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ГЛОБАЛИЗАЦИЯ И ТЕХНОЛОГИЧЕСКАЯ ЭВОЛЮЦИЯ: ВЛИЯНИЕ НА ЭКОНОМИКУ И ОБЩЕСТВО США

GLOBALIZATION AND TECHNOLOGY EVOLUTION: IMPACT ON ECONOMY AND SOCIETY OF THE USA

Аннотация: В данной статье анализируется экономическое развитие США с целью объяснить переход от политики свободной торговли к явному протекционизму. Отмечается, что более 60% населения США не ощутило благотворного влияния процессов глобализации, стремительно разворачивавшихся последние 20 лет. Продолжающаяся автоматизация производств без изменения политики в области занятости населения в ближайшем будущем усугубит эту проблему.

Ключевые слова: США, глобализация, свободный рынок, протекционизм, ВВП, коэффициент Джини, умные фабрики, искусственный интеллект.

Abstract: This article analysis the economic development in the USA to explain the change from strong support of global trade to a protectionist policy. It finds that the overall economic development for the USA was positive for more than the last 20 years, but that the gains of this development were highly concentrated with negative gains for more than 60% of the US population. Causes are the inability of the system to adapt to a changing portfolio of available jobs as well as large automatization in industry.

Key words: USA, globalization, free market, protectionism, GDP, Gini coefficient, smart factories, artificial intelligence.

Introduction

Presently problems assumed to be caused by globalization are generating protectionist measures and political crises. The most serious and disruptive activities started with Donald Trump's "America First" policy which was ridiculed by the press in many European countries with "...and our country second" calls. A second example was Marine Le Pen's description of "Globalizers versus Patriots" in her statements during the last presidential election in France. While many analysts and journalists defended the present evolution of global trade and consider Adam Smith's work "An Inquiry into the Nature and Causes of the Wealth

of Nations" published in 1776 [1] still as a clear proof that global trade is best for all nations, the feeling in large groups in the developed countries seems to tend against globalization and global trade. It therefore is necessary to analyze the impact of global trade on the economic situation of various groups in developed countries. An important aspect here is also the question of the influence of technology evolution and in how far issues ascribed to globalization may be caused by technology evolution instead or in how far both aspects work together to create the present situation.

In the following, we will use publicly available data from the World Bank, The United States Federal Reserve Bank, and other open sources to first look at the evolution of the growth in Gross Domestic Product (GDP) as well as the changes in income and net-worth over the last 15 to 20 years in the United States of America. Then we will look at the specific case for manufacturing which is one of the main points cited by the USA president. Finally, we will look into the potential threads and prospects of new technologies like the "Industrial Internet of Things" [10], "Industrie 4.0" [10, 5] or "Smart Factories" [10, 9] and Artificial Intelligence [10, 2, 11] with special emphasis on the impact of economic and social structures.

The focus in this article is on the USA because in dollar terms it is still the largest economy. Secondly, while having been a strong supporter of globalization in the past, it is now applying strong protectionist policies; thirdly, there are large statistic data sets publicly available. Nevertheless, it can be expected that many of the issues causing the present protectionist policies exist in other developed countries.

The evolution of GDP, income, and net-worth

For most developed countries, including the USA, real GDP shows a clear growth over time on timescales of more than 5 years. However, there also was substantial population growth in many developed countries. Therefore, there is a chance that this growth outpaced the growth in GDP. However, Figure 1 with data from the World Bank [16] shows strong growth in GDP per head data for the USA. From 1960 to 2017 there was substantial growth by a factor of about 19.8 or by 18.79% in GDP per head. If we look at the last 20 years, the growth is still 88.6%. The only visible kink in the curve is at the year 2010 where the values for 2009 and 2010 are smaller than the value for 2008, but 2011 is already larger than 2008. Hence, for the nation as a whole the growth in GDP and GDP per head was very good

for the USA as visible from Figure 1. For the world as a whole GDP per head grew by a factor of 23.8 from 1960 to 2017, but from a much smaller base, which leaves the USA value for 2017 still a factor 5.6 larger than the world value. Considering the GDP per head value evolution, there is no reason to be disappointed by global trade. If there is reason for disappointment it must be with the distribution of the GDP per head gains onto different groups in the country.

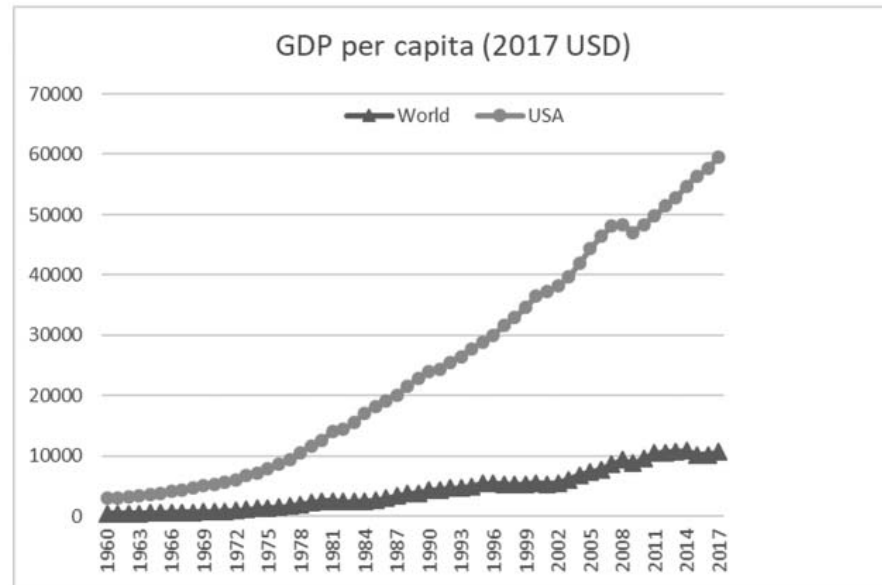


Figure 1. GDP per head evolution (data from [16])

Looking at available data on income changes and net-worth changes, there is one world-bank paper [3] showing substantial income growth over nearly the entire range of incomes globally, just with one small range on this global scale where the income growth was negative. Corresponding data from the Federal Reserve Bank of the USA (Table 1 of [15]) show negative income growth and even more negative growth in net worth (Table 4 of [15]) for the ranges associated with the so-called working class in the USA while at the same time income and net-worth substantially improved for the top 10 to 20% of earners. Figure 2 shows the median distribution in incomes in 2017 USD for the comparison between the year 2016 and 2001 and Figure 3 shows the corresponding distribution for net-worth for the same years. The impact of course is larger for the net-worth since this results from the income changes accrued over all the years between 2001 and 2016.

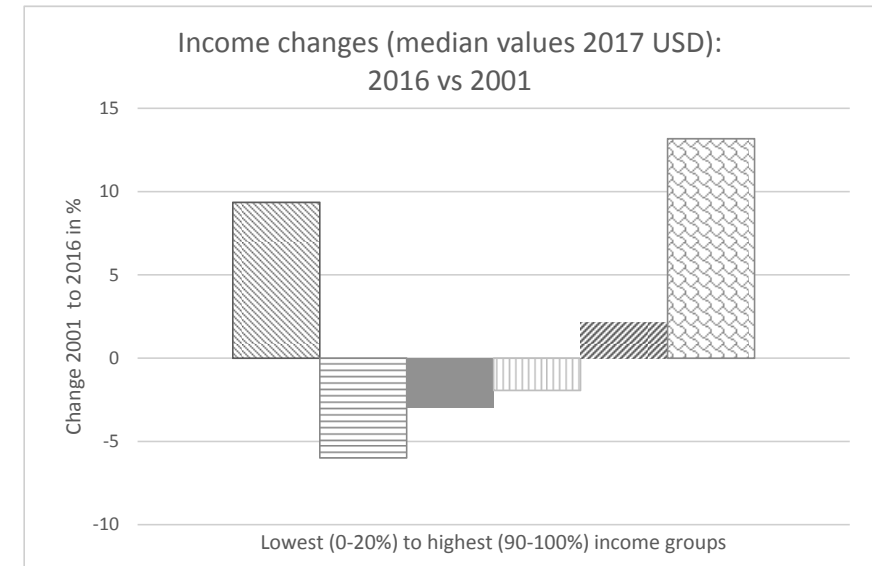


Figure 2. Income changes over 15 years (data from table 1 of [15])

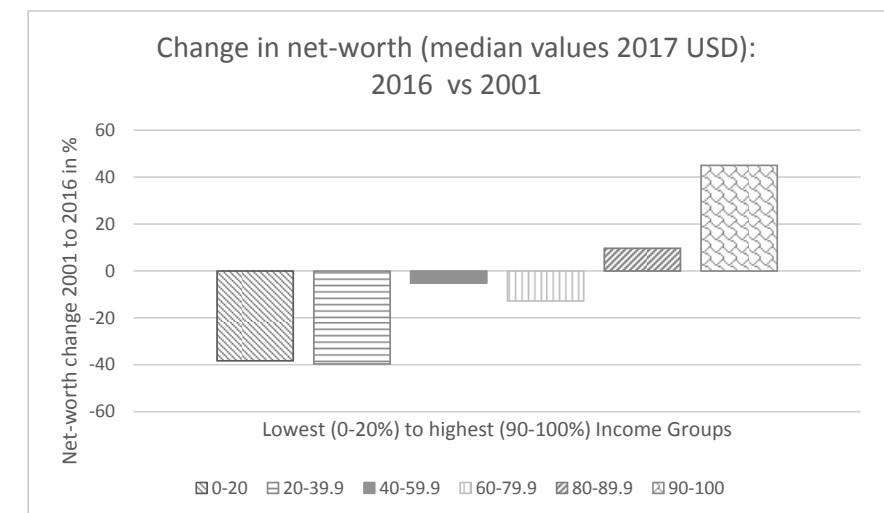


Figure 3. Changes in net-worth over 15 years (data from table 4 of [15])

2016 is the latest year reported by the US Federal Reserve Bank while the choice of the year 2001 is of course somewhat arbitrary. Also, the data are not provided annually but only for every third year. In Figure 4 we therefore show the net-worth changes for the corresponding earning groups between 2016 and the reference years ranging from 1989 to 2013.

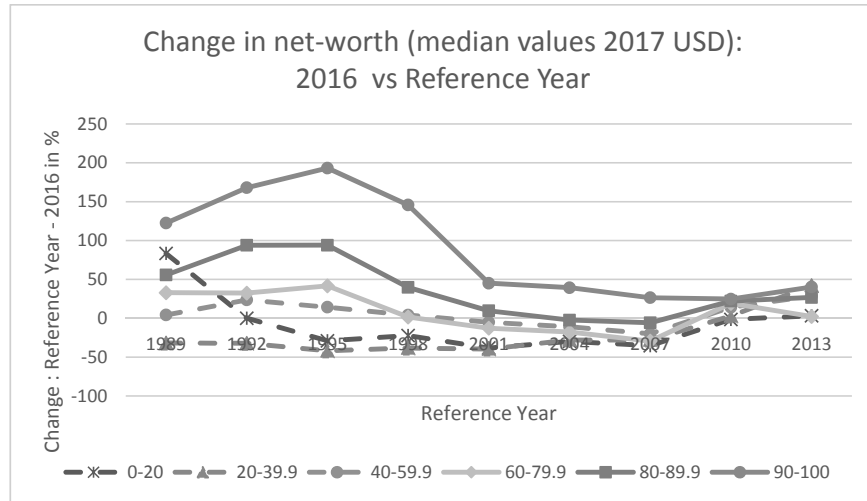


Figure 4. Changes in net-worth vs reference year (data from table 4 of [15])

For the top two earnings groups (80–89.9% and 90–100%) the net-worth change is always positive and reaches values much larger than for 2001 in Figure 3. For the lowest income group (0–19.9%) 6 out of 9 reference years bring negative growth and that for the second lowest income group reach the –40% value from Figure 3 also for many other years. The data from the US Federal Reserve Bank are for “families”. In principle, there is the possibility that there was a substantial shift from families with 2 parents to single parent families, which would result in more families with less income per family, but the family structure data from the US Federal Reserve Bank (Table 2 of [15]) eliminate this possibility. Figure 5 shows the percentage of single adult and adult-couple families for the entire range of years. The changes are completely negligible.

So, while the GDP and GDP per head data show a clear growth over the last 20 years, this growth was very uneven distributed with a large group of more than 60% being worse off than 15 years ago. The exact values depend of course on the choice of the 2 years for which we compare the change in net-worth, but we always find a huge gain for the top 10 to 20% and much lower gains or losses for the other groups of income.

There are two obvious possibilities that may have caused the unequal distribution of the gains from GDP growth: a shift from well-paid jobs to lower paid jobs for the losing groups or different source of income for the losers and the winners.

One aspect connected with globalization is the disappearance of jobs in certain industries. Starting from the point that globalization is good

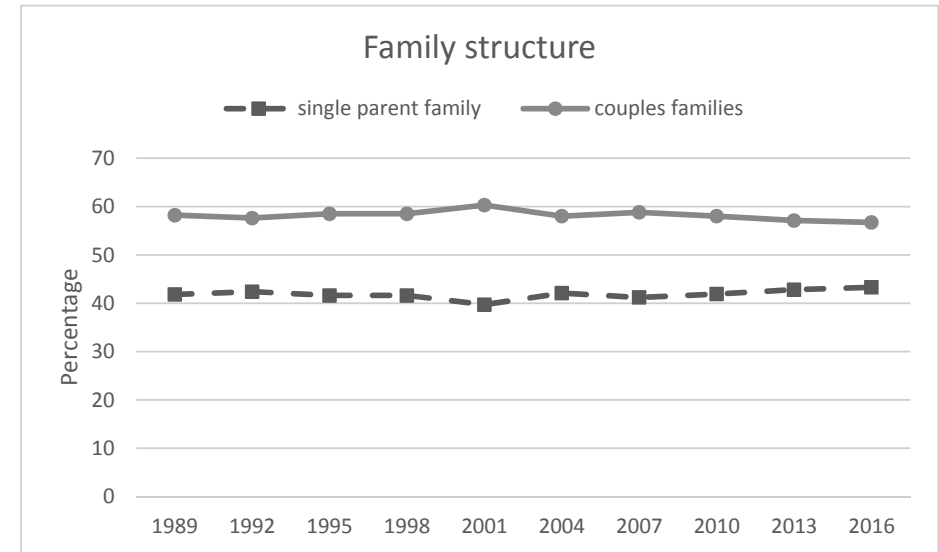


Figure 5. Stability of family structure (data from table 2 of [15])

because it allows every country to focus on creating those products, which bring this country the greatest gains; this is a normal aspect of globalization. However, if the best suitable products to create for a country change e.g. due to developing nations catching up on a developed country, this is a serious disruption for those working in the industries where jobs decline.



Figure 6. Employment changes in the food industry (data from [12])

Looking at the possibility of a shift from well-paid jobs to lower paid service jobs, especially the very low paid jobs in the restaurant and food

area, data from the US Department of Labor, Bureau of Labor Statistics [12] (Figure 6) show a strong increase by about 32% in the food service industry during the time the negative net-worth results for the working class occur. The increase happens over a long period of time and is still ongoing. Hence, there is a clear probability that the global adjustment towards best economic chances for every nation, caused a shift from higher paid to lower paid jobs for those groups which worked in the fields with declining job numbers. Those which were laid off in the fields which were deemphasized in the economy of the USA, were unable to find similarly paid jobs in other fields and had to accept lower paid jobs.

Looking at the sources of income, the USA data (Table 2 of [15]) show in Figure 7 that for the lowest 80% of the net-worth groups salary makes up to 79% of the total income, this value is less than 47% for the top 10%. Here, own business and financial investments make a substantial part of the income. But even the salary increases and bonuses are highly skewed toward the top ranked employees often with no increases for the rest. The result is that the growth in GDP is mostly going to those with own businesses in the international markets, those with substantial investment portfolios in international markets, and top-ranked employees. Since low and medium ranked employees usually can't afford substantial investment portfolios they aren't participating in gains of the GDP growth.

So, there is evidence for the case that those with high income were able to participate better in GDP growth due to the possibility to build own businesses or to invest in growing economic areas, as well as for the case

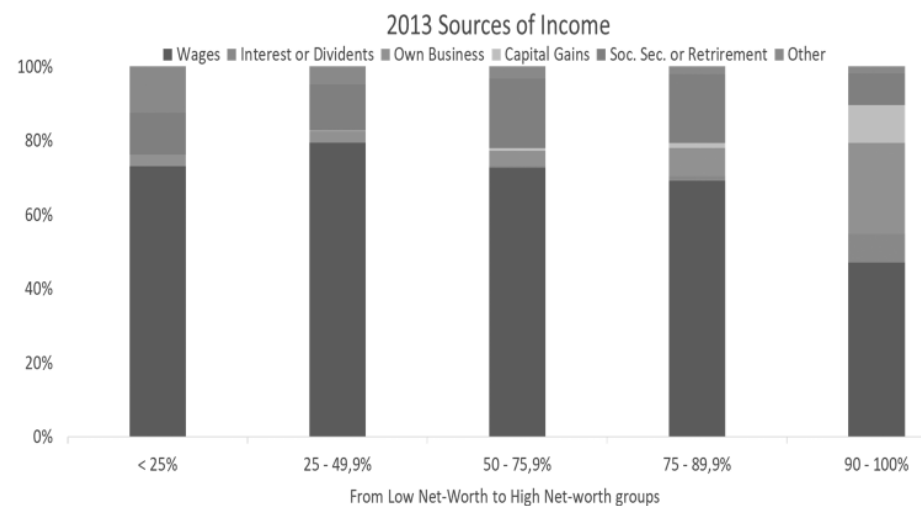


Figure 7. Sources of income (data from table 2 of [15])

that people who lost jobs due to a shift of fields from the USA to other countries, had to accept lower paid jobs and were not able to get jobs equally paid as the ones they lost.

At the same time, due to competition in the market for buying or renting apartments or houses, the gains for the other groups make the situation worse for those not participating in the GDP gains.

The disadvantages accrue over time, which is visible in the fact that the negative change in net-worth for the working class people is larger than the negative change in income. A measure of unequal distribution of income is the Gini coefficient, named after the Italian economist Corrado Gini [7]. The Gini coefficient is a measure of the unequal distribution of income in a country and the same value may be reached with many different income distributions. A value of zero means that everyone has the same income and a value of one means that one person gets all the income. The Gini coefficient usually only shows small changes over time since this is calculated for income and not net-worth. Nevertheless, the Gini coefficient for the USA is close to 0.4 as it also is for Russia. The average Gini coefficient for the OECD countries is 0.32 [8]. The worst Gini coefficient for the OECD countries is 0.67 for South Africa. There are some very well known special cases demonstrating the value of 0.4. The first example is having 2 groups each with the same size, but the first group gets only 10% of the total income and the second group gets all the remaining 90%. The second example is that of 2 groups with the first group containing 90% of the people and the second – just the remaining 10% and each group gets 50% of the total income.

Taking the steady growth of GDP at timescales larger than a few years observed for the USA and many other countries and the observed strongly unequal distribution of the gains from GDP growth we can conclude that the problem is not economic evolution over time and so also not globalization in principle, but the unequal distribution of the gains, even loss in net worth for certain groups which causes the negative feeling about globalization and the growing influence of politicians favoring protection against global trade.

Next, we want to discuss the specific example of manufacturing.

Specific example: Manufacturing

Figure 8 shows the change in manufacturing value-add for the USA and China as percentage of world manufacturing value-add [17]. At the same time, Figure 9 shows a large 30–35% decline of the number of USA manufacturing jobs in that time [13]. This looks like a shift of manufacturing jobs from USA to China. But Figure 10 shows that in dollar value the USA

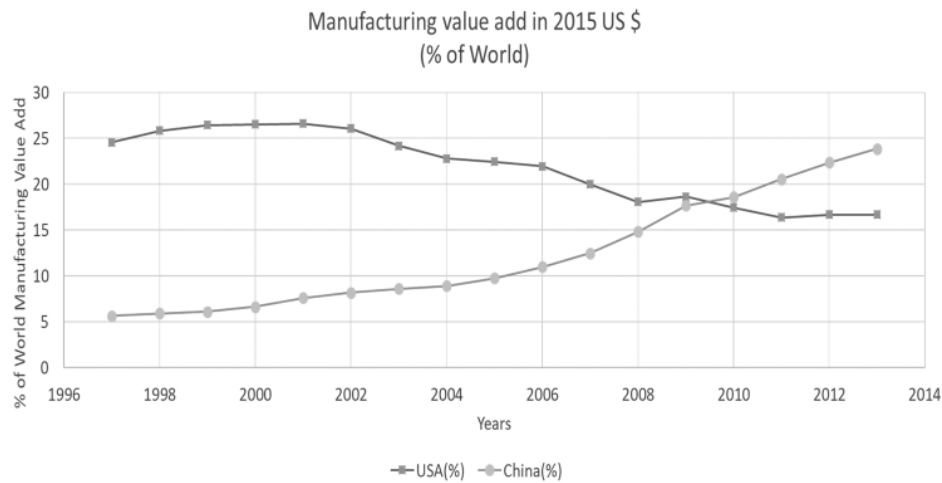


Figure 8. Manufacturing value-add as % of world value-add (data from [17])

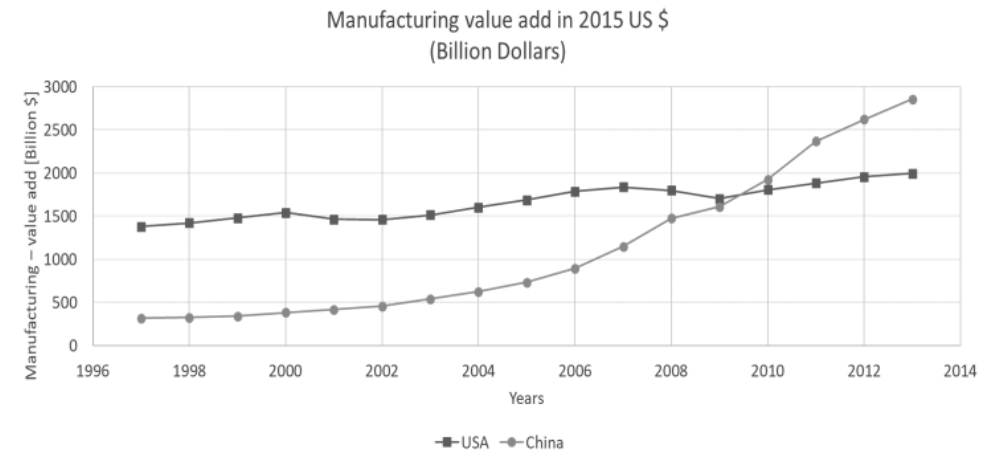


Figure 10. Manufacturing value-add in USD (data from [17])

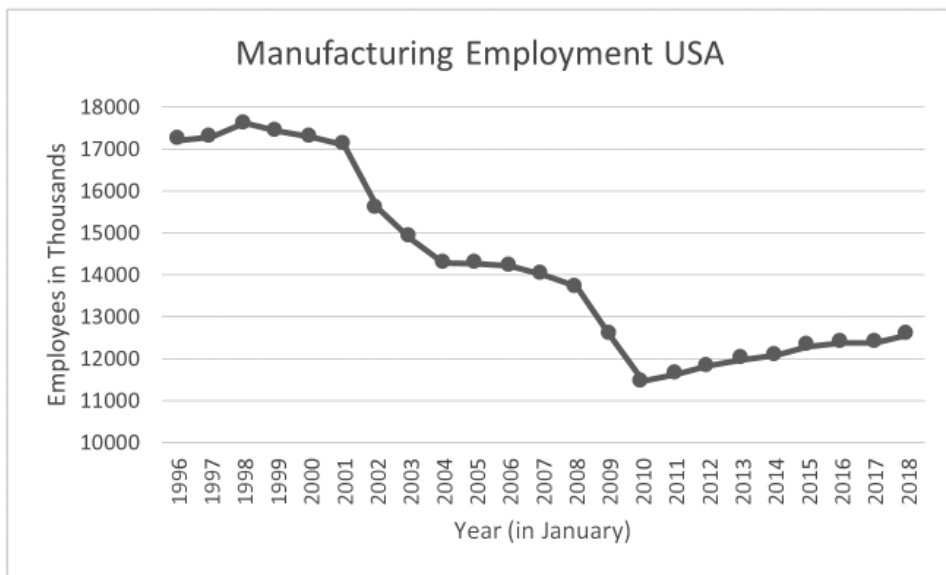


Figure 9. Employment changes in manufacturing (data from [13])

manufacturing value-add in this period is still growing despite a 30–35% drop in manufacturing jobs. Just manufacturing value-add in China was growing significantly faster than in the USA.

We already saw in Figure 6 that at the time with negative net-worth growth for the lower income groups the number of very low paid jobs

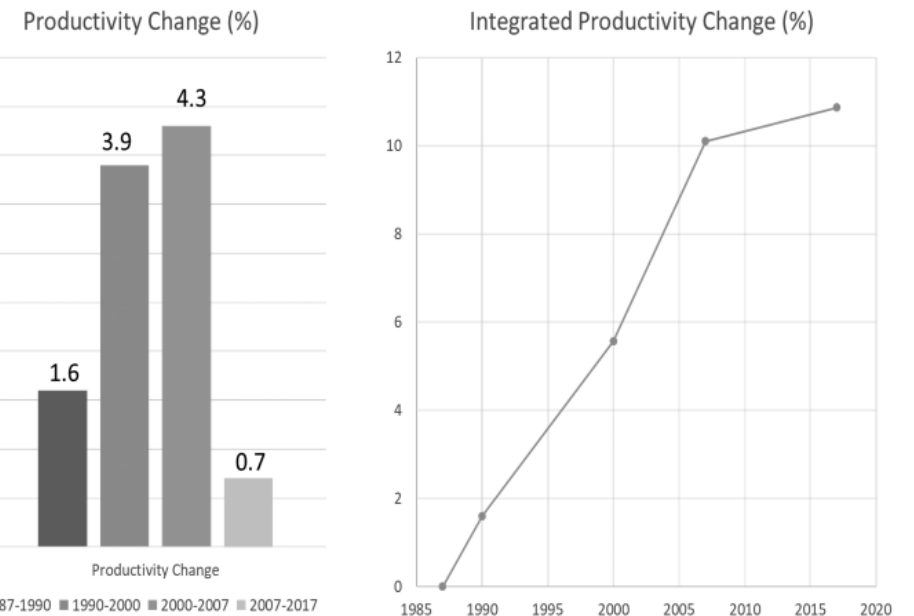


Figure 11. Productivity changes in US manufacturing (data from [14])

in the restaurant and food area grew by about 32%. Now we see that at the same time the number in manufacturing jobs also dropped by 30–35%. So, yes there was a shift of manufacturing jobs from the USA to China, but in the same time the remaining manufacturing in the USA still created growth in manufacturing value-add with a substantially lower number of employees.

Figure 11 shows that there was a growth in manufacturing productivity by about 11% in the same time [14]. We can conclude that automatization played a part in the loss of manufacturing jobs. Old factories needed lots of employees to operate the production tools.

In new factories, a few operators control a complete factory with the help of computers and computer-controlled machines. The number of employees in such a factory is just a fraction of those in the old factories. More important, the skills required by these employees are very different from those needed in the old factories. Mechanical adjustment of production tools is now limited to maintenance operations, production itself is computer controlled. However, the office jobs, like e.g. procurement still exist in these factories. We will look at the impact of future technologies in the next section.

Potential impact of future technologies

The digitalization of business processes is official policy of the EU and many other countries [4]. Germany introduced a government sponsored program called “Industrie 4.0” [5], in the USA several consortiums started research and development collaborations known under the name of “Smart factories” [9]. Both programs have similar goals: exploitation of digitalized business processes within the Industrial Internet of Things (IIoT) [10], highly flexible computer-controlled production tools, and integration of entire value chains. These technologies use a huge number of sensors to automatically determine the status of production processes, the need to order new materials for the production or to replace parts which show signs of degradation. Also, one goal is to increase manufacturing flexibility in a way which changes the economies of scale aspects so that highly personalized products can be generated at costs which are now possible only at a large number of equal products. In other words, single-lot production shall become economically as viable as the production of large numbers of lots. The plan to achieve this is to allow switching to a different model of a product or even a different product by just switching to another input data set for the next production run. But the plans in these programs go even further. Blockchain, a new technology to perform transactions in a secure, provable way, can use so-called “smart contracts” [6] to allow the computer system to order all these materials and components automatically without human involvement after the first setup of the contracts. Hence, the production system will automatically determine the materials it needs to generate the new product from the input data set, then what is available and what is missing, and finally automatically order

every missing component with the use of smart contracts. So, the new factories will not only reduce the number of direct production employees in a plant, but even impact other areas like procurement or bookkeeping.

Another technology which will substantially impact existing jobs even far beyond manufacturing is Artificial Intelligence (AI). At the moment AI [2, 11] is still in its infancy. There is a huge hype about the technology, but if we look into the details, the big improvements are limited mainly to all kind of pattern recognition. Here, the use of several types of neural networks, sometimes a combination of neural networks, has let to huge progress in the recognition and classification of image, voice, and behavioral patterns. Also, there is great progress in robotic systems which make those systems safe enough to operate moving robots in close vicinity to humans. However, despite all these progress in some limited areas, we are still far away from general artificial intelligence. Nevertheless, the present systems already affect existing jobs. For jobs where the productivity improvement due to the use of AI tools does not allow a reduction in the number of employees, the productivity growth will result in quality improvements. Corresponding jobs are e.g. in the medical area where the possibility to analyze huge data sets to find better treatments will not allow to reduce the number of doctors or nurses. For back-office jobs, like analyzing insurance claims for validity and correctness, the AI tools will allow to handle the same number of claims with much fewer people. Anyhow, in all areas where the new tools offer improvements there will be substantial changes to the existing jobs in these areas. Being capable to use the new tools will be a necessity for those working in these fields. Considering the speed of changes in the new technologies this will require constant learning, reeducation, and training for many employees.

Of course, the new technologies used here will also create new jobs and it is very well possible that the number of newly created jobs will exceed the number of jobs lost. But the new jobs will differ substantially from those lost. As long as simple automatization was the main reason for productivity growth and lost jobs, the recommendation usually was to get the best education possible to avoid losing your job. Now with AI tools getting into the game, even highly educated people may be forced to look for a new job. Best education within a narrow area is no longer sufficient if entire job classes disappear. The best recommendation for the future may be to get a broad base education, learn how to get into a new area quickly and constantly update your skills. The present education systems in most countries still do not look ready for this.

Conclusion

Looking at all the points discussed above, my view is that the protectionist measures currently used by some countries and favored by several politicians, are not the solution to the issue. The main problem is the sudden disruption caused by the decline or even disappearance of complete job profiles due to global trade as well as technology evolution. It seems better to use preventive measures in education and professional training for increasing the number of possible job roles for all employees and thereby the chance for these employees to switch to new job classes in a short time.

Even this may not be enough if the unequal distribution of globalization gains leads to serious social problems and then to the appearance of radical political parties and finally to economic wars with serious damage to the world economy.

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