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Manufacturing Jobs: Implications For Income Inequality

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Abstract: The declining share of manufacturing jobs in overall employment has been a concern for policymakers and the broader public alike. Part of this concern stems from the widely held belief that manufacturing offers a unique source of well-paid jobs for less-skilled workers, and that the loss of these jobs worsens overall inequality. We find that manufacturing offers somewhat higher wages for the high and low-skilled workers in advanced countries, while there is no difference for middle skilled workers. We also find that inequality within services and industry, which includes manufacturing, are similar. While the displacement of workers from manufacturing to services in advanced economies has coincided with a rise in labor income inequality, this increase was mainly driven by larger disparities in earnings within all sectors.

Introduction

Historically, manufacturing industries are widely perceived to have been a major source of high-quality jobs. The decline in the share of manufacturing jobs in employment, especially among advanced economies, has thus fueled concern that the disappearance of what are thought to be relatively well-paying manufacturing jobs would hurt the living standards of affected workers and contribute to a variety of social ills.[3] Under this mechanism, the shift of workers from well-paying manufacturing to lower-paid jobs in the service sector contributes to the "hollowing out" of the income distribution by moving workers from the middle to the lower end of the income scale, leading to higher earnings inequality.

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[1] This work is also presented in the International Monetary Fund's April 2018 World Economic Outlook, Chapter 3. The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management.

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[3]For example, Helper, Krueger, and Wial (2012) document that average earnings in manufacturing jobs are about 8 percent higher than in nonmanufacturing jobs when differences in worker and job characteristics are controlled for. Lawrence (2017) stresses that manufacturing has historically provided the opportunity for relatively unskilled workers to earn relatively high wages; he notes that in the United States, the manufacturing sector employed more than one-third of men without a college degree in 1970 and 17 percent in 2015. Autor, Dorn, and Hanson (2017) highlight the effects of the loss in manufacturing jobs on family formation dynamics.

Indeed, countries where inequality in labor earnings has risen since 1980 have typically experienced a decline in the share of manufacturing employment (Figure 1). But further analysis of the mechanisms underlying that correlation is warranted. A large body of research has investigated the causes of growing income inequality and polarization, focusing primarily on the roles of trade and automation.[4] Few studies, however, have sought to isolate the effects of structural transformation on the distribution of labor income.[5] The significance of the latter explanation warrants review because it could mean that, to combat inequality, policy should focus on ensuring more inclusive gains from structural transformation rather than on supporting manufacturing employment.

Figure 1. Change in Manufacturing Employment Share and Inequality, 1980–2010
(Percentage points on x-axis; points on y-axis)

Inequality in labor earnings has tended to increase more in countries that registered a steeper decline in the share of manufacturing employment.
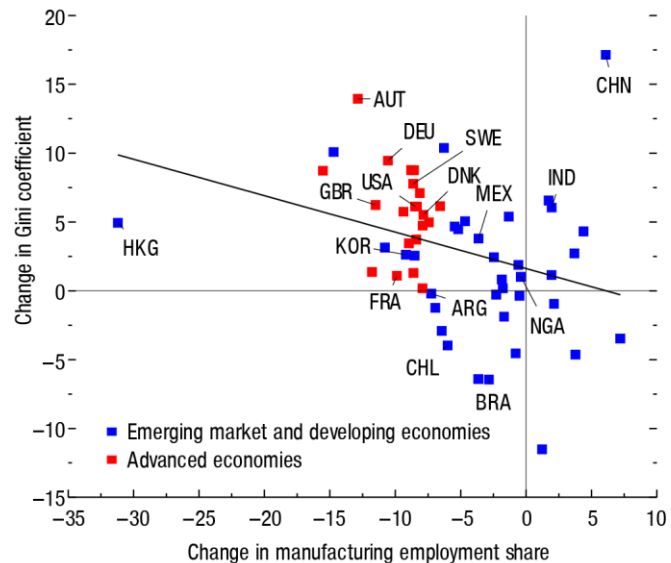
Sources: Standardized World Income Inequality Database (Solt 2016); and IMF staff calculations.
Note: The changes are calculated between the averages during 1980–89 and 2010–16. The Gini coefficient is based on income before taxes and transfers and ranges from 0 to 100. Data labels use International Organization for Standardization (ISO) country codes.

Against this backdrop, this note uses micro-level data for a set of advanced economies to examine if pay is systematically higher and more evenly distributed in the manufacturing sector as is often assumed. It then gauges the extent to which changes in income inequality can be attributed to shifts in employment shares across sectors, exploiting the initial disparity of earnings within and across types of employment. The main takeaway of the analysis is that only a limited portion (less than one-fourth under an extreme assumption) of the rise in income inequality could have resulted from the shift between manufacturing and nonmanufacturing employment.

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[4]The literature on job polarization and labor income inequality has focused mostly on occupations rather than industries. It indicates that, since the 1980s, employment and wages in several advanced economies tended to grow faster for high- and low-skill occupations than for middle-skill occupations (Autor, Katz, and Kearney 2006; Goos, Manning, and Salomons 2014). Autor, Dorn and Hanson (2013, 2016) and Acemoglu and Restrepo (2017) argue that trade and technology are changing the manufacturing sector in the United States by lowering the demand for labor, especially for the middle-skill group.

[5]An exception is Bárány and Siegel (2018), who argue that employment shifts across industries in the United States have enhanced the polarization of the job market.

Data and Methodology

The micro-level data comes from the Luxembourg Income Study database, which offers survey-based data at the household and personal level on income, employment sector, and occupation for a broad set of countries, including a set of 20 advanced economies in an unbalanced panel since the early 1980s.

The data is used to compute labor income inequality across sectors and to look at gross hourly wages across sectors and skills. Three broad sectors are considered: agriculture, industry (which consists of manufacturing, mining, electricity and construction), and services.[6] Because of data limitations, the manufacturing sector is represented by the broader industrial sector.[7]

The LIS data on gross hourly wage of full-time working household members is averaged by skill level.[8] Skill levels are determined according to the following classification of occupations in the International Standard Classification of Occupations (ISCO): managers and professionals (ISCO 1 and 2) are shown as high skill; laborers/elementary (ISCO 9) as low skill; and other skilled workers (ISCO 3–8, 10) as medium skill. Average gross hourly wages for each sector-skill are expressed relative to average economy-wide wages, calculated using people for whom skill data is available.

The measure of inequality used is the Generalized Entropy (GE) index, or mean log deviation, which has the advantage of being decomposable, unlike the Gini coefficient (Shorrocks 1980; Mookherjee and Shorrocks 1982). The mean log deviation, or GE(0), is given by:[9]

$$GE(0) = -\frac{1}{n}\sum_i \ln(\frac{y_i}{\bar{y}}), \text{ (eq. 1)}$$

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[6]When calculating inequality, sectoral information might not be available if the household head is unemployed, out of the labor force, or the data is missing. In those cases, the household is assigned to a separate "missing data" sector to ensure that the aggregate inequality measure is calculated for the entire population, and the sum of the components equals the economy-wide level of inequality.

[7] The Luxembourg Income Study database offers an alternative sectoral classification that distinguishes the manufacturing sector. However, using this classification would significantly reduce the sample size. Moreover, manufacturing accounts, on average, for about two-thirds of employment in the broad industrial sector, and distributional statistics on labor income for manufacturing and overall industry are comparable in countries where data is available for both sectors.

[8]The hourly wages are top and bottom coded to address extreme values. At the bottom, negative or zero wages are set to "missing." At the top, wages greater than 10 times the median for a given country-year are set to 10 times the median.

[9]The general formula for Generalized Entropy is
$GE(\alpha) = \frac{1}{n\alpha(\alpha-1)}\sum_i \left[\left(\frac{y_i}{\bar{y}}\right)^{\alpha} - 1\right]$, when $\alpha \neq 0,1$. When α=0, GE is defined as in equation 1.

in which n is the number of households, y_i is income of household i, and $\overline{y}$ is the mean of y_i.

The economy-wide GE(0) index can be decomposed as a weighted sum of the extent of inequality in each sector (within-sector inequality) and the contribution arising from differences between average incomes across sectors (between-sector inequality):

$$GE(0) = \underbrace{\sum_k v_k GE(0)_k}_{within} + \underbrace{\sum_k v_k \ln(\tfrac{1}{\lambda_k})}_{between}, \text{ (eq. 2)}$$

in which $v_k = \frac{n_k}{n}$ is the population share of sector k, and $\lambda_k = \frac{\overline{y}_k}{\overline{y}}$ is the relative mean income of sector k. The sector of employment of the household head is used to calculate inequality at the sector level. In this note we also use "cross-sector average income differences" to refer to between-sector inequality, as defined in equation 2.

Changes in inequality over time can be analyzed by applying the difference operator to both sides of the previous equation:

$$GE(0)_{t+1} - GE(0)_t = \sum_k v_{k,t} \Delta GE(0)_k + \sum_k GE(0)_{k,t+1} \Delta v_k - \sum_k \ln(\lambda_{k,t+1}) \Delta v_k - \sum_k v_{k,t} \Delta \ln(\lambda_k). \text{ (eq. 3)}$$

The decomposition of the change in generalized entropy over time into four terms can be interpreted as: (1) the effect of intertemporal changes in within-sector inequality; (2) the effect of changes in sectoral employment shares on the "within" component; (3) the effect of changes in sectoral employment shares on the "between" component; and (4) the effect of changes in the relative average sectoral income levels (Mookherjee and Shorrocks 1982). In this note, we sum the second and third term of equation 3, and refer to this as the effect of "change in sector size."

Results

Are earnings higher and more equal in industry than in services?

The data show that labor compensation in industry is indeed somewhat higher than in services for comparable skill levels (Figure 2).[10] For medium-skilled workers in the two sectors, earnings are practically indistinguishable. The median difference in labor earnings between industry and services for high- and low-skilled workers is about 6 percentage points and 9 percentage points, respectively. Nonetheless, the skill premium is more important in explaining the variation in earnings across workers than their sector of employment. For example, the gap between earnings for middle- versus low-skilled workers within a sector is about twice as large as the gap between low-skilled workers in industry and services.

Similarly, there is somewhat less labor income inequality in the industrial sector than in the service sector (as indicated by the two leftmost boxes in Figure 3, panel 1). But the data also show that countries with a relatively high degree of earnings inequality within the service sector tend to have high inequality within the industrial sector as well (Figure 3, panel 2).[11]

Figure 2. Average Gross Wages in Industry and Services in the 2000s
(Difference with respect to average economy-wide gross wages, percentage points)

Labor earnings in industry are somewhat higher than in services for high- and low-skilled workers and broadly comparable for medium-skilled workers.
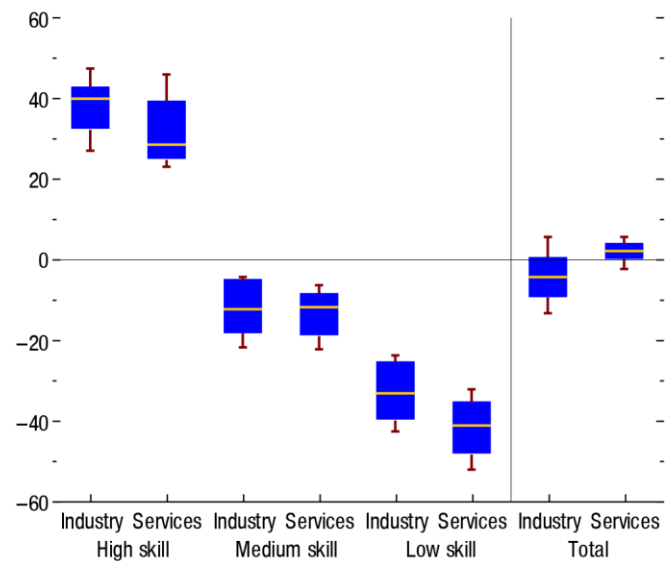
Sources: Luxembourg Income Study database; and IMF staff calculations.
Note: The figure shows the cross-country distribution of the difference between average (among individuals) gross wages by sector of employment and occupation and average economy-wide gross wages for full-time working household members for whom occupation data are available. The horizontal line inside each box represents the median; the upper and lower edges of each box show the top and bottom quartiles; and the red markers denote the top and bottom deciles. The sample corresponds to the latest year available during 2000–09 for 12 countries: Austria (2007), Belgium (2000), Finland (2007), Germany (2007), Greece (2007), Iceland (2007), Ireland (2007), Luxembourg (2007), Netherlands (2007), Spain (2007), Switzerland (2007), United States (2007).

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[10]Average labor earnings in services are higher than in manufacturing, but this is because the service sector employs more high-skilled workers than does manufacturing.

[11]While this note focuses on advanced economies, potentially lower earnings in expanding service-sector jobs is also a concern for developing countries (Hallward-Driemeier and Nayyar 2017).

How did the shift in workers between industry and services affect the distribution of labor income?

To isolate the effects of shifts in sectoral employment shares on earnings inequality, the analysis offers a thought experiment. If the average pay differentials between sectors and the levels of inequality within them had stayed at their initial levels, how much would the shifts in sectoral employment shares have changed the inequality in earnings? A decomposition along these lines suggests that the shift in manufacturing workers to services would not have worsened economy-wide income distribution if the level and distribution of earnings in each sector had remained at their initial levels. Shifts in employment shares between industry and services contributed only about 15 percent of the rise in economy-wide income inequality (keeping the dispersion and relative level of earnings constant at their initial values). [12] Instead, between the 1980s and 2000s, most of the rise in earnings inequality within countries came from the rise in pay inequality within services and industry (Figure 4).

The increase in earnings dispersion within sectors could result, however, in part from the movement of workers across sectors for two reasons. First, the dislocation of manufacturing workers to low-skill (and low-wage)

Figure 3. Labor Income Inequality in the 2000s
(Points)

Labor income inequality is somewhat lower in industry than in services, but country characteristics dominate in explaining within-sector inequality in both industry and services.
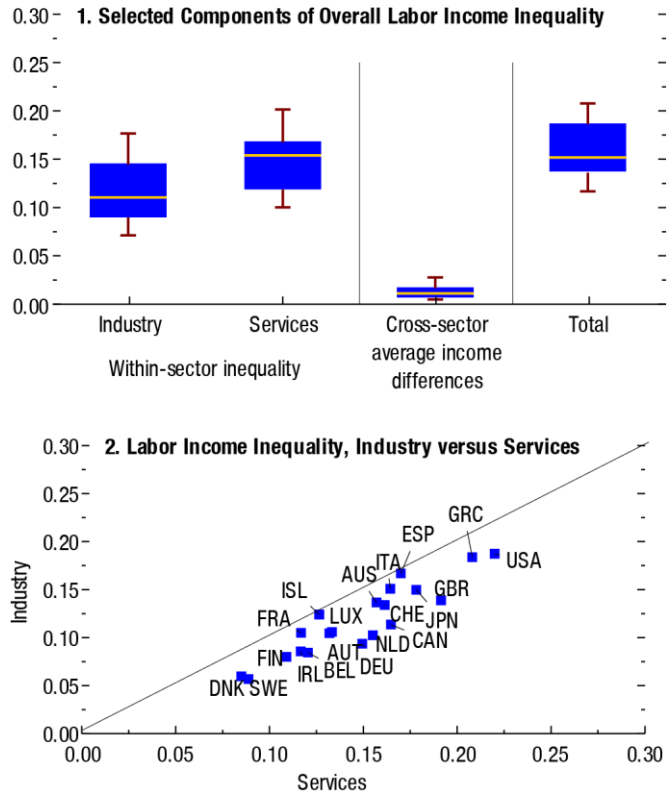
Sources: Luxembourg Income Study database; and IMF staff calculations.
Note: For each country, the analysis is based on data from the latest year available during 2000–09. The measure of inequality used is generalized entropy based on disposable income. Panel 1 shows the cross-country distribution of labor income inequality in industry and services; the contribution of differences in average earnings across sectors to aggregate inequality; and aggregate inequality. The horizontal line inside each box represents the median; the upper and lower edges of each box show the top and bottom quartiles; and the red markers denote the top and bottom deciles. The sample in panel 1 consists of: Australia (2008), Austria (2007), Belgium (2000), Canada (2007), Denmark (2007), Finland (2007), France (2005), Germany (2007), Greece (2007), Iceland (2007), Ireland (2007), Italy (2008), Japan (2008), Luxembourg (2007), Netherlands (2007), Spain (2007), Sweden (2005), Switzerland (2007), United Kingdom (2007), United States (2007). Data labels in panel 2 use International Organization for Standardization (ISO) country codes.

[12] A definitive test of whether the shift of middle-skilled workers from manufacturing to services implies erosion of their income would require data over time at the individual level, which are not available for a broad set of countries.

jobs in services would "mechanically" increase the share of workers at the lower portion of the income distribution and raise income polarization and inequality. With the average income of middle-skilled workers in the industry sector almost 30 percent higher than that of low-skilled service-sector workers (Figure 2), the disappearance of middle-skill manufacturing jobs could imply a large pay cut for workers in that group who move to low-skill jobs in the service sector. Second, a spurt in the number of workers competing for lower-skill jobs can put downward pressure on wages at the lower end of the earnings distribution, widening the gap between incomes at the high and low ends of the spectrum.

To assess the quantitative relevance of the first channel, a stylized exercise assumes that, in the eight economies[13] with available data since the 1980s and where manufacturing employment fell in absolute terms, all manufacturing jobs lost between the 1980s and 2000s were those of middle-skilled workers who moved to low-skill and low-wage jobs in services (set to the 25th percentile of wages in low-skill service jobs). In this scenario, overall labor inequality would have increased, on average, by about 9 percent of the actual increase in inequality between the 1980s and 2000s and up to one-fourth in any of the countries considered.

Figure 4. Contribution to Change in Overall Labor Income Inequality between the 1980s and 2000s
(Points)

Most of the increase in overall labor income inequality between the 1980s and 2000s is explained by rising inequality within sectors, rather than by shifts in the relative size of employment between industry and services.
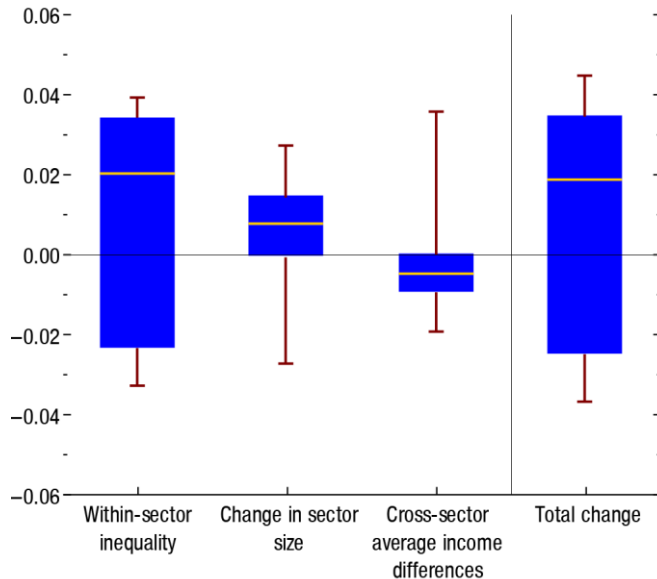
Sources: Luxembourg Income Study database; and IMF staff calculations.
Note: The figure shows the cross-country distribution of the change in aggregate labor income inequality between 1980–89 and 2000–09 and the contribution from changes in inequality within sectors, changes in the relative size of sectors, and changes in the difference of average income levels across sectors. The horizontal line inside each box represents the median; the upper and lower edges of each box show the top and bottom quartiles; and the red markers denote the top and bottom deciles. The measure of inequality used is generalized entropy based on disposable income. The sample consists of 13 countries: Australia (1989 and 2008), Austria (1987 and 2007), Canada (1987 and 2007), Denmark (1987 and 2007), Finland (1987 and 2007), France (1989 and 2005), Germany (1989 and 2007), Ireland (1987 and 2007), Italy (1987 and 2008), Netherlands (1987 and 2007), Sweden (1987 and 2005), United Kingdom (1986 and 2007), United States (1986 and 2007).

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[13] Austria (1987 and 2007), Germany (1989 and 2007), Denmark (1987 and 2007), Finland (1987 and 2007), France (1989 and 2005), Ireland (1987 and 2007), United Kingdom (1986 and 2007), United States (1986 and 2007).

Testing whether the dislocation of manufacturing workers to low-skill jobs exerts downward pressure on wages for all workers at the lower end of the earnings distribution is beyond the scope of this note but could be a fruitful area for future research. Autor (2015) argues that the slow wage growth in low-skill jobs during 1999–2007 in the United States may have been related to middle-skilled workers—including those displaced from highly routinized jobs—taking low-skill jobs.

Conclusion

The findings in this note suggest that changes in aggregate labor income are predominantly explained by rising labor income inequality within sectors. As analyzed widely in the literature, the key drivers behind greater pay inequality over time seem to be the dislocation of middle-skilled workers through technology and trade—and the resultant downward pressure on wages for medium- and low-skill jobs—rather than shifts in the relative size of employment between industry and services.

A word of caution regarding these findings is nonetheless warranted. First, displaced middle-skilled manufacturing workers may end up experiencing prolonged unemployment spells or dropping out of the labor force rather than taking low-wage jobs in services, leading to an increase in overall inequality that would not be captured in the analysis based on workers' labor earnings. Indeed, the analysis in IMF (2018) shows that workers in routinizable occupations were more likely to involuntarily drop out of the labor force. Second, some valuable nonwage attributes of manufacturing jobs appear less widespread in other sectors. Manufacturing jobs tend to be characterized by formal employment arrangements with associated benefits for workers, such as access to retirement plans, paid holidays and sick leave, and health and life insurance. They also tend to provide relatively stable arrangements, relying less on part-time or temporary contracts than other sectors (IMF 2017), and may offer collective bargaining via unions (Jaumotte and Osorio Buitron 2015).

Finally, even if shifts in employment shares between sectors contributed little to aggregate inequality, the negative consequences of declining manufacturing jobs can be sizable for some groups. Transitional costs associated with sectoral reallocation can be substantial for individual workers, both due to prolonged unemployment spells and lower earnings in subsequent jobs (Walker 2013). These individual costs can have nonnegligible aggregate incidence in regions that had developed as manufacturing hubs. A range of factors— including financial constraints, strong ties to their local area, and lack of needed skills—may have prevented workers displaced from manufacturing jobs from taking adequate employment in other sectors. Expanding access to training and education programs aligned with the needs of the evolving economy (including job-search assistance and training) and safety nets and redistribution policies targeted to displaced workers can help soften the blow imposed by structural transformation on workers and their communities.

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