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The impact of employment in industry on income inequality in Great Britain

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Abstract. *Economic inequality is one of the most debated issues in economic science. It is known that politicians have to choose between efficiency and equality, and decisions, which are finally made by them, influence social stability in a state. The factors of income inequality in Great Britain are analyzed in the present article. Regression analysis shows that the main cause of growing market income inequality in the UK in the latest decades is decreasing employment in the British industrial sector. Moreover, shifts in employment in industry directly and indirectly affects other factors of income inequality. Employment in industrial sector is also, in its turn, influenced by technological development and globalization. A combination of factors, having impact on employment in the British secondary sector and, as a consequence, on market income distribution in the UK, is analyzed in the paper.*

Keywords: income inequality, income distribution, industrial sector, structural changes, Kuznets curve.

JEL Classification: D63.

Introduction

The aim of the present article is to study the relationship between share of employment in industrial sector in Great Britain and the Gini index before taxes and transfers on the base of regression analysis. The final conclusions underline the influence of the economic structure on income inequality: the developed industrial sector with existing technologies, level of education and institutions is one of the key factors of narrowing of economic, particularly market income, inequality, while the process of deindustrialization in terms of the decreasing share of employment in industrial sector in Great Britain widens income inequality – this is the central argument of the paper. A regression model is built in order to estimate the effect of this process. However, the share of employment in industry is affected by other forces (described in 'Results' section), which mostly indirectly influence market income distribution in the UK.

Theoretical overview

The variable, which is employed in the model in the present article, is "the share of employment in industrial sector". The data covers the period of 1950-2021, when Great Britain has transformed from the industrial economy into the postindustrial one (it means that the structure of economy, or economic complexity, has changed greatly). By using this variable, it is possible to demonstrate the impact of such a transition on income inequality. Similar approach was used by Mehic (2018), who showed the negative relationship between the share of employment in industry and income inequality. He linked the decline in employment in the secondary, or industrial, sector with trade liberalization and technological changes. Trade liberalization, or economic globalization, is considered as a factor of rising income inequality in a number of articles: e.g. financial globalization is identified as a key factor of growing inequality in the EU by Asteriou et al. (2014); Bergh & Nilsson (2010) and Dreher & Gaston (2008) also demonstrated that globalization and deregulation increased the level of income inequality. Behera & Viswanathan (2022), using the sample of India, concluded that economic globalization can reduce income inequality, while social and political globalization, as well as sectoral shifts (rapid growth of the service sector and the decline of agricultural sector) widen it. They underlined that "although the growth in the services sector triggers economic growth, the employment and income benefits accrue to only a limited segment of the population" (Behera & Viswanathan, 2022: p. 369). The negative relationship between the share of agricultural sector in GDP and income inequality is as well showed by Raeskyesa (2020) on the sample of ASEAN-5 Countries. Harjes (2007) questioned the negative impact of globalization on income inequality and claimed that the increase in income inequality in euro-area countries can be explained by changes in labor market institutions. Sato & Fukushige (2009), using the case of South Korea, came to the results that economic globalization effect on income inequality depended on the angle of economic globalization, from which the effect was studied. Thus, the openness of good markets reduced inequality, while the openness of capital markets widened it. The study of Adams & Klobodu (2018) demonstrates that the share of agriculture in GDP (the structure of economy) does not have a clear impact on income inequality in 21 African countries, while trade liberalization has a positive impact on it. Ghosh et al. (2022) concluded that the structure of economy, i.e. the economic

complexity, had a negative impact on the Gini index, at the same time trade openness led "to fairer income distribution" (p. 2519). However, in order to fully explain the role of structural transformations on income inequality it is necessary to refer to the Kuznets's hypothesis and Milanovich's "neo-Kuznets waves".

In the paper «Economic growth and income inequality» (1955) Simon Kuznets analyzed the causes and factors of long-term changes in personal distribution of income. S Kuznets took into account political and social factors of narrowing of inequality that were the consequences of governmental economic measures, like establishment of a progressive scale of taxation and providing governmental assistance to poor people (free contributions), but the main feature of his hypothesis is the explanation of the reduction in income inequality by determination of structural change in economies. S Kuznets underlined that, besides the interference with legislation and political decisions of the government on upper-income groups of people (e.g. inheritance taxes or indirect influence by inflation, which reduce the real wealth and the real cost of savings of the richest people), the less obvious at first glance forces caused the narrowing of inequality and, in particular, the reduction in the difference in savings between groups. The first force is demographic growth. The demographic growth is usually the feature of the rapid economic growth, because the productivity increase demands a large number of free workers. On the other hand, when the rapid economic growth provides the raising living standards, the latter in its turn creates favorable conditions for population growth. For example, there were waves of «baby boom» in developed countries during and after post-war reconstruction. However, later the population growth stops in developed countries due to changes in an approach to social and cultural issues and rethinking of the family values: i.e. the transition from traditional families to families which plan the quantity of the children. In the agrarian countries the families usually have many children regardless of the economic growth rate, because the children help their parents in the agricultural work.

Nevertheless, S Kuznets paid attention to another result of demographic growth – deconcentration of savings. It leads to narrowing of income inequality as the savings are concentrated in the hands of an increasing number of people (in particular, in the hands of the heirs). This factor is also accompanied by the increasing of an average income in countries with rapid economic growth and by the fact that, as S Kuznets wrote (1955), the inequality of savings is usually sharper than in holdings of assets.

Another group of factors of narrowing the savings inequality is connected with "the very nature of dynamic economy" (Kuznets, 1955: p. 10). S Kuznets meant that new industries arising due to technological progress attract more capital and the old industries have a decreasing specific weight. Nonetheless, it is important to consider the political influence of the entrepreneurs of old industries, who can hinder the rapidly developing industries in some way if these industries hamper their further enrichment. A lot of attention to political factor is paid by J Stiglitz (Stiglitz, 2012), who indicates the connivance of the authorities to the rent-seeking of the richest part of the society. J Stiglitz underlines the big role of the richest 1% of American population in the sphere of the tax legislation, governmental intervention in the economy, budget allocation, etc. (Stiglitz, 2015). All these problems threaten democracy.

Moreover, the idea of S Kuznets about the narrowing of savings and income inequality caused by the development of the new industries instead of the old ones is disputable when, for instance, we talk about the investments in the alternative sources of energy because the oil and coal magnates retain their positions. Therefore, this group of factors is a characteristic of not only a dynamic growing economy, as S Kuznets wrote, but also of a really competitive economy with a high level of economic freedoms and a low level of corruption and other misuse of politicians.

The third group of factors, identified by S Kuznets, is connected with the situation on the labor market ("a shift of workers from lower-income to higher-income industries" (Kuznets, 1955, p. 10)) and the reduction in number of possibilities of people with high incomes to increase their earnings and profit. It is very hard or even practically impossible to maintain the revenue of the company at the constant high level, at least, due to changes in demand volume or the rise in price of raw materials and other market forces. Monopolies can be the exceptions. It is also difficult for an employee to demand a salary increase if the employee already gets a high salary.

In addition to the factors listed above (direct and indirect governmental intervention in the economy; tax legislation; demographic growth; a shift of capital and workers from lower-income or old industries to higher-income or new industries, as a consequence, the deconcentration of savings), S Kuznets wrote about the role of urbanization and migration in the processes of industrialization: the industrialization always needs a large number of free workers, who live in the towns or cities and often come from villages (the agricultural sector) or foreign countries (Kuznets (1930) underlined the significance of immigration in cyclical fluctuations and mentioned that "immigration is conditioned by the same forces that make for economic growth" (Kuznets, 1930: p. 7)). According to S Kuznets, the growing economy with the increasing weight of the nonagricultural sector raises the per capita income and narrows the income inequality.

To summarize, S Kuznets' idea can be expressed in this way: the income inequality is initially increasing and then decreasing during the period of economic development, and, as a result, the inequality should be at low level in a developed economy. S Kuznets' curve explained the income inequality for several decades, but approximately in the 1980-s it faced some problems caused by a widening of income inequality in developed, rich and even egalitarian countries. An attempt to solve the problems of the S Kuznets' curve has been made by B Milanovich.

B Milanovich (2016) underlines the significance of endogenous factors, social democratic and communist political parties, governmental measures, taxation policy, the bargain power of workers trade unions. However, the foundation of this theory is a modified Kuznets theory. B Milanovich uses not Kuznets curve, but Kuznets waves in order to explain modern inequality. This «neo-Kuznets» curve (instead of Kuznets inverted U-shaped curve) includes the period of decreasing of income inequality till approximately 1980-s and also the second period in evolution of income inequality, that was accompanied by widening of economic inequality due to reasons, which B. Milanovich calls «TOP»: technology, openness, policy (but wars, conflicts, humanitarian problems also remain).

In pre-industrial society there was a limit for the increasing of inequality, because the average (mean) income was stagnant, stable (agriculture and slowness of technological progress are the reasons for it) and it can be only reached by decreasing of the population of poor people, so the widening of inequality is the consequence of idiosyncratic events: e.g. wars, epidemics, famine (the importance of demographic changes for the economy was analyzed by T Malthus (1798)). However, modern wars practically do not harm the 'global plutocrats' as some of these plutocrats get profit by selling the weapons and pursue their selfish goals.

During the two world wars and wars before them the destruction of the capital and means of production (factories, logistic chains, etc.) took place and capitalists faced with the damage that led to losses. Nevertheless, there can also be benign factors that narrow income inequality, but their influence is rather limited and not ubiquitous in pre-industrial society (e.g. the Church and its charitable activity).

In the societies with increasing medium income (industrial and postindustrial societies) there is enough room for an increasing inequality level (Milanovich, 2016). However, there are not only negative (wars, civil conflicts, epidemics, famine), but also positive factors, which decrease inequality level in modern societies (political factors, progressive taxation, free healthcare and education, etc.). That is the next phase of Kuznets waves (or cycles).

The breaking point is the WWI (the same breaking point is in Piketty's theory [2017]), but the engine for the structural changes in economies was the technological progress and, more exactly, technological revolution. According to B Milanovich, technological changes which help low-skilled workers, mass education, increasing demand on social protection (direct transfers from government) due to aging of population, political deterrence factors (workers trade unions with strong negotiating positions, social democratic and communist parties and movements) are positive factors that narrow income inequality. In case if the economy begins to stagnate, the situation with inequality levels in different countries will be similar to the situation of preindustrial periods and Kuznets waves will continue in conditions of the permanent medium income. However, the factors influencing the Kuznets waves explain a widening/narrowing of economic inequality within countries, but B Milanovich (2016) is also considering international inequality. The main force that decreases economic inequality between countries is the economic convergence. The Milanovich's paper (2012) underlines the aspects of international inequality, e.g. we see how much richer is the average American in comparison with the average citizen of a poor country. Nevertheless, the issue of the present article is inequality within the country (the UK), so the process of economic convergence is not described here in detail.

To sum up, we see that, Kuznets proposed the idea that structural changes are the key factor of income inequality. His statement that the development of nonagricultural sector narrows income inequality is proved again in the present article from another angle: the decline of industrial sector widens market income inequality. Milanovich (2012, 2016), Mehic (2018) and other authors, whose papers are mentioned above, reveal the influence of globalization, openness and technological change on the structure of economy and, hence, on income distribution.

Data and methodology

In the present paper the United Kingdom has been chosen for the analysis. The reason for it is that there is more open data on developed economies, like the British one, rather than on less developed countries: hence, we can track the dynamics of fluctuations in market income distribution for a long period (since 1950 till 2021). Moreover, Great Britain has become a service economy and finally lost the status of industrial power during this period, mainly due to the policy, being realized since 'Thatcherite Revolution' (e.g., see Jakopovich (2011: pp. 435-442)), therefore, it is possible to study the relationship between rapidly decreasing share of employment in the industrial sector and income distribution. Sources of the data for this study are the Office for National Statistics (ONS, data on the employment in the secondary sector till 2016; after 2016 the OECD data was used)(1), OECD (Gini coefficient for years 1994-2021, market income, before taxes and transfers)(2), Atkinson's paper (2002: p. 35; Gini coefficient, market income, before taxes and transfers)(3). All the data includes only the statistics for Great Britain without overseas territories and former colonies. Although such sources of data as OECD and ONS are rather reliable, we have to remember about statistical error, therefore, even if the data is very close to the reality, it still is not absolutely true. By using the regression model, the relationship between income distribution in Great Britain and the share of employment in the secondary (industrial) sector of the British can be witnessed. OLS method is used here for estimating the regression equation.

Table 1. *Data on income inequality in Great Britain*

Year	Share of employment in the secondary sector (from 0 to 1)	Gini index (market income before taxes and transfers; from 0 to 1)
UK 1950	0,3826	0,41
UK 1951	0,3856	0,4075
UK 1952	0,3819	0,4075
UK 1953	0,3842	0,4075
UK 1954	0,3875	0,4075
UK 1955	0,3915	0,405
UK 1956	0,3920	0,4
UK 1957	0,3919	0,4
UK 1958	0,3895	0,4
UK 1959	0,3896	0,4
UK 1960	0,3976	0,395
UK 1961	0,4005	0,395
UK 1962	0,3970	0,395
UK 1963	0,3941	0,405
UK 1964	0,3977	0,41
UK 1965	0,4001	0,415
UK 1966	0,4015	0,4
UK 1967	0,3924	0,428
UK 1968	0,3887	0,43
UK 1969	0,3879	0,44
UK 1970	0,3821	0,41
UK 1971	0,3731	0,415
UK 1972	0,3619	0,42
UK 1973	0,3603	0,415
UK 1974	0,3579	0,435
UK 1975	0,3462	0,425
UK 1976	0,3399	0,43
UK 1977	0,3384	0,44
UK 1978	0,3337	0,435

Year	Share of employment in the secondary sector (from 0 to 1)	Gini index (market income before taxes and transfers; from 0 to 1)
UK 1979	0,3293	0,43
UK 1980	0,3190	0,43
UK 1981	0,3047	0,44
UK 1982	0,2953	0,44
UK 1983	0,2864	0,46
UK 1984	0,2801	0,47
UK 1985	0,2759	0,48
UK 1986	0,2705	0,49
UK 1987	0,2668	0,488
UK 1988	0,2632	0,5
UK 1989	0,2601	0,51
UK 1990	0,2538	0,51
UK 1991	0,2421	0,5
UK 1992	0,2332	0,52
UK 1993	0,2269	0,51
UK 1994	0,2268	0,507
UK 1995	0,2260	0,5065
UK 1996	0,2242	0,5065
UK 1997	0,2216	0,5065
UK 1998	0,2217	0,5065
UK 1999	0,2134	0,506
UK 2000	0,2068	0,512
UK 2001	0,2007	0,503
UK 2002	0,1931	0,499
UK 2003	0,1866	0,502
UK 2004	0,1814	0,5
UK 2005	0,1771	0,503
UK 2006	0,1740	0,503
UK 2007	0,1725	0,504
UK 2008	0,1680	0,508
UK 2009	0,1630	0,519
UK 2010	0,1569	0,523
UK 2011	0,1561	0,524
UK 2012	0,1549	0,524
UK 2013	0,1527	0,527
UK 2014	0,1515	0,518
UK 2015	0,1508	0,52
UK 2016	0,1511	0,506
UK 2017	0,1414	0,506
UK 2018	0,1400	0,513
UK 2019	0,1400	0,508
UK 2020	0,1403	0,507
UK 2021	0,1385	0,51

Correlation analysis demonstrates us that there is a strong relationship between Gini index and share of employment in industry (the value is -0,95, it is close to -1, hence, there is a strong negative correlation).

The econometric model is as follows:

$Y_t = \alpha + \beta_1 X_t + \varepsilon_t,$

Where:

Y_t denotes Gini index (market income, before taxes and transfers, from 0 to 1), X_t is the share of employment in the industrial sector (from 0 to 1), $\boldsymbol{t}$ is a period of observations.

Figure 1. *Regression Analysis Results*

Regression statistics	
Multiple R	0,951109148
R Square	0,904608611
Adjusted R Square	0,903245877
Standard Error	0,014682503
Observations	72

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,143103341	0,143103341	663,81886	1,9134E-37
Residual	70	0,015090312	0,000215576		
Total	71	0,158193653			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0,595896567	0,005387977	110,5974578	2,562E-80
Share of empl.	-0,471730766	0,018309202	-25,76468242	1,9134E-37

In this case the regression equation is as follows:

$\widehat{Y_t} = 0{,}5958 - 0{,}4717X_t$

$R^2 = 0{,}9046$ means that 90,46% of variation of Gini index before taxes and transfers (Y_t) can be explained by the share of employment in industrial sector (X_t). P-values of the coefficients is less than a significance level α=0,05 and modulo *t-stats* of all coefficients are greater than t_{crit} = 1,994437112, consequently, all regression coefficients are significant at the 5% significance level. F equals 663,81 and is greater than $F_{crit} = 3{,}97$. Significance F is lower than 0,01. We can conclude that the model is statistically significant.

The disadvantage of the model is that the results explain income distribution only at the moment. For forecasting income distribution in future economies with new technologies, AI, demand for new specialists with tertiary education, new institutions and other attributes of a new technological structure, a completely another model is required.

Results

The regression analysis shows us that deindustrialization, in terms of decreasing employment in the secondary (industrial) sector, results in increasing market income inequality. It is also important to reveal, which forces are implicitly included in the model, even though they are not used as variables: employment in industry influences on other, 'derived', factors of income inequality and it is also influenced by some of such factors.

Firstly, most of trade unions are formed in the framework of industrial sector. According to the OECD data, there is a decline of the British trade unions, which is accompanied by the decrease of the share of employees in industry. Trade unions require earnings/wages above the market ones for their members, consequently, income inequality in the country narrows. The service sector, or tertiary sector, does not have such strong workers' unions as the industrial sector has (at least, in the Britain's case).

Secondly, the difference in salaries in the service sector is larger than the one in the industrial sector. This is caused by the absence/lack of strong trade unions and also by the earnings' range that is wider in the service sector (especially in developed economies, like the British economy) as the sector includes more different jobs and specializations with different requirements to education level and other conditions. While there is an earnings' range (from salaries of top-engineers to wages of low-skilled workers) in the industrial sector, it is not so wide as it is in the tertiary sector. Tertiary sector is more heterogeneous and 'motley' itself (growing wage dispersion): it includes high-paid CEOs, managers, specialists from financial, insurance, real estate, IT and many other businesses and liberal professions, like tutors, doctors, lawyers to maintenance staff. Henceforth, a decrease in the share of employment in industry and an increase in the share of employment in service sector lead to fluctuations in income inequality and income inequality widening, if other opposite factors (e.g. education) do not overweight the factor of industrial decline. Especially important role in these fluctuations plays financial sector as a part of the service sector. Deregulated financial markets with high salaries and bonuses for bank executives and financial managers and with growing share of financial sector in a country's GDP results in high levels of income inequality (e.g. see Piketty [2017], Stiglitz [2012]). The philosophy of neoliberalism (in particular, the British version of neoliberalism – Thatcherism) puts forward the idea of control on financial and intangible assets, but not on tangible assets: this point is closely connected with the factor of globalization, which is described below. Hence, the financial sector is growing, the share of the industrial sector is decreasing and, as a consequence, market income inequality is widening.

Thirdly, the level of employment in industry influences, in particular, on the political landscape in democratic countries (e.g. since the 'Thatcherite Revolution' (1979-1990) the politicians of the Labour Party of the UK have been Prime-Ministers only for approximately 13 years, while the Conservatives representatives have been Prime-Ministers for about 20 years). The more people are employed in the industrial sector, the higher is the level of popularity of labour, social democratic and other left-wing parties, while the popularity of these political parties and their actions make an impact on the redistributive policy (however, in the present paper the redistributive policy is not considered as only market income inequality is the object of the analysis) and, as a consequence, on income inequality and such indicators, like Gini index after taxes and transfers.

Fourthly, the industrial sector usually needs workers with an upper-secondary level of education (in the second half of the XX century) and the majority of people in industrial economies has the same level of education. In the service economy the number of people with tertiary education increases. Similar level of education among population is usually a factor of deterrence of income inequality. Together with a large share of the industrial sector, a similar level of educational attainment among the population can be considered as a base of the middle class in the UK in the second half of the XX century, and it remains so in other countries with larger industrial sectors than the one in the UK.

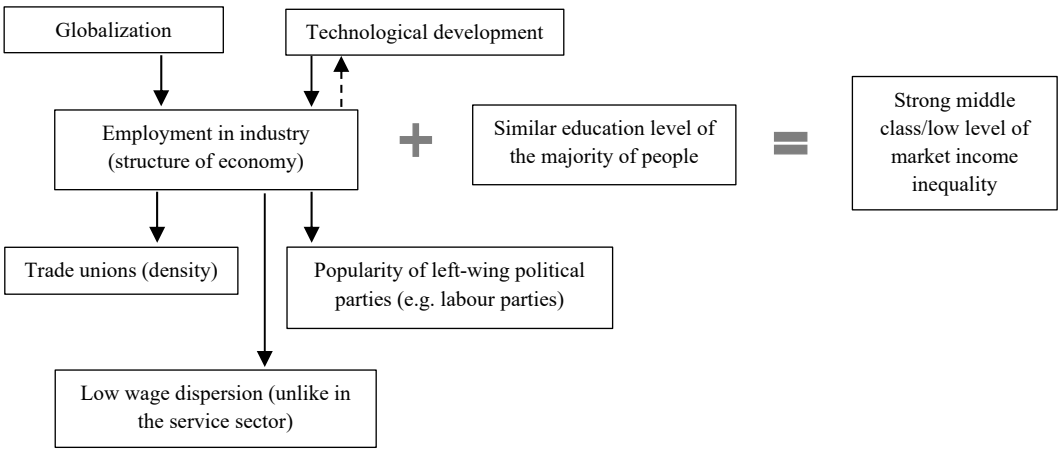
Fifthly, globalization is indirectly included in the presented model as with the acceleration of globalization in the end of the previous century more and more industrial enterprises

have been moving to the countries (mostly Asian) with emerging markets, cheap resources and workforce. Such a process has resulted in the fact, which is proved by B Milanovich (2016), that the winners of globalization are the 'global plutocracy' – the largest owners of the financial assets – and the Asian middle class (due to convergence). Hence, by measuring the share of industrial sector we may also estimate the degree of globalization (openness) influence on market income distribution.

Finally, technological development, undoubtedly, also has an impact on the share of employment in the industrial sector and, thus, on the market income inequality (e.g. see Mehic [2018]). B Milanovich (2016) stressed that technological development may influence income inequality in two ways; it can either increase productivity of low-skilled workers and their wages respectively or cause reduction of personnel: low-skilled workers can be substituted by new technologies (while the productivity and salaries of high-skilled workers may rise with the use of these new technologies). The present paper does not aim at defining which force – technological development or globalization – has had a stronger impact on the employment in industry, as both factors have affected it. However, according to the data on market income inequality in the UK, we can draw a conclusion that in the UK technological development has helped (in terms of increasing productivity and, consequently, salaries) high-skilled workers rather than low-skilled ones.

To summarize, the share of employment in industry in comparison with other sectors of economy influences market income inequality in the UK (inequality level after taxes and transfers are not considered in the present paper), thus, the structure of economy plays a key role in income distribution (at least, for now) as it is both the reason for the impact of other forces, influencing income distribution (like trade unions, labor and left-wing political parties) and the consequence of the impact of such forces, like globalization and technological development (anyway, industry is a factor of technological progress too), and it is itself the force (as well as the growing education level), usually narrowing income inequality. As it is shown in the paper, the industrial sector has been the pillar of the strong middle class in the UK.

Figure 2. *Scheme of factors of market income inequality in Great Britain*



Conclusions

The variable "share of employment in the secondary (industrial) sector" has been employed in the model. This variable reflects transformations in the structure of economy, as a decreasing share of employment in the industrial sector in advanced economies, like the British economy, usually is accompanied by an increasing share of employment in the service sector. The regression analysis shows that there is the negative relationship between the share of employment in industry and income inequality: when the value of the share of employment in industry decreases, Gini index (market income, before taxes and transfers) increases. The roots of deindustrialization and transformations in the structure of economy are economic globalization (trade liberalization) and technological development, and these processes lead to distortions in initial distribution of incomes. The base of the middle class in the UK has been a large industrial sector with a big share of employment in it and a similar level of education among the population. To summarize, the structure of economy, its transformations and the effects of accompanying processes (like the decline of the trade unions) are the main factors, influencing income distribution in Great Britain.

Declarations

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Data availability statement: Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Notes

(1) Due to the difference in counting methods between ONS and OECD, the average value of the difference in OECD and ONS indicators was subtracted from the OECD indicators for years 2017-2021.
(2) There was no exact data for 1995-1998, henceforth, the average indicators (1996 and 1999) were used.
(3) Due to the data extraction from the graph, the data for years 1950-1993 is not absolutely accurate, a small margin of error should be taken into account.

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