



Manufacturing outsourcing, onshoring, and global equilibrium

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Abstract Manufacturing is now a national strategy for many countries to combat slow economic growth, and positively viewed with the current trend of onshoring foreign manufacturing operations. We develop a cross-country regression model that predicts manufacturing employment as a function of population growth, foreign direct investment, and purchasing power parity. Results through the year 2100 suggest that manufacturing is trending toward a global equilibrium with higher levels of manufacturing outputs but much lower levels of manufacturing employment. The reason is that countries tend to evolve from having little manufacturing to commodity manufacturing at large scale and low wages. As infrastructure and human capital develop, there is the tendency to pursue advanced manufacturing in support of higher valued goods. The manufacture of commodity products is then outsourced to those countries with lower costs justified by their less-developed infrastructure and human capital, and so the virtuous cycle continues. While this model suggests that current efforts in revitalization of domestic manufacturing would lead to an increase in wealth in the United States, the bad news is that these gains are unlikely to be sustainable in the long term. However, the good news is that manufacturing acts as a rising tide that raises all nations and our global quality of life.

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1. Manufacturing matters

Manufacturing embodies the creation of wealth through the literal conversion of lower-cost materials to higher-valued products. Manufacturing industries

have historically provided a variety of skilled and unskilled positions with relatively high salaries that contribute to a prosperous middle class. Contrary to public perception, manufacturing wages have not declined over the last few decades; rather, the average hourly earnings of U.S. manufacturing employees increased to \$24.27 by April 2013, according to Federal Reserve Economic Data. Manufacturing thus

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continues to be of significant economic and political interest, as evidenced by recent federal initiatives related to advanced manufacturing (Wessner & Wolff, 2012). Such advanced manufacturing emphasizes the creation of highly valued products such as solar cells, hybrid vehicles, and pharmaceuticals over commodity products such as toys and bolts (Hausmann, 2013).

A real issue in the United States is the fact that manufacturing employment peaked at 19.6 million in May 1979, and has since fallen to just under 12 million as of April 2013. The decline is even more significant when viewed in proportion to the size of the workforce, with manufacturing employment declining from 30.9% in 1979 to 7.7% in 2013. Manufacturing employment has declined even further when viewed as a fraction of the total population.

The reduction in the manufacturing workforce is due to a number of factors, including international outsourcing and productivity gains, which are later analyzed in some detail. First, however, consider the data provided in Figure 1, which plots manufacturing employment along with the publication frequency of terms including 'manufacturing,' 'globalization,' and 'outsourcing.' It is apparent that the publication frequency of the term 'manufacturing' generally follows the level of manufacturing employment.

The notable exception is the significant peak in the publication frequency of 'manufacturing' around 1990, after which there was a very significant decline in both the publication frequency of 'manufacturing' as well as the level of manufacturing employment. Around this same time, there were significant increases in the publication frequency of the terms 'globalization' and 'outsourcing.' Both these terms

seem to have peaked by 2008. It is interesting to note that the term 'advanced manufacturing' is a current buzzword in some political and technical circles. It last peaked in 1990, a time of recession, at a rate of 0.21 occurrences per million published words before declining to less than 0.04 occurrences per million published words in 2008; however, the current rate is surely higher.

Reflecting on the data of Figure 1, we hypothesize that significant structural changes have occurred in manufacturing due to globalization; perhaps a plateau in manufacturing employment will be obtained. The current effort seeks to model the most significant contributing factors. By understanding the dynamics of manufacturing employment, we can predict future employment levels.

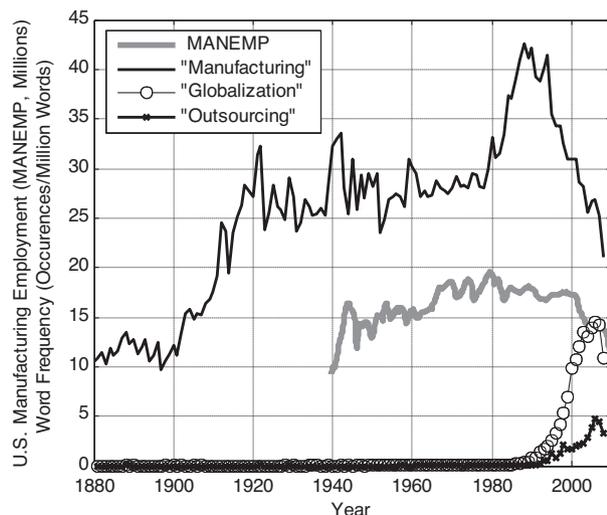
2. Outsourcing and onshoring

The decision to outsource, either to foreign or domestic suppliers, has significant ramifications on the long-term structure and capability of a firm (Coase, 1937). It is a widely held belief among the public that labor costs are primarily responsible for outsourcing (Garrett, 2004), but in actuality, competitive strategy and accompanying supply chain designs are driven by many factors. Table 1 lists some of the decision factors, grouped by whether they are related to increased revenues, reduced costs, or other factors. A detailed discussion of these factors is beyond the scope of this article, but some relevant references are indicated in Table 1 for perusal by the interested reader.

The author believes that the rise in foreign outsourcing and corresponding decline in domestic manufacturing employment were enabled by decreasing transaction costs related to information and transportation that increased access to economical overseas suppliers. For example, in 1990 the author was an engineer at General Electric, where he participated in a teleconference via satellite with colleagues in Japan. Both sites had their own internal videoconferencing facility but the satellite rental still cost \$3,000/hour—in 1990 dollars! Today, of course, a higher quality connection can be procured at negligible cost, directly from each peer's electronic device. Similar, if less pronounced, productivity gains in containerized shipping have also facilitated the development of robust international trade (Gouvernal & Slack, 2012).

There is anecdotal evidence—of which the U.S. Federal Reserve is aware (Kliesen & Tatom, 2013)—that some manufacturers are returning part or all of their foreign production to domestic facilities, an action that has been termed *onshoring*. Rising

Figure 1. Historical manufacturing employment and publication frequency of related terms



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