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GROWTH OF INCOME AND WELFARE IN THE U.S, 1979-2011

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ABSTRACT

We estimate growth rates of real incomes in the U.S. by quintiles using the Congressional Budget Office's (CBO) post-tax, post-transfer data as basis for the period 1979-2011. We improve upon them by including only the present value of earnings that will accrue in retirement and excluding items included in the CBO income estimates such as "corporate taxes borne by labor" that do not increase either current purchasing power or utility. We estimate a high and a low growth rate using two price indexes, the CPI and the Personal Consumption Expenditure index. The major consistent findings include what in the colloquial is referred to as the "hollowing out" of the middle class. According to these estimates, the income of the middle class 2nd and 3rd quintiles increased at a rate of between 0.1% and 0.7%per annum, i.e., barely distinguishable from zero. Even that meager rate was achieved only through substantial transfer payments. In contrast, the income of the top 1% grew at an astronomical rate of between 3.4% and 3.9% per annum during the 32-year period, reaching an average annual value of$918,000, up from $281,000 in 1979 (in 2011 dollars). Hence, the post-tax, post-transfer income of the 1% relative to the 1st quintile increased from a factor of 21 in 1979 to a factor of 51 in 2011. However, income of no other group increased substantially relative to that of the lowest quintile. Oddly, the income of even those in the 96-99 percentiles increased only from a multiple of 8.1 to a multiple of 11.3. We next estimate growth in welfare assuming diminishing marginal utility of income. A logarithmic utility function yields a growth in welfare for the middle class of roughly 0.01% to 0.07% per annum, which is indistinguishable from zero. With interdependent utility functions only the welfare of the 5th quintile experienced meaningful growth while those of the first four quintiles tend to be either negligible or even negative.

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Introduction

While the concept of income and its distribution—amongst the most salient variables in all of economics—is theoretically straightforward, the empirics associated with their real-world version are actually quite complicated. As a consequence, the measurement of income and its growth remains somewhat controversial. Most estimates are based on pre-tax pre-transfer incomes collected by the Census, which are, of course, important in themselves insofar as they reveal market outcomes; however, they fail to reveal accurately either actual purchasing power or the corresponding welfare enjoyed by households. However, post-transfer incomes calculated by the Congressional Budget Office (CBO) has its own problems, namely that much of it is financed through government debt so the burden of the transfers will be born, in the main, by generations yet unborn and consequently cannot be netted against government liabilities. This, of course, introduces a difficult-to-calibrate bias into the calculations insofar as the accumulated debt is not accounted for anywhere in these statistics. Hence, the post-transfer incomes leave the impression that the accumulation of government debt could be income and welfare enhancing.

An additional formidable challenge is posed by a litany of intractable problems associated with the estimates of the rate of inflation which introduce measurement errors upon which the whole exercise might well turn and which might affect various income groups differently.

The goal of this paper is to improve upon the CBO estimate of post-tax and post-transfer income growth in five quintiles and, in addition, also ventures for the first time an estimate of the growth of welfare between 1979 and 2011. In the process we point to major lacunae in the empirical evidence in this critical area of economics without which we are not on solid ground in understanding even the most fundamental aspects of economic performance, namely its ability to generate income and welfare across the income distribution. The paper takes the most recent

CBO data as its starting point, insofar as it is the most comprehensive estimate of disposable household income and its distribution (CBO, 2014). It modifies it slightly in order to make it more appropriate for the purposes at hand, the estimation of income and welfare growth. Subsequently, we use two estimates of the inflation rate to convert nominal into real incomes by quintiles. The 5th quintile is further decomposed into four percentile groups including the top 1%. The upshot is that most Americans are scarcely better off than their parents were a generation ago, except those at the very top and considering relative incomes almost all are actually worse off.

Data

Income

The CBO's main goal is not to calculate income growth per se but to estimate the incidence of taxes on various income groups, whereas our goal is to estimate the increase in real income so as to gauge the gains in welfare along the income distribution. This difference dictates some deviation from the CBO procedure as far as the income transfers are concerned.[1] Hence, we modify the CBO data in three rather minor ways:

1) We exclude those items that do not increase utility such as the CBO's estimate of "Corporate Tax Born by Labor". From the CBO's point of view, the rationale behind including this item as "income" is that taxes levied on corporations induce them to pay lower wages and therefore the assumption is that labor's income would have been greater by this amount in the

[1] Another variant, referred to as comprehensive income, focuses on consumption and changes in net wealth (Armour et al., 2013). Formally, it is defined as $Y = C + \Delta NW$, where Y is income, C is consumption and ΔNW is the change in net worth. We do not use this formulation because we do not have data on net worth. In addition, this formulation has the disadvantage that wealth might well be based on unrealistic prices as many home owners found out in the aftermath of the recent financial crisis. There is also the problem associated with the riskiness of the asset position of the individual that the above formulation does not consider.

absence of corporate taxes. So, in effect, this is the incidence of corporate taxes on labor, i.e., labor foregoes this amount or "pays" this part of the tax. While this procedure is appropriate for understanding tax incidence it is not so for estimating only those components of income that enhance utility, because employees never see or even know about these amounts. Insofar as it is not shown on their paychecks, it does not increase their utility or welfare. Hence, this item is subtracted from the CBO data.

The same argument applies to "Corporate Tax Born by Capital", except it pertains to shareholders rather than to employees. This is the incidence of corporate taxes paid by shareholders, but again these amounts are not utility enhancing, so they will also be subtracted from the CBO data.

2) In addition, it is important to consider that some of the current "income" will actually accrue in the future. Insofar as only their present value generates utility, they should not be conflated with cash income received immediately. After all, the discounting of future incomes is one of the basic tenets of economics. Hence, we add to total income only the present value of future incomes.

The present value of future incomes such as "Employer's Share of Payroll Taxes" are estimated by assuming that the discount rates vary by income quintile from the lowest to the highest as follows: 0.25, 0.20, 0.15, 0.10, and 0.05. To be sure, these values, chosen for convenience, are arbitrary, but useful nonetheless, insofar as "the large empirical literature devoted to measuring discount rates has failed to establish stable estimates for the U.S. There is extraordinary variation across studies" (Frederick et al., 2002). Given the necessity of discounting future income, taking such plausible numbers (even if conjectural) is the best we can do at this time. Nonetheless, it does seem plausible that the discount rate would be inversely

related to the level of income, insofar as one would be more anxious to increase current income the less income one has.

These discount rates imply that the present value of $1 received (with certainty) in retirement (averaged over the forty five age groups between the ages of 20 and 65) in the five quintiles in increasing order are: $0.08, $0.10, $0.14, $0.21, and $0.39.[2] Hence, they do not increase current income substantially. These approximations are used to calculate the present value of "Employer's Share of Payroll Taxes." (They leave out of consideration the probability of surviving into retirement, which would reduce the estimates even further.)

Arguably, even these small amounts are likely to be upwardly biased insofar as they disregard the stark reality that so many people lack confidence that they will reap comparable benefits from the Social Security system in the future. After all, fully half of young people believe that they will not receive any Social Security benefits at all by the time they retire, given the doubts about the survival of the system in its current form, on account of the increases in the political attacks on the system.[3] Another 38% believe that the benefits will be reduced (Pew Research Center, 2014). Only a tiny minority (8%) believe that they will receive benefits at the current level. This implies that the employer's contribution to the Social Security system does not improve welfare of most of the employees by even the small amounts implied by the discounted value of these payments. After all, these payments are not being saved for the

[2] The average of these five discount rates is $0.18, which is used for the median income.
[3] They are paying taxes now to provide for retirement income for their grandparent's generation and are poorer for it, not wealthier. Will future generations yet unborn be honor-bound to continue Social Security payments on their behalf by the time they retire? There is no guarantee that they will. There is no generational contract, no pledge, and no promises that they will have retirement benefits waiting for them. One cannot have a contract with people who are not yet born. With such an uncertain future for the system, they can hardly be blamed for being skeptical about the benefits they will actually receive as a consequence of these contributions to the retirement system ostensibly on their behalf.

employees but are instead used to pay for the retirement benefits of those currently retired. Hence, arguably they could be discounted further insofar as they probably have but an inconsequential effect on welfare. However, we do continue to add their discounted value to total income in order to err on the side of caution.

3) Three items pertaining to health insurance are not considered in total income: "Employer's Contributions to Health Insurance," "Medicare," and Medicaid payments." Employer's Contributions to Health Insurance increased only marginally between 1979 and 2011 from 3.1% to 4.3% of labor income so excluding it is inconsequential in any event. However, even if they had increased by more they would have to be discounted, because the benefits accrue in the future (with uncertainty).

Although Medicare and Medicaid payments did increase from 2.5% to 8.8% of total income, the actual benefits most likely have not increased meaningfully over time. Moreover, these increases were most likely caused by the aging of the population which necessitates greater Medicare expenditures. This consideration points to one of the more serious shortcomings of all of these estimates, namely that they are not standardized for the age structure of the population which changed obviously over time and the demand for medical services is particularly age-sensitive.[4] As a consequence of all these issues, it seems appropriate to leave these items out of consideration until these uncertainties are resolved.[5] They were most likely neither increasing disposable income nor experienced utility noticeably more in 2011 than they did in 1979.

Price Indexes

[4] The share of the population over the age of 65 increased from 11.3% to 13.0 between 1980 and 2010. https://www.census.gov/population/age/data/2012comp.html, accessed November 27, 2015.

[5] Another probable reason for the increases in these payments is that the price of medical services has increased faster than the rest of the price index.

There is no consensus on how best to estimate the rate of inflation either. The CBO converts nominal into real income using the personal consumption expenditures (PCE) price index calculated by the Bureau of Economic Analysis (BEA) while the Census and the Bureau of Labor Statistics (BLS) uses the consumer price index (CPI) for all urban consumers instead.

The two indexes differ in a multitude of large and small ways; for instance, the PCE uses weights derived from business surveys, whereas the CPI uses weights derived from household surveys which are more appropriate for our purposes. The minutiae of differences include the fact that the BEA imputes prices for "financial services furnished without payment,"[6] that is to say, services for which banks do not charge explicitly, such as processing of checking accounts (Hood 2013).

Actually, both indexes are imperfect (Boskin et al., 1998; Whelan, 2002; Hausman, 2003). The main focus of the PCE index is calculating real U.S. national income. This implies that the PCE includes purchases not only by households but also by non-profit institutions (McCully et al., 2007) as well as by intermediaries (such as insurance companies) on behalf of households which may or may not pass price changes onto consumers. Thus, the CPI does have the advantage of using only out-of-pocket expenditures of the consumers themselves, which makes it more suitable for our purposes, i.e., to estimate welfare growth.[7]

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[6] BEA, "What is the "market-based" PCE price index? http://www.bea.gov/faq/index.cfm?faq_id=83 accessed September 23, 2015.

[7] Other differences include the fact that the PCE uses weights that change from quarter to quarter while the CPI market basket is updated every two years. The PCE uses a chained Fisher index formula whereas the CPI uses a Laspeyres-type formula. The PCE uses the CPI for 74% of its items, the producer price index (PPI) for 9%, input-cost indexes 10% and other 7%. The PPI is the price of products for the first commercial transaction which makes it more like a wholesale price index and was called just that until 1978. The weights also differ. Shelter and transportation have a substantially higher weight in the CPI Index than in the PCE index, 32.7% vs 15% and 17.4 vs 11.9% respectively. On the other hand, medical care receives only 6.1% in the CPI but 20.3% in the PCE index. The big difference in the medical care weights is due to the fact that the

However, the CPI also has disadvantages insofar as it is confined to the urban population and unabashedly leaves the prices faced by the rural population entirely out of consideration. This means that the prices faced by 19% (2010) of the population are disregarded, hardly a negligible issue inasmuch as the share of rural population was decreasing over time. In 1980 it was 26%.[8] That alone introduces an uncanny element of uncertainty into the accuracy of the inflation rate estimates.[9] However, this discrepancy creeps into the PCE index as well insofar as for about three quarter of the items it does itself use the CPI as a baseline, thereby automatically absorbing the weaknesses of the CPI in its own index (Moyer, 2006). As it turns out, which index is used does make a substantial difference to the estimates of real growth rates: "the average annual inflation rate of the 1979-2009 period was about 0.2 percentage points lower as measured by the PCE price index than as measured by the CPI" (CBO 2012, p. 21). Although we suspect that the CPI is more accurate for our purposes, we will nonetheless also use the PCE index for the sake of completeness.

There are other conceptual problems with the price indexes as well. The use of hedonic pricing can lead to a rapid decline in the price index of products characterized by changes in technical characteristics.[10] For example, the BLS calculates that the price of television services

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PCE includes payments made not only by households but also by employers and government programs (Moyer, 2006).

[8] The population of urban areas increased between 1980 and 2010 from 73.7% to 80.7%. U.S. Census, "2010 Census Urban and Rural Classification," https://www.census.gov/geo/reference/ua/urban-rural-2010.html https://www.census.gov/population/censusdata/table-4.pdf accessed December 26, 2015.

[9] Suppose that urban prices were 20% higher than rural prices and assume that both urban and rural prices had remained unchanged; although prices had not changed at all, the change in population would imply by itself that prices *as they were experienced* had increased by 1.2%. That alone implies that without considering rural prices the inflation rate is inaccurate.

[10] According to one estimate the decline in the price of television using a hedonic index was 21% just within four years in the mid-1990s (Moulton et al., 1998, Table 5).

has declined from 1980=105 to 2011=6![11] This seems exaggerated insofar as the price of color televisions in the 70s and 80s was somewhere in the $400-$1,400 range.[12] This is not very different from what today's television costs. If the 17.5 ratio were accurate we would be able to buy a new television today for $22 but such televisions do not exist. Arguably today's televisions are smart, have more bells and whistles including more pixels and more channels. On the other hand, the various features of the TV set are bundled and therefore the consumer does not have the choice to pick the ones she prefers insofar as the old system is no longer available for $22. The consumer is forced to use the new system. In such cases the assumptions associated with the use of hedonic prices do not apply in practice,[13] and hedonic regressions may not reflect accurately consumers' willingness to pay for those features.[14]

An additional crucial issue is that the price indexes are unavailable by income quintiles which introduce an immense amount of inaccuracy and uncertainty into all of the calculations on account of the fact that the consumption baskets vary substantially across the quintiles. Inasmuch as the different kind of errors could accumulate over time, the longer is the time that separates the end dates of the growth rate calculation, the less reliable are the price indexes. This is not a

[11] I would like to thank Sharon Gibson of the BLS for providing this information.
[12] Television History http://www.tvhistory.tv/tv-prices.htm, accessed October 16, 2015.
[13] Although theoretically one could estimate a "virtual price". In practice, however, this has too many hurdles (Nesheim 2008).
[14] "This [hedonic regression model] uses television observations … and provides an estimate of the value of each of the significant features and components of the sets for which prices are collected. This yields a mechanism for replacing obsolete televisions in the CPI sample with current ones…" BLS, "Using a Hedonic Model to Adjust Television Prices in the Consumer Price Index for Changes in Quality," http://www.bls.gov/cpi/cpihe01.htm accessed December 30, 2015. However, we are buying entertainment services by watching TV and we still watch one channel at a time and may not obtain more satisfaction out of watching that channel than we did in 1980. I do not know of any evidence that would indicate that we're getting more satisfaction out of TV watching now than we did 32 years ago.

complete list of weaknesses and differences of the price indexes by any means but should give one a sense of the intricacies and challenges of estimating price indexes.[15]

Method of Estimating Welfare

The growth in welfare is a crucial variable of interest in applied economic analysis. An overlooked shortcoming of the literature associated with this complex of issues is that generally welfare growth is conflated with income growth, even though it would be important to recognize widely that income is actually an intermediate product of economic activity and welfare is the final product. After all, income is an input into the generation of welfare. Moreover, insofar as the law of diminishing marginal utility of income is one of the fundamental tenets of economic theory we shall incorporate such non-linear functions into our estimates of welfare after we re-estimated real incomes and their distribution.

Applied welfare analysis has to assume that individual utility can be aggregated into a social welfare function (Usher, 2016). Otherwise, the whole notion of living standards at the population level would make little sense (Sen, 1970). "Our social welfare function will always tend to take the form of a sum (or mean) of individual utilities" (Harsanyi, 1955). Harsanyi argues that "economists and philosophers influenced by *logical positivism* have greatly exaggerated the difficulties we face in making interpersonal utility comparisons" (2008). If the profession insists on ordinal utility functions which cannot be aggregated and do not allow interpersonal comparisons of utility than we should be consistent and expunge concepts such as

[15] BLS, "Comparison of BLS Price and Spending Measures," http://www.bls.gov/cex/oplc_program_comparisons.htm accessed December 27, 2015.

living standards completely from our canon. In sum, in the real world such comparisons are unavoidable; indeed, they are central to applied economic analysis.[16]

Thus, we estimate trends in welfare in the spirit of a Bergson-Samuelson social welfare function that translates the average income of a quintile into the welfare of a representative agent of that quintile assuming diminishing marginal utility of income. This approach bears some similarity to the strategy of Jones and Klenow (2010) who compare welfare across countries using the technical apparatus of a logarithmic utility function on consumption. In a similar vein, Becker et al. (2005) compare utility across countries after augmenting income with the value of the gains in life expectancy.

Analogously, the Human Development Index also assumes that per capita GDP also has diminishing marginal impact on welfare (Fleurbaey and Blanchet, 2013). A comparable problem arises in "the literature on sustainable development [which] has taken human wellbeing to be the object to be sustained (Arrow et al., 2012)." In such cases the tacit assumption is that the utility function of future generations will be comparable—if not identical—to that of the current generation. Nordhaus and Tobin also draw a distinction between welfare and monetary measures of economic activity: "GNP is not a measure of economic welfare.… Economists all know that, and yet their everyday use of GNP as the standard of measure of economic performance apparently conveys the impression that they are evangelistic worshippers of GNP (1973, p. 512)." In other words, in practice one can hardly avoid making some assumptions beyond pure theory: "if one wants to say anything specific about social welfare, one must introduce explicit

[16] For example, Samuelson and Nordhaus discuss "the net social cost" of tariffs by adding the gain of producers to the losses of consumers "counting each of these dollars equally", as though their utility functions and incomes were identical (2009, p. 353).

value judgements (Pattanaik, 2008)." These issues are also part of the optimal taxation literature (Mirrlees 1971; Diamond and Mirrlees, 1971; Saez and Stantcheva, 2016).

Although the form of the utility function is difficult to determine empirically, it is clear that the relationship between income and welfare is concave and non-linear.[17] Hence, we convert estimates of real income into welfare growth as explained below. Subsequently, assume that welfare is not only a function of one's own income but also of relative income (Duesenberry, 1949; Boskin and Sheshinski, 1978). Insofar as there is no consensus on the specification of such reference-dependent utility functions, we propose two interdependent functional forms as explained below (Alvarez-Cuadrado and Long 2011; Ljungqvist and Uhlig 2000).

Results

Note that whenever we refer to the income of the whole population we have the median for all households in mind; however, when we refer to incomes of the quintiles or percentiles we have the *average* of the incomes within that group in mind. Note also that the CBO adjusts incomes "for differences in household size by dividing income by the square root of the average number of people in the household (CBO, 2014, p. i)" and we follow this procedure although this adjustment makes only slight difference to the growth rates, insofar as average household size changed but slightly in this period.[18]

In order to save space, our results are reported as follows: whenever we report the dollar value of incomes we use the values before adjusting for household size. However, when we report growth rates, we report those rates that are obtained after we divided the original values by the square root of household size which are not reported here.

[17] Aggregating welfare has similar conceptual problems as aggregating incomes.
[18] Average household size was 2.76 in 1979, 2.56 in 2000 and 2.55 in 2011. The CBO assumed the same household size for all income quintiles. In order to increase the accuracy of these adjustments one would have to use quintile-specific household sizes which are unavailable.

Improved Growth Rate Estimates, 1979-2011

To reiterate, the high estimates use the modified CBO data (deflated with the PCE price index) while the low estimates use the same data deflated with the CPI.

Improved high estimates of growth rates

The high estimates of the growth of median income are not changed markedly from the original CBO estimates. It increases somewhat from 1.2% to 1.4% per annum (Tables 1 and A1, Panel B). In addition, the growth rates of incomes in the first four quintiles are less than the CBO baseline estimates. The lower the quintile the greater is the difference, with the first quintile's growth rate declining the most from 1.8% to 1.0% or by 44% (Tables 1 and A1, Panel C). The 5th quintile's estimated growth rates do not change at all.

Table 1. Improved High Estimates of Real Household Income (000 of 2011 dollars)

		Average within quintile								
Panel A	All	1 group	2	3	4	5	Average within			
	Median	0-20%	21-40%	41-60%	61-80%	81-100%	81-90%	91-95%	96-99%	Top 1%
1979	42.2	13.4	26.3	37.9	49.9	87.7	64.2	77.4	108.2	280.6
2011	63.6	17.9	31.1	46.0	68.3	165.5	97.5	129.2	202.8	918.2
Panel B		Growth (%)								
1979-2011	57	39	23	26	42	96	58	74	95	240
Panel C		Growth Rates per Annum (%)								
1979-2011	1.4	1.0	0.6	0.7	1.1	2.1	1.4	1.7	2.1	3.9

Note: In these and other tables incomes are not adjusted for household size but growth and growth rates are adjusted. Thus, the growth panels do not pertain to the dollar values reported above which are the raw values before adjustment for household size.
Source: CBO Supplemental tables, Table 5.

Growth rates varied considerably across the income distribution (Table 1, Panel C and Figure 1). The lowest quintile grew well enough at 1.0% per annum, although the dollar value of its average income was still a meager $17,900, which was barely the poverty threshold for a family of three. Moreover, their income grew at a much slower rate than that of the 5th quintile

during this 32-year period. Hence, the income of the 1st quintile declined from 15% of the income of the upper quintile to just 10%. In addition, the growth in income of the lower-middle class (2nd quintile) and that of the middle class (3rd quintile) was the slowest, growing at a modest rate of 0.6% to 0.7% per annum, thereby reinforcing the general impression of a floundering middle class even with these high estimates. However, the upper-middle class (quintile 4) did better, growing at 1.1% per annum, but it also fell behind the 5th quintile which grew almost twice as rapidly, at a rate of 2.1%. Moreover, there were noteworthy differences even within the 5th quintile, insofar as the income of the top 1% grew at an "astronomical" pace of 3.9% per annum, so that in the course of this period it grew from 7 times to 14 times the value of the median income (Table 1 and Figure 1). Only the income of the 5th quintile grew faster than the median income. In addition to the growth in median income which was between 0.9% and 1.4% per annum one can also use the average of the five growth rates across the five quintiles as a measure of central tendency for the whole population (Usher, 2016). Such an average would lower the estimated growth rates of income for the whole population to between 0.6% and 1.1% per annum.

Improved low estimates of growth rate

The low growth rate estimates were 0.5% less than the high ones and, therefore, were quite subdued across the board with the exception of the 5th quintile which grew at a reasonable rate of 1.6% per annum. The estimated growth rates of the 2nd and 3rd quintiles were hardly distinguishable from (0.1%-0.2%) (Table 2, Panel C). They differed the most from the high estimates in percentage terms. In fact, only quintile 5 registered an exceptional performance of 1.6% and within it the income of the top 1% grew at the stellar rate of 3.4%. In the main, all

three middle class quintiles were left very far behind with only quintile 4 advancing slightly at a rate of 0.6% per annum (Table 2 and Figure 1).

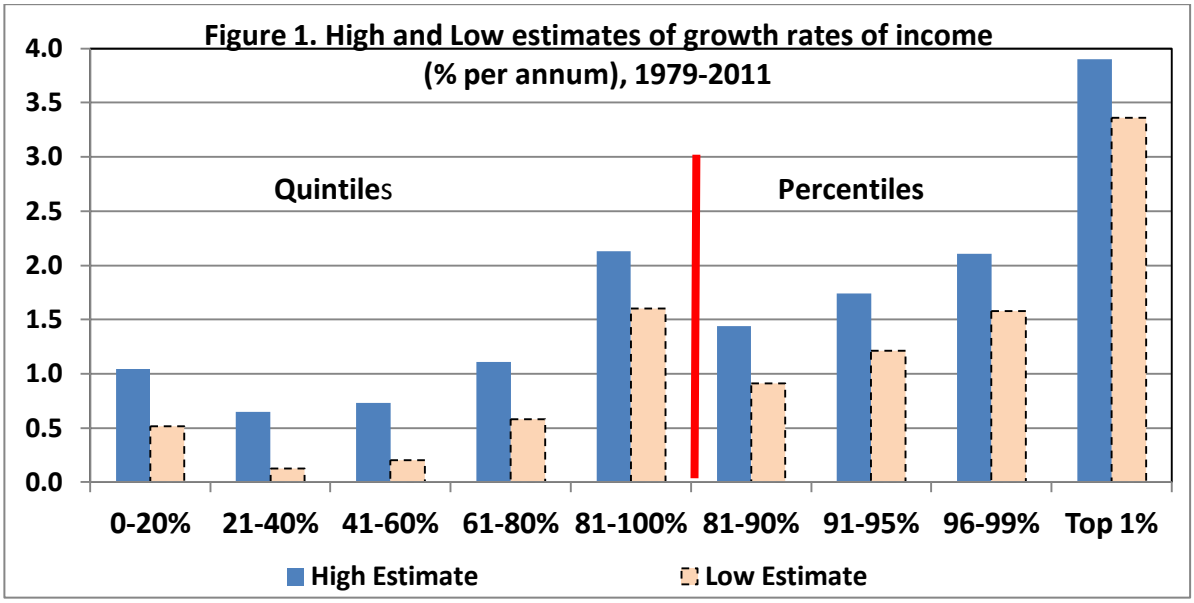


Table 2. Improved Low Estimates of Household Income (Thousands of 2011 dollars)

	All	Average within quintile					Average within group			
		1	2	3	4	5				
Panel A	Median	0-20%	21-40%	41-60%	61-80%	81-100%	81-90%	91-95%	96-99%	Top 1%
1979	49.9	15.8	31.1	44.8	59.0	103.6	75.8	91.5	127.9	331.6
2011	63.6	17.9	31.1	46.0	68.3	165.5	97.5	129.2	202.8	918.2
Panel B					Growth (%)					
1979-2011	33	18	4	7	20	66	34	47	65	188
Panel C					Rates of Growth per Annum (%)					
1979-2011	0.9	0.5	0.1	0.2	0.6	1.6	0.9	1.2	1.6	3.4

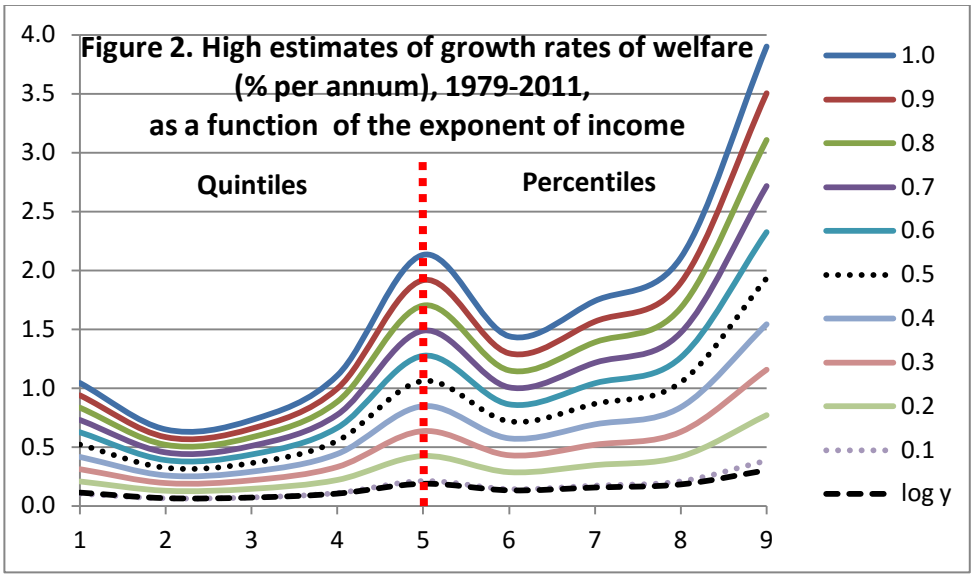
See notes to Table 1.

Growth in Welfare with independent utility functions

Income growth is of interest primarily to the extent it is welfare enhancing. Hence, we next convert incomes into an index of welfare and calculate its growth rate, first by assuming

independent utility functions, i.e., using iso-elastic utility functions[19] (Samuelson, 1969, p. 243): $W(i)=\frac{y(i)^{\alpha}}{\alpha}$ where W(i) is welfare, *y*(i) is the estimated income in quintile i= 1…5, and α is an exponent such that $0.1 \leq \alpha \leq 1.0$. Because we do not have a reliable empirical estimate of α, we let it vary in increments of 0.1 in each of the quintiles. We also calculate W as the logarithm of income as, for example, in Jones and Klenow (2010).

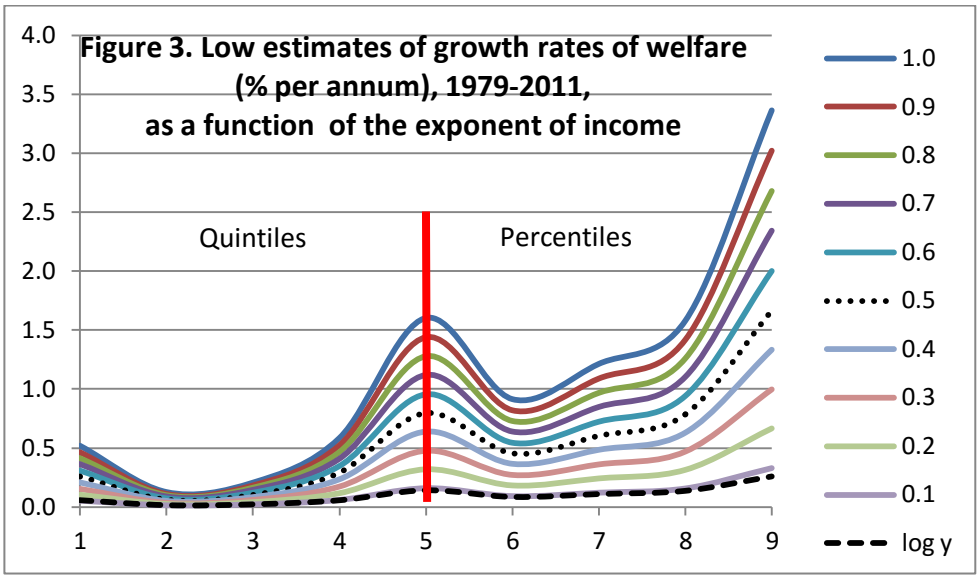
The estimated growth of W depends on the exponent of income (Figures 2 and 3).[20] Generally, the growth rates approach zero as the exponent of income decreases. The range in growth rates is substantial with the middle class 2nd and 3rd quintiles experiencing the smallest increases while the 5th quintile and especially the top 1% holding the lead by quite a margin. (The linear case (α = 1) is the one analyzed above inasmuch as in that case W=Y).



Note: 1-5 are quintiles, 6 = 81-90%; 7=91-95%; 8=96-99%; 9=Top 1%

[19] In this function the marginal utility of income is inversely proportional to income. The estimates of Layard et al. imply that marginal utility falls even faster than that (2008).
[20] In this and subsequent figures the point estimates in each group are connected by a smooth line generated by the Excel program.

The estimates trace a "U" shaped pattern across the five quintiles with a longer right arm, a shape that is frequently referred to in the colloquial as the "hollowing out" of the middle class (Stiglitz 2011). The 2nd and 3rd quintiles together compose 40% of the population which experienced the slowest growth rates even the high estimates; the growth rates for this roughly 125 million people remain at or below 0.5% per annum as long as $\alpha \leq 0.6$ and are as low as 0.1% with the logarithmic utility function (or with $\alpha=0.1$) (Figure 2). This pattern implies that even the high growth rate estimates imply that for the middle class W might well have grown very slowly—perhaps even imperceptibly. In vivid contrast, W of the top 1% of income earners grew consistently at a rate in excess of 1% per annum as long as $0.3 \leq \alpha$ and as fast as 3.9% with $\alpha=1$ (Figure 2).

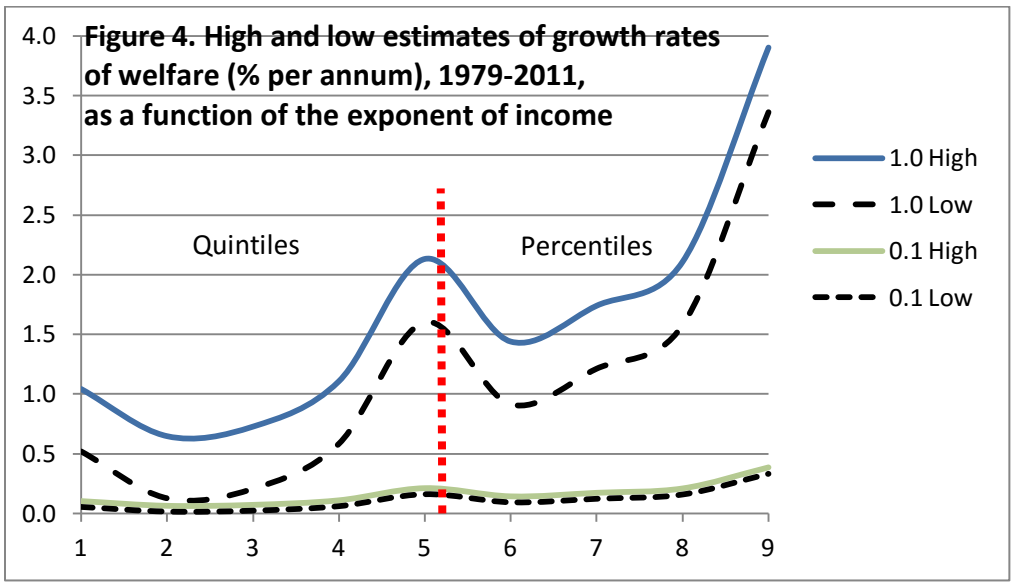


Note: 1-5 are quintiles, 6 = 81-90%; 7=91-95%; 8=96-99%; 9=Top 1%

The low estimates of the growth rate of W (Figure 3) are quite similar in shape and substance to the high ones: these also indicate the "hollowing out of the middle class" as well as the asymmetric "U" shape with a longer right arm. The only major difference between these two sets of estimates is that the growth rates of W in quintiles 2 and 3 are much more compressed

toward zero (0.01%-0.20%) (Figure 3) than in Figure 2 (0.06%-0.73%). In fact, the low estimates are barely distinguishable from zero for quintiles 2 and 3 regardless of α. In other words, the "hollowing out" effect is much more pronounced with the low estimates (Figure 3).

Figure 4 compares the estimated range of the high and low growth rates of W with α = 0.1 and α = 1.0. This makes it clear that with small α growth in W is hardly distinguishable from zero in all of the quintiles and with the low estimates the growth rates are minimal for the middle class 2nd and 3rd quintiles even with large α's.



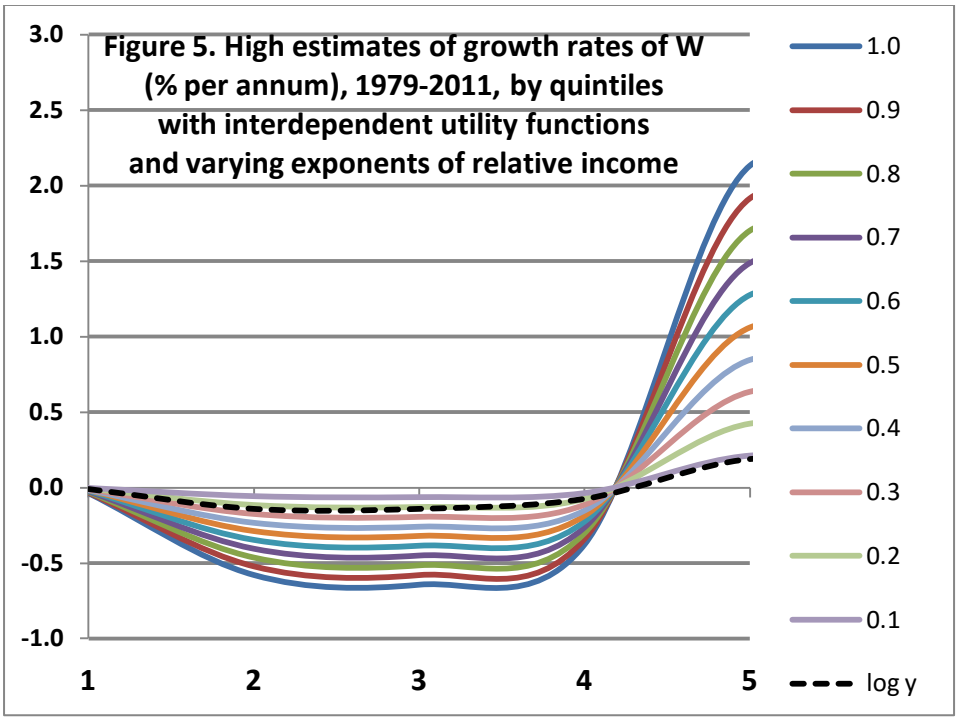
Note: 1-5 are quintiles, 6 = 81-90%; 7=91-95%; 8=96-99%; 9=Top 1%;

Welfare as a function of relative income

We next explore the growth in welfare as a function of relative income, i.e., with reference dependence (Alvarez-Cuadrado and Long 2011; Kahneman and Tversky, 1979; Ljungqvist and Uhlig 2000). We first assume an interdependent utility function such that $W(i) = \left[\frac{y(i)}{\sqrt{y(5)-y(i)}}\right]^{\alpha}$; where y is the estimated income[21] in quintile (i), i=1,…4, α is an exponent such that $0.1 \leq \alpha \leq 1.0$ and takes on

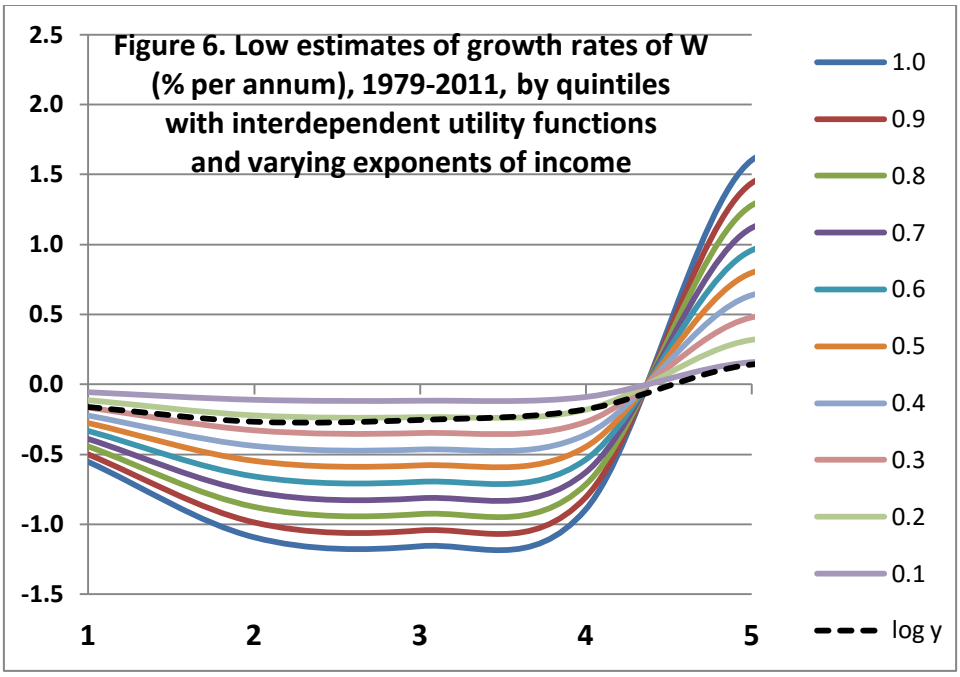
[21] Income adjusted for family size is used for these exercises.

values in increments of 0.1.[22] In this formulation the highest quintile is the reference group to which people compare themselves and actual income is divided by the square root of the difference between the 5th quintile and the other quintiles in the income distribution. For the 5th quintile the denominator is set equal to one insofar as it is the highest quintile and is therefore its own reference. The results of this specification are reported in Figures 5 and 6. We find that the growth in welfare is confined exclusively to the 5th quintile with both the low and high estimates. All other quintiles experienced a decline in welfare with all exponents. The higher are the α's the lower are the growth rates in quintiles 1-4. With large α's the low estimates indicate that the decline is as high as 1% per annum in the middle class quintiles (Figure 6).

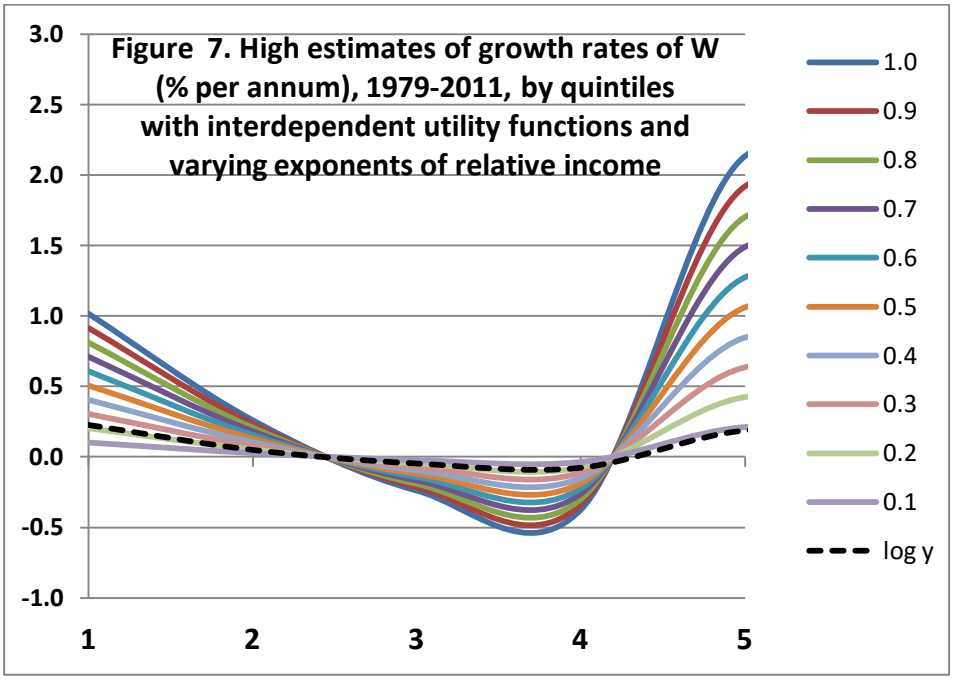


Note: 1-5 are quintiles

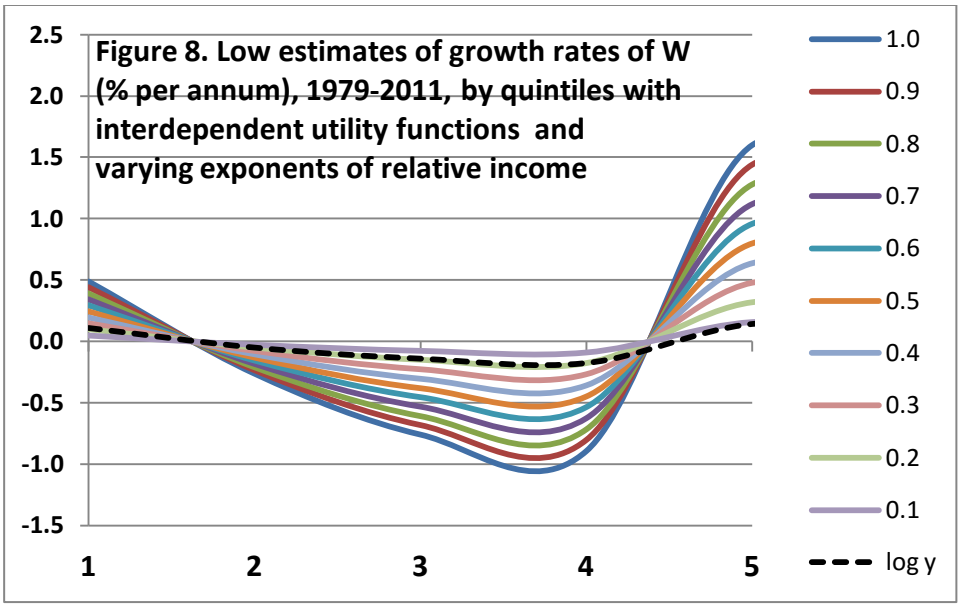
[22] Note that the denominator decreases as the quintiles approach the 5th quintile and therefore the fraction becomes greater. However, this is not the determining factor of the growth rates which depend on the extent to which these fractions changed over time.



Note: 1-5 are quintiles



Note: 1-5 are quintiles



Note: 1-5 are quintiles

We next assume that welfare is given by an interdependent utility function such that $W(i) = \left[\frac{y(i)}{\sqrt{y(i+1)-y(i)}}\right]^{\alpha}$, where y is the estimated income in quintile (i), i=1,…4, α is an exponent such that $0.1 \leq \alpha \leq 1.0$ and takes on values in increments of 0.1. The reference group in this version is the next higher quintile except for the 5th quintile, for which the denominator is again set equal to one. In this case both the high and the low estimates are positive for the 1st quintile inasmuch as it grew faster than the 2nd quintile in both periods (Figures 7 and 8). Growth in the 2nd quintile is slightly positive in the high estimates, while the low estimates are negative. Growth rates in the 3rd and 4th quintiles are negative or negligible in both the low and high estimates. In other words, the middle-class continues to flounder in this specification as well (Figures 7 and 8).

Discussion

This study estimating incomes and their growth rates—arguably among the most important measures of economic performance—accentuates their sensitivity to the way in which real incomes are calculated, especially to the price index used to convert nominal to real values

(McFadden 2014). As astonishing as it might sound, one of the salient outcomes of the above exercise is the realization that these variables and their distribution across the five quintiles cannot be estimated with great precision, given our current knowledge of the prerequisite empirical evidence. The inconvenient truth is that there are too many uncertain elements in our information set, so that much more research is needed in order to overcome these obstacles to our understanding of this crucial topic. One of the many reasons is that the two price indexes available provide substantially diverging estimates of the growth rates of real income.

In addition to the reasons discussed above, there are many products and services today that did not exist in 1979 which makes it challenging to compare the cost of living across generations. For instance, in 1979 we did not have to pay at all for watching television while now we do.[23] Aside from introductory offers, basic cable services cost about $64 per month or $768 per year.[24] If we were to subtract this single expenditure from the annual disposable income of the bottom quintile of $17,948 the growth rates would decline by 0.1%: the upper-bound one from 1% to 0.9% and the lower-bound one from 0.5% to 0.4%. In other words, such expenses did not exist in 1979 but they make it much more difficult for the poor to maintain the living standard that is considered normal for the times in which they live.

Another inaccuracy creeps into the estimates on account of the way households are defined insofar as the 2.3 million people in prison or the 0.5 million homeless, for example, are left entirely out of consideration without explanation why this should be the case.[25] The number

[23] Leichtmann Research Group, 2016. "Press Release: 83% of U.S. households subscribe to a pay-tv service," http://www.leichtmanresearch.com/press/090315release.html accessed January 2, 2016.
[24] Without taxes or other fees. http://www.ehow.com/about_5385381_average-cable-tv-per-month.html, accessed October 17, 2005.
[25] Others left out of consideration include people who live in group–quarters such as dormitories, nursing homes or military barracks amounting to 8 million people.

of people in prison today is about 1.7 million more than in 1979. Suppose that they were all from the first quintile and let us add their presumably zero incomes to those of the 1st quintile (Palaez, 2014).[26] This alone would lower the growth rate in the lowest quintile by 0.2%. Together with paying for cable TV, these two factors alone would lower the income growth of the 1st quintile to between 0.7% and 0.2%. In other words, even such a rough sensitivity analysis indicates that even though the rate of growth in income of the poor exceeded those of the middle class, all of their gains barely sufficed to pay for cable service if one also considers increases in the number who are inexplicably not accounted for in these statistics. In addition, in spite of the gains, the average income of the bottom quintile in 2011 was just $32 above the poverty income of a three-person household.[27]

In order to increase the accuracy of the estimates we would also need to know how household size and age varied by quintiles as well as the composition of the households. A household with two adults has different needs and expenditures than a household with one adult and a child and such issues are now left out of consideration. Yet another inaccuracy is introduced by the fact that sales taxes, which are not progressive, and state taxes and property taxes are also left out of consideration. Growth rates would also look considerably worst if we accounted for economic insecurity which arguably increased during the period considered.

Another question is the extent to which it is rigorous to compare welfare growth between 1979 and 2011 on account of the fact that roughly half of the people alive in 2011 were not alive

[26] In 2011 there were 119.9 million households or approximately 24 million per quintile. https://www.census.gov/hhes/families/files/hh1.csv

[27] The poverty threshold for a family of three was $17,916 compared to an average income of $17,948 for the 1st quintile.

in 1979 (Census, 2011).[28] In other words, we are comparing welfare of people with quite different utility functions. In any event, most people are not going to be impressed by what has happened since 1979 because that is outside of the range of the experience even of most of the people alive today. Instead, they are more likely to compare their current situation with more recent reference points.[29]

An important caveat is that, admittedly, the year 2011 is hardly representative inasmuch as market incomes were supported by government transfers on the basis of a $1.3 trillion deficit, that is to say at the expense of generations yet unborn. This is regrettably a major weakness of using post-transfer incomes as a gauge of economic performance and welfare, insofar as the massive incidence of the burden of the debt on future generations is left out of the calculus. Consequently, it appears as though the accumulation of government debt could improve the welfare of the current generation. This, of course, is illusory not only because of Ricardian equivalence, not only because the welfare of future generations should be included in the calculations, but also because there are people today who do worry about the welfare of future generations and whose anxiety and therefore welfare is influenced by the increasing debt. Given the uncertainties associated with this complex of issues we do not pursue this line of analysis

[28] Population in 2010 was 309 million and in 1980 it was 227. That alone implies that 82 million were not alive at the earlier date. In addition, considering today's life table, roughly one-third of the population dies within a 32 year period. That means that of the people alive in 1980 roughly 75 million probably passed away by 2011. Thus, together, about 158 million were not alive in 2011. This is about half of the 309 million population. U.S. Census, "2014 National Population Projections," https://www.census.gov/population/projections/data/national/2014/summarytables.html accessed December 26, 2015.

[29] Yet another problem with the welfare measure is that it does not include any estimate of risk such as the variance of income over time. The incidence of such risk probably affects most the lower income groups. We also do not consider expected social mobility which also has an impact on utility.

further except to assert that it exacerbates further the uncertainties associated with these and all other post-transfer income estimates.

Table 3. Estimates of transfers minus taxes as a percentage of market income, 2011

Quintiles					Top 1%
1st	2nd	3rd	4th	5th	
31	20	5	-8	-23	-31

Note: Negative values indicate that taxes were greater than transfers.

It is useful to explore the extent to which transfers and taxes modified market incomes. Not surprisingly government transfers minus taxes were the largest in percentage terms in the 1st quintile (Table 3). Their market income was increased by 31% by net transfers. The share declines with higher incomes until it became negative in the 4th quintile. For them taxes were greater than the transfers they received, so that their net income was smaller than their market income by 8%. Only the 5th quintile (including the top 1%) was in a substantially negative position, i.e., only they paid more taxes than the transfers they received. This is an indication of the extent to which the transfers were financed by debt.

Table 4. Estimates of the total increase in transfers minus taxes (2011 dollars), 1979-2011

	Quintiles					Top 1%
	1st	2nd	3rd	4th	5th	
High	-1,057	4,639	8,317	6,706	-15,649	-232,406
Low	-2,013	4,560	9,461	9,010	-9,383	-199,423

Note: Negative values indicate that taxes were greater than transfers.

Another question is the extent to which transfers net of taxes have increased or decreased during this 32-year period (Table 4). Here we stumble upon the unexpected result that net transfers of the 1st quintile have actually decreased over time while that of the three middle-class quintiles increased markedly. The taxes on the 5th quintile (and on the top 1%) increased substantially. The implication is that the hollowing out of the middle class occurred in spite of the increases in government transfers.

Table 5. Change in Net Transfers as a Percentage either of the Estimated Increases in Market Income (in case of negative values) or of the Increases in Total Disposable Income (in case of positive values), 1979-2011

	Quintiles					Top 1%
	1st	2nd	3rd	4th	5th	
High	-19	97	103	37	-17	-27
Low	-49	*	809	97	-13	-25

Note: Negative values imply that taxes were greater than transfers. In such cases the base used for the calculation is the increase in market income, implying that the gain in market income was decreased by that percentage in order to obtain actual increase in total income. In case of positive values the values indicate what share of the increase in disposable income was made up by the increases in net transfers.
* Indicates that the net gains in income were practically nil so that the ratio is too large to be relevant

Consequently, the net transfers made up a substantial portion of the increases in total incomes of the three middle classes (Table 5). According to the high estimates, all of the gains in income in this 32-year period were made up of increases in net transfers in the 2nd and 3rd quintiles whereas in the 4th quintile 37% was. In contrast, according to the low estimates, all of the gain in total income was made up of net transfers (97%) in the 4th quintile. The net gain in total income according to the low estimate was so small in the 3rd quintile that the gain in net transfers was eight times as large as the increase in total incomes. Insofar as the net gains in the 2nd quantile were practically nil, even with the gains in net transfers, the ratio is too large to be relevant. However, unexpectedly for the 1st quintile the increase in market income was greater than the increases in disposable income. Thus, net transfers actually reduced the gains in market income by between 19% and 49% (Table 5). Similarly, in the 5th quintile (and among the top 1%) net transfers were negative and reduced the gains in market income by 13% to 17%.

Conclusion

The main goal of this paper is to ascertain the growth in welfare and that of post-tax, post-transfer real incomes, upon which they are based, in the five quintiles of the income

distribution for the period 1979-2011. The 5th quintile is further decomposed into four percentile groups including the top 1%. We include earnings only to the extent they increase current utility. Hence, we take the CBO's post-tax estimates as the basis, insofar as they pertain to disposable income and, in addition, include cash transfers which the census figures exclude. We differ from the CBO estimates insofar as we include only the present value of those earnings that will accrue to the employees in the future. There are innumerable challenges in undertaking such an exercise. As a consequence, the above estimates have to be considered preliminary. Nonetheless, there are a few consistent patterns in which we have confidence that they will survive successive improvements.[30]

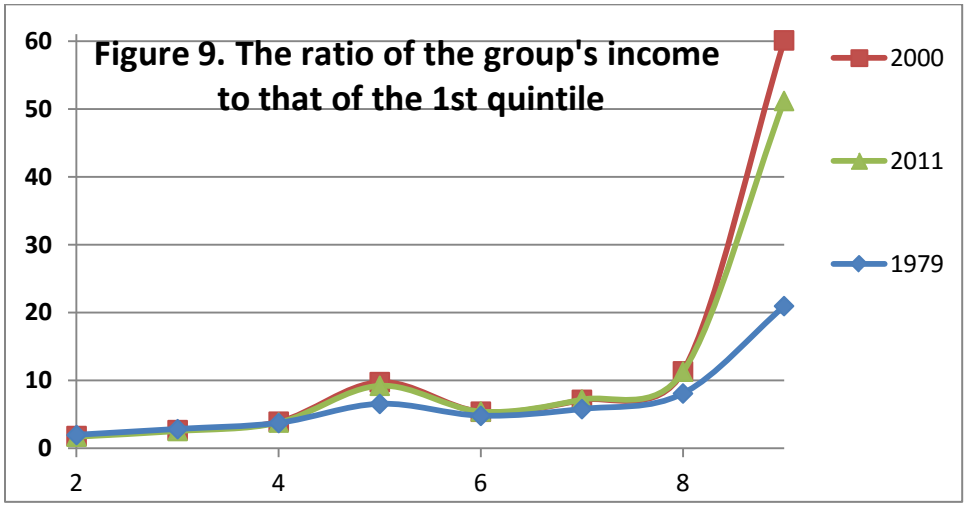
These include most vividly what in the colloquial is referred to as the "hollowing out" of the middle class. The lower-middle class 2nd quintile and the middle class 3rd quintile fared the worst in all specifications: their income increased at a rate of between 0.1% and 0.7% per annum (Figure 1 and Tables 1 and 2). In contrast, the only group whose income grew remarkably was the 5th quintile and especially the top 1% whose income registered an astonishing growth rate of between 3.4% and 3.9% per annum, reaching an average value of $918,000 by the end of the period under consideration (Table 1 and Figure 1).

Somewhat surprising is the consistently positive growth of the income of the lowest quintile. The poorest group registered an income growth estimated to be between 0.5% and 1%, i.e., consistently above that of the 2nd and 3rd quintiles, and equaling that of the 4th quintile (Figure 1). This is all the more surprising insofar as their net transfers decreased over time while those of the three middle class quintiles increased by as much as $9,000 per annum (Table 4). To

[30] One could also incorporate the value of the gains in life expectancy during this period as in Becker et al. 2005. Insofar as the value of these gains differs substantially by age more empirical work needs to be done before we could implement such estimates.

be sure, the income of the 1st quintile remained at the bare minimum to sustain life in the U.S.: their average income of $17,900 per annum in 2011 was roughly at the level of the poverty threshold for a family of three.

The growth in income of the 4th quintile was comparable to that of the 1st quintile and generally better than the 2nd and 3rd quintiles but much worse than the 5th quintile. These patterns imply that the ratio of the income in the 2nd and 3rd quintiles declined slightly relative to that of the 1st quintile whereas that of the 4th quintile remained unchanged and that of the 5th quintile increased considerably (Table 6 and Figure 9), but it was the top 1% whose income grew immensely to reach the spectacular level of 51 times the income of the 1st quintile.



Note: 1-5 are quintiles, 6 = 81-90%; 7=91-95%; 8=96-99%; 9=Top 1%

Table 6. Ratio of the average income in given quintile or percentile to that of the 1st quintile and percentage increase 1979-2011

	21-40%	41-60%	61-80%	81-100%	81-90%	91-95%	96-99%	Top 1%
1979	2.0	2.8	3.7	6.5	4.8	5.8	8.1	20.9
2011	1.7	2.6	3.8	9.2	5.4	7.2	11.3	51.2
increase	-12%	-10%	2%	41%	13%	25%	40%	144%

However, it is astounding that the relative income of the rest of the 5th quintile besides the top 1% did not experience such humongous growth. Relative to the 1st quintile the 81-90

percentiles increased its income only marginally from a multiple of 4.8 to 5.4, the 91-95 percentiles increased from 5.8 to 7.2 and the 96-99 percentiles increased only from 8.1 to 11.3 (Figure 9). Only the top 1% increased enormously from a factor of 21 to a factor of 51, a surge of no less than 144%. This is not only a clear indication of the rise of inequality[31] but also that it was exclusively the top 1% whose income grew disproportionally, corroborating the well-known skewing of the income distribution after 1980 (Lindert and Williamson 2016).

Another recurring pattern is that the income of the 2nd and 3rd quintiles consistently lagged behind the other quintiles. This is referred to in conventional parlance as the "hollowing out of the middle class" (Desilver 2015). The high estimates of the growth rates in these two quintiles are in the range of 0.6% - 0.7% per annum while the low estimates are in the range of 0.1% - 0.2%, i.e., they are actually difficult to distinguish from zero (Figure 1 and Table 7).

According to the low estimates, it would take about 600 years for incomes in the 2nd quintile to double and on the order of a millennium for welfare to double (Table 7). These are growth rates that are reminiscent of those that prevailed prior to the Industrial Revolution. Moreover, they are likely to be below the threshold levels for the brain to register a positive change in the standard of living in real time.[32] This is particularly the case since the annual absolute increases measured in dollars were all tiny except—again—in the 5th quintile. An increase of a few dollars or even a few hundred dollars per annum is not likely to have registered significantly (Table 8).

[31] Inequality also increased in the price of housing (Albouy and Zabek 2016).

[32] As an aside, it would be interesting to find out how fast do incomes have to rise before individuals actually are able to ascertain an increase in their standard of living. Sensory thresholds of real income growth would be the minimum level that a person can detect, perceive, or recognize which is not obvious with thousands of prices changing continuously creating a lot of background noise. Small changes in real income might well be beyond the computing ability of the human brain to detect.

Table 7. Annual growth rates (%) of income and welfare of the 2nd and 3rd quintiles, 1979-2011

	Low Estimates		High Estimates	
	2nd quintile	3rd quintile	2nd quintile	3rd quintile
Income	0.12	0.20	0.65	0.73
Welfare: function of absolute income				
α=0.5	0.06	0.10	0.32	0.36
Logarithmic	0.01	0.02	0.07	0.07
Welfare: function of relative income				
5th quintile is reference, α=0.5	-0.55	-0.58	-0.29	-0.32
next quintile is reference, α=0.5	-0.13	-0.38	0.13	-0.12

Source: Tables 1 and 2 and Figures 1-3, 5-8.

Table 8. Estimates of Increases in total income per annum (2011 dollars)

	Quintiles					Top 1%
	1st	2nd	3rd	4th	5th	
High	142	150	252	574	2,433	19,923
Low	66	0.3	37	290	1,935	18,330

Welfare growth with independent utility functions parallel the growth in incomes but is moderated by its income elasticity (α): the lower is α, the lower is the growth in welfare. Hence, welfare growth rates are most likely to be well below the estimated income growth rates. Put another way, the estimated rates of income growth are the upper bound growth rates of welfare with α=1. The growth in welfare is likely to be roughly half of the rate of income growth which makes the estimated growth in welfare of the 2nd and 3rd quintile practically indistinguishable from zero at between 0.06 and 0.36% per annum (Table 7). A logarithmic utility function yields an even slower growth in welfare for the middle class of roughly 0.01% to 0.07% per annum. However, for the top 1% the growth of welfare with α=0.5 implies a reasonable growth rate of 1.7% -- 1.9% per annum[33] (Figures 2 and 3).

[33] It is worthy of note in this regard that Becker et al. (2005) assert that the elasticity of utility with respect to consumption is 0.2.

With interdependent utility functions the growth in welfare depends not only on one's own income growth but also on the rate of growth of a reference group. Hence, we obtain a pattern that is entirely different from the one obtained for welfare using independent utility functions. In the first specification in which quintile 5 is the reference group it is the only one that experiences positive growth rates (Figures 5 and 6). With the exception of the 5th quintile the high estimates of welfare growth are either zero or negative while the low estimates are all negative without exception.

In the second specification with an interdependent utility function in which the reference is the next higher quintile, the 1st quintile grows somewhat but only the 5th quintile grows meaningfully (Figures 7 and 8). In contrast, welfare growth in quintiles 2-4 was mostly negative. The only slightly positive growth in the three middle-class quintiles was the high estimate of the income growth of the 2nd quintile (Figure 7). In other words, the "hollowing out" effect is quite evident also in this specification.

In sum, none of the estimates point to an economy that is able unambiguously to enhance welfare of most—let alone all—of its participants. Rather, the evidence points consistently to the relative decline in the income and welfare of the middle class which is especially strong with interdependent utility functions. This is one of the most persistent patterns that emerge from this study.

Subjective evaluations of economic well-being support the conclusion of a decline in welfare of the middle class inasmuch as such surveys do not find a lot of positive emotions when people are asked about their economic situation (Scitovsky 1976). For instance, the happiness index in the U.S. has been declining for decades even before the financial crisis (Easterlin, 1974; 2015, Figure 13.8; 2016, Figure 2). Moreover, at the time of writing 55% of the population is

said to be thriving, 42% report that they are struggling financially, while 3% are suffering (Gallup, 2015). These estimates provide quantitative support for these subjective evaluations and why there is a general feeling of malaise in the population that includes a substantial increase in the suicide rate (Curtin et al., 2016). As Stiglitz et al., suggest, "one of the reasons that most people may perceive themselves as being worse off even though average GDP is increasing is because they are indeed worse off (2010)."[34]

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[34] Inequality has an independent negative effect on life satisfaction (Goff et al., 2016).

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Appendix A. Comparison of original Census and CBO income estimates

The estimates in this appendix are based on the original data from the Census and from the CBO. Hence, they are not appropriate for estimating the growth in welfare insofar as the former does not consider transfers and taxes whereas the latter does consider post-tax, post-transfer incomes but it conflates current earnings with earnings that will accrue in the future. We republish them here nonetheless in order to report of the current state of knowledge in this regard and in order to show the differences between these estimates. The Census and the CBO also use different price indexes to convert nominal into real values. Consequently, there are considerable differences between the two estimates although the median incomes for 1979 are almost

Table A1. Disposable Household Income as Calculated by the Congressional Budget Office (Thousands of 2011 dollars)

	Median	Average within quintile				
Panel A	All	0-20%	21-40%	41-60%	61-80%	81-100%
1979	48.0	18.4	30.7	43.6	57.0	100.5
2011	67.2	31.6	42.1	59.0	82.6	188.2
Panel B	Growth in the Period Indicated (%)					
1979-2011	46	79	43	41	51	95
Panel C	Rates of Growth per annum during the period indicated					
1979-2011	1.2	1.8	1.1	1.1	1.3	2.1

Note: Incomes are not adjusted for household size but growth and growth rates are adjusted. Thus, the growth panels do not pertain to the dollar values reported above which are the raw values before adjustment for household size.
Source: CBO Supplemental tables Table 5.

Table A2. Household Income as calculated by the U.S. Census (Thousands of 2011 dollars)

	Median	Average within quintile				
Panel A	All	0-20%	21-40%	41-60%	61-80%	81-100%
1979	47.5	11.7	28.6	47.3	69.3	123.6
2011	50.0	11.2	29.2	49.8	80.1	178.0
Panel B	Growth (%)					
1979-2011	10	0	6	10	20	50
Panel C	Rates of Growth per annum during the period indicated (%)					
1979-2011	0.3	0.0	0.2	0.3	0.6	1.3

Note: see Table 1; Source: De Navas-Walt, et al., 2012, p. 39.

identical; for 2000 they are reasonably close but for 2011 the Census estimate of the median is $17,000 lower than the CBO's estimate (Tables A1 and A2 Panel A). That is quite a discrepancy.

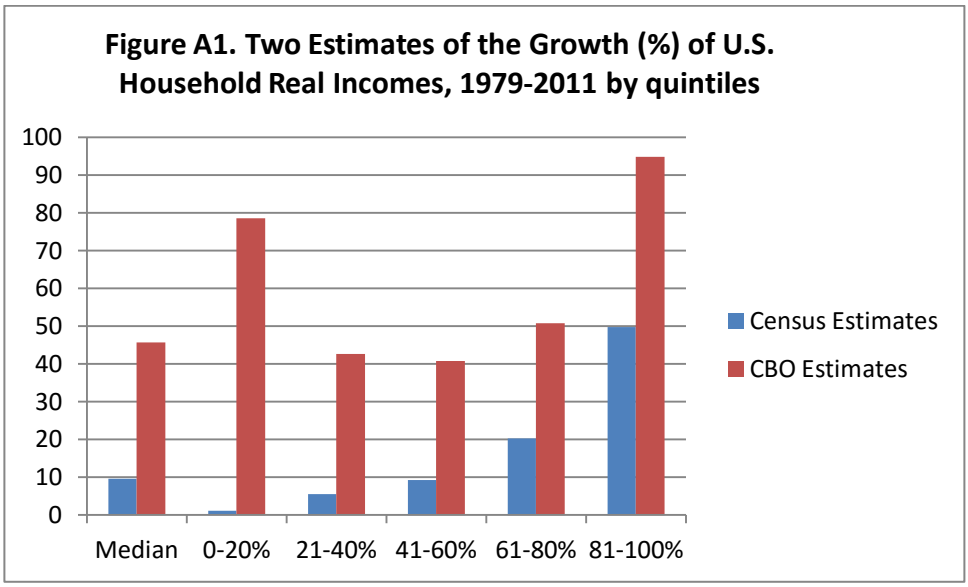
Estimates of growth rates 1979-2011

During the 32 years that elapsed between 1979 and 2011 the increase in median real household income was 46% according to the CBO whereas the Census estimate implies a tepid increase of merely 10% (Tables A1 and A2, Panel B, and Figure A1). The large difference between the two estimates is due to the use of the different price indexes and the fact that 2011 was a year in which the economy was still in the doldrums but there were unusually large transfer payments ($1.3 trillion)[35] for unemployment benefits and for food stamps which increases the CBO data. In 2007 the transfer payments for food stamps amounted to $31 billion whereas by 2011 it rose to $73 billion.[36] Thus, 2011 is hardly a representative year. Because of the humongous federal government deficit, the transfers were actually financed by generations yet unborn.

As far as growth in the five quintiles is concerned, according to the CBO the lowest and the top quintiles made significant advances but the middle three quintiles also grew adequately during this 32-year period: growth rate was above 1.1% per annum in all quintiles (Table A1, Panel C). In stark contrast, the Census's estimate shows no increase at all within the lowest quintile, and only the income growth of the top quintile exceeded 1%. Moreover, the middle three quintiles hardly grew at all (0.0-0.3%) (Table A2, Panel C and Figure A1). If one were to consider the additional issue of the standard error of the price index the confidence interval of

[35] St. Louis Fed, FRED, "Federal government budget surplus or deficit," https://research.stlouisfed.org/fred2/series/M318501A027NBEA accessed December 26, 2015.
[36] That alone added some $1,800 to the income of each of the 22 million low-income households in the first quintile. https://research.stlouisfed.org/fred2/series/TRP6001A027NBEA accessed December 26, 2015.

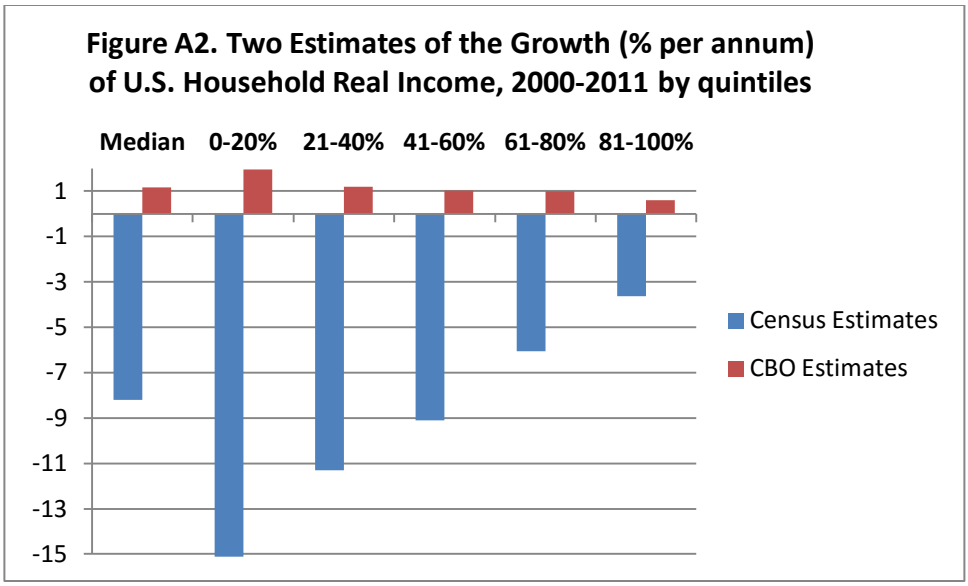
these growth rates would include negative values (Shoemaker 2015). As mentioned above, these estimates are both biased. The Census estimate particularly paints an excessively rosy picture of economic performance.



Estimates of growth rates 2000-2011

The two sets of estimates diverge even more for the 21st century. While the CBO estimate does not indicate a slowdown at all as most growth rates exceed 1.0% per annum, the Census estimates indicate not only a substantial diminution in growth rates but a sinking into negative territory for the median as well as for all quintiles with the first quintile declining the most: -1.4% per annum (Table A2, Panel C and Figure A2). So they could hardly be more different. It is as though they were not referring to the same country at all. The difference is due to the increase in transfers (by 56%) and decline in taxes (by 22%) and the concomitant increase in budget deficit.[37]

[37] In order to calculate the growth rates of welfare more accurately, one would have to consider the extent to which Ricardian equivalence, i.e., the increase in budget deficit impacted on the welfare of the population. This is not possible at the present due to the lack of empirical evidence. While empirical studies tend to disprove the validity of Ricardian equivalence as far as the economic sphere is concerned (Stanley, 1998), in the recent U.S. situation it seems to have



Appendix B. Improved Estimates of income growth in the 21st century

Improved high growth rate estimates, 2000-2011

In the 21st century even the high improved estimates of growth rates in median income was markedly slower than during the 32-year period. The decline was from 1.4% to 0.3% per annum (Tables 1 and B1, Panel C). However, the growth rates of the first three quintiles remained approximately the same as those for the whole period under consideration. This implies that the 1st quintile continued to have relatively decent growth, whereas the growth in the two middle-class quintiles remained weak. The 4th and 5th quintiles joined the ranks of the snail-paced growth ones and the top 1% even experienced a decline in income by about $54,000 from close to a million dollars to closer to $900,000 per annum. In other words, the only group that experienced above-average growth rates was the poor, but, of course, income still remained near the poverty level of just under $18,000 per annum (Table B1). The percentiles between 81% and 99% were also doing well according to these estimates.

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had a large impact on politics insofar as the substantial increase in government debt led to the "Tea Party" movement which then blocked further government action on economic matters.

Table B1. Improved High estimates of household income (000 dollars), 21st Century

	All	Average within group								
Panel A	Median	0-20%	21-40%	41-60%	61-80%	81-100%	81-90%	91-95%	96-99%	Top 1%
1999 or 2000	61.6	**16.2**	29.3	43.4	63.5	157.9	87.4	115.6	183.6	972.8
2011	63.6	17.9	31.1	46.0	68.3	165.5	97.5	129.2	202.8	918.2
Panel B	Growth during the period indicated (%)									
2000-2011	4	11	7	6	8	5	12	12	11	-5
Panel C	Rates of Growth per annum during the period indicated (%)									
2000-2011	0.3	0.9	0.6	0.6	0.7	0.5	1.0	1.1	1.0	-0.5

Table B2. Improved Low Estimates of Household Income (000 dollars)

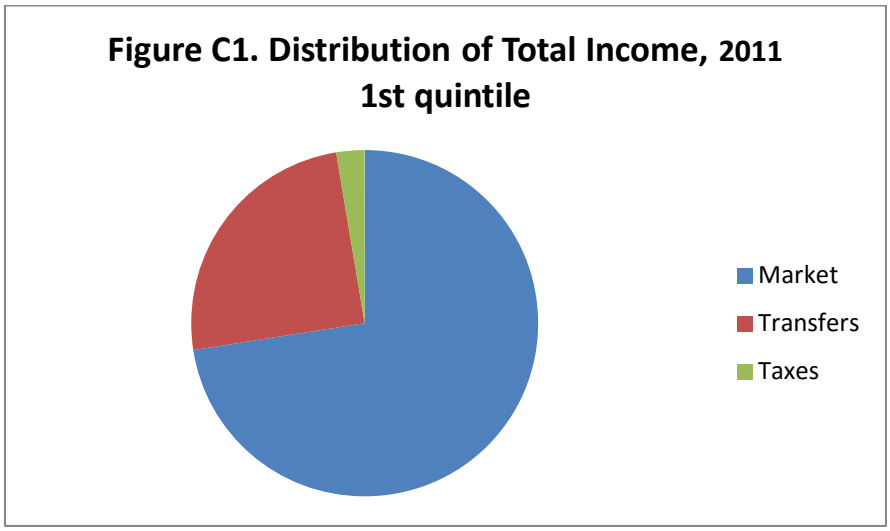
	All	Average within group								
	Median	0-20%	21-40%	41-60%	61-80%	81-100%	81-90%	91-95%	96-99%	Top 1%
1999 or 2000	64.3	**17.0**	30.8	45.3	66.2	164.7	91.1	120.6	191.4	1014.3
2011	63.6	17.9	31.1	46.0	68.3	165.5	97.5	129.2	202.8	918.2
	Growth during the period indicated (%)									
2000-2011	-0	6	1	2	4	1	8	8	7	-9
	Rates of Growth per annum during the period indicated (%)									
2000-2011	-0.0	0.5	0.1	0.2	0.3	0.1	0.7	0.7	0.6	-0.8

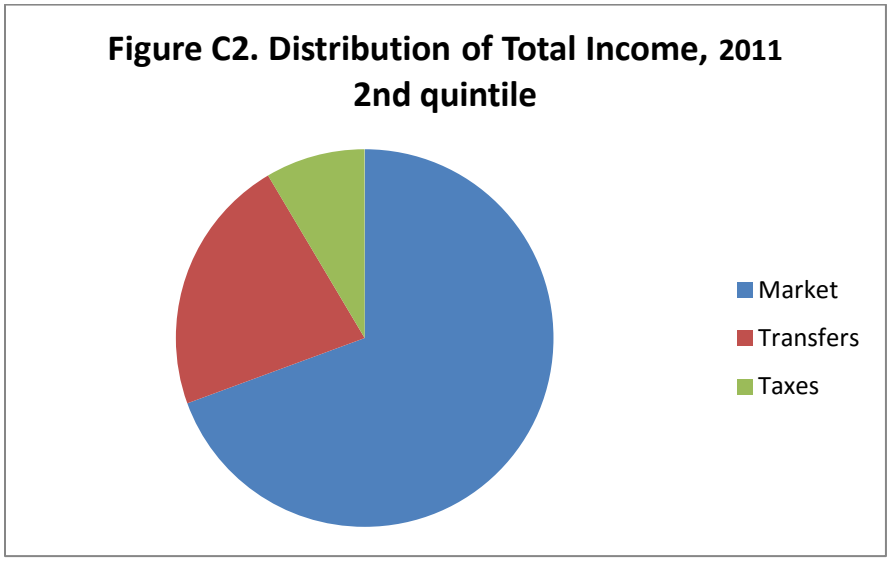
Improved low growth rates estimates, 2000-2011

In the 21st century the improved low estimates of growth of median income came to a complete standstill; growth was also slower in all quintiles as the sluggish growth spread to the upper-middle class as well as to quintile 5 (Table B2). The estimates of the rate of growth in the three middle class quintiles are negligible, between 0.1% and 0.3%.[38] The increase in income in first quintile in the 11 years was a meager $1,700. The upper 1% experienced a decline in average income to just over $900,000 per annum.

[38] Note that growth within each quintile is positive while the growth of the median is zero. While this might appear odd, the reason is that the growth within the quintiles is that of the average in that quintile and not that of the median. Hence, the higher incomes within a quintile have a larger impact on the average than they would have if the medians of the quintiles were reported by the CBO.

Appendix C. The Share of Market Income, Transfers and Taxes in Total Income, 2011





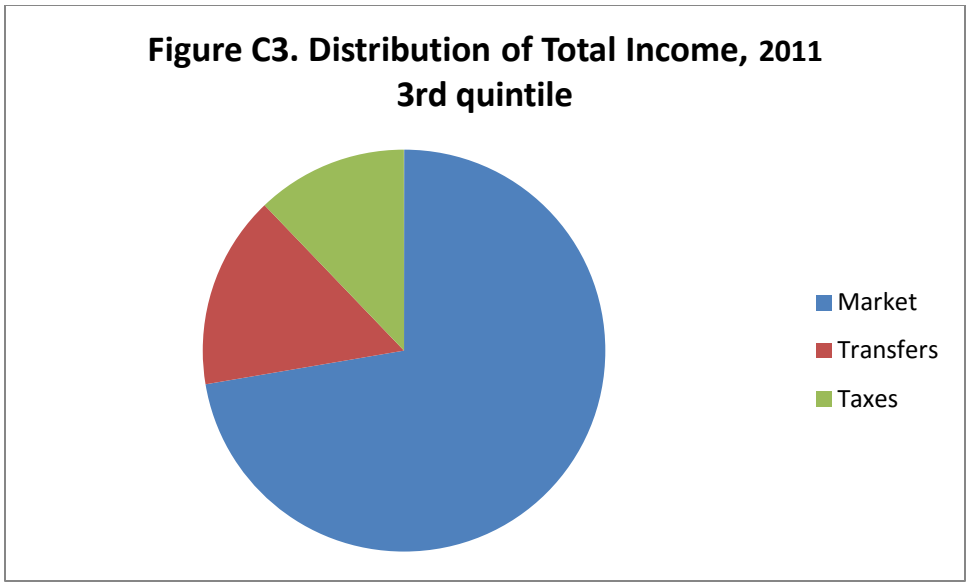


Figure C3. Distribution of Total Income, 2011
3rd quintile
Market
Transfers
Taxes

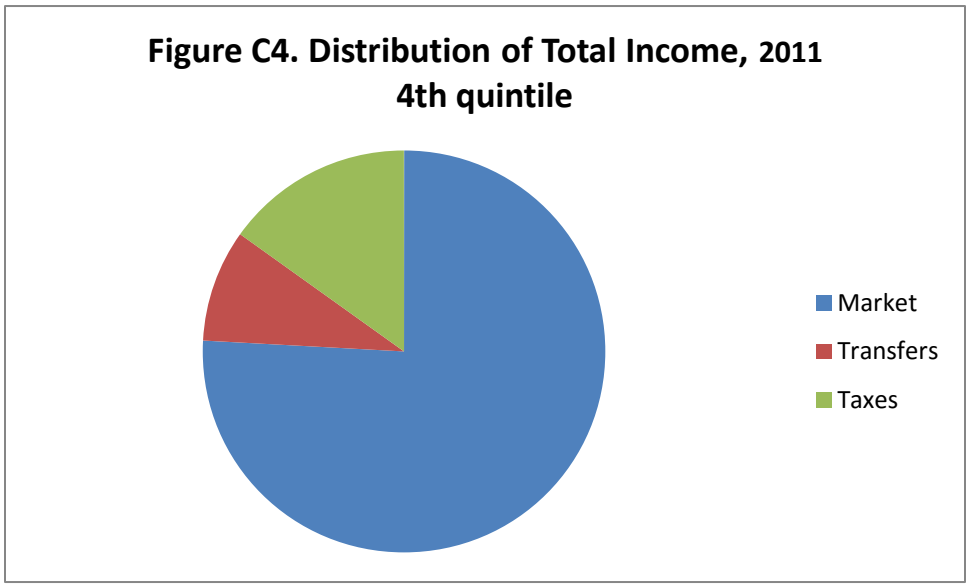


Figure C4. Distribution of Total Income, 2011
4th quintile
Market
Transfers
Taxes

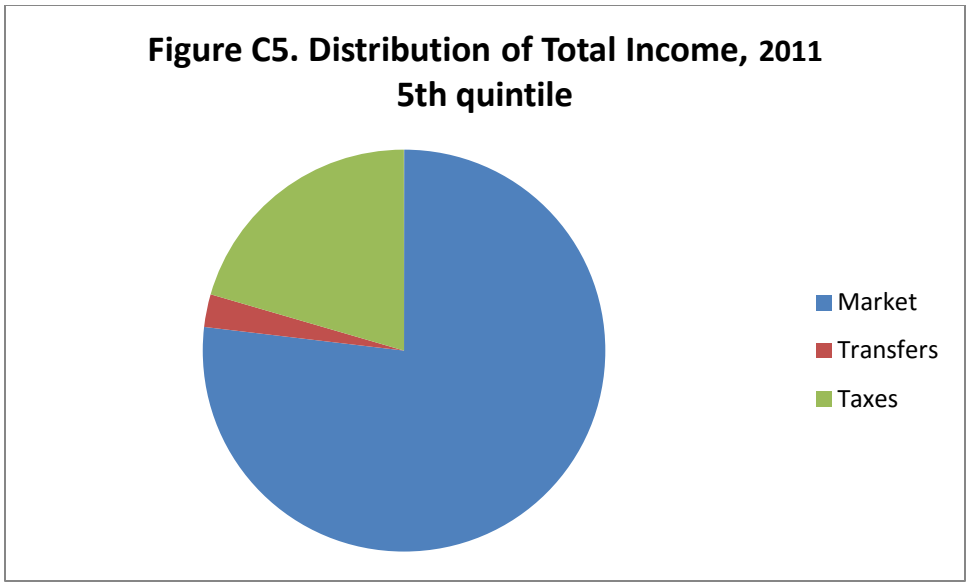


Figure C5. Distribution of Total Income, 2011
5th quintile
Market
Transfers
Taxes

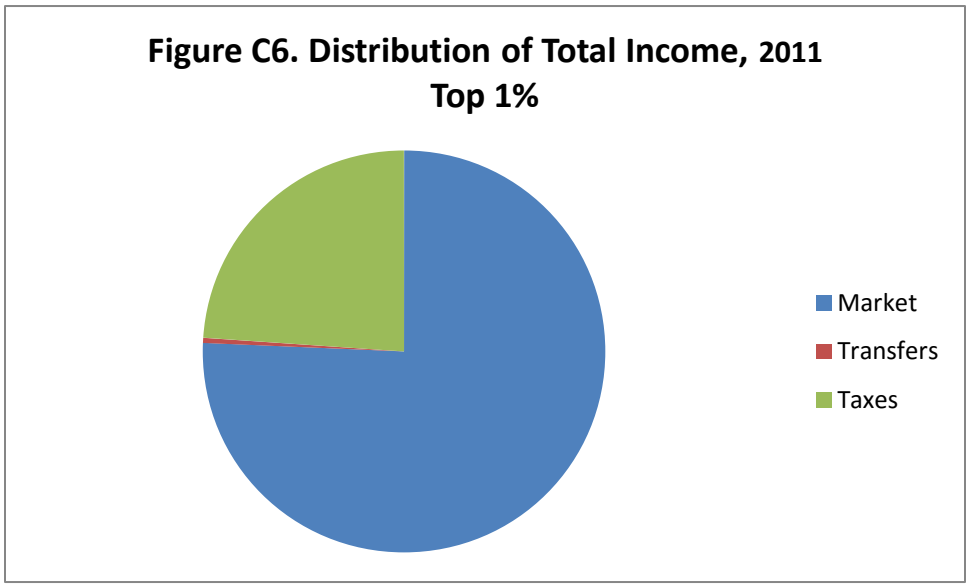


Figure C6. Distribution of Total Income, 2011
Top 1%
Market
Transfers
Taxes