I Z A Institute
of Labor Economics
Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 18033

Three Wages and Two Prices

John H. Pencavel

JULY 2025

DISCUSSION PAPER SERIES

IZA DP No. 18033

Three Wages and Two Prices

John H. Pencavel
Stanford University and IZA

JULY 2025

ISSN: 2365-9793

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Three Wages and Two Prices

Using annual observations on U.S. non-farm workers from the late 1940s to 2019, descriptions of the movements of nominal wages, real consumption wages, and real product wages are reported. The prices faced by consumer workers and the prices faced by owner-managers move differently. Variables associated with movements in these wages are presented and the roles of these wages in accounting for changes in employment, hours of work, and in Labor's share are noted. Changes in real product wages have had a larger (negative) impact on the use of labor than changes in real consumption wages.

JEL Classification: J31, N31, N32

Keywords: real consumption wages, real product wages, nominal wages, labor productivity

Corresponding author:
John Pencavel
Department of Economics
Stanford University
Stanford
California 94025-6072
USA
E-mail: pencavel@stanford.edu

THREE WAGES AND TWO PRICES

John H. Pencavel

"*The ultimate test of any industrial system is the degree to which it improves the condition of life of the people who live under it...... If the real income of the people is diminishing, social unrest necessarily accumulates and changes of some sort almost inevitably follow. It is, therefore, highly desirable to chart the economic progress of the largest group in our country, namely, those who work for wages or for salaries.*" (Paul A. Douglas (1930))

Although economists at an early stage in their education learn the important distinction between nominal wages and so-called real wages, real wages have not been the subject of extensive analysis. This paper reports on some patterns in the movements of real wages that, if replicated with other bodies of data, might constitute empirical regularities concerning real wages. The observations here on wages and on most of the other variables are drawn from the Productivity Statistics Program of the U.S. Bureau of Labor Statistics available at https://www.bls.gov/productivity/tables/.

The observations relate to all U.S. workers both production and non-production workers even though more than 80 per cent of all employees in the private sector are production and non-supervisory employees. Current Population Surveys are drawn upon to allow the BLS to incorporate information on the self-employed. The observations are annual and apply to the non-farm business sector from the late 1940s to 2019 before the onset of the pandemic.

Although the term "wage" will be used, a more appropriate word might be "compensation" in that , in this paper, in addition to before-tax wages and salaries, the observations on wages include fringe benefits such as employer contributions to health and pension plans as well as various additions to wages in the form of profit-sharing and supplements accompanying non-standard work.

The analysis of nominal wages has occupied a distinctive role in macroeconomic research in recent decades. In the years when wages and prices appeared to rise relentlessly, explanations focused on the role of unemployment as an indicator of the tightness of labor markets as a key explanatory variable in the rise of nominal wages, a research literature exemplified by Phillips' (1958) curve. Trade union activity was also offered as an independent force "pushing" up these wages as in Hines (1964) and Ashenfelter *et al.* (1972).

In an examination of Phillips' work, Lipsey (1960) added to unemployment the change in retail prices as an explanation for nominal wage increases. Although he was succinct,[1] his reasoning probably went like this: workers view an increase in consumer prices as a reduction in their real wages and agitate for an increase in nominal wages to offset this loss in well-being. Lipsey did not consider the issue from the perspective of the employer of the archetypal price-taking profit-maximizing firm who might welcome an increase in his or her product prices as it would reduce real wage costs or simply alter the employer's resistance to nominal wage increases. Whereas an increase in retail price increases would put upward pressure on nominal wages, an increase in the output price deflator might put downward pressure on nominal wages.

Once wage inflation became less of an issue, attention turned to the link between movements in real wages and those of labor productivity. In this research, sometimes real wages were measured as those viewed by workers, that is, real consumption wages in which nominal wages are deflated by the price of consumer goods; sometimes real wages were measured as those viewed by employers, real product wages in which money wages are deflated by the price or per unit revenue of the firm's

[1] Lipsey wrote "...an increase in the cost of living makes trade unions more aggressive in demanding increases [in nominal wages] and employers and arbitrators more willing to grant them while a decrease in the cost of living acts in the reverse direction" (p.9).

product. On some occasions (one is Bivens and Mishel (2015) another is Paternesi and Stirati (2023)) both real consumption wages and real product wages have been used.

This paper considers the relation among these three wages - nominal wages, real consumption wages, and real product wages - since the Second World War. Can the specific variables mentioned above - labor productivity, the unemployment rate, retail price increases, changes in the output price deflator, and trade union bargaining strength account for the movements of these wages? After examining variables that might account for wage changes, the analysis turns to the effect of wages on labor's share and on the size of the labor input.

For convenience, a glossary of the variables in this analysis is provided in Table 0.

I. The Construction of Three Wages

The nominal hourly wage is formed in each year t by dividing total labor compensation C_t in year t by aggregate hours worked H_t. C_t is from the national income statistics program of the Bureau of Economic Analysis of the U.S. Department of Commerce. H_t is the product of average weekly hours worked (denoted h_t) and total employment (denoted E_t)and an estimated number of weeks (often 52) using information from the National Compensation Survey and the Current Employment Statistics programs of the Bureau of Labor Statistics. The course of aggregate hours from 1948 to 2019 is shown in Figure 0. It trends positively and also exhibits cyclical movements. The increase in employment exceeded a small decrease in average weekly hours.[2] These are hours paid for but information from the Employment Cost Index and the Current Population Survey are drawn upon to distinguish hours worked from hours paid for. The symbol here for this

[2] From 1948 to 2019, the compound annual growth in aggregate hours, H_t, was 1.25 % while the growth rate of employment, E_t, was 1.47 % and that of average weekly hours, h_t, was -0.223%.

nominal hourly wage is W^N_t in year t ; its annual per cent change is expressed as ΔW^N_t .

Suppose P^C_t is the consumer price index (in earlier years the CPI-U-RS and in recent years the CPI-U) in year t . Then the value of the real consumption wage in year t is formed as the nominal wage (as defined in the previous paragraph) deflated by the consumer price index in year t , that is, $(W^N_t)/(P^C_t)$ and represented here by W^C_t .[3] Its annual per cent change in year t over the previous year is ΔW^C_t .

Denote the value added output price deflator in year t by P^O_t. (Recall that the gross domestic product is the sum of value added across all industries.) Then, the value of the real product wage in year t is defined as the nominal wage relative to P^O_t or $(W^N_t)/(P^O_t)$. The real product wage is expressed here by W^P_t and its annual per cent change by ΔW^P_t . The construction of the real product wage involves the nominal wage and the product price. These variables were also used in the operation of the sliding scales in certain U.S. and British industries in the late 19th and early 20th centuries: workers' nominal wages were adjusted formulaically to the price of the product the workers were helping to make. Sliding scales tended to be proposed by trade unions in bargaining with associations of employers and were designed to avoid strikes. The adjustments were usually subject to limits on nominal wage levels. See Hanes (2010) and Treble (1990).

The real consumption wage and the real product wage have the same numerator, the nominal wage, but they have different denominators so differences in movements between these two wages will depend on differences in these deflators.[4] Figure 1 graphs the annual values of P^C_t and P^O_t

[3]Over the years when they overlap (1958 to 2019) the correlation between the CPI and the personal consumption expenditure price index is 0.997.

[4] Information on the construction of P^O_t and P^C_t is found in the U.S. Bureau of Labor Statistics Handbook of Methods available at https:///www.bls.gov/opub/hom For instance, P^C_t covers the

from 1948 to 2019 and descriptive statistics on P^C_t and P^O_t are provided in Table 1. It is evident from Figure 1 and the information in Table 1 that during this period the consumer price index rose more than the value added output price deflator. This implies the real consumption wage rose less than the real product wage between 1948 and 2019 and this is shown in Figure 2 along with the path of labor productivity.[5] In addition P^C_t displays more annual variation than P^O_t. With a less variable denominator and the same numerator, W^P_t varies more than W^C_t.

The BLS measures labor productivity in the non-farm business sector by dividing real value added output Y_t by aggregate hours worked hours worked H_t. The symbol of labor productivity in year t in this paper is X_t and ΔX_t is the annual per cent change in labor productivity . Table 2 provides descriptive statistics on labor productivity and nominal and real wages and their annual per cent changes from 1948 to 2019. With information on nominal wages and on retail prices routinely available, movements in real consumption wages are easier to construct year by year than real product wages ; to what extent can movements in real product wages be inferred from movements in real consumption wages?

II. Variables Accounting for Changes in Three Wages

Consider now the differences among these three wages with respect to the variables that have been proposed to describe their movements over the previous seventy years or so. A popular candidate to describe the variations of real wages are the movements of labor productivity. Ronald

---

prices of imported goods whereas P^O_t is restricted to the prices of domestically produced goods. P^C_t includes sales taxes while P^O_t excludes taxes.

[5] There were 8 years in which ΔW^C_t was negative and 6 years in which ΔW^P_t was negative. Between 1948 and 2019, the correlation coefficient between the annual values of W^C_t and the annual values of W^P_t is 0.99 while the correlation coefficient between the annual values of ΔW^C_t and ΔW^P_t is 0.82.

Bodkin (1966) and Edwin Kuh (1967) suggested that labor productivity is also a determinant of nominal wage changes and, in view of the evidence they supplied, this deserves consideration. As shown in Figure 2, labor productivity rose at a pace slightly higher than real wages (both real product wages and real consumption wages) from 1948 to the late or mid-1970s since when it has clearly grown faster than both real wages.

Given its celebrated history in macroeconomics research on wage changes, the unemployment rate, U_t is an obvious variable to describe nominal wage movements as are variations in trade union bargaining strength. In view of the extensive evidence (Lewis(1986)) of the association between proportional differences in wages and in union density, D_t (the fraction of workers who are members of trade unions), it is natural to investigate the association between per cent changes in wages and trade union density D_t. The years from 1948 to 2019 include the year (1953) in which D_t reached a maximum in the 20th century, but it has been a long decline for most of these years especially since the 1970s. See Figure 3.

Here are three regression equations to describe the associations between the variables mentioned in previous paragraphs and the three wage variables from 1948 and 2019 :

(1) $\Delta W^N_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 U^{-1}_t + \alpha_3 D_t + \alpha_4 \Delta P^C_t + \alpha_5 \Delta P^O_t + \varepsilon_{1t}$

(2) $\Delta W^C_t = \beta_0 + \beta_1 \Delta X_t + \beta_2 U^{-1}_t + \beta_3 D_t + \beta_4 \Delta P^C_t + \beta_5 \Delta P^O_t + \varepsilon_{2t}$

(3) $\Delta W^P_t = \gamma_0 + \gamma_1 \Delta X_t + \gamma_2 U^{-1}_t + \gamma_3 D_t + \gamma_4 \Delta P^C_t + \gamma_5 \Delta P^O_t + \varepsilon_{3t}$

Table 3 reports descriptive statistics on these right-hand side variables. In view of the fact that the construction of the two real wage variables involves the nominal hourly wage, it is a reasonable starting point to allow the explanatory variables specified to describe changes in nominal wages also to describe changes in real wages. With wages and prices expressed as their per cent annual changes, the coefficients attached to ΔP^{C}_{t} and ΔP^{O}_{t} in the above equations may be interpreted as elasticities of wages with respect to prices.

In these equations, the unemployment rate has been expressed as its reciprocal to be consistent with Phillips' (1958) finding that the effect of unemployment on the rate of change of nominal wages is non-linear. This nonlinearity is preserved in the real wage equations (2) and (3). ΔP^{C}_{t} is the annual percent change in consumer prices that Lipsey (1960) introduced in his examination of Phillips' seminal article. As reasoned above, consumer price increases reduce real wages as seen by workers who reduce their labor supply and agitate for higher nominal wages. The variable ΔP^{C}_{t} became a common feature in the research on nominal wage increases as illustrated by Bodkin (1966).

ΔP^{O}_{t} is the annual per cent change in the output price deflator which affects the net returns of employers: an increase in P^{O}_{t} may indicate an increase in product demand that induces an increase in the derived demand for labor and an accompanying increase in nominal wages. This effect was not usually recognized in the earlier literature but it is the natural counterpart to ΔP^{C}_{t}. Whereas workers assess nominal wage changes with reference to consumer prices, so employers judge nominal wage changes with reference to their product prices.

Omitted variables and errors in measuring wage changes are included in the stochastic terms ε_{1t}, ε_{2t}, and ε_{3t}; these are assumed to be distributed independently of the right-hand side variables. Least-squares estimates of the three equations above for the 72 years from 1948 to 2019 are contained in columns *(i)*, *(ii)*, and *(iii)* of Table 4. The convex from below relationship that Phillips found for the effect of unemployment on nominal wages is reproduced with these observations and the implied relation is drawn in Figure 4.

The nominal wage change equation (1a) gives the appearance of those fitted in the 1960s and 1970s with roles for the unemployment rate, for consumer price increases, and for labor productivity increases. Output price increases are positively associated with nominal wage increases, an association that is greater in magnitude than consumer price increases. Real wage changes are positively associated with consumer price increases and negatively associated with output price increases; it is as if real wages were determined by bargaining and P^C_t represented workers' threat point in year t and P^O_t were employers' threat point. Consumer price increases enhanced the power of workers over real wages and output price increases enhanced the power of employers over real wages. Given the absolute values of the estimated elasticities of real wages with respect to these prices, a simultaneous equal increase in P^C_t and P^O_t favored the employers

Examining the observations around the estimated ΔW^N_t - U_t curve, Phillips suggested that nominal wage increases were also affected by the change in unemployment such that, when the unemployment rate was rising, wage increases moderated. In these observations, when the per cent change in the unemployment rate was added to equation (1) , the estimates implied it was unrelated to ΔW^N_t and the coefficient estimates on the other variables were virtually unchanged.

Although Phillips was criticized for relating unemployment to nominal wages and not to real wages (Friedman (1976, pp. 218-9)), it seems from equations (2a) and (3a) in Table 4 that unemployment is also negatively associated with movements in real wages .

Increases in labor productivity are associated with increases in nominal wages, real product wages and real consumption wages: the estimated coefficients on ΔX_t in Table 4 (equations (1a), (2a) and (3a)) imply that a one percent increase in productivity is associated with an increase in nominal and real wages (both real consumption wages and real product wages) of about 0.4 per cent in wages.

Note that because W^C_t is formed by dividing $W^N{}_t$ by $P^C{}_t$, $\Delta P^C{}_t$ on the right-hand side of equation (2a) is related (negatively) to $\Delta W^C{}_t$ by definition and this offsets (outweighs) the positive effect of $\Delta P^C{}_t$ on $\Delta W^N{}_t$. Similarly, because W^P_t is formed by dividing $W^N{}_t$ by $P^O{}_t$, $\Delta P^O{}_t$ is by definition (negatively) related to $\Delta W^P{}_t$ in equation (3a) of Table 4 and this outweighs the positive effect of $\Delta P^O{}_t$ on $W^N{}_t$. Between 52 per cent and 83 per cent of the variation in the three wages between 1948 and 2019 is removed by the least-squares combination of these variables.

The coefficient estimates in column *(iii)* of Table 4 when $\Delta W^P{}_t$ is the dependent variable are similar to the coefficient estimates in column *(ii)* of Table 4 when $\Delta W^C{}_t$ is the dependent variable. When the 72 observations constituting equation (2a) are pooled with the 72 observations in equation (3a) and a single equation is estimated to the 144 observations, the result is shown in column *(iv)* and the hypothesis that the two equations (equations (2a) and (3a)) embody the same relationship cannot be rejected on a conventional F test. If this is correct, a regression in which $\Delta W^P{}_t - \Delta W^C{}_t$ (the difference between changes in real product wages and changes in real consumption wages in year *t*) is the dependent variable and is regressed on the same variables, the result will be a poor description of variations in this dependent variable. This seems to be the case from the estimates in column (*v*) of Table 4.

III. Two Periods?

Some have suggested that changes took place in the 1970s or early 1980s such that the more recent decades exhibit a different labor market structure from previous decades. A clear statement of this is provided by Paternesi and Stirati (2023, p.426)) who write "in the immediate post-war period....the average (and the median) [real] labor compensation tended to move in step with productivity growth [as suggested in Figure 2] . Since the late 1970s or beginning in the 1980s this pattern has broken, and what is observed in mature economies.....is a decoupling between the average pay and productivity" and they provide pooled observations across 22 countries (including the U.S.A.) and over almost 50 years to support their conclusion. Other researchers have tacitly accepted this finding by concentrating their analysis only on the years since the 1970s.

The price and wage series plotted in Figures 1 and 2 indicate inflexion points in the late 1970s. Descriptive statistics on changes in real and nominal wages for two periods, 1948-1979 and 1980-2019, are given in Table 5 and mean and median annual increases in these variables were lower in the 1980-2019 period than in the 1948-79 period. The mean and median values of ΔW^C_t in the 1980-2019 period are remarkably low; this was a period, of course, when union density collapsed.

Descriptive statistics on other variables in the two periods are given in Table 6 and again the changes in labor productivity, in consumer price changes, in value added output prices and in trade union density are all lower in the 1980-2019 period than in the earlier period.

Compound annual growth rates for thirteen variables in the two sub-periods and in the entire 1948-2019 period are given in Table 7 and, for all but one of these variables, the growth rates were lower in the 1980-2019 period than in the 1948-1979 years. The lone exception is the growth rate of average weekly hours of work which is negative in 1980-2019, but not as negative as the growth of weekly hours in the 1948-1979 years. The growth rate of labor productivity exceeded the growth rate in real hourly wages in both the 1948-79 and the 1980-2019 years although this difference was larger in the later period.[6] Differences in growth rates between variables (in the bottom panel of Table 7) were largest in the 1980-2019 period. These patterns are consistent with the hypothesis that U.S. labor markets in the years from 1980 to 2019 were, indeed, systematically different from those in the 1948-1979 period.

To explore the hypothesis of a changed structure, equations (1), (2), and (3) were estimated to the two non-overlapping periods: from 1948 to 1979 and from 1980 to 2019. Least-squares estimates of these equations are reported in Table 8. In this table, the values of F are the calculated F statistics from testing the null hypothesis of no difference between the estimated structures of 1948-79 and those of 1980-2019 . At conventional significance levels, this hypothesis is rejected when the dependent variable is ΔW^N_t and when the dependent variable is ΔW^P_t but it cannot be rejected when the dependent variable is ΔW^C_t .

In the case of nominal wage changes, the implications of the coefficients on $U^{-1}{}_t$ on ΔW^N_t when estimated with the 1948-79 observations compared with the 1980-1019 observations are plotted in Figure 5. This shows Phillips' Curve shifted such that, during the 1980-2019 period, a given unemployment rate corresponded to a lower rate of change of nominal wages than during the1948-1979 period .

From examining the variables that account for some of the movements in nominal, real product and real consumption wages, consider now variables that nominal and real product and real consumption wages might affect.

[6] The series in Figure 2 look as if, during the 1948-1979 period, ΔX_t grew at about the same rate as the growth rates of ΔW^C_t and ΔW^P_t The scale of the axes in the figure is such that it masks the (small) difference.

IV. The Effects of Three Wages: Labor's Share

The reason for the enduring interest in Labor's share is expressed well by Paul Douglas (1930) in the epigram at the beginning of this paper. Wage-earners are people who engage in what economics formally characterizes as an unpleasant activity (hours of work) usually at the direction of others to derive an income to support their and their households' well-being. In some cases, the total income of the wage-earner may consist of dividends and interest and rent as well as wages, but typically the greater proportion of his or her income will consist of earnings from labor. By contrast, those (once called rentiers) receiving profits, dividends, and rent are not required to undertake working hours to receive an income and this is why these categories of income are often described as "passive". The business owner may also engage in management (as a self-employed individual) and his or her income may be classified as part wages and part profit but with the modern division between ownership and management, this mixed income does not constitute the greater part of passive income.

With C_t defined as aggregate labor compensation and with V_t as value added in year *t* both measured in billions of current dollars, then Labor's share is $S_t = 100(C_t \div V_t)$. Annual values of S_t are shown in Figure 6 from 1947 to 2019 with descriptive statistics on S_t, C_t and V_t in Table 9.

Because the analysis below expresses variables in per cent annual changes, it is convenient to take logarithms of the definition of $S_t = 100[C_t / V_t]$ and differentiate with respect to time: $dlnS/dt = dlnC_t/dt - dln V_t/dt$. Moving from these differentials to discrete per cent annual changes

(4) $$\Delta S_t = \Delta C_t - \Delta V_t$$

here ΔC_t is the annual per cent change in aggregate labor compensation and ΔV_t is the annual per cent change in value added output. As shown in Table 9 between 1948 and 2019 the per cent compound annual growth of V_t exceeded the growth of C_t so the growth in S_t has been negative.

Although Figure 6 gives the impression of large swings in S_t , these variations are within a relatively narrow range of a minimum of 55.7 per cent in 2013 and a maximum of 65.3 per cent in 1960 (as given in Table 9) . As measured by the coefficient of variation *(σ/μ)* and by the quartile deviation relative to its median (*QD/M*), the dispersion of S_t over the years from 1948 to 2019 is the lowest of all the variables analyzed here. The median values of ΔS_t in each of the three periods specified in Table 10 are zero. Thus S_t is not an exact constant but its annual movements are small compared with the movements in the other variables.

Around these variations in Figure 6, S_t trends negatively throughout the 1948-2019 period although (as given by the per cent compound annual growth rate, *G*, in Table 7) its negative trend in the 1980-2019 period was more than twice its negative trend in the 1948-1979 period. This discontinuity in *S* after the 1970s is also evident in a number of other countries (Stockhammer (2017) and (OECD(2012)).

To help understand these movements, break down *S* into two components. That is, with $S_t = [\,C_t / V_t]$ and given that $C_t = W^N{}_t \,.\, H_t$ where H_t is aggregate hours worked and that $V_t = P^O{}_t\, Y_t$ where Y_t is real value added output, S_t may be written

$$S_t = (\,W^N{}_t .\ H_t)/(P^O{}_t .\ Y_t) = (W^N/P^O)_t .(Y/H)^{-1}{}_t = W^P{}_t\ X_t^{-1}$$

where, in the last step above, $(W^N/P^O) = W^P$, the real product wage and $Y/H = X$, labor productivity. In logarithms , the previous equation may be written $\ln(S) = \ln(W^P) - \ln X$ and differentiating with respect to time

$$(5) \qquad dlnS/dt = dlnW^P/dt - dlnX/dt$$

or, moving from continuous time to discrete time and allowing for errors arising from classifying income,

(6) $$\Delta S_t = \Delta W^P_t - \Delta X_t + \varepsilon_{6t}$$

and proportional changes in Labor's share equals proportional changes in the real product wage minus proportional changes in labor productivity plus stochastic shocks. When real product wages increase less than the increase in labor productivity, as has been the case throughout the post-Second World War period , Labor's share declines unless shocks interfere.

Equation (6) is not to be interpreted as implying that an increase in real product wage causes an increase in Labor's share and an increase in labor productivity causes a decrease in Labor's share. Equation (6) must hold because it is simply a rewriting of changes in S_t into its components. Although it might be useful to use $(\Delta W^P_t - \Delta X_t)$ to determine whether Labor's share has changed and to quantify its change, it is an identity . The identity applies to changes in real product wages, not real consumption wages nor nominal wage changes. Indeed the correlation coefficient between ΔS_t and $(\Delta W^P_t - \Delta X_t)$ in the years from 1948 to 2019 is unity whereas the correlation coefficient between ΔS_t and $(\Delta W^C_t - \Delta X_t)$ is 0.78 and between ΔS_t and $(\Delta W^N_t - \Delta X_t)$ is 0.53.

If Labor's share is subtracted from gross value added, the remaining components consist of corporate profits, rental income, proprietors' income, interest income, indirect taxes less subsidies, and depreciation. Denote this passive or Capital income as a percent of Value Added by $N_t = 100 - S_t$. We may infer from the negative association of increases in labor productivity on Labor's share that increases in labor productivity will have a positive association with Capital's share of which corporate profits are the principal component. Similarly, given the positive association of increases in real product wages with ΔS , increases in the real product wage are expected to be negatively associated with ΔN. Expressed differently, the benefits of increases in labor productivity have been enjoyed by those who receive passive income (mainly profits) while increases in real product wages have detracted from passive income.[7]

V. The Effects of Three Wages: Employment and Working Hours

Earlier in this paper, the principal input of labor, aggregate hours H_t were defined as the product of average weekly hours, h_t and employment, E_t and 50-52 weeks. The movements of H_t are presented in Figure 0 and descriptive statistics on H_t , E_t and h_t are given in Table 11 . Consider now which, if any, of the three wages that have been considered may help to describe the movements in aggregate hours. If the determination of employment and hours of work are the outcome of the demand for labor and of the supply of labor, one might suspect that both the cost of labor to employers and the monetary return to labor might help in a description of aggregate hours. To this end, consider the following descriptions of changes in aggregate hours:

(7) $$\Delta H_t = \delta_0 + \delta_1 \Delta W^C{}_t + \delta_2 \Delta W^P{}_t + \delta_3 \Delta Y_t + \varepsilon_{7t}$$

where ε_{7t} is a residual assumed distributed independently of the right-hand side variables. In addition to changes in real consumption wages and real product wages, equation (7) includes changes in real output, ΔY_t . Increases in the output of firms typically require increases in the labor input and it was noted above that aggregate hours display cyclical movements that are associated with movements in output. Bry (1959) demonstrated that working hours have a business cycle component.

One might reason that, if employers played a dominant role in the determination of hours, then the real product wage would figure in accounting for movements in aggregate hours and the

---

[7] Note that, while S_t and N_t are percentages, ΔS_t and ΔN_t are per cent changes. While $N_t = 100 - S_t$, $\Delta N_t \neq - \Delta S_t$. N_t is the complement of S. N_t is the per cent share of total income other than labor income (principally corporate profits).

fitted equation might approximate a labor demand equation. If workers' preferences matter in the determination of hours, then changes in real consumption wages would help to account for changes in hours. δ_1 is the elasticity of aggregate hours with respect to real consumption wages; it is denoted here by $\mathscr{E}(H, W^C)$. δ_2 is the elasticity of aggregate hours with respect to real product wages; it is denoted here by $\mathscr{E}(H, W^P)$. Although the principal concern of workers is with real consumption wages and the principal concern of owner-managers is with the real product wage, it is the nominal wage that is determined in the labor market transaction. Thus it would be useful if the labor input were expressed in terms of the nominal wage without sacrificing estimation of the hours-wages elasticities. To this end, in equation (7), replace ΔW^C_t with $\Delta W^N_t - \Delta P^C_t$ and replace ΔW^P_t with $\Delta W^N_t - \Delta P^O_t$ and upon reorganization,

(8) $$\Delta H_t = \delta_0 + (\delta_1 + \delta_2) \Delta W^N_t - \delta_1 \Delta P^C_t - \delta_2 \Delta P^O_t + \delta_3 \Delta Y_t + \varepsilon_{8t}.$$

The least-squares estimates of this equation fitted to the years from 1948 to 2019 are reported in Table 12 by equation (8a) in which $\mathscr{E}(H, W^C)$ is estimated to be 0.055 and $\mathscr{E}(H, W^P)$ is estimated to be -0.495. Evidently movements in aggregate hours were much more sensitive to changes in real product wages than to real consumption wages. If the procedure to arrive at equation (8) is free of error, the sum of these elasticities (namely, + 0.055 -0.495 = -0.44) should equal the estimated coefficient attached to ΔW^N_t (namely, -0.428) and, indeed, it is within one standard error of the estimated coefficient on ΔW^N_t.

The interpretation of equations (7) and (8) may be facilitated if the components of aggregate hours(that is, employment E and average weekly hours h) were analyzed separately. Therefore the following equations are also specified :

(9) $$\Delta E_t = \mu_0 + \mu_1 \Delta W^C_t + \mu_2 \Delta W^P_t + \mu_3 \Delta Y_t + \varepsilon_{9t}$$

where μ_1 is the elasticity of employment with respect to real consumption wages or $\mathscr{E}(E, W^C)$ and μ_2 is the elasticity of employment with respect to real product wages or $\mathscr{E}(E, W^P)$. Following the same steps as those applied to equation (7) equation (9) may be re-written as

$$(10) \quad \Delta E_t = \mu_0 + (\mu_1 + \mu_2) \Delta W^N{}_t - \mu_1 \Delta P^C{}_t - \mu_2 \Delta P^O{}_t + \mu_3 \Delta Y_t + \varepsilon_{10\,t}$$

and the regression coefficients attached to ΔP^C and ΔP^O are the negative of $\mathscr{E}(E, W^C)$ and of $\mathscr{E}(E, W^P)$ respectively . The least-squares estimates of equation (10) fitted to the 1948-2019 years are reported under equation (10a) of Table 12. With $\mathscr{E}(E, W^C) = 0.055$ and $\mathscr{E}(E, W^P) = -0.351$, employment is more responsive to changes in real product wages than to changes in real consumption wages.

Finally, write changes of average weekly hours as

$$(11) \quad \Delta h_t = \rho_0 + \rho_1 \Delta W^C{}_t + \rho_2 \Delta W^P{}_t + \rho_3 \Delta Y_t + \varepsilon_{11\,t}$$

which may be rewritten

$$(12) \quad \Delta h_t = \rho_0 + (\rho_1 + \rho_2) \Delta W^N{}_t - \rho_1 \Delta P^C{}_t - \rho_2 \Delta P^O{}_t + \rho_3 \Delta Y_t + \varepsilon_{12\,t}$$

The least-squares estimates of equation (12) are given as equation (12a) of Table 12. The elasticity of weekly hours with respect to real consumption wages $\mathscr{E}(h, W^C) = 0.007$ is near to zero and the elasticity of weekly hours with respect to product wages $\mathscr{E}(h, W^P)$ is -0.145. According to the values of F in Table 12 that test the hypothesis that the estimated coefficients on $\Delta P^C{}_t$ and $\Delta P^O{}_t$ are not significantly different from zero, this hypothesis may be rejected in equations (8a), (10a) and (12a).

The usual procedure is not to distinguish between real product wages and real consumption wages, but simply to report the elasticities with respect to nominal wages. According to the entries in Table 12, when retail prices and product prices are held constant, increases in nominal wages are associated with fewer aggregate hours, lower employment, and fewer weekly hours. suggestive of a labor demand function. This might not be true of $\mathscr{E}(h, W^N)$ in which the negative sign indicates the income effect of a nominal wage increase exceeds the substitution effect, an explanation offered by Lewis (1957) for the decline in hours since the nineteenth century. However the absolute values of the elasticities of hours and employment with respect to product prices exceed the corresponding values with respect to retail prices indicating that movements in real product wages prices are associated with larger changes in labor input than movements in real consumption wages. Moreover, since the Second World War, increases in real product wages have exceeded increases in real consumption wages.

In all the equations estimated with changes in the labor input as the dependent variable, changes in the labor input are more responsive to changes in output prices than to changes in consumer prices.[8] By the value of F, these effects are jointly less than zero by conventional criteria.[9] This is consistent with the uncontroversial proposition that both employers' preferences and workers' preferences matter for the determination of aggregate hours The negative effects of both real wages extends to movements in employment in equation (9a) while changes in real product wages appear

---

[8] In view of the fact that $\Delta H_t = \Delta E_t + \Delta h_t$, it is not surprising that the estimated regression coefficient on each variable in the ΔH_t equation equals the sum of these coefficients on that variable in the ΔE_t and Δh_t equations.

[9] Between 1948 and 2019, the correlation coefficient between the annual values of W^C_t and the annual values of W^P_t is 0.99 while the correlation coefficient between the annual values of ΔW^C_t and ΔW^P_t is 0.82.

to have the principal association with changes in weekly hours.[10] In equation (12a) nominal wage increases have a negative association with hours implying perhaps that, in workers' preferences, the negative income effect dominated the positive substitution effect of wage increases, an explanation that Lewis (1957) offered for the decline in hours in years before the Second World War.

V. CONCLUSIONS

Based on the empirical findings above, sometimes the distinction between real product wages and real consumption wages appears important and on other occasions this distinction appears unimportant. An example of relative unimportance is the association between increases in labor productivity and accompanying increases in real wages: for both real product wages and real consumption wages, an x per cent increase in labor productivity is associated with an approximate (0.4) x per cent increase in real product wages and real consumption wages.

An instance in which changes in the product wage have been of special relevance is the link between changes in Labor's share and changes in real wages: in this case, holding productivity constant, an increase of x per cent in real product wages accompanies an x per cent increase in Labor's share whereas an increase of x per cent in real consumption wages accompanies a less than x per cent increase in Labor's share.

Insofar as wages are received disproportionately by those with relatively low income and that those who receive nonlabor income (profits, interest, and dividends) are disproportionately those with relatively high income, the decline in Labor's share is another manifestation of the increase in income inequality in recent decades.

---

[10] Before concluding that equation (11a) is a demand for hours equation, note that changes in the real price of electrical machinery and equipment (a complement or substitute for labor) is uncorrelated with changes in hours and in employment.

Since the Second World War, real product wages have risen more than real consumption wages, a consequence of the index of output prices rising by 0.74 per cent for every one per cent rise in the consumer price index. This was a source of conflict between the employer and the worker: the typical employer saw real wage costs rise more than the average worker viewed the real value of his wages increase. From the perspective of the typical employer, labor has became more expensive whereas, from the perspective of the typical worker, real wages have declined considerably relative to his productivity. Table 13 summarizes these findings: the typical worker's real consumption hourly wage fell relative to the worker's productivity in both the years from 1948 to 1979 and (especially) in the years from 1980 to 2019.

For those not accepting the comparisons in Table13 and who prefer to adopt a historical standard, of beginning- versus- end, the values of all three variables (W^C, W^P ,and X) were higher in 2019 than in 1948, with the growth highest for productivity and lowest for real consumption wages.

The elasticity of the labor input with respect to real wages is negative for real product wages and near zero for real consumption wages. The absolute value of the former exceeds the absolute value of the latter The former may be a labor demand function and the latter a labor supply function in which the negative income effect offsets a positive substitution effect.

The hypothesis that the years from 1948 to 1979 constitute a different labor market structure from the years from 1980 to 2019 receives a mixed assessment. The descriptive statistics are consistent with this hypothesis but the movements in the real wage equations (both consumption and product) do not appear to be different in the two periods.

The patterns reported in this paper are those at a very aggregative level. At a lower level of aggregation, the patterns are likely to vary. How they vary would be a interesting topic for research.

REFERENCES

Ashenfelter, O.C., G.E. Johnson, and J.H.Pencavel , "Trade Unions and the Rate of Change of Money Wages in United States Manufacturing Industry" , *Review of Economic Studies* 39(1) January 1972:27-54

Bivens, Josh, and Lawrence Mishel, "Understanding the Historic Divergence between Productivity and a Typical Worker's Pay". *Economic Policy Institute*, September 2015: 1-39

Bodkin, Ronald G., *The Wage-Price-Productivity Nexus*, University of Pennsylvania Press, Philadelphia, 1966

Bry, Gerhard, "The Average Workweek as an Economic Indicator" NBER Occasional Paper No. 69, National Bureau of Economic Research, New York, 1959

Friedman, Milton, *Price Theory* Aldine Publishing, New York, 1976

Douglas, Paul H. *Real Wages in the United States 1890-1926,* Houghton Mifflin Company, Cambridge, Massachusetts, 1930

Hanes, Christopher, "The Rise and Fall of the Sliding Scale, or Why Wages are no Longer Indexed to Product Prices" *Explorations in Economic History*, 47(1), January 2010 : 49-67

Hines, A.G., "Trade Unions and Wage Inflation in the United Kingdom 1893-1961", *Review of Economic Studies*, 31(4) October 1964 : 221-52

Hirsch, Barry T, and David Macpherson, Union Membership and Coverage Database from the CPS, https:///.unionstats.com , 2021

Kuh, E. “A Productivity Theory of Wage Levels -An Alternative to the Phillips Curve” *Review of Economic Studies* 34(4), October 1967: 333-360

Lewis, H. Gregg, “Hours of Work and Hours of Leisure” in *Proceedings of the Ninth Annual Meeting of the Industrial Relations Research Association* , ed. L. Reed Tripp Madison, 196-206

Lewis, H. Gregg, *Union Relative Wage Effects: A Survey*, University of Chicago Press, Chicago and London, 1986

Lipsey, Richard G., “The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1862-1957", *Economica* 27(105), February 1960:1-31

OECD “Labour Losing to Capital: What Explains the Declining Labour Share?”, *Employment Outlook* , 2012, OECD Publishing : 109-161

Paternesi,Meloni, W. and Antonella Stirati , “The Decoupling between Labour Compensation and Productivity in High-Income Countries: Why is the Nexus Broken?” *British Journal of Industrial Relations*,61(1), January 2023: 425-63

Phillips, A.W., “The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957” *Economica* 25 (100) November 1958:283-299

Stockhammer, Engelbert, “Determinants of the Wage Share: A Panel Analysis of Advanced and Developing Economies” *British Journal of Industrial Relations*, March 2017 : 3-33

Treble, John G. “The Pit and the Pendulum: Arbitration in the British Coal Industry, 1893-1914" *The Economic Journal*, 100, December 1990 : 1095-1108

Troy, Leo, and Neil Sheflin *Union Sourcebook*, Industrial Relations Data Information Services , West Orange, NJ , 1985

FIGURES

Figure 0

Billions of Aggregate Hours Worked H_t in the Non-Farm Business Sector 1948-2019

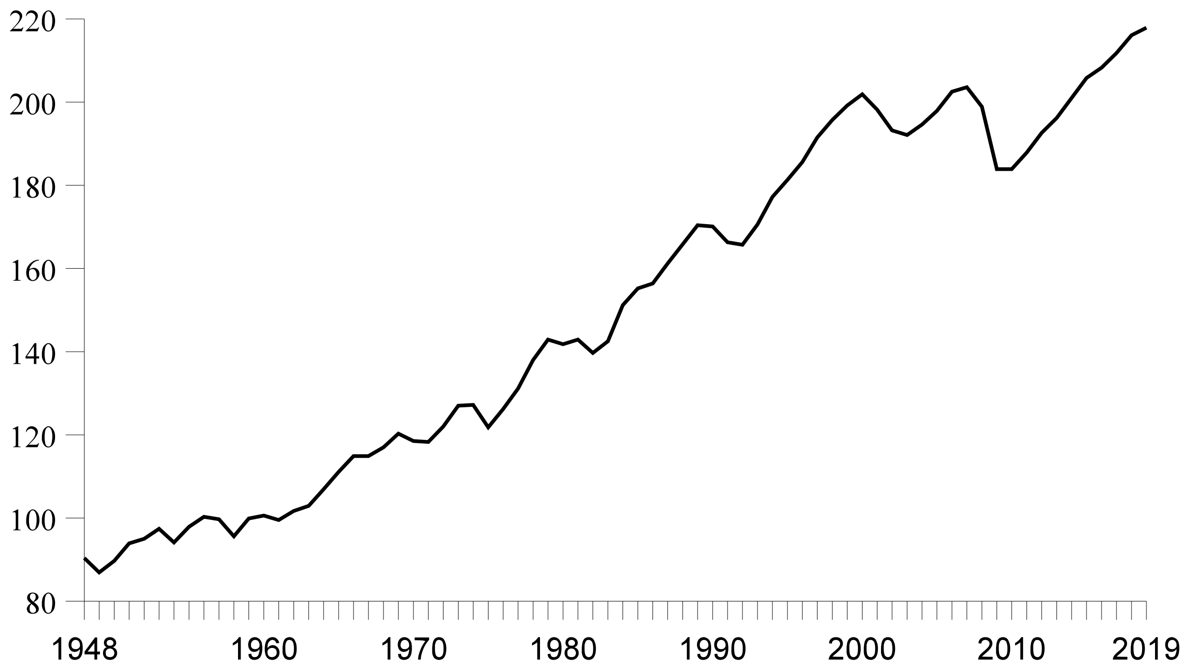
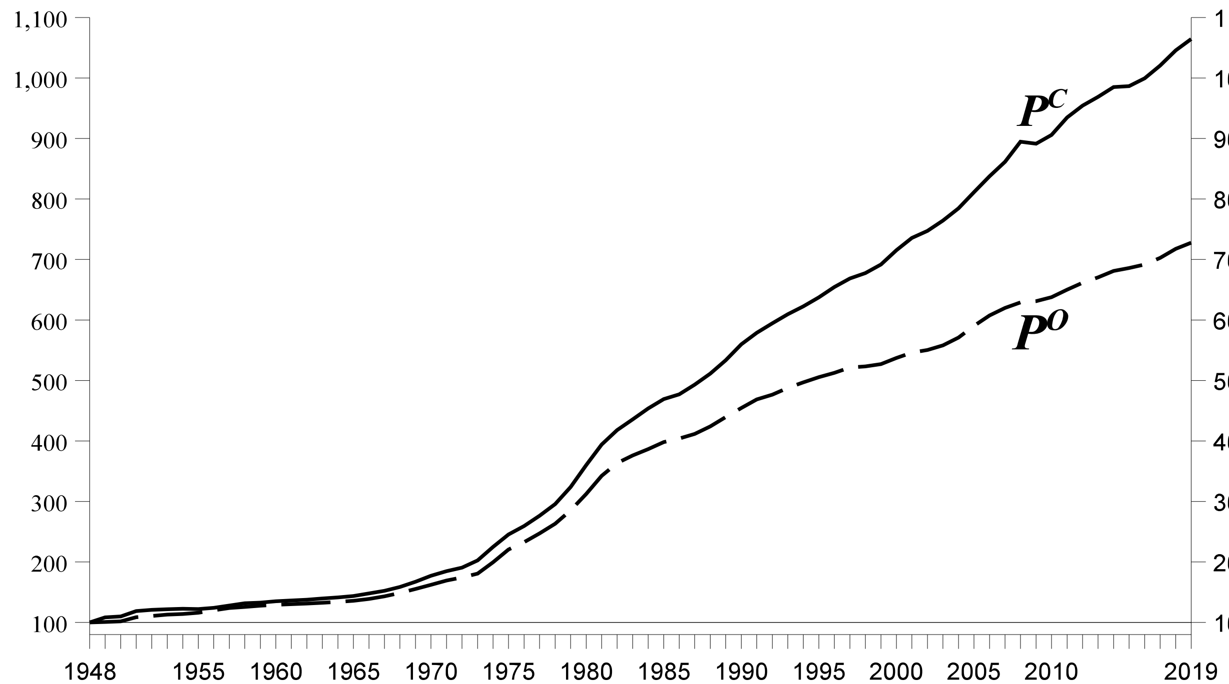


Figure 1

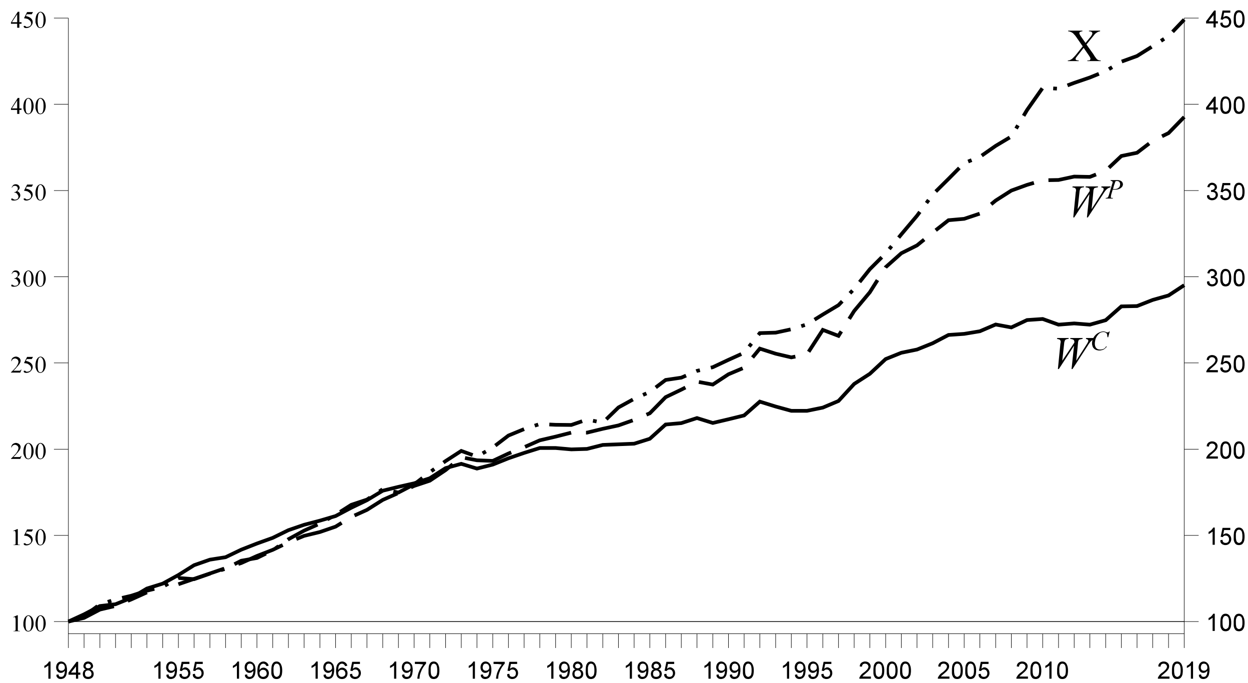
Annual Values of Two Price Deflators from 1948 to 2019



P^C is a consumer price index with which the nominal wage is deflated to arrive at the real consumption wage, W^C . P^C is the solid series in the figure above. P^O is a deflator of Value Added Output and drawn in the figure by the dashed series. When the nominal wage is deflated by P^O, the result is the real product wage W^P. In this figure, both P^C and P^O take the value of 100 in 1948.

Figure 2

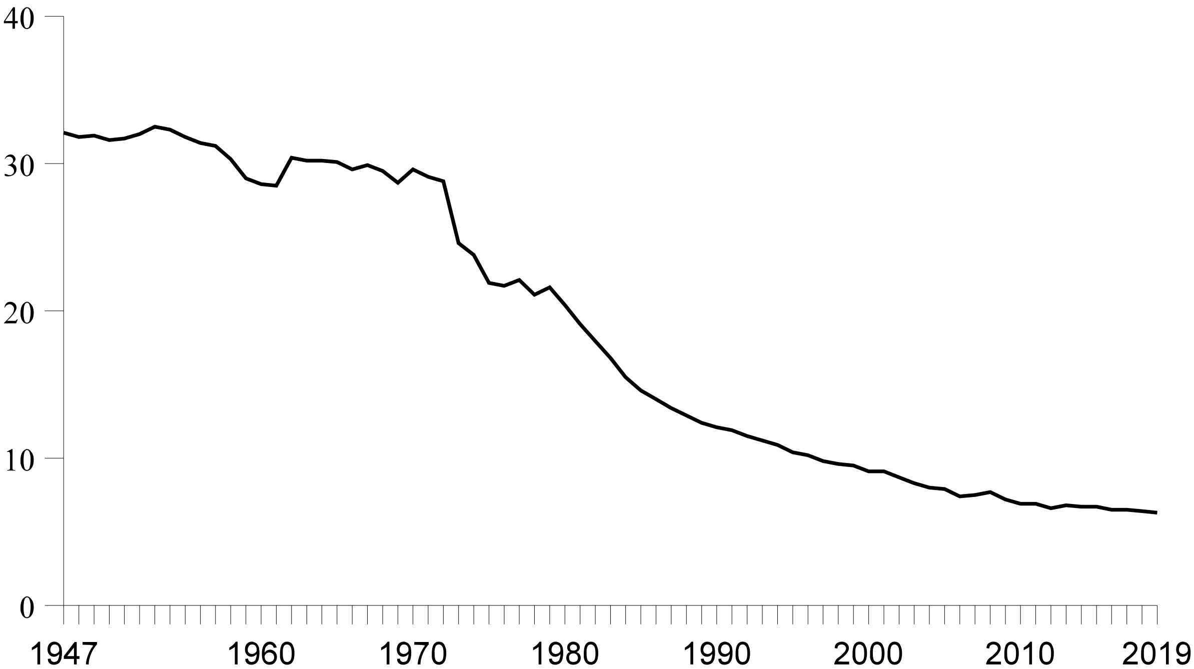
Annual values of Real Hourly Wages and Labor Productivity of U.S. Non-Farm Business Sector Workers from 1948 to 2019



In the figure above, the real hourly consumption wage W^C is the solid series, the real hourly product wage W^P is the dashed series and labor productivity X is the mixed dashed-and-dotted series. The growth in productivity from 1948 to 2019 exceeded both the growth in real hourly product wages and, a fortiori, the growth in real hourly consumption wages. In this figure, all three variables take the value of 100 in 1948.

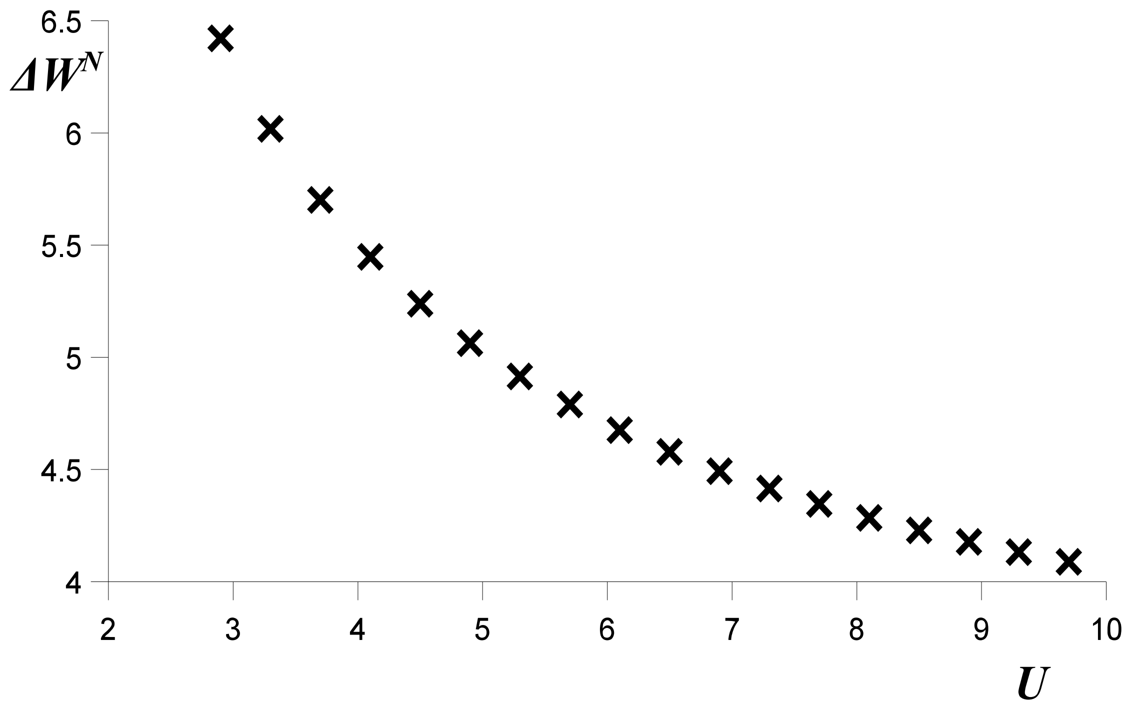
Figure 3

Trade Union Membership as a per cent of Non-Agricultural Employment, D_t 1947-2019



The observations on union density from 1947 to 1972 are from Troy and Sheflin (1985, p.A-1) and the observations from 1973 to 2019 are drawn from the Current Population Survey as reported by Hirsch and Macpherson (2021). The 1982 CPS included no union questions so the value for 1982 interpolates the 1981 and 1983 values.

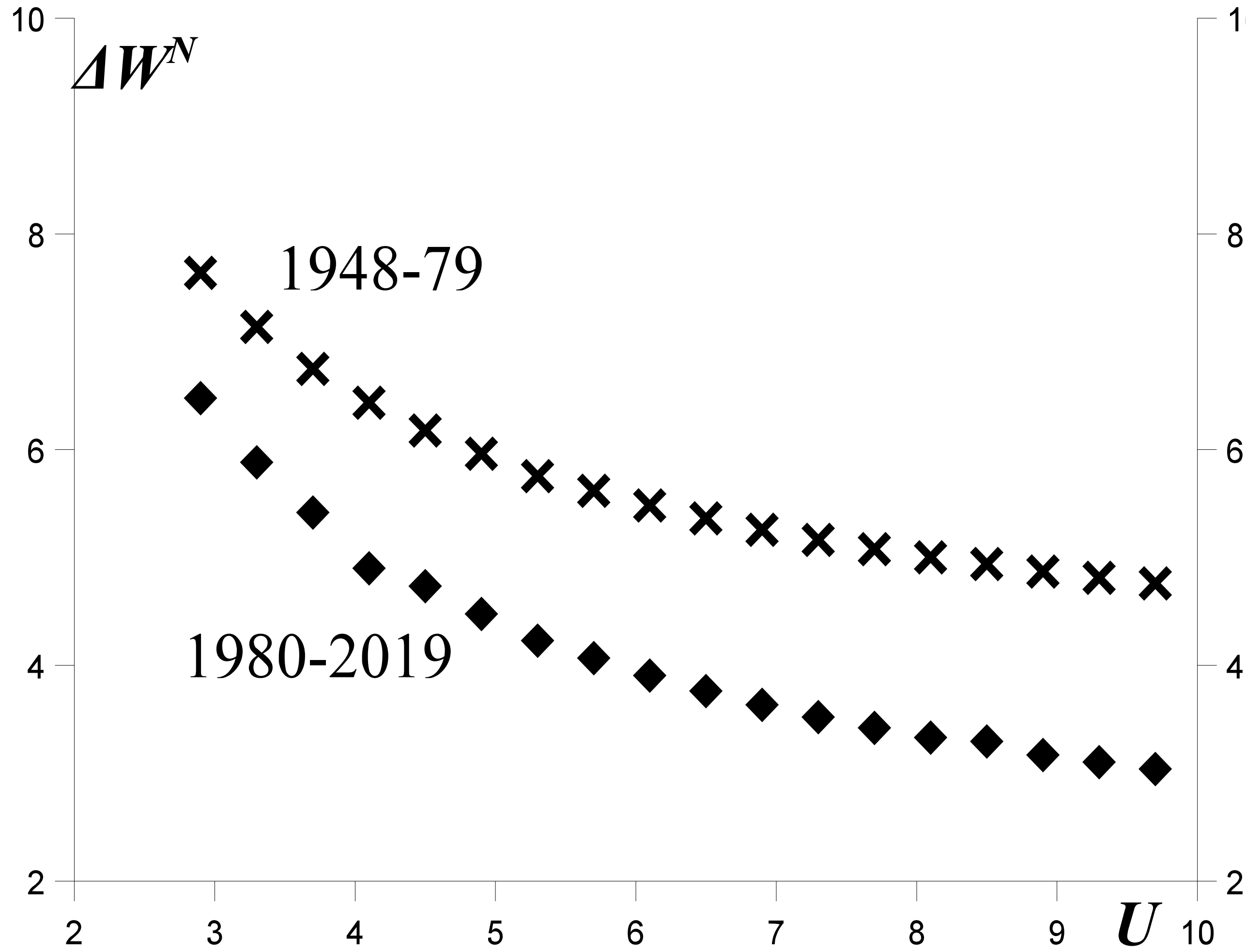
Figure 4
The relation between the rate of change of nominal wages and the unemployment rate implied by equation (1a) of Table 4



In the years from 1948 to 2019, unemployment rates (measured on the horizontal axis) ranged from a minimum of 2.9% in 1953 to a maximum of 9.7% in 1982. The figure above simulates the value of ΔW^N (measured on the vertical axis) implied by the coefficient on U^{-1}_t (namely 9.652) in equation (1a) in Table 4 with other variables held constant at their mean values.

Figure 5

Estimated Phillips' Curves Implied for two Periods: 1948-1979 and 1980-2019

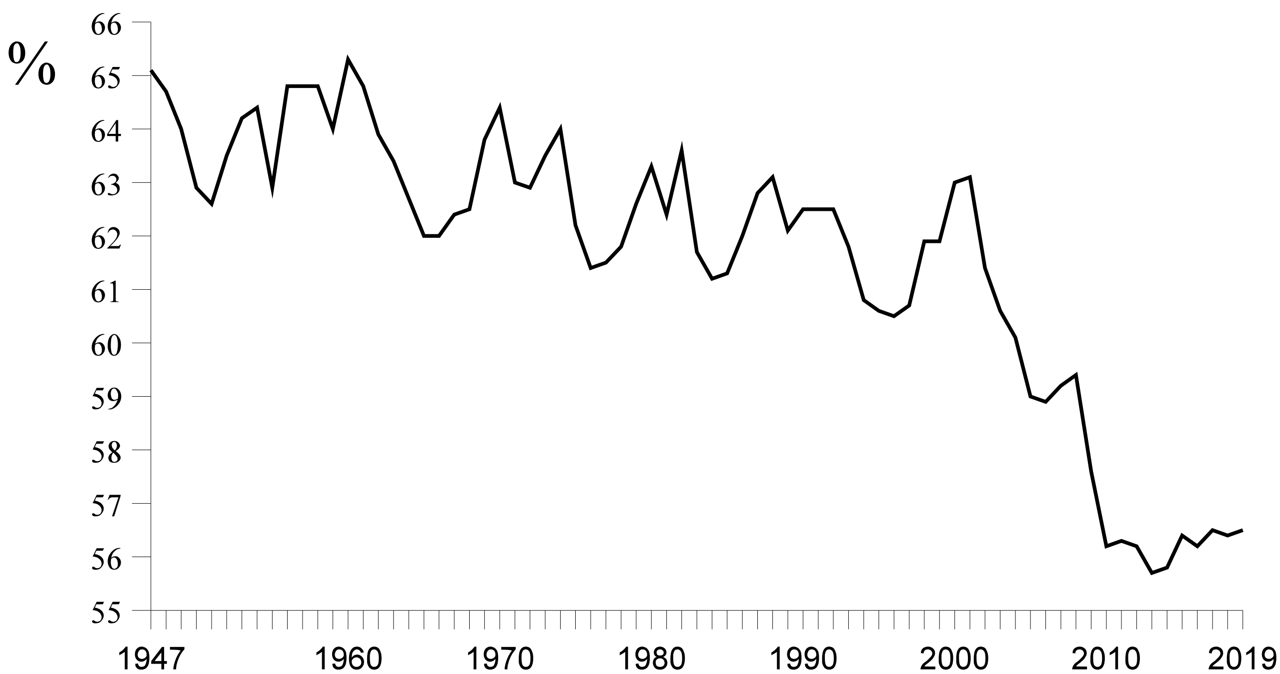


The scatter with the crosses corresponds to equation (1b) in Table 8 fitted to the observations from 1948 to 1979 in which the estimated coefficient on U^{-1} is 11.895. The scatter with the diamonds corresponds to equation (1c) in Table 8 estimated to the observations from 1980 to 2019 in which the estimated coefficient on U^{-1} is 14.223. For both simulations, the values of the other variables are held constant at their mean in each period.

Figure 6

Labor's Share 1947-2019

Aggregate Compensation received by Workers as a Per Cent of the Total Value of Output



TABLES

Table 0

Variables and their Labels

h_t = average weekly hours of work
E_t = total employment in millions
H_t = aggregate annual hours worked = the product of *(*h_t and E_t and 50-52) divided by 1,000
D_t = trade union density (trade union membership as a per cent of non-agricultural employment)
$C_{t,}$ = nominal aggregate compensation in $ billions
W^N_t = nominal hourly wage = $C_{t,}$ divided by H_t
P^C_t = consumer price index
W^C_t = real consumption wage (100 in 1948) = W^N_t divided by P^C_t
P^O_t = value added output price deflator
W^P_t = real product wage (100 in 1948) = W^N_t divided by P^O_t
V_t = nominal value added output in $ billions
Y_t = real value added output = $V_t \div P^O_t$
X_t = Labor productivity = $Y_t \div H_t$
U_t = % unemployment rate
S_t = Labor's Share = 100 ($C_t \div V_t$) = nominal aggregate compensation as a per cent of nominal value added output
N_t = 100 - S_t = nonlabor income as a per cent of value added output

Table 1

Descriptive Statistics on Annual Values of the Price Deflators P^C_t and P^O_t from 1948 to 2019

	P^C_t	ΔP^C_t	P^O_t	ΔP^O_t
mean, μ	472.7	3.35	366.34	2.915
stan dev,σ	319.06	2.644	213.26	2.4275
minimum	100 [1948]	-1.672 [1948]	100 [1948]	0.302 [2009]
$Q_L = 25\%$	143.63	1.621	135.86	1.371
median, M	444.75	2.79	381.29	1.9285
$Q_U = 75\%$	747.31	4.272	550.54	3.536
maximum	1064.6 [2019]	11.21 [1980]	727.69 [2019]	10.657 [1975]
G	3.39		2.84	
σ / μ	0.675	0.790	0.582	0.833
QD/M	0.679	0.475	0.544	0.561

P^C_t is the consumer price deflator and P^O_t is the value added output price deflator graphed in Figure 1. Beneath the minimum and maximum values are the years (in square brackets) when these values were registered. σ/μ is the coefficient of variation (the standard deviation (σ) of a variable divided by its mean value (μ)). If the values of a variable are arranged in ascending order, Q_L is the value at the lower quartile(the 25th percentile) and Q_U is the value at the upper quartile(the 75th percentile). The quartile deviation (QD) is ½ (Q_U - Q_L) and, in the table, it is divided by the median value M so dispersion may be compared between variables measured in different units (as may the coefficient of variation) . G denotes the per cent compound annual growth rate of the variable.

Table 2

Descriptive Statistics on Annual Values of Nominal and Real Hourly Wages and on Labor Productivity from 1948 to 2019

(72 years)

	W^N_t	ΔW^N_t	W^C_t	ΔW^C_t	W^P_t	ΔW^P_t	X_t	ΔX_t
mean, μ	15.29	4.913	205.3	1.543	232.4	1.952	248.2	2.156
stan dev, σ	12.78	2.364	54.18	1.543	86.9	1.371	103.3	1.478
minimum	1.484 [1948]	0.979 [1994]	100 [1948]	-1.461 [1974]	100 [1948]	-1.12 [1993]	100 [1948]	-1.7 [1974]
Q_L = 25%	3.127	3.285	161.2	0.366	155.1	1.05	161.87	1.2
median, M	12.185	4.34	203.0	1.432	215.4	2.025	226.71	2.15
Q_U = 75%	26.01	6.215	257.7	2.528	318.2	2.534	335.4	3.3
maximum	42.4 [2019]	10.73 [1980]	295.1 [2019]	4.815 [1949]	392.6 [2019]	5.42 [1998]	449.1 [2019]	6.7 [1950]
G	4.83		1.54		1.95		2.14	
σ / μ	0.836	0.481	0.264	1.0	0.374	0.702	0.416	0.686
QD/M	0.939	0.338	0.238	1.755	0.379	0.366	0.383	0.488

Please read the notes beneath Table 1. Δ denotes annual per cent change. W^N_t is the nominal hourly wage in current dollars. W^C_t and W^P_t, are index numbers of, respectively, the real consumption wage and the real product wage. X_t is an index of labor productivity. W^C_t, W^P_t, and X_t each takes the value of 100 in 1948.

Table 3

Descriptive Statistics on Annual Values of the Explanatory Variables in Equations (1), (2), and (3) from 1948 to 2019

	ΔX_t	$U^{-1}{}_t$	D_t	$\Delta P^C{}_t$	$\Delta P^O{}_t$
mean, μ	2.156	0.188	18.46	3.35	2.92
stan dev,σ	1.478	0.054	9.909	2.644	2.428
minimum	-1.7 [1974]	0.1031 [1982]	6.3 [2019]	-1.672 [1948]	0.302 [2009]
$Q_L = 25\%$	1.2	0.147	8.7	1.621	1.371
median, M	2.15	0.182	16.15	2.79	1.928
$Q_U = 75\%$	3.3	0.222	29.6	4.272	3.536
maximum	6.7 [1950]	0.345 [1953]	32.5 [1953]	11.21 [1980]	10.66 [1975]
G			-2.25		
σ / μ	0.686	0.287	0.537	0.790	0.832
QD/M	0.488	0.206	0.647	0.475	0.144

Please see the notes beneath Table 1.

Table 4

Least-Squares Estimates of Equations (1), (2), and (3) and variants of these equations fitted to annual observations from 1948 to 2019

regressors ⇓	dependent variable				
	(i)	*(ii)*	*(iii)*	*(iv)*	*(v)*
	ΔW^N_t equation (1a)	ΔW^C_t equation (2a)	ΔW^P_t equation (3a)	pooling of ΔW^C_t and ΔW^P_t	$\Delta W^P_t - \Delta W^C_t$
intercept	-0.981 (0560)	-1.205 (0.602)	-0.941 (0.546)	-1.073 (0.412)	0.263 (0.476)
ΔX_t	0.441 (0.094)	0.395 (0.101)	0.431 (0.092)	0.413 (0.069)	0.036 (0.080)
U^{-1}_t	9.652 (2.465)	7.132 (2.647)	9.476 (2.402)	8.304 (1.810)	2.343 (2.093)
D_t	0.019 (0.014)	0.053 (0.015)	0.018 (0.014)	0.036 0.011)	- 0.035 (0.012)
ΔP^C_t	0.134 (0.078)	0.036 (0.084)	0.137 (0.076)	0.087 (0.057)	0.100 (0.066)
ΔP^O_t	0.796 (0.088)	-0.189 (0.095)	-0.213 (0.086)	-0.201 (0.065)	-0.024 (0.075)
n	72	72	72	144	72
R^2	0.831	0.543	0.523	0.510	0.148
D-W	1.94	1.93	1.92	1.78	2.05

Estimated standard errors are in parentheses beneath their estimated coefficients. *n* is the number of observations.

Table 5

Descriptive Statistics on Annual Values of the per cent Changes in Nominal and Real Wages :

Comparing the 1948-1979 period (32 years) with the 1980-2019 period (40 years)

	ΔW^N_t		ΔW^C_t		ΔW^P_t	
	1948-1979	1980-2019	1948-1979	1980-2019	1948-1979	1980-2019
mean, μ	6.009	4.037	2.247	0.977	2.368	1.618
stan dev,σ	2.205	2.13	1.444	1.393	1.093	1.488
minimum	2.821 [1964]	0.979 [1994]	-1.461 [1974]	-1.378 [1989]	-0.87 [1974]	-1.12 [1993]
Q_L = 25%	3.887	2.474	1.29	0.131	1.84	0.711
median,M	5.973	3.795	2.177	0.917	2.345	1.545
Q_U = 75%	7.79	4.87	3.198	1.604	3.11	2.33
maximum	10.44 [1975]	10.73 [1980]	4.815 [1949]	4.361 1998]	4.75 [1950]	5.42 [1998]
σ / μ	0.367	0.528	0.642	1.426	0.462	0.920
QD/M	0.327	0.316	0.438	0.803	0.271	0.524

Please read the notes beneath Table 1.

Table 6

Descriptive Statistics of the Annual Values on the changes in Labor Productivity, on Trade Union Density, on the Inverse of the Unemployment Rate and on the changes in Retail and Value Added Output Prices. Comparing the 1948-1979 period (32 years) with the 1980-2019 period (40 years)

	ΔX_t		D_t		U^{-1}_t		ΔP^C_t		ΔP^O_t	
	1948-79	1980-2019	1948-79	1980-2019	1948-79	1980-2019	1948-79	1980-2019	1948-79	1980-2019
mean, μ	2.5	1.88	28.67	10.28	0.208	0.173	3.733	3.040	3.576	2.387
stan dev,σ	1.612	1.317	3.603	3.781	0.058	0.044	3.203	2.087	2.774	1.992
minimum	-1.7 [1974]	-0.8 [1982]	21.2 [1978]	6.3 [2019]	0.1176 [1975]	0.103 [1982]	-1.672 [1948]	-0.349 [2009]	0.74 [1949]	0.302 [2009]
$Q_L = 25\%$	1.7	0.9	28.5	6.9	0.1695	0.1351	1.188	1.817	1.261	1.386
median,M	2.6	1.65	29.75	9.3	0.185	0.1724	3.011	2.669	3.081	1.817
$Q_U = 75\%$	3.5	3	31.6	12.4	0.263	0.204	6.242	3.40	5.452	3.048
maximum	6.7 [1950]	4.5 [1992]	32.5 [1953]	20.4 [1980]	0.345 [1953]	0.270 [2019]	11.049 [1974]	11.21 [1980]	10.657 [1975]	9.582 [1981]
σ / μ	0.645	0.701	0.126	0.368	0.279	0.254	0.858	0.687	0.776	0.835
QD/M	0.346	0.636	0.052	0.296	0.253	0.200	0.839	0.297	0.680	0.457

Please read the notes beneath Table 1.

Table 7

Per Cent Compound Annual Growth Rates of Wages, Labor Productivity, Trade Union Density, Two Price Indices, Labor's Share, Value Added, Total Labor Compensation, Aggregate Hours, Employment, and Weekly Hours in Three Periods .

Variables	Per Cent Compound Annual Growth Rates		
⇓	1948-2019	1948-1979	1980-2019
$G(W^C_t)$	1.54	2.27	1.00
$G(W^P_t)$	1.95	2.37	1.62
$G(W^N_t)$	4.84	5.9	3.85
$G(X_t)$	2.14	2.49	1.92
$G(D_t)$	-2.19	-1.24	-2.97
$G(P^C_t)$	3.39	3.86	2.82
$G(P^O_t)$	2.84	3.44	2.19
$G(C_t)$	6.142	7,477	5.00
$G(V_t)$	6.344	7.590	5.309
$G(S_t)$	-0.191	-0.106	-0.291
$G(H_t)$	1.247	1.489	1.108
$G(E_t)$	1.47	1.82	1.23
$G(h_t)$	-0.223	-0.331	-0.121
Differences betweenGrowth Rates of Variables in three periods			
	1948-2019	1948-1979	1980-2019
$G(W^P_t)- G(W^C_t)$	0.41	0.11	0.62
$G(X_t) - G(W^P_t)$	0.19	0.11	0.30
$G(X_t)-G(W^C_t)$	0.60	0.22	0.92
$G(P^C_t)-G(P^O_t)$	0.55	0.42	0.63

G denotes the per cent compound annual growth rate of the variable in parentheses.

Table 8

Least-Squares Estimates of Equations (1), (2), and (3) fitted to the 32 years from 1948 to 1979 and to the 40 years from 1980 to 2019.

Regressors ⇓	dependent variable					
	ΔW^N_t		ΔW^C_t		ΔW^P_t	
	equation (1b)	equation (1c)	equation (2b)	equation (2c)	equation (3b)	equation (3c)
	1948-79	1980-2019	1948-79	1980-2019	1948-79	1980-2019
intercept	5.046 (1.779)	-3.279 (1.164)	1.533 (2.797)	-3.202 (1.149)	4.920 (1.686)	-3.252 (1.142)
ΔX_t	0.271 (0.092)	0.500 (0.147)	0.250 (0.145)	0.500 (0.145)	0.255 (0.087)	0.496 (0.144)
U^{-1}_t	11.895 (2.889)	14.223 (4.499)	6.561 (4.542)	13.844 (4.438)	11.397 (2.738)	14.202 (4.411)
D_t	-0.164 (0.063)	0.182 (0.083)	-0.012 (0.100)	0.177 (0.082)	-0.157 (0.060)	0.180 (0.082)
ΔP^C_t	0.006 (0.060)	0.434 (0.290)	-0.030 (0.094)	-0.545 (0.286)	0.012 (0.057)	-0.409 (0.284)
ΔP^O_t	0.697 (0.077)	0.304 (0.303)	-0.291 (0.121)	0.290 (0.299)	-0.309 (0.073)	-0.673 (0.297)
R^2	0.919	0.780	0.535	0.501	0.705	0.567
D-W	2.17	2.04	1.75	2.075	2.19	2.02
F	3.143		1.388		3.187	

F is the calculated F statistic testing the null hypothesis that the estimated 1948-1979 structure is indistinguishable from the estimated 1980-2019 structure. The critical value of the F distribution is about 2.4 at the five per cent significance level. The null hypothesis is rejected when ΔW^N_t and ΔW^P_t are the dependent variables, but it cannot be rejected when ΔW^C_t is the dependent variable.

Table 9

Descriptive Statistics on Annual Values of Labor's Share S_t, Labor's Total Compensation, C_t and Value Added Output V_t and their annual per cent changes in the years from 1948 to 2019

	S_t	ΔS_t	C_t	ΔC_t	V_t	ΔV_t
mean, μ	61.55	-0.183	2791.6	6.264	4717.3	6.371
stan. dev, σ	2.636	1.299	2713.5	3.654	4760	3.533
minimum	55.7 [2013]	-3.03 [2009]	132.67 [1949]	-6.374 [2009]	207.22 [1949]	-3.526 [2009]
Q_L = 25%	60.6	-1.116	347.24	4.865	560.196	4.392
median, M	62.3	0	1791.2	5.899	2914.75	5.876
Q_U = 75%	63.4	0.644	5,035.4	8.682	8180.97	8.602
maximum	65.3 [1960]	3.021 [1956]	9,235.9 [2019]	14.223 [1978]	16,346.7 [2019]	14.46 [1951]
G	-0.191		6.142		6.344	
σ / μ	0.043	-7.1	0.972	0.583	1.01	0.555
QD/M	0.022	ND	1.309	0.324	1.307	0.358

C_t is total labor compensation in year t in billions of current dollars

V_t is value added output in year t in billions of current dollars

ND means not defined as the operation involves dividing by zero

Please read the notes beneath Table 1.

Table 10

Descriptive Statistics on Annual Values of Labor's Share S_t and Annual Per Cent Changes in Labor's Share ΔS_t in Three Periods

	1948-2019		1948-1979		1980-2019	
	S_t	ΔS_t	S_t	ΔS_t	S_t	ΔS_t
mean, μ	61.55	-0.183	63.37	-0.1134	60.09	-0.239
stan. dev.σ	2.636	1.299	1.097	1.355	2.609	1.267
minimum	55.7 [2013]	-3.03 [2009]	61.4 [1976]	-2.813 [1975]	55.7 [2013]	-3.03 [2009]
Q_L = 25%	60.6	-1.116	62.45	-1.12	56.50	-1.12
median, M	62.3	0	63.43	0	60.75	0
Q_U = 75%	63.4	0.644	64.36	0.94	62.44	0.509
maximum	65.3 [1960]	3.021 [1956]	65.3 [1960]	3.021 [1956]	63.6 [1982]	1.977 [1998]
G	-0.191		-0.106		-0.291	
σ / μ	0.043	-7.1	0.017	-11.95	0.043	5.30
QD/M	0.022	ND	0.015	ND	0.049	ND

ND means not defined as it involves dividing by zero. Please read the notes beneath Table 1.

Table 11

Descriptive Statistics of Annual Values on Aggregate Hours of Work H_t, Employment E_t, and average Weekly Hours of Work h_t from 1948 to 2019 in the Non-Farm Business Sector

	H_t	ΔH_t	E_t	ΔE_t	h_t	Δh_t
mean, μ	150.31	1.285	82.45	1.506	35.66	-0.225
stan dev,σ	41.41	2.153	26.48	2.137	2.007	0.684
minimum	86.918 [1949]	-7.531	43.44 [1949]	-5.7	32.8 [2009]	-1.9
Q_L = 25%	111.07	-0.171	55.04	0.6	33.9	-0.6
median,M	147.08	1.845	81.21	1.85	34.75	-0.3
Q_U = 75%	192.64	2.97	109.38	2.8	38	0.3
maximum	217.889 [2019]	6.329	126.24 [2019]	5.6	38.9 1948]	1.5
G	1.247		1.472		-0.223	
σ / μ	0.275	1.956	0.321	1.419	0.056	-3.04
QD/M	0.277	0.851	0.335	0.595	0.059	-1.5

E is measured in millions and *H* in billions. Please read the notes beneath Table 1.

Table 12

Least-Squares Estimates of Equations (8) through (12) fitted to observations from 1948 to 2019

	dependent variable					
	ΔH_t		ΔE_t		Δh_t	
	(8a)	elasticity	(10a)	elasticity	(12a)	elasticity
intercept	-1.142 (0.364)		-1.037 (0.285)		-0.122 (0.127)	
ΔW^N_t	-0.428 (0.108)		-0.185 (0.114)		-0.233 (0.037)	
ΔP^C_t	-0.055 (0.087)	$\Rightarrow - \mathscr{E}(H, W^C) =$ + 0.055	-0.055 (0.092)	$\Rightarrow - \mathscr{E}(E, W^C)$ = + 0.055	-0.007 (0.031)	$\Rightarrow - \mathscr{E}(h, W^C)$ = + 0.007
ΔP^O_t	0.495 (0.126)	$\Rightarrow - \mathscr{E}(H, W^P) =$ - 0.495	0.351 (0.133)	$\Rightarrow - \mathscr{E}(E, W^P)$ = - 0.351	0.145 (0.044)	$\Rightarrow - \mathscr{E}(h, W^P)$ = - 0.145
ΔY_t	0.837 (0.050)		0.648 (0.053)		0.186 (0.018)	
R^2	0.810		0.704		0.683	
F	13.09		6.34		7.23	
D-W	1.70		1.55		1.75	

$\mathscr{E}(H, W^C)$ is the elasticity of aggregate hours with respect to W^C_t and $\mathscr{E}(H, W^P)$ is the elasticity of aggregate hours with respect to W^P_t

$\mathscr{E}(E, W^C)$ is the elasticity of employment with respect to W^C_t and $\mathscr{E}(E, W^P)$ is the elasticity of employment with respect to W^P_t

$\mathscr{E}(h, W^C)$ is the elasticity of weekly hours with respect to W^C_t and $\mathscr{E}(h, W^P)$ is the elasticity of weekly hours respect to W^P_t

F is the calculated F statistic testing the null hypothesis that the estimated coefficients on ΔP^C_t and ΔP^O_t are jointly insignificantly different from zero. At the 5% level of significance, the critical value of the F distribution is 2.15. Hence in the three equations (8a), (10a), and (12a), this hypothesis is rejected.

Table 13

Real Consumption Wages Relative to Real Product Wages and to Labor Productivity and Real Product Wages Relative to Labor Productivity from 1948 to 2019

year	W^C Relative to W^P	W^C Relative to X	W^P Relative to X
1948	1	1	1
1979	0.968	0.937	0.968
1980	0.954	0.934	0.979
2019	0.752	0.657	0.874