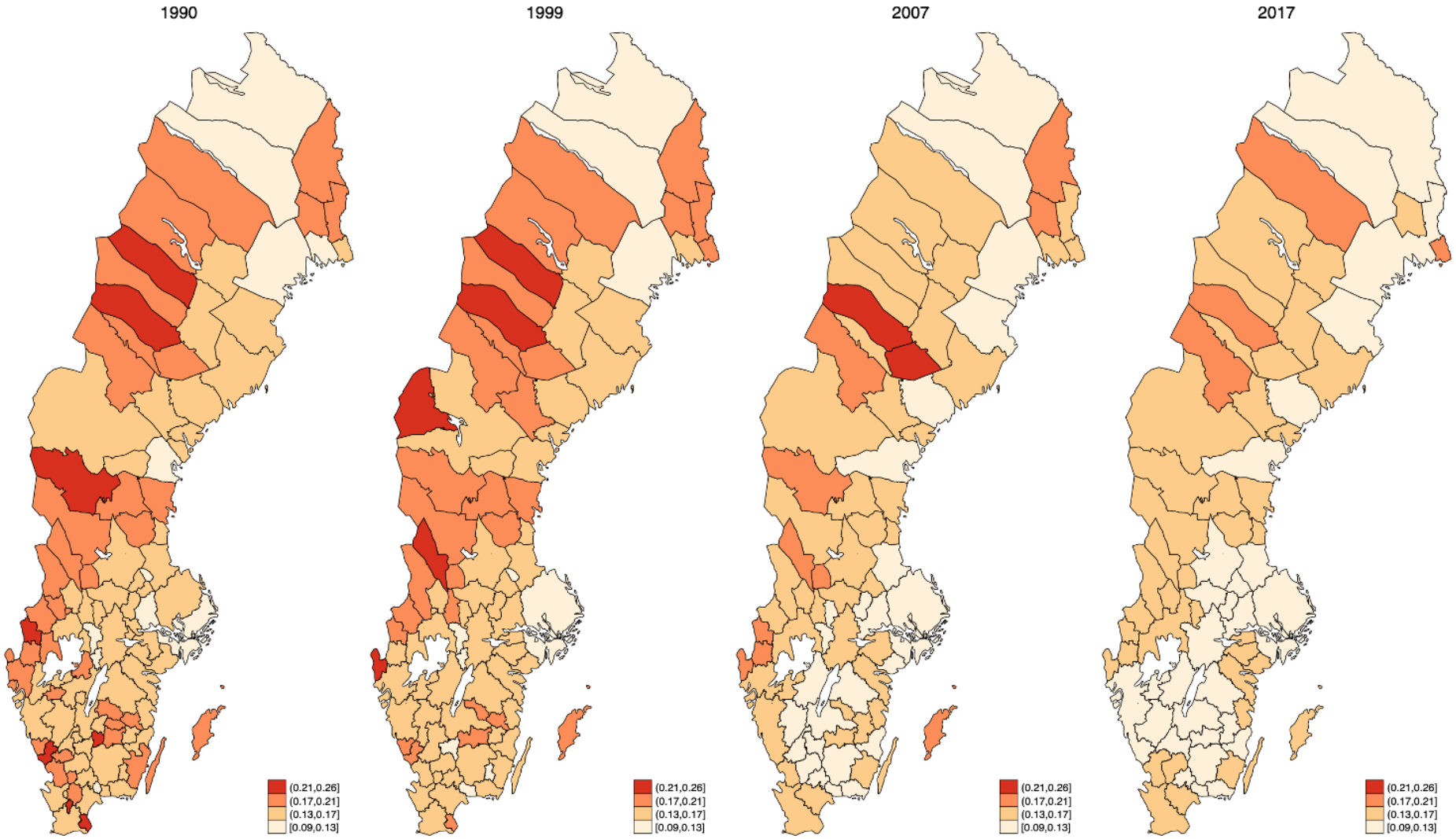

Figure 3: Percentage of low-income jobs by labor market region – 1990, 1999, 2007, and 2017

Figure 4 presents weighted scatterplots depicting the relationship between the percentage of low-income jobs and high-income jobs for the four selected years. Markers are weighted by the size of the labor market (employees + not employed residents) and fit lines are unweighted. The most important pattern to be observed is that, consistent with the findings by VanHeuvelen and Copas (2019), geography seems to matter less and less for low-income jobs, and, if not more, at least equally for high-income earners. The great differentiator between regions is not how many low-income jobs are there (in relative terms), but how many high-income jobs each host. The correlation coefficient between these two percentages has gone consistently down, from -0.69 in 1991 to -0.59 in 2018.

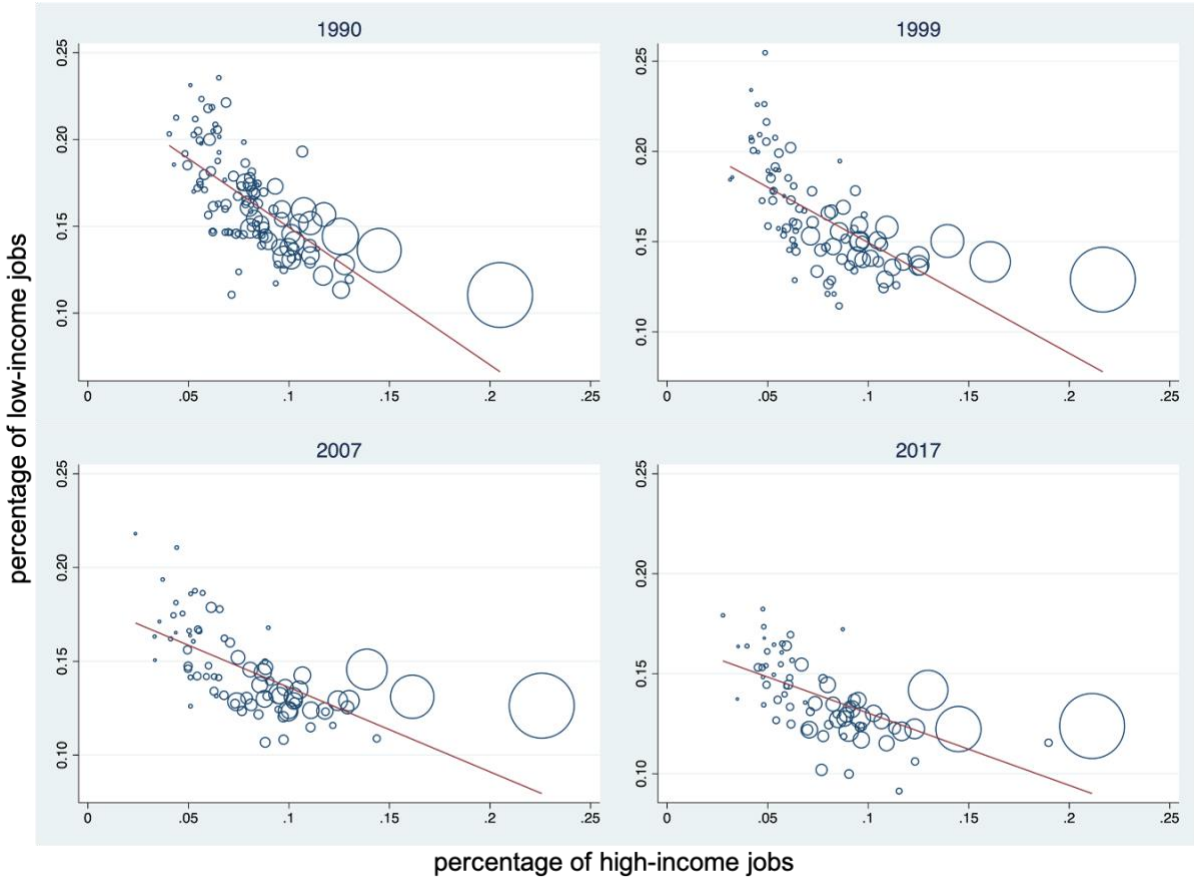

Figure 4: Share of low-income jobs vs Share of high-income jobs – 1990, 1999, 2007, and 2017. Fitted lines are unweighted.

This, on the one hand speaks to the success of the Swedish model to reduce low-income work across the country, while on the other not being entirely able to spread affluence. However, given that "superstar" cities in most advanced economies have pulled further ahead in the recent decades (M. P. Feldman, Guy, & Iammarino, 2020), the fact that in Sweden the three large labor market regions of Stockholm, Gothenburg, and Malmö have not, could be read as a relative success of the model as well. Further, when comparing 2007 and 2017, there is a small but noticeable "move" of these three regions toward "re-joining the pack".

Figure 5 adds another dimension to the relationship between low- and high-income jobs. Here we compare the share of the regional income accrued by the bottom 20% of earners versus the share of the regional income accrued by the top 5% of earners. A clear and overtime increasing negative relationship is observed, as the correlation coefficient between these two shares was only -0.30 in 1991 and -0.68 in 2018.

However, when excluding the largest three labor market regions, we can see only minor changes in the rest of the regional system, which is confirmed by a simple correlation analysis. The story then is one about the decoupling of the three large labor market regions, in terms of polarization with Stockholm leading the pack by far. This does not mean that those holding low-income jobs in these regions are worse-off than low-income workers in other regions but instead it indicate an increasing urban divide (Florida, Matheson, Adler, & Brydges, 2018), something that has been extensively discussed in the context of the rise of the knowledge economy and the creative class. It is very likely, however, that this divergence is the result of a prospering region where a disproportionate share of that prosperity has been accumulated by a small group of top earners, but also where the low-end of the labor market has done relatively better than in the rest of the system.

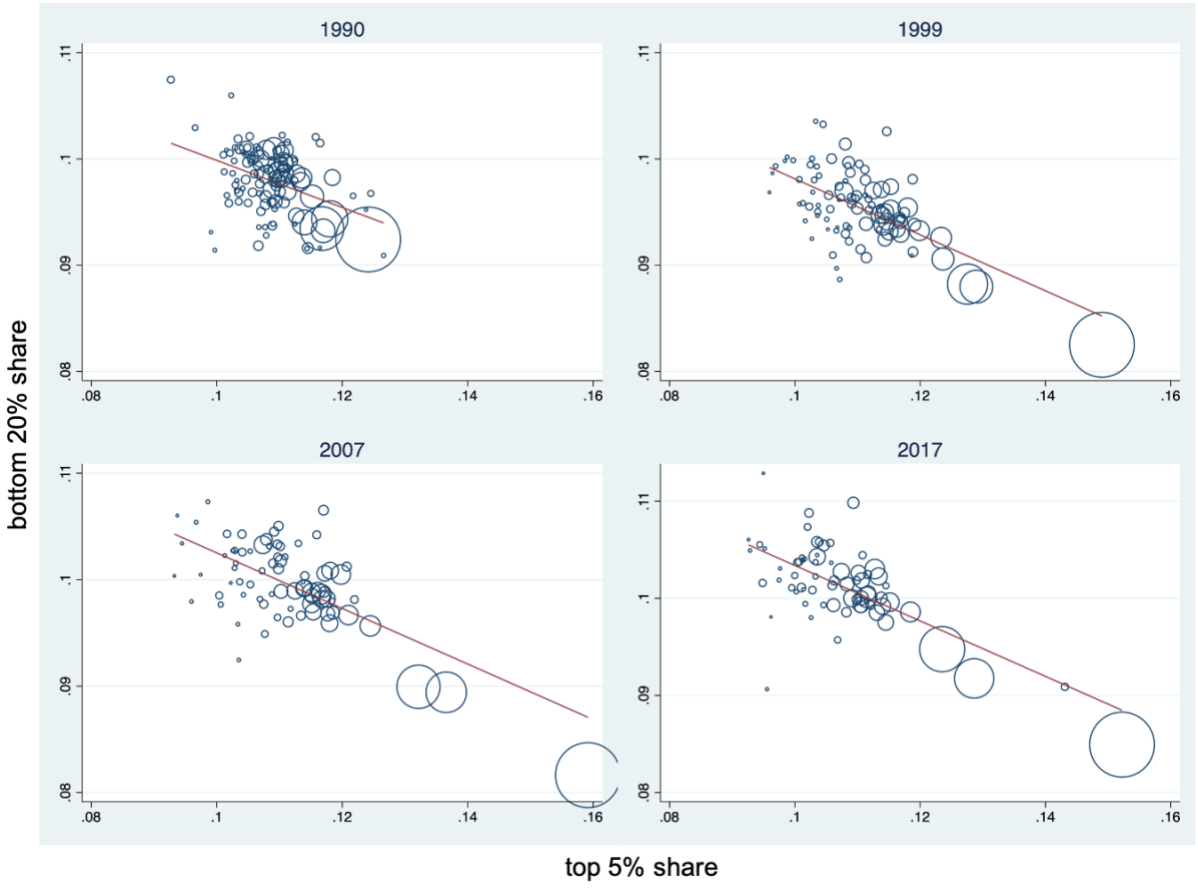

Figure 5: Share of income to the bottom 20% vs Share of income to the top 5% – 1990, 1999, 2007, and 2017. Fitted lines are unweighted.

The relationship between the prevalence of low-income jobs and the polarization/inequality of labor markets (Gini index) is not clear and it seems to have changed importantly over time. In Figure 6 we can see that in 1991 there was a positive, although weak relationship between the incidence of low-income jobs and polarization (with a significant correlation of 0.4). However, from the year 2000 onwards there is no such relationship, and, if anything, the relationships has become negative but very weak. The same pattern is observed if instead of the Gini index we use the ratio between the share of income by the top 5% to the bottom 20%.

The descriptive statistics thus provide a mixed picture as regards **hypothesis 2.** The incidence of low-income jobs is negatively correlated with the incidence of high-income jobs (suggesting a rejection of hypothesis 2). However, it is clear that the high-income earners take an increasing share of the overall income, thus polarization is increasing. Increasing polarization measured by the Gini index is positively correlated at the beginning of the observation periods with the prevalence of low-income jobs (suggesting some support for hypothesis 2).

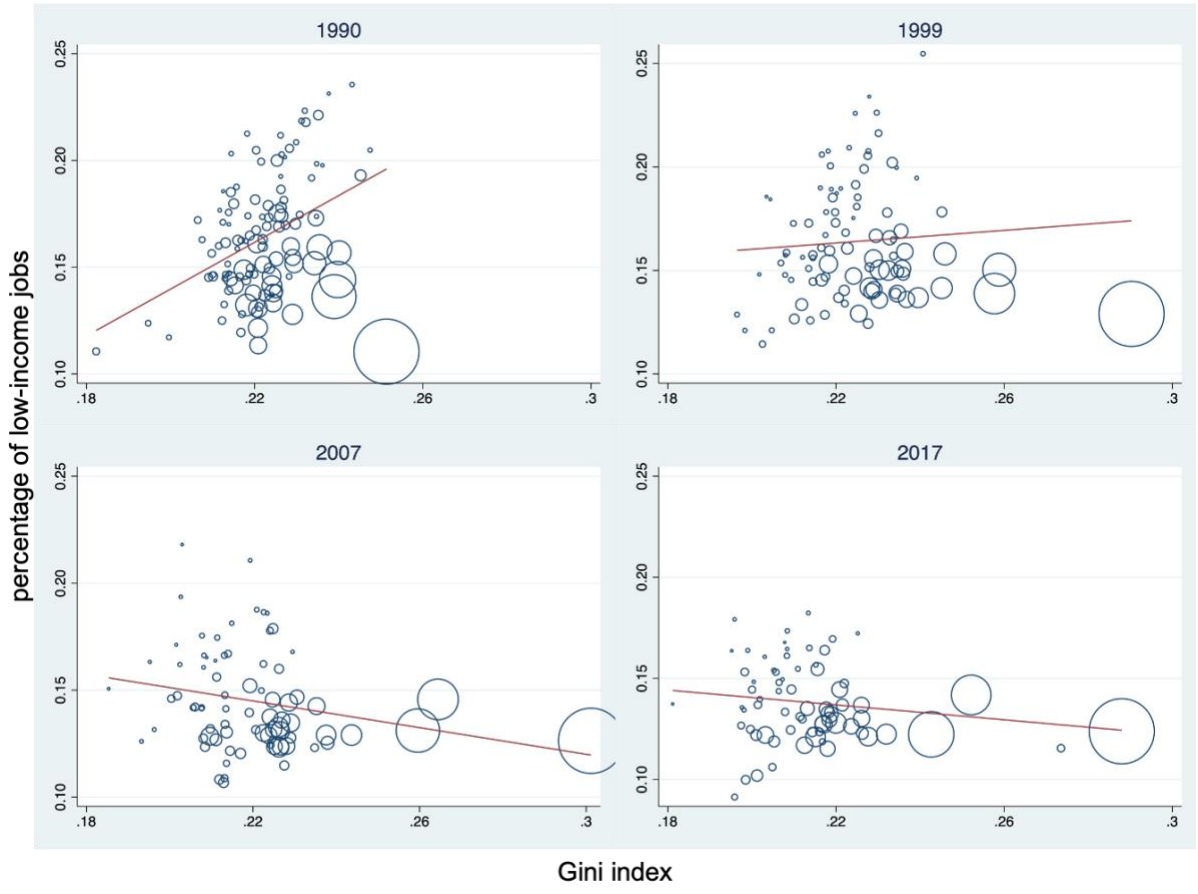

Figure 6: Share of low-income jobs vs Gini index – 1990, 1999, 2007, and 2017. Fitted lines are unweighted.

Regarding size, Figure 7 shows a sustained negative relationship. And although, because places have tended to converge, the relationship has "flattened-out" the correlation has become stronger over time. In Figure 8 we can observe a similar pattern on the development of the relation between the prevalence of low-income jobs and the share of employment in knowledge

intensive services (KIBS). This seems to point towards the fact that larger regions with a greater presence of the knowledge economy have been (and still are) engines of prosperity where the lower segments of the labor market have higher incomes than in the rest of the regional system. This means, the descriptive statistics suggest to reject hypotheses 3 and 4.

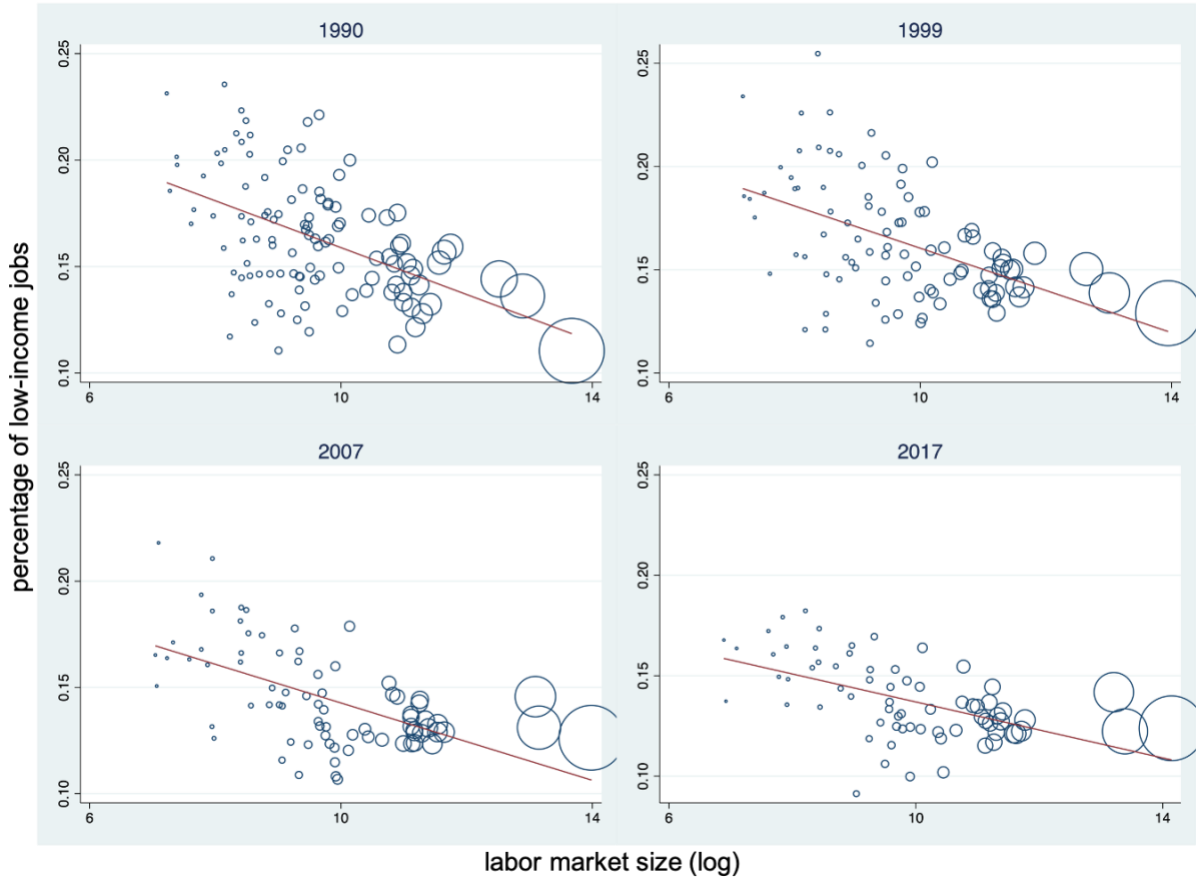

Figure 7: Share of low-income jobs vs Labor market size (log) – 1990, 1999, 2007, and 2017. Fitted lines are unweighted.

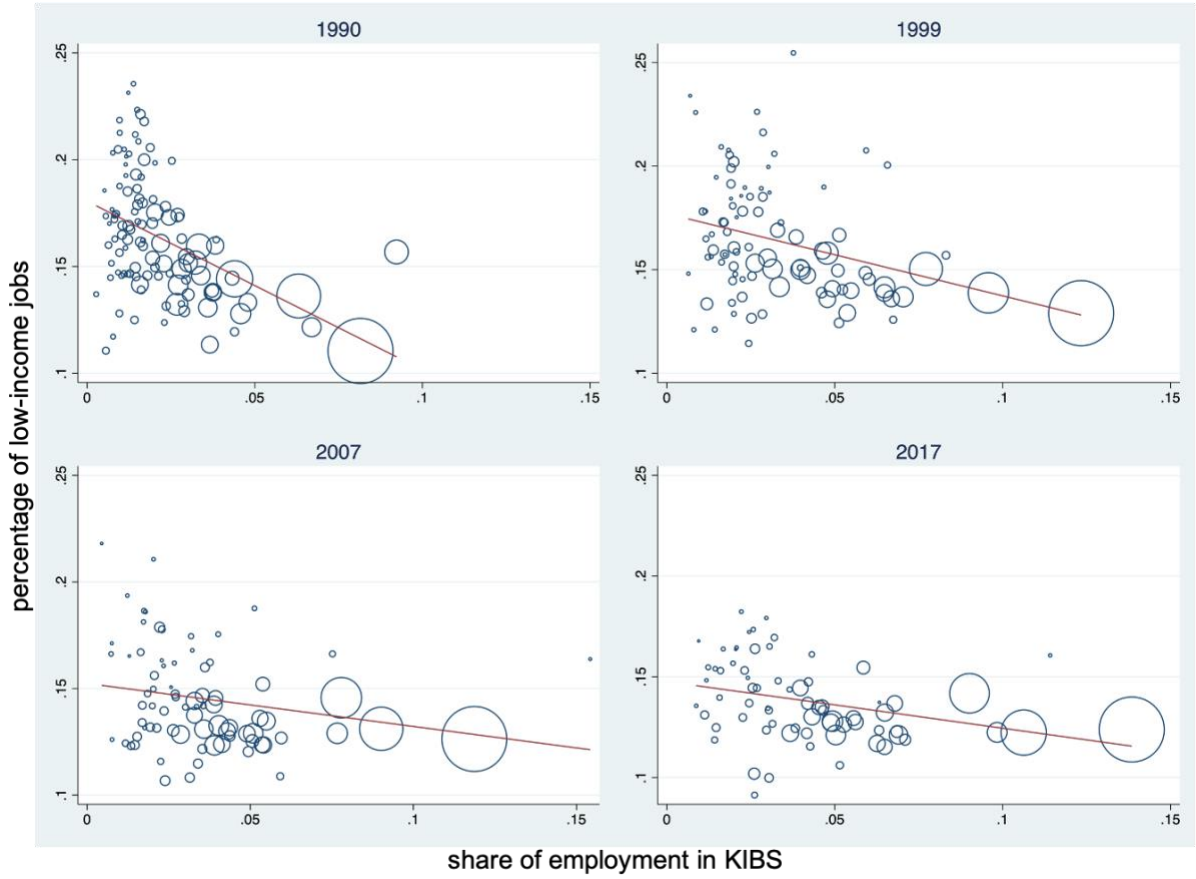

Figure 8: Share of low-income jobs vs Share of employment in KIBS – 1990, 1999, 2007, and 2017. Fitted lines are unweighted.

Table 2 presents the results of the cross-sectional regression for the years of 1990, 1999, 2007, and 2017, with the share of low-income jobs as dependent variable. Firstly, when looking at the controls, we can see that the level of employment has a negative effect over the prevalence of low-income jobs. This means that, similarly to what has been found at the country level (Bosch & Gautié, 2011), there seems to be no "trade-off" between employment and the incidence of low-income jobs at the regional level as tighter labor markets lead to lower levels of low-income jobs. The variable "establishments by workers" shows a consistent positive and significant relationship with low-income jobs, which might be counterintuitive at first glance because if the number of establishments by workers is small, the establishment have more power (control) on the labor markets. Yet, the result speaks to the importance of large firms in Sweden (Edquist & Lundvall, 1993; Fassio & Nathan, 2020; Henrekson & Jakobsson, 2001; Heyman, 2007), which owning to innovation and economies of scale are more productive, are in need of high-skill labor, in the position to pay high salaries, and at the same time not able to exploit their market power position because of inclusive wage setting institutions. This is also consistent with the fact that regions with more self-employed workers tend to have more low-income jobs (a relationship that has become stronger over time), further supported by the basic fact that the prevalence of self-employment is much higher among low-income workers than among mid- or high-income ones.

Secondly, we confirm the main findings so far related to our research questions, namely: polarized (Gini index) labor markets tend to have larger shares of low-income jobs but this relationship has been weakening over time to the point that in 2017 the coefficient is very small and not significant; larger labor markets tend to have a lower incidence of low-income jobs; and the share of employment in the knowledge economy also has historically been related to a lower incidence of low-income jobs. However, regarding the latter, the coefficient cut-down about two thirds from 1990 to 2007 and it is insignificant in 2017. This means that the knowledge economy was a driver of inclusive prosperity for regions in Sweden, but it doesn't seem to be working that way anymore.

So far, we can attest that together with increasing living standards, the incidence of low-income jobs has decreased in Sweden as a whole, and regions have converged under this metric. The last 30 years, dominated by the knowledge economy, have led to a much more even geography of low-income jobs, and today the presence of such activities in regions seem to have little effect over the incidence of low-income jobs. Although the effects of the concentration of such industries in the largest metropolitan areas over the rest of the regional system remains to be determined, it seems to be the case that the prosperity of these regions (in particular Stockholm) have also benefited the rest of the regional system in a way that has been questioned in other countries, in particular liberal market economies like the US and the UK (M. Feldman, Guy, & Iammarino, 2021; Martin, 2015). However, at the same time, there is little doubt that the biggest winners of this period have been the most affluent classes (the top 5% or even the top 1%) living in these metropolitan areas.

Table 2: Regressions at the labor market region level – 1990, 1999, 2007, and 2017. Dependent variable: Share of low-income jobs (national threshold)

Variables	Share of low-income jobs (national line)			
	1991	1999	2007	2017
Log of labor market size	-0.00251	-0.00658***	-0.000785	-0.000546
	(0.00218)	(0.00234)	(0.00201)	(0.00175)
Gini index	0.559***	0.559***	0.224*	0.143
	(0.172)	(0.185)	(0.127)	(0.133)
Share of employment in KIBS	-0.442***	-0.276***	-0.140**	0.00130
	(0.135)	(0.0944)	(0.0634)	(0.0697)
Employment level	-0.0850	-0.0821	-0.168***	-0.182***
	(0.0596)	(0.0494)	(0.0378)	(0.0391)
Share of employment in manufacture	-0.0260	-0.0804**	-0.0115	-0.0421*
	(0.0300)	(0.0338)	(0.0236)	(0.0244)
Shae of employment in public sector	-0.0829***	-0.0689**	-0.00886	0.0397
	(0.0260)	(0.0307)	(0.0282)	(0.0305)
Share of workers with a Masters degree or higher	0.691**	-0.280	0.0472	-0.107
	(0.309)	(0.351)	(0.265)	(0.161)
Share of workers with direct foreign background	-0.0706**	-0.0520	-0.0662***	-0.00123
	(0.0312)	(0.0315)	(0.0196)	(0.0218)
Share of workers in self-employment	0.0136	0.335*	0.399***	0.611***
	(0.157)	(0.171)	(0.122)	(0.156)
Establishments per worker	0.572***	0.307**	0.308***	0.0917**
	(0.0969)	(0.142)	(0.0570)	(0.0399)
Constant	0.116	0.174**	0.191***	0.214***
	(0.0701)	(0.0734)	(0.0554)	(0.0586)
Observations	112	92	78	70
R-squared	0.835	0.842	0.858	0.813

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Now, in order to address the central question of the regional divide we need to somehow account for the inter-regional differences on income level. We do this by re-calculating the shares of low-income jobs at the regional level. This is, we calculate the incidence of low-income jobs considering low-income jobs to be those that pay below 60% of the *regional* median income.

Table 3, then, presents the same regressions as above only this time with the share of low-income at the regional threshold as the dependent variable. Already the first thing to catch the attention is that the models explain between 14% (1990) and 20% (2007) less of the variance of the dependent variable, which hints to the possibility of other factors not considered having an impact over "regional low-income jobs". Then, regarding the relationships of interest, we can see that, unlike in the previous models, the negative association between polarization (Gini index) and low-income incidence does not fizzle-out in time. The size of the coefficient decreases by around a third between 1990 and 2017, but it remains highly significant throughout the period. Labor market size still has a small negative effect over the share of low-income jobs, only statistically significant at the 5% level in 1999. Finally, the size of the

knowledge economy still has a negative effect over the incidence of low-income jobs but is much smaller than in the previous models and never statistically significant. This means that even accounting for regional differences in income levels, a large presence of the knowledge economy, in the Swedish context, would not be related to the parallel development of a highly-paid "creative class" and a lowly-paid "service class". This is in line with the findings of Lee and Rodriguez-Pose (2016) whom, for the case of the US, show that although the high-tech economy somewhat drives wages of low-skill workers up, it does not have a sizeable effect over the level of poverty. We can, therefore, say that the knowledge economy does not seem to be the savior of regional economies in the way some have thought of it (Moretti & Thulin, 2013), neither inherently leading to labor market polarization and the urban crisis that others have been warning about (Florida et al., 2018).

Now, we have not taken into consideration differences in the cost of living, which could potentially change the picture. As it has been documented in the literature (Grimes, Prime, & Walker, 2019; Kemeny & Osman, 2018), it is very likely that low-income jobs in large, core metropolitan regions like Stockholm, Gothenburg or Malmö are considerably better paid than in smaller regions but most of that "extra income" ends-up going to paying for the overall higher cost of living, mainly housing and transportation. This is something we do not explore in this paper because of the lack of data about cost-of-living levels across labor markets but it should be addressed in future research.

In sum, the empirical results provide support for **hypothesis 2** that the prevalence of low-income jobs is related to the polarization on local labor markets. However, the results let us reject **hypotheses 3 and 4** that the dynamics of the knowledge economy and in large urban areas increase the prevalence of low-income jobs. In contrast, in the Swedish context, the development of the knowledge economy appears to have been a driver for prosperity not only for high-income earners but also reduces the likelihood of individuals ending up in low-income jobs. Yet, the effect of KIBS, which are considered to be at the core of the knowledge economy in urban areas, has watered out over time. The reasons for this need further investigation. One potential explanation could be that the sector has become increasingly mature not offering the same growth potentials than in the earlier phases of the development of the knowledge economy.

Table 3: Regressions at the labor market region level – 1990, 1999, 2007, and 2017. Dependent variable: Share of low-income jobs at the regional threshold.

Variables	Share of low-income jobs (regional line)			
	1991	1999	2007	2017
Log of labor market size	-0.00120	-0.00279**	-0.000894	-0.000329
	(0.00134)	(0.00130)	(0.00138)	(0.00119)
Gini index	0.648***	0.504***	0.455***	0.422***
	(0.106)	(0.103)	(0.0869)	(0.0904)
Share of employment in KIBS	0.0333	-0.0353	-0.0170	-0.0299
	(0.0829)	(0.0523)	(0.0434)	(0.0474)
Employment level	-0.0262	-0.104***	-0.0726***	-0.105***
	(0.0367)	(0.0273)	(0.0259)	(0.0266)
Share of employment in manufacture	0.0343*	0.00318	0.0102	-0.0144
	(0.0185)	(0.0187)	(0.0162)	(0.0166)
Shae of employment in public sector	-0.0301*	-0.0255	0.0185	0.0337
	(0.0160)	(0.0170)	(0.0193)	(0.0208)
Share of workers with a Masters degree or higher	0.116	-0.107	0.0484	0.0255
	(0.190)	(0.194)	(0.181)	(0.110)
Share of workers with direct foreign background	-0.0153	-0.0473***	-0.0227*	-0.0119
	(0.0192)	(0.0175)	(0.0134)	(0.0149)
Share of workers in self-employment	-0.00436	0.267***	0.0852	0.269**
	(0.0967)	(0.0948)	(0.0832)	(0.106)
Establishments per worker	0.230***	-0.0250	0.122***	-0.00839
	(0.0597)	(0.0784)	(0.0390)	(0.0272)
Constant	0.0104	0.145***	0.0632	0.100**
	(0.0432)	(0.0407)	(0.0379)	(0.0398)
Observations	112	92	78	70
R-squared	0.694	0.677	0.662	0.662

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Finally, it is important to mention that we obtain similar results with different specification of the models. Results stand if we change the threshold for low-income and/or expand the population to consider people between 20 and 25 years of age. Also, results are largely the same if we utilize a different measure of polarization like the ratio of the share of income going to the top 5% to the share of income going to the bottom 20%. Finally, results also hold if we use different sets of years and other geographical unit like municipalities.

5 Conclusions

Concerns about low-income jobs have increased during the last decade as a direct result of the financial recession, the migration crises, and rise of the platform economy that came with an explosion of *gig jobs*. In this paper we have focused on the (changing) spatial concentration of low-income jobs throughout the last 30 years in Sweden, a period that has been characterized, among other things, by the rise of what has become known as the knowledge economy. A considerable amount of ink has been spilled over to explore and unravel the social, economic,

and geographic, consequences of this new economy. However, so far, little attention had been paid to the geographies of low-income jobs, in particular outside the US; and this is precisely what we have begun to do here by mapping and trying to understand what drives the concentration of low-income jobs in certain regions and how that has changed in time.

Overall, our main findings are twofold. First, the prevalence of low-income jobs has decreased in Sweden during the last three decades. Moreover, in accordance with the findings by VanHuevelen et al. (2019), we observe convergence between regions in terms of the incidence of low-income jobs. The great differentiator between regions is not how many low-income jobs they host, but the number of very well-paid ones. Secondly, in relation to the knowledge economy, we find that regions with higher shares of employment in KIBS tend to have historically had a lower incidence of low-income jobs, both measured with respect to the national and to the regional income, which, nevertheless, has ceased to be the case somewhere between 2007 and 2017 when KIBS seem to be unrelated to the incidence of low-income jobs. This requires a careful reading and should not automatically be understood as the knowledge economy not being a source of regional prosperity anymore. Instead, this period has meant a continuous upgrading of jobs and living standards in Sweden, and a convergence between regions in terms of the incidence of low-income jobs, which means that the concentration of KIBS in the large metropolitan areas could be hypothesized as a driver of prosperity not only for themselves but also for the whole regional system. Now, the tightness of the labor market (high employment levels) is an important factor to reduce the incidence of low-income jobs. A high employment level in high-cost countries must have the creation of relatively high-skill / high-income jobs as reason. It is thus reasonable to assume that the knowledge economy is nowadays widely diffused throughout the Swedish regional system, in line with the jobs upgrading thesis/model mentioned above. The downside, however, is the increasing effect of self-employment on the prevalence of low-income jobs, which might be connected to the raise of the gig work (Huws, Spencer, Syrdal, & Holts, 2017).

Therefore, despite the ongoing discourse about the degradation of the Nordic model, we provide some evidence showing that it still seems to be working in Sweden under this new and complex knowledge-dominated era. Yet, we cannot conclude that everything is rosy. While we have only explored the aggregate at labor market regions level, we know that certain groups (women, young, and foreign-born) are systematically disadvantaged and pushed to take low-quality and low-income jobs. However, the results are also promising since they differ substantially from studies on polarization and poverty in more liberal market economies such as the US or the UK (Autor & Dorn, 2013; Dwyer & Wright, 2019). This is to be expected since, as already mentioned, labor market institutions are essential for labor market outcomes (Oesch, 2013). However, it refutes the idea that the knowledge economy, and the growth of high-skill and high-pay jobs necessarily go hand in hand with the growth of precarious low-skill and low-income jobs. The alternative is an upgrading of the labor market, a phasing out of low-skill and low-income jobs, and higher remuneration for personal service jobs. The outcome depends on the institutions regulating labor markets, which is within the sphere of influence of national level policy makers. However, it may also have to do with how knowledge intensive activities diffuse in different sectors of the economy, whether it is stuck in bubbles of e.g. IT or biotech, or if it spreads to other more traditional sectors through e.g. enhanced automation, which is common in Swedish industry (Fassio & Nathan, 2020).

We have just begun exploring these changing geographies of low-income jobs and there are many interesting open questions to explore around this topic. For example, even if at the regional level the picture is still rather rosy, it would be important to examine intra-regional patterns of exclusion and segregation (Hochstenbach & Musterd, 2021). Moreover, since we have good indications that certain groups of the society are more prevalent to get trapped in low-income situations (Bosch & Weinkopf, 2008; Cai, 2015; Lucifora et al., 2005), it would be important to intersect the spatial dimension with some individual characteristics like gender, migratory background, age, life course, etc.

Another possibility would be to move away from the large metropolitan areas and concentrate in medium and small labor market regions, which have been the most hard-hit by the structural transformation of the economy and have also found the most difficulty, in general, to adapt to the rise of the knowledge economy. In addition, it would be interesting to investigate if and to what extent the diffusion of the knowledge economy over time, has contributed to the observed decrease and convergence of low-income jobs, and what the drivers for such a diffusion are. Finally, it would be worthwhile to zoom all the way in to the individual level, and understand which regional and individual factors affect the likelihood of people falling into or getting out from low-income situations. Here, moreover, the role of commuting and migrating could also be explored in order to make sense of the changing individual life trajectories across the landscape.

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