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The wider impacts of high-technology employment: Evidence from U.S. cities

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ABSTRACT

Innovative, high-technology industries are commonly described as drivers of regional development. 'Tech' workers earn high wages, but they are also said to generate knock-on effects throughout the local economies that host them, spurring growth in jobs and wages in nontradable activities. At the same time, in iconic high-tech agglomerations like the San Francisco Bay Area, the home of Silicon Valley, the success of the tech industry creates tensions, in part as living costs rise beyond the reach of many non-tech workers. Across a large sample of U.S. cities, this paper explores these issues systematically. Combining annual data on wages, employment and prices from the Quarterly Census of Employment and Wages, the Department of Housing and Urban Development and the Consumer Price Index, it estimates how growth in tradable tech employment affects the real, living-cost deflated wages of local workers in nontradable sectors. Results indicate that high-technology employment has significant, positive, but modest effects on the real wages of workers in nontradable sectors. These effects appear to be spread consistently across different kinds of nontradable activities. In terms of substantive wider impacts, tech appears benign, though fairly ineffectual.

1. Introduction

In 2017, the online retailer Amazon announced it would build a second headquarters, dubbed HQ2, somewhere in North America. Policymakers throughout the US and Canada clamored to have their city chosen, reportedly wooing the company with offers of as much as $7bn in state and local tax breaks and other incentives (CNN Money, 2018). Though the numbers involved are unusual, the contours of the story are not a typical. Scholars widely hold that innovative, high-technology industries drive regional development, and it is commonplace for policymakers to expend great effort to attract them to their localities (Clark, 1972; Duranton, 2011). 'Tech' workers command high wages, and as such their presence contributes to regional prosperity. Above and beyond this direct effect, tech industries are thought to generate wider economic benefits in the local economies that host them. Durable employment growth in tech and other tradable sectors raises demand for local nontradable activities, such as health care, restaurants and dry cleaners. Higher demand for nontradables can be expressed through job creation as well as, potentially, higher pay. Since wages in tech are on average higher than in many other tradable industries, one might expect indirect benefits from tech to be comparatively large.

Still, dark clouds hang over this sunny-seeming picture. Cities hosting larger concentrations of workers in tech and other skill-intensive activities have also witnessed faster growth in local prices (Shapiro, 2006; Florida 2017). Studies of the most iconic technology clusters in the U.S. highlight the deleterious effects of rising costs, especially housing, on workers whose jobs support tech and other traded sectors (Schafran, 2013; Hyra, 2015). Ganong and Shoag (2017) illustrate the point, observing that, while janitors working in New York City in 2010 earned nearly one third more in nominal pay than their counterparts in 'Deep South' States, after adjusting for housing prices they earn six percent less. This raises questions about the narrative that tech employment generates outcomes that are "unambiguously positive" (Moretti and Thulin, 2013, p.343). They also confirm a need to measure not just job quantity but also quality (Feldman et al., 2016), the latter reflected in part by real (cost-adjusted) wages.

Motivated by this debate, the present paper aims to better understand the links between tech and the economic welfare of workers in nontradable sectors – those parts of the economy that are primarily oriented towards local consumption. This is the first known paper that measures the effects of local employment changes in tradable high-technology activities on the real wages of workers in local nontradables. Using data on a large sample of U.S. metropolitan areas, we test three

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hypotheses. First and most generally, we test the hypothesis that permanent expansions in high technology employment raise the real wages of workers in local nontradables. Second, given the emphasis placed on tech as a uniquely important catalyst for regional development, we consider whether the indirect impacts of tech tradables are larger than those that flow from non-tech tradable employment. Third, guided by anecdotes suggesting that tech workers disproportionately consume particular kinds of nontradables, especially wage-, skill- and creativity-intensive activities like fine dining, we seek to determine whether tech has larger wage impacts on activities that are rich in such characteristics.

To test these hypotheses, we combine annual industry data drawn from the U.S. Bureau of Labor Statistics' (BLS) Quarterly Census of Employment and Wages (QCEW) with information on local prices from the Department of Housing and Urban Development (HUD) and the BLS' Consumer Price Index for All Urban Consumers (CPI-U). Over a study period ranging from 2001 to 2015, we estimate how annual changes in metropolitan tradable high-technology employment are associated with changes in the average real wages of workers in local nontradable sectors. We leverage the panel nature of our data to eliminate bias from time-invariant unobserved city-specific factors, as well as economy-wide dynamics. We aim to account for the effects of idiosyncratic shocks using two instruments: a shift-share measure of predicted tech employment (Bartik, 1991), and a measure of local patents per capita accumulated during the 19th century.

We find stable and consistent evidence that growth in local tech employment augments the real wages earned by workers in nontradable sectors. However, the influence of tech is minor. Across a range of models with different controls and estimation strategies, we find that a ten percent increase in local tech employment raises the annual real wages of workers in nontradable activities by between 0.1 and 0.7 percent. In relation to the second hypothesis, we find that tech and non-tech tradable employment have roughly comparable impacts on nontradable real wages. Regarding our third hypothesis, we decompose the nontradable sector and find little unambiguous evidence that growth of the tech sector engenders demand for highly paid nontradables. Further, we find little clear support for the proposition that demand derived from growth in local tech employment is directed towards more 'creative' or 'original' nontradable activities, though we do find that workers in more skill-intensive nontradables reap moderately higher returns. We interpret these last pieces of evidence cautiously, recognizing that industrial categories may not offer sufficient differentiation across industries of interest.

Taken together, the evidence we produce indicates that there are indeed wider benefits to be enjoyed from growth in a region's high-technology employment, but that these benefits are likely to be small. Policy efforts aimed at boosting tech employment are not likely to powerfully augment the economic welfare of those working in local-serving nontradables. On the other hand, we find no support for the idea that tech industry growth systematically decreases these workers' real wages.

2. Literature review

Innovative, high-technology activities have long enjoyed a privileged position among researchers and policymakers concerned with economic development (Clark, 1972; Malecki, 1981; Scott and Storper, 1987; Duranton, 2011; Howells, 2005; Block and Keller, 2009; Kemeny, 2011; Storper et al., 2015). Nonroutine high-technology activities tend to be strongly localized in space, as firms and workers congregate to match with each other and to efficiently produce and exchange tacit knowledge (Storper and Walker, 1989; Glaeser et al., 1992; Saxenian, 1996; Chatterji et al., 2014).

The increasing importance of high-technology goods and services has stimulated job growth in these industries, through the expansion of existing firms and the birth of new ventures. Growth in this sector can have direct and indirect effects on the localities that play host to it. First and most directly, it will expand the local employment base. And as workers in high-technology industries tend to be well paid, growth in tech employment is likely to increase local per capita incomes. Such direct income effects can be large. At the extreme, consider the tech boom of 1994–2000. Over this period, Galbraith and Hale (2004) document that the California counties of San Mateo, Santa Clara and San Francisco (all in the San Francisco Bay Area that contains Silicon Valley), as well Washington's King County (home to Microsoft and Amazon) together accounted for nearly all of the growth in between-county income inequality.

The indirect effects of tech employment are subtler. To understand them, one must first distinguish between tradable and nontradable economic activity. Tradable goods are those produced to serve national, and potentially global markets, and as such face prices that are not defined locally. Many such activities are subject to internal or external increasing returns to scale in production, and consequently will tend towards a high degree of geographic concentration. Meanwhile, nontradable activities serve local needs and face local prices. As described in the introduction, these include goods and services like health care, dry cleaning, and restaurants. Nontradables comprise the majority of local employment; in the U.S. context, they are also responsible for the bulk of employment growth in recent years (Spence and Hlatshwayo, 2012).

Using export-base theory and input-output methods, scholars have long considered that local tradable and nontradable employment are linked (North, 1955; Richardson, 1985). Moretti (2010) provides a theoretical update, describing a general equilibrium framework under which the national economy is comprised of a system of cities in which workers choose locations. Each city contains a mix of tradable and nontradable activities. A positive shock to local labor demand in the tradable sector stimulates demand for workers in nontradables. This will lead to new jobs for dry cleaners, medical technicians and chefs, as well as higher pay for workers in these sectors. As Moretti and Thulin (2013) outline, the extent to which expansions of the tradable sector produce job growth as opposed to wage growth in nontradables depends on the supply of housing in a location, as well as on potential migrants' responsiveness to new opportunities. Locations facing strong constraints on housing supply will experience higher nominal wage growth and lower job creation. Meanwhile, all else equal, a greater elasticity of migration will tip the balance towards larger job multipliers and weaker upward pressure on wages (Hsieh and Moretti, 2015). On the basis that high-productivity tech work produces a larger expansion in local income relative to other tradables, growth in tech ought to create especially large demand for nontradables.

There are some other reasons why workers in nontradable sectors will experience pay growth as a consequence of an expansion in tradable employment. One is that workers in tradables may generate knowledge externalities that spill over to workers in nontradables, making the latter more productive. These effects ought to be somewhat minor, in that, for a wide range of nontradable activities such as barbers, dry cleaners, and restaurants, proximity to software engineering and pharmaceutical development likely offers very modest potential for productivity enhancement. Baumol's (1967) 'cost disease' represents another potential channel. Observing that the wages of workers in nontradable sectors like education have risen despite significant increases in productivity, Baumol suggests that pay must be indexed to rates of wage growth in productive sectors, as a means of ensuring that teachers do not defect to activities where productivity, and hence pay, are rising. To the extent that this mechanism is in operation, in the present context it is essential to note that not all workers are equally likely to switch to the productive sector. The average barber is less likely than a physics teacher to become a software engineer.

Evidence tracing the wider impacts of tech tradable employment