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A Consistent Data Series to Evaluate Growth and Inequality in the National Accounts

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Frequent headlines present rising per capita Gross Domestic Product (GDP) and yet refer to people who have not shared equally in this growth. Late last year the *New York Times* stated: "Growth hasn't translated into gains in middle class income," and included a figure that showed the growth in per capita GDP outpacing the change in median household income between 1993 and 2013 (with per capita GDP growing over 40 percent and median household income increasing only 5 percent). This disconnect between aggregate growth and its distribution to individuals has been amplified during the past few years, fueled by the Great Recession. The relationship between macroeconomic growth and income inequality has been the focus of many recent studies (see OECD (2011), Boushey and Hersh (2012), Boushey and Price (2014), OECD (2014)). The concern is whether all segments of society have benefited from the growth of real GDP.

Almost 70 years ago, Kuznets (1943) in his original report on the national accounts suggested that growth in GDP was not sufficient to evaluate social welfare. This view is echoed in recent *Economic Report of the President* and is the theme of the *Report by the Commission on the Measurement of Economic Performance and Social Progress* (or Stiglitz (2009) report).

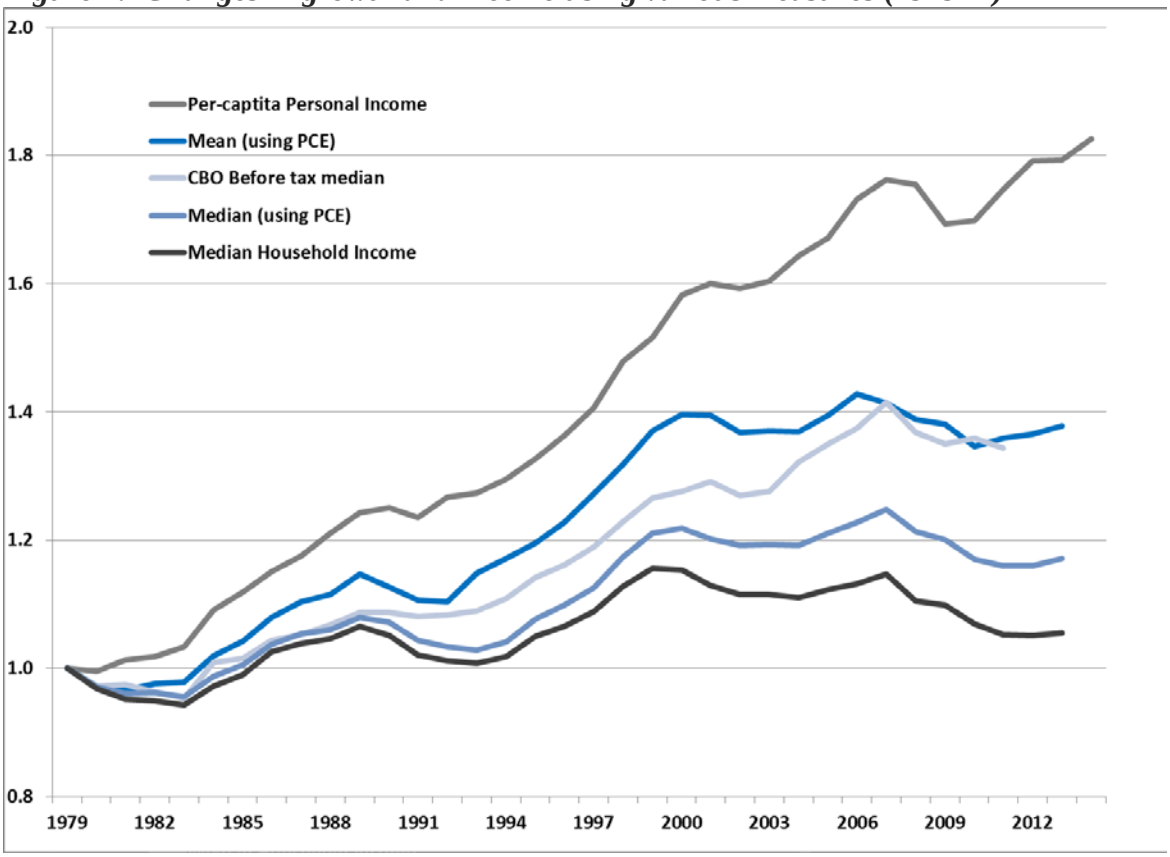
There is considerable agreement about the increase in inequality in the US during the past 30 years (see Congressional Budget Office (CBO) (2013), Johnson and Smeeding (2014)); there is, however, considerable disagreement regarding the relationship between inequality and growth. The most recent *Economic Report of the President* (2015) states that if inequality had not increased from 1973 to 2013, then (under certain assumptions) "…income for the typical household would have been 18 percent, or about $9,000, higher." New OECD analysis suggests that income inequality has a negative and statistically significant impact on medium-term

growth.[2] Even the business community is concerned about rising inequality. A recent Standard and Poors report stated: "Our review of the data, as well as a wealth of research on this matter, leads us to conclude that the current level of income inequality in the U.S. is dampening GDP growth…" (see Standard and Poors (2014)). However, a recent OECD report (OECD (2012) suggested that there is "…no general consensus has emerged and the empirical evidence is rather inconclusive."

Figure 1 confirms the results from the New York Times story mentioned above that per capita income (from BEA) has increased much more that median household income (from Census). This figure also highlights the impact of using alternative income measures (as from CBO (2013)) and price indexes. For example, the median household income increases 5.1 percent (using the CPI-U-RS) between 1979 and 2012, while adjusting for inflation using the PCE deflator yields a 16 percent increase. In addition, using the median before tax income from CBO yields a 34.4 percent increase (between 1979 and 2011) (see Fixler and Johnson (2014).

[2] "Rising inequality by 3 Gini points, that is the average increase recorded in the OECD over the past two decades, would drag down economic growth by 0.35 percentage point per year for 25 years: a cumulated loss in GDP at the end of the period of 8.5 per cent." See OECD (2014)

Figure 1: Changes in growth and income using various measures (1979=1)



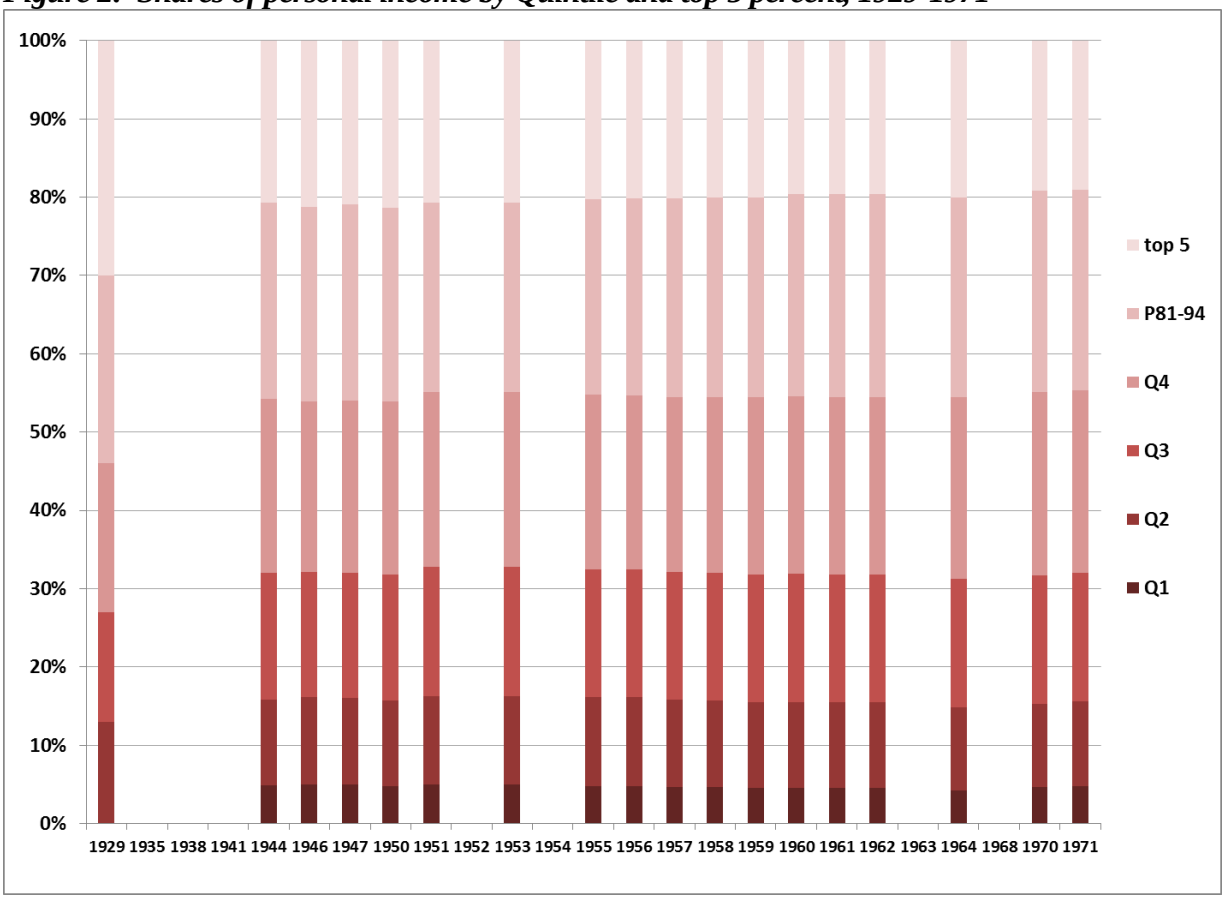
This paper creates a short time series of data that can be used to determine the relationship between growth and the size distribution of income in the national accounts. As the national accounts provide the source data for discussions of economic growth, the main issue with relating growth and inequality is obtaining comparable measures of both; that is the focus of this paper. GDP is, after all, a measure of production for some time period and the corresponding measure for much of the income is the payments to the factors of production. Accordingly, we examine the distribution and movement of household income, as measured by personal income. With the distributional aspects of personal income, one can examine how various changes in policy may impact households at various points in the distribution. This paper builds on Fixler and Johnson (2014) and McCully (2014) and uses the Current Population Survey (CPS) and the Consumer Expenditure (CE) Survey to construct distributional and inequality measures for the

NIPA measure of Personal income from 2006-2012.

Income Distribution and Macroeconomics

Since the development of national accounts, the relationship between the distribution of income and economic growth has been an area of ongoing research. Kuznets (1955, 27), in his famous paper on inequality and growth, stated: "The distribution of national product among the various groups is a subject of acute interest to many and is discussed at length in any half-articulate society." In conjunction with Kuznet's article, in the 1950s the Office of Business Economics, the predecessor to BEA, began producing measures of the income distribution in the United States. These first estimates were released in 1953 and began with estimates for 1947 (see Office of Business Economics (1953)). Similar to our method, these estimates used the CPS to account for distribution, and allocated the measure of personal income to quintiles. These estimates were regularly released in the *Survey of Current Business* from 1950-1962 (see Fitzwilliams (1964)), and the last estimates were produced for 1971 (See Radner and Hinrichs (1974)). Figure 2 shows the distribution of personal income by quintile and the top 5 percent for the years produced.

Figure 2: Shares of personal income by Quintile and top 5 percent, 1929-1971



As one can see, there was little change in inequality during this period with the shares remaining fairly constant over the entire period. This period has been labeled the "age of shared growth" (see ERP (2015)).

Currently, most research examines the distribution of income – either money income as used by the Census Bureau (see DeNavas-Walt et al. (2014)) or after-tax income (see CBO (2013)). Other researchers have also examined IRS data (see Piketty and Saez (2003)). However, none of these definitions of income match the definition of personal income from the NIPAs. The goal of this paper is to provide consistent distributional measures of personal income that can be used to compare to the growth rates.

The interest in understanding the role of the income distribution in macroeconomics,

specifically economic growth, has a long history. For example, Ricardo focused on the functional distribution of income, that is, roughly speaking, the distribution of income between labor and capital.[3] The distribution of personal income, which is the focus of this paper, received later attention and now is the subject of much discussion. Intuitively, there is a relationship between these two perspectives of the income distribution. For example, the Solow growth model with its focus on saving and capital accumulation determines both capital and labor income, which then is distributed over the population.[4] Kuznets' (1955) seminal paper sparked numerous studies testing his hypothesized inverted U-shaped relationship between growth and the income distribution that depended on the state of the economy—whether it was developed or less-developed.[5]

A metric that is commonly used in studies of the relationship between economic growth and inequality is GDP per capita. This measure blurs the distinction between the functional/personal distributions of income because it is both an indicator of the production of goods and services and therefore the use of a capital labor and the income payments to the owners of capital and labor, the population. To relate growth to a notion of inequality, one can think of a simple regression in which the dependent variable is the growth in GDP per capita and the independent variable is some measure of income inequality; the Gini coefficient is commonly used. The central issue is the sign and magnitude of the coefficient on the Gini variable. There is no consensus; some studies find a negative relationship and some studies find a positive relationship. Much of the literature is devoted to trying different forms of the regression equation just described. A good summary of this literature and the robustness of the findings can

[3] See Sandmo (2013) for a history of economic thought on the income distribution/
[4] Jones (2015) uses Solow growth model, along with the Pareto distribution to examine the source of the income distribution in the top tail.
[5] See Gallo (2002) for a discussion of the empirical examining the testing the inverted U shaped inequality hypothesis.

be found in Dominicis, Floras and DeGroot (2008).

Another perspective on the relationship between economic growth and income inequality expands the set of explanatory variables to include social and political dimensions that may influence the relationship. More specifically, this strand of analysis looks at variables such as investment in education and fertility (see Galor and Zeira (1993) and Cline (1970)). These studies also use GDP per capita along with measures of these non-economic dimensions.

As mentioned, currently the data used in the above described regression equation are usually on a different accounting basis. GDP is computed using national income account methods; typically those described in the System on National Accounts (SNA). The inequality measure, however, is typically based on an income measure that comes from a different accounting scheme. Sometimes the income measure is based on Federal Income Tax data, say, Adjusted Gross Income and sometimes it is based on the Census definition of money income. For dimensional consistency the relationship between economic growth as measured by GDP and the income inequality measure, the latter should be based on the national account concept of personal income. Personal income, as computed by BEA, is different from the IRS computed Adjusted Gross Income and different from the Census money income. One goal of this paper is to provide a measure of inequality that is based on personal income.

Why is such dimensional consistency important? As shown in Fixler and Johnson (2014) there can be a substantive difference in the measure of inequality. This difference can bear on economic policy. Recently some attention has been directed to the how this relationship can influence economic policy—see for example *Economic Report of the President* (2015) and Boushey and Price (2014). More specifically the attention is directed to how the income distribution affects fiscal policy multipliers. The underlying intuition is that the marginal

propensity to consume is higher for lower income categories than for higher income categories and so the government expenditure multipliers should be higher for the lower income categories; the consequence being that redistribution from higher to lower increases economic growth. On the other hand, some would argue that redistribution from higher income to lower income via the tax code creates tax distortions that reduce investment and thereby reduce the economic growth.

We follow the methods presented in Fixler and Johnson (2014) and McCully (2014) to allocate aggregate personal income to households. Cynamon and Fazzari (2015) and Jones (2015) use other methods. Jones (2015) uses the shares of tax income from the high income data base to allocate aggregate GDP and then determine a per capita measure for the top 0.1% and the bottom 99.9%. Figure 1 in Jones (2015) shows that the mean for the top 0.1% increases 6.86% annually since 1980, while the bottom 99.9% increases only 1.83%.[6] Instead of using the tax shares of income, this paper uses over 65 categories of income to allocate aggregate personal income.

Measuring Income

In order to fully evaluate the relationship between the distribution of income and growth, however, we need comparable measures of income. As discussed in NBER volume, Conference on Research on Income and Wealth (1943), there are many choices that need to be made in determining the appropriate components of income to include in a measure of income distribution. The most inclusive concept of income and consumption derives from the suggestions of Haig and Simons. Haig (1921) stated that income was "the money value of the net accretion to one's economic power between two points of time" and Simons (1938) defined personal income as "the algebraic sum of (1) the market value of rights exercised in consumption

[6] Recently Zucman (2015) has used a similar method to adjust the NIPA totals by the shares of income in the tax data.

and (2) the change in the value of the store of property rights between the beginning and end of the period in question."

The focus of this paper is to evaluate the level, trend, and distribution of personal income (as measured by BEA). The Systems of National Accounts (SNA) defines household income as "…the maximum amount that a household or other unit can afford to spend on consumption goods or services during the accounting period without having to finance its expenditures by reducing its cash, by disposing of other financial or non-financial assets or by increasing its liabilities."

There are a multitude of income measures used by researchers and the government. Table 1 in Fixler and Johnson (2014) compares multiple definitions of income. One of the main differences among the various definitions is the treatment of retirement income. Most studies of income and its distribution include the money income, but do not examine changes in assets, and only a few examine the impact of capital gains (e.g., CBO (2011), CBO (2012), Piketty and Saez (2003)).

Before discussing our data sources and how the distribution of personal income is created, we give the broad outline of our approach. We start with Census money income because that is a household based concept and provides the basis for the distribution. Though Census money income in many ways is a more narrow definition of income it includes variables that are not in personal income, such as retirement disbursements. Accordingly, to move from Census money income to personal income, we must first subtract from money income the components that are not in personal income and then, using the residual add the components that are in personal income but not in money income. Unfortunately, the first step is difficult to implement because many of the money income components are commingled; that is, they contain

components not in personal income as well as those in personal income. Thus, we construct an approximation to the net money income computed in the first step by adding up the components of personal income that are in money income. We call this approximation pseudo income.

Data Sources and methods

This paper constructs distributional estimates that are fully consistent with the NIPA personal income concept, closely following the work of McCully (2014), Furlong (2014), and the OECD Expert Group on measuring Disparities in National Accounts (EGDNA).[7] Previous work by Fixler and Johnson (2014) focused on creating a NIPA adjusted measure of Census money income, which kept the definition of money income – and then added other NIPA-specific income components such as health spending and imputed interest. However, because the Census definition includes income components that are not included in personal income, such as retirement disbursements, the Fixler-Johnson NIPA-adjusted income measure is still conceptually different than personal income, albeit closer than the commonly used money income concept. For example, personal income includes, but the NIPA-adjusted money income concept excludes the following: rental income from owner-occupied housing, employer fringe benefits (e.g. retirement contributions and health insurance premiums), and imputed interest on insurance policy reserve funds.

To estimate the distribution, we use the Annual Social and Economic Supplement of the Current Population Survey (CPS) integrated with the Consumer Expenditure (CE) Survey. The CPS collects data on income, while the CE collects data on both income and expenditures. CPS and the CE surveys are nationwide household surveys designed to represent the U.S. civilian non-institutional population. There are differences between the surveys in the unit of measure,

[7] This is an ongoing working group, currently in the experimental phase of developing distributional estimates fully consistent with the System of National Accounts (SNA).

and significant differences between in frequency and design (see McCully (2014) for more information on the surveys). The sources used for the NIPA estimates of personal income and outlays are many and diverse – sample surveys conducted by Census, administrative data from Social Security Administration and governmental benefits from other agencies.

To construct distributional estimates, personal income is first decomposed into its underlying detail level, consisting of over 65 components ranging from the more salient wages and salaries and social security disbursements to the less obvious components such as imputed interest on life insurance and pension reserve funds. Each of these components is then matched to corresponding micro data to obtain distributional information. Both CPS and CE surveys are necessary because neither one contains all the information required to define personal income. For example, only the CE contains information on the rental *value* of owner-occupied housing, mortgage interest, and homeowner's insurance, all of which is needed to construct the rental *income* of owner-occupied housing.

Although both surveys are comprehensive, covering a wide range of income and consumption variables, it is not always possible to find an exact match in the micro data. In these instances, indicator variables are constructed from the micro data which are used to distribute the NIPA aggregates across each household accordingly. For example, neither survey contains a variable for employer contributions to retirement plans. However, the CPS includes a variable indicating if the person participates in a pension plan or not. This variable is used in combination with a person's wage, which is assumed to be proportional to the employer contribution. Therefore, a person with a higher wage would receive a larger share of the NIPA aggregate than a person with a lower wage, given that they participated in a pension plan. Similarly, the imputed interest received from depository institutions is assumed to be proportional to a household's

savings and checking account – two variable obtained from the CE.

Because information is used from two surveys, personal income could not directly be estimated for each household in each survey. To overcome this problem, a synthetic data set is constructed using a statistical matching procedure, which links housing units in the CPS to units in the CE through the use of 20 common variables in both surveys. [8] A CPS and CE household are assumed to be statistically identical if a distance function between the two is minimized for all possible housing combinations.

Another issue with using the survey data for the NIPA distribution is that the underlying populations covered are different. The CPS and CE surveys cover only the civilian non-institutional population, while personal income estimates in the NIPAs cover the income (and expenditures) of those defined as U.S. residents in the national accounts, which includes nonprofit institutions serving households (NPISHs), the institutionalized population, federal civilian and military personnel stationed abroad, and persons whose usual place of residence is the U.S. who are private employees working abroad for a period of less than one year. Excluded from the NIPA definition of residents are foreign nationals who work and reside in the U.S. for part of the year and foreign nationals studying in the U.S. In addition, NIPA estimates include the income of those who died during the preceding year, who are not captured in the CPS. Excluding NPISHs income and accounting for transfers between households and NPISHs gives a measure of household income, which will be used for the integration of the micro and macro estimates.

In order to align the NIPA population with that of the household surveys, we adjust the

[8] Statistical matching first began to be widely used in the early 1970s through the work of Budd (1971), Okner (1972), Ruggles and Ruggles (1974), Radner (1981), Barr and Turner (1981), Rodgers and DeVol (1984), Rubin (1986) and more recently by Kadane (2001), D'Orazio et al. (2001), Moriarity and Scheuren (2001 and 2003), and Denk and Hackl (2003).

NIPA aggregates to align with the population covered in the household surveys. In most cases this means removing certain population groups from the estimates, though in a couple of instances it means adding population groups.[9] (See Appendix table for the coverage ratios and McCully (2014) for more details on their construction.)

The next step is to construct the totals of each income component defined by the NIPA definition using the synthetic data and calculate scaling factors using the actual NIPA totals. We then apply these factors to the underlying micro-data, hence ratio adjusting each income component for each household using the component specific scaling factors.

Specifically, consider household i, with income, $y_i = \sum_{jk} \alpha_j y_{jki}$, where the scaling factors, α_j, depend on the source, j, of income (e.g., wages or dividends) and are given by the ratio of aggregate personal income to aggregate income in the surveys (either CPS or CE in the integrated data set). Here $\alpha_j = Y_j/X_j$, where Y_j is the aggregate for source j in the personal income measure (in the NIPAs) and X_j is the aggregate for source j in the integrated data. This procedure increases each household's income by source and the new scaled household data is then used to obtain distribution measures.[10]

To illustrate, consider only one source of income, such as wages. Then the scaled income for household i is equal to [NIPA wages/CPS wages] x CPS wages for household i. Additional sources of income would be similarly calculated and added to the total. This procedure generates a NIPA-based scaled income series for households in the CPS and thereby yields an NIPA based income distribution.

[9] The following population groups are removed from the macro estimates – Institutionalized, Decedents, U.S. residents not physically present in the U.S., U.S. government civilian and military personnel stationed abroad, Private employees whose usual place of residence is the U.S. who are on foreign assignment for a period of less than one year, and Domestic military living on post. Alternatively, the following groups are added to the macro estimates -- Foreign nationals studying in the U.S.; Foreign temporary agricultural and nonagricultural workers living in the U.S.; Foreign professionals temporarily residing in the U.S.

[10] The simple ratio-adjustment mentioned above is for $\alpha_j=\alpha$ for all sources.

One limitation of the above approach is that we assume that the levels of under-reporting (and the difference between survey reports and NIPA measures) are the same for all households. Hence, every household receives the same scaling factor for each source of income. However, it is likely that different households have different levels of under-reporting. Research has shown that there is a large underreporting at the top of the distribution (see Sabelhaus et al. (2014)).

We follow this procedure for 2006 to 2012 and obtain annual estimates for household money income (see DeNavas-Walt et al. (2015)) and all the components, along with personal income measure and all of the additional components. The table in the Appendix describes the income sources included in the various income definitions (see also Fixler and Johnson (2014) Table 1 that compares the income definitions across a variety of agencies and income measures.)

All estimates in the tables have been converted to 2006 dollars using the PCE price index, and all measures of inequality (e.g., Gini coefficient) have also been household size adjusted using an equivalence scale given by the square root of family size.[11] These methods are similar to those recommended by the new OECD expert group on disparities in the national accounts (see Fesseau and Mattonetti (2013)).

Results

The different definitions of income are shown in Table 1. The top row shows the money income used by the Census Bureau. Our measure of pseudo income is shown below, and the right column shows the scaled values using the adjustments discussed above. Similar to Fixler and Johnson (2014), the scaled pseudo income is larger than money income. Not-scaled pseudo income is less than money income due to the exclusion of retirement income from the NIPA concept and the comingled factors mentioned above. Using the NIPA totals to scale pseudo

[11] The square root of family size is often used in international comparisons. We have also compared these results to those using the OECD equivalence scale.

income increases it by 28 percent (which is 20 percent larger than money income). Personal income is much larger than pseudo income due to the inclusions of financial factors (such as imputed interest and imputed rent), health factors (such as the cost of Medicare and Medicaid), other transfers (such as food stamps (SNAP) and Energy assistance), and less contributions (such as employer and employee FICA contributions). As a result, personal income is 45 percent larger than money income (and scaling increases it by 24 percent).

Table 1: From Money income to Personal income (2012 in 2006$)

	Estimated from CPS (not scaled)	Adjusted to match NIPA (scaled)
Money Income (Census)	$ 63,593	N/A
Wages and Salaries	$ 47,857	$ 50,091
Finance and Business (interest, dividends, farm/non farm, rent)	$ 6,058	$ 17,003
Government transfers	$ 5,924	$ 7,779
Retirement and other	$ 3,754	N/A
less comingled factors	$ 213	N/A
equals Pseudo Income	$ 59,626	$ 76,137
plus financial	$ 13,765	$ 13,765
plus health and other transfers	$ 5,517	$ 8,304
health	$ 9,370	$ 12,274
net transfers (payouts less contributions)	$ (3,853)	$ (3,970)
equals Personal Income	$ 78,908	$ 98,206

Table 2: Money, Pseudo and personal income at various percentiles, 2006-2012 (2006$)

	Money Income (census)				
Year	**Average**	**10th Percentile**	**Median**	**90th Percentile**	**95th Percentile**
2006	$66,531	$12,000	$48,020	$133,726	$174,020
2007	$65,968	$11,846	$48,778	$133,101	$172,668
2008	$64,761	$11,509	$47,334	$131,374	$170,401
2009	$64,371	$11,470	$47,175	$130,726	$170,512
2010	$62,903	$11,082	$45,887	$129,541	$168,656
2011	$63,362	$10,915	$45,478	$130,511	$169,410
2012	$63,593	$10,910	$44,931	$130,400	$170,690
Percent change	-4.4%	-9.1%	-6.4%	-2.5%	-1.9%

	Pseudo Money Income				
Year	**Average**	**10th Percentile**	**Median**	**90th Percentile**	**95th Percentile**
2006	$77,231	$12,152	$51,000	$156,751	$220,327
2007	$78,863	$12,293	$52,434	$162,682	$227,986
2008	$78,425	$11,974	$51,241	$158,476	$223,676
2009	$73,913	$11,737	$48,969	$151,713	$210,981
2010	$73,562	$11,533	$48,706	$151,873	$210,378
2011	$74,319	$11,063	$47,366	$152,661	$211,464
2012	$76,137	$11,123	$48,168	$157,571	$221,779
Percent change	-1.4%	-8.5%	-5.6%	0.5%	0.7%

	Pseudo Money Income (not scaled)				
Year	**Average**	**10th Percentile**	**Median**	**90th Percentile**	**95th Percentile**
2006	$62,755	$9,980	$44,532	$128,237	$168,378
2007	$62,222	$9,941	$44,684	$127,789	$166,837
2008	$60,865	$9,696	$42,900	$126,600	$164,982
2009	$60,489	$9,663	$42,312	$125,611	$165,418
2010	$58,931	$9,237	$41,305	$124,720	$162,882
2011	$59,272	$9,105	$40,581	$125,259	$162,793
2012	$59,626	$9,129	$40,846	$125,536	$164,711
Percent change	-5.0%	-8.5%	-8.3%	-2.1%	-2.2%

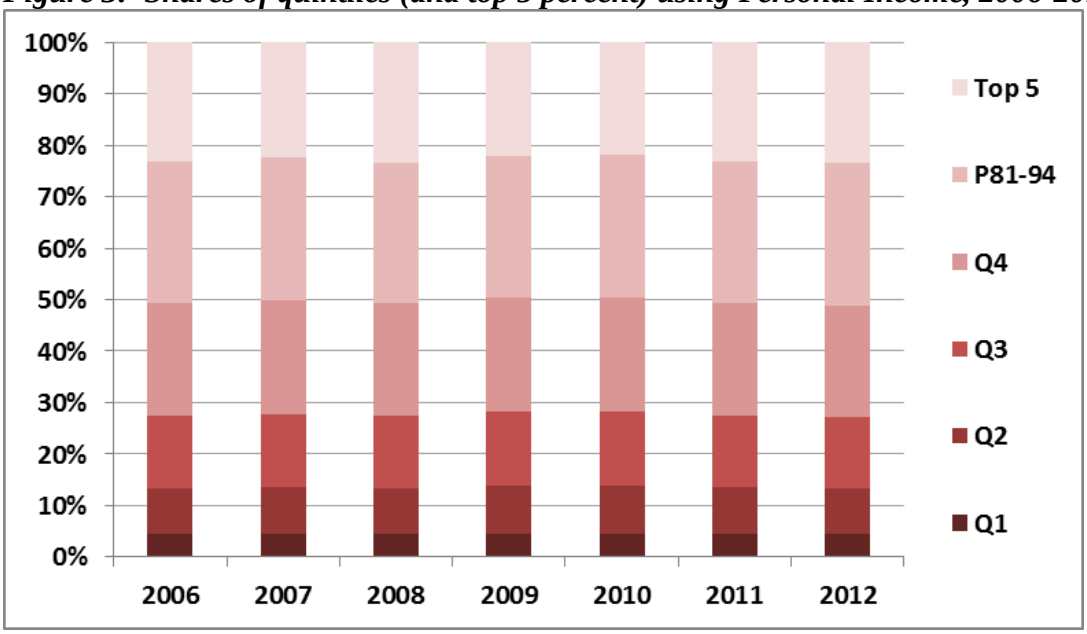
	Personal Income				
Year	**Average**	**10th Percentile**	**Median**	**90th Percentile**	**95th Percentile**
2006	$95,119	$21,752	$66,354	$185,636	$254,118
2007	$97,351	$22,259	$68,356	$192,960	$262,312
2008	$97,713	$22,525	$68,354	$188,991	$261,562
2009	$94,289	$22,557	$67,424	$184,236	$250,676
2010	$95,165	$22,617	$68,125	$186,526	$253,427
2011	$96,718	$22,364	$67,441	$188,994	$256,307
2012	$98,206	$22,447	$67,803	$193,828	$265,025
Percent change	3.2%	3.2%	2.2%	4.4%	4.3%

Table 2 shows the various measures at different points in the distribution – mean, median, 10^{th}, 90^{th} and 95^{th} percentile. The first two panels of this table show that our pseudo income concept is less than Census money income—as it should be because in principle we have subtracted elements from money income. The figures indicate that our pseudo money income is a fairly good approximation of Census money income. (The not scaled refers to the adjustment factors that scale the pseudo income to personal income values.) The personal income amounts represent the scaled pseudo income adjusted further by the finance, health and other transfer adjustment factors. Note that while Census money income and pseudo income have declined across the board, personal income has increased.

As expected the incorporation of scaling increases the mean and median of pseudo money income and thereby increases the difference between pseudo income and Census money income. More specifically, the median Census money income falls 6.4% over the period, and the median scaled pseudo money income falls 5.6%. In contrast, the median personal income increases 2.2%. This pattern holds for the means as well. Using the mean and median we can compute the Pierson measure of skewness for Census money income and personal income. The Census money income is about 0.7 for each year of the period and for personal income it is about 0.8. Thus both distributions are stable in terms of skewness and skewed toward higher incomes.

Using these new measures, we can construct the distributions by quintile and compare them to those shown in Figure 2. Figure 3 shows that the shares of income by quintile are fairly stable over this short period. Over the period of the Great Recession, the share of the top 5 percent falls, but then comes back up between 2011 and 2012.

Figure 3: Shares of quintiles (and top 5 percent) using Personal Income, 2006-2012



Using these shares and the personal income measures, we can construct a measure similar to Jones (2015). Figure 4 shows the mean for the top 5 percent and bottom 95 percent using the shares presented in Figure 3, total personal income and the population for each component. Following Jones (2015), this figure uses data from the Top Income Database along with our measures.[12] Similar to Jones (2015), this Figure shows that, between 1979 and 2012, using the Top Income Database yields a much larger increase in income for the top 5 percent than the bottom 95 percent (95 percent and 49 percent). As expected, the tax data also shows much higher shares on income for the top 5 percent of the population compared to the top 5 percent using our methods. This is mainly due to the non-tax income components included in personal income. The trends over this short period, however, are similar, with both falling between 2006 and 2009 and rising in 2011 and 2012.

[12] Figure 1 in Jones (2015) shows the trends in the mean GDP for the top 0.1 percent and the bottom 99.9 percent, while our paper examines personal income for the top 5 percent and bottom 95 percent so that it can be compared to the shares found using the microdata (as the sample size for the top 0.1 percent is too small).

Figure 4: Growth in Personal Income for top 5 percent and bottom 95 percent

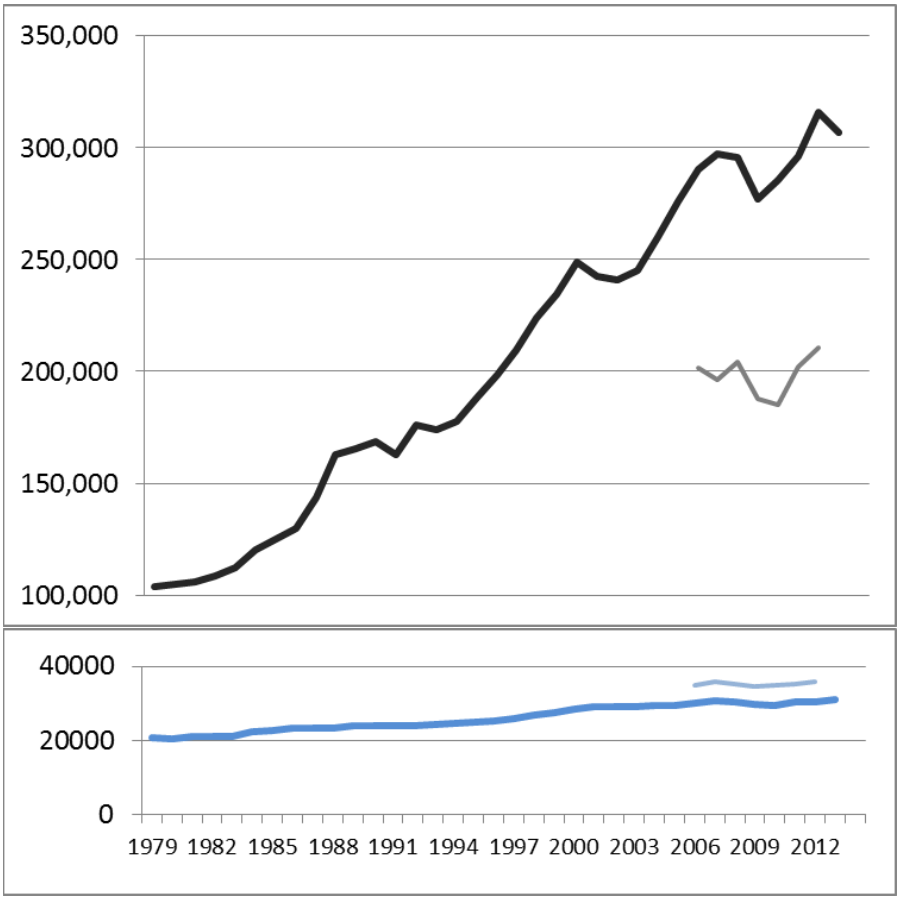


Figure 5 shows the Gini coefficients from these adjusted measures. The Gini coefficient is on the left axis for the different income measures and the right axis is for GDP per capita. For this limited period, there are differences in the relationships between GDP per capita and the different income Gini coefficients: GDP per capita is strongly positively correlated with personal income, weakly positively correlated with pseudo income and weakly negatively correlated with Census money income. These relationships may not hold for longer time periods but they are consistent with the absence of a consensus about the relationship between GDP per capita movements and income inequality.

Figure 5: Gini Coefficient and GDP per capita, 2006-2012

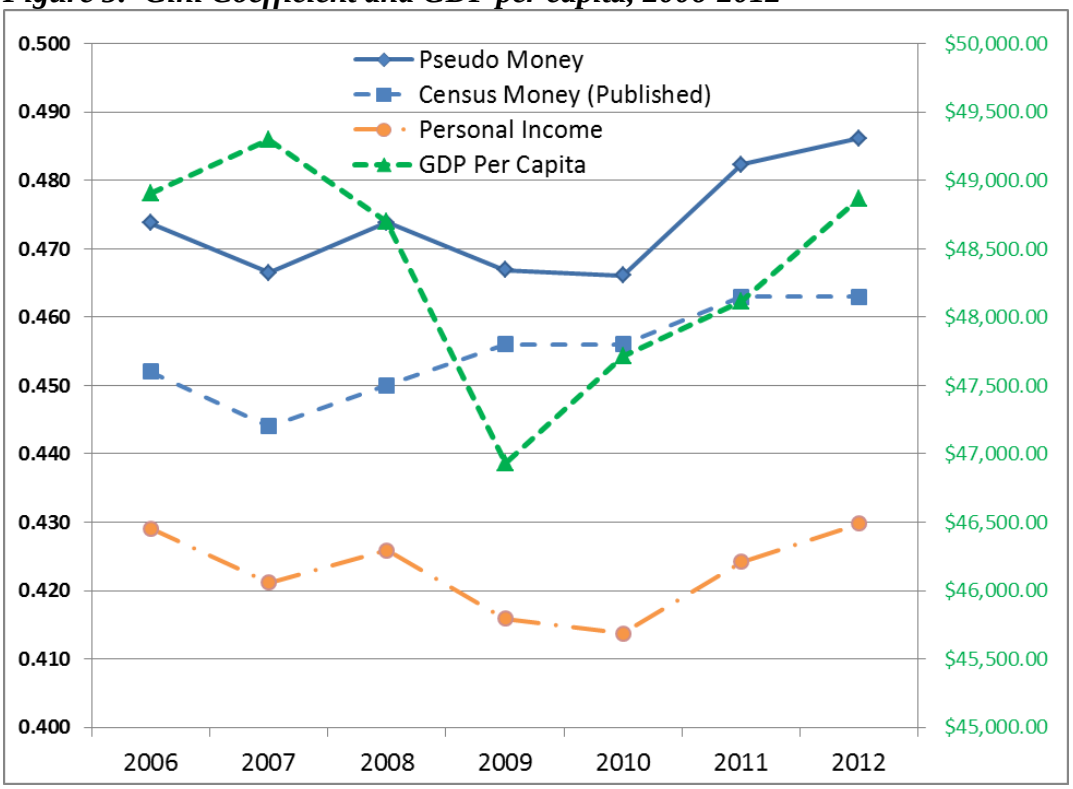


Figure 6: Effects of income components on Gini coefficient, 2006-2012

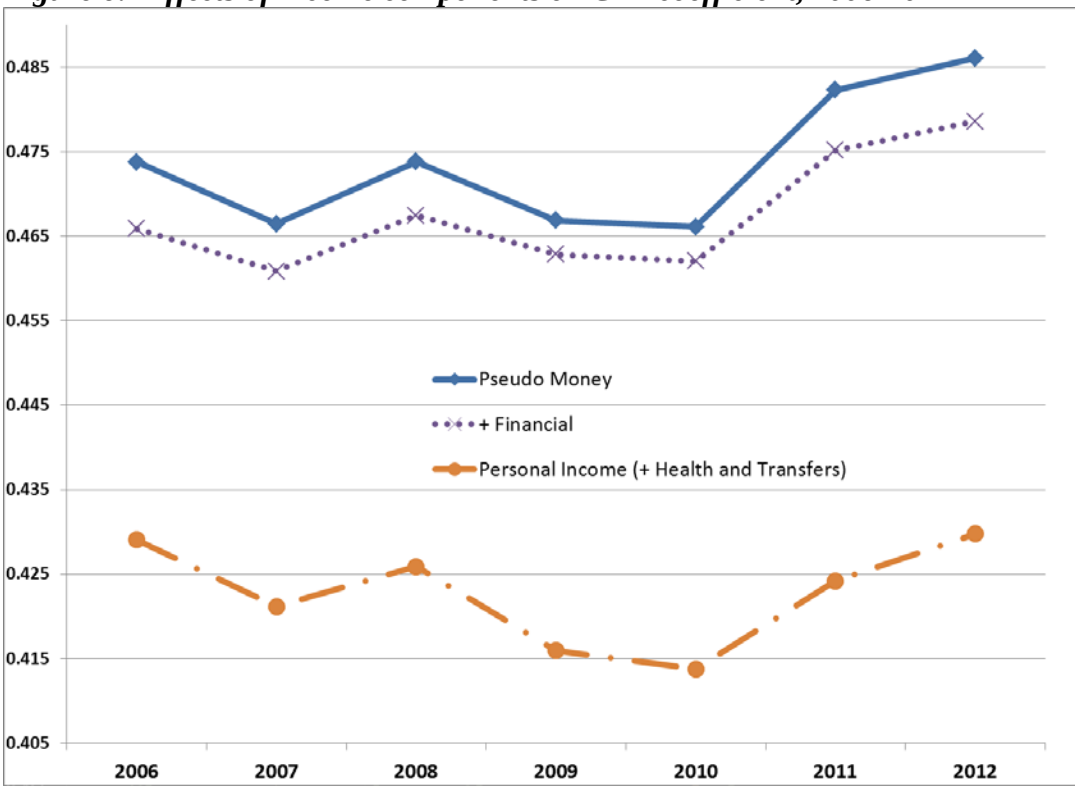


Figure 6 depicts the incremental changes in the Gini coefficients as the concept of income moves from pseudo to personal income. Qualitatively the ordering of the adjustments does not impact the results, only the point at which the impact on the trend is observed. Figure 6 also shows that the addition of transfers and health related adjustments have the greatest impact on the Gini coefficients. In fact, over the period, the pseudo income Gini increases 2.6 percent, while the Gini for personal income increases only 0.2% (with the main difference coming from transfers and health. (The Gini for pseudo income + financial increases 2.7 percent.) In Figure 5, the Census money income Gini increases 1.5 percent.

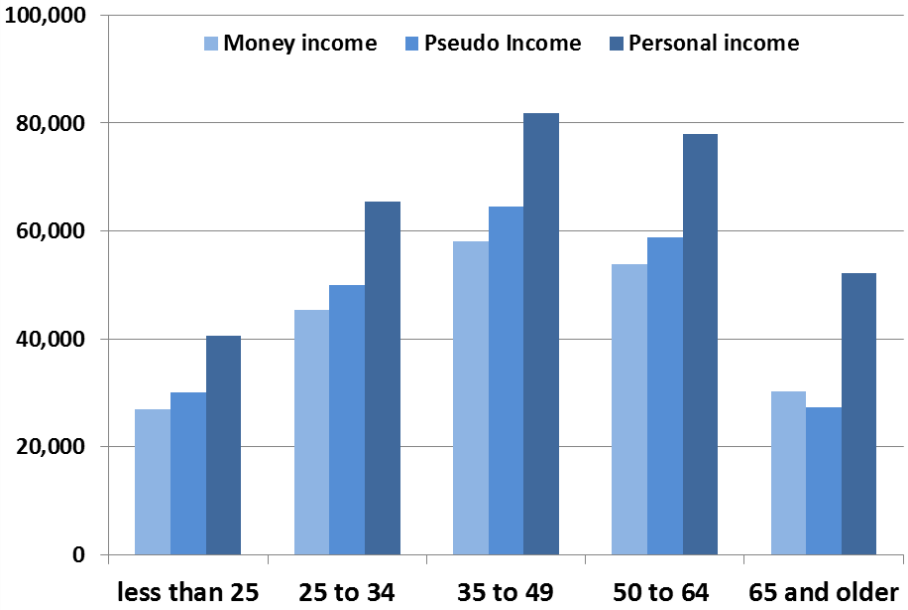
Similar to Burkhauser et al. (2010) and Meyer and Sullivan (2011), including the imputations for health care benefits yields an even greater increase in the mean and median and a smaller increase in inequality. It is clear that the social safety net, the combination of the transfers and health expenditures, substantially reduce the changes in the Gini coefficient for the period. This result is qualitatively similar to the result in Fixler and Johnson (2014).

One can construct a measure of money income plus the imputed value of Medicare and Medicaid (see Hardy and Johnson (2015)). This measure increases 0.5% between 2006 and 2012, less than the similar pseudo income plus health. In fact, this measure is fairly flat between 1990 and 2012, while the money income measure increases. Hardy and Johnson (2015) also produce an extension of Fixler and Johnson from 1979-2010 and find results similar to those shown here – using only money income (or pseudo) the scaling slightly increases both the level and trends in inequality.

Our focus is to construct a distribution of income with the proper definition comparable to personal income; however, we can also use this measure to evaluate the distribution of income by various demographic groups. For example, Figure 7 shows the median income by age group

for three income measures. All three measures show the common life-cycle pattern for income -- income increasing in early years, peaking in the middle years and falling in retirement age. Even though these income concepts treat retirement contributions and distributions differently (and Medicare benefits), personal income for the elderly has a similar relationship to the income of other age groups as the relationship for money income.

Figure 7: Median Income by age for Money, Pseudo and Personal Income, 2012 (in 2006$)



Conclusions

Sixty years ago, Kuznets (1955) stated: "Today, there is increased concern about the skewed income distribution, and the increase in skewness over time." He also argued that the distribution of income must be linked to the measure of national income. Building on the earlier work of BEA that also occurred sixty years ago, we construct a micro data set that can produce a proper measure of income that can be used to examine the income distribution. We find that these measures yields different levels and trends in the median and inequality than obtained using the usual money income measure. While these relationships may not hold for longer time

periods, they are consistent with the absence of a consensus about the relationship between GDP per capita movements and income inequality. It is only using these measures of income that are consistent with the NIPA income measures that one can accurately examine the relationships between inequality and growth. The results in this paper may provide a framework for developing measures of median personal income, GDI and their distribution that could be produced on a regular basis.

Our work also contributes to the new OECD international project on measuring distribution in the national accounts and the OECD initiative on inclusive growth. In support of the OECD Expert Group on Distribution in the National Accounts, the results of this paper will be expanded to include demographic distributions and additional details on the various income components.

Future work includes the analysis of the matched household data with the tax records to obtain a more complete measure of income underreporting (see Fixler and Johnson (2014)). A more complete method of determining the aggregate impacts of the joint distribution of income and consumption requires similar decompositions of PCE and personal income that rely on the distribution of the household survey data. In addition, this project will be expanded to incorporate the Integrated Macro Accounts and construct consistent distributions of income, consumption and wealth. With these complete distributions, we will be able to produce estimates of the average propensity to consume by quintiles of income and further examine the macroeconomic relationships between growth and the distribution of income and consumption. This information, along with the attending marginal propensities to consume is relevant for the policy discussions that rely on the magnitude of the expenditure multipliers for different income categories.

References:

Atkinson, A., Piketty, T., and Saez, E., 2011, "Top Incomes in the Long Run of History, Journal of Economic Literature, 49:1, pp 3-71.

Australian Bureau of Statistics: Methodology Advisory Committee. 2004. "Statistical Matching of the HES and NHS: An Exploration of Issues in the Use of Unconstrained and Constrained Approaches in Creating a Basefile for a Microsimulation Model of the Pharmaceutical Benefits Scheme."

Bar, R. S. and S. J. Turner. 1981. "Microdata File Merging Through Large-Scale Network Technology." *Mathematical Programming Study* 15: 1-22.

Budd, E. C. 1971. "The Creation of a Microdata File for Estimating the Size Distribution of Income. *Review of Income and Wealth* 17: 317-333.

Budd, E. and Radner, D., 1975, "The Bureau of Economic Analysis and Current Population Survey Size Distributions: Some Comparisons for 1964," in *The Personal Distribution of Income and Wealth*, James D. Smith, ed., NBER 1975.

Buhmann, B., Rainwater, L., Schmauss, G., and Smeeding, T., "Equivalence Scales, Well-being, Inequality, and Poverty: Sensitivity estimates across Ten Countries Using the Luxembourg Income Study Database," *Review of Income and Wealth*, 34, 115-142, 1988.

Burkhauser, R., Larrimore, J. and Simon, K., 2010, "A "Second Opinion" On The Economic Health Of The American Middle Class" NBER Working Paper 17164.

Boushey, H. and Hersh, A. 2012, The American Middle Class, Income Inequality, and the Strength of Our Economy New Evidence in Economics," Center for American Progress report, May 2012

Boushey, H. and Price, C. 2014, How are Economic Inequality and Growth Connected?, Washington Center for Equitable Growth, October 2014.

Cline, W.R. 1970 "The Potential Effect of Income Redistribution on Economic Growth in Six Latin American Countries", Discussion Paper No. 13, Woodrow Wilson School, Princeton University

Conference on Research in Income and Wealth, 1943, "Comparability and Deficiencies of Existing Data and the Construction of a Size Distribution for the United States," in *Income Size Distributions in the United States, Part I*, NBER, 1943.

Congressional Budget Office, 2012, "The Distribution of Household Income and Federal Taxes, 2008 and 2009, *CBO report*, 2012.

Congressional Budget Office, 2013, "The Distribution of Household Income and Federal

Taxes, 2010, *CBO report*, 2013.

Council of Economic Advisors, 2012, *Economic Report of the President, 2012*, GPO.

Council of Economic Advisors, 2015, *Economic Report of the President, 2015*, GPO.

Cynamon, B.Z and Fazzari, S.M. 2014. "Household Income, Demand, and Saving: Deriving Macro Data with Micro Data Concepts," (March 27, 2014). Available at SSRN: http://ssrn.com/abstract=2211896.

Cynamon, B.Z and Fazzari, S.M. 2014. "Rising Inequality, Demand, and Growth in the US Economy," working paper, Institute for New Economic Thinking.

Denk, M. and P. Hackl. 2003. "Data integration and Record Matching: An Austrian Contribution to Research in Official Statistics." *Austrian Journal of Statistics* 32: 305:321.

D'Orazio, M., M. Di Zio, and M. Scanu. 2001. "Statistical Matching: A Tool for Integrating Data in National Statistical Institutes." *Procedings of the Joint ETK and NTTS Conference for Official Statistics*. Crete.

de Domininics, L., Florax, R.J.G., and de Groot, H, L.F, 2008, "A Meta-Analysis on the Relationship between Income Inequality and Economic Growth" *Scottish Journal of Political Economy,* 55:005, 654-682

DeNavas-Walt, Carmen and Bernadette D. Proctor, U.S. Census Bureau, Current Population Reports, P60-249, Income and Poverty in the United States: 2013, U.S. Government Printing Office, Washington, DC, 2014.

Fesseau, M., and Mattonetti M-L. (2013), Distributional Measures across Household Groups in a National Accounts Framework, Working Paper n°53, Paris: OECD. http://www.oecdilibrary.org/economics/oecd-statistics-working-papers_18152031

Fisher, J., Johnson, D., and Smeeding, T.M. (2014). `Inequality of Income and Consumption: Measuring the Trends in Inequality from 1984–2011 for the Same Individuals.' *Review of Income and Wealth*, forthcoming

Fitzwilliams, J.M., 1964. "Size Distribution of Income in 1963," Survey of Current Business, Vol. 44, No. 4, April 1964.

Fixler, D. and Johnson, D. 2014. "Accounting for the Distribution of Income in the US National Accounts" in *Measuring Economic Stability and Progess*, D. Jorgenson, J. S.Landefeld, and P. Schreyer, editors, forthcoming from University of Chicago Press.

Furlong, K. "Synthetic Data - Unconstrained Statistical Matching: Technical Appendix, BEA unpublished document, 2012.

Gallo, C. 2002, Economic Growth and Income Inequality: Theoretical Background and Empirical Evidence", Working Paper No. 119, Development Planning Unit, University College, London

Galor, O. and J. Zeira,, 1993 "Income Distribution and Macroeconomics," *The Review of Economic Studies,"* 60: 35-52

Goldsmith, S., 1955, "Income Distribution in the United States, 1950-53," *Survey of Current Business*, March 1955.

Goldsmith, S., 1960, "Size Distribution of Personal Income, 1956-59," *Survey of Current Business*, April 1960.

Goldsmith, S., 1957, "Changes in the Size Distribution of Income," *The American Economic Review* 47:2, pp 504-518.

Goldsmith, S., 1958, "The Relation of Census Income Distribution Statistics to Other Income Data," in *An Appraisal of the 1950 Census Income Data*, CRIW ed, NBER.

Haig, Robert M., "The Concept of Income—Economic and Legal Aspects". *The Federal Income Tax*. New York: Columbia University Press. pp. 1–28, 1921.

Hardy, B. and Johnson, D. 2015, "Inequality in America: The Role of National Income, Household Income, and Transfers," forthcoming manuscript.

Johnson, D. and Smeeding, T., "Income Distribution and Inequality: Measurement Issues," in *The International Encyclopedia of the Social and Behavioral Sciences*, 2nd ed., 2014.

Jones, C., 2015. "Pareto and Piketty: The Macroeconomics of Top Income and Wealth Inequality." *Journal of Economic Perspectives*, 29(1): 29-46.

Jorgenson, D. W., 1990, "Aggregate Consumer Behavior and the Measurement of Social Welfare," *Econometrica*, 58:5, pp. 1007-1040.

Kadane, J. B. 2001. "Some Statistical Problems in Merging Data Files." *Journal of Official Statistics* 17: 423-433.

Katz, A., 2012, "Explaining Long-term Differences between Census and BEA Measures of Household Income," BEA Working paper.

Kuznets, S. 1955. "Economic Growth and Income Inequality," *The American Economic Review*, Vol. 45, No. 1, pp. 1-28.

McCully, Clint. 2014. "Integration of Micro and Macro Data on Consumer Income and Expenditures," in *Measuring Economic Stability and Progess*, D. Jorgenson, J. S.Landefeld, and P. Schreyer, editors, forthcoming from University of Chicago Press.

Meyer, B. and J. Sullivan, "The Material Well-Being of the Poor and Middle Class Since 1980," AEI Working Paper #2011-04, 2011.

Moriarity, C. and F. Scheuren. 2001. "Statistical Matching: A Paradigm for Assessing the Uncertainty in the Procedure." *Journal of Official Statistics* 17: 407-422.

Moriarity, C. and F. Scheuren. 2003. "A Note on Rubin's Statistical Matching Using File Concatenation with Adjusted Weights and Multiple Imputations." *Journal of Business and Economic Statistics* 21: 65 – 73.

OECD (2011), *Divided We Stand: Why Inequality Keeps Rising*, OECD Publishing

OECD (2012), "Reducing Income inequality while boosting economic growth: Can it be done?" in *Economic Policy Reforms 2012*, OECD, 2012.

OECD (2014), "Focus on Inequality and Growth - December 2014." Online access www.oecd.org/social/inequality-and-poverty.htm

Office of Business Economics, *Income Distribution in the United States by Size, 1944-1950*, Washington: U.S. GPO, 1953.

Okner, B. A. 1972. "Constructing a New Data Base from Existing Microdata Sets: The 1966 MERGE File." *Annals of Economic and Social Measurement* 1: 1972.

Piketty, T. 2014. *Capital in the Twenty-First Century* Belknap Press.

Piketty, T. and E. Saez, "Income Inequality in the United States, 1913-1998," *Quarterly Journal of Economics*, 118(1), 1-39, 2003.

Sabelhaus, J., D. Johnson, S. Ash, D. Swanson, T. Garner, J. Greenlees, and S. Henderson, "Is the Consumer Expenditure Survey Representative by Income?" in *Improving the Measurment of Consumer Expenditures*, C. Carroll, C., T. Crossley, and J. Sabelhaus, editors, forthcoming from University of Chicago Press, 2014.

Radner, D.B., and Hinrichs, J.C., "Size Distribution of Income in 1964, 1970 and 1971, Survey of Current Business, April 1974.

Radner, D. B. 1981. "An Example of the use of Statistical Matching in the Estimation and Analysis of the Size Distribution of Income." *The Review of Income and Wealth* 27: 211-242.

Rodgers, W. L. 1984. "An Evaluation of Statistical Matching." *Journal of Business and Economic Statistics* 2: 91-102.

Rubin, D. B. 1986. "Statistical Matching Using File Concatenation with Adjusted Weights and Multiple Imputations." *Journal of Business and Economic Statistics* 4: 87-94.

Ruggles, N. and R. Ruggles. 1974. "A Strategy for Merging and Matching Microdata Sets."

Annals of Economic and Social Measurement 3: 353-371.

Saez, E. and Zucman, G., "Wealth Inequality in the United States since 1913: Evidence from Capitalized Income Tax Data," NBER Working Paper 20625, 2014.

Sandmo, A. 2013, The Principal Problem in Political Economy: Income Distribution in the History of Economic Thought", Norwegian School of Economics, available at SSRN: http://ssrn.com/abstract=2337488

Simons, Henry, *Personal Income Taxation: the Definition of Income as a Problem of Fiscal Policy*. Chicago: University of Chicago Press, 1938.

Standard and Poors, "How Increasing Income Inequality Is Dampening U.S. Economic Growth, And Possible Ways To Change The Tide," S&P Economic Research, Aug 2014.

Stiglitz, J.E., Sen, A., Fitoussi, J. 2009. *Report by the Commission on the Measurement of Economic Performance and Social Progress*. United Nations Press

Yellen, Janet. 2014. "Perspectives on Inequality and Opportunity from the Survey of Consumer Finances," Remarks at the Conference on Economic Opportunity and Inequality, Federal Reserve Bank of Boston.

Zucman, G. "Distributional National Accounts," Presentation at the American Economic Association, January, 2015.

Category	Source	Addition/ Subtraction	Coverage Factors
Wage and salary disbursements	CPS	Add	0.9915
Farm	CPS	Add	0.9896
Nonfarm	CPS	Add	0.9912
Other private business rental income (includes tenant-occupied housing & royalties)	CPS	Add	0.9786
Received by persons including fiduciaries, IRA-KEOGH, mutual fund private pensions	CPS	Add	0.9775
Household dividend income	CPS	Add	0.9784
Social security /1/	CPS	Add	0.9483
Unemployment insurance	CPS	Add	0.9875
Railroad retirement	CPS	Add	0.9875
Pension benefit guaranty	CPS	Add	0.9875
Veterans' life insurance	CPS	Add	0.9875
Workers' compensation	CPS	Add	0.9865
Temporary disability insurance	CPS	Add	0.9875
Veterans pension and disability	CPS	Add	0.9875
Veterans readjustment (education & training)	CPS	Add	0.9875
Black lung benefits	CPS	Add	0.9875
Supplemental security income	CPS	Add	0.9875
Other public assistance and income maintenance	CPS	Add	0.9875
Education assistance	CPS	Add	0.9875
All other government social benefits	CPS	Add	0.9875
Household current transfer receipts from NPISHs	CPS	Add	0.9841
Alimony received	CPS	Add	1.0000
Child support received	CPS	Add	1.0000
Medicare /2/	CPS	Add	0.7062
Medicaid	CPS	Add	0.7008
Group health insurance	CPS	Add	0.9865
Old-age, survivors, disability, and hospital insurance	CPS	Add	0.9893
Military medical insurance	CPS	Add	1.0000
Military medical insurance	CPS	Add	1.0000
Other state & local medical care	CPS	Add	0.9875
Supplementary medical insurance (Medicare)	CE	Subtract	0.9907
Pension and profit sharing	CPS	Add	0.9728
From employee pension plans	CPS	Add	0.9775
Imputed interest received by households from depository institutions	CE	Add	0.9775
RICs to persons	CE	Add	0.9775
RICs to private pensions	CPS	Add	0.9775
Life insurance carriers	CE	Add	0.9775
Imputed interest received from property and casualty insurance companies	CE	Add	0.9772
From employee pension plans	CE	Add	0.9972
Group life insurance	CPS	Add	0.9757
Rental value of owner-occupied dwellings	CE	Add	0.9786
Intermediate expenses	CE	Subtract	0.9786
Taxes on production & imports less subsidies	CPS	Subtract	0.9786
Current transfer payments (net insurance settlements)	CE	Subtract	0.9786
Net interest	CE	Subtract	0.9786
Consumption of fixed capital	CE	Subtract	0.9786
Alaska dividend payments	CPS	Add	0.9875
Workers' compensation	CPS	Add	0.9865
Supplemental unemployment	CPS	Add	0.9865
Other	CPS	Add	0.9906
Supplemental Nutrition Assistance Program (SNAP) (formerly Food Stamps)	CPS	Add	0.9785
Refundable tax credits	CPS	Add	0.9875
Energy assistance	CPS	Add	0.9875
WIC Food	CPS	Add	0.9875
Retired military personnel & dependents at nonmilitary facilities	CPS	Add	0.9875
State & local employment & training	CPS	Add	0.9785
Other current transfer receipts, from business (net)	CE	Add	0.9841
Employer's actual social contributions	CPS	Subtract	0.9896
Employee's actual social contributions	CPS	Subtract	0.9904
Self-employed	CPS	Subtract	0.9907
Pseudo Money			
Health related adjustments			
Financial related adjustments			
Transfer program adjustments			