Unintended consequences on gender diversity of high-tech growth and labor market polarization

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ABSTRACT

There has been considerable media coverage highlighting the lack of gender diversity in Silicon Valley, stressing the relatively low participation of women in the high-tech economy. Austin offers a unique case for testing whether similar gender issues characterized other high-tech regions because the city has historically benefited from the expansion of Silicon Valley’s large high-tech firms since the 1980s. The gender-biased business practices identified in Silicon Valley’s firms may have been transferred to their branch plants in Austin. Our analysis shows women’s losses in middle-skill occupation employment shares were concentrated in the low-tech industry and were partially offset by significantly larger job share gains in high-skill occupations in the same sector between 1980 and 2015. Men’s losses in middle-skill occupation job share were also mainly concentrated in the low-tech sector but were partially offset by employment share gains in high-skill occupations only in the high-tech industry during this period. Women made large gains in relative real wages only in high-skill occupations in the high-tech industry while their relative real wages in other skill occupations and in the low-tech industry stagnated around zero during this period. Men’s gains in relative wages were also concentrated only in the high-tech industry but were less than half than those of women and were negative (between −10 and −21 percent) in other occupations and the low-tech industry. As noted in previous studies, the impact of job polarization is not well understood across sectors and gender. This study finds the high-tech industry in Austin has had unintended consequences in terms of job polarization across gender, providing relatively fewer job opportunities in high-skill occupations to women than men but offering much higher gains in relative real median wages to women than men. Males also found relatively more job opportunities in high-skill occupations in the high-tech industry than women but experienced only half of the women’s gains in relative wages in this industry between 1980 and 2015.

1. Introduction

In 2014, Google released data on the number of women and minorities it employed. Other companies in Silicon Valley followed, including LinkedIn, Yahoo, Facebook, Twitter, Pinterest, EBay, and Apple. These data show that about 70 percent of employees at the top technology companies in Silicon Valley were male (Lev-Ram, 2015). Fortune magazine reported these high-tech companies have pledged not only to disclose the demographic breakdown of their employee base but to put money into programs that aim to increase the pipeline of women and minorities in technology and to make changes to their hiring practices (Lev-Ram, 2015). In 2015, another large Silicon Valley high-tech company, Intel, set the goal of achieving full diversity in its workforce by 2020; however, despite committing $300 million to the effort and some early progress, Intel acknowledged in January 2017 that there was a great deal of work to be done (Spencer, 2017).

Considerable media coverage has highlighted the lack of gender diversity in Silicon Valley, stressing the relatively low participation of women in the high-tech economy with its associated wage benefits (Kenney and Patton, 2015). The law firm Fenwick and West (2014) tracked women in senior leadership positions in public technology companies in Silicon Valley. They consistently found that women represent a relatively small percentage of top executives in local companies, reflecting the relatively small portion of technology company employees that are women—a likely leading indicator for women accessing senior management positions in later years. The question of whether the gender imbalance in job opportunities at high-tech firms is a problem unique to Silicon Valley remains unanswered. Indeed, to our knowledge, no academic study has addressed high-tech-related gender demand imbalance in other regions, and the few studies conducted for
Silicon Valley have used small samples based on self-reported surveys. This paper fills this void in the literature. It studies how skill employment shifts in Austin, within and between high- and low-tech industries, have affected relative job opportunities for male and female workers between 1980 and 2015. It also studies the combined effects of changes in skill demand and supply of male and female workers on their relative median wages during this period.

Over the past almost four decades (1980–2016), Austin has become an important high-tech center as semiconductor manufacturing, computer manufacturing, and software companies from Silicon Valley (and other high-tech regions) have rapidly expanded in the city. The links between these two regions started very early with the expansion of Silicon Valley companies such as Advanced Micro Devices, Intel, and LSI corporation in Austin in the 1980s and the location of two large research consortia, MCC and Sematech, formed by many of these companies (Gibson and Rogers 1994; Echeverri-Carroll and Oden, 2016). Echeverri-Carroll and Ayala (2004) note that American Airlines made news in the fall of 1992 when it began direct flights from Austin to San Jose and that by 2014 these direct flights became known as “nerd births” because they claimed the highest laptop-per-passenger ratio in the airline industry. The expansion of Silicon Valley companies in Austin has not abated. Apple just finished building its second-largest campus in Austin in 2016 (after its new “spaceship” headquarters in Cupertino), a massive 1.1 million-square-foot facility (Hawkins and Novak, 2015). Similarly, Oracle is building a cutting-edge 560,000-square-foot cloud campus, and Google just rented 200,000 square feet of space in a new building in downtown Austin. Until the 1980s, Austin’s economy was largely based on income generated by the state government and by its large research university, the University of Texas at Austin. The takeoff of the high-tech industry started in the 1980s as shown by several indicators. The high-tech location quotient index shows how concentrated the high-tech industry is in Austin in relation to the nation by comparing the high-tech industry’s share of Austin full-time employment with its share of national full-time employment. While in 1970, the index was 0.73, indicating a lower concentration of high-tech industries in Austin than in the nation, it moved from 1.05 in 1980–1.40 in 2015, showing the high-tech industry is nearly 40 percent more concentrated in Austin than in the nation to date. Another indicator, the share of full-time employment accounted by the high-tech industry in the city illustrates that this proportion increased from 17 percent to 22 percent between 1980 and 2015, while the proportion of government jobs decreased from 32 percent to 18 percent during the same period (Echeverri-Carroll and Oden, 2016).

The increasing importance of Austin as a high-tech center has been noted in both academic studies and the media. The Milken Institute has used criteria such as job creation, wage gains, and technology trends to develop the Best-Performing U.S. Cities Index since 2008. Austin captured the fourth spot in 2015 and is the most consistent top-five finisher in the history of the index (DeVol et al., 2015). A recent analysis of U.S. cities that benefited the most from the 2004–2014 tech boom, published in Forbes, finds a group of cities including San Francisco, San Jose, and Seattle that have long been identified with robust growth in innovation and technology based industries. The city that placed first in this accounting, Austin, boasted the strongest expansion in tech-sector employment of any of the nation’s 52 largest metropolitan areas in this period, 73.9 percent, as well as 36.4 percent growth in STEM jobs, the fourth-highest growth rate in the country (Kitkin and Schill, 2015).

Austin has not only become a vibrant high-tech center, with a high-tech economy represented by industrial clusters similar to those in Silicon Valley, but has also shown an increasingly polarized labor market as depicted by a rise in the value of the Wolfson index from 0.31 in 1980–0.37 in 2015, signaling a growing dispersion of incomes at the top and bottom from those at the median of the income distribution during the birth and growth of the high-tech economy in Austin. However, most of the discussion of job polarization in industrialized countries has focused on the relative job losses and gains for workers with different skill levels (not on income dispersion of workers at the top and bottom from those around the median). This skill-based polarization analysis is particularly insightful in our study of the relative contribution of high-tech industries to job polarization across gender in Austin because it allows us to answer two key questions in our analysis: How have high- and low-tech industries’ changes in the relative demand for skills affected relative job opportunities for male and female workers between 1980 and 2015, and how have combined changes in relative demand and supply during this period affected relative wages across skills and gender?

Similar to the U.S. case, this paper finds the share of middle-skill jobs, those in which workers perform routine tasks that are procedural and repetitive, has fallen rapidly in Austin. As the share of middle-skill jobs has shrunk, the share of high- and low-skill jobs has increased. As noted in Autor and Dorn (2013), high-skill jobs are intensive in abstract, cognitive tasks while low-skill jobs are concentrated in non-routine, manual tasks, both of which are difficult to codify. More specifically, our data show that the employment share of workers in high-skill occupations in the Austin labor market increased by 11.9 percentage points from 38.2 percent in 1980–50.1 percent in 2015. Similarly, low-skill workers increased their participation in the local labor market, but only by 2.1 percentage points from 9.8 percent to 11.9 percent during the same period. In contrast, the share of middle-skill workers, in accordance with a more polarized local labor market, shrunk 14.0 percentage points from 51.9 percent to 37.9 percent during this period.

What has been the relative contribution of the high-tech industry to job polarization across gender in Austin? This article examines about four decades (1980–2015) of microdata from the Census of Population and American Community Survey (ACS), made compatible by the Integrated Public Use Microdata Series (IPUMS) (Ruggles et al., 2015) to characterize changes in Austin’s labor market by gender due to the relative contribution of job polarization by industry. More specifically, the shift in the composition of skilled jobs in Austin’s labor market is documented using 5 percent microdata sample from the 1980 U.S. population census and a five-year aggregated sample for 2015 (1 percent samples 2011–2015) from the ACS. The data contain detailed demographic information on workers’ gender and on employment and wages by industry and occupation.

The demand side of our analysis of the contribution of high- and low-tech industries to the polarization of employment across gender in Austin shows the bulk of the job losses in middle-skill occupations can be explained by the relatively large drop in demand for these skills in

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1 As noted by Baum-Snow and Pavan (2013), measurement error is a justification for using full-time workers. Baum-Snow and Neal (2009) demonstrate that census and American Community Survey (ACS) data appear to contain false reports of part-time hours. More specifically, some of these errors involve false reports of daily hours worked instead of usual weekly hours. Following these results, this paper uses full-time employment when using census and ACS data.

2 We use U.S. Census and ACS data. The 2015 data is an average for the years 2011–2015, discussed later.

3 The Foster-Wolfson index is the “gold standard” aggregate measure of polarization (Foster and Wolfson, 1992, 2013; Wolfson, 1994, 1997). The index determines polarization by comparing all incomes in a distribution to the median income. This income-based measure of polarization essentially divides the distribution into the two groups above and below the median and measures the distance of each unit’s income to the median (spread) and the amount of clustering away from the median (bipolarity). Using the freely available DASP (Distributive Analysis Stata Package, http://dasp.ecn.ulaval.ca/ ) (Ankar and Duclos, 2013), we found 95 percent confidence interval estimates for the Foster-Wolfson polarization index of Austin’s income distribution for full-time workers. However, our analysis focuses on the polarization of employment by three skill-groups and by hourly wages at the individual level rather than by household income; the present study and the rising polarization index suggest that Austin may have experienced polarization in more than one aspect, but the perspective of income polarization is beyond the scope of this paper.

4 This paper refers to 2015 throughout the analysis for data the ACS reported as an average for five years: 2010–2015.
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