Class struggle and distribution in the United States

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Abstract

Within a capitalist economy, the set of feasible income distributions is constrained by capitalists' control over investment. According to many on the Left, such constraints are extremely tight and any attempts at redistributing income in favour of the working class – either via the state or at the bargaining table – can have at most a temporary success. This belief is widespread and has led to a capitulationist approach in much of the organized labour movement. Yet, our empirical analysis of the postwar US economy raises significant doubts on this view. Class struggle, and the power resources of the working class can affect the long run distribution of income between classes.

Keywords: structural dependence thesis; class struggle; social democracy; income distribution

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1 Introduction

Over the last four decades, widespread pessimism has dominated on the Left – both mainstream parties and more radical orgnizations and movements – concerning the possibility of obtaining a major redistribution of income in favour of labour. This is explained, in part, by scepticism concerning the workings of the political system. But the theoretical foundations of this paralysing belief largely rest on a particularly popular version of the so-called "structural dependence thesis" (henceforth, SDT), according to which any attempt to increase the share of income going to labour – either via government intervention, or at the bargaining table – is doomed to fail because of the inner logic of capitalism.

There are two versions of SDT, a weak and a strong one. According to the *weak SDT*, the labour movement, and socialist governments, cannot freely set the distribution of national income within a capitalist economy. The economic logic of capitalism imposes *some* relevant limits to the attainable values of the wage share and the profit share. This weak version of SDT is hardly disputable. It is certainly true, for example, that the wage share cannot be pushed below a level that does not guarantee the physical subsistence of the labour force for any sustained period of time. A profit rate (and thus profit share) equal to, or below, zero is incompatible (except possibly for a very short period) with the functioning of a capitalist economy. Nonetheless, the weak SDT is in principle consistent with a wide range of distributions of income between classes. Thus it has limited explanatory power and it does not impose severe constraints on the actions of socialist and social democratic parties, or the labour movement more generally.

The *strong* SDT has much more stringent implications. It postulates that there exists a distribution of national income that emerges in equilibrium from the inner working of capitalism and *any* attempt to increase the wage share above its equilibrium value – thus

reducing the profit share – leads to an investment strike on the part of capitalists which causes an economic downturn. If the increase in the wage share is the product of a redistributive attempt by a Left-wing government, this causes widespread dissatisfaction in the electorate and a quick reversal in policy, as highlighted by a large literature comprising both neo-pluralist and neo-Marxist authors.[1] This is "why the market might be characterized as a prison. For a broad category of political/economic affairs, it imprisons policy making, and imprisons our attempts to improve our institutions. It greatly cripples our attempts to improve the social world because it afflicts us with sluggish economic performance and unemployment simply because we begin to debate or undertake reform"[2].

According to SDT, however, the structural power of capital is exercised even beyond the political sphere. If trade unions and the labour movement manage to alter the distribution of income against capitalists, this also negatively affects investment and activates a so-called *profit squeeze* mechanism: investment drops leading to a slowdown in economic activity and an increase in unemployment which, in turn, will eventually weaken the working class causing the wage share to return to its equilibrium value.

In other words, capitalist control over investment implies, according to the strong SDT, that the margins for government intervention, and for the transformative actions of the labour movement are extremely narrow, if they exist at all. As two of the most prominent theorists of SDT famously put it, "No government ... can reduce the share of income that owners of capital consume. Any additional income for wage earners, whether it consists of wage gains won at the bargaining table or as transfer payments won through election,

[1]The literature is too vast for a comprehensive list of references. Seminal contributions in the two traditions include, respectively, Lindblom 1977; Lindblom 1982 and Coates 1975; Block 1982; Offe 1984; Przeworski 1985a; Przeworski 1985b. For more recent work on the SDT, see for example, Krippner 2011; Panitch and Gindin 2014; Streeck 2014; Woll 2016; Starr 2019.

[2]Lindblom 1982, p.329.

reduces total investment, *dollar for dollar*"[3].

It is difficult to overestimate the popularity of the strong version of SDT both in academia and in popular discourse. While we have focused so far on the neo-pluralist and neo-Marxist literature, the basic idea is shared by many authors belonging to very different traditions[4]. It lies at the heart of neoliberal approaches and provides the foundations for criticisms of social democratic parties, the welfare state, and Keynesian policies.[5]

Further, SDT has strongly influenced policy debates and the elaboration of political programmes. German chancellor Helmut Schmidt – the architect of the reunification of Germany – famously remarked, "The profits of enterprises today are the investments of tomorrow and the investments of tomorrow are the employment of the day after"[6]. The rhetoric and policy proposals of 'Third Way' approaches in the 1990s and 2000s have been based on SDT. Mark Wickham-Jones has shown that during the 1990s and 2000s the UK Labour Party (first in opposition and then in government) formulated policy programmes explicitly on the basis of a belief in SDT.[7]

In the last few decades, the resurgence of finance after the great financial crisis, the widespread failure of left-wing parties and movements to make a major, long-lasting impact even when in power, globalization, and the renewed political prominence of big business have largely been taken as confirmation of the validity of SDT. This has fueled capitulationist attitudes on the Left, especially as concerns the fight for economic justice.

[3]Przeworski and Wallerstein 1988, p.16, emphasis added.

[4]See, e.g., Peltzman 1976; Becker 1983.

[5]To be sure, SDT may also be interpreted as sanctioning the idea that the only way to win redistribution for the working-class is to break with capitalism altogether. However, this option does not seem currently on the horizon, and waiting (or even organizing) for the downfall of capitalism ends up having a paralyzing effect in the here and now. We thank an anonymous referee for raising this important issue.

[6]Quoted by Glyn 2001, p.16.

[7]Wickham-Jones 1995; Wickham-Jones 2003.

In this paper, we shall therefore focus on the strong version,[8] and we shall investigate in particular its *empirical* validity. In fact, and perhaps surprisingly, notwithstanding the popularity of SDT, there is precious little empirical evidence that definitively supports the idea that income distribution in capitalist economies is severely constrained. Indeed, the widespread belief in SDT is – per se – an interesting puzzle.

In closing this section, an important caveat is in order. Structural dependence, or structural constraint theory is actually much broader than the previous discussion suggests. There are many different theories that emphasize the structural constraints that capital imposes on the state. Not all of them are, in the first instance and primarily, theories of income determination, or the wage share. Historically, they arose as a response to pluralist theories of the state and their main function was to try to show that the state cannot be a neutral arbiter between labor and capital, that it will necessarily be biased towards capital – a claim that does not *necessarily* have strong implications on income distributions. In this paper, we focus on versions of SDT that emphasize the distributive implications of the structural dependence of the state on capital, and in particular the influential version of SDT elaborated by Adam Przeworski and coauthors.[9]

2 Empirical literature

Empirical analyses of SDT are few and inconclusive. Existing studies focus in the main on the *redistributive* policies of different governments. At least part of the intuitive support for SDT derives from the failure of governments elected with radical programmes in the 1970s and 1980s (e.g., Allende's Chile, Manley's Jamaica, or Mitterand's first government

[8] Unless otherwise specified, in the rest of the paper we use the acronym SDT to denote the strong version.
[9] Przeworski 1985b; Przeworski 1985a; Przeworski and Wallerstein 1988; Benhabib and Przeworski 2006.

in France). Yet, contrary to the received view, it is unclear that these historical episodes confirm the validity of SDT.

First, the limiting cases of governments with vast reform programmes implemented in a short period of time might at most provide insights on, and qualify, the *weak* version of SDT. Second, and perhaps more important, while these historical episodes at best prove generically the failure of radical attempts to transform capitalist economies, they hardly validate the specific mechanism highlighted by SDT. These experiments have been heavily influenced by cold war dynamics that are only indirectly related to the economic logic of SDT. Remarkably, using a newly-digitized dataset of stock market prices, a recent empirical paper by Daniele Girardi has shown that the ambitious pro-labour programme implemented by the Left coalition after the 1981 electoral victory in France produced no negative effect on aggregate private business investment, which continued to move in line with other industrialized economies in 1981-1983.[10]

According to Przeworski and Wallerstein, such empirical analyses of SDT are uninformative because they "cannot speak to the issue of limits and possibilities".[11] On the one hand, the issue of "possibilities cannot be determined on the basis of limited historical experience".[12] What happened in a handful of historical episodes may be fully determined by the specific conditions in which individual countries found themselves at a given time, and may tell us nothing about the general mechanisms at play in capitalist economies. On the other hand, even focusing on less radical, and therefore more frequently observed, attempts to redistribute income in favour of labour, differences in policies across governments would not prove much about "the existence of structural constraints that bind all governments. We

[10] Girardi 2024.
[11] Przeworski and Wallerstein 1988, p.14.
[12] Przeworski and Wallerstein 1988, p.14.

cannot know whether the observed differences exhaust the realm of possibility".[13] In other words, we can observe actual choices made by governments but we do not know whether such choices were forced by the structural constraints of capital or rather alternative options existed which would have had better outcomes. Is the failure of an attempt to redistribute income the product of mistakes, or is failure inevitable, due to the inexorable logic of capital?[14]

Those doubts about empirical tests of SDT that cannot distinguish between actual and possible choices are cogent. Trying to test choices generally involves counterfactual statements about what could have been done, and these are notoriously difficult to pin down. Yet to move from these problems to advocating a purely theoretical analysis of SDT, by constructing "a formal model with which the internal logic of the theory can be explored"[15] is both doubtful and unwarranted. It is doubtful because while SDT is a theoretical construct to explain the empirical world, Przeworski and Wallerstein's claim suggests that it cannot be subjected to empirical scrutiny. Taken literally, this claim would place SDT in the realm of metaphysics: a transcendent truth that cannot be empirically falsified. It is unwarranted because the examination of isolated historical episodes and of government choices does not exhaust the content of possible empirical tests. Indeed, although limiting cases of radical redistributive policies are interesting, it is the "more routine political-economic interactions that serve as a crucial test of the generalized form of [SDT]".[16]

Fiorio, Mohun and Veneziani argue that in order to properly appraise SDT, one should focus on the set of economic claims, in particular concerning the feasible distributive out-

[13] Przeworski and Wallerstein 1988, p.14.

[14] For a survey of the older literature focusing on the differences in choices under different governments, see the classic study by Cameron 1984. More recent contributions include King and Wickham-Jones 1990; Swank 1992; Wickham-Jones 1995.

[15] Przeworski and Wallerstein 1988, p.14.

[16] Swank 1992, p.39.

comes within a capitalist economy.[17] Is income distribution tightly constrained?Is there a steep distributive trade-off? Can the profit squeeze dynamics be observed? What are its characteristics? In other words, rather than looking at the choices made by actors in the economy and trying to determine, counterfactually, whether alternative choices were available to them which could have led to different outcomes, they suggest to look at the outcomes themselves. In a given historical conjuncture a government may make a mistake. In a certain situation the labour movement may adopt the wrong strategy to obtain substantial distributive gains for the working class. However, over a sufficiently long period of time, it should be possible to observe ex post the *effects* of the structural dependence of labour upon capital on income distribution without ascertaining the full set of choices available ex ante to economic actors at any given point in time. For if SDT is correct and relevant, then any attempts to redistribute income should only yield short run, temporary effects and the range of income distributions attainable in capitalist economies should be narrowly circumscribed, especially in the long run.

Fiorio, Mohun and Veneziani implement this approach focusing on UK data from 1892 to 2018.[18] Their analysis casts doubts on SDT: income shares are much more variable in the long run than SDT suggests, and class struggle and the power resources available to social classes are among the key determinants of distributive outcomes.

The UK data used by Fiorio, Mohun and Veneziani, however, do not allow one to unpack the wage share which is defined as the ratio of 'employee compensation' to national income.[19] This notion of wage share encompasses *all* employees: the statistical definition of employee compensation includes the labour income of the highest paid executives on the same basis

[17] Fiorio, Mohun, and Veneziani 2021.
[18] Fiorio, Mohun, and Veneziani 2021.
[19] Fiorio, Mohun, and Veneziani 2021.

as the labour income of the most lowly paid unskilled worker.

This is a major limitation because it may be objected that SDT concerns the wage share as a *class share*. For example, the fomulation of SDT by Przeworski focuses on the working class narrowly defined as "manual wage-earners employed in mining, manufacturing, construction, transport, and agriculture, persons retired from such occupations, and inactive adult members of their households".[20] Granting that this is a very restrictive definition of the working class, it seems hard to deny that, in general, a notion of wage share that includes CEOs and top management is highly inaccurate if one wants to capture income distribution from the viewpoint of class analysis.

But this data limitation is also problematic more specifically if one wants to test the economic logic of SDT. To see this, suppose the wage share (defined to include all employee compensation) increases as a consequence of a surge in the compensation of firm managers. It is rather unclear that this would activate a profit squeeze mechanism of the kind postulated by SDT, let alone an investment strike.

In this paper we extend, and improve on, the analysis by Fiorio, Mohun and Veneziani[21] by focusing on US data, which allow us to unpack the wage share and identify a closer proxy of the share of income that goes to the working class. Two issues are of considerable interest in evaluating SDT, and its widespread popularity in academia and policy circles, as well as in the wider debates: first, whether there has in fact empirically been a profit squeeze mechanism of the sort postulated in the literature; and second, the behaviour (and determinants) of the long run income distribution.

[20] Przeworski 1985b, p.104.
[21] Fiorio, Mohun, and Veneziani 2021.

3 The basic model of SDT

There are many possible ways of formalizing the economic mechanism at the core of SDT by considering specific causal links between the variables. However, we do not wish to analyze a specific version of SDT, and so we keep our analysis at a general level. We focus first on the simplest possible two-class model and assume that the wage share accurately measures the share of national income that goes to the working class, while the rest goes to the capitalist class in the form of profits. (We discuss the complications arising from unpacking the wage share below.)

In order to capture the logic of SDT we focus on just two variables: the aggregate wage share and the aggregate employment rate, and we can map movements of these variables in terms of class struggle outcomes. For the working class benefits when the wage share rises (because of more income), and when the employment rate rises (because employment is better than unemployment, and more employment strengthens the working class). Conversely, capital benefits when the profit share rises (i.e. the wage share falls), and when unemployment rises (i.e. the employment rate falls, weakening the working class). These two variables lie at the core of the profit squeeze mechanism postulated by SDT and their link can be described based on the model developed more than 50 years ago, by economist Richard Goodwin[22] based on a well-known model in mathematical biology originally formulated by Alfred Lotka and Vito Volterra,[23] noting that the structure of the argument was similar to one put forward by Karl Marx a hundred years earlier.[24]

Suppose that, perhaps by virtue of a tight labour market (a high employment rate), the labour movement manages to obtain a general increase in the wage rate. As wages rise,

[22] Goodwin 1967.
[23] Lotka 1925; Volterra 1926.
[24] Marx [1887] 1954.

profitability falls. So capitalists cut back on investment, and hence reduce their demand for workers. This puts downward pressure on the wage rate, which increases profitability. As profitability increases, capitalists invest more, which increases the demand for workers, putting upward pressure on the wage rate. And so it goes on in an endless cycle which, in a diagram with the employment rate on the vertical axis and the wage share on the horizontal axis, would appear to be clockwise.[25] Despite its abstract and stylized nature, we can use this basic cyclical model to formalize the key empirical questions of our analysis.

Consider a simple diagram with the wage share on the horizontal axis and the employment rate on the vertical axis. SDT postulates the existence of two possible scenarios. Either the economy is in equilibrium with a stable income distribution that emerges from the inner functioning of the unfettered capitalist economy; or it gravitates tightly around that equilibrium in clockwise cycles. In both cases, the income distribution would be highly constrained. However, the economic mechanism underlying the relative stability of income shares would be rather different. As Fiorio, Mohun and Veneziani argue, "The latter pattern would derive from attempts to redistribute income by trade unions or social democratic parties when in power; the former would emerge in the absence of such attempts (because for example of an awareness of their futility given SDT)."[26]

In summary, if SDT is correct, and relevant, a connected scatter graph with the wage share on the horizontal axis, and the employment rate on the vertical axis should depict a set of points closely clustered around the equilibrium – possibly with some clockwise cycles in the short run. How closely clustered should the income distribution be in order for the

[25] This is a highly stylized description which abstracts from important microeconomic and macroeconomic phenomena, including intracapitalist competition, productivity enhancing investment, and aggregate demand effects. These complexities are not central in SDT and therefore we ignore them. Despite its abstract and stylized nature, we can use this basic cyclical model to formalize the key empirical questions of our analysis.

[26] Fiorio, Mohun, and Veneziani 2021, p.989.

empirical evidence to validate SDT? Our analysis in the next section is largely descriptive and therefore it is not possible to identify statistically a precise threshold of significance. However, we believe that the descriptive statistics we derive are sufficient to raise doubts on SDT and motivate our econometric analysis in Section 5.

4 SDT: the short and the long run

The data we use are more precisely defined in Appendix B; here we give a brief overview. The data describe the nonfarm private sector of the US economy; they are annual and cover the years 1948 to 2022. Because we focus on the class struggle discussed in the previous section, we consider the wage share and the employment rate. For the employment rate, we simply take the ratio of nonfarm private sector employees to the total civilian labor force.[27] The wage share is the ratio of wages to output (ie value added), where output is the sum of wages and all non-labour incomes over the whole economy. Graphing a connected scatter of the wage share and the employment rate generates Figure 1:

Based on Figure 1, it would seem difficult to draw clear conclusions on SDT. On the one hand, the data ranges are quite wide on both axes, thus rejecting the hypothesis that the income distribution is tightly constrained. On the other hand, however, one might argue that much of the observed variation reflects either random deviations or perhaps short-to-medium run cyclical movements around a reasonably stable equilibrium.

But the wage share variable merits further consideration. For wages (or more properly,

[27]We focus on the employment (rather than the unemployment) rate because this is the variable used in the literature on the profit squeeze we consider, as discussed in Section 3. We exclude state sector wages and employment, because we are trying to look at pure capitalist behaviour. US national and local state sector employment (in the military, in medical insurance, in high schools and so on) is not (at least in the first instance) driven by profitability considerations, and hence we would not expect any profit squeeze mechanism to apply proximately to the state sector.

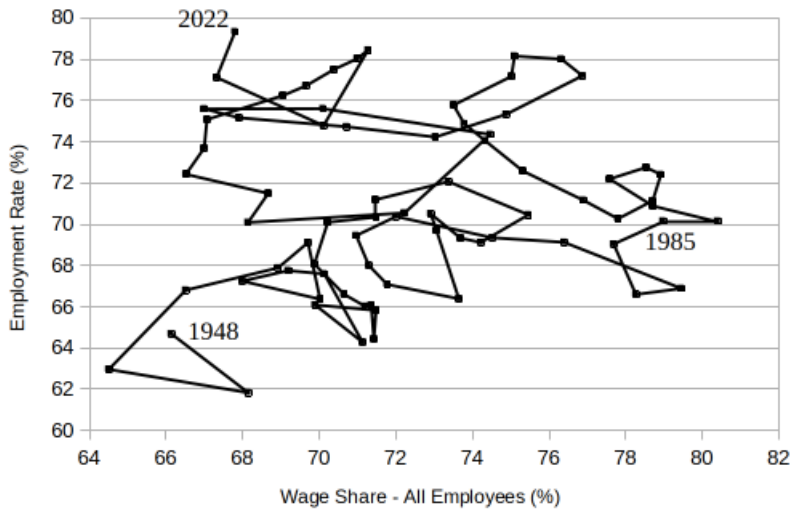


Figure 1: Wage Share and Employment Rate, 1948-2022

compensation of employees) is too broad a category, since it includes the wages of all employees, whether top corporate executives or the low paid cleaners of their offices. We want a category that describes (or at least approaches the description of) the labour income of the working class. One way to do this is to focus on power relations, for capitalist production processes are typically organized in hierarchical and authoritarian structures. Within those structures, some predominantly supervise and others are predominantly supervised. Using US Bureau of Labor Statistics data, we are able empirically to distinguish these two categories, so that, combining with data from the US National Income and Product Accounts, our 'working class' wage share is the ratio of the wages of 'production and 'nonsupervisory employees' to the sum of total wages and profits.[28]

A first take on a working class wage share in this manner against the employment rate

[28]Production and nonsupervisory employees were about 92% of total nonfarm private sector employees in 1948, falling fairly steadily to 83-84% by the mid-1980s, and remaining at that level through to 2022. In part this fall in the 35 years after 1948 reflects a structural transformation of family firms into more corporate capitalist structures with their associated hierarchies of white-collar workers.

generates a connected scatter shown as Figure 2. It is striking how different Figure 2 is from

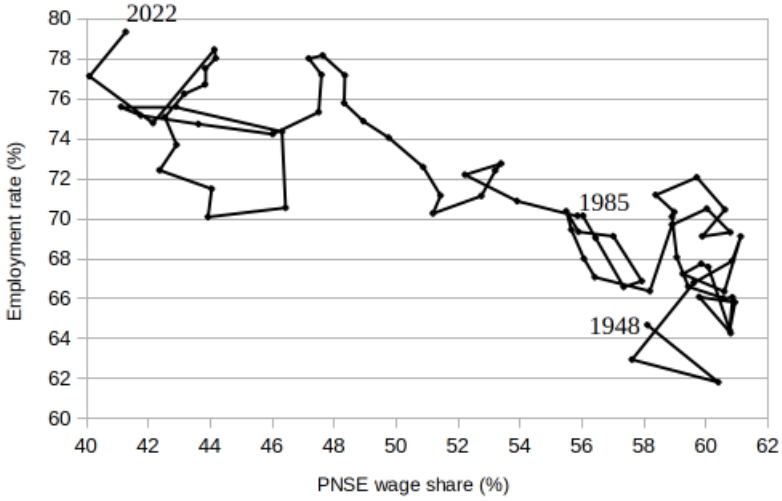


Figure 2: PNSE Wage Share and Employment Rate, 1948-2022

Figure 1. Stripping out supervisory wages and focusing on the wages of production and nonsupervisory employees generates a connected scatter that may, at the same time, help explain the popularity of SDT, while raising some doubts on its empirical validity.

For, first, there seems to be some evidence that a profit squeeze mechanism of the sort postulated by SDT is indeed operating. Although two cycles are anti-clockwise (1951-55 and 1971-75) and two periods display not even the hint of any cycle at all (1982-86 and 1991-2000), in the raw data displayed in Figure 2, nine clockwise cycles of the kind described in Section 3 can be identified.

Yet, and this is the second key feature of Figure 2, it is implausible to interpret these as cycles around an equilibium position. In no way are they centred on some average wage share and some average employment rate over time. Rather, they jump around through time and the patterns displayed are very variable. The PNSE wage share and employment rate

do not display the stability that SDT requires, and this severely limits SDT's explanatory efficacy - there is rather more going on than SDT allows.

In order to investigate this further, we consider each of our time-series as a combination of trend and deviation from trend. Technically, we filter the data using a standard statistical procedure (the Hodrick-Prescott filter) to determine the trend, and the results are displayed as Figure 3. Deviations are then determined simply by subtracting for each year the raw

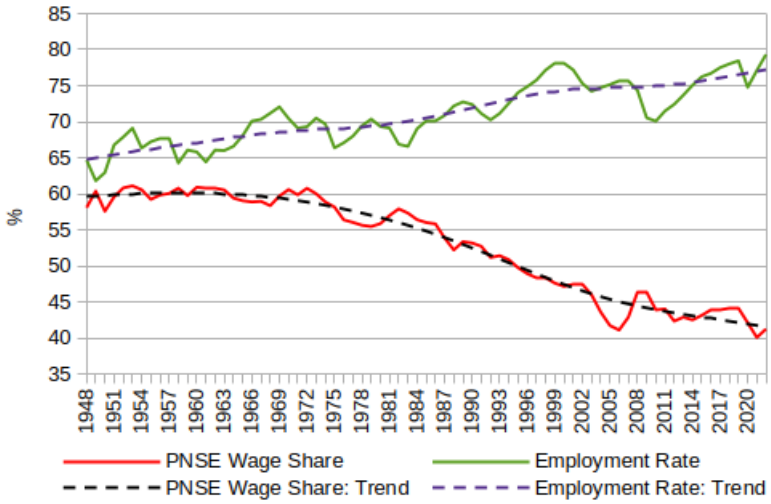


Figure 3: Trend and Deviation: PNSE Wage Share and Employment Rate, 1948-2022

data from the trend data. So consider connected scatters of the deviations from trend, again with the employment rate on the vertical axis and the wage share on the horizontal axis. We show one example of a clockwise cycle as Figure 4. Of the nine identifiably clockwise cycles in the raw data, eight remain clockwise in terms of deviations from the trend, and the other (1959-62) displays no cycle at all in terms of deviations from the trend; in addition one (1982-86) shows no cycle of any sort in the raw data, but becomes a clockwise cycle in terms of deviations from the trend. So in deviations from the trend, nine out of 11 cycles display a clockwise shape, two anti-clockwise, and two periods show no cycle at all. The cycles are

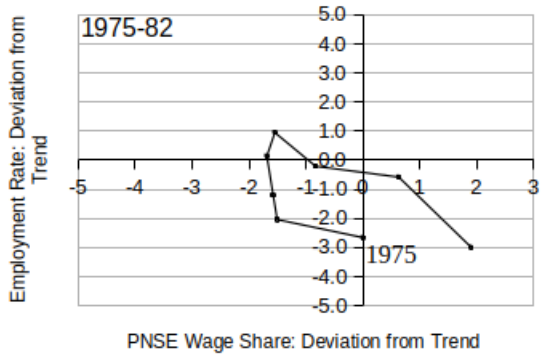


Figure 4: Trend and Deviation: PNSE Wage Share and Employment Rate, 1948-2022

centred (more or less) on a zero deviation from trend. Again, this is tentative evidence for a sort of modified SDT in terms of cycles of deviations from the trend, but it is not *strong* evidence, because it ignores long run trends in income distribution.

The foregoing discussion of cycles as deviations from trend suggests that the underlying long run trend in income distribution can be shown as a connected scatter of the *trend* series. This is shown as Figure 5. The trend employment rate rises for the whole period. The trend PNSE wage share in 1948 is 59.7%, rises to a maximum of 60.2% in 1959, and then falls below its 1948 level by 1967. Indeed, from 1959 it falls for the whole period. If a rising trend PNSE wage share is seen as an unambiguous working class gain, the 1950s were the only post-1945 years in which this occurred (which might have something to do with the rose-hued nostalgia with which the years of the Eisenhower presidency are sometimes viewed). If one interprets trend values as a proxy for the equilibrium income distribution, a trend wage share ranging between 40-60% is prima facie inconsistent with SDT, which seems unable to explain the dynamics of the long run political-economic equilibrium configuration of the USA.

More purchase can be acquired on this overall history by considering the ratio of an

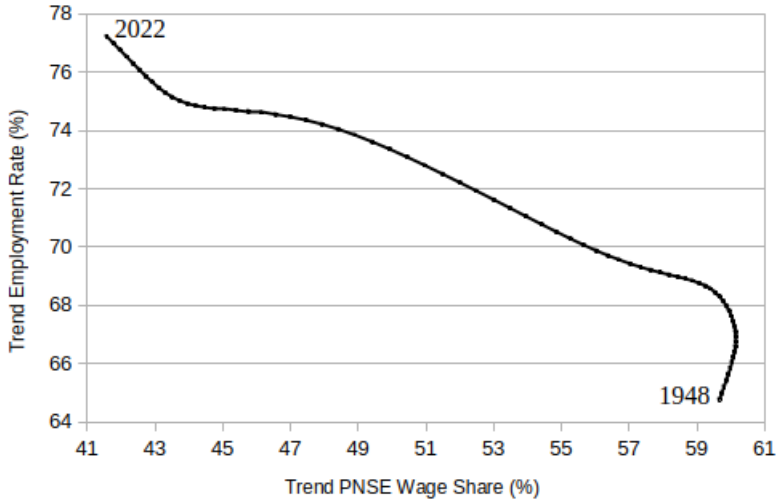


Figure 5: Trends: PNSE Wage Share and Employment Rate, 1948-2022

average supervisory employee's annual pay to an average production and nonsupervisory employee's pay. There is no trend in this ratio – indeed little difference in average annual pay – through the Golden Age. In 1973 the ratio was 1.04, meaning that on average supervisors were only paid 4% more than production and nonsupervisory employees.[29] But from 1973, this changes, as shown in Figure 6. From 1.04 in 1973, the ratio rises to 1.34 by the end of the 1970s. These were the years of stagflation and an intensification of class struggle with no clear outcome. But the rising income differentials were a foretaste of what was to come; by 1979 an average supervisory employee was paid a third more than the salary of an average production and nonsupervisory employee.

Everything began to change in the fall of 1979, with the Volcker interest rate shock, the election in the UK of the Conservatives led by Thatcher and the election of Reagan to the

[29] 1973 is conventionally considered to be the final year of the 'golden age', and we shall adopt such a convention below. Arguably, however, in the US the 'golden age' came to an end earlier, around 1966, with the turmoil induced by the civil rights campaigns and the Vietnam War, and the deficit financing of LBJ's 'great society' and the Vietnam war, leading to the collapse of the Bretton Woods arrangements when Nixon broke the link between the dollar and gold.

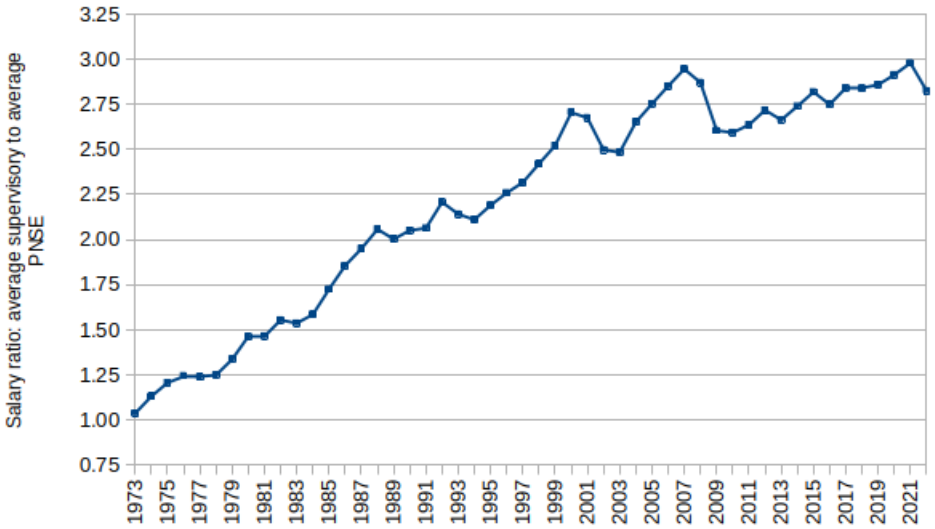


Figure 6: Trends: Ratio of Annual Pay: Average Supervisory to Average PNS Employee, 1973-2022

US Presidency. Pay differentials began to increase more steeply, peaking at almost 3 by 2007. These were the years of neoliberalism, years of continuing and sustained working class defeat, culminating in the financial crisis of 2007-9. But the financial crisis was resolved through a bailout of Wall Street rather than Main Street, so that there was no return to the greater equality of the pre-neoliberal era. After the shock of the financial crisis, the upward trend in the ratio continued, as Figure 6 shows.

But in this context, averages are highly misleading because of the way income distribution is skewed towards the top. In the data used thus far, from the mid-1960s, between 17% and 19% of private sector nonfarm employees have supervisory functions, while 81-83% do not. In a broader study, considering all employees and using tax data, Piketty and Saez have emphasized this skew.[30] Some of their results are collected in Table 1.[31]

[30] Piketty and Saez 2003.

[31] While the theoretical and methodological framework behind Table 1 has been elaborated in Piketty and Saez 2003, we have used the updated data in Piketty and Saez 2024.

	Total Growth in Real Income			
	P0-90	P90-95	P95-99	P99-100
1948-1973	97.8	116.5	98.6	32.2
1973-1979	-4.0	-1.3	-3.5	0.3
1979-2007	3.7	32.6	56.6	194.7
2007-2022	-5.7	7.7	14.3	9.0
	Income Relative to P0-90 Income			
	P0-90	P90-95	P95-99	P99-100
1948-1973	1.0	2.9	4.1	11.8
1973-1979	1.0	3.1	4.3	10.6
1979	1.0	3.1	4.3	10.7
2007	1.0	3.9	6.4	30.4
2022	1.0	4.5	7.8	35.1

Source: Piketty and Saez 2024

Table 1: Real Income Growth and Relative Income Levels, USA 1948-2022

Piketty and Saez divide the number of households (more technically, tax units) into one hundreths, or 100 percentiles, where P1 is the bottom one-hundreth of households, P0-90 is the bottom nine-tenths, P90-100 the top ten percent, and P99-100 the top one percent.[32] The top half of Table 1 shows the total growth in real income over the 25 years of the 'golden age' (1948-73), the years of transition (1973-79), the neoliberal era up to the financial crisis (1979-2007), and the post financial crisis era (2007-22). The 'golden age' saw a mild compression of income distribution, the real average income of the top one percent growing much less than all other percentiles. This trend begins to be reversed during the 1970s, and then spectacularly so through the 28 years of the neoliberal era. While for 90% of households, those 28 years saw a feeble total of 3.7% growth in real income (real GDP growth was 130.4%), the experience of the top ten percent was rather different. Within that ten percent, the bottom half saw growth of 32.6%, P95-99 a growth of 56.6%, and the top one

[32]Piketty and Saez 2003.

percent 194.7%. Clearly, the top one percent did rather well. These trends continued in the post-financial crisis years, with average real income from 2007 to 2022 for 90% of households falling by 5.7%, but fractions of the top ten percent experiencing positive growth, the more growth the higher up the ten percent.

The bottom half of Table 1 shows how this differential growth experience translates into average incomes relative to the average income of the bottom 90% of households. During the 'golden age' and the years of transition, on average the top one percent received 10-12 times the income of the bottom 90% of households. By 2007, it was 30.4 times, and by 2022 35.1 times.[33] There has been much loose comment about the underlying sources of right wing populism in recent times. But one thing is certain: the 'left behind' constitute the overwhelming majority of the population, and in the neoliberal era and the post-financial crisis years, they really have been left far, far behind. It is this historical experience that underlies the trend scatter of Figure 5.

5 The power resources of the working class

The empirical evidence presented in Section 4 shows that there exists no equilibrium income distribution around which the economy tightly gravitates, contrary to SDT. The data show some short run cycles of the kind predicted by SDT – which may explain its popularity – but the significant variability of the long run income distribution is inconsistent with it.

Lacking an explanation of the source of long run variability in the distribution of income, however, this evidence is only suggestive. If the long run dynamics of the distributive shares were entirely, or mostly, driven by factors that were completely independent of class struggle,

[33]Piketty and Saez 2024 also show that half of the 35% total growth in average real income from 1993 to 2022 was captured by the top one percent; their real income grew by 123.3%, whereas the real income growth of P0-99 grew by 20.3% (57.3% for P95-99, 35.1% for P90-95, and only 8.2% for P0-90.

then one might defend a qualified version of SDT: the long run distribution of income is not fixed but its dynamics are exogenously determined so that any attempts to redistribute income generate a profit squeeze cycle around the (exogenously) moving trend.

Yet it is unclear that a convincing explanation of the long run distribution of income based on purely exogenous factors can be provided. While economists sometimes adopt the fictional assumption of exogenous changes in institutions, technical change, demographics, or culture, it seems difficult to assert that these are all independent of class struggle. Long run changes in the institutional and legislative framework,[34], the cultural and education system,[35] and the basic structural features of the economy, including long run trends in technological progress, labour supply, skills, and so on,[36] are hardly independent of distributive conflict and government policies. There is actually robust historical evidence that political actors intentionally act to modify the structural and institutional features of the economy in order to change the balance of power between classes.[37] Indeed, Tali Kristal shows empirically that class conflict, power and institutions matter even controlling for technical change, R&D, and productivity.[38]

In order to provide further evidence against SDT, however, in this section we directly analyze the relation between the long run distribution of income and the power resources at the disposal of the working class. If SDT were correct, then a stronger working class would be unable to reap anything more than merely temporary gains at the bargaining table.

Capitalism is based on labour market transactions between those who sell their ability to work and those who possess (either by ownership or through loan contracts) the non-

[34]Korpi 1991; Korpi 2002; Wright 2009.
[35]Bowles and Gintis 1976.
[36]Jayadev and Bowles 2006; Guy and Skott 2007; Kristal 2013.
[37]Korpi 2002; Korpi 2006; Rothstein 1984.
[38]Kristal 2013.

labour means of production. In principle, these are individualized contracts. But those in possession of the means of production have a common interest in defending their property rights, whereas those in possession of nothing except their ability to work have only the commonality of that possession. This at least potentially pits each worker against the other in the competition for jobs.

Consequently, in parallel with the formation of an industrial urbanized working class, the growth of trade unions was motivated by the realization that only some sort of collective organization could enable significant countervailing power to the power of capital. That countervailing power is measured by trade union density – the proportion of total employment that is unionized. For particular industrial struggles, the density in the particular industries will be important, but for the economy as a whole, some indication of actual and/or potential working class power is given by the overall measure of union density. Union density measures the *power resources* possessed by the working class,[39] and if SDT is correct, and relevant, there should be no long term relation between distributive shares and union density.

We test whether there exist a relation between the wage shares of supervisory and non-supervisory employees, the employment rate, and trade union density in the US since the mid 20th century. In the profit squeeze mechanism described in section 3 above, economic activity plays a key role in linking distribution (the wage share of the working class) and the employment rate: when the share of income going to the working class increases, capitalists reduce economic activity, which eventually affects the employment rate. Therefore in our analysis we also include the logarithm of Net Domestic Product, NDP, attributable to business, $\ln Y$.[40] Our annual data (described in Appendix B) comprise 75 yearly observations

[39] Korpi 1991; Korpi 2002.

[40] It may be argued that in the profit squeeze mechanism underlying SDT, it is more specifically *investment* and not *income* that provides the link between distribution and the employment rate. We do not find this argument entirely compelling because, theoretically, what matters is economic activity in general rather than

from 1948 to 2022.

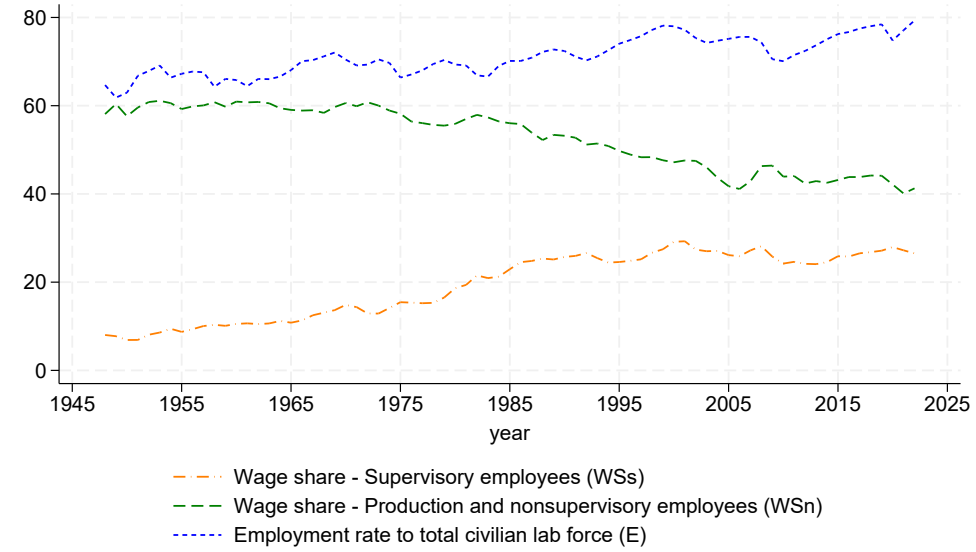
Figures 7a and 7b display the long run picture of the five variables in the US.[41] The employment rate displays a clear cyclical movement along a mildly increasing trend. Union density and the two wage shares have the same qualitative dynamics: they remained reasonably constant during the first three decades of the post-war period, and then experienced marked trends either upward (the wage share of supervisory employees) or downward (union density and the wage share of nonsupervisory employees). As already noted in Section 4, focusing on the wage share for all employees is rather misleading as its constancy hides the more significant movements *within* the set of employees. The main stylized fact is, arguably, the large gain of supervisory employees – whose interests coincide or at least align with those of the capitalist class – at the expense of the working class, something which cannot be detected by focusing only on the profit share.

Figures 7a and 7b do seem to suggest that union density is negatively correlated with the wage share of supervisory employees and positively correlated with that of the working class, as expected. Eyeballing the diagrams, however, will only get one so far. Moreoever, we are not generically interested in the relation between the various variables: as argued in Sections 3 and 4, in order to test SDT, we need to examine *the long run* relation between union density and distributive shares. To this end, we need to use econometric techniques.[42]

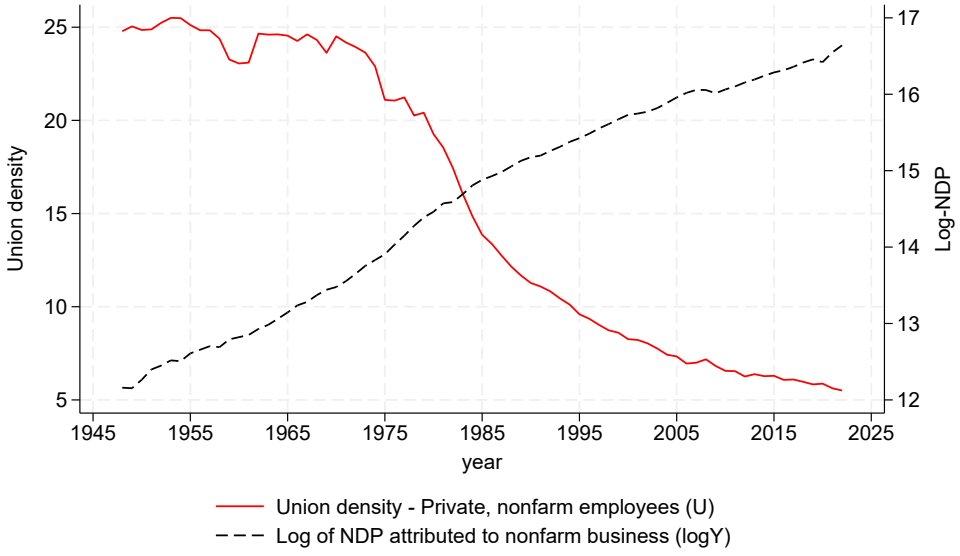
investment, and NDP more accurately measures overall economic performance.

[41] Basic summary statistics of all variables are provided in Table 2 in Appendix B below.

[42] It is important to stress that our time series analysis can only detect over-time *correlations* between the relevant variables but cannot definitively establish *causal relationships*. Nonetheless, we believe that, together with the descriptive analysis in Section 4 and historical narrative sketched in the conclusions, the econometric evidence presented here raises major doubts on SDT and supports an analysis of the long-run movement of income shares based on the power resources of the two classes.



(a) Wage shares and employment rate



(b) Union density and log-NDP

Figure 7: Descriptive trends, 1948-2022

Modern econometric theory assumes that variables are stationary (that is, their statistical properties, like mean and variance, do not change over time) or are cointegrated (that is, a linear combination of them is stationary, even though the individual series themselves are nonstationary). As each of the five variables considered is nonstationary, we follow a well established methodology to analyze possible long term relationships between them, which is based on the specification of an error correction (VEC) model that includes both the long term equilibrium and the short term dynamics. This methodology allows us to test whether there exists a long run relationship between the individually nonstationary variables that makes them stationary.[43] Based on this methodology we estimate, over the period 1951-2022, a model with three lags and two long run cointegrating equations, and outline details of the econometric estimation in Appendices C and D.

To present results, we use impulse response functions (IRFs). These are used to describe how the system's variables react over time to external shocks or impulses using our preferred specification of the VEC model. They show the estimated reaction of each variable to a one-time shock in one of the variables, providing a time path of the effects, helping in understanding the short term and long term dynamics within the system, and capturing the interdependencies and feedback loops between variables. IRFs help visualize how deviations from long run equilibrium are corrected over time. Specifically, in Figure 8 we shock the union density variable (U) and look at the estimated response in turn of each of the wage share, the employment rate and the log of the net domestic product, holding everything else constant for a time lag that goes from 1 to 10 years.

Figure 8 shows a positive and permanent effect on the wage share of the working class WSn (panel in the first row, second column) and a negative and permanent effect on the

[43] Soren Johansen 1995; Lütkepohl and Krätzig 2004.

wage share of the supervisory class, WSs (panel in the second row, first column). The effect on employment, E, is negative but with some delay (panel in the first row, first column), while union density seems to have no effect on economic activity, $\log Y$ (second row, second column). This is consistent with our description of union density as being a power resource of the working class: union density and the working class wage share move together, so that as density declines, so does the working class wage share. Correspondingly, the supervisory wage share rises.

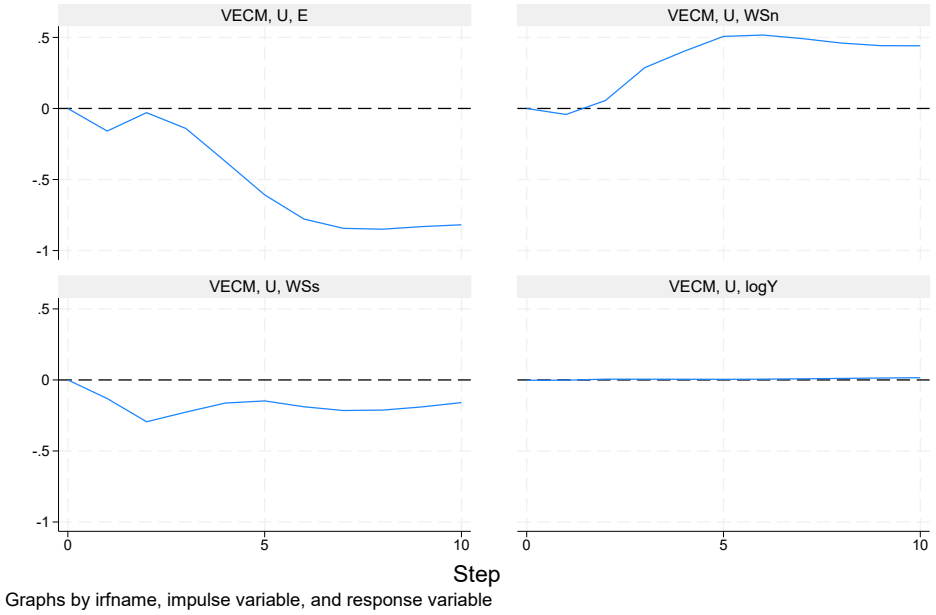


Figure 8: Impulse response functions after a shock on U, 1948-2022.

6 Conclusions

The structural dependence thesis is widely held, and it provides theoretical foundations to the capitulationist posture of much of the Left. While it is certainly true that not all income

distributions are feasible within a capitalist economy, our results raise significant doubts on the economic mechanism that lies at the foundation of the strong version of SDT. For we find a long run correlation between the wage share and union density, and we interpret this as evidence that the strong version of SDT has no explanation of long run trends in income distribution. This matters because those long run trends have been of dramatic importance. While it might seem paradoxical to rest our critique of the strong version of SDT on the long run defeat of the US working class and its association with a collapsing union density, nevertheless that association points a way forwards for progressive struggles.

For we think our evidence also supports the view that the history of the US economy is a history of class struggle, determined by the power resources that each class has at its disposal. Even when class struggle has limited effects in the short run, the long run distribution of income is not cast in stone and the balance of power between the two classes – including the power resources at the disposal of capitalists, and primarily their control over investment and pricing (which we have not explicitly considered in this paper) – have a major impact. Of course, we do not choose our immediate circumstances and the constraints that they imply, but the future course of class struggle is always open and not predetermined.

Indeed, we can interpret the period under consideration as one characterised by major shifts in the power resources at the disposal of the two classes, consistent with our econometric analysis. For the US, in very broad brush terms, the Great Depression and subsequent war destroyed the power of finance, and led to an accommodation between the unions representing the working class and industrial capital. That accommodation, against the background of a post-war recast international order under US tutelage, was very successful and has come to be characterised as the "golden age". But it began to breakdown in the mid-60s. Japan and Germany (and other European economies) had recovered from post-war impoverish-

ment, and the post-war international economic order was under increasing strain. This was then exacerbated by the borrowing (necessary in the absence of extra taxation) to finance both the reforms that were the outcome of the civil rights movement, and the Vietnam war. This had two effects. First, currency crises forced the abandonment by the US of the system of fixed exchange rates against the dollar, with the US dollar linked to gold. And second, off-shore dollar accounts (facilitated through the City of London) began to be much more important as dollar-holders sought to insulate themselves from the domestic controls of the Fed (the US central bank). Finance, that is, was seeking a comeback.

The 1970s were then an era of instability, characterised by relatively high levels of unemployment and inflation relative to the Golden Age. Industrial capital wanted low interest rates and high levels of aggregate demand to support profitability, whereas finance wanted above all high rates of interest to resist the ravages of inflation on bond portfolios. The stalemate of stagflation that then ensued undermined the ideologies of social democracy and in so doing began to undermine the alliance between organised labour and industrial capital. Finance became stronger and launched its coup in the fall of 1979 with the Volcker interest rate shock. In short order, Reagan began his term in 1980-81 with the destruction of PATCO (the air traffic controllers' union), and Thatcher in the UK began laying the groundwork for a raft of anti-union legislation and the mid-80s destruction of the National Union of Mineworkers. That is, industrial capital lined up with Wall Street and ushered in the era of neoliberalism, whose effects on income distribution we have described above.

While the economic logic of capitalism constrains the set of feasible income distributions, the boundaries of the feasible are much wider than is commonly assumed. The last four decades have witnessed a major shift in the power balance against the working class, which has experienced a decline in the power resources at its disposal – first and foremost, its

collective force – while the power resources of the capitalist class have increased, thanks to the elimination of restrictions in the movement of capital across borders, the weakening of antitrust legislation, and so on. But none of this is cast in stone. There is no iron law of distribution that makes class struggle and activism redundant. The actual history of capitalism and class struggle is more complex and underdetermined than the strong version of SDT suggests.

Yet if socialist and social democratic parties, and the labour movement more generally, want to improve the conditions of the working class and reverse the current trends in distribution, they must shift the focus of their action back to measures that fundamentally alter the balance of power between classes. In other words, campaigns for more progressive taxation and other redistributive measures must be combined with strategic thinking about the long term and how to create the (power-based) conditions for a major, permanent shift in the distribution of income between classes. This does not mean a return to the social democracy of the Golden Age – conditions today are very different. It rather entails an imagination on how to rebuild a collectivism in an era of climate change without which a working class revival will not be possible. The future remains open, and is not predetermined by any strong version of SDT.

A Abbreviations used

BLS: Bureau of Labour Statistics (https://www.bls.gov/);

CCA: Capital consumption adjustments;

CE: Compensation of employees;

HSUSME: Carter et al;[44]

IV: Inventory valuation;

NIPA: National Income and Product Accounts (https://www.bea.gov/)

PI: Private industries;

PNSE: Production and nonsupervisory employees;

T: Table.

Unless otherwise stated, the NIPA industrial coverage is Private Industries less Farms.

B Data

B.1 Construction of the economic variables

Wage Share of production and nonsupervisory employees (WSs)

Numerator: Total compensation of PNSE.

Denominator: Total compensation of PNSE plus Total compensation of supervisory employees (equals CE) plus Total profits.

The current dataset (prefix CEU) of the Employment, Hours and Earnings Survey at BLS begins in 1964, and the discontinued dataset (prefix EEU) has data from 1947 to 2002. Using the values for 1964, splice the discontinued dataset from 1964 backwards (to 1948) on

[44]Carter et al. 2006.

to the current dataset for the following series for PI (the survey excludes Farms): (a) number of PNSE, splicing the series BLS EEU00500003 from the discontinued database on to the current database series BLS CEU0500000006; (b) average weekly earnings of PNSE, splicing the series BLS EEU00500004 from the discontinued database on to the current database series BLS CEU0500000030.

Wage share numerator: Total number of PNSE: take the ratio of PNSE (BLS CEU0500000006 spliced as above) to Total Employees (BLS CEU0500000001) and apply to NIPA Total employees (NIPA T6.4), thereby determining PNSE numbers;

multiplied by

PNSE Average earnings per week: BLS CEU0500000030, spliced as above;

multiplied by

the NIPA ratio of CE to Wage and Salary Accruals, where in each case the industrial coverage is Nonfarm Private Industries (NIPA T6.2 and T6.3) less Private Households and Non-profit Institutions Serving Households (NIPA T1.13);

multiplied by 50, the assumed number of weeks worked in a year.

Wage share denominator: Total CE (loosely, "total wages") is the sum of CE in Corporate Business plus CE in Non-Corporate Business less CE in Government Enterprises (all from NIPA T1.13) less CE in Farms (NIPA T7.3.5). This is the sum of the total compensation of PNSE and Supervisory Employees (where the latter is Total CE less compensation of PNSE). Total Profits are the sum of Corporate Profits Before Tax (without IVA and CCA and Proprietors' Income with IVA and CCA, less Farm Proprietors' Income, less the Current Surplus of Government Enterprises (all from NIPA T1.13). There is no data on the Current Surplus of Government Enterprises from 1948 to 1958 (incl.)

Employment Rate (E)

The ratio of Total Private Non-Farm Employees (BLS CEU0500000001) to Total Civilian Labor Force (BLS LNU01000000).

Union Density (U)

The percentage of all employees who are members of a union.

Union density numerator: unionized employees, private non-agricultural industries For 1983-2019, BLS series LUU0204794600. For 1973-1982, HSUSME series Ba4787 (from the same Current Population Survey). The missing 1982 figure is constructed from the 1982-83 annual rate of growth in the Troy-Sheflin data (see below) and interpolated into the Current Population Survey data. For 1948-72, the Current Population Survey data are extrapolated backwards using the annual rate of growth of Troy-Sheflin union members (HSUSME series Ba4785) less Canadian members of US unions (HSUSME series Ba4786).

Union density denominator: all employees: BLS: CEU0500000001

Net domestic product (in log, $logY$)

Net domestic product (attributable to non-farm business): NIPA T1.9.5 line 3.

B.2 Summary statistics

Basic summary statistics of the five variables considered (WSs, WSn, U, E and $logY$) over the period 1947-2022 are provided in Table 2.

Table 2: Summary statisitcs for variables used in the analysis.

Variable	Obs	Mean	Std. dev.	Min	Max
WSs	75	19.418	7.360	6.899	29.281
WSn	75	52.863	6.948	40.101	61.118
E	75	71.067	4.196	61.830	79.330
U	75	15.549	7.778	5.505	25.501
$\log Y$	75	14.580	1.404	12.153	16.640

Notes: WSs is the "Wage share - Supervisory employees"; WSn is the "Wage share - Production and nonsupervisory employees"; E is the "Employment rate to total civilian lab force"; U is the "Union density - Private, nonfarm employees"; $\log Y$ is the "Log of NDP attributed to nonfarm business"

C The vector error correction model

At any time t, our data are represented as a vector of five variables, y_t, comprising measures of supervisory and nonsupervisory wage share (WSs and WSn, respectively), employment rate (E), trade union density (U), and the natural logarithm of the net domestic product ($logY$). For any t, $\Delta y_t = y_t - y_{t-1}$ denotes the change in the five variables between period t and period $t-1$.

The VEC representation of the relationships between our five variables considered can be written as:

$$\Delta y_t = \alpha(\beta y_{t-1} + \mu + \rho t) + \sum_{i=1951}^{2022} \Gamma_i \Delta y_{t-1} + \gamma + \epsilon_t, \tag{1}$$

where, based on the visual inspection of the time-series of the five variables considered and a set of test statistics, we assume it includes a linear trend and a constant in the cointegrating equations and no linear trend in the differenced equations. In our analysis, $y_t = (WSs_t, WSn_t, E_t, U_t, \log Y_t)'$; ϵ_t is a sequence of independently and identically distributed shocks, with zero mean and full rank variance-covariance matrix; Γ_j is the 5×5 matrix capturing the short term interactions among the variables.

Given our interest in detecting the long run interaction between the five variables considered, we focus on the error correction part of the VEC model, which is the term that adjusts for deviations from the long term equilibrium relationship between the cointegrated variables. This part ensures that any short term deviations are corrected over time, bringing the variables back toward their long term equilibrium. The error correction part of model (1) is $\alpha(\beta y_{t-1} + \mu + \rho t)$, where α is the vector of adjustment coefficients, indicating how quickly the variables return to their long term equilibrium after a short term deviation, and $(\beta y_{t-1} + \mu + \rho t)$ is the set of long run relationships.

Based on standard criteria for optimal lag selection, the Johansen rank test, a set of tests for assessing serial correlation, model misspecification and the stationarity of the cointegrating equation,[45] we estimate a VEC with two cointegrating equations and three lags and obtain the simultaneous estimation of Γ_j, α and β using the full information maximum likelihood framework provided by Johansen.[46]

Table 3 shows the estimates of the two cointegrating equations. It provides an estimate of the long term equilibrium relation, as shocks that affect this relationship have only a temporary effect. Normalizing the coefficient of WSs to one in the first equation (supervisory wage cointegrating equation) and of WSn to one in the second equation (nonsupervisory wage cointegrating equation), Table 3 shows that union density (U) is positively correlated in the long run with both the supervisory and nonsupervisory employee wage shares.[47]

Table 4 provides the estimates of the adjustment coefficients vector. Using the standard 95% significance level threshold, Table 4 suggests that the nonsupervisory employees' wage

[45] More details on this in the Appendix D.

[46] Søren Johansen 1988.

[47] The correlation between supervisory employees' wage share and union density is equal to 0.853 in the first cointegrating equation and the correlation between non supervisory employees wage share and union density is equal to 1.855 in the second cointegrating equation.

share (WSn) adjusts to possible deviations from the long term equilibrium, contributing to correcting any disequilibrium in the system and the speed of adjustment is high, as about 50% of the deviation from the long term equilibrium is corrected in the next period.

In order to analyse the dynamics of the model, the estimates in Tables 3 and 4 should be read together. A coefficient equal to 1.855 for the union density (U) variable in the second cointegrating equation (WSn) suggests that an increase in union density by 1, all else equal, pushes the long run relation out of its long term equilibria; 55% of which is corrected by an *increase* in WSn within the next period. Similarly, if U increases by 1, it pushes the long run relation out of its long term equilibrium and 50% of the disequilibrium in the first cointegrating equation is absorbed by *reducing* WSn by about 0.4 points. The net effect is an increase in WSn. A disequilibrium in the first cointegrating equation is also corrected, though at a lower speed ($\alpha_{WSs,1} = -0.239$), by an increase in the wage share of supervisory employees, which *increases* by about 0.20 within the following period. The adjustment coefficients for $logY$, E, and U in Table 4 are not significant, which suggests that the net domestic product, employment rate, and union density variables do not adjust to deviations from the long term equilibrium, with no contribution to correcting any disequilibrium in the system.

D Additional tests

In order to investigate the number of lags p in the model, we use the final prediction error (FPE), Akaike's information criterion (AIC), Schwarz's Bayesian information criterion (BIC), and the Hannan and Quinn information criterion (HQIC) lag-order selection statistics for a series of vector autoregressions of order 1 through a requested maximum lag. They suggest

Table 3: Vector error-correction model: long run relationships

Cointegrating equation 1

	Coeff.	Std. err.	$P > z$
Wage share - Supervisory employees (WSs)	1.000	.	.
Wage share - Prod. and nonsuperv. employees (WSn)	0.000	(omitted)	
Employment rate to total civilian lab force (E)	-0.683	0.163	0.000
Union density - Private, nonfarm employees (U)	-0.853	0.294	0.004
Log of NDP attributed to nonfarm business (lY)	-19.632	3.137	0.000
Linear trend	0.799	0.137	0.000
Constant	296.265	.	.

Cointegrating equation 2

	Coeff.	Std. err.	$P > z$
Wage share - Supervisory employees (WSs)	0.000	(omitted)	
Wage share - Prod. and nonsuperv. employees (WSn)	1.000	.	.
Employment rate to total civilian lab force (E)	-0.276	0.196	0.158
Union density - Private, nonfarm employees (U)	-1.855	0.352	0.000
Log of NDP attributed to nonfarm business (lY)	-14.998	3.761	0.000
Linear trend	0.714	0.165	0.000
Constant	185.132		

Notes: Johansen normalization restrictions imposed.
Sample: 1951 - 2022. Number of obs = 72.
AIC = 3.904; HQIC = 4.710; SBIC = 5.928

Table 4: Vector error-correction model: adjustment coefficients

		Coefficient	Std. err.	$P > z$
Cointegration equation 1	$\alpha_{WSs,1}$	-0.239	0.089	0.007
Cointegration equation 2	$\alpha_{WSs,2}$	0.099	0.079	0.213
Cointegration equation 1	$\alpha_{WSn,1}$	0.505	0.105	0.000
Cointegration equation 2	$\alpha_{WSn,2}$	-0.556	0.093	0.000
Cointegration equation 1	$\alpha_{E,1}$	0.309	0.187	0.098
Cointegration equation 2	$\alpha_{E,2}$	-0.018	0.166	0.914
Cointegration equation 1	$\alpha_{U,1}$	0.118	0.065	0.070
Cointegration equation 2	$\alpha_{U,2}$	-0.043	0.058	0.458
Cointegration equation 1	$\alpha_{logY,1}$	0.000	0.004	0.988
Cointegration equation 2	$\alpha_{logY,2}$	0.002	0.004	0.487

Notes: Johansen normalization restrictions imposed.
Sample: 1951 - 2022. Number of obs = 72.

esimating a model with 1 to 3 lags (Table 5). This is not surprising given the yearly frequency of our data. We selected a lag-order of 3 considering the analysis of residuals and the results of Jesús Gonzalo[48] warning that underspecifying the number of lags in a VEC model can significantly increase the finite-sample bias in the parameter estimates and lead to serial correlation.

Consistent with the pattern of the series under analysis, we assume a model with only a constant in the cointegrating equation, and estimate the cointegrating rank by iterating the cointegration test from $r = 0$. Table 6 shows the trace test, allowing us to reject the hypothesis that $r = 3$ but not that $r = 2$.

We have checked that the residuals of the estimated VECM are not subject to significant heteroskedasticity, and the results presented in Table 7 allow us to conclude that we cannot

[48] Gonzalo 1994.

Table 5: Lag-order selection criteria

Sample: 1952 - 2022. Number of obs = 71

Lag	df	p	FPE	AIC	HQIC	SBIC
0			134.975	19.095	19.158	19.254
1	25	0.000	0.000	4.370	4.751	5.327*
2	25	0.000	0.000	3.774	4.471*	5.526
3	25	0.000	0.000*	3.600*	4.614	6.149
4	25	0.036	0.000	3.754	5.084	7.100

Notes: * optimal lag
Endogenous: WSs, WSn, E, U, lY
Exogenous: constant

Table 6: Johansen tests for cointegration

Maximum rank	Params	LL	Eigenvalue	Trace statistic	Critical value 5%
0	55	-97.576	.	109.666	87.310
1	65	-74.984	0.466	64.482	62.990
2	73	-63.286	0.277	41.087*	42.440
3	79	-53.870	0.230	22.255	25.320
4	83	-47.520	0.162	9.554	12.250
5	85	-42.743	0.124		

Notes: Trend: Restricted; Sample: 1951 - 2022, Number of obs = 72, Number of lags = 3
* selected rank.

reject the null hypothesis of no autocorrelation up to lag 6. The results of the residual autocorrelation test reported in Table 7 show that there is no evidence to reject the null hypothesis of no autocorrelation in the residual of the estimated VECM model.

Table 7: Lagrange-multiplier test for autocorrelation in the residuals of the VECM model

Lag	χ^2	Degrees of freedom	$P > \chi^2$
1	14.345	16	0.573
2	24.509	16	0.079
3	11.802	16	0.758
4	21.248	16	0.169
5	5.665	16	0.991
6	14.746	16	0.543

Notes: H_0 : no autocorrelation at lag order

Finally, Figure 9 shows the plot of the predicted cointegrating equations and results of the the Dickey-Fuller test for stationarity over the considered period.

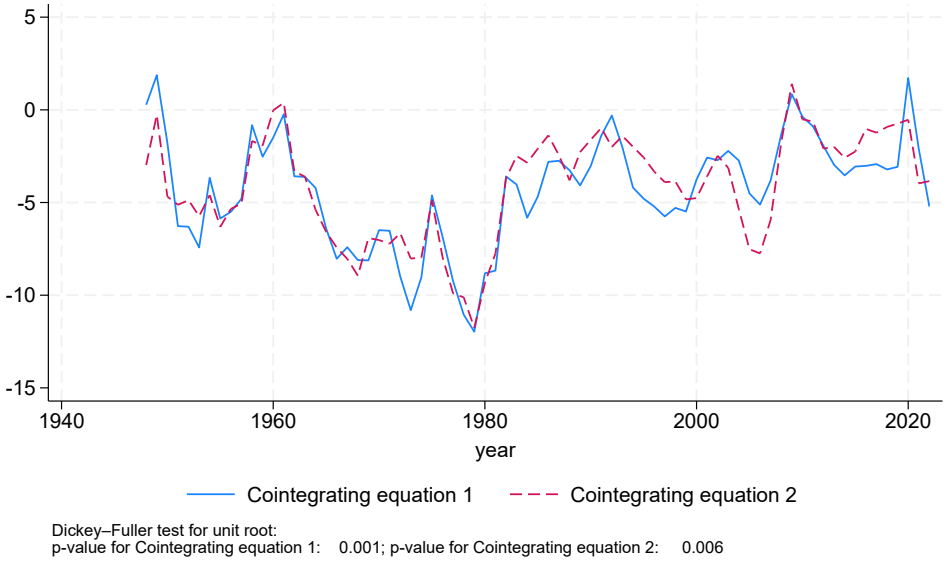


Figure 9: Stationarity of the cointegrating equations