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Barkai, Simcha

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The Decline of the Labor Share is not Explained by the Capitalization of Intellectual Property Products

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The Decline of the Labor Share is not Explained by the Capitalization of Intellectual Property Products

Simcha Barkai

Boston College

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Stigler Center for the Study of the Economy and the State
University of Chicago Booth School of Business
5807 S Woodlawn Ave
Chicago, IL 60637

The Decline of the Labor Share is not Explained by the Capitalization of Intellectual Property Products

Simcha Barkai*

June 2021

Abstract

The U.S. labor share has clearly been declining since the early 1980s. This does not depend on whether or not we capitalise intellectual property products. Koh, Santaeulàlia-Llopis and Zheng (2020) approximate the labor share by a single linear time trend over the entire period of 1929–2019. This period includes a long period of time over which the labor share is known to be mostly stable and a shorter period of time over which the labor share is known to decline. Once we separate out the period starting in the 1980s we recover the decline in the labor share.

*Email: barkai@bc.edu

1 Introduction

There have been many recent empirical and theoretical contributions to the study of the decline in the labor share. Elsby, Hobijn and Şahin (2013) provide detailed documentation of the decline in the U.S. labor share and Karabarbounis and Neiman (2014) document a global decline in the labor share. Many possible explanations for the decline in the labor share have been put forward, including capital-augmenting technological change and the mechanization of production (Acemoglu and Restrepo (2018), a decline in the relative price of capital (Karabarbounis and Neiman (2014)), capital accumulation (Piketty (2014), Piketty and Zucman (2014)), globalization (Elsby, Hobijn and Şahin (2013)), a decline in the bargaining power of labor (Blanchard and Giavazzi (2003)), an increase in the cost of housing (Rognlie (2015)), and a rise in industry concentration and market power (Barkai (2020), Autor et al. (2020), De Loecker, Eeckhout and Unger (2020))

This entire body of research points to a decline in the labor share that starts around the early 1980s. For example, Karabarbounis and Neiman (2014) start their paper with the statement:

> At least since the work of Kaldor (1957), the stability of the labor share of income has been a fundamental feature of macroeconomic models, with broad implications for the shape of the production function, inequality, and macroeconomic dynamics. We document that the global labor share has declined significantly since the early 1980s, with the decline occurring within the large majority of countries and industries.

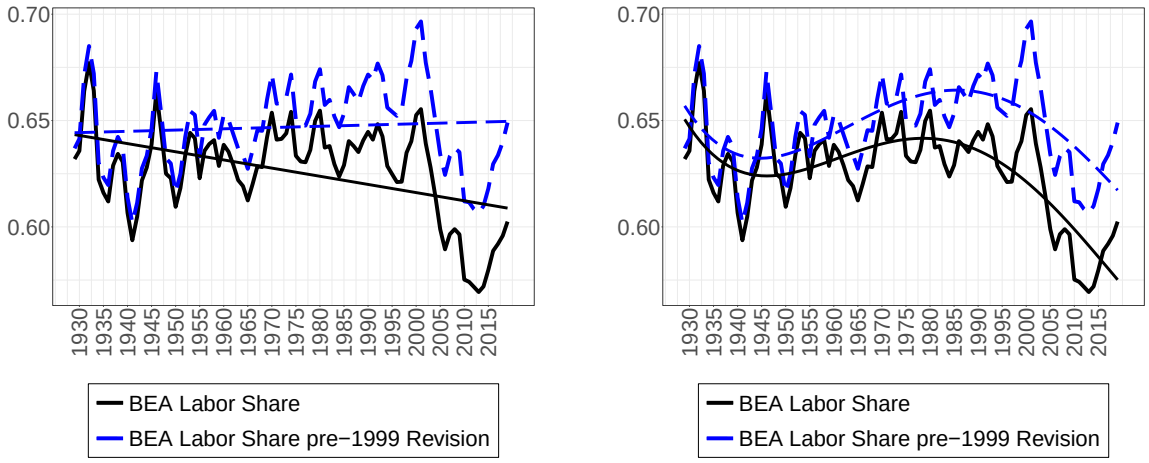
Koh, Santaeulàlia-Llopis and Zheng (2020) (henceforth KSLZ) argue that the U.S. Bureau of Economic Analysis's (BEA) recognition of software as a fixed asset in 1999, and the further recognition of other forms of intellectual property products (IPP) as fixed assets in 2013 is fully responsible for the measured decline in the labor share.

In this paper, I show that the U.S. labor share has clearly been declining since the early 1980s and that this does not depend on whether or not we capitalise intellectual property products.

The findings of KSLZ are due to the way in which they approximate the labor share by a single linear time trend over the entire period of 1929–2019. This period includes a long period of time over which the labor share is known to be mostly stable and a shorter period of time over which the labor share is known to decline. Once we separate out the period starting in the 1980s we recover the decline in the labor share.

A graphic representation of this point is presented in figure 1. The figure presents two measures of the labor share of gross value added for the U.S. nonfinancial corporate sector over the period 1929–2019. The first measure is based on the current BEA standards in which all intellectual property products are capitalized. The second measure is based on the pre-1999 BEA standards in which no intellectual property products are capitalized. Panel A includes a linear approximation to the labor share and this specification matches KSLZ. Based on this linear approximation, KSLZ argue that the recognition of IPP is fully responsible for the measured decline in the labor share. Panel B includes a polynomial approximation to the labor share. This approximation clearly shows that, no matter how we treat IPP, the labor share is mostly stable prior to the early 1980s and has been declining since.

The remainder of this paper proceeds as follows. Section 2 describes the data and a basic framework for IPP adjustments. Section 3 presents the results. Section 4 discusses and concludes.



(a) KSLZ Linear Approximation

(b) Polynomial Approximation

Figure 1: **Long-Run Trends of the U.S. Nonfinancial Corporate Labor Share**
The figure shows the labor share of gross value added for the U.S. nonfinancial corporate sector over the period 1929–2019. Each panel presents two measures of the labor share. The first measure is based on the current BEA standards in which all intellectual property products are capitalized. The second measure is based on the pre-1999 BEA standards in which no intellectual property products are capitalized. Panel A presents a linear approximation to the labor share and this specification matches KSLZ. Panel B presents a fourth-degree polynomial approximation. See section 2.4 for the construction of the labor share series. See section 3 for further details.

2 Framework and Data

The labor share of gross value added is defined as the ratio of compensation of employees to gross value added

$$\text{Labor Share} = \frac{\text{Compensation of Employees}}{\text{Gross Value Added}}. \tag{1}$$

In a wide set of models, this ratio is determined by the labor-intensity of production and by firm market power in both labor and product markets.

2.1 Nonfinancial Corporate Sector

A significant body of research has highlighted potential difficulties in measuring both the numerator (compensation of employees) and the denominator (gross value added) in Equation 1. In unincorporated firms, we don't have good measures of labor compensation and several methods exist to split profit income of these unincorporated firms into labor and capital income. Rognlie (2015) shows that U.S. aggregate measures of gross (and net) value added include in them a large amount of residential housing, an undesirable feature if we wish to understand how the labor share is determined by the labor-intensity of production and firm market power in both labor and product markets.

In the U.S., both issues can be avoided by studying the corporate sector. This is the reason that most of the past research on the labor share has focused on the U.S. nonfinancial corporate sector or the U.S. corporate sector. It is worth noting that outside the U.S., these issues cannot be as easily avoided. Gutiérrez and Piton (2020) show that, globally, there are differences across countries in the delineation of corporate sectors. While the U.S. excludes all self-employed and almost all residential housing, other countries include large amounts of both.

For these reasons, this paper only presents analysis of the U.S. nonfinancial corporate sector. This has the additional benefit of allowing easy comparison to existing research on the labor share.

2.2 Capitalization of Intellectual Property Products

In the 11th comprehensive revision of NIPA in 1999, the BEA changed the way in which it classifies the purchase and production of software. Prior to the revision, software was treated as an intermediate input. After the revision, both the internal production and the purchase of software

were treated as investment. The 14th comprehensive revision of NIPA in 2013 further expanded its recognition of intangible capital beyond software to include expenditures for R&D and for entertainment, literary, and artistic originals as fixed investments. To clarify, in each revision the BEA construct a complete time series starting in 1929 that is consistent with the revised methodology.

The way in which we treat IPP (intermediate input vs investment) has no effect whatsoever on compensation of employees. Once we restrict attention to the U.S. nonfinancial corporate sector, compensation of employees is a number that can be measured in the data and does not in any way depend on changes in the way that the BEA accounts for IPP.

The way in which we treat IPP (intermediate input vs investment) does have a significant effect on gross value added. Gross value added measures the total value of goods and services produced less the amount paid to acquire intermediate inputs used in the production of goods and services. The value of goods and services produced include the production of investment goods even if these are not sold and instead retained by the firm. When the BEA reclassifies expenditures on IPP as investment, this increases gross value added by the value of the expenditures. This is true for both expenditures to acquire such IPP from another firm and for expenditures to internally generate such IPP.

When comparing the pre-1999 revision to the current BEA classification, the effect of reclassification of IPP on the labor share is given by

$$\frac{\text{Compensation of Employees}_t}{\text{Gross Value Added}_t} = \frac{\text{Compensation of Employees}_t}{\text{Gross Value Added}_t^{\text{pre-1999 classification}} + \text{I}_t^{\text{IPP}}}. \tag{2}$$

where $\text{Gross Value Added}_t$ is gross value added in year t, as is currently calculated by the BEA, $\text{Gross Value Added}^{\text{pre-1999 classification}}$ is gross value added in year t as would be calculated by the BEA prior to the 1999 revision, and I_t^{IPP} is investment in IPP in year t as is currently calculated by the BEA.

The recognition of IPP as investment clearly increases the denominator of the labor share thereby lowering the level labor share. To the extent that the ratio of IPP to gross value added is increasing over time, the recognition of IPP as investment may have the effect or leading to a declining trend in the labor share.

2.3 Data

Data on nominal gross value added are taken from the National Income and Productivity Accounts (NIPA) Table 1.14 (line 17). Data on compensation of employees are taken from the NIPA Table 1.14 (line 20). Compensation of employees includes all wages in salaries, whether paid in cash or in kind and includes employer costs of health insurance and pension contributions. Compensation of employees also includes the exercising of most stock options;[1] stock options are recorded when exercised (the time at which the employee incurs a tax liability) and are valued at their recorded tax value (the difference between the market price and the exercise price). Compensation of employees further includes compensation of corporate officers.

Data on investment in IPP are taken from the BEA Fixed Asset Table 4.7 (line 40). To further study the separate effects of the 1999 revision and the 2013 revision, we need to separate out investment in software from investment in other forms of IPP. Unfortunately, the BEA does not provide a decomposition of IPP capital for the nonfinancial corporate sector. To overcome this data limitation, I use data on non-residential investment in the different types of IPP capital, taken from BEA Fixed Asset Table 2.7, to construct a time series of the ratio of software investment (line 78) to IPP investment (line 77). I then construct nonfinancial corporate investment in software as the product of investment in IPP (nonfinanical corporate) and the ratio of software investment to IPP investment (non-residential investment).

2.4 Adjusted Labor Share Series

this paper uses three series for the U.S. nonfinancial corporate labor share. The baseline series, called "BEA Labor Share", is the ratio of compensation of employees to gross value added. The second series, called "BEA Labor Share pre-2013 Revision", is the ratio of compensation of employees to the difference between gross value added and investment in those forms of IPP reclassified in the 2013 revision. The last series, called "BEA Labor Share pre-1999 Revision", is the ratio of

[1]There are two major types of employee stock options: incentive stock options (ISO) and nonqualified stock options (NSO). An ISO cannot exceed 10 years, and options for no more than $100,000 worth of stock may become exercisable in any year. When the stock is sold, the difference between the market price and the exercise price of the stock options is reported as a capital gain on the employee's income tax return. The more common stock option used is the NSO. When the option is exercised, the employee incurs a tax liability equal to the difference between the market price and the exercise price (reported as wages); the company receives a tax deduction for the difference between the market price and the exercise price, which reduces the amount of taxes paid. Compensation of employees includes the exercising of NSO, but not the exercising of ISO. For further details see **?**.

compensation of employees to the difference between gross value added and investment in all forms of IPP. In equation form

$$\text{BEA Labor Share}_t = \frac{\text{Compensation of Employees}_t}{\text{Gross Value Added}_t} \tag{3}$$

$$\text{BEA Labor Share pre-2013 Revision}_t = \frac{\text{Compensation of Employees}_t}{\text{Gross Value Added}_t - (\text{I}_t^{\text{IPP}} - \text{I}_t^{\text{Software}})} \tag{4}$$

$$\text{BEA Labor Share pre-1999 Revision}_t = \frac{\text{Compensation of Employees}_t}{\text{Gross Value Added}_t - \text{I}_t^{\text{IPP}}} \tag{5}$$

where $\text{I}_t^{\text{IPP}} - \text{I}_t^{\text{Software}}$ is investment in IPP other than software, which is the newly recognized investment in the 2013 revision.

3 Results

Figure 1 presents two measures of the labor share of gross value added for the U.S. nonfinancial corporate sector over the period 1929–2019. The first measure is based on the current BEA standards in which all intellectual property products are capitalized. The second measure is based on the pre-1999 BEA standards in which no intellectual property products are capitalized. Both measures are described in Section 2.4. Panel A includes a linear approximation to the labor share and this specification matches KSLZ. Based on this linear approximation, KSLZ argue that the recognition of IPP is fully responsible for the measured decline in the labor share. Panel B includes a polynomial approximation to the labor share. This approximation clearly shows that, no matter how we treat IPP, the labor share is mostly stable prior to the early 1980s and has been declining since.

Note that the values in this figure should match Panel (b3) of figure 5 in KSLZ. My construction of adjusted labor share series presented in Section 2.4 fully matches Barkai (2020) and the description presented in KSLZ Table 1. A comparison of the two figures show that the trends in the labor share are very closely aligned, but the KSLZ figure has values of the labor share that are about 5 percentage points higher in each and every year. Moreover, KSLZ do not provide sufficient details to replicate their figure.

The results presented in Figure 1 stress the need to separate out in our analysis those years in which the literature has found that the labor share is declining.

Figure 2 presents the labor share of gross value added for the U.S. nonfinancial corporate sector over time periods that match two papers in the existing literature. Panel A presents the labor share over the period 1975–2012, studied by Karabarbounis and Neiman (2014) (henceforth KN). Panel B presents the labor share over the period 1984–2104, studied by Barkai (2020) (henceforth Barkai). Each panel presents three measures of the labor share. The first measure is based on the current BEA standards in which all intellectual property products are capitalized. This first measure is used by Barkai. The second measure is based on the pre-2013 BEA standards in which software is capitalized but other forms of intellectual property products are not capitalized. This second measure is used by KN. The third measure is based on the pre-1999 BEA standards in which no intellectual property products are capitalized. Both panels present linear approximations to each of the series of the labor share. All measures of the labor share are declining.

Table 1 presents the estimated decline in labor share of gross value added for the U.S. nonfinancial corporate sector. Panel A presents the labor share over the period 1975–2012, studied by KN. Panel B presents the labor share over the period 1984–2104, studied by Barkai. Each panel presents three measures of the labor share. The first measure is based on the current BEA standards in which all intellectual property products are capitalized. This first measure is used by Barkai. The second measure is based on the pre-2013 BEA standards in which software is capitalized but other forms of intellectual property products are not capitalized. This second measure is used by KN. The third measure is based on the pre-1999 BEA standards in which no intellectual property products are capitalized. The fitted values and percentage point declines are based on a linear approximation. These approximations match the results presented Figure 2. The table clearly shows that all measures of the labor share decline. While the measures of the labor share that remove investment in IPP show smaller declines, this difference is smaller in magnitude than the difference across sample periods.

4 Discussion and Conclusion

This paper presents and compares adjusted measures of the labor share that differ in their treatment of investment in intellectual property products. Contrary to the claims of KSLZ, the results in this paper clearly show that all measures of the labor share of gross value added for the U.S. nonfinancial corporate sector are declining.

The findings of KSLZ are entirely due to the way in which they approximate the labor share by a single linear time trend over the entire period of 1929–2019. This period includes a long period of time over which the labor share is known to be mostly stable and a shorter period of time over which the labor share is known to decline. Once we separate out the period starting in the 1980s, the period of time identified and studied by the large literature on the declining labor share, we recover the decline in the labor share.[2]

This paper uses aggregate U.S. nonfinancial corporate sector data to explore the contribution of the capitalization of IPP on the measured decline in the labor share. An alternative approach would consider measures of the labor share that do not depend on the treatment of IPP.

BEA measures of IPP investment do not exist at the establishment- or firm-level. The census micro data do not include any such information and outside of the manufacturing sector the census micro data does not contain or provide information on any form of investment. It is therefore the case that all existing research on the labor share the relies on firm-level or establishment-level data do not depend on the capitalization of IPP. This includes papers that use micro-level data on firms and establishments, such as Hartman-Glaser, Lustig and Xiaolan (2019), Autor et al. (2020), and Kehrig and Vincent (2021). This also includes papers that use data aggregated from firms and establishments such as Barkai (2020) and Autor et al. (2020) that show a widespread decline across industries in the payroll share of sales and show that those industries with large increases in concentration also have larger declines in their labor share.

[2]Considering a single linear approximation to the complete time series of the labor share is conceptually similar to using a single linear approximation to the share the share of income going to the top. The income share of top earners was high in the 1920s, low in the 1980s and is high again today. If we approximated the share of income going to top earners by a linear time trend we would conclude that the have been no interesting changes over the 20th century.

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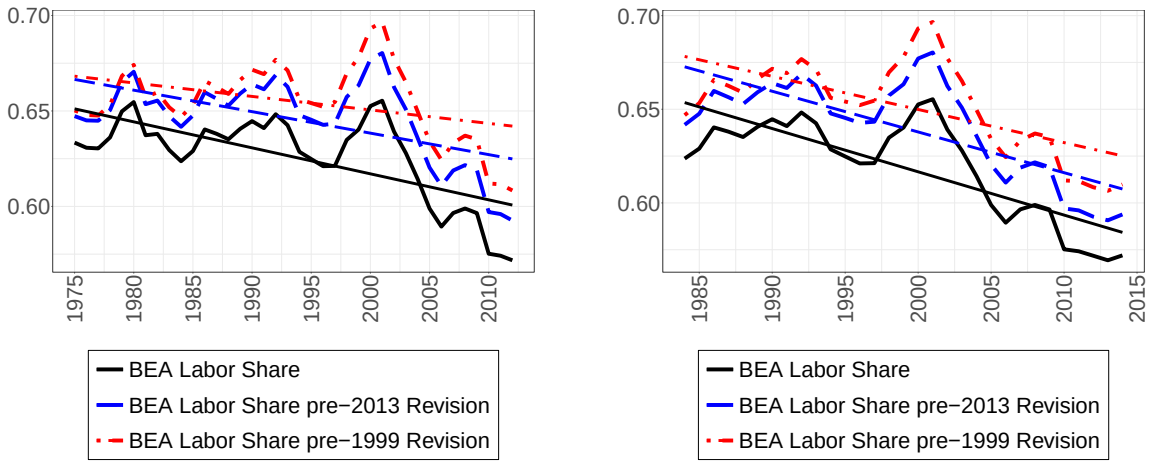

(a) KN Sample Period (1975–2011)

(b) Barkai Sample Period (1984–2014)

Figure 2: **Matching Existing Literature: Comparison of Labor Share**
The figure shows the labor share of gross value added for the U.S. nonfinancial corporate sector. Panel A presents the labor share over the period 1975–2012, studied by Karabarbounis and Neiman (2014) (KN). Panel B presents the labor share over the period 1984–2104, studied by Barkai (2020) (Barkai). Each panel presents three measures of the labor share. The first measure is based on the current BEA standards in which all intellectual property products are capitalized. This first measure is used by Barkai. The second measure is based on the pre-2013 BEA standards in which software is capitalized but other forms of intellectual property products are not capitalized. This second measure is used by KN. The third measure is based on the pre-1999 BEA standards in which no intellectual property products are capitalized. All panels present a linear approximation to the labor share.

Table 1: **Matching Existing Literature: Estimated Decline in the Labor Share**
The table presents the estimated fitted value and decline of the labor share of gross value added for the U.S. nonfinancial corporate sector. Panel A presents the labor share over the period 1975–2012, studied by Karabarbounis and Neiman (2014) (KN). Panel B presents the labor share over the period 1984–2104, studied by Barkai (2020) (Barkai). Each panel presents three measures of the labor share. The first measure is based on the current BEA standards in which all intellectual property products are capitalized. This first measure is used by Barkai. The second measure is based on the pre-2013 BEA standards in which software is capitalized but other forms of intellectual property products are not capitalized. This second measure is used by KN. The third measure is based on the pre-1999 BEA standards in which no intellectual property products are capitalized. The fitted values and percentage point declines are based on a linear approximation. This specification and approximation matches the results presented Figure 2. See section 2.4 for the construction of the labor share series. See section 3 for further details.

(a) KN Sample Period (1975–2011)

	Fitted Value 1975	Estimated Decline 1975–2012
BEA Labor Share	65.1%	-5.0pp
BEA Labor Share pre-2013 Revision	66.7%	-4.2pp
BEA Labor Share pre-1999 Revision	66.8%	-2.6pp

(b) Barkai Sample Period (1984–2014)

	Fitted Value 1984	Estimated Decline 1984–2014
BEA Labor Share	65.4%	-6.9pp
BEA Labor Share pre-2013 Revision	67.3%	-6.5pp
BEA Labor Share pre-1999 Revision	67.8%	-5.3pp