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THE DECLINE OF THE US LABOR SHARE ACROSS SECTORS*

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We provide novel insights on the functional distribution of income in the postwar US economy, based on a Log Mean Divisia Index decomposition of the labor share by 14 sectors. We identify contributions from four components: real compensation, labor productivity, employment shares, and relative prices. The results are presented for the entire period as well as golden age (1948–1979) and neoliberal era (1979–2017), painting a detailed picture of structural changes. We find that (1) real compensation and labor productivity dominate; (2) manufacturing plays an important role in the recent decline of the labor share; (3) employment shifts toward service sectors with higher labor shares have buffered the decline; and (4) relative prices of services are increasing. We discuss these results in the context of Baumol's and Lewis's seminal contributions. Both theories build on the notion of coexistence of progressive and stagnant activities, which is documented in our sectoral decomposition.

JEL Codes: C43, D33, O41

Keywords: Baumol, labor share, Lewis, sectoral decomposition, stagnation, structural change

1. INTRODUCTION

This paper presents novel findings on the sources of the decline in the United States (US) labor share in the postwar period. We provide a systematic analysis of sectoral contributions to changes in the aggregate labor share using a Log Mean Divisia Index (LMDI) decomposition of US data from 1948 to 2017. Specifically, we present statistics on contributions to the aggregate labor share from changes in sectoral real wage, sectoral labor productivity, the structure of the economy as measured by employment shares, and the sectoral terms-of-trade or relative prices.

Our paper situates itself within the fast-growing literature on the changing nature of the distribution of income and the associated rise in income inequality. Several studies have used decomposition methods to delineate drivers of change of the aggregate labor share, and have mostly employed regression analysis to identify its correlates (Elsby *et al.*, 2013; Autor *et al.*, 2017; IMF, 2017; Böckerman and

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Maliranta, 2012; Taylor and Ömer, 2020). These studies have emphasized simple shift-share effects, or focused on analysis at the firm level.

Our contribution to this literature lies in the focus on sectoral dynamics, and is, in essence, twofold: first, we provide novel descriptive results on the sources of the decline in the labor share, and, second, discuss these in the context of Baumol's and Lewis's seminal theoretical contributions on structural change.

Specifically, we provide detailed documentation of the evolution of sectoral pay, productivity, output and employment over time, and how these trajectories feed into the changing labor share using a Divisia index-based decomposition. We then delineate the stark differences in aggregate and sectoral labor share changes during the immediate postwar period, often dubbed a "golden age" of capitalism (1948–1979), and the subsequent decades, often dubbed the "neoliberal era" (1979–2017).[1]

Key results of the decompositions can be summarized as follows. First, growth of real compensation and labor productivity dominate the overall change in the labor share. Second, the manufacturing sector plays a critical role throughout the entire postwar period. Initially, strong real compensation gains relative to labor productivity growth increase the labor share. In the later period, the accelerating collapse of employment in manufacturing coincides with strong growth of labor productivity in the sector, which in turn consistently exceeds that of real compensation. Third, sectors with rising employment shares feature on average lower real compensation and lower labor productivity growth, and furthermore higher labor shares. These structural changes thus imply downward pressure on aggregate labor productivity growth, and at the same time buffer the overall decline of the labor share. Fourth, relative prices have increased for stagnant service sectors.

Our second contribution is to contextualize decomposition results in light of Baumol's and Lewis's seminal theories on structural change. Recent literature has emphasized the phenomenon of structural change, particularly in regard to deindustrialization. van Neuss (2019) presents a comprehensive survey. Similarly, Kruger (2008) and Herrendorf *et al*. (2014) highlight old and new theories of structural change. However, much of this recent literature does *not* focus on the interaction between structural change and the functional distribution of income.

Both Baumol and Lewis view the economy as composed of "stagnant" and "progressive" activities, and put structural change center stage.[2] Crucially, a shift toward service sectors with relatively low labor productivity growth has been observed, and a slowdown in growth much discussed under the label "secular stagnation". Simultaneously, the labor share has *decreased*, raising questions about the underlying mechanisms.

Baumol (1967) assumes homogenous labor in a competitive labor market. The critical assumptions are (1) that nominal wages across sectors increase in line with

[1]The term "golden age" was employed by Robinson (1956) in her seminal contribution on growth; it labels a situation of steady, high growth, and full employment. Similarly, Hobsbawm (1994) labels the period between 1950 and 1975 a golden age. The term "neoliberalism" is used widely in the public debate to describe a decisive turn toward deregulation, de-unionization, and trade and capital account liberalization in the wake of conservative electoral victories, particularly in US and UK. For further discussion, see Marglin and Schor (1992).

[2]In line with research in this area, we define structural change as pronounced changes in employment shares in a multi-sector economy—where some *progressive* sectors experience relatively high labor productivity growth, and some *stagnant* sectors experience relatively low or zero labor productivity growth.

labor productivity growth in the dynamic sector, and (2) that prices in the dynamic sector are constant while (3) prices in the stagnant sector rise at the rate of nominal wages. As a result, growth rates of sectoral real *consumption* wages equilibrate and match that of *aggregate* labor productivity, leaving the labor share unchanged.[3] Our analysis finds, in contrast, that growth of real sectoral consumption (and product) wages in progressive sectors lags labor productivity growth, driving a decline in progressive sector and aggregate labor shares.

Lewis, in contrast, assumes that real wages are not equal across sectors and that aggregate real consumption wage growth does not equal aggregate labor productivity growth. The disconnect between modes of employment—Lewis's duality—is of central importance to the variability of the functional distribution of income in the context of structural change. Building on this notion of duality, Storm (2017) and Temin (2017) have argued that the US economy might be re-dualizing: high productivity growth sectors that consistently shed labor coexist with low productivity, low pay sectors that absorb released "surplus labor." Taylor and Ömer (2018) have labeled the phenomenon a "reverse-Lewis" shift, where the buildup of surplus labor in stagnant sectors puts a significant drag on real wage growth in dynamic sectors.

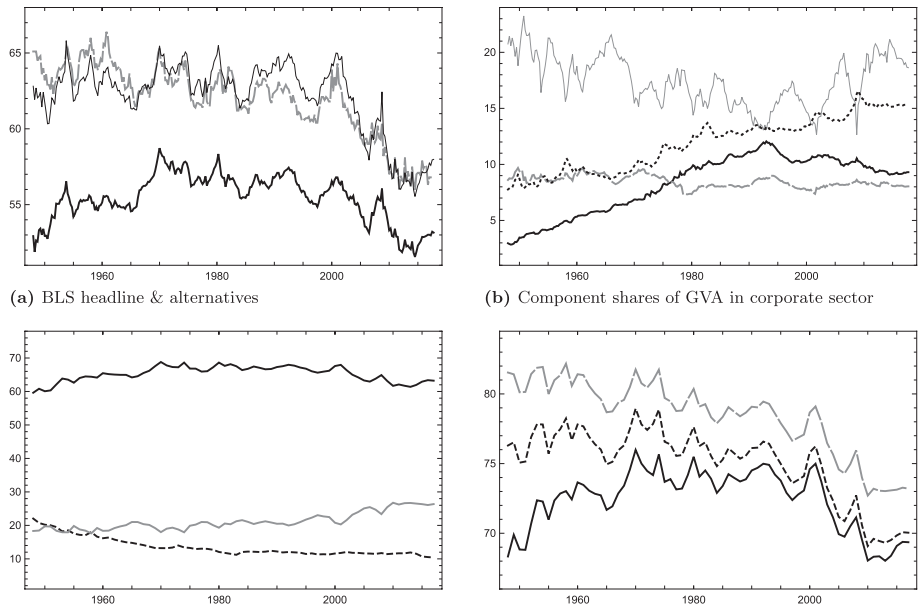
The remainder of the paper is organized as follows. The following section discusses various definitions of the labor share and offers details on the particular measure constructed here based on sector-specific data. Section 3 presents the Divisia decomposition technique as applied to the components of the labor share across sectors, and Section 4 provides details on data and methodology. Section 5 discusses results for the postwar period and the subsamples of golden age and neoliberal era. Section 6 analyzes these findings in the context of Baumol's and Lewis's ideas on two-sector models. Finally, we briefly conclude.

2. Measuring the Labor Share

What is labor's share of income? Measurement is not straightforward, and several problems typically arise. First, it is not clear what properly can be counted as compensation for work. Is the contracted salary of superstar CEOs really *labor* income, or are such flows rather rents and therefore profit-like income? Further, it is not clear what portion of income from self-employment should be treated as remuneration for work. It is not obvious either which economic activities should or should not be included in an accounting of the total.

In this section, we seek to disentangle some of these issues, to motivate our approach to constructing a measure of the labor share based on a consistent set of sectoral accounts of production and distribution. Inevitably, to do so forces us to make assumptions. To foreshadow these, our measure of the labor share (1) focuses on private economic activity, (2) is based on gross income flows, (3) excludes real estate and the associated imputed rental income, (4) applies the corporate payroll share to non-corporate income streams, and (5) excludes taxes on production and imports.

[3]The sectoral real consumption (product) wage is the sectoral nominal wage deflated by an aggregate price (sectoral output price) index. Labor is the only input in Baumol's original model; therefore, the labor share remains unity by design. We discuss these issues further in Section 6.



(a) BLS headline & alternatives

(b) Component shares of GVA in corporate sector

(c) Component shares of value added

(d) Different labor share definitions

Figure 1. Aggregate Labor Share. The figure shows different measures of the aggregate labor share.

Notes: **Panel (a)** reports three series: the BLS headline measure of the labor share in the nonfarm business sector (gray dashed); compensation relative to gross value added in the corporate sector (gray thin); and the share of compensation for all employees (private and government) relative to gross domestic income (black thick). **Panel (b)** provides further detail on flows relative to gross value added in the corporate sector. From the top, in 2017, these are net operating surplus (gray thin); depreciation (black dotted); supplements to wages and salaries (black); and taxes on production and income (gray dashed). The bottom panels illustrate the aggregate labor share based on the sectoral data set used here. **Panel (c)** shows component shares of value added; solid black (gray) is compensation (profits) in the corporate sector, and dashed black non-corporate income. **Panel (d)** shows different treatments of non-corporate income: the top line allots all non-corporate income to labor; the middle line excludes non-corporate income from the denominator; and the black line (our preferred approach) applies the payroll share to non-corporate income flows; see also Section 2.

Regarding terminology, we follow Elsby et al. (2013). First, the *payroll share* is the share of employee compensation in total income—it thus excludes income from self-employment, alternatively labeled as non-corporate income. It includes wages, salaries *and* supplements, which are in turn composed of employer contributions for employee pension and insurance funds, and for government social insurance. Second, and as mentioned, payrolls need to be augmented by non-employee labor income. The BLS publishes the labor share for the nonfarm business sector that includes an estimate of such non-corporate labor income.

This so-called headline measure serves as a standard reference, and is shown in Panel (a) of Figure 1. The chart includes two potential alternatives: the corporate payroll share and the payroll share in gross domestic income. These three series differ both in numerator and in denominator. For one, only the third includes compensation of employees in the public sector. Only the first addresses the problem of allocating some portion of self-employment income. All three are based on gross measures of income. A key issue here is that all three series portray different

medium-term trends. Specifically, only the third series shows an increase in the labor share during the golden age, and the subsequent decline during the neoliberal era. BLS headline measure and the corporate compensation share show, roughly, stability during the golden age, and a decline after 1980 (BLS) or 2000 (corporate).

Panel (b) delves further into the corporate data. Several issues stand out. The corporate profit share—net operating surplus relative to gross corporate value added—saw a sustained decrease followed by recovery, with the turning point only in the mid-90s. Further, taxes on production and imports as a share of gross value added are roughly stable throughout the postwar period. On the basis of this relative constancy of the tax share, we exclude this flow from our data set.[4]

In sharp contrast, both supplements and depreciation show important medium-term trends. The expansion of the social safety net drove a steep increase in the share of corporate contributions toward employee benefits, from about 3 percent in 1948 to 12 percent in the first quarter of 1993. These increases largely substituted for wages and salaries, as the relative stability of the payroll share indicates. After 1993, the share of employer contributions (to both private and public insurance plans) declined as a share of income. In summary, and clearly, any measure of the labor share must include supplements. The depreciation share of corporate gross value added takes flight in the early 70s. What drives the increase? Certainly, the changing nature of technology plays a role here, since both computers and software depreciate faster than buildings and machinery. However, since the standards for accounting for depreciation are conventional and, crucially, depreciation presents an income flow at a point in time, it should as well be incorporated.

Next, we consider which activities should or should not be included in the total. Let us begin with public payrolls. First, government's net capital share in nonmarket activities is zero by construction.[5] However, the evolution of public payrolls appears to matter for economy-wide developments. The expansion of public sector employment after the Second World War seems to have strengthened the labor share.[6] If public employment affects bargaining in other sectors, it would be preferable to include it in any study on the sources of the decline of the total labor share. However, while measurement of payrolls in the public sector is straightforward, an assessment of labor productivity—necessary for the decompositions—is complicated both due to the imputation of output at cost and the treatment of capital. Our data set therefore includes only private activity.

The real estate sector represents a different quandary. Rognlie (2015) discusses it in detail. The concern is that only about one-fifth of income in the real estate sector represents wages and that a large majority of that capital share do not represent a monetary flow, but an *imputed rent*. These rents are assigned as capital income to homeowners, but are not available for expenditures, are likely artificially inflated

[4]On this and other issues, we conducted robustness tests. The exclusion of taxes on production and imports does not have a significant impact on results. Details are available upon request.

[5]See the BEA's *NIPA Handbook*, especially chapter 9; available at US Bureau of Economic Analysis (f), accessed May 17, 2019.

[6]Recall the black line in Panel (a) of Figure 1. This is based on *NIPA* Table 1.10, which does not report public compensation separately. According to *NIPA* Table 1.12, the share of public compensation in national income—assuming fixed supplement shares, which likely biases it downwards—increased from 8 percent in 1948 to 14 percent in 1970.

due to trends in rents, and possibly reflect labor by homeowners themselves. As Rognlie (2015, p. 13) puts it, "Housing … does not conform to the traditional story of labor versus capital, nor can its growth be easily explained with many of the stories commonly proposed for the income split elsewhere in the economy, such as the bargaining power of labor and the role of technology." In summary, we exclude the entire real estate sector from our data set.

Further, recent literature contends with changes in the treatment of intellectual property in the national accounts. As Koh *et al*. (2020) document, the switch to account for intellectual property products (IPP) as investment expenditure, rather than intermediates, necessitates to also include them on the income side—where these flows now add to *capital income*, thus automatically decreasing the labor share. These authors' analysis suggests that the decrease in the labor share is entirely explained by such accounting changes, and the rise in IPP products' share in the economy. This is clearly an important facet in the debate and deserves further attention. However, it does not *a priori* upend the issue. IPP-related incomes are properly labeled as rents, and where they arise, questions regarding the distribution of income need to be asked.

A still-different issue arises with regard to the very high incomes of top earners, particularly in finance but in other sectors as well. As already alluded to, it is not clear whether CEO pay (or that of other "superstars," see Gordon and Dew-Becker, 2008) truly represents labor income, or rather rents. Data generated by Piketty and collaborators indicate that the share of national income accruing to the bottom 50 percent of the income distribution has fallen dramatically since 1980; see Panel B of Figure 1 in Alvaredo *et al*. (2018). Needless to emphasize, incomes of the bottom 50 percent truly are wages paid for work. Similarly, Figure 4 in Elsby *et al*. (2013)—which is based on the same data—documents that the bottom 90 percent share of corporate labor compensation showed stability during the golden age, but decreased by about 10 percentage points between the mid-70s and the onset of the Great Recession. EPI's well-known wage-and-productivity tracker (see Bivens *et al*. 2014) provides further detail: until 1973, cumulative growth of the average real wage of production and non-supervisory workers, making up about four-fifths of employees in the Current Employment Statistics, matched that of economy-wide growth of labor productivity. In the mid-70s, a gap opened that became wider only in subsequent decades. The evidence clearly indicates that *average* real labor income has fallen dramatically relative to labor productivity.

Moreover, top incomes in the distribution of wages and salaries are confounded by the use of stock options. A significant portion of executive pay in the corporate sector is structured as non-qualified stock options. These are included in this measure of labor compensation but, in this context of a discussion of the functional distribution of income, might be more appropriately classified as capital income. Of course, and as previously argued, even base salaries of CEOs could be seen as a form of rent, or a form of distribution of profit. Clearly, trends in the payroll share are muted due to the tremendous increase in wage inequality, and the runaway gains of the top 1 percent of the compensation distribution. In summary, we would argue that wage and salary income at the very top of the distribution should be excluded from an ideal measure of the labor share. Since this cannot be done in a consistent fashion for the sectoral data set used here, we proceed without

such adjustments.[7] However, the potential bias introduced is to limit the decline in the labor share. This implies that the measure presented and analyzed here should be seen as a conservative estimate of the decline of compensation relative to productivity.

Last but not least: what portion of self-employment income should be allocated to the labor share? Only the payroll share can unambiguously be attributed to labor. Underlying the BLS headline measure is the assumption that hourly wages in the corporate sector and self-employment are the same. This amounts to adjusting the payroll share by the ratio of self-employment hours to corporate hours. The assumption is ad-hoc and appears to be violated: the distribution of non-corporate income flows differs from that of payrolls, and these components have evolved differently over time. At the sectoral level and in our data set, it is also difficult to replicate. We therefore assume instead that non-corporate activity features the same labor share as corporate activity. This amounts to adjusting the payroll share by the ratio of non-corporate income to total income. We therefore implicitly assume that (1) the "real wages" of the self-employed reflect their labor productivity and (2) the ratio of the two is equal to that in corporate activities.[8] While we find this underlying rationale defensible, it is ad-hoc as well. However, it can easily be implemented, and therefore we proceed in this fashion.

The bottom panels of Figure 1 summarize the aggregate labor share resulting from the aggregation of our sectoral data set. Panel (c) reports the three main components as a share of total value added: aggregate non-corporate income declines as a share of total value added from above 20 percent to about 10. Panel (d) shows different possible allocations of non-corporate income flows to the labor share, following the discussion in Elsby *et al*. (2013, section I.B). The top line in Panel (d) allots all non-corporate income to labor ("all-to-labor"); the middle line excludes non-corporate income from the denominator ("economy-wide"); and the black line—our preferred approach—applies the payroll share to non-corporate income flows.

The resulting labor share in the aggregate shows a sustained increase during the golden age, and a substantial decline during the neoliberal era. The medium-term trends of the measure constructed here thus conform more closely to the share of total payrolls in gross domestic income than the BLS headline number or corporate payrolls.

Finally, Figures 2 and 3 report sectoral labor shares and sectoral valued added and employment shares for all 14 sectors of our data set, respectively. Marked differences in levels and trends of all three shares arise, particularly when comparing manufacturing (MAN) and select service sectors, such as professional business

[7]For a related discussion, see Barrales and von Arnim (2017, p. 201), who adjust the aggregate corporate payroll share by the share of wages of the top 1 percent. The resulting proxy of the "bottom 99 percent" of payrolls, in their paper relative to corporate net value added, shows a steady trend increase from 1948 to 1980, and a steady decrease thereafter. Related insightful discussion focused on the role of managers and their incomes, including the role of stock options, can be found in Duménil and Lévy (2015) and Lazonick (2015).

[8]In other words, the *ratio* of real income to productivity is the same in corporate and non-corporate activities: suppose, for the sake of the argument, that both types of workers produce the same output, but the self-employed require more hours. Our assumption implies that their real hourly income will be lower as well, to obtain the same labor share as in corporate activities. For an evaluation of implications of imputation methods of self-employed income in an international context see Izyumov and Vahaly (2015).

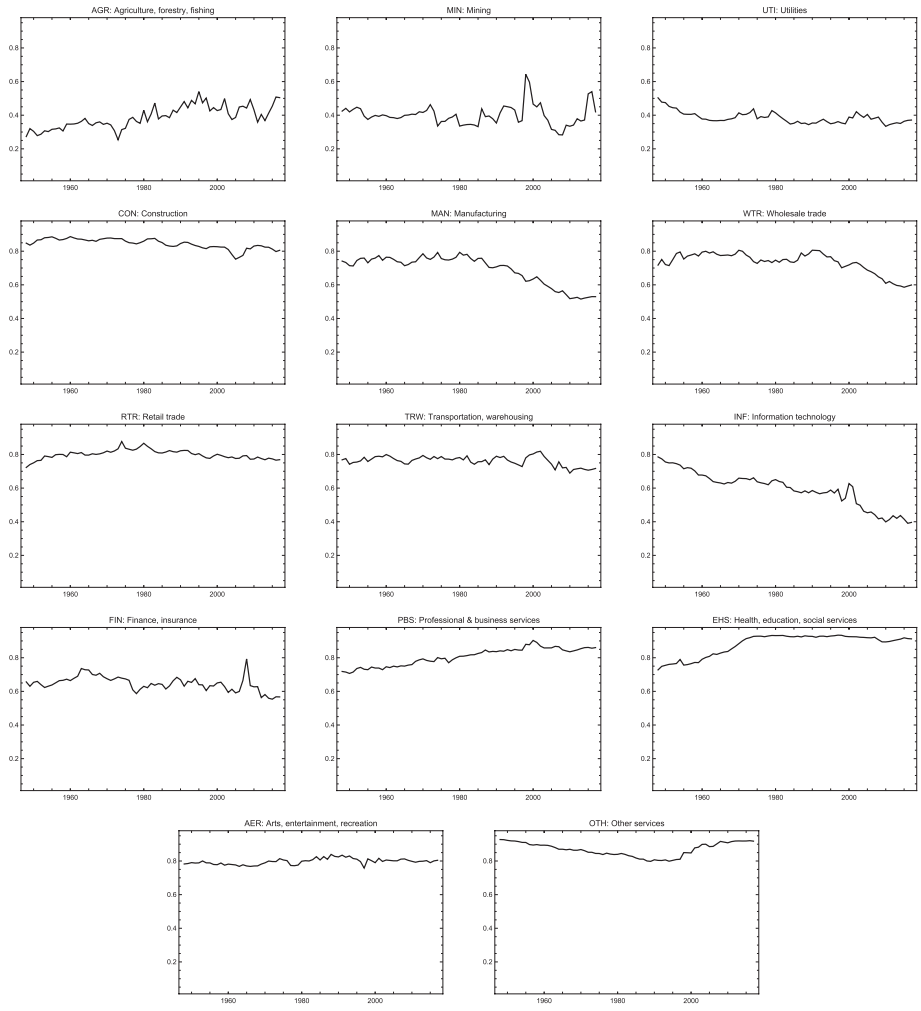


Figure 2. Sectoral Labor Shares, 1948–2017: The 14 panels of this figure show sectoral labor shares. See Sections 2 and 4 for details on data sources and methods.

services (PBS) and education, health, and social services (EHS). We will draw on these figures repeatedly in discussion that follows.

3. A Divisia Decomposition of the Labor Share

We take the aggregate labor share to be a Divisia index that captures changes in sectoral quantities of output and employment, as well as sectoral prices of goods and services and labor compensation. Index decomposition analysis dates back to the 1970s when it was used to assess the effect of changes in the structure of industrial production on energy demand. Decomposition techniques have since been refined and applied widely across disciplines, including economics. Development and growth economics, in particular, have been concerned with the interaction of changing

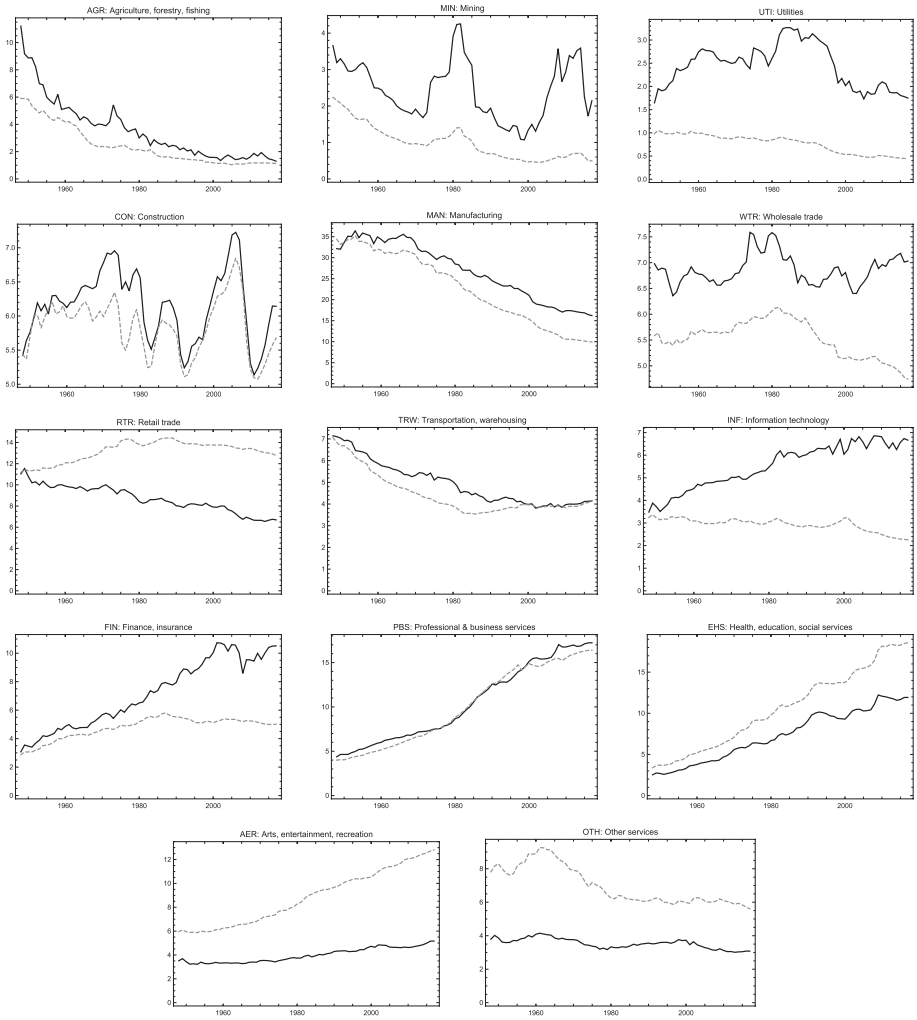


Figure 3. Sectoral Value Added and Employment Shares, 1948–2017: The 14 panels of this figure show sectoral shares of value added (Black) and employment (Gray Dashed). See sections 2 and 4 for details on data sources and methods.

economic structure and economic growth ever since the mercantilists, and more formally since Leontief's seminal contribution on input-output analysis (Dietzenbacher and Los, 1998). Crucially, the LMDI decomposition employed here satisfies the factor-reversal test and has desirable theoretical properties such as being a symmetric and additive indicator of relative change, thus making it a perfect decomposition. In other words, it does *not* produce a residual (Ang and Zhang, 2000; Ang, 2004). Its discrete representation as a Törnqvist index is also a good approximation of the Fisher ideal index that lies behind data provided by the Bureau of Economic Analysis, our source of data for the exercise in this paper (Dumagan, 2002).[9]

[9]Dumagan (2013) and Ang and Zhang (2000) survey different decomposition techniques and provide important insights into which methods are preferable given the data.

Building on Diewert (2010), we detail in the following paragraphs the decomposition technique for the labor share, which is generally defined as the ratio of nominal values of the wage bill and value added. If there are i sectors the labor share can be written as:

$$\psi = \frac{\sum_{i=1}^{n} w_i L_i}{\sum_{i=1}^{n} P_i X_i} \tag{1}$$

where w_i, L_i, P_i, X_i are the nominal wage, employment, price level, and quantity of output at the sectoral level, respectively. Multiplying equation (1) by PL/PL we get

$$\psi = \frac{\sum_{i=1}^{n} w_i L_i}{PL} \frac{PL}{\sum_{i=1}^{n} P_i X_i} = \omega/\varepsilon \tag{2}$$

where P and L are the general price level and total employment, and ω,ε are the average real wage and productivity, respectively.[10] These can in turn be disaggregated:

$$\omega = \frac{\sum_{i=1}^{n} w_i L_i}{PL} = \sum_{i=1}^{n} \omega_i \lambda_i \tag{3}$$

$$\varepsilon = \frac{\sum_{i=1}^{n} P_i X_i}{PL} = \sum_{i=1}^{n} \frac{P_i X_i}{PL_i} \frac{L_i}{L} = \sum_{i=1}^{n} p_i \varepsilon_i \lambda_i \tag{4}$$

where $\omega_i, \varepsilon_i, \lambda_i, p_i$ indicate real compensation or the nominal wage deflated by the general price level P, labor productivity, employment share, and terms-of-trade at the sectoral level, respectively. Using equations (3) and (4) the aggregate labor share can be written as

$$\psi = \frac{\sum_{i=1}^{n} \omega_i \lambda_i}{\sum_{i=1}^{n} p_i \varepsilon_i \lambda_i} \tag{5}$$

The labor share can now be decomposed into several components: the sectoral real consumption wage, the employment shares, sectoral labor productivity, and relative prices (or, equivalently, the terms-of-trade).

[10] ω and ε are arithmetic averages defined as the wage bill in real terms divided by total employment (i.e. $\omega = \sum_i w_i L_i / PL$) and total real output divided by total employment (i.e. $\varepsilon = \sum_i P_i X_i / PL$.)

Assuming that all variables are continuous, differentiating equation (5) with respect to time, t, and dividing both sides by ψ yields:

$$d\ln(\psi)/dt = \sum \phi_i[(d\ln(\omega_i)/dt) + (d\ln(\lambda_i)/dt)] - \sum \theta_i[(d\ln(p_i)/dt) + (d\ln(\varepsilon_i)/dt) + (d\ln(\lambda_i)/dt)] \tag{6}$$

The weights ϕ_i and θ_i are the nominal share of sector's i wage compensation in total wage compensation and the sector's i share in total value added, respectively.[11] Integrating equation (6) over the interval $[t-n, t]$ gives the Divisia decompositions of the growth rate of the economy-wide labor share:

$$\ln\frac{\psi_t}{\psi_{t-n}} = \int_{t-n}^{t}\sum \phi_i[d\ln(\omega_i)/dt]dt + \int_{t-n}^{t}\sum \phi_i[d\ln(\lambda_i)/dt]dt - \int_{t-n}^{t}\sum \theta_i[d\ln(p_i)/dt]dt - \int_{t-n}^{t}\sum \theta_i[d\ln(\varepsilon_i)/dt]dt - \int_{t-n}^{t}\sum \theta_i[d\ln(\lambda_i)/dt]dt \tag{7}$$

Applying the exponential to equation (7) we get:

$$D_T = D_\omega D_\lambda D_p^{-1} D_\varepsilon^{-1} \tag{8}$$

where the terms represent contributions from real compensation ω, employment structure λ, relative prices p, and labor productivity ε to the total change D_T, respectively:

$$D_\omega = \exp\left[\int_{t-n}^{t}\sum \phi_i[d\ln(\omega_i)/dt]dt\right] \tag{9}$$

$$D_\lambda = \exp\left[\int_{t-n}^{t}\sum (\phi_i - \theta_i)[d\ln(\lambda_i)/dt]dt\right] \tag{10}$$

$$D_p = \exp\left[\int_{t-n}^{t}\sum \theta_i[d\ln(p_i)/dt]dt\right] \tag{11}$$

$$D_\varepsilon = \exp\left[\int_{t-n}^{t}\sum \theta_i[d\ln(\varepsilon_i)/dt]dt\right] \tag{12}$$

[11]For the wage bill the nominal and real labor shares are the same since both the numerator and the denominator are deflated with the same price index.

To match the discrete format of the data we can write the components of the decomposition in discrete terms:

$$D_{\omega} = \exp\left[\sum [(\phi_{i,t} + \phi_{i,t-n})/2] \ln (\omega_{i,t}/\omega_{i,t-n})\right] \quad comp, \tag{13}$$

$$D_{\lambda} = \exp\left[\mathrm{X}[((\phi_{i,t} + \phi_{i,t-n})/2) - ((\theta_{i,t} + \theta_{i,t-n})/2)] \ln (\lambda_{i,t}/\lambda_{i,t-n})\right] \quad empl, \tag{14}$$

$$D_{p} = \exp\left[\sum [(\theta_{i,t} + \theta_{i,t-n})/2] \ln (p_{i,t}/p_{i,t-n})\right] \quad pric, \tag{15}$$

$$D_{\varepsilon} = \exp\left[\sum [(\theta_{i,t} + \theta_{i,t-n})/2] \ln (\varepsilon_{i,t}/\varepsilon_{i,t-n})\right] \quad prod, \tag{16}$$

The labels *comp*, *empl*, *pric*, and *prod* will be utilized in all subsequent discussion (and figures and tables) to represent contributions of real consumption wages, employment shares, relative prices, and labor productivity to the overall change of the labor share, respectively.

The sectoral components of real wage and labor productivity have the same effect on the aggregate labor share as the aggregate real wage and aggregate labor productivity in equation (2). A positive change in the real wage in sector i raises the labor share, while a positive change in the sector's labor productivity lowers the labor share. The real wage component is weighted by the sector's share in the wage bill, while labor productivity has the sector's share in value added as the weight.

The interpretation of the structural component—equation (14)—requires nuance. If a sector's share of employment declines, $ln(\lambda_i)$ is negative. However, if the sector's labor share is below the aggregate labor share, the weight is negative since $\phi_i - \theta_i = \psi_i/\psi - 1$. It follows that the aggregate labor share increases when employment shares decline for sectors with lower than average labor shares. This apparent improvement in the labor share is not necessarily advantageous to workers if the sector that sheds labor (in either relative or absolute terms) is a sector with higher than average real wage and labor productivity. In this case the change in the structure of the economy takes place toward sectors with higher labor share yet a lower productivity and therefore a lower real wage in absolute terms. We will return to these issues further below in the discussion of results.

The interpretation of the contribution from changes in relative prices captured by equation (15) also requires care. At the aggregate level, changes in relative prices reflect changes in the structure of the economy, since prices affect sectoral weights (Tang and Wang, 2004; Diewert, 2010). For example, and as shown by Diewert (2010) the contribution from the relative price component exceeds unity and thus reduces the aggregate labor share, if sectors with relatively high labor productivity also experience rising relative prices. Furthermore, when prices in all sectors grow at the same rate, there is no relative price effect, that is, $D_p = 0$.

A nil relative price term does not, however, imply that the rise in the general price level has no effect on the labor share: the real wage and therefore the labor share decline if nominal wages do not keep up with the increase in the general price level. At the sectoral level, the contribution of the relative price term is negative when a sector's price level grows faster than the general price level. For example, rising relative prices of services imply downward pressure on the sectoral labor share, and therefore a negative contribution to the aggregate labor share. Similarly, the decline in the relative price of manufactures can offset the negative effect of productivity growth in the sector on the aggregate labor share.

Last but not least, it should be emphasized that the aforementioned discrete representation of the conventional Divisia index method produces a residual. Following Sato (1976), Ang and Choi (1997) propose a logarithmic mean weight scheme instead of the arithmetic mean. It can be shown that the LMDI method produces no residual (Ang *et al*., 1998). Specifically, the weights we use in decomposing the aggregate labor share are $L(\phi_{i,t-n},\phi_{i,t}) = (\phi_{i,t} - \phi_{i,t-n})/ln(\phi_{i,t}/\phi_{i,t-n})$ and $L(\theta_{i,t-n},\theta_{i,t}) = (\theta_{i,t} - \theta_{i,t-n})/ln(\theta_{i,t}/\theta_{i,t-n})$.[12]

4. Data and Methodology

This section outlines the methodology and data used in the decomposition of the US labor share by 14 major sectors over the 1948–2017 period. As described in Section 2, we compute the labor share for the private industries sector only, as the ratio of *Labor Compensation* to *Value Added* (VA) net of *Taxes on Production and Imports, less Subsidies* (TOPI). The decomposition (see Section 3) requires data on sectoral real wages, employment shares, labor productivity, prices, nominal value added shares, and wage bill shares. We have collected the following time series data by sectors: compensation, value added, full-time-part-time (FTPT) employment, and chain-type Fisher price indexes for value added by industry.

Fisher-type indexes provide the convenience that a Fisher quantity can be obtained by dividing the nominal value by the Fisher price index (Meade, 2010). Thus, sectoral real value added that is needed to calculate sectoral labor productivity is obtained by deflating nominal quantities by the sector's value-added price index. Real consumption wage for each sector is calculated as the ratio of real total compensation to FTPT employment in the sector. We are interested in measuring the purchasing power of workers, which prompts us to use the price deflator for the overall private industries sector.[13]

Key features of our methodology and data are documented in the following paragraphs. In brief, compensation must include the labor share of non-corporate income. We deal with this issue by applying the corporate payroll share to

[12]Since the sum of the weights is very slightly below unity, we further normalize the sectoral weights by the sum of the weights over all sectors, $\sum_i L(\phi_{i,t},\phi_{i,t-n})$ and $\sum_i L(\theta_{i,t}\theta_{i,t-n})$, respectively.

[13]It must be noted that a more accurate measure of consumer purchasing power would require the consumer price index (CPI) as the deflator. Although differences exist between private industries' price index, the GDP deflator, and the CPI, they tend to move together over time. However, the private industries' price index allows us to produce an exact decomposition of the aggregate labor share by sectors and provide a more straightforward interpretation of the decomposition terms.

non-corporate income to obtain labor income in the non-corporate sector. Second, the industry classification has undergone several changes—the most consequential one being the change from the Standard Industrial Classification (SIC) system to the North American Industry Classification System (NAICS) in 1997. Third, we exclude the real estate sector for the reasons explained in the paper. Details on how we dealt with the last two issues and sources of data are provided in the following section.

4.1. *Data Sources*

The data used for this study come from the National Income and Product Accounts (NIPA) and from the Industry Accounts published by the Bureau of Economic Analysis (BEA). Table 1 provides a summary of data in terms of type and coverage, and links to sources.

The data set covers 14 sectors organized at the two-digit classification: (1) AGR: agriculture, forestry, and fishing; (2) MIN: mining; (3) UTI: utilities; (4) CON: construction; (5) MAN: manufacturing; (6) WTR: wholesale trade; (7) RTR: retail trade; (8) TRW: transportation and warehousing; (9) INF: information; (10) FIN: finance and insurance; (11) PBS: professional and business services; (12) EHS: education, health, and social services; (13) AER: arts, entertainment, and recreation; and (14) OTH: other services.

In the postwar era, NIPA have been organized according to two major industrial classification systems, the SIC and NAICS. Each has its own vintages (72SIC, 87SIC, 07NAICS, and 12NAICS). Our industry headings and concordance for each of these are shown in Tables A1–A3 in the appendix.

The BEA has prepared and published NAICS estimates for value added, FTPT employees, and chain-type quantity indexes for value added for the entire period of 1948–2017. One challenge is to obtain consistent series for VA components.

4.2. *Value Added and its Components for Private Industries*

Value Added

Value added in the National Accounts is defined as the sum of employee compensation, corporate gross operating profits (GOP), non-corporate gross operating profits, and TOPI.[14] Since our focus is on the labor share, we subtract TOPI from the VA and focus on the VA distributed solely between labor and capital income.

According to the US Bureau of Economic Analysis (a) "the VA data for 1997–2017 are from the GDP by Industry accounts released on April 19, 2018, as part of the advance annual to the industry economic accounts (IEAs). The data for 1947–1996 are from GDP by industries historical comprehensive revision time-series released on February 19, 2016 and have been updated to be consistent with IEAs Statistics were prepared with methodologies that are unique to the GDP by

[14]For all private sectors it is confirmed that VA = Compensation + GOP + TOPI; however, there is a discrepancy at the aggregate level (i.e. private industry) between BEA data and the sum of the three main components of VA. This discrepancy is counted in the BEA data by the *statistical discrepancy* row. This discrepancy does not interfere with our calculations as we compute the VA as the sum of the components.

TABLE 1
Data Sources and Coverage

	NAICS	SIC
Employment	FTPT: 1948–2017 https://www.bea.gov/sites/default/files/2018-04/GDPbyInd_FTPT_1948-1997.xls 1998–2017: Table 6.4D	FTPT: 1948–1997 https://apps.bea.gov/industry/xls/GDPbyInd_VA_SIC.xls see NIPA Tables 6.4
Value added	1948–2017 https://www.bea.gov/sites/default/files/2018-04/GDPbyInd_VA_1947-2017.xlsx	1948–1997 https://apps.bea.gov/industry/xls/GDPbyInd_VA_SIC.xls
VA components	3 components: 1987–1997 https://apps.bea.gov/iTable/iTable.cfm?reqid=147&step=2&isuri=1 1998–2017: https://apps.bea.gov/industry/xls/underlying-estimates/GDPbyInd_VA_Components_1998-2018.xlsx	All components: 1948–1997 https://apps.bea.gov/industry/xls/GDPbyInd_VA_SIC.xls
Chain-price indexes	1948–2017 (2009=100) https://www.bea.gov/sites/default/files/2018-04/GDPbyInd_VA_1947-2017.xlsx	1977–1997 (2009=100) https://apps.bea.gov/industry/xls/GDPbyInd_VA_SIC.xls

Industry accounts and are for industries defined according to the 2007 North American Industry Classification System (NAICS). The 'NAICS codes' tab contains a concordance of the I-O codes to the associated 2007 NAICS codes."[15] In this study we use *Value Added* and *Price Indexes* data from the US Bureau of Economic Analysis (a). Note, however, that there are slight differences between these data and the most recent BEA release from October 29, 2019, available at Interactive Access to Industry Economic Accounts Data:vGDP by Industry, US Bureau of Economic Analysis (e).

VA Components

Data on all VA components by sector are available for the NAICS only starting in 1997.[16] Prior to this date, sectoral component statistics are available for the 72 and 87 SIC vintages. Therefore, the NAICS VA components are estimated using the SIC-based components data, and the NAICS-based VA added. This is preferable to alternatives because detailed price indexes are not available for SIC data before 1977.

Estimation of NAICS VA components has been done as follows. First, we aggregate compensation, corporate GOP, non-corporate GOP, and TOPI for the 14 major sectors according to the concordance tables. Next, we calculate the shares of each of these components in VA for each industrial classification. Third, we apply these shares to the NAICS value added data, which are available going back to 1948. We provide here a more detailed description of the procedure used to obtain compensation.

Compensation

Compensation is total remuneration, both monetary and in kind, payable by employers to employees in return for their work during the period. It consists of wages and salaries and of supplements to wages and salaries. NAICS-based sectoral compensation data are estimated according to the following formula:

$$Comp^{est}_{NAICS} = VA_{NAICS} \frac{Comp_{SIC}}{VA_{SIC}} \tag{17}$$

where VA_{NAICS} and VA_{SIC} are BEA data for sectoral value added for the NAICS and SIC vintages, respectively, and $Comp_{SIC}$ is the BEA data for compensation for the SIC vintages. The VA_{NAICS} data have been discussed earlier. The VA_{SIC} is calculated as the sum of main VA components (Compensation, GOP, and TOPI). Data for $Comp_{SIC}$ come from the NIPA, Section 6: Income and Employment by Industry. For VA and other components including Compensation see also BEA's Historical Industry Accounts Data, US Bureau of Economic Analysis (c).

[15]See US Bureau of Economic Analysis (a) data published on April 19, 2018, as part of its Industry Economic Accounts Data and the *ReadMe* note: GDP by Industry (Historical).

[16]BEA has estimated NAICS VA components for the 1987–1997 decade but without differentiating between corporate and non-corporate GOP that precludes us from using these estimates in this study without making further assumptions.

4.3. *Employment*

The BEA has estimated FTPT NAICS-based employment for 1948–1997 (see US Bureau of Economic Analysis (b)). According to the BEA, "The estimates are consistent with the results of the 2003 comprehensive revision of the national income and product accounts (NIPAs) released on December 10, 2003 and with the integrated annual industry accounts for 1998–2003 that were released on June 17, 2004."[17] Statistics for FTPT NAICS-based employment for 2017–1998 are available online in Table 6.4.D of Section 6 of NIPA (see US Bureau of Economic Analysis (d)).

4.4. *Relative Prices*

Value-added price indexes (2009 = 100) have been estimated by the BEA for the NAICS going back to 1948 (see US Bureau of Economic Analysis (a)). The data we use in this study were released on April 19, 2018.

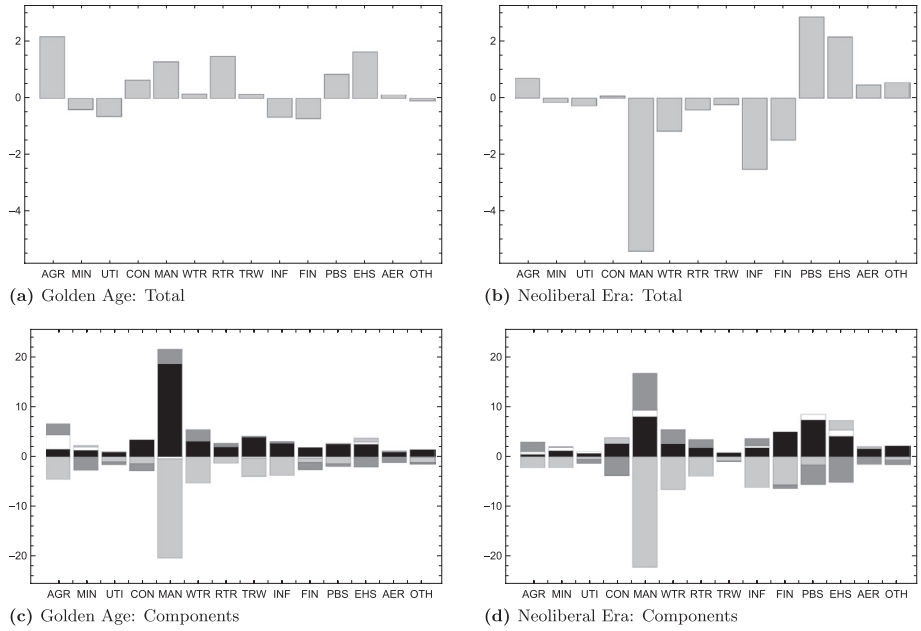
One issue that concerns price indexes is the removal of the real estate sector from the analysis. This change is easily implemented for compensation, value added, and employment by simply subtracting the real estate data from the financial sector data. However, we need to re-estimate the (overall) private sector price index, which in our application excludes the real estate price index. The calculation of the private sector price index for value-added is done using sectoral quantity weights, $\alpha = Q_i/Q$ and sectoral price indexes for value added, P_i, both of which are provided by the US Bureau of Economic Analysis (a).

5. Results: Sectoral and Component Contributions to Labor Share Changes in the US, 1948–2017

In this section, we present the main results of the Divisia index decomposition of the labor share. The focus will be on the distinction between the golden age and the neoliberal era, and structural changes occurring throughout. The topic of the next section is a contextualization of these results vis-à-vis Baumol and Lewis, but we will foreshadow some of the issues here.

We begin with a brief motivation of the sample split. As mentioned, we define the golden age as the period from 1948 to 1979, and the neoliberal era as the period from 1979 to 2017. The choice of the turning point can be controversial. The Great Moderation is thought to have begun only in 1985, whereas the golden age is often considered to have ended in 1973. We choose 1979 as the cutoff because it (roughly) marks the turning point for several critical variables, from the manufacturing labor share to the wage-productivity gap for non-supervisory workers to the income share of the bottom 50 percent. It is furthermore a business cycle peak: November 1948 and January 1980 are the relevant NBER peak months, which we compare to the latest data available (2017). The aggregate labor share from our sectoral data set saw an increase of 5.8 percentage points during the golden age, and a decrease of −4.8 percentage points during the neoliberal era. A look back

[17]See US Bureau of Economic Analysis (b) *ReadME* note.



(a) Golden Age: Total (b) Neoliberal Era: Total

(c) Golden Age: Components (d) Neoliberal Era: Components

Figure 4. Sectoral Contributions Across "Golden Age" and "Neoliberal Era"
Notes: The Top Two Panels Show Total Sectoral Contributions, and the Bottom Two Panels Sectoral Component Contributions: Real Compensation is Black; Employment Structure White; Labor Productivity Light Gray, and Relative Prices Dark Gray Data are reported in percentage point change. The sum across stacked bars in each sector in the bottom panel is equal to the bar height in the top panel.

at Figure 1 indicates that the bulk of the increase occurred early in the golden age, and the bulk of the decrease late in the neoliberal era.

Figure 4 and Table 2 provide decomposition results, which can be summarized as follows.

First, changes in real consumption wages and labor productivity dominate: Of the four components—real consumption wages *comp*, employment composition *empl*, labor productivity *prod*, and relative prices *pric*, as in equations (13)–(16), and equivalently labeled in the table—*comp* and *prod* have clearly the largest impact. For an example, consider the first five cells in the first row of Table 2: over the entire sample period, the US labor share increased from 68.3 to 69.4, or about 1 percentage. *comp* contributed 80.5, *empl* 9.1, *prod* −88.1 and *pric* −0.5.

Second, manufacturing matters: Despite its rapidly falling employment share, the manufacturing sector (MAN) plays an outsized role in contributions from *comp* and *prod*. It is the only sector with double-digit productivity contributions over the entire sample and both subperiods. During the golden age, *comp* is roughly on par with *prod*, with 18.5 and −19.8, respectively. The sector also exhibits consistently the largest positive impact on the overall labor share from relative price changes.

Third, structural change puts upward pressure on the labor share: The contribution from *empl* is consistently positive. *Ceteris paribus*, the labor share would have risen 5.7 percentage points during the neoliberal era. The dominant sectors here are AGR, MAN, PBS, and EHS—all of which have a positive impact on the

TABLE 2
CONTRIBUTIONS TO PERCENTAGE POINT CHANGE OF THE US LABOR SHARE

	1949–2017					1949–1979					1979–2017				
Sec	Sum	Comp	Empl	Prod	Pric	Sum	Comp	Empl	Prod	Pric	Sum	Comp	Empl	Prod	Pric
Sum	1.0	80.5	9.1	−88.1	−0.5	5.8	46.2	3.8	−42.8	−1.3	−4.8	39.8	5.7	−48.8	−1.5
AGR	2.8	2.0	2.8	−7.6	5.6	2.1	1.5	2.9	−4.5	2.3	0.7	0.5	0.4	−2.2	2.0
MIN	−0.5	2.7	1.2	−2.2	−2.2	−0.4	1.3	0.6	0.3	−2.6	−0.6	1.2	0.7	−2.1	0.1
UTI	−0.8	1.3	0.4	−1.3	−1.2	−0.6	0.9	0.1	−1.	−0.6	−0.3	0.6	0.4	−0.5	−0.8
CON	0.8	5.8	0.04	−0.4	−4.7	0.6	3.3	0.1	−1.4	−1.4	0.1	2.7	−0.1	1.1	−3.7
MAN	−5.8	21.3	1.3	−38.3	9.9	1.3	18.5	−0.3	−19.8	2.9	−5.4	7.9	1.4	−22.0	7.3
WTR	−1.1	5.4	0.0	−11.6	5.0	0.2	3.	0.	−5.3	2.4	−1.2	2.6	0.1	−6.6	2.8
RTR	0.8	3.7	0.1	−5.5	2.5	1.5	2.	0.2	−1.3	0.6	−0.4	1.7	−0.1	−3.8	1.74
TRW	−0.1	4.5	−0.2	−4.5	0.1	0.1	3.8	−0.2	−3.7	0.3	−0.2	0.8	0.0	−0.9	−0.1
INF	−3.2	4.1	0.3	−9.3	1.7	−0.7	2.7	0.	−3.7	0.4	−2.5	1.8	0.3	−6.1	1.5
FIN	−1.8	6.4	−0.3	−5.4	−2.5	−0.7	1.9	−0.2	−0.9	−1.4	−1.5	4.9	0.0	−5.7	−0.7
PBS	4.4	10.0	1.7	−3.6	−3.8	0.8	2.5	0.2	−1.4	−0.5	2.8	7.4	1.1	−1.7	−3.9
EHS	3.9	6.4	1.7	2.4	−6.6	1.6	2.4	0.5	0.7	−2.1	2.1	4.0	1.4	1.9	−5.1
AER	0.9	2.7	0.4	0.6	−2.9	0.1	0.9	0.1	0.3	−1.1	0.5	1.6	0.2	0.3	−1.6
OTH	0.8	4.1	−0.3	−1.6	−1.5	−0.1	1.4	−0.1	−1.	−0.4	0.5	2.1	−0.1	−0.5	−1.

Notes: The table presents contributions by the four sectoral components to changes in the labor share, in percentage point changes. The four components are real compensation (*comp*), employment share (*empl*), labor productivity (*prod*), and relative prices (*pric*), from left to right. The first block of columns represents the entire sample (1949–2017), the second block the "Golden Age" (1949–1979), and the third the "Neoliberal Era" (1979–2017). Figure 4 presents selected growth contributions visually. The sectors are labeled AGR (agriculture, forestry, fishing), MIN (mining), UTI (utilities), CON (construction), MAN (manufacturing), WTR (wholesale trade), RTR (retail trade), TRW (transportation and warehousing), INF (information technology), FIN (finance and insurance), PBS (professional and business services), EHS (education, health, and social services), AER (arts, entertainment, recreation), and OTH (other services).

overall labor share. However, and as discussed already in Section 3, this does not necessarily bode well for workers. Indeed, service sectors with swelling employment shares have relatively high labor shares, but feature also relatively low real wages and labor productivity. In contrast, labor shares in AGR and MAN are lower, so that a decline of employment here has a positive effect, while at least manufacturing real wages and labor productivity are certainly higher than in many services.

Lastly, relative price changes show a pattern consistent with Baumol's cost disease. Yet, *pric* has the smallest impact of the four components on the aggregate labor share. At the sectoral level, the impact of relative price changes on labor shares tends to be positive in progressive sectors (e.g. MAN and WTR), and negative in stagnant sectors (e.g. PBS and EHS). Put simply, stagnant service sectors experienced sustained relative price increases in both periods, and an acceleration of these trends in the neoliberal era. In contrast, manufacturing and some services often considered susceptible to productivity increases through the use of information technology, experienced sustained relative price decreases in both periods, and an acceleration thereof in the neoliberal era.

The critically important issue is that the golden age exhibits a sense of balance. While some sectors contribute negatively, others contribute positively. In the aggregate, the labor share rises, but no single sector's total contribution stands out. The reason is to be seen in the fact that across sectors, contributions from the real compensation component are roughly proportional to that of productivity.

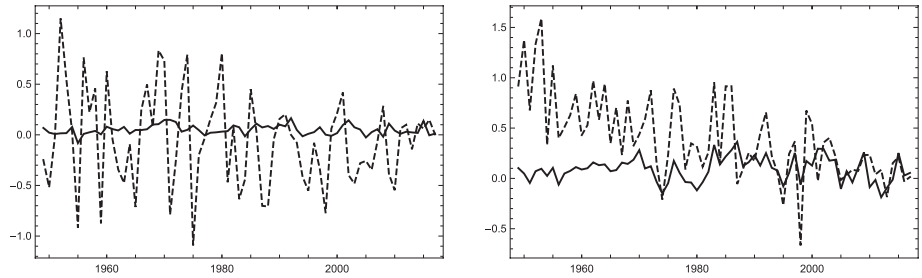
In sharp contrast, the neoliberal era is marked by large *negative* contributions from MAN, WTR, INF, and FIN, and large *positive* contributions from PBS and EHS. The former exhibit relatively high productivity growth, the latter relatively low productivity growth. Data reported in Table 2 and Figure 4 indicate that across sectors, contributions from labor productivity components exceed that of real compensation; and this gap is especially dramatic in the progressive sectors: MAN, WTR, RTR, INF but FIN as well.

The importance of the manufacturing sector for the overall change of the labor share cannot be overstated. The very large contribution from MAN to the aggregate labor productivity component in both periods—holding steady at 46 and 45 percent, respectively—is one side of this coin, and the difference in the sector's contribution to the aggregate real compensation component—falling from 40 to 20 percent—is the other.[18] Figure 5 emphasizes this further. The left panel shows strong cyclical variation in the manufacturing contribution, which, however, decreases over time. The right panel illustrates the decline in the real compensation contribution from manufacturing, and compares these to a representative stagnant sector, EHS.[19]

It should be emphasized that *comp* is deflated by the economy-wide price index, whereas *prod* is deflated by the sector's price index. Comparing these component contributions could therefore be misleading, since only *prod* will reflect relative price changes. However, and as Figure 2 shows, the collapse of the

[18]These percentages are simply the ratios of the sectoral contribution to the total component contribution, in the respective period.

[19]An (online) appendix provides further figures and tables to complement these results, including time series of contributions across sectors, contributions of components, and a variance decomposition.



(a) Total sectoral contribution (MAN & EHS) (b) Sectoral compensation contribution (MAN & EHS)

Figure 5. Sectoral Contributions from Manufacturing (MAN) and Education, Health, and Social Services (EHS).

Notes: The Figure Provides Selected Results of the Divisia Index Decomposition for Two Sectors The left panel shows total sectoral contributions in percentage point changes by MAN (dashed) and EHS (black). The right panel shows contributions from real compensation by MAN (dashed) and EHS (black).

manufacturing labor share (and therefore the sector's real product wage relative to labor productivity) is dramatic and sustained: the stagnation of manufacturing real wages, however measured, relative to the sector's labor productivity is the key issue, not the relative price change.[20]

In summary, it is widely recognized and we confirm here that the overall change in the labor share is driven by within-sector changes. Our findings furthermore suggest, however, that the nature of structural change is indeed important. At the center of it is a sustained decline of employment and a widening compensation-productivity gap in progressive sectors on the one hand, and a sustained rise of employment without such a compensation-productivity gap in stagnant sectors on the other. Without the buffering effect of this type of structural change on the aggregate labor share, its decline would have been still more pronounced. At the same time, this buffering effect applies only to the labor share: the shift toward service sector employment implies downward pressure on real compensation. In the following section, we discuss these results in the context of the seminal theories of Baumol and Lewis.

6. Baumol and Lewis: Structural Change, Stagnation, and the Labor Share of Income

There is no shortage of explanations for the decline in the labor share in recent literature. Karabarbounis and Neiman (2014) and Piketty (2014), for example, employ a neoclassical model with perfect competition in product and factor markets. Changes in factor income shares are possible if the elasticity of substitution between labor and capital differs from unity, and capital intensity changes. The critical assumption in this and related research is that the factor elasticity of substitution is larger than unity. There is inconclusive empirical support for this

[20]We are grateful to an anonymous referee for pointing us in this direction.

assumption; for recent contributions on the matter see Raval (2017), Chirinko and Mallick (2017) and Fukao and Perugini (2020).

Similarly, Elsby *et al*. (2013) evaluate the predictions of the neoclassical model for the US economy and conclude evidence in its favor is rather weak. A shift to capital-intensive techniques of production is not the main cause behind the decline in the labor share, and neither is the decline in unionization of workers. Instead, these authors suggest that sectors with the largest import exposure have faced the biggest decline in the payroll share. Using data on commuting zones, Autor *et al*. (2013) reach a similar conclusion: trade-exposed labor markets have been affected negatively in terms of both employment and compensation. These findings appear to hold for other countries. Hogrefe and Kappler (2013) and Rada and Kiefer (2016) show similar results on the basis of econometric analysis for OECD countries. Unlike Elsby *et al*. (2013), the latter authors also find that union density remains a fairly robust correlate of the labor share even when including an index of globalization.

Structural change remains a sideshow within this growing literature. This is in part due to the fact that the decomposition exercises do not identify structural change as a main source of change in the labor share. Specifically, the labor share has not declined because workers moved to sectors with relatively lower labor shares. Rather, employment has shifted to sectors with higher labor shares, but intra-industry dynamics dominate: real wage and labor productivity contributions within a sector tend to be much larger than the contribution from changes in employment shares.[21]

Yet, we can gain a deeper understanding of the decline in the labor share through careful consideration of the process of structural change. Our aim in this section is to do just that, by way of placing our results in the context of seminal research on structural change by W. J. Baumol and W. A. Lewis. Both consider an economy with two sectors, one of which is progressive (i.e. featuring high labor productivity growth) and one of which is stagnant (i.e. featuring no or low labor productivity growth). Baumol wrote about the vicious implications of structural change from progressive manufacturing toward stagnant service activities, while Lewis worked on the virtuous possibilities of structural change from stagnant agricultural to progressive manufacturing activities.

For the purposes of our discussion, we do not want to emphasize these differences, which appear predicated merely by their specific interests and time of writing. Instead, our focus lies on the very different treatment of labor markets. Crucially, in Baumol's theory, real wages in stagnant activities are required to grow at the rate of aggregate productivity growth, to continually attract labor in a competitive labor market. In sharp contrast, in Lewis's theory, jobs in the progressive sector are limited, and while its real wages feature a premium, they remain depressed by the existence of a pool of underemployed—a "reserve army of labor"—in the stagnant sector.

[21]Recall the top row in Table 2. Further, note that *empl* in equation (14) is weighted by the difference between a sector's compensation share and value added share—which is a significantly smaller weight than the sector's compensation or value added share by themselves.

Baumol does not provide a theory of the distribution of income: with labor the only factor of production, the aggregate labor share remains constant at unity.[22] The centrally important assumption in his model is that real consumption wages in the stagnant sector increase at the rate of aggregate labor productivity growth. Baumol's "cost disease" then manifests through the perpetual rise of relative nominal unit labor costs of the stagnant sector.[23] The key results pertain to labor transfer and stagnation. To obtain these, it must be assumed that the ratio of real sectoral outputs is constant, presumably because demand for stagnant sector output is highly income elastic and price inelastic. Since the relative price of stagnant sector output continuously rises with the cost disease, its nominal output share rises, too. Further, satisfying demand for stagnant sector output requires transfer of labor to that sector, which reduces aggregate labor productivity growth.

Again, the critical underlying assumption in this conceptualization is the competitive labor market, where the uniform growth rate of real consumption wages matches that of aggregate labor productivity. In summary, employers must increase wages at this rate even in stagnant sectors to attract labor. Importantly, all of the stylized facts derived from Baumol's theory are observed—relative price change, labor transfer, stagnation—*except for the underlying and critically important assumption of real consumption wage growth at the rate of aggregate labor productivity growth*.

The Lewis model, in contrast, describes a path toward modernization for developing economies in the context of dual labor markets. We provide here a brief sketch of the model.[24] As before, assume that the economy is characterized by two activities, one progressive and one stagnant. Crucially, the latter absorbs all labor that cannot be employed in the former. Further, *marginal* labor productivity in the stagnant sector is zero: output does not change with the removal of the marginal worker. The implication, however, is that average labor productivity rises with the rate of transference of labor toward the progressive sector. Second, the progressive sector features high productivity growth, but this productivity growth does not translate into real product wage growth.

Various approaches regarding real wage formation have been pursued in the literature. To illustrate, and to draw a clear distinction to Baumol, let us assume here (1) that prices are *not* proportionate to nominal unit output costs, but instead constant (see also Meier and Rauch, 2005, p. 360); (2) that nominal wages in the stagnant sector grow at the rate of that sector's labor productivity growth; and (3) that nominal wages in the progressive sector are a constant multiple of stagnant sector wages, and therefore grow at the same rate.

These assumptions imply that real consumption wages in the two sectors differ in levels, but that both grow at the rate of stagnant sector labor productivity

[22]The original papers are Baumol and Bowen (1965) and Baumol (1967). The discussion here is largely based on the latter.

[23]As Baumol emphasizes, this result does not depend on the assumption that nominal wages increase with progressive sector labor productivity growth, since the latter could translate into *falling progressive sector prices* instead. Real product wages would show the same pattern of change, and sectoral and aggregate labor share would still be constant.

[24]For original writings, see Lewis (1954), Kalecki (1976) and Kaldor (1978). For a textbook discussion and further references, consider Meier and Rauch (2005, p. 360ff). According to Fields (2004), a dual or segmented labor market implies that comparable workers are paid different wages.

growth. It follows that the stagnant sector labor share remains constant, but progressive sector and aggregate labor share fall. The labor share moreover experiences downward pressure from a compositional effect. If stagnant sector labor shares are higher than progressive sector labor shares—as in US data—the shift of employment toward progressive sectors implies a decrease in the labor share. In summary, employers must increase wages even in progressive sectors only at the rate of stagnant sector productivity growth, since labor is abundantly available. According to Lewis, the higher flow of profits thus generated is the very precondition for accumulation, growth, and modernization.

The relevant case to consider in the modern US context, however, is a "reverse-Lewis" shift: the employment share of stagnant sector activities is rising, and growth is slowing. According to Lewis, this should go along with an increase in the labor share, as the just-outlined process unfolds in reverse. Baumol's prediction of the rise in the stagnant sector relative price appears to be borne out, but the observed gap between real product and consumption wage growth on the one hand and labor productivity growth on the other suggests that the Baumolian mechanism of upward real wage convergence is inoperative. On the other hand, the observed patterns could be consistent with aspects of Lewis's theory: progressive and stagnant sectors appear increasingly decoupled in terms of productivity performance, and the simultaneously widening gap between real wage and labor productivity growth in progressive sectors is consistent with Lewis's notion of a dual labor market.[25]

7. Conclusion

The key contribution of this paper lies in the presentation of a Divisia index decomposition of the change in the US postwar labor share into its four principal components in 14 sectors. Our findings confirm prior results. Specifically, the change in the aggregate labor share is dominated by within-sector changes, and by the dramatic decline of the labor share in manufacturing. Our findings also critically augment prior results, primarily through the rich detail on the contributions from real compensation, employment structure, labor productivity, and relative prices.

First, the aggregate measure of the labor share, based on our sectoral data set of US private economic activity excluding real estate, shows a strong increase during the golden age, and a decline thereafter. Second, the contribution from real compensation growth across all sectors (except other services) has declined markedly from golden age to neoliberal era. This result would likely be exacerbated if the data were to exclude stock options, or more generally, the top sliver of the compensation distribution: our results are a quite cautious estimate of the decline

[25]A different but related take on the potential mechanisms behind the decline in the labor share is provided by Fukao and Perugini (2020) for Japan. Differentiating between regular and non-regular workers across main sectors of the economy, the authors find that non-regular work adversely affects aggregate labor share. However, its quantitative effect on the aggregate remains limited. The prevalence of non-regular workers has a larger impact on regular workers' labor share in low-knowledge intensive industries where, according to Fukao and Perugini (2020), the two types of labor are highly substitutable.

in the labor share. At the same time, the contribution from labor productivity has changed less. Third, observed patterns of structural change are closely related to the change in the aggregate labor share: dynamic, high productivity growth activities with relatively high real wages but low labor shares are shedding labor; whereas stagnant, low productivity growth activities with low real wages and high labor shares are absorbing it. This trajectory buffers the overall decline of the labor share.

The corresponding decline in the aggregate growth rate of labor productivity raises further questions. To what extent and in what manner are structural change, inequality, and the stagnation of growth connected? Our preliminary assessment, outlined in the preceding section in light of Baumol's and Lewis's theories of structural change, is that it would be an unjustified simplification to view these developments as the natural occurrence along a trajectory of tertiarization. Particularly, Lewis's characterization of labor markets as dual, where high productivity jobs are sought after, but most labor is absorbed in low productivity jobs, deserves further attention in future research on the underlying mechanisms.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Figure A.1: Component contributions to aggregate labor share change
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Table A2: 87 SIC concordance to 14 major sectors
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Table A4: Component and sectoral contributions across business cycles
Table A5: Variance decomposition of annual changes in the US labor share