

MICHAEL W. L. ELSBY

University of Edinburgh

BART HOBIJN

Federal Reserve Bank of San Francisco,

VU University Amsterdam, and Tinbergen Institute

AYŞEGÜL ŞAHİN

*Federal Reserve Bank of New York**

APPENDIX

The Decline of the U.S. Labor Share

Description of data sources, methods, and replication files.

This appendix contains a description of the data sources used, methods applied, and replication files available for the main paper. The material is ordered by figure and table numbers. For each figure and table it describes the main data sources used for the analysis, the calculations done, and where to find these relevant calculations in the replication files.

The relevant replication files are available in a zipped archive named

“BPEA – Elsby Hobijn and Sahin F13 – replication files.zip”

* The views expressed in this appendix solely reflect those of the authors and not necessarily those of the Federal Reserve Bank of New York, Federal Reserve Bank of San Francisco, nor those of the Federal Reserve System as a whole. The results are based on data through July 28, 2013.

Workbook structure

All workbooks have the same structure. Worksheets with green tabs contain the source data. Worksheets with purple tabs contain calculations. Worksheets with red tabs contain tables with results. Worksheets with orange tabs contain figures.

Figure 1:

Labor share, payroll share, and replicated labor share in U.S. nonfarm business sector.

Replication files

Workbook: Section I.xlsxm. Figure is in sheet Chart - Figure 1.

Data sources and calculations

- *Published*: Labor share in the nonfarm business (NFB) sector. BLS series PRS8500617
- *Payroll share*: NFB payroll compensation (see explanation of figure 2 on how it is calculated) as a percentage of NFB gross value added (NIPA series 1.3.5:3¹).
- *Self-employment share*: labor share minus payroll share.
- *Replicated*: Is replicated using $\lambda \equiv \left(1 + \frac{L^S}{L^P}\right) \lambda^P$. Here, λ^P is the payroll share, L^P is number of hours by payroll employees, and L^S is the hours of the self-employed. The hours of the self-employed, L^S , are constructed in sheet Plumbing - avg hours self emp of Section I.xlsxm and L^P is constructed by sector and aggregated in sheet Plumbing - NFB hours worked.

Sheet Plumbing - P&C comp hours growt compares the replicated growth in hours worked as well as in compensation per hour with the published time series. As can be seen from this sheet, our replication closely matches the released numbers.

¹ NIPA series identifier convention is *.*.*:#, where *.*.* is the table number and # is the line number.

Figure 2:
Composition of nonfarm business sector income.

Replication files

Workbook: Section I.xlsm. Figure is in sheet Chart - Figure 2. Calculations are in sheets Plumbing - GNFBI calculations and Plumbing - NFB accounts.

Data sources and calculations

Table A1 lists the data series from the NIPA that we combined to get the NFB income accounts. Some of the relevant series are only available at an annual frequency and we used a cubic spline method for quarterly interpolation. Our calculations resulted in a statistical discrepancy between GVA and GDI in the NFB sector. We eliminated this discrepancy by proportionately rescaling all capital income sources, those classified in Table A1 under *K*. Figure 2 plots the resulting distribution of Gross Value Added in the NFB sector into the different sources of income.

Figure 3:
Alternative measures of labor share based on four estimates of self-employment labor income.

Replication files

Workbook: Section I.xlsm. Figure is in sheet Chart - Figure 3. Calculations are in sheet Plumbing - Kravis.

Data sources and calculations

- *Published:* NFB labor share from figure 1.
- *Economy-wide basis:* This is calculated using the sources of NFB income in figure 2 in the following way. Let Y be gross value added in the NFB sector, $W^P H^P$ payroll compensation in the NFB sector, Y^S be proprietors' income without capital consumption allowances and inventory valuation adjustment, and $Y^K = Y - W^P H^P - Y^S$ is the part of gross value added that we unambiguously attribute to capital. Then, the economy-wide basis labor share, λ , is calculated by assuming the same share of Y goes to labor as of Y^S . This means that λ can be calculated using the identifying assumption that $\lambda Y = W^P H^P + \lambda Y^S$. That is, the economy-wide labor share equals $\lambda = W^P H^P / (Y - Y^S)$. See Gomme and Rupert (2004) for a more extensive discussion of this economy-wide share.

- *MFP-share*: Ratio of total compensation in the NFB sector based on the MFP estimates divided by gross value added of the NFB sector. The total compensation is measured as the labor compensation in the private nonfarm business sector from the BLS (2013) MFP release plus the compensation of government enterprises, which is calculated assuming that postal employees make the same wages as other government employees.

Figure 4:

Nonfarm business labor share split up by income fractile.

Replication files

Workbook: Section I.xlsm. Figure is in sheet Chart - Figure 4. Calculations are in sheet Plumbing - SOI by percentile and Plumbing - labor share of rich.

Data sources and calculations

- *Payroll income*: Total labor income of a fractile group is imputed as total income from the IRS' Statistics Of Income (SOI) times the share of income earned by a fractile times the share of income of the fractile that is wages, salaries, and pensions. The latter two shares are from Alvaredo et al. (2013). The problem with the SOI data is that there is a substantial amount labor income that goes unreported to the IRS because low-income earners do not have to file income tax returns. We use data from the BEA to adjust for this unreported income and assume that it is all earned by the bottom 90 percent of households in the income distribution.²
- *Self-employment income*: Total labor income of a fractile group is imputed as total income from the IRS' Statistics Of Income (SOI) times the share of income earned by a fractile times the share of income of the fractile that is entrepreneurial income. The latter two shares are from Alvaredo et al. (2013). Unfortunately the data on entrepreneurial income in Alvaredo et al. (2013) does not perfectly match up with the definition of proprietors' income in the data and includes some other sources of income as well. This might lead us to overstate the share

² The adjustments we make are based on several articles in the Survey of current business, which can be found at <http://www.bea.gov/scb/pdf/NATIONAL/NIPAREL/2000/1100pinagi.pdf> and http://www.bea.gov/scb/pdf/2007/11%20November/1107_pi_agi.pdf. The data we obtained from these articles can be found in the sheet BEA - NIPA vs SOI adjustments.

of the rich. On the other hand, NIPA table 7.14 suggests that the proprietors' income is severely underreported to the IRS and Johns and Slemrod (2010) suggests that this underreporting is disproportionately done by rich individuals. This would lead us to understate the share of the rich. Our own assessment of these numbers and estimates is that the second effect dominates and that the numbers in this figure understate the share of the rich in proprietors' income.

Figure 5:

Cross-industry distribution of payroll share.

Replication files

Workbook: Section II.xlsm. Figure is in sheet Chart - Figure 5. Calculations are in sheet Plumbing - percentiles.

Data sources and calculations

Payroll share distribution: Payroll share of an industry is total compensation divided by value added from the BEA's industry accounts. From 1948-1986 this is done for the 59 most detailed set of SIC72 industries that cover the nonfarm business sector in the industry accounts. From 1987-2011 this is 60 NAICS industries. The industry accounts are for the private sector and thus include Nonprofit Institutions Serving Households (NISH). This means that the aggregate payroll share in the industry accounts deviates slightly from the headline number published for NFB. We reflate the industry payroll shares by reflating their compensation to match total payroll compensation in the NFB sector and by rescaling their value added to match total value added in the NFB sector. These adjustments turn out to be only minor. They make the industry-level payroll shares aggregate to the published NFB payroll share from Figure 1. We use these rescaled value of compensation and value added for the rest of our calculations. The mean and percentiles are the time series of these statistics for the cross-industry value-added-weighted distribution of payroll shares.

Figure 6:

Contributions of changes in payroll shares in tech and investment banking to aggregate.

Replication files

Workbook: Section II.xlsm. Figure is in sheet Chart - Figure 6. Calculations are in sheet Plumbing - tech bubble.

Data sources and calculations

- *Change in payroll share:* Is change in annual payroll share of NFB sector from BLS labor productivity and cost release. Thus, this is the change in the “mean” time series plotted in Figure 5.
- *Securities and investments and tech sector series:* Plots the shift part of the shift share decomposition

$$\Delta\lambda^P = \underbrace{\sum_i \omega_i \Delta\lambda_i^P}_{\text{Shift}} + \underbrace{\sum_i \Delta\omega_i \lambda_i^P}_{\text{Share}}. \quad (1)$$

For the industries with the NAICS codes 523 for “Securities and investments” and 334,335,511,514,5415 for the “tech sector”. The shift part is evaluated at the average value added share over the two periods, i.e. ω_i is the average value added share of the industry over the two years the change in the labor share between which is being decomposed.

Figure 7:

Growth of real hourly compensation and output per hour in the nonfarm business sector.

Replication files

Workbook: Section IIIa.xlsm. Figure is in sheet Chart - Figure 7. Calculations are in sheet Plumbing - real wage vs ALP.

Data sources and calculations

- *Growth in real hourly compensation:* Growth in compensation per hour deflated by the output deflator for the NFB sector. Both are taken from the BLS’ Labor Productivity and Costs release. Note that this is different from the real compensation per hour series in the

BLS LPC release which uses the CPI as the deflator. This makes a difference for the trend since the CPI grows faster than the implicit price deflator for the NFB sector that we use.

- *Growth in output per hour*: Growth rate of output per hour in the nonfarm business sector from the BLS' Labor Productivity and Costs release.

All series are 10-year centered moving averages.

Figure 8:

Growth of capital-labor ratio and investment-specific technological change in the business sector.

Replication files

Workbook: Section IIIb and V.xlsm. Figure is in sheet Chart - Figure 8.

Calculations are in sheet plumbing - kover1 and istc.

Data sources and calculations

- *Capital-labor ratio*: Growth in capital labor ratio from Fernald (2012).
- *Investment-specific technological change*: Growth in equipment plus consumer durables price, relative to price of other business output from Fernald (2012).

All series are 10-year centered moving averages.

Figure 9:

Theoretical path of labor share implied by skill deepening and capital-skill complementarity.

Replication files

Workbook: Section IIIc.xlsm. Figure is in sheet Chart - Figure 9. Calculations

are in sheet From Acemoglu and Autor.

Data sources and calculations

Implements equation

$$d \ln \lambda = -(1 - \lambda) \left\{ [\omega_s \rho_{ks} + (1 - \omega_s) \rho_{ku}] d \ln k + \left[\frac{s}{1-s} (1 - \omega_s) \rho_{ku} - \omega_s \rho_{ks} \right] d \ln s \right\}, \quad (2)$$

By using its implications for the relative wages and of the skilled and unskilled and the share of labor that is skilled. Data on these relative wages and the skill share are taken from Acemoglu

and Autor (2010). Values of the parameters ρ_{ks} and ρ_{ku} are chosen to match those in Krusell et al. (2000).

Figure 10:

Changes in payroll shares and equipment price inflation by industry.

Replication files

Workbook: Section IV.xlsm. Figure is in sheet Chart - Figure 10. Calculations are in sheets Plumbing - price of eq NAICS 02 and Plumbing - Scatter plots.

Data sources and calculations

- *Change in payroll share:* Percentage point change in payroll share of NAICS sector between 1987 and 2011.
- *Change in equipment price:* Annualized percentage point change in the implicit price deflator of industry's equipment investment. Both nominal investment and quantity indices are taken from the Bureau of Economic Analysis Fixed Tangible Wealth tables, at http://www.bea.gov/national/FA2004/Details/xls/detailnonres_inv1.xls for nominal spending and http://www.bea.gov/national/FA2004/Details/xls/detailnonres_inv2.xls for quantities. We used total equipment and software investment (coded as EQ00). The implicit deflator is the nominal amount divided by the quantity index.

Figure 11:

Deunionization and changes in payroll shares by industry.

Replication files

Workbook: Section IV.xlsm. Figure is in sheet Chart - Figure 11. Calculations are in sheets Plumbing - Unionization rates and Plumbing - Scatter plots.

Data sources and calculations

- *Change in payroll share:* Percentage point change in payroll share of NAICS sector between 1987 and 2011.

- *Change in union coverage rate*: Percentage point change in the fraction of workers covered by a collective bargaining agreement between 1987 and 2011. Taken from updated data based on Hirsch and Macpherson (2003).

Figure 12:

Import competition and changes in payroll shares by industry.

Replication files

Workbook: Section IV.xlsm. Figure is in sheet Chart - Figure 12. Calculations are in sheets Plumbing - Import exposure and Plumbing - Scatter plots. MATLAB programs transform the input-output tables.

Data sources and calculations

- *Change in payroll share*: Percentage point change in payroll share of NAICS sector between 1987 and 2011.
- *Change in import exposure*: Percentage point change in import exposure between 1993 and 2010. Import exposure is calculated as described below using annual input-output tables from the BLS, described in Graham (2012).

Calculation of import exposure

Let \mathbf{f} be the vector of final purchases consisting of consumption, investment, government spending, and exports. The final demand portion of the input-output matrices allows us to trace where these final purchases come from. Part of them are value added produced in trade and transportation. This is value added that directly gets sold to consumers and we denote it by the vector \mathbf{v}_0 . In particular, the input-output matrices contain information on markups in trade and transportation, which allows us to write $\mathbf{v}_0 = \mathbf{B}\mathbf{f}$, where \mathbf{B} is a matrix with markups. Similarly, we can calculate how much gross output of different U.S. sectors flows to final purchases, denoted by the vector \mathbf{y}_0 . In particular, if we denote the domestic gross output shares in final purchases at producer prices by the matrix \mathbf{C} , then we can write $\mathbf{y}_0 = \mathbf{C}\mathbf{f}$. Similarly, we can denote the imports directly sold to final demand as $\mathbf{m}_0 = \mathbf{D}\mathbf{f}$. This defines all the goods and services that get directly sold to final demand.

Next, we recursively define the gross output, value added, and imports that take s steps before being sold as final purchases. These can be defined using recursive equations constructed using the use-matrix from the input-output tables. In particular, $\mathbf{y}_{s+1} = \mathbf{A}^D \mathbf{y}_s$, where the domestic use matrix \mathbf{A}^D contains the domestically produced intermediate input shares. Similarly, $\mathbf{m}_{s+1} = \mathbf{A}^M \mathbf{y}_s$, where \mathbf{A}^M contains the imported intermediate input shares. Finally, the recursive value added equation is $\mathbf{v}_{s+1} = \mathbf{A}^V \mathbf{y}_s$ where \mathbf{A}^V contains the value added shares in gross output for each sector.

Solving these recursive equations, we basically obtain the Leontieff inverse. That is, we obtain that total value added, given by the vector \mathbf{v} , equals

$$\mathbf{v} = \sum_{s=0}^{\infty} \mathbf{v}_s = \mathbf{B}\mathbf{f} + \mathbf{A}^V \sum_{s=0}^{\infty} (\mathbf{A}^D)^s \mathbf{C}\mathbf{f} = \mathbf{B}\mathbf{f} + \mathbf{A}^V (\mathbf{I} - \mathbf{A}^D)^{-1} \mathbf{C}\mathbf{f}. \quad (3)$$

If there are no imports in this economy but the markups and the intermediate input shares and value added shares are the same, then the domestic value added needed to satisfy final demand is given by

$$\tilde{\mathbf{v}} = \sum_{s=0}^{\infty} \tilde{\mathbf{v}}_s = \mathbf{B}\mathbf{f} + \mathbf{A}^V (\mathbf{I} - (\mathbf{A}^D + \mathbf{A}^M))^{-1} (\mathbf{C} + \mathbf{D})\mathbf{f}. \quad (4)$$

Import exposure of sector i is the percentage increase in value added for the sector if all imports were produced domestically (at current (factor) prices and productivity levels). That is import exposure of sector i is $\frac{\tilde{v}_i - v_i}{v_i}$ expressed as a percentage.

Figure 13:

Measured TFP growth and counterfactual TFP growth under constant labor share.

Replication files

Workbook: Section IIIb and V.xlsm. Figure is in sheet Chart - Figure 13. Calculations are in sheets Plumbing - Counterfactual tfp.

Data sources and calculations

Labor share and average labor share are taken directly from Fernald (2012). Average is calculated over 1947Q1 through 2012Q2. TFP growth is calculated as $d \ln TFP^* = d \ln Y - \lambda d \ln L - (1 - \lambda)d \ln K$. Here λ is either the time-varying or the constant (average) labor share.

Table 1:

Sources and magnitude of the decline in the labor share.

Replication files

Workbook: Section I.xlsm. Table is in sheet Table 1.

Data sources and calculations

Summary statistics based on time series plotted in Figures 2 and 3.

Table 2:

Shift-share analysis of changes in payroll share by major sector, 1948-2011.

Replication files

Workbook: Section II.xlsm. Table is in sheets Table 2 – Panel A and Table 2 – Panel B.

Data sources and calculations

The shift-share analysis columns are those for the major sectors, based on the BEA's industry accounts data used in Figure 5. The workbook contains the results based on aggregating the shift share analysis done at the detailed industry level as well. As can be seen by comparing these columns, this does not make much of a difference.

Table 3:

Variance decomposition of annual changes in the aggregate payroll share, 1948-2011.

Replication files

Workbook: Section II.xlsm. Table is in sheets Table 3. The shift-share analysis columns are those for the major sectors.

Data sources and calculations

Based on the BEA's industry accounts data used in Figure 5 and on variance decomposition of detailed industry shift-share analysis.

Table 4:

Regressions to explain cross-industry variation in changes in payroll shares, 1987-2011.

Replication files

Workbook: Section IV.xlsm. Data is in sheet To STATA. The regressions are run in the STATA do file Section IV.do provided.

References

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Table A5. NIPA series used for the construction of the NFB sector's income accounts.

Component	Classification		I	II	III	IV	V	VI	
			Total	Farm	Households and NISH	NISH	Government	Housing	
			+	-	-	-	-	-	
1	Gross value added of NFB	=	$L + A + K$	1.3.5:3 ^a	1.3.5:4	1.3.5:5	-	3.10.5:3	1.3.5:11
2	Compensation of employees	+	L	1.10:2	7.3.5:15 ^b 7.3.5:18 ^b	AT1 1.13.43 ^b	AT1 1.13.50 ^b	3.10.5:4	7.4.5:14 ^b
3	Consumption of fixed capital	+	K	7.5:28 ^a	7.3.5:16 ^b	7.5:20	-	-	-
4	Rental income	+	K	1.10:14	-	1.13:46 ^{b,c}	1.13:53 ^{b,c}	-	-
5	Corporate profits	+	K	1.10:15	7.3.5:28 ^b	-	-	-	-
6	Net interests	+	K	1.10:11	7.3.5:24 ^b	1.13:47 ^b	1.13:54 ^b	-	-
7	CCA on proprietors' income	+	K	1.12:36 ^a	-	-	-	-	-
8	IVA on proprietors' income	+	K	1.12:37 ^a	-	-	7.3.5:28 ^{b,c}	-	-
9	Current surplus of government enterprises	+	K	1.10:20	-	-	-	-	-
10	Proprietors' income w/o CCA and IVA	+	A	1.12:35 ^a	-	-	-	-	-
11	Taxes on production	+	A	1.10:7	7.3.5:21 ^b	1.13:48 ^{b,c}	1.13:55 ^{b,c}	-	-
12	Subsidies	-	A	1.10:8	7.3.5:22 ^b	1.13:48 ^{b,c}	1.13:55 ^{b,c}	-	-
13	Business current transfer payments	+	A	1.10:12	7.3.5:25 ^b	1.13:48 ^{b,c}	1.13:55 ^{b,c}	-	-
14	Statistical discrepancy	+	A	imputed	-	-	-	-	-

Notes: Example: 1.10:2, is NIPA table number 1.10, line 2. (a) for the nonfarm sector, (b) is annual data, (c) included in as part of NIPA line. AT is additional table.