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Technology Adoption and the Changing Role and Background of Clerical Workers

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From 1980 through 2015, the share of clerical jobs in the employed labor force declined more significantly in large and expensive cities than in smaller cities. Moreover, the remaining workers performing these occupations in large and expensive cities had, on average, higher education levels and were more likely to perform tasks usually done by managerial and professional personnel when compared to their small-city counterparts. In this *Economic Commentary*, we show how these patterns are related to the uneven adoption of information communication technologies (ICT) across geographies and discuss adoption's impact on clerical jobs' tasks and worker requirements.

Topics Labor economics, Economic growth, State and local economies

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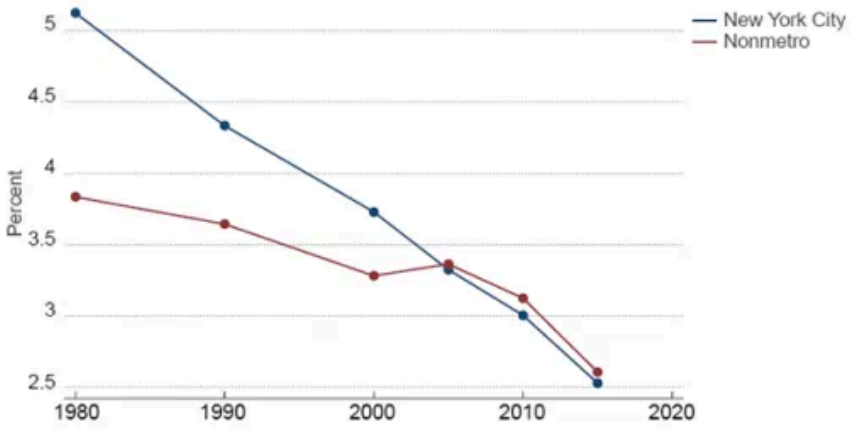
Introduction

The workforce and the share of workers in each sector are not evenly distributed across geographies. Each local labor market is unique in terms of the size of its labor force, regional cost of living, and the composition of occupations workers hold, tasks workers perform, and skills workers possess. This composition also changes over time. In this *Economic Commentary*, we look at the changes in skills

composition across local labor markets from 1980 through 2015, focusing on metropolitan statistical areas (MSAs) and clerical jobs, the occupations most affected by the introduction of new information and communications technologies, or ICTs. [1]

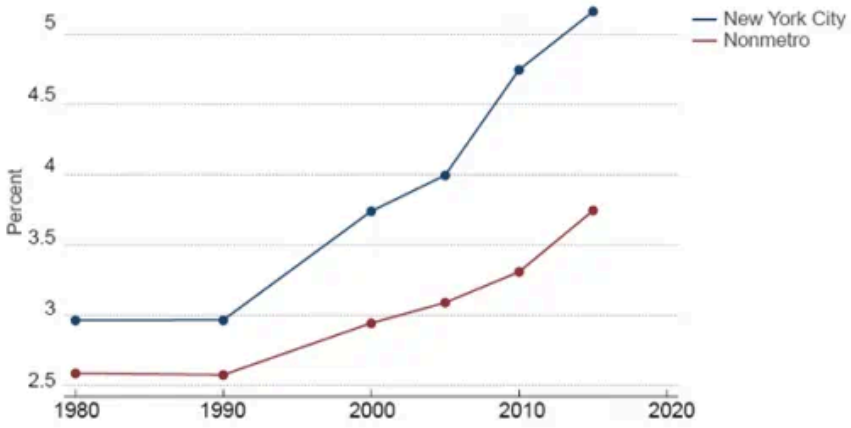
Eeckhout et al. (2021) show that from 1980 through 2015, [2] expensive MSAs—those in the top tercile in the 1980 rent index distribution—saw a 6.5 percentage point decline in the share of employed workers in clerical jobs. In contrast, affordable MSAs—the ones at the bottom tercile of the 1980 rent index distribution—faced just a 2.3 percentage point decline in the share of clerical jobs. To illustrate this pattern with a concrete example, in Figure 1 we present the share of administrative assistants [3] in the MSA that contains New York City compared to in nonmetro areas in the United States. [4] While the New York City MSA had a significantly larger share of administrative assistants in its employed labor force in 1980 compared to that in US nonmetro areas, the share gap had largely disappeared by 2005. Moreover, the background of workers performing these occupations not only changed over time, but also changed unevenly across geographies. As we can see in Figure 2, while the share of administrative assistants that hold a four-year college degree had increased everywhere during this time period, since the population became more educated over time, the share of administrative assistants that held a BA had increased significantly more in the New York City MSA (from 9.5 percent in 1980 to 31.5 percent in 2015, compared to an increase in US nonmetro areas from 6 percent in 1980 to 17.5 percent in 2015).

Figure 1: Share in Local Employed Labor Force: Administrative Assistants



Notes: Shares calculated using Census data from 1980, 1990, and 2000 and ACS data for 2005, 2010, and 2015 accessed through IPUMS (Ruggles et al., 2020). MSAs defined following Baum-Snow and Pavan (2013).

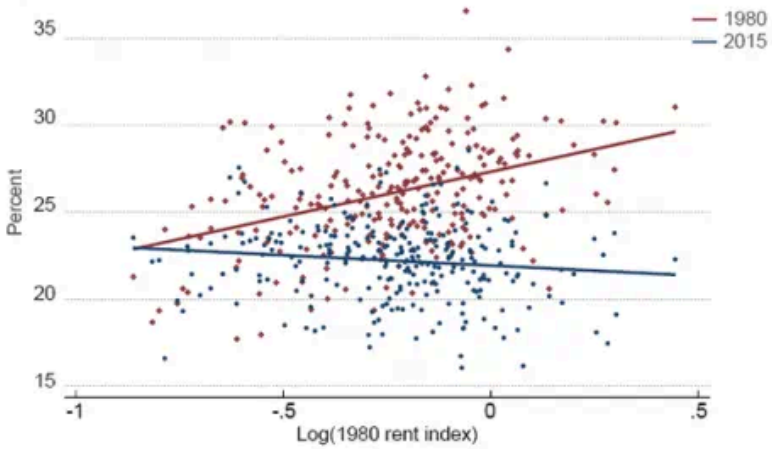
Figure 2: Share of Administrative Assistants with a BA in the Local Labor Market



Notes: Shares calculated using Census data from 1980, 1990, and 2000 and ACS data for 2005, 2010, and 2015 accessed through IPUMS (Ruggles et al., 2020). MSAs defined following Baum-Snow and Pavan (2013).

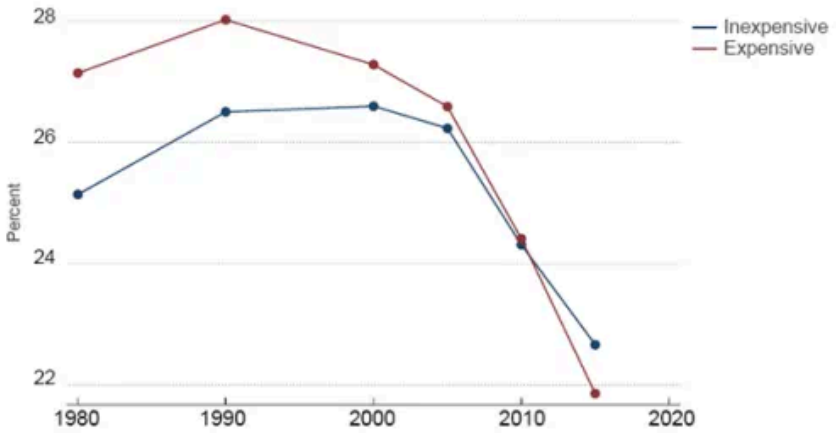
It is important to keep in mind that neither the New York City MSA nor administrative assistants are exceptions in this pattern. Rather, as we can see in Figure 3, the relationship between the share of clerical workers and cost of living changed significantly over time, going from positively related to negatively related. To further illustrate this change, in Figure 4 we look at the change in the share of clerical workers for below-median-rent-index (that is, inexpensive) MSAs and above-median-rent-index (that is, expensive) MSAs. As we can see, the share of clerical workers in the local labor force is now slightly higher for inexpensive locations. Moreover, we have seen not only a change in the share of clerical workers, but also a change in the composition of worker characteristics among clerical workers. In Figure 5, we see that the prevalence of clerical workers who hold a four-year degree or higher, while increasing everywhere over time, increased relatively more in expensive MSAs.

Figure 3: Share of Clerical Workers across MSAs: Role of Cost of Living



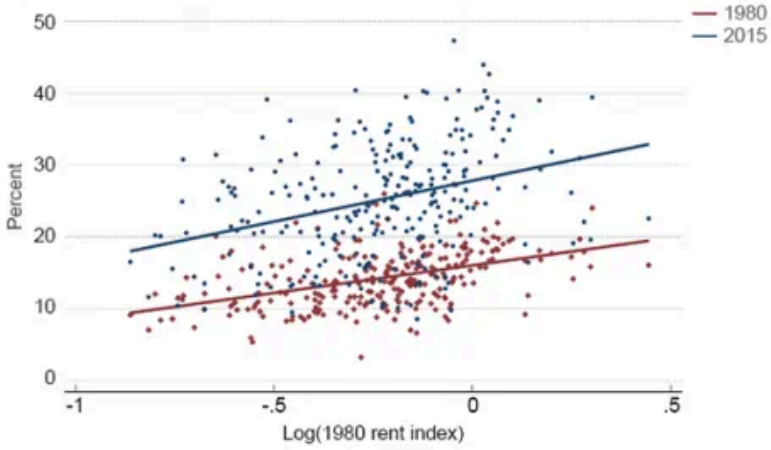
Notes: Shares calculated using Census data from 1980, 1990, and 2000 and ACS data for 2005, 2010, and 2015 accessed through IPUMS (Ruggles et al., 2020). The log rent index for 1980 is calculated following Eeckhout et al. (2021). Finally, clerical workers are defined as in Cortes et al. (2017), and MSAs are defined following Baum-Snow and Pavan (2013).

Figure 4: Share of Clerical Jobs in MSA: Inexpensive versus Expensive Cities



Notes: Shares calculated using Census data from 1980, 1990, and 2000 and ACS data for 2005, 2010, and 2015 accessed through IPUMS (Ruggles et al., 2020). Inexpensive and expensive MSAs correspond to MSAs above and below the 1980 rent index median, as calculated by Eeckhout et al. (2021). Finally, clerical workers are defined as in Cortes et al. (2017), and MSAs are defined following Baum-Snow and Pavan

Figure 5: Share of BAs among Clerical Workers across MSAs: Role of Cost of Living



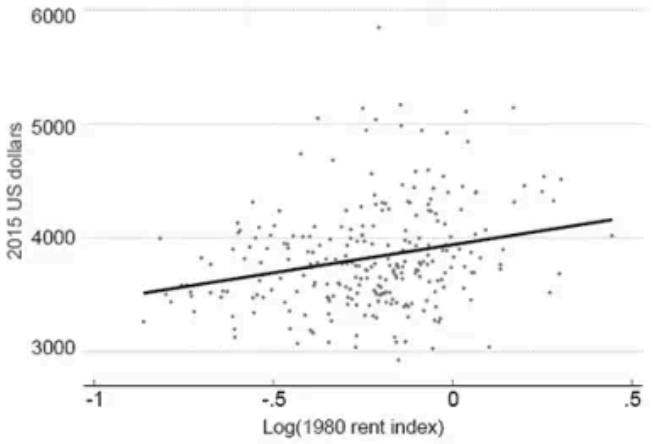
Notes: Shares calculated using Census data from 1980, 1990, and 2000 and ACS data for 2005, 2010, and 2015 accessed through IPUMS (Ruggles et al., 2020). The log rent index for 1980 is calculated following Eeckhout et al. (2021). Finally, clerical workers are defined as in Cortes et al. (2017), and MSAs are defined following Baum-Snow and Pavan (2013).

Role of technology and automation shaping local labor markets

As pointed out by Eeckhout et al. (2021), one underlying reason for the change in share of clerical jobs and composition of worker characteristics across MSAs has been the introduction of ICTs and their uneven adoption across geographies. As we see in Figure 6 (reproduced from Figure 2 in Eeckhout et al., 2021), investment in ICT per clerical employee is higher in expensive MSAs than in inexpensive MSAs. Eeckhout et al. (2021) highlight the role of automation and how it interacts with cost of living. For example, consider when a firm in New York City and a firm in Billings, Montana, each need a new accounting assistant. In order to hire someone qualified for the position, the New York firm must, in theory, pay a wage high enough to allow the employee to live at commuting distance from the office. The cost of living in or near New York City is quite high relative to the United States average, [5] significantly increasing the labor cost of a new hire for the firm. In contrast, Billings is more affordable

than New York City, so when we focus on the cost of information technology, the actual labor cost of hiring a new worker with the same qualifications across these two cities is not as high in real dollars (that is, adjusting for inflation) for the Billings firm. Now, imagine software that could automate the tasks performed by an accounting assistant. The price of software does not generally change across geographies, so the cost of such automation software should not vary significantly for the New York City and Billings firms. As a result, it is more cost effective for the New York City firm to acquire the software in order to automate the needed tasks and replace (or just not hire) the accounting assistant than it is for the Billings firm; this is because of the larger gap in the cost of the software and the labor cost of an employee in an expensive MSA. Notice that the revenue generated by the firm's output in a given city does not depend on the choice of using either the accounting software or the new accounting assistant to perform the needed tasks. Hence, the choice of the optimal blend between labor and ICT to produce depends only on the relative price of labor and ICT. What we want to highlight is that this relative price varies across geographies.

Figure 6: Average IT Budget per Worker versus Local Price Level



Notes: Rent index calculated using 1980 Census data accessed through IPUMS (Ruggles et al., 2020), as calculated by Eeckhout et al. (2021). Data on IT budget from Aberdeen Group LLC (2015). Calculations follow Eeckhout et al. (2021). Please see Eeckhout et al. (2021) for details.

Because some roles with relatively easier tasks and that require less critical thinking can be automated with ICTs, the adoption of new technologies impacts the types of workers demanded by firms. According to Dillender and Forsythe (2022), when firms adopt new software at the job-title level, they then increase the skills required of job applicants, not only in terms of knowledge about the new technologies, but also in terms of skills related to high-skill white-collar tasks. Dillender and Forsythe's database comprises more than 8 million job ads for the years 2007 and 2010–2016, with detailed information on occupation, job location, desired education and experience, and tasks required of the job. They show that as firms require more technological use in their job ads, they also increase the requirements for education and experience. In fact, they show that one additional technology requirement listed in a job ad is associated with an increase in the likelihood that a job will require a college degree by 3.9 percentage points (using a panel regression with commuting zone fixed effects). Similarly, one additional technology requirement listed in a job ad is associated with a

4.2 percentage point increase in the likelihood that the ad requires a certain minimum experience level and is not an entry-level position.

Along with impacts on the types of workers demanded by firms, the introduction of new technologies also impacts the types of tasks performed by workers in clerical occupations. Dillender and Forsythe (2022) show evidence of upskilling; that is, the use of new technologies at the occupation level increases the likelihood that these occupations require high-skill tasks such as legal, accounting, or finance expertise. In other words, as new technologies are introduced and higher-skill workers are hired to fill clerical positions, firms are more likely to delegate to these roles tasks that were previously performed by managerial and professional personnel. Moreover, these upskilled positions are nonroutine cognitive tasks and thus are less likely to be automated.

Importance of Changing Requirements

That the share of clerical workers has declined to a greater degree in expensive MSAs and that the tasks and education attainment of workers filling these occupations in expensive MSAs has changed significantly over time implies that further declines in ICT prices may have different impacts across geographies. The quality-adjusted price of software declined by a total of 54 percent from December 2007 to August 2024; within that time, between December 2015 and August 2024, it declined 35 percent.[6] The decline in ICT prices may trigger additional investment in technologies by establishments for whom this may not have been a viable solution previously; in turn, this investment may induce a further decline in the share of clerical jobs in the employed labor force, with some jobs having been replaced more easily by automation. That said, this decline may affect inexpensive or smaller MSAs disproportionately, not only because they now employ a larger share of workers in clerical jobs, but also because these workers are particularly at risk of being displaced by automation given that they perform routine cognitive tasks. In contrast, because of upskilling, clerical workers in expensive or larger MSAs perform tasks that are less likely to be automated, reducing their displacement risk.[7]

Furthermore, there are signs that artificial intelligence and large language models may negatively affect clerical workers' employment. According to Gmyrek et al. (2023), clerical workers are highly exposed to the employment effects of AI technology, with 24 percent of traditional clerical tasks being highly exposed to replacement by AI and an additional 58 percent having medium-level exposure. These numbers are in contrast to those for other broad occupational groups, in which the authors found a small replacement risk such that the technology is likely to be used for augmentation rather than replacement, automating some tasks within an occupation while leaving workers time for other duties. Similarly, in a recent study, Aghion et al. (2024) show a negative impact on clerical work with the adoption of AI technologies by 321 French firms from 2019 through 2020. This is in contrast with an overall increase in employment by the adopting firms, at which there was no negative impact to other jobs in these same firms.[8] Consequently, any policies that may incentivize firms to adopt these

technologies are likely to affect clerical workers disproportionately, particularly in smaller MSAs, where they tend to perform more traditional routine tasks.

Conclusion

The distribution of occupations and the types of workers and what they do in a given occupation vary across geographies. These differences are important to keep in mind when evaluating how technology adoption may unevenly affect workers and MSAs. The continued decline in ICT costs and the advancement of new AI technologies may have a particularly negative impact on clerical workers in smaller MSAs, since in these areas a larger share of the employed labor force remains in clerical jobs that perform more traditional clerical tasks.

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Endnotes

1. We follow Cortes et al. (2017) and Eeckhout et al. (2021) and define clerical jobs as sales and related occupations (2010 OCC 4700–4965) and office and administrative support occupations (2010 OCC 5000–5940). Return to 1
2. In the most recent version of the paper, we focus on 1990 as a starting point. However, results are qualitatively the same and quantitatively stronger if we start in 1980. Return to 2

3. We refer to the occupation code 43-6000 ("secretaries and administrative assistants") from the BLS' 2010 Standard Occupational Classification. Return to 3
4. A metropolitan statistical area (MSA) consists of one or more counties that contain a city of 50,000 or more inhabitants or contain a Census Bureau-defined urbanized area (UA) and have a total population of at least 100,000 (75,000 in New England). Counties containing the largest city and surrounding densely settled area are components of the MSA. Additional counties qualify for inclusion by meeting a specified level of commuting to the counties containing the population concentration and by meeting certain other requirements of metropolitan character such as a specified minimum population density or percentage of the population. In contrast, nonmetro areas are the remainder areas, that is, rural areas and small towns that do not qualify as part of an MSA. Return to 4
5. Considering the 2015:Q2 composite cost of living from the Council for Community and Economic Research (C2ER), the average of the cost of living indexes for the NYC divisions (CBSA code 35614) is the third highest among 237 metro and micropolitan areas surveyed by C2ER, behind only the Honolulu and San Francisco metro areas. Similarly, using the Eeckhout et al. (2021) rent index for 2015, the New York City metro area ranks 6 of 277, while the Billings, Montana, metro area ranks 68 of 277. Return to 5
6. Authors' calculations based on the Bureau of Labor Statistics series CUUR0000SEEE02, "Computer software and accessories in US city average, all urban consumers, not seasonally adjusted." Return to 6
7. For the United States, the data on upskilling through tasks is available only for new job posts. Hence, at the moment, we are unable to fully explore the change of composition in tasks for the workers who are currently employed. Return to 7
8. You can find a detailed presentation by Philippe Aghion at https://www.frbsf.org/news-and-media/events/2024/04/philippe-aghion-the-growth-and-employment-effects-of-ai/. Return to 8

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