

Supplementary Materials for “Class Structure and the US
Personal Income Distribution, 1918–2012”

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1 Total Wages, Salaries and Pensions

1.1 NIPA basis

GDP including and excluding imputations from 1929 is from NIPA Table 7.12. GDP 1918-29 is from Table Ca 9-19 in Carter et al (2006). Using 1929 ratios, the pre-1929 figures are adjusted for compatibility with 1929 GDP (both including and excluding imputations), to obtain continuous series from 1918-2012.

Total Personal Income is from NIPA Table 2.1 and total Personal Income excluding imputations is from NIPA Table 7.12. For the years 1929-43, regress Personal Income less imputations on GDP less imputations, and use the regression coefficients to construct Personal Income less imputations 1918-28.

Personal Current Transfer Receipts for 1929-2012 are from NIPA Table 7.12. For 1918-28 use the 1929 ratio of Personal Current Transfer Receipts to Personal Income less imputations on the constructed 1918-28 Personal Income less imputations series.

Total Wages and Salaries 1929-2012 are from NIPA Table 6.3, and imputations from NIPA Table 7.12 (lines 203-205 only) are subtracted. For 1918-28, annual earnings of farm wage workers are from Douglas, Table Ba-4330 in Carter et al (2006). Multiplying by fte farm workers $N_i^{f,e}$, $i = 1918, \dots, 1929$ yields total farm wages, which are then rescaled on the basis of the 1929 NIPA farm wage and salary accruals (Table 6.3A). Average earnings of nonfarm employees are from Lebergott, Table Ba4282 in Carter et al (2006). Multiplying by NIPA nonagricultural ftes $N^{n,f,e}$ yields total nonagricultural wages, which are then rescaled on the basis of the 1929 NIPA nonagricultural wage and salary accruals (Table 6.3A). Total wages are formed by adding total farm wages to total nonagricultural wages. Finally, they are rescaled again by the 1929 NIPA figure for total wage and salary accruals less imputations (imputations from NIPA Table 7.12 lines 203, 204 and 205 only). This gives a NIPA-based continuous series from 1918 for Total Wages and Salaries.

From the production worker data above, multiply the BLS-derived production worker average wage w_k^{BLS} , $k = 1919, \dots, 2012$, by the BLS-derived number of production workers $N_k^{e,pw}$, $k = 1919, \dots, 2012$, to derive total wages and salaries paid to production workers, and then find the ratio of this to the NIPA-based series for Wages and Salaries; this is the proportion paid to P&NSE and hence the working class; call it p_{wc} . Hence $1 - p_{wc} = p_s$ is the proportion paid to Supervisory Workers.

Form the ratio of this NIPA-based Total Wages and Salaries to NIPA-based Personal Income less Personal

current transfer receipts (both excluding imputations), and multiply by PS Total Income for each k to derive a final figure for Total Wages and Salaries for each k . Call it W_k^{NIPA} , $k = 1918, \dots, 1944$.

1.2 IRS basis

For IRS-based Total Wages and Salaries 1940-2012, take the ratio of Salaries and Wages to (Total AGI Income less Net Capital Gains less Losses) and apply to PS Total Income. Call the derived series W_k^{IRS} , $k = 1940, \dots, 2012$. The data is from

1940-1989: “Ninety Years of Individual Income and Tax Statistics, 1916-2005”, Table 1;

1990-1998: “Table A. All Returns: Selected Income and Tax Items in Current and Constant 1990 Dollars, Tax Years 1990-2012”

1999-2012: “SOI Bulletin Historical Table 1 1999-2012”

1.3 Total Wages and Salaries

Comparing the two series W_j^{NIPA} and W_j^{IRS} , $j = 1940, \dots, 1943$, and take the higher figure. The final series is therefore W_k^{NIPA} , $k = 1918, \dots, 1939$, and W_k^{IRS} , $k = 1940, \dots, 2012$. Call it WS_k , $k = 1918, \dots, 2012$.

1.4 Pensions

Total private sector defined benefit pensions are from the U.S. Department of Labor, Employee Benefits Security Administration (EBSA) Table E17, 1975-2012.

Total public sector defined benefit pensions are from FRED, series B4938C0A144NBEA, 1929-2011. The 2012 figure is the sum of NIPA Table 7.23 line 26 and Table 7.24 line 20.

Total defined contribution pensions are from the U.S. Department of Labor, Employee Benefits Security Administration (EBSA) Table E17, 1975-2012.

Total private sector defined benefit pensions are constructed backwards from 1974 to 1929 on the basis of the 1975 ratio of private sector defined benefit pensions to public sector defined benefit pensions. Similarly, total defined contribution pensions are constructed backwards from 1974 to 1929 on the basis of the 1975 ratio of defined contribution pensions to public sector defined benefit pensions. Summing gives NIPA-EBSA-based total pensions 1929-2012.

Take the 1929 figure thereby constructed as a proportion of Personal Income excluding imputations less Personal Current Transfer Receipts excluding imputations, and multiply this 1929 ratio by Personal Income excluding imputations less Personal Current Transfer Receipts excluding imputations to derive a total pensions figure for 1918-28.

IRS-based total pensions and annuities in AGI 1990-2012 are from the IRS sources listed above. Take the ratio of Pensions and Annuities in AGI to Total AGI Income less Net Capital Gains, and multiply by PS Total Income. This determines Total Pensions 1990-2012.

For 1944-89, find the 1990 ratio of All Other Income to AGI Income less Net Capital Gains, and call it A.; find the 1990 ratio of Pensions and Annuities in AGI Income to AGI Income less Net Capital Gains, and call it B. Form the ratio B/A, and use it to multiply the annual ratio of All Other Income to AGI Income less Net Capital Gains back to 1944; multiplying by PS Income then determines Total Pensions 1944-89.

For 1918-1943, take the ratio of NIPA-EBSA-based total pensions to Personal Income excluding imputations less Personal Current Transfer Receipts excluding imputations, and multiply by PS Total Income. This determines Total Pensions 1918-44.

But extending this latter calculation through to 1965 shows that the Pensions 1944-64 exceed the NIPA-EBSA determined Pensions. So use the latter from 1944-64.

1.5 Total Wages, Salaries and Pensions

Adding the annual total pension figure to $WS_k, k = 1918, \dots, 2012$, gives Total Wages, Salaries and Pensions, or Total Labour Income. Call it $WSP_k, k = 1918, \dots, 2012$.

2 The Construction of the Working Class Wage

2.1 Total employment 1918-28

Let N be total employment, divided into farm employment N^f and nonfarm employment N^{nf} . Employees, measured in full-time equivalents, are $N^e, N^{f,e}$ and $N^{nf,e}$ respectively.

$N_i^f, i = 1918, \dots, 1929$ is from Lebergott and Weir, in Carter et al. (2006), Table Ba-472. Rescale it

to the NIPA figure for 1929 from Table 6.8A by multiplying each i by $\left(N_{1929}^{f,NIPA}/N_{1929}^f\right)$. Then multiply each i by the NIPA ratio $(N^{f,e}/N^f)_{1929}$, using Table 6.5A for $N^{f,e}$ and Table 6.8A for N^f to determine a NIPA-consistent figure for farm fte employment $N_i^{f,e}, i = 1918, \dots, 1929$

$N_i^{n_{f,e}}, i = 1918, \dots, 1929$ is from Bureau of the Census (1975) Table D127. Rescale it to the NIPA figure for 1929 from Table 6.5 by multiplying each i by $\left(N_{1929}^{n_{f,e},NIPA}/N_{1929}^{n_{f,e}}\right)$. Total fte employment is the sum of fte farm employment and fte non-farm employment.

2.2 Total employment 1929-2012

Employment in ftes $N_j^e = 1929, \dots, 2012$ is from NIPA Tables 6.5A to 6.5D.

2.3 BLS Total employees

In their discontinued *Employment, Hours, and Earnings from the Current Employment Statistics survey (National, SIC basis)*, BLS report data for Mining (EEU10000001), Construction (EEU20000001), Manufacturing (EEU30000001) and Total Private (EEU05000001) from 1919 to 2002. In their current *Employment, Hours, and Earnings - National (Current Employment Statistics - CES)* BLS report data on Mining (CEU1021000001) from 1958, and on Construction (CEU2000000001), Manufacturing (CEU3000000001) and Total private (CEU0500000001) from 1939. Regress each CEU series on its EEU counterpart over the years for which there are data for both, and then construct the earlier data using the regression coefficients and the EEU data. This constructs CEU-like series from 1919 to 1957 for Mining, and from 1919 to 1938 for the three other series, and combining with the actual CEU series gives a series from 1919 to 2012 for each of the four series.

2.4 BLS Production and Nonsupervisory Employees (P&NSE) and Production Workers (PW)

Regress CEU Mining P&NSE (CEU1021000006) on EEU Mining PW (EEU10000003)1958-2002, and use the regression statistics on EEU Mining to construct CEU-like Mining P&NSE from 1947 to 1957.

CEU Construction P&NSE (CEU2000000006) begins in 1947.

CEU Manufacturing P&NSE (CEU300000006) begins in 1939. Regress this on EEU Manufacturing PW (EEU30000003) from 1939 to 2002, and use the regression statistics on the EEU series to construct a CEU-like Manufacturing series back to 1919.

Regress CEU Total Private P&NSE (CEU050000006) on EEU Total Private PW (EEU00500003) from 1964 to 2002, and use the regression coefficients on EEU Total Private PW to obtain estimates of CEU-like Total Private P&NSE 1947-63.

So this gives CEU-like series for P&NSE for
Mining 1947-2012
Construction 1947-2012
Manufacturing 1919-2012
Total Private Industry 1947-2012.

Combine the data to construct the following series:

EEU PW: Total Private Industry less the sum of Mining, Construction and Manufacturing 1947-2002

CEU P&NSE: Total Private Industry less the sum of Mining, Construction and Manufacturing 1947-2012

CEU: ratio of P&NSE to Total employees for the sum of Mining, Construction and Manufacturing, 1947-2012.

Regress this last on the CEU ratio of P&NSE to Total employees for Manufacturing 1947-2012, and then use the regression coefficients and the ratio for Manufacturing to construct a ratio for the sum of Mining, Construction and Manufacturing going back to 1919. But the number of working class PW and P&NSE is understated for these three industries (Bureau of Labor Statistics (2009), Ch. 2). So adjust the data as follows. Find the average ratio of P&NSE to Total employees, for the years 1947-51, for

Total Private less the sum of Mining, Construction and Manufacturing

the sum of Mining, Construction and Manufacturing.

Take the ratio of the first to the second, and apply it to each year 1919-46 to the estimated ratio of P&NSE to total employees for Mining, Construction and Manufacturing. This proxies a ratio 1919-46 of P&NSE to Total employees for total Private less the sum of Mining, Construction and Manufacturing. Call this ratio $(P\&NSE/N)_{BLS}$ and apply it (instead of the ratio for Total Private Industry) to total fte employment $N_k^e, k = 1919, \dots, 2012$ to estimate the total number of production workers in each year $N_k^{e,pw}$. To estimate

the number of production workers in 1918, regress the number of production workers on total fte employment, 1918-1928, and apply the regression coefficients to the 1918 fte employment figure.

2.5 BLS wage

Convert to \$2012 (using the price index in PS (2015)) the following average weekly earnings series:

PW: Manufacturing (EEU30000004) and Total Private (EEU00500004)

P&NSE: Manufacturing (CEU300000030) and Total Private (CEU050000030)

Regress CEU P&NSE Manufacturing on EEU PW Manufacturing 1939-2002, and use the regression coefficients on EEU PW Manufacturing to construct a CEU-like series for P&NSE Manufacturing 1917-38.

Regress CEU P&NSE Total Private on EEU PW Total Private 1964-2002, and use the regression coefficients on EEU PW Total Private to construct a CEU-like series for P&NSE Total Private 1947-63.

Regress CEU P&NSE Total Private on CEU P&NSE Manufacturing 1947-63, and use the regression coefficients on CEU P&NSE Manufacturing to construct a CEU-like series for P&NSE Total Private average weekly earnings 1918-46.

Convert the constructed series CEU P&NSE Total Private average weekly earnings 1918-2012 to nominal values (using the price index in PS (2015)) and annualise by multiplying by 52. Call this the BLS wage

2.5.1 NIPA wage (1929-2012)

Using NIPA Tables 6.3 and 6.5, construct wages and salaries per fte employee for All, and for Private Industries less Farms and Private Households, form the ratio of the former to the latter, and multiply the BLS wage by this ratio.

2.5.2 NIPA-like wage (1918-1928)

Take the ratio of whole economy wages and salaries per fte to nonfarm wages and salaries per fte, rescale this by the same NIPA 1929 ratio, and then multiply the BLS wage by this rescaled ratio.

2.5.3 Adjusted BLS wage

These adjustments determine the final BLS wage. Call it w_k^{BLS} , $k = 1918, \dots, 2012$.

3 Working Class Non-Labour Income

In the PS data, income from self-employment is classified as a component of aggregate entrepreneurial income, and hence is a component of non-labour income. Assume that only non-labour income accruing to the working class is their self-employment income. Estimate it as follows.

3.1 Self-employment numbers

Numbers of self-employed are from NIPA Table 6.7. Divide them into Farm and Nonfarm and construct Total Self-employment back to 1918 on the basis of the 1929 ratio of self-employment to fte employment, and divide them into Farm and Nonfarm on the basis of their 1929 proportions. Multiply the total, farm and nonfarm numbers by $(P\&NSE/N)_{BLS}$ to derive the working class numbers of self-employed, 1918-2012.

3.2 Self-employment earnings

1918-29: multiply working class farm self-employment by the annual earnings of farm employees; similarly for nonfarm; add

1929-2012: Derive total working class self-employment income, and both farm and nonfarm components, by multiplying the respective employment figures by the working class wage per fte, weighting by the NIPA ratio of wages and salaries per fte, farm to total, and nonfarm to total. On the basis of the 1929 figures so derived, rescale the 1918-28 figures.

Find the proportion of this total working class SE income to Personal Income less personal current transfer receipts less wages and salaries, and apply to PS Total Income. This is working class tax unit self-employment income, assumed to be the only source of working class nonwage income.

4 Pareto Calculations

Let $F(y)$ be the Paretian distribution function of income y , where, for constants c , and a ,

$$F(y) = 1 - \left(\frac{c}{y}\right)^a \quad (1)$$

The corresponding Paretian density function $f(y)$ is

$$f(y) = \frac{dF}{dy} = \frac{ac^a}{y^{1+a}} \quad (2)$$

An important property of the Paretian form is that of a particular sort of proportionality. Let $y^*(y)$ be the average income of all those with an income greater than y . Then

$$\begin{aligned} y^*(y) &= \frac{\int_y^\infty zf(z)dz}{\int_y^\infty f(z)dz} \\ &= \frac{a}{a-1}c\left(\frac{c}{y}\right)^{a-1}\left(\frac{c}{y}\right)^{-a} \\ &= \frac{a}{a-1}y \end{aligned} \quad (3)$$

so that $y^*(y)$ is proportional to y . The proportionality factor $a/(a-1)$ is defined as b and is known as the inverted Pareto coefficient.

From equation (1), the percentile P is

$$P = 1 - F(y) = \left(\frac{c}{y}\right)^a \quad (4)$$

so that

$$\log P = a \log c - a \log y \quad (5)$$

and using equation (3)

$$\begin{aligned} \log P &= a \log c - a \log \left(\frac{a-1}{a}y^*\right) \\ &= a \log c - a \log(a-1) + a \log a - a \log y^* \end{aligned} \quad (6)$$

The share S in income of those whose average income is y^* is by definition

$$S = \frac{N^*y^*}{N\bar{y}} \quad (7)$$

where N^* is the number of units (people, families, households, or here tax units) with average income y^* , N is the total number of units in the economy, and \bar{y} is average income in the economy. Since $N^*/N = P$, substitute in equation (7), take logs and rearrange:

$$\log\left(\frac{S}{P}\right) + \log\bar{y} = \log y^* \quad (8)$$

Substitute in equation (6):

$$\log P = a \log c - a \log(a-1) + a \log a - a \left(\log\left(\frac{S}{P}\right) + \log\bar{y} \right)$$

Collecting constant terms and call them k , where

$$k = a \log c - a \log(a-1) + a \log a + \log\bar{y}$$

Then

$$\log P = k + a \log\left(-\frac{S}{P}\right) \quad (9)$$

For each year, PS give the shares corresponding to P90, P95, P99, P99.5, P99.9 and P99.99 (that is, for $P=10, 5, 1, 0.5, 0.1$ and 0.01 respectively); hence use OLS regression to construct estimates for k and a , and determine b as $a/(a-1)$. Note that equation (9) can be rearranged as

$$S = \exp\left(\frac{k}{a} + \frac{\log P}{b}\right) \quad (10)$$

so that

$$P = \exp\left[b\left(\log S - \frac{k}{a}\right)\right] \quad (11)$$

and that equation (7) can be rearranged using equation (3) as

$$y \equiv y_T = \frac{S\bar{y}}{Pb} \quad (12)$$

Follow the same procedure to construct the Pareto coefficients for labour income and nonlabour income.

5 Thresholds for Defining the Capitalist Class

The issue is the determination of a minimum amount of nonlabour income, the possession of which determines that its owner does not have to enter the labour market. Seven possibilities are explored, labelled A to G.

- A.** Find the threshold income for entry to the managerial class, which is effectively the maximum working class income. Apply the proportion p_s to WSP for each year to find supervisory wages, salaries and pensions, and divide by PS total income to find the supervisory labour income share. Find the corresponding P value using equation (11) with the Pareto coefficients from the Pareto distribution of labour income. Then find the corresponding threshold income using equation (12).
- B.** Take the BLS wage $w_k^{BLS}, k = 1918, \dots, 2012$, and apply a weight of 1 for each adult in the tax unit and 0.5 for each child (0-13 1918-44; 0-17 1945-2012). Total number of tax units is given by PS; population estimates are from the Census Bureau; all tax units are assumed to have the same population composition of adults and children.
- C.** Take the BLS wage $w_k^{BLS}, k = 1918, \dots, 2012$, and multiply by the number of people in a tax unit raised to the power of one half. Again, total number of tax units is given by PS; population estimates are from the Census Bureau; all tax units are assumed to have the same population composition of adults and children.
- D.** Find the average income over all tax units by dividing PS total income by PS total tax units.
- E.** Find the average labour income of a tax unit over those units that have some employment labour income by dividing PS total nominal labour income by PS total number of tax units with a wage (worksheet B1 in PS). There is no value for 2012 for these series in PS.
- F.** Use the Census Bureau's historical income statistics beginning in 1967 (Table H3) to find the P40-80 mean household income. Convert the series to a tax unit basis by multiplying by the ratio of the number of households (Table H1) to the PS number of tax units.

G. Use the Congressional Budget Office's matched Census Bureau and IRS study (Congressional Budget Office (2011)) to find the threshold for the top decile (P90) of household market income plus transfers less Federal taxes. Again, convert the series to a tax unit basis by multiplying by the ratio of the number of households (Census Bureau Table H1) to the PS number of tax units.

6 Calculating Capitalist Class Income Share and Tax Units

Using any of these thresholds, substitute equation (10) into equation (12) to find the corresponding P value in the nonlabour income distribution; then use equation (10) to find the share corresponding to that P, and multiply by PS total income to find total nonlabour income. Use the data in PS worksheet A7 to interpolate values for the percentage of nonlabour income in income by log differences in intervals of 0.01; find the relevant P and the percentage at that P, and then use total nonlabour income to find total capitalist income. Labour income is then the difference between total income and nonlabour income.

Given total capitalist income, divide by PS total income to find the income share, and use equation (11) with the coefficients from the Pareto income distribution to find the relevant P value; multiplying by PS total tax units then determines the number of capitalist tax units. The threshold income for the capitalist class is then determined by equation (12).

7 Working Class and Managerial Class Income Share and Tax Units

7.1 Working class income

Working class nonlabour income is self-employment income, calculated above in 3.2. Working class labour income is found by multiplying WSP by p_{wc} from 1.1. Working class income is then the sum of the two, and dividing by PS total income yields the income share.

7.2 Managerial class income

Managerial labour income is found by subtracting capitalist labour income and working class labour income from *WSP*. Total nonlabour income is PS total income less *WSP*. Subtracting capitalist nonlabour income and working class nonlabour income yields managerial nonlabour income.

7.3 Managerial class tax units

Given total managerial class income, divide by PS total income to derive the income share, and then add the capitalist income share to get a total non-working-class share, and find the corresponding P value by using equation (11) and the Pareto coefficients of the income distribution. Applying this P value to the PS total tax units gives the number of non-working-class tax units, and subtracting capitalist tax units gives the number of managerial tax units and hence the managerial tax unit share after dividing by PS total tax units.

7.4 Working class tax units

Given the total non-working-class tax units, the number and share of working class tax units is determined.

8 Data sources

Bureau of Economic Analysis: National Income and Product Accounts (NIPA), at <http://www.bea.gov/>

Bureau of Labour Statistics: Current Employment Statistics (Employment, Hours, and Earnings - National) survey (both current and discontinued databases), at <http://www.bls.gov/>

Census Bureau: population estimates at <http://www.census.gov/popest/data/historical/index.html>

Census Bureau: historical income statistics, Tables H1 and H3, at

: <http://www.census.gov/hhes/www/income/data/historical/household/>

Federal Reserve Bank of St. Louis: Federal Reserve Economic Data (FRED), at

<http://research.stlouisfed.org/fred2/>

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Internal Revenue Service:

1. All Individual Income Tax Returns: Sources of Income and Tax Items (in Current and Constant Dollars). Tax years 1913-2005. Published as SOI Bulletin article - Ninety Years of Individual Income and Tax Statistics, 1916-2005, Tables 1 and 1A [Excel file 05in01an.xls]
2. Selected Income and Tax Items for Selected Years (in Current and Constant Dollars). Tax years 1990-2011. Published as Individual Complete Report (Publication 1304), Table A [Excel file 11intba.xls]

both at <<http://www.irs.gov/uac/SOI-Tax-Stats-Individual-Time-Series-Statistical-Tables>>

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