Accounting for the Distribution of Income in the U.S. National Accounts

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"The welfare of a nation can, therefore, scarcely be inferred from a measurement of national income…."

Simon Kuznets, 1943

"Measured GDP growth is not the only contributor to the quality of life that Americans seek to enjoy."

Economic Report of the President, 2012

Frequent headlines present rising per capita Gross Domestic Product (GDP) and frequent newspaper articles present people who have not shared equally in this growth (see Gertner (2010) and Reinhardt (2011)). This disconnect between aggregate growth and its distribution to individuals has been amplified during the past few years, fueled by the Great Recession. It has further motivated a movement to examine measures of individual well-being that go beyond GDP per capita. For example, the United Nations voted (in resolution 65/309) to create a Gross National Happiness index[1] because "the gross domestic product does not adequately reflect the happiness and well-being of people."

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 the 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). The Stiglitz report suggests that the "time is ripe for our measurement system to shift emphasis from measuring economic production to measuring people's well-being."

Recent data show that real per-capita GDP increased 65 percent in the past 30 years, while median household income rose only 11 percent. In the past decade (between 1999 and 2010), real mean household income (from the Census Bureau) fell 5.7 percent, while real per

[1] See http://www.grossnationalhappiness.com for a description of the gross national happiness index developed by the Center for Bhutan studies.

capita personal income (from the Bureau of Economic Analysis (BEA)) increased 11.1 percent (see Figure 1). And the recent CBO (2012) report shows that using a comprehensive income measure, average income decreased 0.5 percent between 1999 and 2009. Reconciling these divergent trends is one goal of this paper.

The BEA's national accounts measures are often interpreted at the microeconomic level as information on the behavior of representative consumers; however, most of the economic well-being literature requires (and measures of inequality require) more information about households across the income distribution. The question is whether the changes in the aggregate levels of economic activity are adequate indicators of the changes in individual well-being.

This relationship between macroeconomic growth and income inequality has been the focus of many recent studies (see OECD (2011), Boushey and Hersh (2012)), and part of the impetus for the Occupy Wall Street movement. The concern is whether a rising tide is lifting all boats equally. While most studies agree that "the rich have gotten richer," the issue is whether those on the lower levels of the distribution have also experienced an improvement in their economic well-being. The question is if growth and inequality have both increased, how has overall economic well-being changed?[2]

There is considerable disagreement regarding the relationship between inequality and growth. As stated in a recent OECD report (OECD (2012), "Despite a vast theoretical literature on the link between inequality and growth, no general consensus has emerged and the empirical evidence is rather inconclusive." The Stiglitz (2009) report states: "If inequality increases enough relative to the increase in average per capita GDP, most people can be worse off even though average income is increasing." However, Lucas (2004) disagrees stating: "But of the vast

[2] In this paper we focus on income but many look to the distribution of consumption as the measure of well-being. See for example Meyer and Sullivan (2011), Fisher et al. (2012)

increase in the well-being of hundreds of millions of people that has occurred in the 200-year course of the industrial revolution to date, virtually none of it can be attributed to the direct redistribution of resources from rich to poor."

The 2012 *Economic Report of the President* suggests that redistribution from high income to lower income households could increase aggregate spending, and hence, growth. The report suggests that the differences in the propensities to consume between income levels could create this difference. For example, the rise in income inequality may reduce aggregate demand because the highest income earners typically spend a lower share of their income—at least over intermediate horizons—than do other income groups. How the size distribution of income affects aggregate consumption, and hence, growth, is not clear.[3] Blinder (1975) provides the conditions under which a redistribution would lead to increased aggregate consumption. His empirical results suggest, however, that a rise in income inequality, holding disposable income constant, would either have no effect on consumption or would actually increase it.

The main issue with relating growth and inequality is to have comparable measures of both and that is the focus of this paper. We examine the distribution and movement of household income, as measured by Personal Income, and how it influences the movements of Gross Domestic Income (GDI), and hence GDP. As proposed by BEA (BEA (2012)), we undertake "a decomposition of personal income that presents median as well as mean income and other measures of the distribution of income across households." With the distributional aspects of personal income, one can examine how various changes in policy may impact households at

[3] See Dynan (2012b) and Pistaferri and Saporta-Eksten (2012)

various points in the distribution. Just as BEA creates a decomposition of personal income across states and geography, this paper provides a decomposition across the income distribution.[4]

Since its inception, the Conference on Research in Income and Wealth (CRIW) of the National Bureau of Economic Research (NBER) has been a leader in the evaluation of the distribution of income and its relationship to the national accounts.[5] This paper follows in that tradition and contributes by bringing together the relevant literature on the distribution of national accounts and the measurement issues associated with household income compared to national income, creating alternative measures of the median and distribution of personal income and suggesting simple methods that could be reproduced regularly. This paper provides distributional measures of personal income, which can then inform research to determine whether the growth rate of GDI depends on changes in the income distribution.

This paper presents simple methods to adjust the household survey (Current Population Survey (CPS)) to more closely match the national accounts measure of personal income. Using the underlying distribution in the CPS along with these adjustments yields a higher mean and median adjusted household income than the reported household income, and yields a larger increase in inequality. Adjusting the distribution by the income distribution available from tax records, increases inequality further, but does not change the trend. Finally, creating a more complete measure of personal income by imputing the value of in-kind health care benefits yields a smaller increase in inequality.

We include two applications that discuss how income inequality might matter in determining social welfare and gauging the efficacy of fiscal policy. Sen's (1973) original social welfare function requires estimates of both income growth and inequality; we use our estimates

[4] In fact, one could use the geographic decomposition to estimate a national distribution, which is the focus of future research.
[5] In fact, the first NBER volume (Mitchell et al. (1921)) was devoted to income distribution.

to examine Sen-type social welfare functions. Since Keynes' introduction of the expenditure multiplier, there has been much focus on its size; Modigliani and Brumberg (1954) and Friedman (1957) thought differences in income were important, and Conrad (1955) specifically examined the role of the income distribution. Using a simple framework, we show how our estimates can be used to examine whether the income distribution can affect an expenditure multiplier.

The next section of this paper presents alternative the measures of income, previous research, and the implications of measurement error in the household data. The second section discusses the data and the results. The third and fourth sections provide applications of our results to calculating a social welfare function and a fiscal multiplier, and the final section concludes this paper.

I. Measuring Income

BEA is responsible for producing the aggregate statistics on income growth, while the Census Bureau releases the distributional measures along with the growth in median household income. Each agency, however, uses a different measure of income. Income distribution and aggregate growth were not always separate estimates (see Goldsmith (1955), (1958) and (1960)); the Office of Business Economics (the predecessor to BEA) produced annual estimates of the income distribution from 1950-1962.

Since the development of national accounts, income distribution has been important in examining growth. Kuznets (1955), 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." The Canberra Report, the report of an expert group recommending an income measure to use in income distribution estimates, stated that the original "…intention of the SNA [System of National Accounts] was to include a

disaggregation of household income by socio-economic group as a standard part of national accounts output.…"

In order to fully evaluate the distribution and growth in income, however, we need comparable measures of income. As discussed in NBER (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 and (2) the change in the value of the store of property rights between the beginning and end of the period in question."

Economists have used the equation that income (Y) equals consumption (C) plus the change in net worth (ΔW) as the working definition of Haig-Simons income ($Y = C + \Delta W$). No household survey, however, has the necessary variables to create a full measure of Haig-Simons income. In an attempt to relate all three components, the Canberra Group Handbook on Household Income Statistics (2011) states: "Household income receipts are available for current consumption and do not reduce the net worth of the household through a reduction of its cash, the disposal of its other financial or non-financial assets or an increase in its liabilities." Similarly, 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." To create international standards on this Haig-Simons equation, the OECD has organized two expert

groups on (1) micro statistics on household income, consumption and wealth, and (2) disparities in the national accounts.

The focus of this paper is to evaluate the level, trend, and distribution of personal income (as measured by BEA). Personal income, which consists mainly of compensation, transfer payments received, and investment income, has averaged about 85 percent of GDI over the period 1980 to 2010. Assuming that the distribution of the extra components in GDI (beyond those in personal income) are similarly distributed, one can use the distribution of personal income to examine how various changes in policy may affect households at various points in the distribution of GDI.[6]

There are a multitude of income measures used by researchers and the government. Table 1 compares Personal Income, Census money income, the CBO income measure, and Adjusted Gross Income (AGI) to a Haig-Simons measure and the international measure recommended by the Canberra Group (Canberra (2011)). As Table 1 shows, there are many components of income that are included in the measures. The first column shows those included in a Haig-Simons definition of income. Only three components are included in all income measures – employment income, investment income, and cash transfers from the government.

Looking at Table 1, the main differences in the income definitions are the treatment of imputed income, retirement income, capital gains (realized and unrealized), unrealized interest on property income and the inclusion of government and in-kind transfers. Even the Canberra definition, which is viewed as the standard in international comparisons, is different than the BEA definition, which follows the SNA.

[6] Figure 2 shows that the difference between GDI and Personal Income has remained fairly constant between 1999 and 2010, with personal income increasing 23.4 percent while GDI increased 21.6 percent.

Since the Census Bureau has issued its first reports on income, the Bureau has distinguished between BEA's personal income measures and the CPS household income measures.[7] Personal income is the income received by persons from participation in production, from government and business transfers, and from holding interest-bearing securities and corporate stocks. Personal income also includes income received by nonprofit institutions serving households, by private non-insured welfare funds, and by private trust funds. The CPS measure of money income, produced by Census, is defined as the total pre-tax money income received by people on a regular basis, excluding certain lump-sum payments and excluding capital gains.

One of the main differences among the various definitions is the treatment of retirement income. Consider an elderly person with both a savings account and a defined contribution retirement account. The interest on these accounts will be counted as income in all measures. The regular withdrawal (or payment) will be included in two measures -- Haig-Simons and Canberra. If the person withdraws more money from his retirement accounts, this will be recorded as income only in the Haig-Simons, CBO, and Canberra measures. Finally, if the retiree withdraws money from his or her savings account, this will only be included in Haig-Simons income because these savings withdrawals are actually decreases in net worth that will be spent. However, with other definitions of income, one would observe consumption increases with no change in 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

[7] The first P60 reports (Census (1948)) stated: "The purpose of the Census data is to show the distribution of families and persons by income levels. They do not show estimates of aggregate income. The Office of Business Economics estimates, on the other hand, provide information on aggregate income received by the population. If an estimate of aggregate income were derived from Census Bureau data, it would be smaller than that shown in the personal income series…"

(2011), CBO (2012), Piketty and Saez (2003), and Smeeding and Thompson (2011), Wolff et al. (2012)). Two recent papers present alternative measures of a more comprehensive income. Wolff et al. (2012) construct the Levy Institute Measure of Economic Well-being (LIMEW) as the sum of Census money income, income from wealth, net government expenditures (both cash and non-cash transfers and public consumption, net of taxes), and household production. The "more complete income" (MCI) concept in Smeeding and Thompson (2011) is based on Haig-Simons income and estimated using Survey of Consumer Finance data. They define MCI as earnings and net transfers and include that portion of capital income received as capital gains and royalties. They subtract reported interest, rent, and dividends and include an imputed return to all forms of net worth in order to capture the concept of the change in net worth. This combines the two approaches used by BEA and CBO regarding capital income, including both capital gains and imputed interest. Using MCI, Smeeding and Thompson (2011) find a larger concentration of income at the top of the distribution. Wolff et al. (2012) also show a larger increase in the mean and median using more comprehensive measures of income (see also Burkhauser et al. (2010)).

Adjustments for "real" and equivalent income

Once a measure of income is determined, there are two key measurement choices that must be made in evaluating the trends and distribution in income. These choices are crucial to making comparisons over time with changing cost of living and changing demographics. The cost-of-living adjustments are made by converting dollars into constant terms using a price index, while the demographic changes are made by adjusting by household size with an equivalence scale that adjusts for the economies of scale in a household.

Slesnick (2001), Meyer and Sullivan (2011), and Broda and Weinstein (2009) show the important impact that alternative price indexes have on the increase in the mean and median, and on the inequality measures. The Census Bureau uses the CPI-U-RS to deflate household income and produce a series of mean and median income in constant dollars, and BEA uses the PCE deflator. For example, real median household income, using the CPI-U-RS, increased 10.8 percent between 1980 and 2010. However, because the PCE deflator increases less than the CPI-U-RS, if the PCE deflator is used to convert income into constant dollars, the respective increase in median household income would be 17.3 percent. Meyer and Sullivan (2011) and Boskin et al. (1996) suggest that the CPI-U (and hence, CPI-U-RS) is biased upward by 0.8 to 1.2 percentage points per year. Meyer and Sullivan (2011) use an alternative price index that adjusts the CPI-U-RS downward by 0.8 percentage points per year. Using this alternative index to create real median income yields a 40 percent increase between 1980 and 2010. Because our focus is on producing a national accounts based income distribution, we use the PCE to convert all income into constant 2010 dollars.[8]

The second adjustment that is required is to account for the changes in household size over time and the respective economies of scale that may occur within households. Using a simple per-capita measure (as in per-capita personal income) does not deal with the economies of scale in the household and the household measure produced by the Census Bureau simply assumes perfect economies of scale in the household. Since household size has fallen over the past 30 years, if the household income is adjusted for household size using an equivalence scale, then the respective increase in the median income is 17.1 percent (compared to 10.8 percent without an adjustment). Using both the equivalence adjusted median and the PCE deflator yields

[8] The new CBO report on household income, CBO (2012), changed to using the PCE deflator to adjust for inflation instead of the CPI-U-RS.

a 23.9 percent increase between 1980 and 2010. In this paper, we report both the household measure and an equivalized measure of inequality using the square root of household size as the equivalence scale (see Fisher et al. (2012) and Buhmann et al. (1988)).

Reconciling household and aggregate income

During the first years of the CRIW, a conference was organized and a volume produced on the size distribution of income (CRIW (1943)). This volume began with a chapter by Kuznets entitled "The Why and How of Distributions of Income by Size." The volume also includes a chapter that presents one of the first uses of multiple data sources to "…give a reasonably reliable estimate of the distribution of income among all individuals or families in the country."

CRIW has been involved in evaluating income distribution and its impact on the national accounts for its entire history. A few volumes have been devoted to distributional issues and this new conference will produce a volume with continued research on this topic.[9] In the 1975 volume, Budd and Radner (1975) present a method to use both CPS and IRS data to construct a distributional measure for the national accounts. By adjusting income by tax records, they find higher mean income and more families with high income than in the survey data. However, the income distribution shifts in such a manner as to yield a lower inequality measure than that found in the survey data.[10]

In the spirit of these first volumes, from 1950-1962, the Office of Business Economics produced annual measures of the income distribution in the US. Goldsmith creates a distribution measure and continues with regular releases in the Survey of Current Business (see Goldsmith

[9] Juster edited a CRIW volume in 1975 on The Distribution of Economic Well-being," and in 1980, Smith edited one on "Modeling the Distribution and Intergenerational Transmission of Wealth," and David and Smeeding, edited "Horizontal Equity, Uncertainty, and Economic Well-Being" in 1985.

[10] For example, using the tables shows that the adjusted Gini is lower than the Gini from the CPS. The adjustment basically shifts the entire distribution to the right.

(1955) and (1960)). These estimates also show higher mean incomes than those in the CPS, but the inequality measures, both levels and trends, are similar to those in the CPS data.

There are various methods to obtain a distribution of aggregate data. In all cases, one needs both the aggregate data and a household survey. Fesseau (2009) and Accardo et al. (2009) use distribution of survey data to create a distribution for national account data in France. This relies on the assumption that the distribution in the household survey is the same as in the national accounts. Landefeld et al. (2010) create a median discretionary income measure using the distribution in the IRS Statistics of Income (SOI) tables. Coli and Tartamella (2010) and McColl et al. (2010) both attempt to reconcile survey and national accounts data for Italy and Australia. Other methods are to create a Social Accounting Matrix (as in Mussard and Savard (2010)) or to use a reweighting procedure to adjust the survey estimates of inequality (as in Robilliard and Robinson (2003). The method presented in this paper uses a household survey and benchmarks it to the aggregate totals.

Underreporting in household surveys

Katz (2012) shows that the changes in Census household income are similar to a comparable measure of personal income between 1980 and 1999, but diverge in recent years. He suspects that much of the difference occurs because of capital income (interest, dividends, etc.) One possible reason for the difference in both the distribution and the growth rates can be the underreporting of income in the CPS. Meyer, Mok, and Sullivan (2008)) state that for all surveys examined (including the CPS) they "…find that under-reporting is common and has increased over time…."

Recently, there have been papers that attempted to reconcile differences between the BEA and Census measures of household income. Weinberg et al. (1999), Wheaton (2007), and

Ruser et al. (2004) examine the quality of CPS data. Ruser et al. (2004), a joint effort between BEA and Census, demonstrates that the CPS under-estimates the income in the National Accounts data for many components. They construct a reconciliation between BEA personal income and Census household income, and show that most of the discrepancy is due to definitional differences. However, the remaining differences can be due to the different sources, which could suggest that the administrative tax data may better represent the distributional aspects of GDI.

The presence of underreporting (measured as the difference between the survey data and the aggregate data) will not only affect the means and growth rates of income, but will also impact the change in inequality. As shown in Bound et al. (2001) and Gottschalk and Huynh (2010), if measurement error is classical, independent of income (or consumption), then an increase in error will increase inequality (and measured inequality could be biased upward). Gottschalk and Huynh (2010), however, extend this result to non-classical measurement error, which could be mean reverting. In this case, it is not clear whether measurement error (or an increase in error) increases inequality. Hence, increased measurement error can imply an increase or a decrease in inequality of the reported resource measure. If the measurement error is correlated with income, such that higher income households are increasingly likely to underreport their income, then mean reversion in measurement error increases. As a result, measured inequality (and increases in inequality) could be biased downward.

II. Data and Results

To construct measures of income and its distribution, we use the CPS Annual Social and Economic Supplement (ASEC). The CPS/ASEC includes about 100,000 households who are interviewed from February to April of each year and asked about the previous year's income.

While some of the tables and figures depict income and inequality since 1980, we focus on the 1999-2010 period. During this period, the ratio of aggregate CPS income to personal income fell from 74 percent to 65 percent after remaining fairly constant between 1980 and 1999 (see Figure 2 and Katz (2012)).

There are important conceptual differences between BEA's measure of real personal income and the Census Bureau's measure of real money income. Many components of personal income are not included in money income and a number of components of money income are not included in personal income (see Katz (2012)). Conceptually, BEA personal income measures the income of the entire household sector and non-profit institutions serving households (NPISHs). In contrast, the money income concept at the Census Bureau measures the incomes of individual families and persons, which can be used to examine the distribution of income across all families and persons (excluding people in institutions).

To directly compare the income estimates in the CPS to those in the national accounts, we need to use comparable income measures. We follow Katz (2012) to construct an adjusted personal income measure (see Table 2) and compare it to a similar measure in the CPS. As shown in Table 2, most of the adjustments take various types of in-kind income out of personal income, including employer benefits, government in-kind transfers, imputed rent from owner-occupied housing, and imputed interest from life insurance reserves. In addition, pensions are measured by benefits paid rather than by employer contributions to pension funds and the income earned on the plan assets (reserves) and employee contributions to social insurance are added back into personal income because they are included in money income, but not personal

income. Adjustments are also made to take out the income of non-profit institutions and to add in transfers between and among households.[11]

With these adjustments, the levels are more similar (as shown in Figures 1 and 2) and the trends from 1980-2010 show both series increasing at similar rates between 1980 and 1999, but diverging between 1999 and 2010, with the ratio falling from 89 percent to 80 percent. Table 2 shows that personal income increased 23.4 percent between 1999 and 2010, while adjusted income increased 21.2 percent because the adjustments increased 33.5 percent between 1999 and 2010, with one of the largest increases being the doubling of government transfers of health care.[12]

We assume that the household survey data are underreported because the aggregate estimates are less than those obtained in the national accounts data. A simple method to obtain a distribution of personal income from the national accounts is to use the income distribution in the CPS. In this case, the mean and median are simply ratio adjusted by the same amount (and hence, inequality remains unchanged).

Another simple method would be to use the median adjusted gross income (AGI) in the SOI tables. Figure 1 shows the changes in the mean and median AGI from the SOI tables between 1999 and 2009 (the latest year available) and compares these to the CPS income measures. As shown, the median AGI falls 1.5 percent compared to a fall of 3.3 percent for CPS median income. In addition, similar to the CPS mean income, mean AGI falls by 2.9 percent and is much more volatile than personal income (mainly due to the inclusion of capital gains in AGI).

Landefeld et al. (2010) follows a different approach and uses the distributional tax tables to obtain a change in median income by using the mean of the income category that includes the

[11] Semega (2012) shows a similar comparison between the Canberra Income and Household Income.
[12] Table 9 in Katz (2012) provides details on the components of income in the BEA measure and the CPS.

median taxpayer. They also adjust the reported income from the soi tables to include additional income sources in personal income. Because the adjustments are small, we can compare this approach to the changes in the median AGI presented in Figure 1. In contrast to the results in Figure 1 that suggest a decrease of 0.2 percent, Landefeld et al. (2010) find, for 2000-2007, "a rough measure of real after-tax income for the median income taxpayer rose at a 1.2 percent annual rate", which implies an approximate 8% increase.

In order to change the distribution in the CPS, different factors are needed for different households. Since the income composition varies at different points in the distribution, we could use alternative factors to ratio adjust the various sources of income. These adjustments could then change the overall distribution of income. Figure 5 shows the income shares by total income level in the CPS for 2010. This figure shows that the share of property and interest income is higher for the highest income group.

We consider two adjustment methods. First, consider, household i, with income, $y_i = \sum_{jk} \alpha_j y_{jki}$, where the adjustment 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 CPS income ($\alpha_j = Y_j/X_j$, 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 CPS). This procedure increases each household's income by source and the new adjusted household data is then used to obtain distribution measures.[13]

To illustrate, consider only one source of income, such as wages. Then the adjusted income for household i would simply be

Adjusted income for the i^{th} household = [NIPA wages/CPS wages] x CPS wages for household i.

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

Additional sources of income would simply be added to the right hand side. This procedure generates a NIPA based adjusted income series for households in the CPS and thereby yields an NIPA based income distribution.

These NIPA adjustments are shown in Figure 3. The adjustments for wages are fairly small,[14] but the adjustments for property income (interest and dividends) are large and increase over time. Since higher income households have more property income, which has a larger factor (see Figures 3 and 5), these households obtain a larger increase in their adjusted income, which can increase inequality.

One limitation of the above approach is that every household receives the same adjustment for each source of income even though it is likely that different households have different levels of underreporting. In addition, research has shown that there is a large underreporting at the top of the distribution (see Sabelhaus et al. (2012)). To assess these differences, we compare the distribution of income in the CPS to that in the SOI published tables.[15]

To illustrate the way we remove the limitation of a constant adjustment factor for each household source of income, we include another factor that adjusts for different income groups. Again, considering just wages, the adjusted income for household i, y_i becomes

$$y_i = \frac{NIPAwages}{CPSwages} \times \frac{\frac{SOIwages}{CPSwages}\Big|_{incomegroupk}}{\sum_k \frac{SOIwages}{CPSwages}\Big|_{incomegroupk}} \times wages_{CPS,i},$$

[14] Comparing the wage distribution (and levels), shows that the trend of wages in the CPS is similar to that in NIPA and SOI (see also Nichols et al. (2011), Turek et al. (2012), and Roemer (2000)).

[15] The adjustments used in this paper compare the average income by source for taxpayers ranked by their total AGI and compares these to the aggregate income by source for households in the CPS. Households and taxpayers are slightly different. Nichols et al. (2011) attempts to correct for the unit of analysis, and obtain similar ratios

where income group k follows from the level of CPS income for household i. In general, household i has income $y_i = \sum_{jk} \gamma_{jk}\alpha_j y_{jki}$, where the adjustment factors, α_j, depend on the source (as above), and $\gamma_{jk} = (Y_{jk}/X_{jk})/(Y_j/X_j)$, where Y_{jk} is the aggregate for source, j, for income group, k, in SOI tables and X_{jk} is the aggregate for source, j, for income group, k. As a result, the first adjustment factor, α_j, is augmented by the distributional information for the source-income combination from SOI data. Other sources of income would be added to the right hand side of the above equation in a similar manner, yielding NIPA based adjusted income series that derives from the CPS income data. From this series another distribution of income is obtained. As shown in Figure 4, the ratio of income in the CPS to that in the SOI tables falls with income and is 1.3 for the highest income.

To adjust income by different factors for each source and income level in our second adjustment method, we use the aggregate income by source for various levels of total AGI in the SOI tables (see "SOI Tax Stats - Individual Statistical Tables by Size of Adjusted Gross Income" at http://www.irs.gov/taxstats/indtaxstats/article/0,,id=96981,00.html). We allow the γ_{jk} to depend on various income levels (that is, the factors for each source can vary for different households across the income distribution). Since we want to benchmark to the aggregate personal income, the distribution factors are only used to redistribute income and are normalized so that the average factor is 1.

The results of these methods are shown in Table 3. As expected, the NIPA adjustments yield a higher mean and median; the mean NIPA adjusted household income is 21.4 percent higher than the Census money income, and the median is 17.5 percent higher. Although Census median household income falls 3.6 percent between 1999 and 2010, the NIPA adjusted household income increases 1.9 percent. The increase in the NIPA adjusted mean income

exceeds the increase in the NIPA adjusted median by more than the increases in the Census money income, which suggests that inequality increases more under the NIPA adjusted income.[16]

Using the SOI adjusted data increases the volatility of the mean and median (as can be seen in Figure 1), and hence, increases the volatility of the Gini coefficient shown in Table 5. Although the distribution of property income is highly skewed in the SOI data, the large factors for high income households are offset by similarly large factors for low income households (see Figure 4). Since the SOI data are only used to redistribute income, and the NIPA adjustments are used to benchmark income, the SOI adjusted mean increases at a rate similar to the NIPA adjusted mean. However, because of the slight u-shaped pattern in the factors shown in Figure 4, using these factors to adjust the CPS data yields a median SOI adjusted income that increases only 0.8 percent between 1999 and 2009 (see Table 3), compared to a 2.5 percent increase for the NIPA adjusted median.[17]

A more accurate method for adjusting for underreporting in the CPS would be to use the actual tax records data matched to the CPS.[18] Using the 2010 IRS 1040 data linked to the CPS data, we can compare the income distributions. Figure 6 shows that the ratio of CPS to IRS income is fairly constant until the higher levels of income. Similar to Sabelhaus et al. (2012), the largest differences are in the high income categories and using the tax data yields a larger Gini coefficient.[19]

While the money income measure produced by the Census Bureau excludes many of the components of income included in personal income, the Census Bureau attempts to impute some

[16] With a log normal distribution, the ratio of mean to median income represents a measure of inequality.
[17] 2009 is the latest year for which SOI data are available. Some of the differences between the Gini coefficients using the SOI adjusted income and the SOI tables is due to the differences between households and taxpayers.
[18] Sabelhaus et al. (2012) demonstrate that high income households are missing from the Consumer Expenditure Survey, and suggest that the CPS similarly suffers.
[19] The Gini coefficient in 2010 for the matched AGI tax income is .489 as compared to .449 for the AGI from the CPS. Further research includes obtaining data for 1999, and additional years to compare trends.

of these components. We can use these imputed values to obtain a more comprehensive measure of income, which contains items denoted in Table 1 (Table 1 denotes these items by footnote a, which includes the market value of Medicare and Medicaid, employer contributions to health insurance, and imputed value of home equity for homeowners.) Similar to Burkhauser et al. (2011) 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.[20]

All of these adjusted measures can then be used to determine inequality. Using the Gini coefficient is the most commonly used measure (see CBO (2011), Burkhauser et al. (2010), and Fisher et al. (2012)). Table 5 shows the Gini coefficients from these adjusted measures. Similar to the relationship between the mean and medians, the NIPA adjusted measure yields a larger increase in inequality (a 2.7 percent increase between 1999 to 2010 compared to 1.9 percent for the household income measure).

As shown in Table 4, the inclusion of imputed health care benefits (either from the employer or government) not only increases income, but also increases the change in income between 1999 and 2010. In addition, Table 5 shows that these income sources decrease inequality (and lower the increase in the trend) as they are more likely to accrue to low income households. The Census Bureau construct an alternative income measure of after-tax-and-transfer income that also includes the imputed value of Medicare, Medicaid, employer provided health insurance (definition 14), and shows a decrease in inequality between 1999 and 2009 (the latest year available).[21]

[20] Burkhauser et al. (2011) and Meyer and Sullivan (2011) show that the median has increased between 25% and 50% between 1979 and 2007; CBO (2011) shows a 20% increase; Census median household income increased only 11%.

[21] See http://www.census.gov/hhes/www/cpstables/032010/rdcall/toc.htm. For a complete description of Definition 14 see http://www.census.gov/hhes/www/poverty/prevcps/p60-186rd.pdf

Burkhauser et al. (2010) show that including the value of government health care benefits causes the change in inequality between 2000 and 2007 to increase less than the inequality using money income. Similarly, CBO (2011) shows that including health care benefits yields a smaller increase in inequality between 1999 and 2007. Using a more comprehensive income measure, Wolff et al. (2012) find a larger increase in the median income between 2000 and 2004 (an increase of 0.6 percent) compared to a decrease of 1 percent for the standard money income definition. Wolff et al. (2012) also find a smaller increase in inequality during this period.

To obtain a closer approximation of personal income, we could use the same adjustments to account for the imputed interest and employer provided retirement benefits. As shown in Table 2, these components account for most of the remaining difference between adjusted personal income and personal income. If we assume that these are distributed similar to wages and reported property income, we simply increase these two factors, α_{Wage} and $\alpha_{property}$. Table 4 shows that this more comprehensive measure increases the mean by 5.5 percent and the median by 6.5 percent.[22]

In sum, we began with the fact that over the past decade (between 1999 and 2010), the mean household income (from the Census Bureau) fell 5.7 percent, while per capita personal income (from the Bureau of Economic Analysis (BEA)) increased 11.1 percent, which can be construed as a difference of 16.8 percentage points with the assumption that persons per household is constant over time. Using a more comparable definition of income and national accounts data, we found that the mean adjusted real personal income per household increased 5.3 percent during this period. In comparison, using the CPS data and after taking into account

[22] An additional method to obtain a Gini is to decompose the Gini using alternative measures of the income components. Using Lerman and Yitzhaki (1985) and Liberati and Yitzhaki (2011), the Gini can be decomposed by source as $G = \sum S_j G_j R_j$, where is the share of source, S_j, in income, G_j is the Gini for source, j, and R_j is the correlation between the source and the total income. Using a variety of sources can then be used to estimate the separate factors, S, R, and the source-specific Ginis. One can then aggregate these factors to obtain the overall Gini.

differences in the price index, accounting for underreporting and incorporating distributional information from both the CPS and SOI data, we obtain an increase of 5.7 percent (between 2000 and 2009) so that the adjustments reduce the difference between national accounts and Census data on mean household income to 0.4%. In addition, with the adjusted measures of income there are larger increases in the median, yielding larger increases in inequality. However, as discussed above, the comparison is not straightforward when one considers imputations such as those for health benefits. There are two dimensions to the analysis: the reconciliation of published data and the definition of the "best" concept of income to use in determining well-being.

III. Determining a Social Welfare Function: an application

In his new book, *The Price of Inequality*, Stiglitz (2012) claims that rising inequality in the United States threatens economic growth. There has been much research on obtaining independent measures of various social welfare functions that depend on both the level of aggregate income and its distribution (see Sen (1973), Jorgenson (1990), Jones and Klenow (2011)). All of these measures attempt to aggregate the mean level of growth with changes in the distribution as measured by an inequality index (like the Gini).

Over the past three decades, the Gini coefficient increased along with per-capita GDP, with a correlation of .92. Sen (1973) recommends a social welfare function (SWF) that is simply the product of mean income, μ, and a measure of equality given by (1 – Gini). Many studies have recommended using a similar SWF, or indicator of social welfare. Jorgenson (1990) constructs a consistent SWF such that "…the individual welfare function and the individual expenditure function can be used to construct measures of the household standard of living and its cost." He then uses the same data and structure to estimate an equity index to obtain a SWF

measure as the product between adjusted expenditures and equity, which is similar to Sen's SWF.

Jones and Klenow (2011) follow a different approach and construct a SWF for a variety of countries using GDP, the Gini indexes, and other factors. Their data suggest that the Sen SWF (using the product of per capita GDP and (1 - Gini index)) yields a correlation (for a variety of countries) between the Jones and Klenow (2011) SWF and Sen's measure of .95.

If aggregate income growth is the result of increases in the income for households at the top of the distribution, then this growth may be offset by increases in inequality, which could yield a smaller increase in the SWF. That is, if inequality increases, then the equity index (using 1-G) falls, which diminishes the growth of SWF. For example, using a simplified SWF as the product of real per-capita GDP and (1- the Census Gini for money income), SWF increases about 48 percent between 1980 and 2009 (per-capita GDP increases 65 percent and the Gini increases 16 percent). However, using the more comprehensive measure of household income from CBO (2012), which increases 20 percent, yields a 35 percent increase in SWF.

In order to completely evaluate the relationship between inequality and growth, we need measures of both using similar concepts (as in Jorgenson (1990)). Many attempts have been made to create a summary welfare measure using GDP growth and distributional measures from household surveys. However, if there is measurement error, then inequality can be biased upward or downward, depending on the level of mean reversion. And if error is increasing over time, then inequality increases could be biased downward, while growth could be more accurate.

We can examine the recent decade (from 1999-2010) by using the results in the previous section (and Table 4 and 5) and construct consistent SWFs. Using per capita GDP and the Census Household Gini (as mentioned above) yields an increase in the SWF of 5.9 percent

between 1999 and 2010. Using the household adjusted personal income measure (as the μ) and the respective Gini (using the similarly adjusted data) yields an increase in SWF of 3.1 percent. However, using the more complete income measure that includes health benefits yields a 7.4 percent increase in SWF mainly because of fall in inequality (shown in Table 5).

IV. Distribution of income and consumption and multipliers: an application

Since Keynesian models rely on the propensity to consume as a cornerstone of the multiplier, there has been intense interest in its value. As stated above, the *Economic Report of the President* suggests that with APCs falling with income, a more equal distribution of income could lead to larger increases in spending, and hence, growth. The key issue is whether the propensity to consume varies with income levels. The life-cycle and permanent income models rely on a representative agent. However, if agents are heterogeneous and there is a distribution of income across them, there may be a distribution of propensities to consumer and the simple expenditure multiplier may be affected. More specifically, if the propensities to consume differ by income groups then there is an implication for both the magnitude of the multiplier and the efficaciousness of a redistribution of income. If propensities to consume are higher for lower income groups, then government expenditure multipliers will be higher and so it will pay to transfer money from higher to lower income classes. If not, then redistribution efforts could lower expenditure multipliers and thereby hurt growth.

The relationship between income inequality and growth has been the focus of many studies. Both positive and negative relationships have been posited and supported by empirical evidence (see for example, Forbes (2000) and Berg and Ostry (2011)). The multiplier analysis presented here is but one facet of the identification of the relationship between income inequality and growth.

The relationship between the income distribution, the multiplier and macroeconomic analysis is not a new concern. In fact, Keynes (1936; 1964 reprint) thought that:

> "The amount that the community spends on consumption obviously depends (i) partly on the amount of its income, (ii) partly on the other objective attendant circumstances, and (iii) partly on the subjective needs and the psychological propensities and habits of the individuals composing it and the principles on which the income is divided between them (which may suffer modification as output is increased)….. But, in general, we shall in what follows take the subjective factors as given; and we shall assume that the propensity to consume depends only on changes in the objective factors."[23]

Keynes places the income distribution in the category of a subjective factor. Stone and Stone (1938), in support of Keynes, also examine the relationship between the marginal propensity to consume and the income distribution and find no relationship. Haveelmo (1945) looked at the same question in terms of the impact on the balanced budget multiplier. Goodwin (1949) and Chipman (1950) looked at the multiplier as a matrix across sectors and the latter allowing for income redistribution and Conrad (1955) used a similar method to look at the income effects of redistribution.

To illustrate how our estimates can be used to evaluate the fiscal multipliers, consider a simple closed Keynesian model (similar to Chipman's) in which the autonomous expenditure component captures all expenditures save a consumption expenditure that is a fraction of income. Ignore taxes as well as that can be viewed as simply a change in income. Let Y_i denote income, A_i autonomous expenditure, and c_i the marginal propensity to consume for the i^{th} income class

$$Y_i = A_i + c_i Y_i \quad \text{i=1...N}$$
$$dY_i = dA_i + c_i dY_i$$

The model shows that for income category, its marginal propensity to consume determines the sector expenditure multiplier and thereby the aggregate multiplier. Specifically,

[23] Book III, chapter 8, page 91

for N income categories, we can compute the impact of a change in autonomous expenditures in each category and then add up across categories to obtain the aggregate expenditure multiplier.

The system can be written as

$$1-c_i \;\; dY_i = dA_i$$

Or in matrix form

$$\begin{bmatrix} dY_1 \\ \vdots \\ dY_N \end{bmatrix} = \; I - C \;^{-1} \begin{bmatrix} dA_1 \\ \vdots \\ dA_N \end{bmatrix}$$

Where

$$C = \begin{bmatrix} \begin{pmatrix} c_1 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & c_N \end{pmatrix} \end{bmatrix}$$

Let I denote the identity matrix and D be the determinant of $I - C$

And let D_i be the determinant of the matrix resulting from the substitution of $\begin{bmatrix} dA_1 \\ \vdots \\ dA_N \end{bmatrix}$ into the ith

column of $I - C$, then $dY_i = \frac{D_i}{D}$ and $dY = \sum_{i=1}^{N} \frac{D_i}{D}$

Using quintiles, we have

$D = \Pi_i(1\text{-}c_i)$, and $D_i = (\Pi_{j \neq j}(1\text{-}c_j))$

If $c = c_i$ for all i, then we obtain the usual expenditure multiplier, $5/(1-c)$.[24] The implication is that taking into account different propensities to consume by income category can have significant effects on the value of the autonomous expenditure multiplier.

Using the ratio of Personal Consumption Expenditures (PCE) to Personal Disposable income, we can see an increase over time in the aggregate APC, with a recent fall. Between 1999 and 2010, the aggregate APC fell from 93 percent to 92 percent (see Figure 7).[25] Fisher et al. (2012) calculate the APC using household level data from the Consumer Expenditure (CE) Survey, and find a similar slight decrease from 76 to 75 percent between 1999 and 2010.

Using the quintile distribution of personal income, and the reported data in the Consumer Expenditure Survey to determine expenditures by income quintile, we can obtain APCs for each quintile. Using these adjusted APCs, the MPCs can be found by assuming that the elasticities, ε, are constant over the income distribution and given by 0.1 (as in Dynan (2012)).[26] Since ε = MPC/APC, then the MPCs are basically one-tenth of the APCs.

Fisher et al. (2012) create the APCs by quintile using the CE data. For 2010, these APCs are .92, .82, .80, .76, and .69 (with an average of .75). Using an elasticity of 0.1, yields MPCs of .092, .082, .08, .076, and .069. Using the above equation, yields a multiplier of 5.43 compared to the multiplier for constant MPCs of 5.40, for a difference of .03.[27] As a result, an equalizing redistribution will have a small positive impact on consumption.

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[24] Suppose N=2. Then have the total change multiplier arising from all the dAi and $dY = (2-c_1-c_2)/(1-c_1-c_2-c_1c_2)$, and a finite solution requires $c_1+c_2+c_1c_2 < 1$. If $c_1=c_2 = c$ then we obtain the usual expenditure multiplier (2/1-c), where the 2 derives from there being two sectors. To compare with the simple multiplier that assumes constant MPC we would divide the N-sector multiplier by 1/N (for the two sector example we obtain 1/(1-c)).

[25] Using personal income, instead of disposable income, yields a similar result, but with lower APCs.

[26] Oh and Reis (2011) use an average MPC of 0.11 in their estimates of the effectiveness of government transfers, and Parker et al. (2012) find MPCs ranging from .12 to .30.

[27] Oh and Reis (2011) using a more robust model of redistribution and MPCs that are decreasing with income find a similarly small positive impact of redistribution.

Using the ratios presented above (derived from Katz (2012)) to adjust for income and similar underreporting ratios from McCulley (2012), we can uniformly increase all APCs (with an average of .92 to match the national accounts estimates). Using a similar elasticity of 0.1, the multiplier increases to 5.44 (and hence, a transfer multiplier of 0.04). Finally, one could use the results in this paper to create adjusted personal income averages by quintile, and the results in McCulley et al. (2012, this volume) to create adjusted expenditures by quintile and obtain APCs that would be consistent with Personal income and PCE. Bear in mind that these are simple expenditure multipliers without monetary feedback or any other of the other standard macroeconomic counter influences on multiplier values.

V. Future Work and Conclusion

Since their beginnings, the NBER and the CRIW have been concerned about the distribution of income and its relationship to the national accounts. Almost 60 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. Using previous work on creating a comparable measure of personal income in the CPS, we have provided a couple simple methods to produce a median personal income and its Gini coefficient.

These methods yield a variety of results on the growth of median income and inequality, depending on the definition of income used, and the method used to obtain the distribution. Stiglitz (2009) argued that averages must "…be accompanied by indicators that reflect their distribution. Median consumption (income, wealth) provides a better measure of what is happening to the "typical" individual or household than average consumption (income or wealth)." We showed that adjusting for the underreporting in the CPS yields a larger level and

increase in the trend of the mean and median between 1999 and 2010. This, in turn, yields a larger increase in inequality. Using a more comprehensive income measure that includes the government and employer provided health benefits yields a flatter trend in inequality.

Future work involves analysis of the matched household data with the tax records to obtain a more complete measure of income underreporting. 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.

There are two dimensions to the analysis: the reconciliation of published data and the definition of the "best" concept of income to use in determining well-being. 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.

Tables and Figures

Table 1: Comparison of Income concepts

SOURCE	Haig/ Simons	Census	PI/NIPA (BEA)	CBO	SOI (AGI)	Canberra
Employment income	Yes	Yes	Yes	Yes	Yes	Yes
Employer contribution to Soc Sec	Yes	No	Yes	Yes	No	Yes
Employer-provided benefits[a]	Yes	No	Yes	Yes	No	Yes
Investment income	Yes	Yes	Yes .	Yes	Yes	Yes
Imputed investment income	Yes	No	Yes	No	No	No
Government cash transfers	Yes	Yes	Yes	Yes	Yes (taxable)	Yes
Employee contribution to Soc Sec	Yes	Yes	No (subtract)	Yes	Yes	Yes
Retirement income	Yes	Yes	No (only int.)	Yes	Yes	Yes
Cash assistance from others	Yes	Yes	No	Yes	No	Yes
Realized capital gains	Yes	No	No	Yes	Yes	No
Lump sum (IRA disbursements)	Yes	No	No	Yes	Taxable	Yes
In-kind government transfers[a]	Yes	No	Yes	Yes	No	No[b]
Other In-kind transfers[a]	Yes	No	No	No	No	No[b]
Home production	Yes	No	No	No	No	In concept
Imputed rent[a]	Yes	No	Yes	No	No	Yes
Unrealized capital gains	Yes	No	No	No	No	No
Savings withdrawals	Yes[c]	No	No	No	No	No

[a] Estimates are imputed in the CPS

[b] included in the final measure of disposable income

[c] included in the Haig-Simons equation; depletions in savings will simply increase consumption

Table 2: Katz (2012) categories included in adjusted personal income

Adjustments to Personal Income, Selected Years			
	1999	2007	2010
Personal Income	**10,030**	**12,546**	**12,374**
Employer health benefits	(450)	(637)	(620)
Employer pensions benefits	(267)	(396)	(470)
Imputed interest	(433)	(480)	(457)
Imputed rent for homeowners	(187)	(68)	(236)
Government transfers in-kind	(575)	(919)	(1,132)
Adjustment for social security contributions	428	526	514
Adjustments for pension treatment	(148)	123	257
Other adjustments	(100)	(92)	(167)
Total adjustments	(1,731)	(1,943)	(2,311)
Adjusted Personal Income	**8,299**	**10,603**	**10,062**
Census Money Income	**7,387**	**8,316**	**8,015**

Table 3: Mean and Median household income using alternative adjustments. In 2010$

	Household Mean	Household Median	Mean - NIPA adjusted	Median - NIPA adjusted	Mean - SOI dist adj	Median - SOI dist adj	Adj personal income per hhold
1999	69110	50945	77773	56674	78237	66006	80474
2000	70100	51820	79586	57294	80778	65806	82697
2001	70341	50986	79726	56539	81511	63644	83442
2002	68981	50472	79621	56705	80471	66012	83196
2003	69287	50609	79529	56718	81273	66010	83139
2004	68829	50339	81688	57474	82795	68179	85262
2005	70042	51043	82748	57507	83230	65987	86262
2006	71672	51920	85801	59190	86410	68074	88734
2007	70934	52660	87574	61472	88467	69085	90648
2008	69458	50995	88071	60664	90319	67831	90445
2009	68840	50279	81907	58137	82678	66535	84536
2010	67516	49109	81946	57739			84769
Percent change (1999-2010)	-2.3%	-3.6%	5.4%	1.9%	5.7%*	0.8%*	5.3%

*from 1999-2009

Table 4: Adjusted means and medians including non-cash benefits (in 2010$)

	Mean (NIPA adjusted with health benefits)	Median (NIPA adjusted with health benefits)	Mean (NIPA adjusted with all imputations)	Median (NIPA adjusted with all imputations)
1999	86709	65113	97850	70351
2000	88892	66550	100177	71706
2001	89725	66227	97949	70195
2002	90078	66926	95757	69955
2003	90500	67155	96844	70795
2004	93066	68435	98882	71690
2005	94573	69144	100684	72498
2006	97824	71264	103828	74531
2007	99846	73406	105920	76662
2008	100422	72982	103921	75625
2009	94867	71243	103032	75085
2010	95028	71013	103197	74945
Percent change	9.6%	9.1%	5.5%	6.5%

Table 5: Gini coefficients

	Household Income	**NIPA-Adjusted Income**	**SOI Adjusted Income**	**NIPA adj, with health, retirement and imputed interest**	**SOI tabulated AGI**	**Household income With health benefits**	**R&D Defn 14**
1999	0.425	0.441	0.427	0.428	0.593	0.400	0.408
2000	0.426	0.443	0.443	0.431	0.602	0.400	0.410
2001	0.430	0.452	0.459	0.426	0.583	0.399	0.412
2002	0.426	0.451	0.445	0.416	0.576	0.395	0.405
2003	0.428	0.451	0.450	0.416	0.581	0.396	0.394
2004	0.429	0.456	0.440	0.419	0.597	0.393	0.404
2005	0.433	0.460	0.452	0.423	0.611	0.395	0.402
2006	0.435	0.461	0.451	0.424	0.620	0.396	0.405
2007	0.426	0.455	0.456	0.417	0.626	0.394	0.403
2008	0.430	0.465	0.468	0.417	0.622	0.396	0.392
2009	0.434	0.452	0.433	0.419	0.609	0.399	0.392
2010	0.433	0.453		0.417		0.398	
Percent change	1.9%	2.7%	1.4%*	-2.6	2.7%	-.5%	-3.9%

Figure 1: Mean and Median household (or taxpayer) income from various measures. In 2010$ using the PCE deflator.

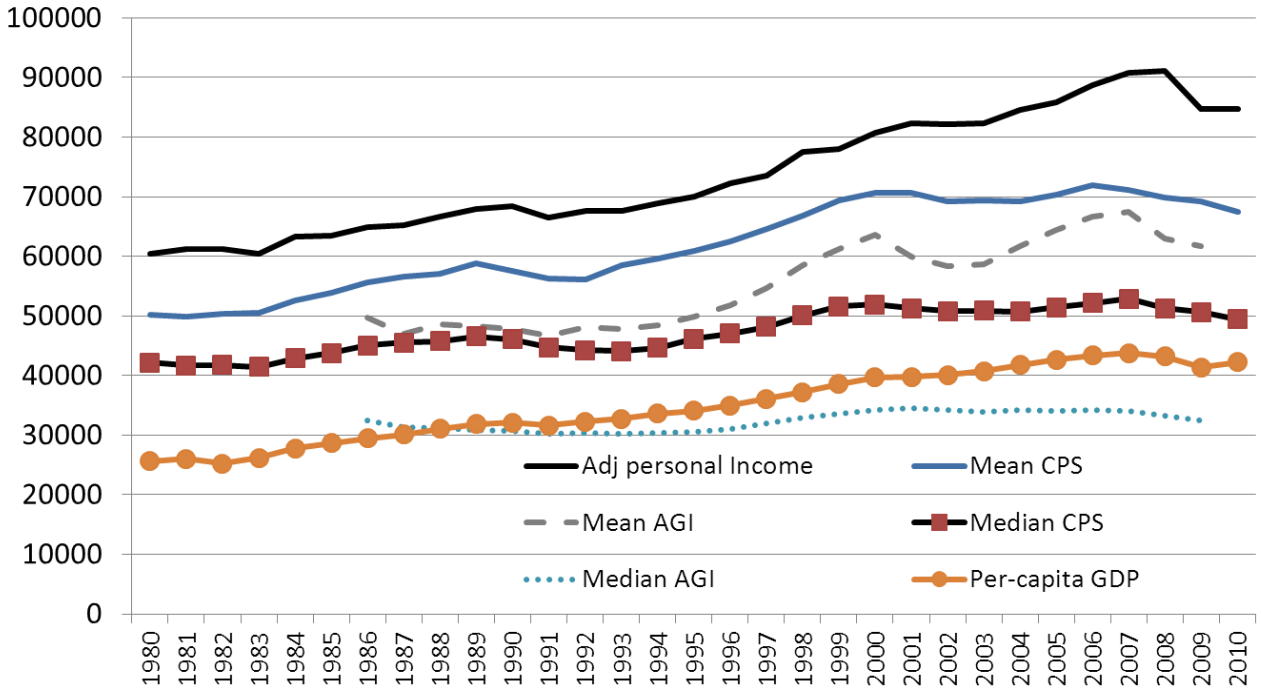


Figure 2: The growth in aggregate income from various measures. In billions of 2010$ using the PCE deflator

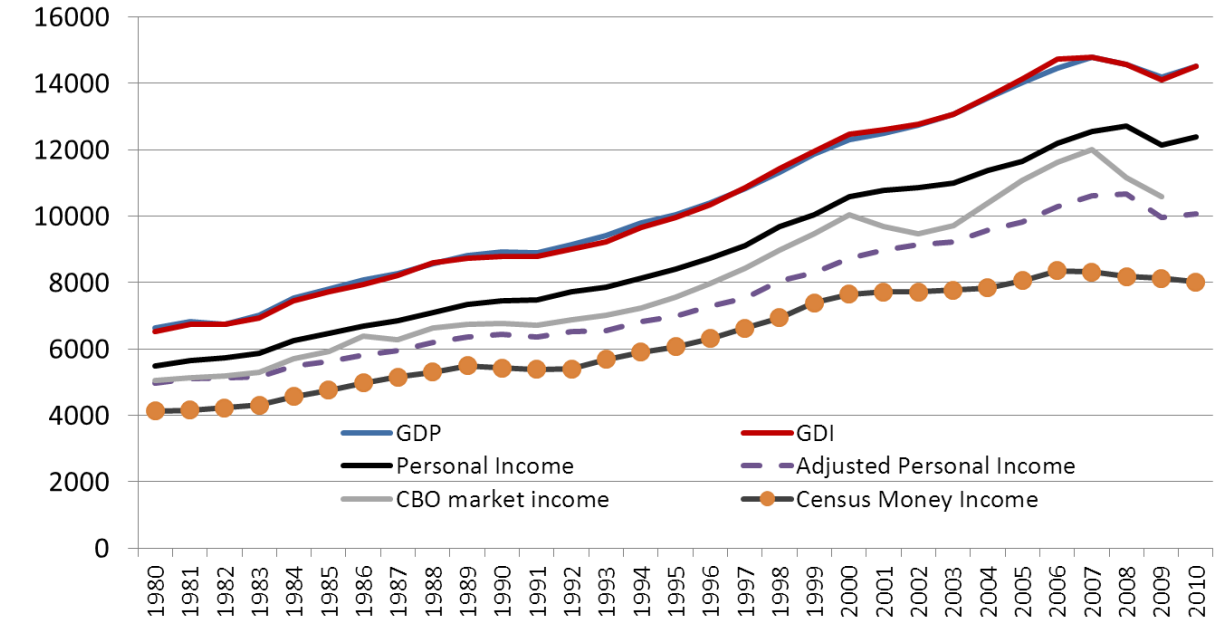


Figure 3: Ratio of CPS aggregate income to NIPA income, adjustment factors α_j (Katz (2012))

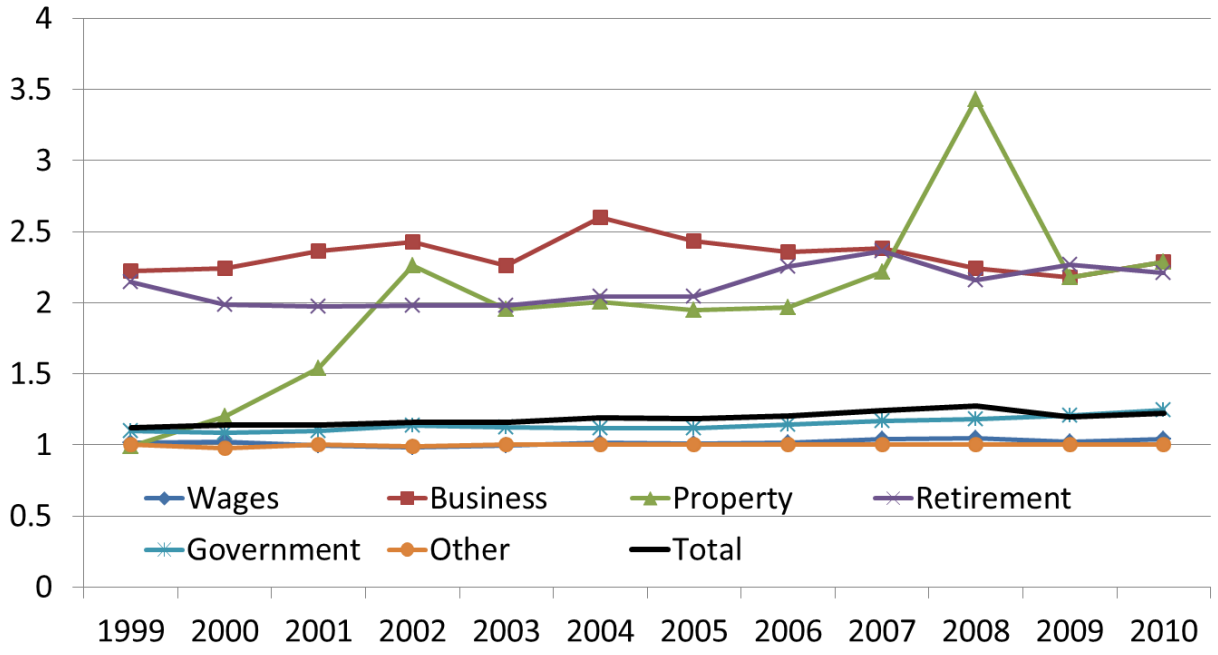


Figure 4: SOI Factors used to adjust CPS income (ratio of aggregate income by source for level of AGI), factors, γ_{jk}



Figure 5: Shares for components on CPS money income, by total income

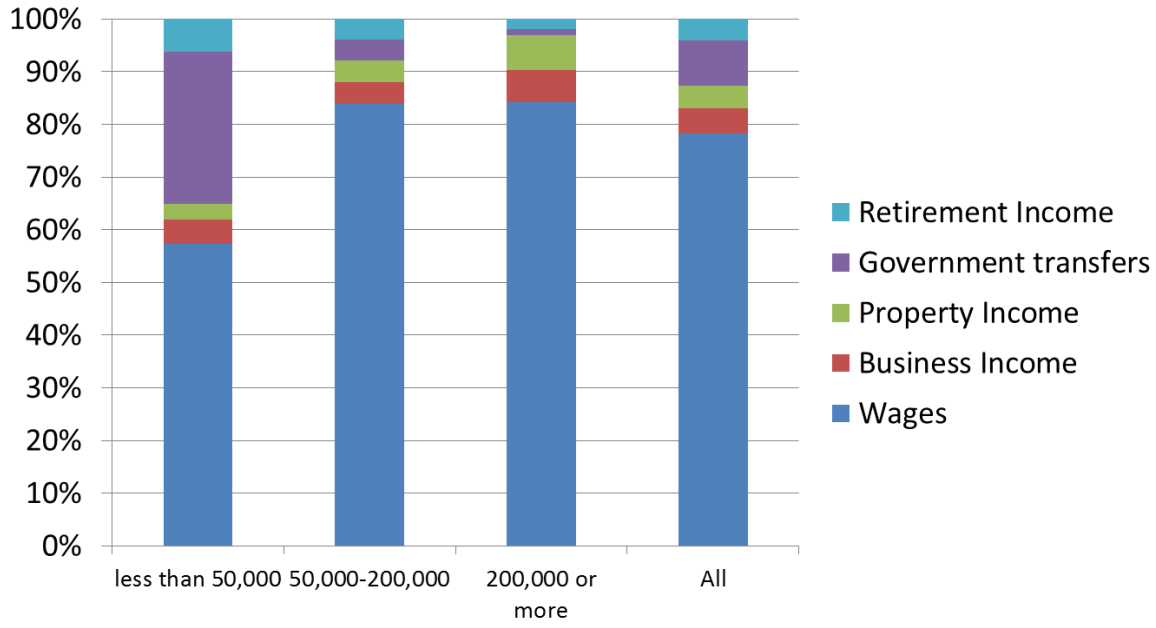


Figure 6: Ratio of CPS AGI income to Tax form 1040 AGI income, by AGI percentile, 2010

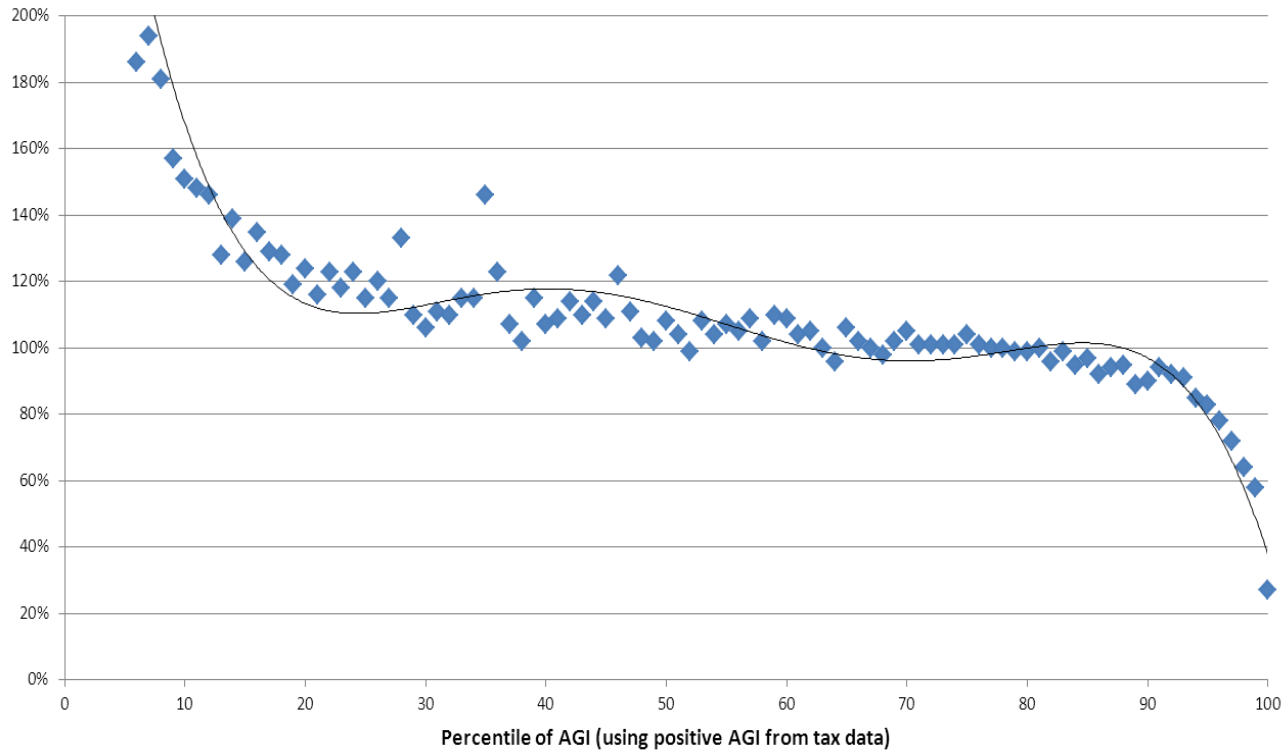
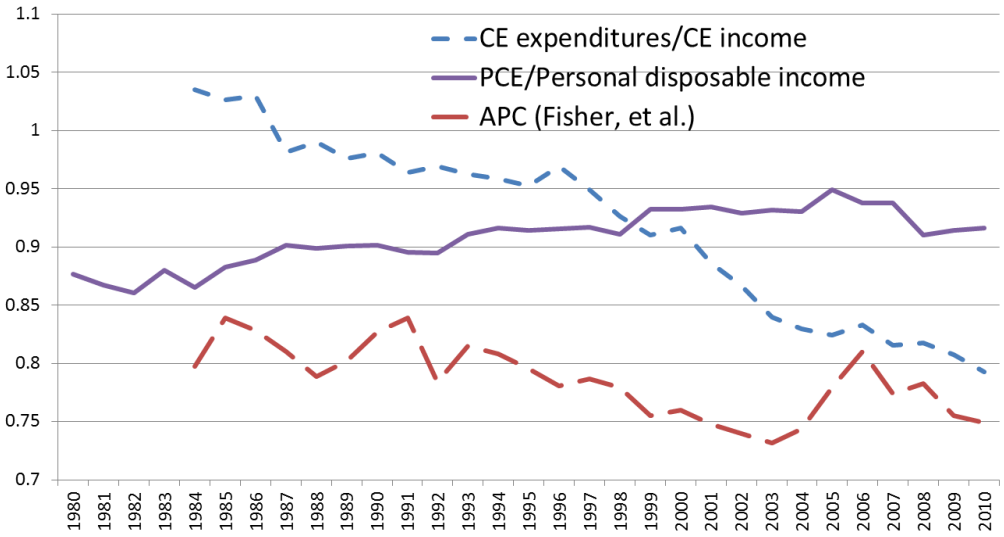


Figure 7: Various Average Propensities to Consume (APC)



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