The Missing Reallocation Effect: Decomposing The Declining Labour Share*

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Abstract

Since the mid-1980s, the labour share in the United States fell considerably and the economy reallocated towards sectors with high labour shares. Previous studies argue this reallocation played a minor role in the evolution of the labour share, so the decline should be primarily understood as a within-sector phenomenon. Leveraging a decomposition method that explicitly accounts for simultaneous reallocation between sectors and changing labour shares within sectors, I show the observed reallocation towards high labour share sectors offsets around half of the aggregate labour share decline - an order of magnitude larger than previous studies claim. My results imply that sectoral labour shares cannot be studied in isolation to explain the fall of the aggregate labour share.

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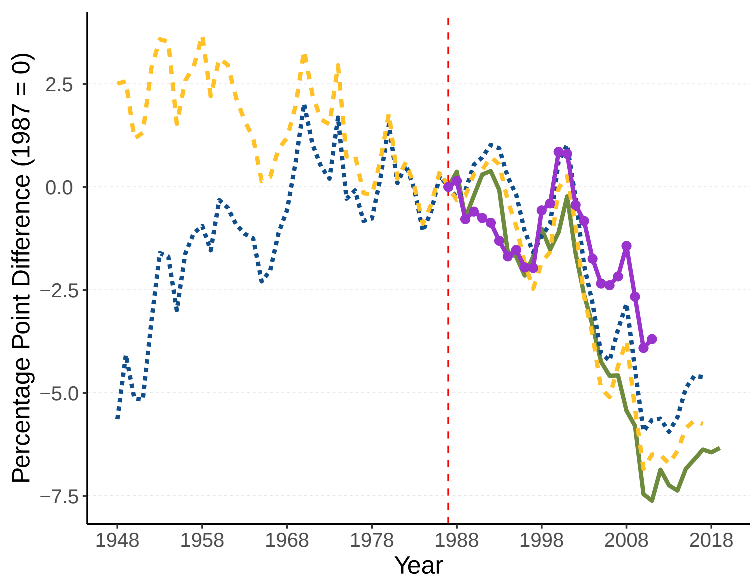
1 Introduction

The US labour share has fallen considerably since the mid-1980s. Figure 1 plots the decline for four different measures of the labour share after 1987. The shifting distribution of income away from labour challenges one of the Kaldor (1961) stylised facts about constant factor shares, a cornerstone assumption in many modern macroeconomic models. A large literature has attempted to uncover the mechanisms behind the falling labour share, yet no clear consensus has been reached.

Figure 1. Aggregate labour share decline relative to 1987, percentage point difference



Notes: The aggregate labour share equals labour income (self-employed labour income + payroll labour income) divided by GDP. The labour income of self-employed individuals is imputed four different ways. Section 2 contains the data description of the four methods I use to measure the labour share.
Source: Bureau of Economic Analysis (BEA), Bureau of Labour Statistics (BLS), and author's calculations.

The decline in the labour share since the mid-1980s coincided with a marked reallocation of value-added towards sectors with high labour share levels, mainly in services (Boppart, 2014, Bridgman and Herrendorf, 2023, Gaggl et al., 2023, Herrendorf et al., 2013). All else equal, such reallocation should counterfactually raise the labour share, as the aggregate comes to reflect the higher labour shares in the growing sectors to a greater extent. A natural question in the context of the reallocation is how much of the declining labour share is offset by the compositional shift and, therefore, how much arises due to labour shares falling within sectors?

Numerous studies argue that reallocation between sectors plays a minor role, so the labour share's fall should be understood primarily as a within-sector phenomenon (Dao et al., 2019, Elsby et al., 2013, Karabarbounis and Neiman, 2014). The reason is that while sectoral labour shares have generally fallen in recent decades, they have also tended to converge. As a result, the reallocation towards high labour share sectors has had limited quantitative effects on the aggregate labour share. In this paper, I show that the apparent lack of a reallocation effect, which is puzzling given the substantial compositional shift in the economy, is due to the specific decomposition method used in previous studies. By noting the aggregate labour share is a weighted sum of sectoral labour shares, movements in the aggregate can be decomposed into a part derived from the weights of sectors changing ('between-sector') and a part derived from labour shares changing within sectors ('within-sector') using a shift-share decomposition. The shift-share methodology is used in all previous studies decomposing the declining labour share. Alternatively, the falling labour share can be decomposed using the Haltiwanger (1997) method, which measures a between-sector, within-sector and cross contribution. The cross term measures the effect coming from the comovement of sectoral weights and sectoral labour shares. In this paper, I show theoretically how the shift-share and Haltiwanger techniques are connected since they both exactly decompose the labour share's decline. In particular, the shift-share between- and within-sector contributions include half of the Haltiwanger cross term. As a result, using the shift-share method to decompose changes in the labour share inadvertently counts half of the impact of comovement as between-sector reallocation. The same holds for the within-sector contribution. Intuitively, by not allowing for the cross term in the decomposition, the shift-share method splits the non-linear impact of comovement equally into the two linear between- and within-sector terms.

To see clearly when using the shift-share instead of the Haltiwanger method poses an issue, consider the case when the cross term is negative. Following the theoretical result, both the shift-share between- and within-sector terms are reduced by half of the cross term. A positive between-sector contribution measured by the Haltiwanger decomposition is biased towards zero, and a negative within-sector contribution is biased away from zero. Accordingly, the shift-share decomposition loads onto the within-sector term, and the reallocation towards sectors with high labour shares plays a minor role in explaining changes in the aggregate labour share - only due to the decomposition method used.

In the second part of this paper, I take the decomposition framework to the data and show the cross term is large and negative in US industry data. Subsequently, following the theoretical result relating to the two decomposition methods, the between- and within-sector contributions measured using the shift-share decomposition are downward biased because half of the negative cross term is added to each. Using the shift-share method to decompose the declining labour share from 1987 to 2011, 4% of the total fall is apportioned to reallocation and the remaining 96% to within-sector mechanisms, as found in Elsby et al. (2013). The results from a standard shift-share decomposition imply it is enough to understand the determinants of sectoral labour shares to explain the decline in the aggregate labour share. However, using the Haltiwanger method instead, reallocation towards high labour share sectors offsets -47% of the aggregate labour share decline. The reason is that the Haltiwanger decomposition cleanses the reallocation effect of half of the comovement effect. Additionally, in isolation, within-sector mechanisms only account for 45% of the fall in the aggregate labour share when using the Haltiwanger decomposition. The number is 96% when using the shift-share decomposition. The main decomposition results are based on the payroll labour share data used in Elsby et al. (2013), however, the results are robust to three different definitions of the aggregate labour share[1].

The between- and within-sector results emphasise that cross (comovement) effects are also important in explaining the decline in the labour share. All three channels operate in tandem to depress the labour share: reallocation towards industries with high labour share levels, declining labour shares within sectors, and the negative comovement between sectoral weights and sectoral labour shares. Future work that parses out the causal mechanisms behind the declining labour share should take the reallocation effect into account.

Related Literature. This paper contributes to the literature that attempts to explain the fall in the US labour share. The negligible reallocation effect found in previous studies motivated economists to propose within-sector mechanisms to explain the declining labour share. Declining labour shares within sectors are related to the increased adoption of automation (Acemoglu and Restrepo, 2019), rising concentration (Barkai, 2020), intermediate input prices (Castro-Vincenzi and Kleinman, 2022), and differences in trade exposure (Elsby et al., 2013). Why these mechanisms would not also cause reallocation between sectors, each with different labour share levels, is not clear. For instance, increased trade exposure to China displaced manufacturing employment and automation is likely to promote growth heterogeneously across sectors that benefit differently from its adoption (Acemoglu and Restrepo, 2019, Autor et al., 2013). My contribution to the literature is to show that reallocation between sectors is a quantitatively relevant source for changes in the aggregate labour share and, in particular, that compositional shifts offset part of the decline.

Bridgman and Herrendorf (2023) and Feijo Moreira (2022) find a positive reallocation effect on the aggregate labour share in two-sector structural models. The reason is that the economy

[1] See Elsby et al. (2013) for a discussion about measuring the aggregate labour share.

reallocates towards the sector with a higher labour share (services and manufacturing, respectively). Neither paper explains why their results differ from previous seminal studies which claim the falling labour share is a within-sector phenomenon. Hubmer (2023) also finds that falling labour shares within sectors are not the sole driver of the aggregate labour share, however, he interprets reallocation towards high labour share sectors as stemming from economic growth and an income effect due to non-homothetic preferences. I view my findings as complementary to all three papers because they all highlight the importance of compositional shifts for the US labour share. However, my paper explicitly bridges the gap to previous studies that claim reallocation does not play a role in the decline of the labour share. In particular, I show the discrepancy is due to the decomposition method used.

Finally, my paper relates to Autor et al. (2020) and Kehrig and Vincent (2021), who decompose changes in sectoral labour shares at the establishment level using US Census data. The authors examine the role of comovement between establishments' size (reallocation) and their labour shares for changes in different industries' labour shares. Both papers find that negative comovements drive sectoral trends - when firms grow, their labour share falls. Both papers' establishment-level data allows for a more granular analysis than the industry-level data I use. However, the establishment-level data is not consistently measured across sectors, whereas the industry-level data I employ can be used to analyse the labour share of the entire economy at the same time.

2 Data

The aggregate labour share in year t, λ_t, can be written as the weighted sum of N sectoral labour shares

$$\lambda_t = \sum_{i=1}^{N} \omega_{it} \lambda_{it}. \tag{1}$$

in which the sectoral weights and labour shares are defined as

$$\omega_{it} = \frac{VA_{it}}{\sum_{i=1}^{N} VA_{it}} \tag{2}$$

and

$$\lambda_{it} = \frac{WL_{it}}{VA_{it}} \tag{3}$$

in which VA_{it} and WL_{it} denote sector i's gross value-added and labour income in year t, respectively. To measure ω_{it} and λ_{it}, I use value-added data from the Bureau of Economic Analysis (BEA) industry accounts.

In general, labour income WL_{it} equals the sum of payroll workers' labour income WL^p_{it} and self-employed persons' labour incomes WL^s_{it}. The first is measured using payroll tax records. However, self-employed labour income needs to be imputed. Self-employed individuals report their total income but not the split between labour and capital. Following the literature, I exploit four different assumptions for imputing self-employed labour income, resulting in the four labour share definitions I use throughout the paper.

First, I examine the payroll labour share $\frac{WL^p_{it}}{VA_{it}}$ in isolation to avoid incorrectly imputing self-employed labour income. The payroll labour share represents the part of the aggregate labour share which is unambiguously labour income and is used in Elsby et al. (2013). The second approach is the 'same-wage-distribution' used in the BEA-BLS integrated industry-level production account (Eldridge et al., 2020). To construct WL^s_{it}, assume the average wage for self-employed individuals and payroll workers are equal within a skill×demographic cell j, sector i, and year t. Using the observed working hours L^p_{jit} and L^s_{jit}, the labour income of self-employed individuals can be backed out from the labour income of payroll workers

$$WL^s_{jit} = WL^p_{jit} \times \frac{L^s_{jit}}{L^p_{jit}}. \tag{4}$$

Third, I use the 'same-labour-share' approach following Mendieta-Muñoz et al. (2021). The approach corrects total self-employed individuals' income $Y^s_{it} \equiv WL^s_{it} + RK^s_{it}$ (remember, the labour-capital split is not known) by the payroll labour share $\frac{WL^p_{it}}{VA_{it}}$

$$WL^s_{it} = \frac{WL^p_{it}}{VA_{it}} \times Y^s_{it}. \tag{5}$$

Lastly, I use the 'economy-wide labour share' approach which subtracts the total self-employed persons' income from the denominator in the payroll labour share in equation (5)

$$WL^s_{it} = \frac{WL^p_{it}}{VA_{it} - Y^s_{it}} \times Y^s_{it}. \tag{6}$$

The final choice required to specify ω_{it} and λ_{it} is the level at which sectors i are defined. Aggregating the economy into fewer sectors would mechanically reduce the extent to which reallocation can affect the aggregate labour share. For example, the reallocation of value-added from Paper Manufacturing to Chemical Manufacturing is always measured as a within-sector contribution when examining the Manufacturing labour share. The issue arises even if the labour share is constant within the Paper and Chemical Manufacturing sectors[2]. Therefore, aggregating the economy into coarser sectors loads onto the within-sector contribution. Ideally, I would use establishment-level labour shares, but the data is not consistent across sectors (Autor et al., 2020). To compromise, and for comparison to previous studies, I use sectors classified at the North American Industry Classification System (NAICS) 3-digit classification for the 'same-wage-distribution' and 'payroll labour share' measures. For the 'same-labour-share' and 'economy-wide' assumptions, I can only use data aggregated into 14 sectors because total self-employed income Y_{it}^s is not measured at a more disaggregated level.

Given the four definitions of the labour share and the choice for how i is defined, I construct ω_{it} and λ_{it} annually for each sector i beginning in 1987. I choose 1987 as the beginning year of my analysis because industry classifications were changed by the BEA then, and using data from before requires bridging industry classifications. Table 1 shows the average sectoral labour share falls from the first 5 years to the last 5 years for each of the four labour share definitions.

Table 1. Average sectoral labour share for each definition.

Measure	Mean (first five)	Mean (last five)	Years	Number of sectors
Payroll	0.65	0.62	1987-2011	60
Same-wage-distribution	0.69	0.61	1987-2019	60
Same-labour-share	0.69	0.65	1987-2017	14
Economy-wide	0.78	0.68	1987-2017	14

Source: see Appendix A.1 for the data sources of each measure.

3 The Missing Reallocation Effect?

Using the industry-level data, in this section I demonstrate why the absence of a reallocation effect in previous studies is puzzling. Again, note the aggregate labour share in year t can be written as the weighted sum of sectoral labour shares

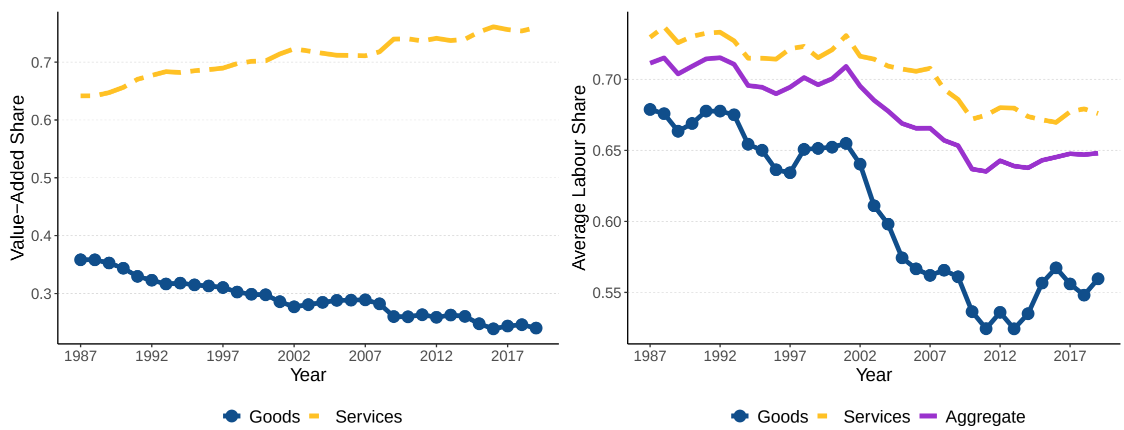
$$\lambda_t = \sum_{i=1}^{N} \omega_{it} \lambda_{it} \tag{7}$$

[2] Appendix A1 demonstrates that aggregating North American Industry Classification System (NAICS) 3-digit sectors into NAICS 2-digit classifications eliminates the entire between-sector effect, even though the effect is positive at the 2-digit level.

in which ω_{it} denote a sector's value-added-to-GDP weight and λ_{it} is sector i's labour share of value-added.

To pin down the role of reallocation in the evolution of the aggregate labour share, the left panel in figure 2 shows the share of value-added shifted towards service-producing industries since 1987, which is already well documented in the literature (e.g. Bridgman and Herrendorf (2023), Herrendorf et al. (2013)). The reallocation only matters if sectoral labour shares differ. The right panel in figure 2 shows the average labour share in the growing service-producing sectors is higher and declines slower than in shrinking good-producing sectors. Considering both panels together, the reallocation of value-added towards higher labour share sectors in services should at least partially offset the decline in the labour share. Indeed, in the right panel, the fall in the aggregate labour share is muted relative to the larger decline in the average labour share in good-producing sectors.

Figure 2. Value-added share and mean labour shares of goods and services industries.



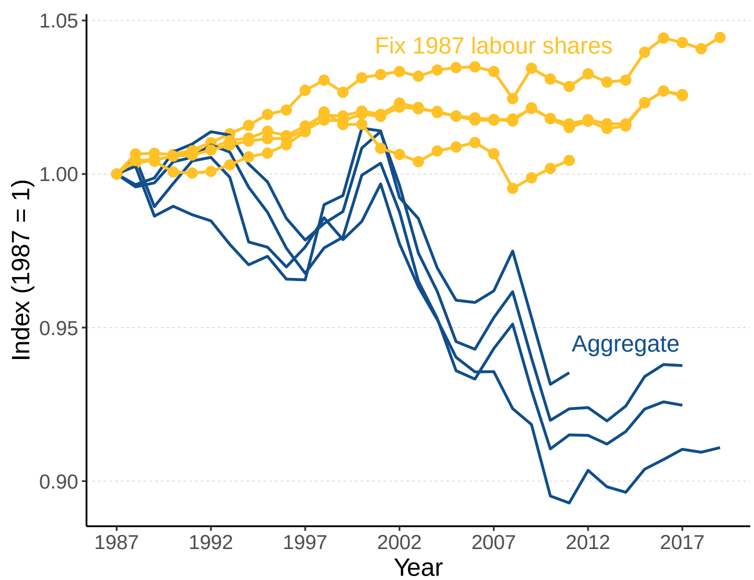
Notes: The left panel shows the value-added-to-GDP share of goods and service sectors. The right panel shows the mean labour share within goods and service sectors.
Source: BEA-BLS integrated industry-level production account and author's calculations.

Next, I conduct a simple counterfactual exercise in which I fix sectoral labour shares λ_{it} at their 1987 values, allowing only the weights ω_{it} to change. The counterfactual labour share is given by

$$\lambda_t^{\text{counterfactual}} = \sum_{i=1}^{N} \omega_{it}\lambda_{i1987}. \tag{8}$$

If reallocation does not affect the aggregate labour share, then the counterfactual labour share should neither increase nor decrease from 1987 onwards. In figure 3 shows the counterfactual labour share increased after for all four labour share definitions, albeit to a different extent for each. Why then is the positive reallocation effect missing from previous studies? To show why, in the next section I develop a decomposition framework that relates the shift-share method used in prior research to, as I argue, a more suitable decomposition method.

Figure 3. Counterfactual labour shares holding sectoral labour shares fixed.



Notes: The four lines sloping downward plot the aggregate labour share for each labour share definition. The four lines sloping upward plot the counterfactual labour share for each definition had sectoral labour shares stayed fixed at their 1987 values: $\lambda_t^{\text{counterfactual}} = \sum_{i=1}^{N} \omega_{it}\lambda_{i,1987}$. All lines are indexed to the respective 1987 labour share.
Source: Bureau of Economic Analysis (BEA), Bureau of Labour Statistics (BLS), and author's calculations.

4 Decomposition Framework

In this section, I introduce two related decomposition methods - the shift-share and the Haltiwanger decomposition. I show theoretically how they are related and discuss how they can lead to different conclusions about the reallocation effect.

Using the weighted-average definition of the labour share in equation (7), the change in the labour share, $\Delta\lambda_t = \lambda_t - \lambda_{t-1}$, can be decomposed into two terms using the shift-share technique

$$\Delta\lambda_t = \underbrace{\sum_{i=1}^{N} \Delta\omega_{it}\tilde{\lambda}_{it}}_{\text{Between}} + \underbrace{\sum_{i=1}^{N} \tilde{\omega}_{it}\Delta\lambda_{it}}_{\text{Within}} \tag{9}$$

in which $\Delta x_{it} = x_{it} - x_{it-1}$ and $\tilde{x}_{it} = \dfrac{x_{it-1} + x_{it}}{2}$, $x \in \{\omega, \lambda\}$. The first term measures the between-sector effect. Holding sectoral labour shares fixed to their arithmetic mean $\tilde{\lambda}_{it}$, the term measures the effect of reallocation between sectors with different labour share levels. The second term measures the effect of changing labour shares within sectors, keeping the sectoral composition fixed.

Alternatively, one can use the Haltiwanger decomposition, which keeps the bases fixed at their $t-1$ values, instead of the arithmetic means. The change in the labour share can then be decomposed into a between, within, and cross term

$$\Delta\lambda_t = \underbrace{\sum_{i=1}^{N} \Delta\omega_{it}\lambda_{it-1}}_{\text{Between}} + \underbrace{\sum_{i=1}^{N} \omega_{it-1}\Delta\lambda_{it}}_{\text{Within}} + \underbrace{\sum_{i=1}^{N} \Delta\omega_{it}\Delta\lambda_{it}}_{\text{Cross}} \tag{10}$$

in which $\Delta x_{it} = x_{it} - x_{it-1}$.

Using either decomposition, the 'Between' term is used to measure the effect of reallocation between sectors with different labour shares. The 'Within' terms capture the effect of changing labour shares within industries. The 'Cross' term in the Haltiwanger decomposition captures the impact of the comovement between sectoral weights and labour shares. Theorem 1 demonstrates how the two decompositions are related since they are both exact decompositions of changes in the labour share $\Delta\lambda_t$.

Theorem 1. *Combining half of the Haltiwanger Cross term with the Haltiwanger Between term yields the shift-share Between term*

$$\underbrace{\sum_{i=1}^{N} \Delta\omega_{it}\tilde{\lambda}_{it}}_{\textit{Shift-Share Between}} = \underbrace{\sum_{i=1}^{N} \Delta\omega_{it}\lambda_{it-1}}_{\textit{Haltiwanger Between}} + \frac{1}{2}\underbrace{\sum_{i=1}^{N} \Delta\omega_{it}\Delta\lambda_{it}}_{\textit{Haltiwanger Cross}} .$$

The same relationship holds for the within-sector terms

$$\underbrace{\sum_{i=1}^{N} \tilde{\omega}_{it}\Delta\lambda_{it}}_{\textit{Shift-Share Within}} = \underbrace{\sum_{i=1}^{N} \omega_{it-1}\Delta\lambda_{it}}_{\textit{Haltiwanger Within}} + \frac{1}{2}\underbrace{\sum_{i=1}^{N} \Delta\omega_{it}\Delta\lambda_{it}}_{\textit{Haltiwanger Cross}} .$$

Proof. See Appendix B. □

Theorem 1 demonstrates the shift-share between-sector term, which is used to measure the effect of reallocation, also captures half of the impact of comovement between ω_{it} and λ_{it}. The same logic applies to the within-sector terms. Consequently, a non-zero Haltiwanger cross term may lead to opposing findings about the effect of between-sector reallocation and within-sector mechanisms depending on the decomposition method used. For example, suppose the

Haltiwanger between-sector term is positive, which means reallocation, keeping sectoral labour shares fixed at $t-1$, leads to a counterfactually higher aggregate labour share. Using the shift-share decomposition instead may result in a zero reallocation effect if the Haltiwanger cross term is large and negative, because it subtracts from the positive Haltiwanger between-sector term, via Theorem 1. In addition, the negative cross term will then lead to negative within-sector mechanisms being overcounted. The presence of comovement in sectoral weights and labour shares masks the conclusions that can be drawn about between- and within-sector contributions to the declining labour share when using the shift-share decomposition. As I will show in the next section, sectoral weights and labour shares do covary.

The Haltiwanger method is also preferable to the shift-share method in the presence of trends in either λ_{it} or ω_{it}. Trends affect the arithmetic means used in the shift-share decomposition. For example, a downward trend in λ_{it} depresses the arithmetic mean, $\tilde{\lambda}_{it}$, each period. The result is the shift-share between term captures reallocation and sectoral labour share trends - a within-sector phenomenon. Díez-Catalán (2018), Elsby et al. (2013) and Gutierrez (2017) show the labour share is trending down in virtually every sector and rising in a few. In contrast, the presence of sectoral trends does not pose an issue when using the Haltiwanger decomposition because the bases are fixed at the previous period values λ_{it-1} and ω_{it-1}.

It is worth noting that by examining only the shift-share and Haltiwanger decompositions, I omit several other commonly used decomposition techniques. For example, changes in the aggregate labour share can also be decomposed as in Olley and Pakes (1996). I employ the shift-share method since it is typically used in studies that decompose the declining labour share. Then, I introduce the Haltiwanger method because, as Theorem 1 shows, the two decompositions are closely related.

5 Decomposition Results

Armed with the decomposition framework and Theorem 1, I decompose the decline of the aggregate labour share since 1987. For the main exposition, I use the payroll labour share, as in Elsby et al. (2013). The advantage of examining the payroll labour share is self-employed labour income does not need to be imputed. Payroll labour income represents the part of the labour share that accrues unambiguously to labour.

The left panel in figure 4 shows the cumulative between-sector terms for each decomposition method, overlaid with the aggregate labour share and the cross term. I plot the cumulative decompositions so my results are not sensitive to the starting and end years chosen. The payroll labour share falls by 3.7pp from 1987 to 2011. The shift-share decomposition estimates that between-sector reallocation adds a cumulative -0.1pp to the labour share from 1987 to 2011, around 4% of the total decline. Using the shift-share decomposition, one would conclude there is a zero reallocation effect and sectoral labour shares can be studied in isolation to explain the decline in the aggregate labour share. However, the Haltiwanger decomposition estimates that the observed reallocation towards high labour share sectors cumulatively adds 1.7pp to the labour share, around -47% of the total decline. The reason for the marked shift in the reallocation effect is that the Haltiwanger cross term reduces the labour share by 3.8pp. Via Theorem 1, the negative cross term pushes the shift-share between-sector term towards zero relative to the positive Haltiwanger between-sector term. Using the Haltiwanger decomposition purges the reallocation effect of the comovement, which allows the missing positive effect to be recovered. Moreover, in the right panel of figure 4, the shift-share decomposition apportions 96% of the total decline in the labour share to falling labour shares within sectors, whereas the Haltiwanger decomposition apportions only 45%. The negative within-sector contribution in the shift-share decomposition is overstated due to the negative cross term, which pushes the within-sector effect down.

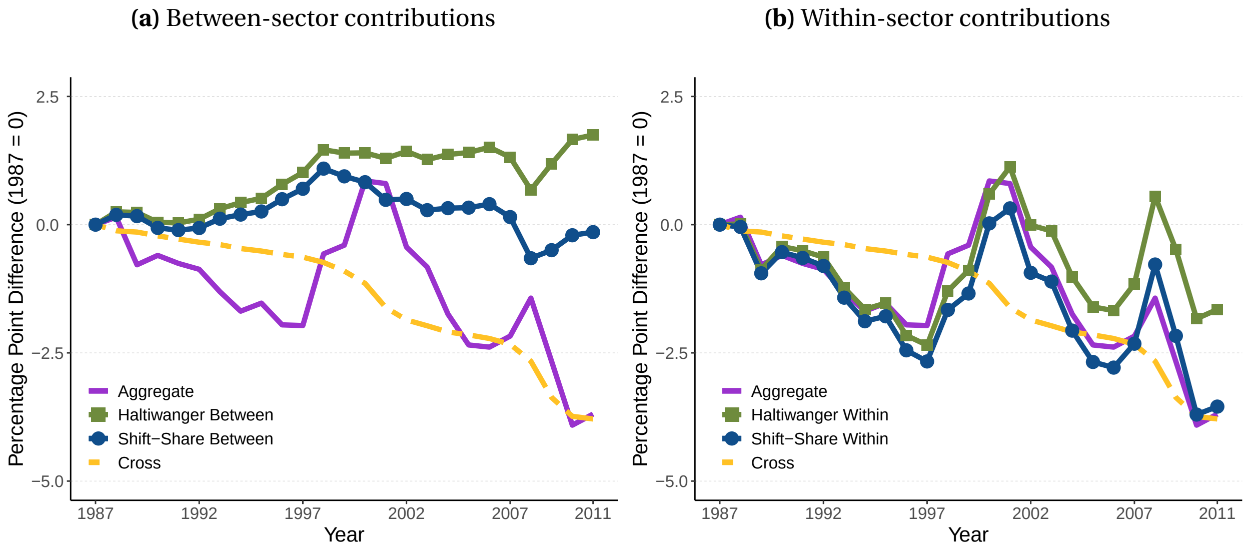
Since the between, within, and cross contributions must add up to 100%, the Haltiwanger decomposition implies negative comovements between sectoral weights and labour shares account for 102% of the decline in the labour share. Negative cross movements must arise due to value-added changes (VA_{it} appears in the numerator and denominator of ω_{it}), so the result shows that value-added dynamics are a relatively more important source for the decline in the aggregate labour share than labour income (WL_{it} appears only in the numerator of λ_{it}). Appendix A.3 shows the cumulative cross term is negative for virtually every sector. Kehrig and Vincent (2021) also find that value-added dynamics at the establishment level are the main driver behind the declining manufacturing labour share in the US.

5.1 Robustness: Accounting For Self-Employed Labour Income

While the payroll labour share captures the part of the aggregate labour share accruing unambiguously to labour income, how do the results differ when self-employed labour income is accounted for? I repeat the decompositions for the three definitions of the labour share that impute self-employed labour income.

Table 2 displays the results. The first column shows the decline in the labour share from 1987 to 2011 for each labour share definition. The second, third, and fourth columns show the percentage contribution of each decomposition term. A similar picture emerges to the payroll labour share definition results. First, the final column demonstrates that the cross term is neg-

Figure 4. Cumulative decomposition of the payroll labour share.



Notes: Cumulative between, within and cross terms for both decomposition methods using the 'payroll labour share' approach, 1987 to 2011. The Aggregate and Cross lines are equivalent across both panels.
Source: BEA, Elsby et al. (2013) replication package, and author's calculations.

ative in each sample. As a result, the shift-share between- and within-sector contributions are pushed down, which we can see when comparing the Haltiwanger and shift-share numbers in the Between and Within columns. In panels B, C, and D, the Haltiwanger decomposition apportions between 10pp and 19pp more than the shift-share decomposition to reallocation. On the other hand, the Haltiwanger decomposition apportions between 10pp and 19pp less to falling sectoral labour shares than the shift-share method does.

While the reversal of the reallocation effect is not as stark as in the payroll sample, the offsetting impact that reallocation towards high labour share sectors has in the three self-employed labour income samples remains quantitatively important. Regardless of the labour share definition used, Table 2 highlights the relevance of all three channels - between, within, and cross - for changes in the aggregate labour share. Sectoral labour shares cannot be studied in isolation to examine the decline of the aggregate labour share.

6 Conclusion

In this paper, I demonstrate reallocation towards high labour share sectors offsets -47% of the decline in the aggregate labour share since the mid-1980s. Previous studies using the shift-share decomposition put the number at around 4%. The reason for the dramatic reversal is

Table 2. Contribution of decomposition terms for each labour share definition, 1987 to 2011.

	Total Decline	Between	Within	Cross
A. Payroll labour share	-3.7			
Shift-share		4%	96%	
Haltiwanger		-47%	45%	102%
B. Same-wage-distribution	-7.6			
Shift-share		-15%	115%	
Haltiwanger		-34%	96%	38%
C. Same-labour-share	-5.7			
Shift-share		-27%	127%	
Haltiwanger		-38%	116%	22%
D. Economy-wide	-6.5			
Shift-share		-24%	124%	
Haltiwanger		-34%	114%	20%

Notes: The Between, Within, and Cross columns divide the cumulative respective contributions by the total decline in the labour share. For example, 4% implies the shift-share decomposition apportions 4% of the total decline to between-sector reallocation. I make the calculation for each labour share definition. Appendix A.4 tabulates the ratios for each sample until the last year it is available.
Source: BEA, BLS, and author's calculations.

that not accounting for comovements in sectors' weights and labour shares biases a positive reallocation effect towards zero when using the shift-share decomposition, which is used in the majority of earlier decompositions of the declining labour share. Purging the impact of comovement, the Haltiwanger decomposition recovers the reallocation effect that is missing in previous studies. The results emphasise the importance of three channels that operate in tandem to depress the aggregate labour share: reallocation towards sectors with high labour shares, falling labour shares within sectors, and the negative comovement between sectors' weights and labour shares.

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A Appendix Tables And Figures

A.1 Data Sources And Construction

Table A1 shows the data sources for each of the four labour share definitions.

Appendix Table A1. Information about samples.

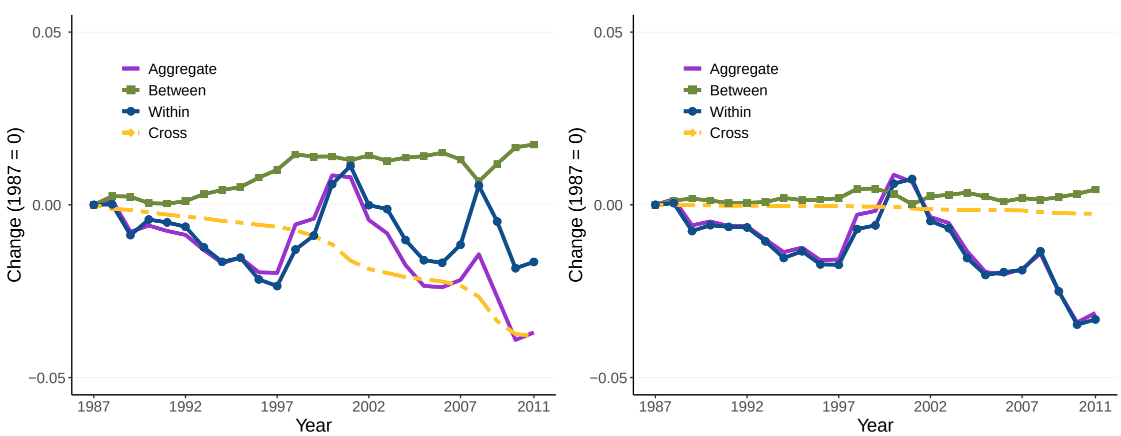
Measure	Source	Years	Notes
Payroll	BEA & Elsby et al. (2013)	1987-2011	Non-farm private sector
Same-wage-distribution	BEA-BLS (Eldridge et al., 2020)	1987-2019	Private sector excluding real estate
Same-labour-share	BEA & Mendieta-Muñoz et al. (2021)	1987-2017	Private sector excluding real estate
Economy-wide	BEA & Mendieta-Muñoz et al. (2021)	1987-2017	Private sector excluding real estate

A.2 Effect Of Aggregating Sectoral Data

Aggregating the economy into coarser sector classifications mechanically dampens the reallocation effect. The left panel in figure A1 plots the cumulative Haltiwanger decomposition using the ‘payroll labour share’ approach and uses data from 60 sectors defined at the NAICS 3-digit level. The upward-sloping ‘Between’ line indicates there is a positive reallocation effect. The decomposition in the right panel in figure A1 uses weights and labour shares aggregated into ten NAICS 2-digit industries. Both the between-sector and cross terms disappear - the Between and Cross lines are flat - even though reallocation is quantitatively important at the 3-digit classification level. Reallocation between any two NAICS 3-digit industries is always counted as a within-sector contribution at the NAICS 2-digit level when the 3-digit industries are in the same 2-digit classification. This is even true when the labour share does not change in each of the 3-digit industries. Aggregating the economy into coarser definitions loads onto the within-sector contribution. In an attempt to negate the issue, I use the most disaggregated data possible for each labour share definition.

Appendix Figure A1. Between-sector effect disappears when aggregating NAICS 3-digit to NAICS 2-digit

(a) NAICS 3-digit sectors **(b)** NAICS 2-digit sectors



Notes: Cumulative between, within, cross terms for the Haltiwanger method using the payroll labour share. The left panel uses data at the NAICS 3-digit level (60 sectors) and the right panel uses the same data but aggregated into NAICS 2-digit level (10 sectors). ‘0.05’ on the y-axis corresponds to 5 percentage points (pp).
Source: BEA and the Elsby et al. (2013) replication package.

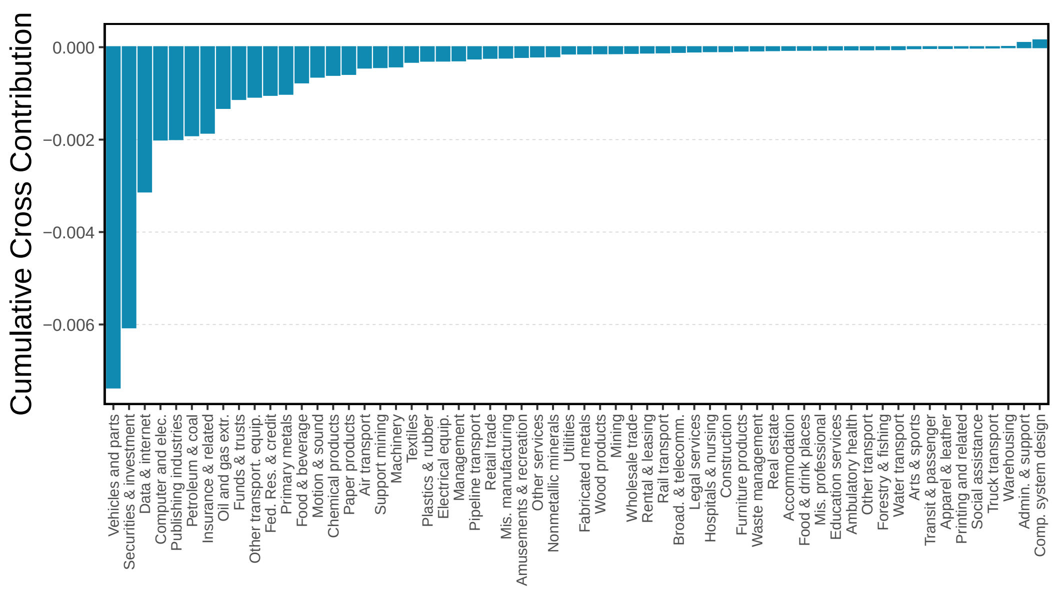
A.3 What Is The Cumulative Haltiwanger Cross Contribution For Each Sector?

For each sector, I sum the cross contribution over each year using the payroll labour share

$$\underbrace{\sum_{t=1}^{T} \Delta\omega_{jt}\Delta\lambda_{jt}}_{\text{Haltiwanger: Cross}} \quad \forall j \in \{1, \ldots, N\}$$

Figure A2 shows the cumulative Haltiwanger cross contribution is negative for virtually every sector. The reason is that, holding labour income WL_{it}^{p} constant, an increase in value-added VA_{it} generates an upward movement in the sector's weight and downward movement in its labour share: $\Delta\omega_{it} > 0 \implies \Delta\lambda_{it} < 0$. When allowing WL_{it}^{p} to change, as it obviously does when running the decompositions, the effect of value-added changes outweighs the effect of labour income changes.

Appendix Figure A2. Size of cumulative cross contribution for each sector



Notes: Each bar indicates the cumulative sum of each sector's Haltiwanger cross contribution

$$\underbrace{\sum_{t=1}^{T} \Delta\omega_{jt}\Delta\lambda_{jt}}_{\text{Haltiwanger: Cross}} \quad \forall j \in \{1, \ldots, N\}$$

Source: BEA, Elsby et al. (2013) replication package, and author's calculations.

A.4 Contribution of each term until end of sample

Table A2 shows the percentage of the total labour share decline that each decomposition term accounts for from 1987 until the end of each respective sample.

Appendix Table A2. Contribution of decomposition terms for each labour share definition, 1987 to end of sample.

	Total Decline	Between	Within	Cross
A. Payroll labour share	-3.7			
Shift-share		4%	96%	
Haltiwanger		-47%	45%	102%
B. Same-wage-distribution	-6.3			
Shift-share		-35%	135%	
Haltiwanger		-62%	107%	55%
C. Same-labour-share	-4.6			
Shift-share		-50%	150%	
Haltiwanger		-68%	132%	36%
D. Economy-wide	-5.8			
Shift-share		-39%	139%	
Haltiwanger		-53%	124%	29%

Notes: The Between, Within, and Cross columns divide the cumulative respective contributions by the total decline in the labour share. For example, 4% implies the shift-share decomposition apportions 4% of the total decline to between-sector reallocation. I make the calculation for each labour share definition.
Source: BEA, BLS, and author's calculations.

B Theorem 1 Proof

The Haltiwanger decomposition for the change in the labour share, $\Delta\lambda_t = \lambda_t - \lambda_{t-1}$, is

$$\Delta\lambda_t = \underbrace{\sum_{i=1}^{N} \Delta\omega_{it}\lambda_{it-1}}_{\text{Between}} + \underbrace{\sum_{i=1}^{N} \omega_{it-1}\Delta\lambda_{it}}_{\text{Within}} + \underbrace{\sum_{i=1}^{N} \Delta\omega_{it}\Delta\lambda_{it}}_{\text{Cross}}$$

in which $\Delta x_{it} = x_{it} - x_{it-1}$. Divide the 'Cross' term into two

$$\Delta\lambda_t = \underbrace{\sum_{i=1}^{N} \Delta\omega_{it}\lambda_{it-1}}_{\text{Between}} + \underbrace{\sum_{i=1}^{N} \omega_{it-1}\Delta\lambda_{it}}_{\text{Within}} + \underbrace{\frac{1}{2}\sum_{i=1}^{N} \Delta\omega_{it}\Delta\lambda_{it}}_{\equiv \text{Cross: A}} + \underbrace{\frac{1}{2}\sum_{i=1}^{N} \Delta\omega_{it}\Delta\lambda_{it}}_{\equiv \text{Cross: B}}. \tag{B1}$$

Add 'Cross: A' to the 'Within' component in equation (B1)

$$\begin{aligned} &= \frac{1}{2}\sum_{i=1}^{N} \Delta\omega_{it}\Delta\lambda_{it} + \sum_{i=1}^{N} \omega_{it-1}\Delta\lambda_{it} \\ &= \sum_{i=1}^{N} \frac{\Delta\omega_{it}}{2}\Delta\lambda_{it} + \sum_{i=1}^{N} \omega_{it-1}\Delta\lambda_{it}. \end{aligned}$$

Collect like terms

$$\begin{aligned} &= \sum_{i=1}^{N} \left(\frac{\Delta\omega_{it}}{2} + \omega_{it-1}\right)\Delta\lambda_{it} \\ &= \sum_{i=1}^{N} \left(\frac{\omega_{it} - \omega_{it-1}}{2} + \omega_{it-1}\right)\Delta\lambda_{it} \\ &= \sum_{i=1}^{N} \left(\frac{\omega_{it} + \omega_{it-1}}{2}\right)\Delta\lambda_{it} \\ &= \sum_{i=1}^{N} \tilde{\omega}_{it}\Delta\lambda_{it} \end{aligned} \tag{B2}$$

in which I denote $\tilde{x}_{it}$ as the arithmetic mean of x_{it-1} and x_{it}. The last line in equation (B2) is the within-sector term in shift-share decomposition. Next, add 'Cross: B' to the 'Between' component in equation (B1)

$$\begin{aligned} &= \frac{1}{2}\sum_{i=1}^{N} \Delta\omega_{it}\Delta\lambda_{it} + \sum_{i=1}^{N} \Delta\omega_{it}\lambda_{it-1} \\ &= \sum_{i=1}^{N} \Delta\omega_{it}\frac{\Delta\lambda_{it}}{2} + \sum_{i=1}^{N} \Delta\omega_{it}\lambda_{it-1}. \end{aligned}$$

Collect like terms

$$
\begin{aligned}
&= \sum_{i=1}^{N} \left(\frac{\Delta\lambda_{it}}{2} + \lambda_{it-1} \right) \Delta\omega_{it} \\
&= \sum_{i=1}^{N} \left(\frac{\lambda_{it} - \lambda_{it-1}}{2} + \lambda_{it-1} \right) \Delta\omega_{it} \\
&= \sum_{i=1}^{N} \left(\frac{\lambda_{it} + \lambda_{it-1}}{2} \right) \Delta\omega_{it} \\
&= \sum_{i=1}^{N} \Delta\omega_{it} \tilde{\lambda}_{it}
\end{aligned}
\tag{B3}
$$

in which $\tilde{x}_{it}$ denotes the arithmetic mean of x_{it-1} and x_{it}. The last line in equation (B3) is the between-sector term in the shift-share decomposition. □