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**Manufacturing Jobs and Inequality:
Why is the U.S. Experience Different?**

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Abstract

We examine the extent to which declining manufacturing employment may have contributed to increasing inequality in advanced economies. This contribution is typically small, except in the United States. We explore two possible explanations: the high initial manufacturing wage premium and the high level of income inequality. The manufacturing wage premium declined between the 1980s and the 2000s in the United States, but it does not explain the contemporaneous rise in inequality. Instead, high income inequality played a large role. This is because manufacturing job loss typically implies a move to the service sector, for which the worker is not skilled at first and accepts a low-skill wage. On average, the associated wage cut increases with the overall level of income inequality in the country, conditional on moving down in the wage distribution. Based on a stylized scenario, we calculate that the movement of workers to low-skill service sector jobs can account for about a quarter of the increase in inequality between the 1980s and the 2000s in the United States. Had the U.S. income distribution been more equal, only about one tenth of the actual increase in inequality could have been attributed to the loss of manufacturing jobs, according to our simulations.

I. INTRODUCTION

There is a concern in advanced economies that the loss of manufacturing employment means the loss of "good" jobs, especially for low- and middle-skilled workers. Historically, manufacturing attracted low-skilled workers from agriculture, offering higher and faster-growing wages. According to Helper, Krueger and Wial (2012), manufacturing used to provide high-wage jobs for workers who would otherwise earn lower wages. Lawrence (2017) states that manufacturing helped the United States achieve more inclusive income growth because it provided opportunities for workers without a college degree to earn relatively high wages and enter the middle class. Over the past decades, however, there was a steady decline in manufacturing employment across advanced economies (IMF 2018). Middle-skilled workers in routinizable jobs have suffered the most severe cuts (Autor and Dorn, 2013; Goos and Manning, 2007), many of whom have had to switch to low-skill service sector jobs instead.

If workers are losing "good" jobs in manufacturing, is this driving an increase in income inequality across countries? Several recent studies focusing on the United States demonstrate a link between manufacturing employment decline and a variety of societal problems. Gould (2018) finds that manufacturing decline (and low-skilled immigration) have contributed to rising wage inequality in the United States. Barany and Siegel (2018) show a link between manufacturing decline and polarization of the job market in the United States. Autor, Dorn and Hanson (2018) find that manufacturing decline has reduced the marriage market value of young men in the United States. Case and Deaton (2017) find that lower job security in manufacturing, and in low- and middle-skilled employment in general, is related to recent increases in mortality and morbidity among white non-Hispanic Americans in midlife.

However, in a broad sample of advanced economies IMF (2018) finds that manufacturing employment decline, in general, is not associated with an increase in inequality. In some countries—Denmark, France, Ireland—inequality declined despite a strong decline in manufacturing employment for the three different measures of inequality that we consider (Figure 1).[2] This suggests that factors other than manufacturing can be (more) important drivers of income inequality.

In this paper, we focus on individual advanced economies to explore their different experiences with manufacturing employment decline and income inequality between the 1980s and 2000s. First, we do a decomposition exercise to identify how the decline in the

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[2] The Gini index and generalized entropy are both standard measures of inequality. In this paper we use a sub-class of the generalized entropy index known as mean log deviation, or GE(0) for short, which is characterized by a high degree of inequality aversion. The Gini coefficient ranges from 0 (complete equality) to 1 (complete inequality). The GE(0) ranges from 0 (complete equality) to larger positive values of increasing inequality. The hollowing-out index was recently defined by Alichi et al. (2017); its goal is to measure the weight of the middle class in society, with larger values indicating greater inequality.

manufacturing sector employment might have affected within- and between-sector inequality. Second, we perform simulations to quantify how much of the change in inequality could possibly be attributed to the decline in manufacturing employment between the 1980s and 2000s in each country. Next, we zoom in on the United States and analyze two factors that may have exacerbated the potential for declining manufacturing to contribute to increasing inequality: namely, the size of the manufacturing wage premium and the initial level of income inequality.

One possibility is that U.S. workers forced to switch from the manufacturing to the service sector experience a large loss in income simply because they lose their manufacturing wage premium. This large loss of income among formerly well-paid manufacturing workers could then lead to an overall increase in inequality. We consistently estimate manufacturing wage premia for a set of advanced countries and show that manufacturing wage premia are indeed large in some countries, but insufficient to explain changes in overall income inequality.

Another possibility is that the magnitude of the income loss for those forced to switch from the manufacturing to the service sector

Figure 1. Manufacturing employment decline and the change in inequality
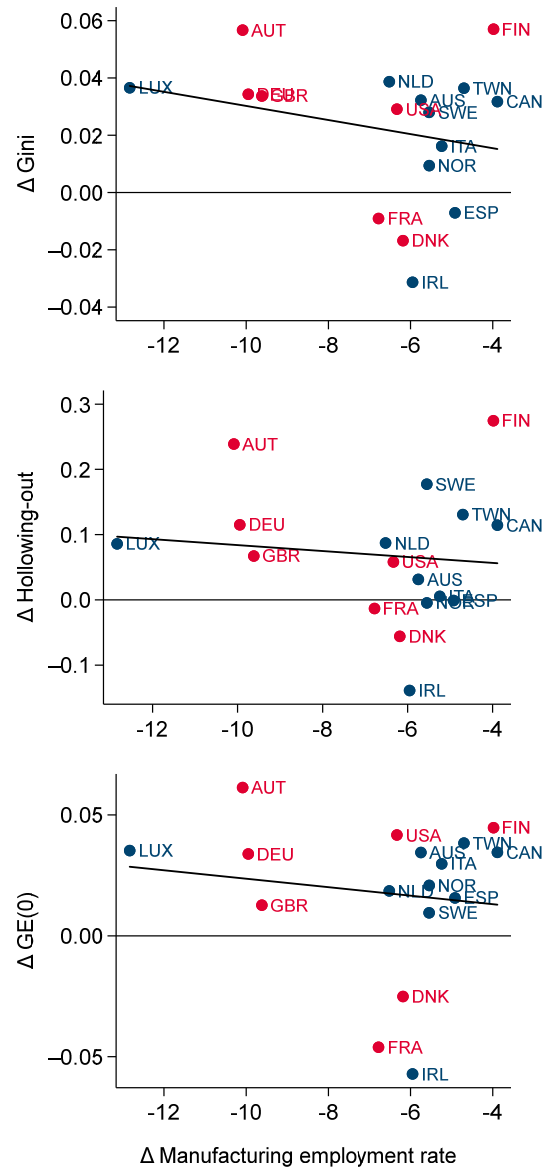
Sources: Inequality measures are from the Luxembourg Income Study. Manufacturing employment is from IMF (2018).
Note: The figure shows the change in inequality and manufacturing employment rate from the 1980s to the 2000s. Red colors indicate the country sample used in this paper's analysis. Fitted regression lines in black.

depends on the existing level of income inequality. Consider the example of a median middle-skill manufacturing worker (i.e. a worker receiving a median wage in the wage distribution for middle-skill manufacturing workers). Upon losing their job, and not finding a similar manufacturing job due to shrinking employment in the sector, they will likely seek

employment in the service sector. Without specific skills needed in the service sector, this worker will likely have to start at a low-skill service sector job and accept a wage cut relative to their old job in manufacturing. [3] Of course, there is some probability that they obtain a high wage job in the service sector, but this probability is likely low when they are new to the sector. Conditional on accepting a wage cut, middle-skill manufacturing workers will, on average, suffer a larger pay cut in countries with high wage dispersion, such as the U.S., than in countries with low wage dispersion. [4]

To explore these questions, we use micro-level survey data from the Luxembourg Income Study (LIS) database, which offers household and personal information on income, sector of employment, type of occupation, and other demographic characteristics. Based on this data, we estimate manufacturing wage premia, country-wide inequality, which we further decompose into inequality within and between different sectors of employment, and we perform a shift-share analysis. We focus on seven advanced economies—Austria, Denmark, Finland, France, Germany, the United Kingdom, and the United States—that have detailed employment data going back to the late 1980s. We then perform a thought-experiment using simulations with LIS data to quantify how much of the actual change in inequality could be attributed to the decline in manufacturing employment, and how these calculations are affected if we eliminate the manufacturing wage premium or compress the initial income distribution.

We present two main findings. First, the decline in manufacturing employment does not explain a large share of the change in inequality in any of the seven countries we study. Our decomposition exercise suggests that factors other than manufacturing are likely more important in explaining changes in overall inequality. However, the United States stands out as the country with the highest contribution of manufacturing decline toward rising inequality. For the United States, our simulations suggest that about a quarter of the rise in inequality could be attributed to the loss of manufacturing jobs.

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[3] In the United States, based on data from the Current Population Survey between 1994-2008, the majority of manufacturing workers who lost their job and found a new job, moved to the service sector (around 55%). Of those who are employed after manufacturing job loss, and switched to the service sector, over 60% experienced a decline in wages relative to their manufacturing wage. Among those who worked in manufacturing for more than 10 years before losing their job, around 80% experience a wage decline. The median wage decline was around 35%, and it is around 45% for those with more than 10 years of working in manufacturing.

[4] Based on data from the Luxembourg Income Study, detailed in Appendix Table 3, the income of a median middle-skill manufacturing worker in the United States in the 1980s was 107% of an overall median worker in the U.S., while the income of a 25th percentile low-skill service sector worker was 50% of an overall median worker. In contrast, in Finland, which has a more equal income distribution, these numbers are 103% (80%) for a median middle-skill manufacturing (25th percentile low-skill service) sector worker. Appendix Figures 1 and 2 present the clear positive relationship between income inequality and the difference between median middle-skill manufacturing wage and 25th percentile low-skill service sector wages. Of course, over time the movement of workers from middle-skill manufacturing jobs to low-skill service sector jobs may have further endogenously lowered the low-skill service sector wages (Autor 2015).

Second, to the best of our knowledge, we are the first paper to explore factors that might exacerbate the relationship between manufacturing employment decline and increasing inequality. We explore manufacturing wage premia and initial inequality as two such factors. We find that high initial inequality in the United States may have made manufacturing job loss particularly costly, more so than an initial manufacturing wage premium.

The rest of the paper is organized as follows. Section II introduces the data used in the analysis. Section III presents stylized facts on inequality and the shift-share analysis. Section IV presents our estimates of the manufacturing wage premia across advanced economies. In section V we present our simulation exercises. Section VI concludes.

II. DATA

We use micro-level survey data from the Luxembourg Income Study (LIS) database, which compiles independent datasets from many advanced countries and emerging market economies, and currently covers 48 countries with the earliest survey dating back to 1967. LIS provides income, employment, and demographic data in two "flavors": at the household level and at the personal level, i.e. separately for each household member. The major, and unique, strength of LIS data is that surveys are fully harmonized, so that reliable cross-country analysis of inequality is possible. However, weaknesses are that countries are not surveyed in every year, households cannot be linked over time, and surveys before the 1990s are rare and not as detailed.

We look at advanced economies and compare two decades: the 1980s, when manufacturing employment was relatively high, and the 2000s, when manufacturing employment declined significantly in many advanced economies. Our sample includes seven countries: Austria (1987, 2007), Denmark (1987, 2007), Finland (1987, 2007), France (1989, 2005), Germany[5] (1989, 2007), the United Kingdom (1986, 2007), and the United States (1986, 2007).[6] We do not consider years after 2008 to exclude changes in manufacturing employment or inequality that might be attributed to the Global Financial Crisis. Throughout the text when we refer to the 1980s or the 2000s, we are referring to the specific years listed above.

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[5] The data for Germany in 1989 is available only for the Federal Republic of Germany. We made a choice to use the data from 1989 rather than from the 1990s after reunification. We feel this choice is appropriate given our focus on manufacturing, which was largely driven by industries in West Germany.

[6] LIS provides cross-country harmonized dataset based on underlying data from Statistics Austria Microcensus (Austria 1987), Survey on Income and Living Conditions (Austria 2007, Finland 2007), Law Model (Denmark), Income Distribution Survey (Finland), Household Budget Survey (France), German Socio-Economic Panel (Germany), Family Expenditure Survey (UK 1986), Family Resources Survey (UK 2007), Current Population Survey (USA).

To calculate inequality, we use disposable household income, which comprises of labor income, capital income, social security transfer income, less income taxes and social security contributions. Following the LIS methodology for calculating inequality, household income is equivalized by the square root of the number of household members and top-/bottom-coded for outliers. The inequality measures are weighted by person-level adjusted weights (number of household members multiplied by the household sampling weights). Inequality by sector of employment is calculated by assigning households to sector of employment of the household head. Four broad sectors are considered (based on ISIC 3.1 classification): (1) agriculture and fishing; (2) services; (3) manufacturing; and (4) other industry (mining, construction, and electricity).[7]

When analyzing manufacturing employment premia, we also account for the workers' skill levels and demographic characteristics. Skill levels are determined according to the classification of occupations by the International Standard Classification of Occupations (ISCO): managers and professionals (ISCO 1 and 2) as high skill; other skilled workers (ISCO 3–8, 10) as middle skill; and laborers/elementary (ISCO 9) as low skill. The demographic characteristics include region of residence, gender, age, education, and, for the United States only, race (White, African-American, Asian). Education is classified into three categories: less than high school as low education level; high school as middle education level; and college and above as high education level.

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[7] Given our focus on manufacturing, we chose the sector breakdown that separates it from other industry. Taken together, the two sectors are available for more countries in LIS, and our findings using this broader combined sector are similar.

III. Inequality: Stylized Facts and Shift-share analysis

As we showed in Figure 1, many countries have experienced a rise in disposable income inequality between the late 1980s and the 2000s. There is, however, a substantial difference in the levels of inequality between these countries (Figure 2). Notably, while the United States is about average in our sample in terms of the *change* in inequality, it stands out as the most unequal country, in both the 1980s and the 2000s. This is true regardless of the measure of inequality used: the Gini index, the generalized entropy, or the hollowing-out index.

To understand the role of the manufacturing sector in overall inequality, as a first step, we turn to shift-share analysis, which is a traditional way to analyze changes in inequality over time and across sectors. For this purpose, we measure inequality with generalized entropy—GE(0), also called log mean deviation—because it is the only decomposable measure of inequality. We also use generalized entropy in all other parts of the paper. All the necessary mathematical derivations are presented in Appendix A.

First, we decompose inequality by sector of employment of the household head at two points in time: in the late 1980s and the 2000s. Second, we decompose the change in inequality over those 20 years into several components, such as pure within-sector changes in inequality, changes in sector size, and changes in sectoral income levels. This analysis sheds some light on the

Figure 2. The levels of inequality
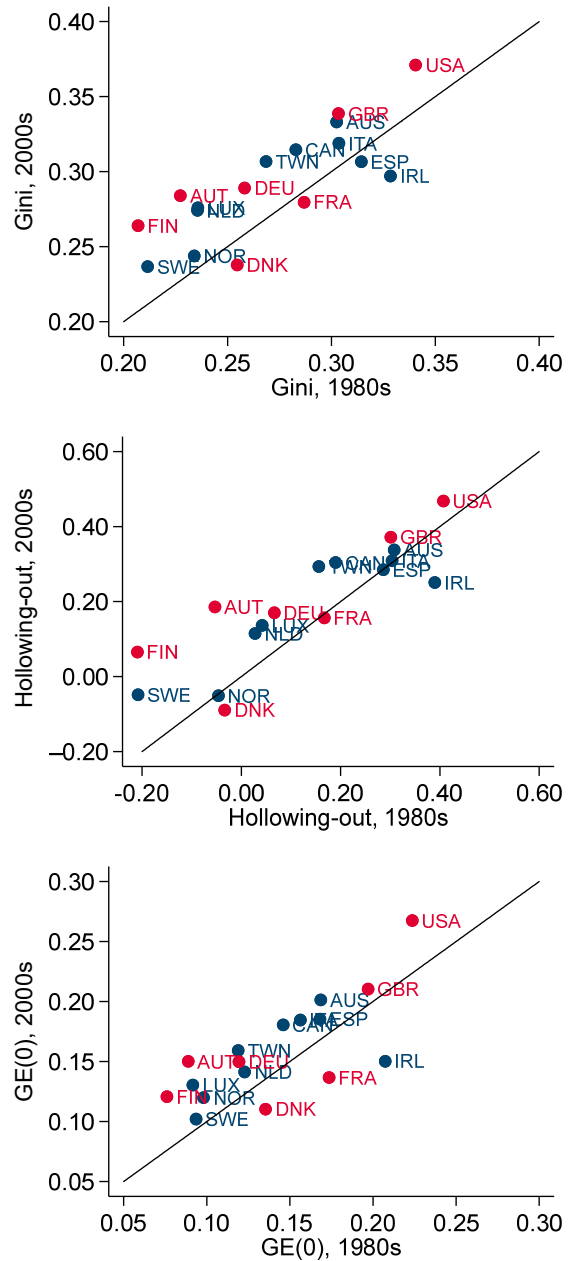
Source: Authors' calculations based on the Luxembourg Income Study database.
Note: Red colors indicate the country sample used in this paper's analysis. The 45° lines in black.

relative importance of changes in sector size, i.e. structural transformation, versus overall trends in inequality that affect all sectors. However, it cannot provide any insight into factors which may have helped some countries achieve a more equitable income distribution.

A. Inequality at a point in time: the 1980s and the 2000s

Overall inequality decomposed into within- and between-sector components (see eq.2 in Appendix A) for each of the seven advanced economies we study is presented in Figure 3. Within-sector inequality is shown for each of the four sectors: agriculture, manufacturing, services, and other industry (mining, construction, and electricity). We also include "missing" as an additional sector, whenever information about the sector of employment of the household head is unavailable, for example, if the household head is unemployed, out of the labor force, or if the data is simply missing. This is done to ensure that the aggregate country-wide inequality (i.e. the sum of all within and between components) is calculated for the entire population.

This decomposition indicates that most of the variation in inequality is due to inequality within sectors (red bars), rather than between sectors (blue bars, Figure 3). This is expected when each sector has workers with both high and low wages. In contrast, the between-sector component would be very large if there were some sectors where all workers received high wages and other sectors where all received low wages.[8]

Figure 3. Within- and between-sector inequality
(Index GE(0))
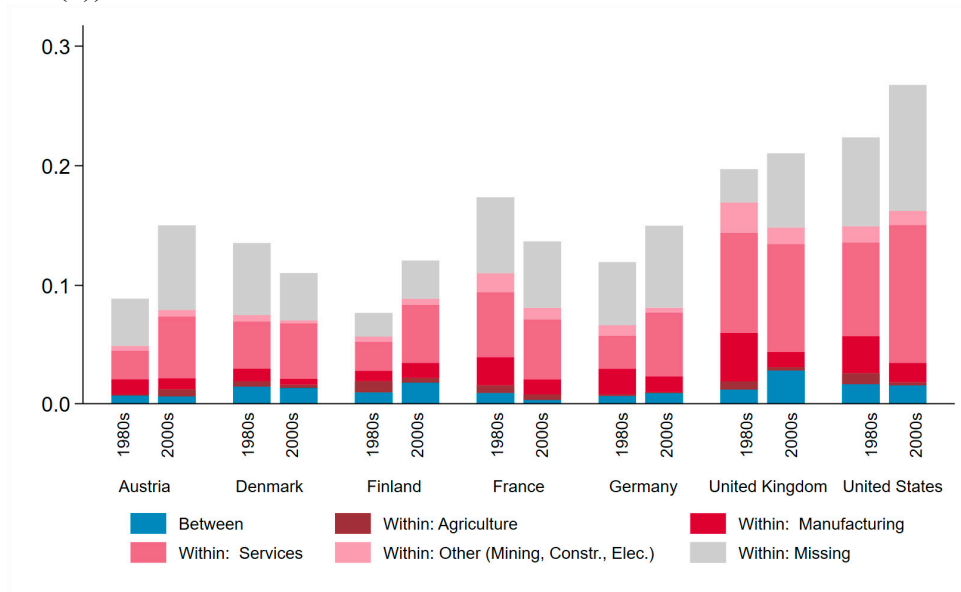
Source: Authors' calculations based on the Luxembourg Income Study database.
Note: The between-sector inequality (blue bar) is the sum of the between components for each sector, including the "missing" category.

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[8] It is difficult to infer from Figure 3 whether inequality is higher within the manufacturing or the service sector because each sectoral component in Figure 3 is weighed by the size of the sector, so that all the components would add up to the total economy-wide inequality.

In Figure 4, we compare inequality in the manufacturing and service sectors in each country, without weighting by sector size as in Figure 3. It is clear from the figure that these two variables are strongly correlated—in any given country, if inequality is high (low) in services it is also high (low) in manufacturing. This suggests that country characteristics are more important drivers of inequality, rather than sectoral differences. In addition, the graph reveals that inequality is somewhat higher in the service sector in all countries, as observations are located below the 45° line. To some extent, of course, greater wage dispersion in the service sector is expected given that it is typically a much larger and diverse sector than manufacturing. Appendix Table 3 provides points in the wage distrubtions for different sectors and skill levels for our sample of advanced countries.

Figure 4. Manufacturing vs. Services, the 2000s
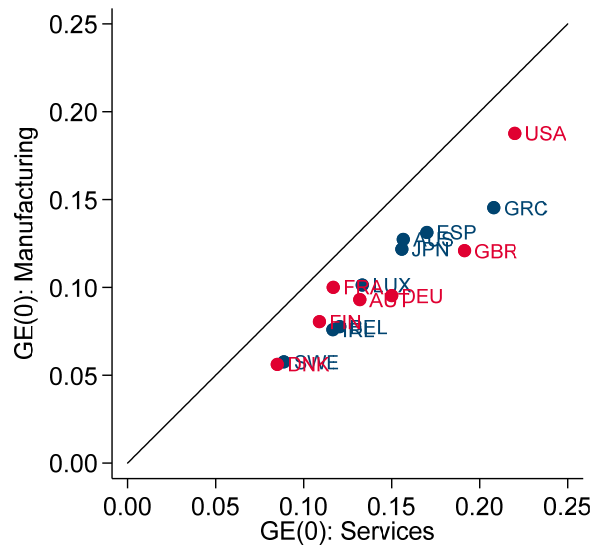
Source: Authors' calculations based on the Luxembourg Income Study database.
Note: Red colors indicate the country sample used in the analysis.

B. Change in inequality over time: Shift-share analysis

Changes in inequality, as measured by generalized entropy, can be analyzed over time by differencing the decompositions in the 1980s and the 2000s (see eq.3 in Appendix A). This can show how much of the change in inequality over time is due to changes in purely within- and between-sector components, and how changes in sector size over time additionally affect within- and between-sector inequality.

Specifically, the four terms in this decomposition over time are interpreted as: (1) intertemporal changes in pure 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) changes in the relative average sectoral income levels (Mookherjee and Shorrocks, 1982). Figure 5 shows the results of that decomposition for our sample of advanced economies, and the mathematical derivations of the four terms are relegated to Appendix A.

Figure 5. Changes in inequality: decomposition over time
(Index GE(0))
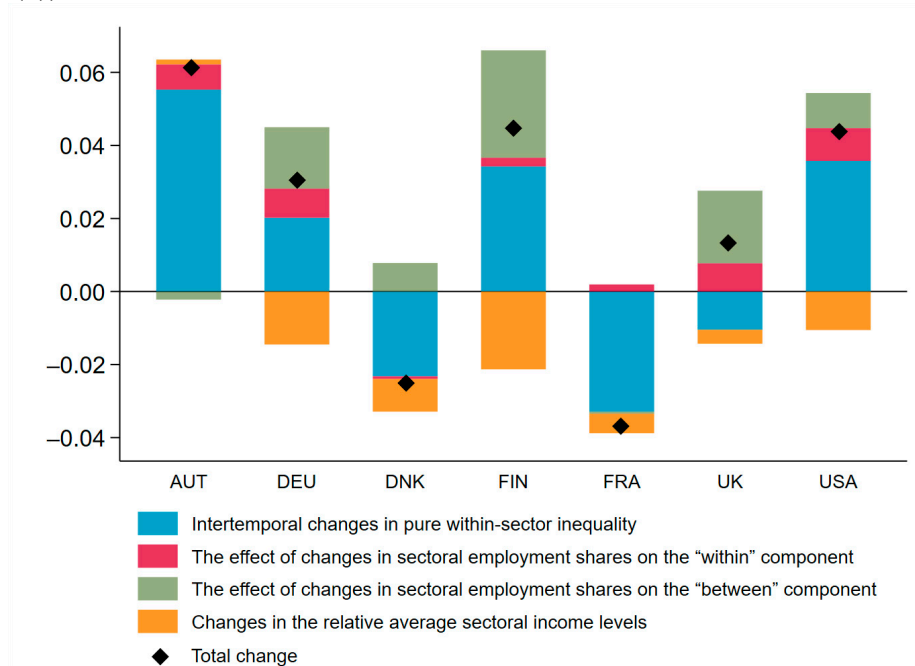
Source: Authors' calculations based on the Luxembourg Income Study database.

The most salient finding from this decomposition is that the change in inequality is mostly due to changes in pure within-sector inequality (i.e. the blue bars are the largest). This key point is also displayed in Figure 6, where we plot overall versus within-sector change in inequality and see that all the countries are aligned closely along the 45° line.

Second, changes in sector size (and in this sample this is mostly due to the decline in manufacturing employment) contribute towards increasing inequality in almost all the countries we consider. This corresponds to the fact that the green and red bars are almost always positive in Figure 5, which gives some credence to the anxiety about manufacturing employment losses.

Figure 6. Overall vs. pure within-sector change in inequality
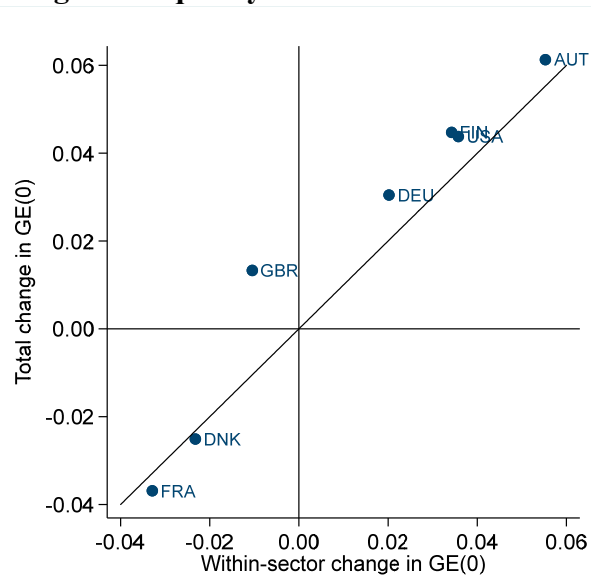
Source: Authors' calculations based on the Luxembourg Income Study database.

Third, the effect of changes in sector size on the within-sector inequality are generally not very large in this sample (i.e. red bars are small). Hence, even though manufacturing job losses may have contributed to higher inequality, it does not appear that manufacturing decline is the main component that is driving overall increases in inequality. Instead, as mentioned above, pure within-sector inequality is typically the largest component explaining the overall change in inequality between the 1980s and the 2000s in our sample of countries. Pure within-sector inequality is likely to happen for other reasons, separate from structural transformation, such as changes in taxation, changes in social safety nets, unemployment benefits, etc.

Finally, the effect of sector size on between-sector inequality (green bars) and the change in average sector income levels (yellow bars) typically offset each other, being of opposite sign and relatively similar magnitude. This means that direct and indirect changes in between-sector inequality are not important in driving overall changes in inequality over this period.

IV. MANUFACTURING WAGE PREMIA

To illustrate the evolution of manufacturing wage premia over time, we begin by showing the premia for Germany and the United States[9] since the 1980s (Figure 7). Over this period, the manufacturing wage premium in the United States steadily declined from around 14 percent to 7 percent, while the premium in Germany generally hovered between 8 and 14 percent.[10]

The wage premium is calculated using personal-level LIS files by regressing the natural logarithm of gross hourly wage on indicator variables for each worker's sector of employment, controlling for skill-level, education, and other characteristics such as gender, age, region and race[11], as in the following equation:

$$\ln(W_i) = \alpha_0 + \beta_M Sector_i^M + \beta_A Sector_i^A + \alpha_H Skill_i^H + \alpha_M Skill_i^M + \gamma_H Education_i^H + \\ + \gamma_M Education_i^M + Controls + \varepsilon_i,$$

in which i indexes individuals and ε_i are robust standard errors. The skill level, education, and sector of employment enter as indicator variables (L = low, M = middle, H = high for skill and education levels; and A = agriculture, M = manufacturing, S = service for sectors).

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[9] Germany and the USA are used for comparison since these are the only two LIS countries with such long and frequent historical data on individual workers' incomes.

[10] Helper, Krueger and Wial (2012) estimate that the manufacturing wage premium in the United States is around 8.4 percent, which is close to our estimate around 2010. However, they estimate the manufacturing wage premium compared with non-manufacturing in general, rather than comparing manufacturing with services, as we do in this paper.

[11] Race information was only available in the United States.

The coefficient of interest—β_M for the manufacturing sector, which is measured with respect to the service sector—is plotted in Figure 7. Full estimation results are presented in Appendix B.

We also calculate manufacturing wage premia in the 1980s and the 2000s using household-level files (Figure 8), because this allows greater country coverage.[12] Household-level files record the total disposable income for the whole household, equalized by the number of household members. This equalization serves as a proxy for the total number of adults in a household, each of whom receive the same income. We label a household as a "manufacturing household" if the household head is employed in manufacturing.

Figure 7. Manufacturing wage premia: United States vs. Germany (personal-level files)
(Percent)
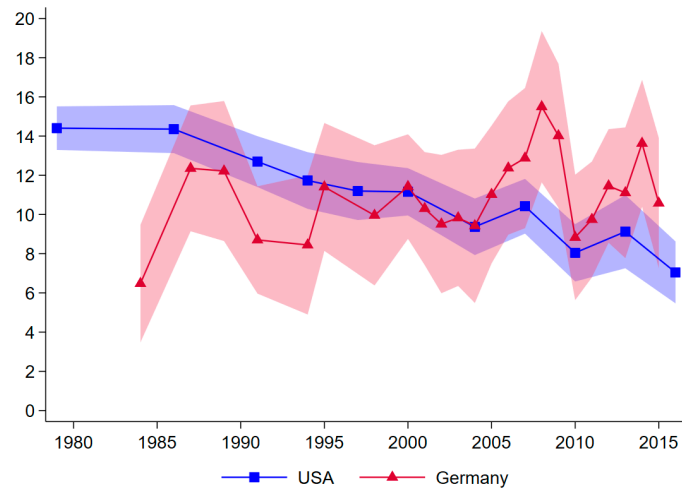
Source: Authors' calculations based on the Luxembourg Income Study database.
Note: Shaded areas represent 95% confidence intervals. Regression results are presented in Appendix B, Table 1.

The manufacturing premium using household data is calculated as in the above equation, but now *i* indexes households, instead of individuals. Certainly, the manufacturing wage premium calculated at the household level should be lower than when it is calculated at the personal level because a sizable portion of the household income could be coming from a second earner who works outside of manufacturing, and because income is recorded after taxes and transfers. For example, for Germany and the United States we can compare the estimates in Figures 7 and 8, to find that the manufacturing wage premium estimated at the personal level is about 6 to 8 percentage points higher than that estimated at the household level.

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[12] The personal-level files in LIS are generally preferable for calculating wage premia, as they only use the wage of the manufacturing sector worker while ignoring other household income. But wage information from personal-level files is available for only a limited set of countries, and typically only in the 2000s.

In Figure 8, the large magnitude of the manufacturing household wage premium in the United States in the 1980s is notable, and it is staggering when compared to other advanced countries at the time. In the 1980s, the United States manufacturing household premium is twice the size of the next largest premium (in Denmark), and these are the only two countries where the premium is statistically different from zero. By the 2000s, the manufacturing premium in the United States declined

Figure 8. Manufacturing wage premia in the 1980s and the 2000s (household-level files)
(Percent)

Source: Authors' calculations based on the Luxembourg Income Study database.
Note: Error bars represent 95% confidence intervals. Regression results are presented in Appendix B, Table 2.

substantially. Meanwhile, other countries—such as the United Kingdom, Finland, France and Denmark—have developed manufacturing premia of about 4–8 percent at the household level. Given this wage premium, manufacturing workers could be wary of changing sectors because for them even a perfect job in the service sector, i.e. one that would perfectly match their skills and characteristics, would on average offer a lower salary.

V. HOW MUCH COULD DECLINING MANUFACTURING EMPLOYMENT INCREASE INEQUALITY?

Ideally, to gauge the extent to which declining manufacturing employment might increase inequality, we would study the evolution of wages, benefits and household income of those who lost manufacturing jobs. Then we would calculate changes in inequality in their communities and evaluate the contribution of manufacturing employment loss. However, such data are unavailable in a comparable cross-country setting. We rely on LIS data, which allows impeccable cross-country comparability in terms of inequality analysis but does not allow us to follow individuals over time.

Our approach is to do a simple thought-experiment. We assume the following scenario in terms of inequality: that all manufacturing jobs that were lost (and not replaced) between the 1980s and 2000s belonged to middle-skill workers, who then had to accept employment in low-skill service sector jobs with a lower wage. This dynamic should increase inequality as middle-skill manufacturing workers are forced to move from approximately the middle to the bottom of the income distribution. The change in inequality that results from such reallocation of workers across sectors gives us an estimate of the potential effect that the decline of manufacturing employment might have on inequality. We do this for all countries
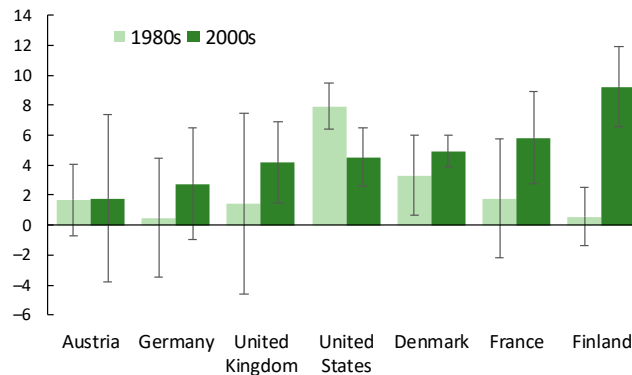
in our sample. We then extend this framework to see how a lower manufacturing premium or lower initial inequality would affect the change in inequality in the United States.

A.   A baseline scenario: results

We imagine instant structural transformation, i.e. each economy in our sample instantly moves from high manufacturing employment to low manufacturing employment. Excess manufacturing workers are all assumed to move to the service sector. To make it most unfavorable for inequality, we assume that only middle-income manufacturing workers are forced to move, and they *all* must take low-paying service sector jobs. No other workers change their jobs or income. We evaluate the effects of this scenario using generalized entropy and data from the Luxembourg Income Study, as in the previous sections.

We make the following specific assumptions. We define the number of jobs lost between the 1980s and the 2000s as the difference between the total number of households employed in manufacturing[13] in the 2000s and the 1980s. Then, we randomly pick middle-skill manufacturing households from the 1980s LIS survey, reassign them to the service sector and set their disposable household income at the 25th percentile of the distribution of *low*-skilled service sector disposable household incomes in the 1980s.[14][15] Then we calculate the hypothetical resulting inequality in each country under these assumptions, keeping the jobs and wages of all other households fixed. Note that the assumption that middle-skill manufacturing workers are forced to take a *very* low wage—specifically, at the 25th percentile of the low-skill service sector distribution—suggests that our findings should be interpreted as an upper bound of the possible effect of declining manufacturing jobs on inequality.

These results are presented in Figure 9. The blue bars indicate the difference between inequality calculated under the hypothetical scenario and actual inequality in the 1980s, while the yellow bars show the actual difference in inequality over time. In other words, the blue bars represent the change in inequality that is attributed to structural transformation, i.e. the reallocation of household heads from middle-skill manufacturing jobs to low-skill service sector jobs. The confidence intervals on the blue bars show the maximum and the minimum

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[13] The sector of employment of the household head is used to assign households to sectors (similarly, for occupation: high skill, middle skill, and low skill). The number of households in a sector is measured as the sum of household weights that were scaled to the total household population size for the country in a given year.

[14] The wage distributions by sector and skill are summarized for each country in Table 3 in the Appendix. These can be used to compare the size of the assumed wage cuts in each country.

[15] We pick middle-skill manufacturing households at random, until the total number of households to be reallocated matches the number of households that actually lost manufacturing sector jobs between the 1980s and the 2000s.

difference in hypothetical scenario and actual inequality obtained from 100 random seeds to determine which households are reallocated in the 1980s.[16]

There are two main messages from this exercise. First, the negative effect on inequality attributable solely to manufacturing job loss is, in fact, very small. In all the countries in our sample, except the United States, the effect is negligible compared to the actual change in inequality between the 1980s and the 2000s. Second, the simulated negative effect is the highest in the United States, where it explains around a quarter of the overall increase in inequality from the 1980s to the 2000s. Given the large magnitude of the simulated negative effect in the United States, which is in contrast with the rest of advanced economies, we seek to determine which factors in the United States may have contributed to the more pronounced negative relationship between manufacturing decline and a rise in inequality.

Figure 9. Actual changes in inequality vs. simulation

(Change in GE(0) index)
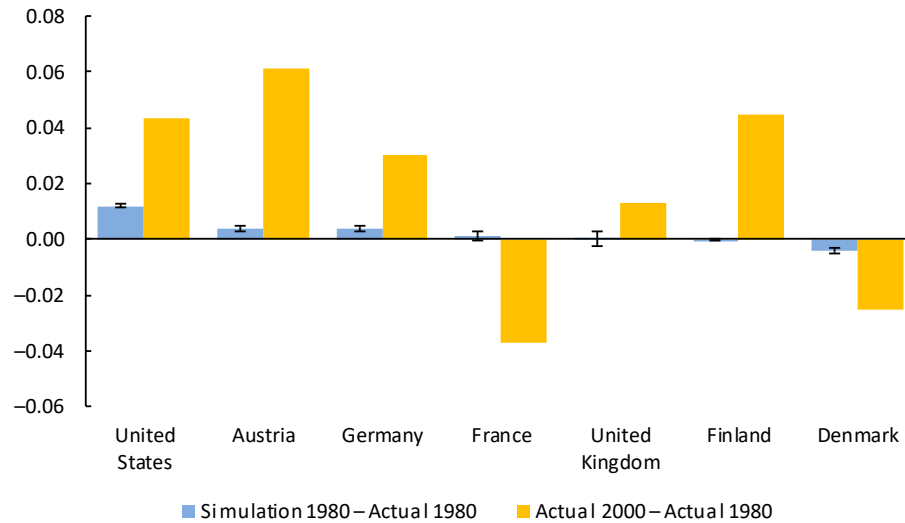
Source: Authors' calculations based on the Luxembourg Income Study database.
Note: Blue bars represent the difference between inequality estimated using the hypothetical income distribution in the 1980s (where middle-skill manufacturing households are reassigned to low-skill service sector with a wage at the 25th percentile of the low-skilled service sector wage distribution, to simulate the decline in manufacturing employment that took place between the 1980s and the 2000s) and the actual inequality in the 1980s. The yellow bars represent the actual change in inequality between the 1980s and the 2000s. The confidence intervals on the blue bars show the maximum and the minimum difference in hypothetical scenario and actual inequality obtained from 100 random seeds to determine which households are reallocated in the 1980s.

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[16] Readers may wonder how it is possible that the blue bars are ever negative, as is the case in Denmark and Finland. The reasoning would be that—if middle-skilled workers lose their jobs and get a lower salary—inequality could only worsen, not improve. In practice, however, whether inequality improves or worsens will depend on the income distribution of workers before the reassignment. If a country is very equal to begin with—such as Finland and Denmark—then the wage differences between low skilled and middle skilled workers might not be large, so that increasing the mass of "poorer" people would make the society overall more, rather than less, equal. Also, generalized entropy is a measure of inequality that puts heavier weight on the poor.

B.   What if the United States had a lower initial wage premium?

Now we extend our thought-experiment to evaluate the role of the manufacturing wage premium. To do that, we reduce the initial income of all manufacturing households in the United States by the size of the estimated manufacturing wage premium in the 1980s. In other words, we assume the manufacturing wage premium is equal to zero. We keep the rest of our assumptions unchanged. Since we assume no change in the wages of service sector jobs, the reassigned workers obtain the same wage in the service sector as in our baseline. The only difference compared to the baseline is that the workers who are reassigned from manufacturing to services suffer a smaller loss in disposable income because, in the absence of a manufacturing wage premium, their manufacturing wage is now assumed to have been initially lower.

Figure 10. United States: Actual changes in inequality vs. simulation without a manufacturing wage premium
(Change in GE(0) index)
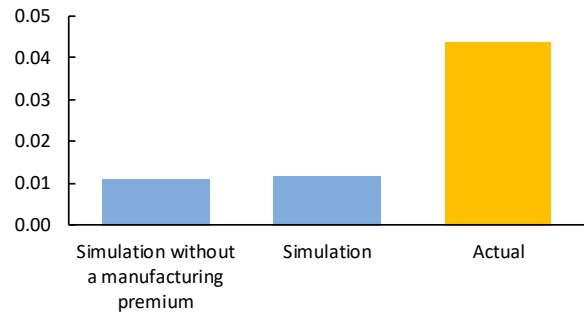
Source: Authors' calculations based on the Luxembourg Income Study database.
Note: Bars "Simulation" and "Actual" are the same as presented in Figure 9 for the United States.

This exercise shows that the elimination of the manufacturing wage premium, as estimated at the household level, makes almost no difference compared to our initial findings (Figure 10). Given the large magnitude of the estimated manufacturing household wage premium in the United States in the 1980s (see Figure 8), it might seem surprising that its elimination would not make a big difference. However, while the U.S. manufacturing wage premium from the 1980s was very high in comparison to other countries, its magnitude was small in comparison to the loss of income associated with moving from the median middle skilled manufacturing wage to a 25th percentile low income service sector wage (see Appendix C).

C.   What if the United States had lower initial inequality?

Next, instead of changing the wage premium, we compress the 1980s income distribution in the United States so that it equals that of an average of Finland, Austria, Denmark, and Germany—the four most equal countries in our sample. Specifically, we start by calculating for each U.S. household its deviation from the median household income ($Actual_{HH} - Median_{HH}$). Then, we calculate new household income as:

$$New_{HH} = Median_{HH} + \alpha * (Actual_{HH} - Median_{HH}).$$

We solve this computationally by iterating over different values of the parameter α that compresses the income distribution, such that generalized entropy for the U.S. in the 1980s when New_{HH} is used is approximately equal to 0.1, which is the average generalized entropy for Finland, Austria, Denmark, and Germany. We find $\alpha = 0.7$.

Compressing the U.S. income distribution in this way preserves the value of the median income in the economy, as well as the complete ordering of household incomes. The key difference is that each household's income is now closer to the median income than it was in the actual 1980s distribution.

Figure 11. United States: Actual changes in inequality vs. simulation with compressed income distribution
(Change in GE(0) index)

Source: Authors' calculations based on the Luxembourg Income Study database.
Note: Bars "Simulation" and "Actual" are the same as presented in Figure 9 for the United States.

Given that the whole income distribution is now compressed, in our hypothetical scenario households that are randomly picked for reallocation from manufacturing to the service sector are assigned new household income at the 25th percentile of the low-skill service sector, which is higher compared to what it was in the baseline distribution.

Our analysis suggests that the level of initial inequality is crucial. Had the United States had a more equal income distribution in the 1980s, the increase in inequality due to the loss of manufacturing employment could have been much smaller, and in line with the rest of the countries in the sample. This contrast is striking. Comparing the two blue bars in Figure 11—the simulation with the compressed distribution versus the baseline (i.e. the original distribution)—reveals that with lower initial inequality the increase in inequality is approximately halved.

D. Discussion

Our thought experiment has its advantages and weaknesses. While it uncovers interesting patterns in the data, it may lead to an overestimate or an underestimate of the effect of manufacturing employment decline on inequality by ignoring other economic forces.

For example, the assumption that workers immediately shift from manufacturing to service sector employment—rather than unemployment—would cause us to underestimate the true negative effects. If the associated unemployment is temporary, this simplification may be
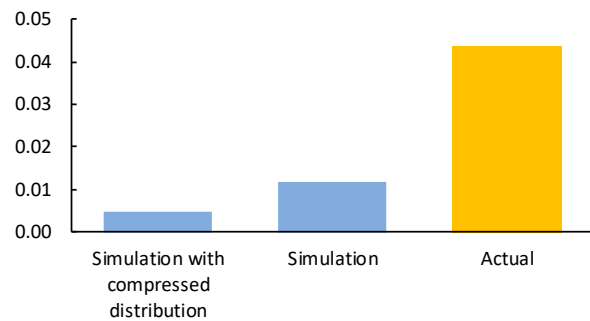
appropriate. However, long unemployment spells could have permanent negative effects which should not be ignored. Unemployment during the transition towards more service sector employment can be extremely painful for the affected workers and could affect entire communities. Walker (2013) suggests that these unemployment spells were long and very costly for workers in the United States.

Also, we may underestimate the effect if the switch from manufacturing to services leads to more competition for jobs, such that low-skill service sector wages fall. This would increase the loss of income for those who switch from manufacturing to services beyond our assumptions and, by pushing them even lower down the income distribution, would further increase inequality. Autor (2015) suggests this may have happened in the United States.

On the other hand, our assumptions may lead to an overestimate because not all middle-skilled workers who lose their jobs might move to low-skill service sector jobs that are also low paid. Alichi et al. (2013) use data from the United States to show that about one third of U.S. workers who lost manufacturing jobs have actually moved to high skilled jobs. Furthermore, even the remaining two-thirds of workers who stay at middle-skill or go to low-skill jobs in services do not necessarily end up with wages at the low end of the low-skill distribution.

Nevertheless, analysis using this thought-experiment suggest several important findings:
- Except for the United States, it seems unlikely that the decline of manufacturing employment was associated with significant increases in inequality in advanced economies. Rather, it seems that other forces, unrelated to manufacturing, may have played a role.

- In our sample, the United States is the only country where manufacturing decline may have been an important contribution to rising inequality. High initial income inequality in the U.S. in the 1980s—which implied a large gap between low-skill service sector wages and middle-skill manufacturing sector wages—probably exacerbated this. In contrast, high manufacturing wage premium in the U.S. seems to have played a minor role.

- Some emerging markets that are still expanding their manufacturing sectors have a high level of inequality. Our analysis suggests that this may pose a problem in the future when these countries reduce manufacturing employment in a shift toward larger service sectors (Appendix Figure 2).

VI. Conclusion

This paper explores whether manufacturing employment decline is associated with increases in inequality, and whether factors such as high initial inequality or a manufacturing wage premium may exacerbate that relationship.

We base our analysis on a sample of seven advanced economies (Austria, Denmark, France, Finland, Germany, United Kingdom, United States) from the late 1980s to the 2000s using consistent household survey data from the Luxembourg Income Study database. We explore the levels of inequality, with decomposition into within- and between-sector inequality, and estimate manufacturing wage premia across these countries. We use simulations to quantify how much of the actual change in inequality could be attributed to the decline in manufacturing employment, under the assumption that displaced manufacturing workers find low-skill service sector employment. We extend this analysis to calculate what inequality might have been if there were no manufacturing wage premium, or if initial inequality were lower.

We find that declining manufacturing employment generally does contribute to rising inequality, however this contribution is minor compared to all other factors that also affect inequality. One exception is the United States, where in our baseline scenario we calculate that about a quarter of the rise in inequality between the late 1980s and 2000s may have been due to the loss of manufacturing jobs.

We further find that for the United States, which had the largest manufacturing wage premium in our sample in the 1980s, eliminating the manufacturing wage premium would not have significantly lessened the negative contribution of manufacturing employment decline towards rising inequality. However, given that the United States has the highest level of inequality in our sample, we find that compressing the U.S. income distribution in the late 1980s to make it more equal—matching the average of Finland, Austria, Denmark, and Germany—would significantly lessen the blow from manufacturing employment decline. Specifically, with a compressed income distribution manufacturing employment decline would explain only about ten percent of the actual increase in inequality in the United States. This is significantly less than under our baseline scenario and in line with what we calculate for other countries.

Of course, the loss of manufacturing jobs and their replacement with lower-paying service jobs carried with it more than income losses. In the United States, these job losses meant loss of good pensions and good health insurance, which low-paying service jobs rarely provide. Moreover, in the United States job stability in low-paying service sector jobs is very low when compared with job stability of the manufacturing sector. These factors can help explain why the societal effects associated with manufacturing job losses in the United States may have been greater than income distribution metrics alone can explain.

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APPENDIX

A. Generalized Entropy and Shift-Share Analysis Formulas

The measure of inequality used for the shift-share analysis is the generalized entropy index, or, more specifically, mean log deviation. It has the advantage of being decomposable, unlike the Gini coefficient (Shorrocks 1980; Mookherjee and Shorrocks 1982). The mean log deviation, or GE(0), is defined as:[17]

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

in which i indexes households, n is the total 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 inequality in each sector (within-sector inequality) and the contribution arising from differences between average incomes across sectors (between-sector inequality):

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

in which $v_k = \frac{n_k}{n}$ is the employment 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 sectoral level. Figure 3 in the main text shows between sector inequality and within-sector inequality separately for each sector in each country we study.

Changes in inequality over time can be analyzed by applying the difference operator to both sides of equation 2 above:

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

The four terms can be interpreted as: (1) intertemporal changes in pure 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) changes in the relative average sectoral income levels (Mookherjee and Shorrocks 1982).

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[17]The general formula for generalized entropy is

$GE(\alpha) = \frac{1}{n\alpha(\alpha-1)}\sum_i [(\frac{y_i}{\overline{y}})^{\alpha} - 1]$, when $\alpha \neq 0,1$. When α=0, GE is defined as in equation 1.

B. Regression results

Manufacturing wage premia is estimated using gross hourly wage from personal-level LIS datasets in Table 1 (as presented in Figure 7, for the 1980s and 2000s) and using equalized disposable household income in Table 2 (as presented in Figure 8).

Table 1: Manufacturing wage premia (personal level)

	Germany		United States	
	1989	2007	1986	2007
Sector: Manufacturing	0.122 ***	0.129 ***	0.144 ***	0.104 ***
	(0.018)	(0.018)	(0.006)	(0.007)
Sector: Other Industry	0.076 ***	0.063 **	0.161 ***	0.122 ***
	(0.026)	(0.026)	(0.011)	(0.009)
Sector: Agriculture	-0.492 **	-0.218 ***	-0.405 ***	-0.280 ***
	(0.213)	(0.081)	(0.031)	(0.032)
Skill: High	0.201 ***	0.520 ***	0.373 ***	0.514 ***
	(0.048)	(0.047)	(0.013)	(0.012)
Skill: Medium	0.012	0.274 ***	0.145 ***	0.205 ***
	(0.033)	(0.043)	(0.011)	(0.011)
Education: High	0.431 ***	0.464 ***	0.488 ***	0.566 ***
	(0.042)	(0.036)	(0.011)	(0.011)
Education: Medium	0.288 ***	0.258 ***	0.276 ***	0.271 ***
	(0.028)	(0.033)	(0.009)	(0.010)
Age	0.096 ***	0.095 ***	0.067 ***	0.058 ***
	(0.006)	(0.005)	(0.002)	(0.001)
Age^2	-0.001 ***	-0.001 ***	-0.001 ***	-0.001 ***
	(0.000)	(0.000)	(0.000)	(0.000)
Sex: Male	0.138 ***	0.140 ***	0.318 ***	0.236 ***
	(0.018)	(0.017)	(0.006)	(0.005)
Region Fixed Effects	Yes	Yes	Yes	Yes
Race Fixed Effects	No	No	Yes	Yes
Number of Observations	4,127	6,865	51,584	73,648
R^2	0.49	0.45	0.32	0.31

Note: Regressions are estimated using personal-level files. Dependent variable is natural logarithm of gross hourly wage (observation with negative gross hourly wage are excluded and outliers are top-coded at ten times the median). Low skill, low education, and service sector variables are excluded to account for multicollinearity. Sample is restricted to household members that are employed full time. Personal sampling weights are used. Robust standard errors in parenthesis.

* $p<0.1$; ** $p<0.05$; *** $p<0.01$.

Table 2: Manufacturing wage premia (household level)

	Austria		Denmark		Finland		France		Germany		United Kingdom		United States	
	1987	2007	1987	2007	1987	2007	1989	2005	1989	2007	1986	2007	1986	2007
Sector: Manufacturing	0.017	0.018	0.033 **	0.049 ***	0.006	0.092 ***	0.018	0.058 ***	0.005	0.028	0.014	0.042 ***	0.079 ***	0.045 ***
	(0.012)	(0.029)	(0.014)	(0.005)	(0.010)	(0.014)	(0.020)	(0.016)	(0.020)	(0.019)	(0.031)	(0.014)	(0.008)	(0.010)
Sector: Other Industry	-0.006	-0.076	0.024	0.044 ***	0.002	0.052 ***	-0.105 ***	-0.008	-0.041	0.018	-0.016	0.050 **	0.017	0.018
	(0.015)	(0.050)	(0.016)	(0.008)	(0.012)	(0.019)	(0.028)	(0.020)	(0.037)	(0.028)	(0.040)	(0.020)	(0.012)	(0.012)
Sector: Agriculture	-0.020	-0.055	-0.299 ***	-0.380 ***	-0.103 ***	0.048 **	-0.232 ***	-0.137 ***	-0.067	-0.033	-0.251 ***	-0.328 ***	-0.422 ***	-0.062 **
	(0.069)	(0.060)	(0.030)	(0.067)	(0.018)	(0.024)	(0.042)	(0.035)	(0.070)	(0.052)	(0.088)	(0.088)	(0.032)	(0.029)
Skill: High	0.295 ***	0.276 ***	0.008	0.237 ***	0.093 ***	0.331 ***	0.271 ***	0.420 ***	0.261 ***	0.467 ***	0.355 ***	0.386 ***	0.297 ***	0.408 ***
	(0.029)	(0.054)	(0.020)	(0.009)	(0.019)	(0.029)	(0.041)	(0.029)	(0.051)	(0.047)	(0.051)	(0.021)	(0.015)	(0.015)
Skill: Medium	0.166 ***	0.149 ***	-0.003	0.104 ***	0.007	0.147 ***	0.137 ***	0.145 ***	0.101 ***	0.245 ***	0.137 ***	0.176 ***	0.122 ***	0.171 ***
	(0.020)	(0.038)	(0.017)	(0.007)	(0.015)	(0.026)	(0.022)	(0.023)	(0.035)	(0.042)	(0.045)	(0.019)	(0.014)	(0.014)
Education: High	0.210 ***	0.212 ***	0.132 ***	0.103 ***	0.223 ***	0.223 ***	0.315 ***	0.314 ***	0.352 ***	0.279 ***	0.000 ***	0.421 ***	0.523 ***	0.619 ***
	(0.031)	(0.059)	(0.017)	(0.007)	(0.017)	(0.023)	(0.040)	(0.021)	(0.044)	(0.039)	(0.000)	(0.022)	(0.013)	(0.014)
Education: Medium	0.172 ***	0.124 **	0.034 ***	0.050 ***	0.054 ***	0.090 ***	0.088 ***	0.151 ***	0.196 ***	0.093 ***	0.000 ***	0.159 ***	0.285 ***	0.344 ***
	(0.014)	(0.048)	(0.012)	(0.006)	(0.010)	(0.020)	(0.019)	(0.016)	(0.032)	(0.035)	(0.000)	(0.019)	(0.011)	(0.013)
Age	0.010 **	0.028 **	0.022 ***	0.039 ***	0.020 ***	0.013 ***	0.021 ***	0.006	0.006	0.026 ***	0.026 ***	0.009 **	0.023 ***	0.024 ***
	(0.004)	(0.011)	(0.003)	(0.001)	(0.003)	(0.004)	(0.007)	(0.005)	(0.008)	(0.007)	(0.006)	(0.004)	(0.002)	(0.002)
Age^2	0.000	0.000	0.000 ***	0.000 ***	0.000 ***	0.000	0.000 **	0.000	0.000	0.000 **	0.000 ***	0.000	0.000 ***	0.000 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sex: Male	0.276 ***	-0.057 **	0.302 ***	0.006	0.251 ***	0.141 ***	0.192 ***	0.058 ***	0.036	0.020	0.168 ***	0.076 ***	0.213 ***	0.125 ***
	(0.017)	(0.024)	(0.014)	(0.005)	(0.013)	(0.014)	(0.027)	(0.014)	(0.028)	(0.019)	(0.043)	(0.013)	(0.010)	(0.007)
Region Fixed Effects	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Race Fixed Effects	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes
Number of Observations	5,262	2,802	7,120	43,223	8,161	7,230	5,296	6,321	2,954	5,889	4,599	14,059	38,791	50,585
R^2	0.32	0.12	0.15	0.17	0.20	0.25	0.12	0.25	0.18	0.24	0.05	0.17	0.25	0.24

Note: Regressions are estimated using household-level files. Dependent variable is natural logarithm of disposable household income, equivalized by the square root of the number of household members and top-/bottom-coded for outliers. Households are assigned to a sector of employment using information for the household head. Low skill, low education, and service sector variables are excluded to account for multicollinearity. Regressions are weighted by household sampling weights times the number of household members. Robust standard errors in parenthesis.

* $p<0.1$; ** $p<0.05$; *** $p<0.01$.
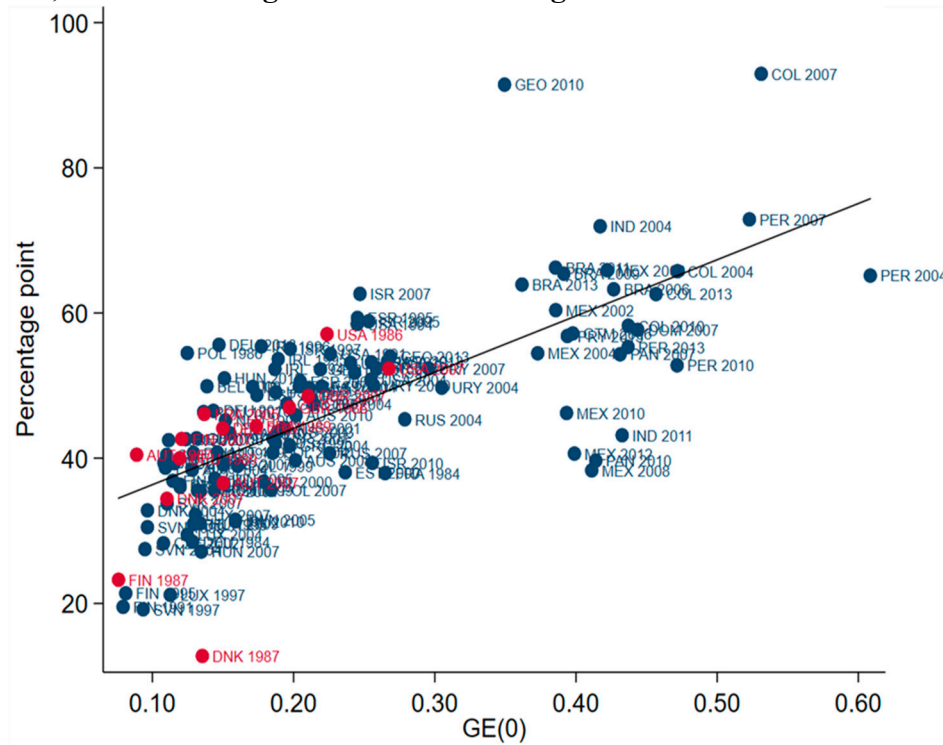
C. Wages by sector and skill: 1980s and 2000s

To have a sense of the overall wage distribution by sector and skill in each country, Table 3 below presents the 10th, 25th, 50th, 75th and 90th percentile of the distribution of wages for the economy overall, and in manufacturing and service sectors, by skill level. These statistics can also be used to calculate the wage cut used in our simulations in Section V, and presented in Figure 2. To be able to compare the wages across countries, we express them relative to the overall median wage in the country, and multiply by 100. For example, in the U.S. in the 1980s a median middle-skilled worker in manufacturing earns 107% of the overall median, and the 25th percentile worker in low skilled services earns 50% of the overall median wage in the overall economy. Hence, the wage cut shown in Figure 2 for the U.S. in 1986 is 107-50=57.

Table 3: Summary of the wage distribution by sector and skill

Country	Sector	Skill	1980s					2000s				
			p10	p25	p50	p75	p90	p10	p25	p50	p75	p90
Austria	Overall		56	76	100	130	162	51	71	100	137	183
	Manufacturing	High	113	125	178	221	288	63	76	133	161	221
		Medium	71	85	105	132	161	62	80	105	138	178
		Low	61	78	93	112	145	58	75	98	122	144
	Services	High	91	110	135	169	212	65	97	137	184	259
		Medium	70	86	105	131	162	64	85	111	147	184
		Low	52	65	82	107	130	49	69	87	116	157
Denmark	Overall		50	70	100	127	161	56	73	100	127	157
	Manufacturing	High	83	101	120	141	176	98	114	135	162	195
		Medium	73	90	109	135	161	76	92	109	130	152
		Low	76	90	105	122	145	70	85	100	118	138
	Services	High	66	88	112	141	181	86	107	129	159	195
		Medium	72	90	110	133	161	70	90	110	133	160
		Low	83	97	108	122	132	59	75	95	115	137
Finland	Overall		59	77	100	125	151	53	72	100	132	171
	Manufacturing	High	73	95	125	154	181	91	117	141	179	231
		Medium	72	86	103	122	141	73	89	108	130	152
		Low	67	90	102	114	129	48	67	92	105	123
	Services	High	78	100	126	154	189	79	104	135	173	219
		Medium	66	83	103	124	148	60	78	99	124	148
		Low	68	80	102	124	145	54	66	87	107	124
France	Overall		52	71	100	136	182	52	73	100	136	184
	Manufacturing	High	105	138	173	235	298	109	135	162	217	280
		Medium	66	84	106	135	171	67	81	103	130	160
		Low	55	65	84	103	121	53	63	84	101	132
	Services	High	62	107	147	201	270	76	111	149	197	257
		Medium	66	83	108	136	168	60	78	100	127	156
		Low	57	62	78	101	121	46	57	79	99	117
Germany	Overall		57	75	100	135	170	52	72	100	136	182
	Manufacturing	High	88	110	138	178	226	95	118	159	206	281
		Medium	66	80	102	131	165	71	87	110	134	163
		Low	62	73	96	116	137	60	66	77	110	127
	Services	High	88	106	139	176	216	79	108	148	197	285
		Medium	70	83	105	136	169	59	80	104	138	177
		Low	58	62	87	111	148	57	66	87	110	133
UK	Overall		51	68	100	144	194	47	67	100	147	207
	Manufacturing	High	80	114	145	186	236	86	111	148	190	243
		Medium	53	75	105	143	181	63	83	107	142	179
		Low	51	64	89	122	142	55	66	82	119	156
	Services	High	64	95	138	190	255	78	109	153	212	303
		Medium	50	72	100	138	178	58	77	107	147	196
		Low	44	58	81	100	148	47	59	78	106	138
USA	Overall		37	62	100	148	204	38	61	100	152	216
	Manufacturing	High	83	114	159	215	283	89	122	164	219	298
		Medium	53	76	107	145	186	50	70	100	140	185
		Low	39	59	86	116	149	41	56	83	118	167
	Services	High	68	100	143	198	263	71	103	148	204	288
		Medium	44	67	101	143	192	44	66	100	144	195
		Low	35	50	78	116	160	34	48	72	105	144

D. Inequality and possible wage cuts during structural transformation

Appendix Figures 1 and 2 relate the level of income inequality to the size of the possible wage cut, after involuntary job loss of a median middle-skill manufacturing worker. Specifically, we calculate the wage difference between a median middle-skill manufacturing sector worker and the 25th percentile low-skill service sector worker. For the seven countries used in the main analysis in this chapter these wages can be directly taken from Appendix Table 3.

Appendix Figure 1 shows the relationship for all advanced countries available in the Luxembourg Income Study, and Appendix Figure 2 presents that same information but also includes all the emerging market economies available in the Luxembourg Income Study. While this is not directly relevant to our analysis of advanced countries, it sheds some light on how structural transformation—from manufacturing to services—might develop in emerging market economies.

Appendix Figure 1. Overall level of inequality and the possible wage cut, when switching from manufacturing to services

Source: Authors' calculations based on the Luxembourg Income Study database.
Note: The possible wage cut is calculated in the following way. We assume that a middle-skill manufacturing sector worker, with median earnings for their sector and skill level, switches to the service sector. Because the worker has no prior experience in the service sector, they are assigned the wage at the 25th percentile of the low-skill service sector wage distribution. To be able to compare across countries, we express the wages as percent of the overall median income in the country. In other words, the possible wage cut is calculated using this formula: [(50th percentile of manufacturing middle-skill income) – (25th percentile of service sector low-skill income)] / (50th percentile of overall income)] * 100.

Appendix Figure 2. Overall level of inequality and the possible wage cut, when switching from manufacturing to services

Source: Authors' calculations based on the Luxembourg Income Study database.

Note: The possible wage cut is calculated in the following way. We assume that a middle-skill manufacturing sector worker, with median earnings for their sector and skill level, switches to the service sector. Because the worker has no prior experience in the service sector, they are assigned the wage at the 25th percentile of the low-skill service sector wage distribution. To be able to compare across countries, we express the wages as percent of the overall median income in the country. In other words, the possible wage cut is calculated using this formula: [(50th percentile of manufacturing middle-skill income) – (25th percentile of service sector low-skill income)] / (50th percentile of overall income)] * 100.