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Local Multipliers in the High-Technology Sector

In 2012, the Economic Institute published T*echnology Works: High-Tech Employment and Wages in the United States*, a first-of-its-kind look at high-technology sector employment, wages, and the ripple effect the sector has on job creation in local metros. In the 10 years that have passed since publication, high-tech firms have grown to become some of the largest in the world and expanded to metros across the country, while providing a greater diversity of services than ever before. Given high-tech's importance to the U.S. economy, revisiting the so-called "local multiplier effect" is important to provide updated context to policymakers as they consider the growth of the high-tech sector.

Why Examine High-Tech's Local Multiplier?

Why should local authorities care about attracting high-tech jobs when they still represent a relatively small share of total employment nationally? The answer is that these jobs provide a lot of economic bang for the buck. This occurs through two channels—first through income gains generated by innovation, productivity, and a global marketplace, and second from the local jobs that are supported by that income generation.

Understanding that well-paying jobs are critical to economic development, local and regional authorities have used tax incentives to attract companies that provide them. For example, officials in Alabama, Kentucky, South Carolina, and Tennessee have devoted considerable effort to attracting foreign auto manufacturing facilities. Doing so created jobs for many middle-skilled workers that pay in excess of what those workers might have earned in local-serving positions.

Like auto manufacturing, high-tech industries generally fall into the "tradable" segment of the U.S. economy. The tradable sector produces goods and services that can be consumed outside of the region where they are produced. For example, manufactured goods can be bought or sold around the world and web searches can be conducted anywhere with an internet connection. Because companies in the tradable sector have access to markets outside their home region, this also means they must compete nationally and globally.

As a result, the tradable sector drives innovation and in turn productivity, fueling economic growth. As evidence of this, economic output on a per-worker basis (a broad measure of labor productivity) increased an inflation-adjusted 37 percent faster in the tradable sector between 2000 and 2019 compared with the rest of the economy. Furthermore, despite accounting for 29 percent of U.S. economic output in 1990, the tradable sector now represents nearly two-thirds of the U.S. economy, at 61 percent.[1]

High-tech industries are emblematic of this, having been among the fastest growing in terms of economic output and productivity in recent decades.[2] High-tech industries were also responsible for 72 percent of total private sector research and development in 2019, despite accounting for only 2.7 percent of total private-sector employment.[3]

The large and growing income generated by the tradable sector has an important secondary effect of supporting other local jobs. The "non-tradable" sector produces goods and services that are consumed in the same region where they are produced. This primarily includes localized services such as health care, restaurants, education, hotels, and personal services, but it also includes the construction sector as well.

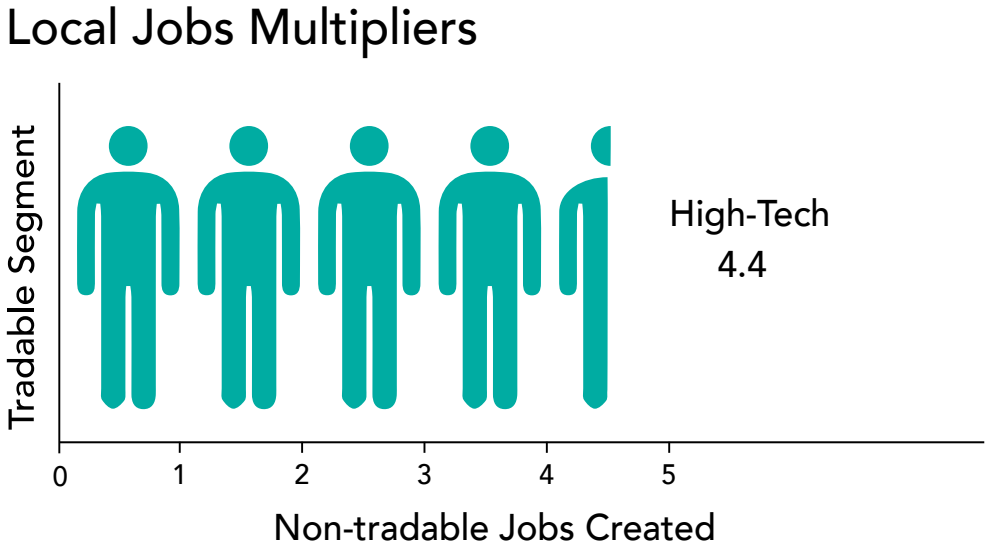
Businesses in the non-tradable sector serve the local economy and are generally shielded from competition outside of the region. As a result, innovation and productivity growth in the non-tradable sector are generally low. Non-tradable jobs are precisely the types of jobs that are supported by the innovative tradable sector, which captures dollars from other regions of the country or the world. Those dollars then filter through the local economy, creating a multiplier effect.

Constructing the Multiplier

Moretti (2010) provides the framework for quantifying this local multiplier effect. That methodology is applied here to estimate the secondary job creation stemming from economic activity in high-tech industries, as defined in this report. In particular, it provides a long-run estimate of the number of jobs – both high-wage and low-wage – that are created in the local non-tradable sector by the creation of one job in the local high-tech sector (see Methodology).

In 2012, our analysis spanned all U.S. metropolitan regions using employment data from 1990 to 2010 and found a high-tech multiplier of 4.3. In this updated analysis, our dataset covers 1999 to 2019, with 2020 being excluded due to the COVID-19 pandemic. As shown in the figure below, the local multiplier effect for high-tech has remained relatively stable in this new analysis. For each job created in the local high-tech sector, approximately 4.4 jobs are created in the local non-tradable sector in the long run. These jobs could be for lawyers, dentists, schoolteachers, cooks, or retail clerks. In short, the income generated by high-tech industries spurs a high rate of economic activity that supports local jobs.

The especially large local multiplier for the high-tech sector reflects the fact that workers in these industries have higher levels of disposable income, which is spent on meals, transportation, housing, and other services in the local community. It also reflects the fact that high-tech companies tend to cluster around one another, which attracts additional high-tech firms and the local service providers that support their business activities.



Source: Bureau of Labor Statistics (BLS), calculations by Bay Area Council Economic Institute

Methodology

Moretti (2010) provides the framework for estimating local multipliers.[4] This framework captures the long-term local job-creating effect of the addition of one job in the tradable sector, which is channeled primarily through increased demand for local goods and services. However, it also accounts for the partial offset of this positive effect on employment by general equilibrium effects that are induced by changes in local wages and prices. More specifically, it quantifies "the long-term change in the number of jobs in a metropolitan area's tradable and non-tradable sectors generated by an exogenous increase in the number of jobs in the tradable sector, allowing for the endogenous reallocation of factors and adjustment of prices."

Using data from the Quarterly Census of Employment and Wages in 1999, 2009, and 2019, variants of the following two models are estimated:

$$\Delta E_{mt}^{NT} = \alpha + \beta_1 \Delta E_{mt}^{T1} + \beta_2 \Delta E_{mt}^{T2} + \gamma d_t + \varepsilon_{mt}$$

$$\Delta E_{mt}^{NT} = \alpha' + \beta'_1 \Delta E_{mt}^{*T1} + \beta'_2 \Delta E_{mt}^{*T2} + \gamma' d_t + \varepsilon'_{mt}$$

where ΔE_{mt}^{NT} is the log-change of employment in the non-tradable sector in metro *m* over a specified period of time *t* (ten years); E_{mt}^{T1} is the log-change in employment in a segment of the tradable sector (e.g. high-tech); E_{mt}^{T2} is the log-change in employment in the remainder of the tradable sector (e.g. non-high-tech); and E_{mt}^{*T1} and E_{mt}^{*T2} are the log-changes of employment in both segments of the tradable sector combined with an instrument that accounts for exogenous shifts in demand for labor in the tradable sector. The sample period includes two observations per metro, 1999–2009 and 2009–2019. The variable *d* is a dummy for each time period. Standard errors are tabulated at the metro level.

To isolate exogenous shifts in the demand for labor in the high-tech sector, an instrument of the weighted average of nationwide employment growth within the sector is combined with metro-specific employment weights in the sector at the beginning of the period in the following specification:

$$\Delta E_{mt}^{*T} = \Sigma \omega_{m,t-1} \Delta N_t^T$$

where $\omega_{m,t-1}$ is the share of tradable jobs in metro *m* in the prior period (for example, in 1999); and ΔN_t^T is the log-change in the tradable sector nationally (for example, between 1999 and 2009).

Whereas Moretti defines the theoretical construct of the tradable sector principally as manufacturing, and the non-tradable sector as the rest of the economy outside of agriculture, mining, government and military, this report uses a different approach to define the two segments of the U.S. economy. Jensen (2011) provides the weighting for tradability of sectors at the level of two-digit NAICS.[5]

High-tech industries are defined using the methodology developed by Goldschlag and Miranda (2019), which uses the concentration of STEM occupations within industries to define high tech. Industries with STEM occupation concentrations of more than five times the economywide average are included. These high-tech industries, by NAICS code, are listed below:

NAICS	Industry Description
2111	Oil and Gas Extraction
3254	Pharmaceutical and Medicine Manufacturing
3341	Computer and Peripheral Equipment Manufacturing
3342	Communications Equipment Manufacturing
3344	Semiconductor and Other Electronic Component Manufacturing
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing
3364	Aerospace Product and Parts Manufacturing
5112	Software Publishers
5171	Wired Telecommunications Carriers
5179	Other Telecommunications
5182	Data Processing, Hosting, and Related Services
5191	Other Information Services
5413	Architectural, Engineering, and Related Services
5415	Computer Systems Design and Related Services
5417	Scientific Research and Development Services

Note: Industries are drawn from 2007 NAICS. High-tech industry codes remained the same across all years, with the exception of code 5171. To control for this change, 517311 was used in 2019.

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Endnotes

1. Bureau of Economic Analysis, Industry Economic Accounts; Bay Area Council Economic Institute.

2. Bureau of Economic Analysis, Industry Economic Accounts; and Michael Spence and Sandile Hlatshwayo, "The Evolving Structure of the American Economy and the Employment Challenge," a Council on Foreign Relations Working Paper. March 2011.

3. Business Enterprise Research and Development Survey (BERD), U.S. Census Bureau for the National Science Foundation; Bay Area Council Economic Institute.

4. Enrico Moretti, "Local Multipliers," American Economic Review: Papers & Proceedings, Volume100, Issue 2, May 2010: 373–377.

5. See Table 2.3 on page 59 of J. Bradford Jensen, Global Trade in Services: Fear, Facts, and Offshoring (Peterson Institute of International Economics, 2011); adjustments made by Bay Area Council Economic Institute.

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